

THE  
ELECTRICAL REVIEW.

---

VOL. LXX.

JANUARY 5 — JUNE 28, 1912.

---

125636  
26/12/12

LONDON :

H. ALABASTER, GATEHOUSE & CO.,

4, LUDGATE HILL, E.C.



TR  
1  
E 45  
V. 70

London:  
PUBLISHED BY THE PROPRIETORS,  
AT 4, LUDGATE HILL, E.C.



## INDEX.

List of sub-headings:—AUTHORS, CITY NOTES, CONTRACTS CLOSED AND OPEN, CORRESPONDENCE, LEGAL, LIGHTING AND POWER NOTES, NEW COMPANIES, NEW ELECTRICAL DEVICES, FITTINGS AND PLANT, OBITUARY, OFFICIAL RETURNS, PARLIAMENTARY, PROCEEDINGS OF SOCIETIES AND INSTITUTIONS, PROSPECTUSES, RAILWAY NOTES, REVIEWS, TELEGRAPH NOTES, TELEPHONE NOTES, TRAMWAY NOTES.

**ACCIDENT**, Live wire, 806, 973  
**Accidents in London**, 'Bus and tram, 546  
**Accumulative energy**, The degradation of, by A. G. Collis, 361  
**Accumulator**, An improved, 692  
 " electrodes, *Volume* changes in, by C. Toone, 481  
 " sell? Another, 593  
**Accumulators**, On the efficiency of, by W. Hibbert, 6  
**Aezol**: A new preservative material for timber, 1059  
**Advance in German prices**, 910  
 " in prices, 298  
**Advertising media**, Electrical signs as, by G. A. Cooper, 911  
**A.E.G. in Mexico**, The, 581  
**Agreement**, Engineering trades, 682  
**Agricultural machinery competition**, 567  
**Agriculture**, Electricity in, 106  
**Aldershot**, A Royal visit to, 871  
**All-electric scheme**, An, 552  
**Alloys**, The magnetic properties of, 860  
**Alternating-current lighting circuits**, The use of condensers on, by A. W. Ashton, 328  
 " current, Tungsten lamps on, 312  
**Aluminium**, 107  
 " Copper and, 783  
 " enterprise, A new Swiss, 755  
 " in Italy, 56  
 " industry, 211  
 " Nitrate production from the raw material of, 931  
 " overhead line conductors, The characteristics of copper and, by E. V. Pannell, 771, 915  
 " prices, Advance of, 960, 1042  
 " process, A French, 104  
 " Syndicate, The proposed, 675, 834  
 " The physical constants of, by Dr. F. J. Briselee, 37  
**America**, Commercial electric motor vehicles in, 185  
**American deputation to England**, 972  
 " industrial affairs, 931  
**Annual festivities**, 25, 1011  
**Application of electricity to railway-cab signalling**, by William H. Hammond, 1661  
**Applied Chemistry**, International Congress of, 908  
**Appointment was made**, How an, 972  
**Appointments Board**, The Civil Engineers', 306  
 " vacant, 27, 67, 107, 144, 185, 220, 260, 307, 342, 384, 429, 469, 512, 551, 592, 646, 682, 721, 763, 805, 842, 932, 973, 1012, 1056  
**Arbitration in trade disputes**, Compulsory, 409  
**Arbitrator**, The engineer as, 930  
**Arc**, A novel use of the electric, 382  
 " lamp tenders, 743  
 " Works Engineering Society, Conversation of the, 762  
**Arcs**, Yellow flame, by M. Solomon, 89  
**Armatures for rail conveyance**, On packing, by S. Lees, 181  
**Articles**, Institution of Electrical Engineers, 50, 661, 781  
**Artistic street lamp standards**, 479, 952  
**Ashcroft**, Memorial to Prof., 275  
**Association of Consulting Engineers**, The, 41, 67, 82, 141, 144, 184, 201  
 " of Mining Electrical Engineers, 321  
**Asynchronous motors**, An automatic starting device for, by N. Pensabene Perez, 36, 49  
**Auditors**, Remuneration of, 722  
**Australia**, 186  
 " British manufacturers in, 415  
 " Electrical progress in, 994  
 " To prevent smoke nuisance in, 342  
 " Trade statistics of, 154  
**Australian Electrical Wages Board**, The, 510  
 " labour questions, 66  
 " tariff, The, 63

**Australian tramway companies and their employés**, 694, 733, 747, 906, 959  
 " Tramway Officers' Association, The, 939  
 " views on electrical development, 1030  
**Austrian cable syndicate**, 793  
**AUTHORS—**  
 Ablett, C. A., on The electrical driving of rolling mills, 235, 577  
 Addey, T., on A vector calculator, 156  
 Allingham, G. C., on A battery substation plant at Hucknall Colliery, 49  
 Ashton, A. W., on The use of condensers on alternating-current lighting circuits, 328; on Condensers in series with metal-filament lamps, 983  
 Ayton, Frank, on Means of securing reliability and maintaining continuity of supply, 993  
 Baily, Prof. F. G., on The electrical engineering laboratory at the Heriot-Watt College, Edinburgh, 50, 114  
 Barnes, Prof. H. T., on Location of icebergs by a recording microthermometer, 917  
 Baumann, K., on Recent developments in steam turbine practice, 317, 359  
 Best, C. E., and H. L. Parrott, on Brazil: its present condition and the possibilities for future commercial relations with Great Britain, 83  
 " B. K., on Notes on rheostats, 315  
 Booth, W. H., on Petroleum in England, 527  
 Brewerton, A. E., and J. Walton, on Wages systems, 981  
 Bright, C., on Trans-Atlantic telegraphy, 563  
 Briselee, Dr. F. J., on The physical constants of aluminium, 37  
 Broadbent, Frank, on The successes and failures of profit-sharing and co-partnership, 452  
 Bullen, A. T., on The earth fault, 159  
 Burge, H., and J. C. Macfarlane, on The supply and transmission of power in self-contained road vehicles and locomotives, 535  
 Burleigh, J. W., on Continuous-current motors with commutating poles and cast-iron magnets, 4  
 "Change-Over," on Council or company? 459  
 Chorlton, A. E. L., and Dr. Edward Hopkinson, on The evolution and present development of the turbine pump, 279  
 Clark, A. B., on The inter-relation of capacity in three-phase three-core cables, 532  
 Collis, A. G., on The degradation of accumulative energy, 361  
 "Colonial," on Colonial references, 501  
 Cooper, G. A., on Electrical signs as advertising media, 911  
 " W. R., on the Benkö primary battery, 37  
 Crouch, L., on Electrical development in industrial areas, 71, 117  
 Cummins, W. R., on Auxiliary machinery for internal combustion engine vessels, 129  
 Cunliffe, R. G., and Prof. A. Schwartz, on The corrugation of rails, 862  
 Hammond, W. H., on Application of electricity to railway-cab signalling, 1061  
 Diesel, Dr. Rudolph, on The Diesel oil engine and its industrial importance, particularly for Great Britain, 655  
 Duddell, W., on High-frequency currents, 862  
 Dyke, G. B., and J. A. Fleming, on The power factor and conductivity of dielectrics, 736  
 Eastland, W. H., and S. W. Melsom, on The behaviour of direct-current watt-hour meters, 914  
 Eck, Justus, on The illumination of printing works by electricity, 874  
 Fleming, J. A., and A. H. Dyke, on The power factor and conductivity of dielectrics, 736

**AUTHORS—continued.**  
 Frith, W. W., on Flashing-over in commutator machines, 484  
 Goody, H. E., on The trouble with the electric cooker, 664; on The engineer and the clerk—a study in relative values, 905  
 Hay, Chas. E., on The capacity of small condensers, 703; on A method of determining the distance of a partial disconnection in a submarine cable, 1063  
 Hibbert, W., on The efficiency of accumulators, 6  
 Highfield, J. S., on The transmission of electrical energy by direct current on the series system, 985, 1021  
 Holmes, H. H., on Electric cooking and electric cooking apparatus, 1033  
 Hooper, P. N., on The formation of deposit by transformer oils, 275  
 Hopkinson, Dr. Edward, and A. E. L. Chorlton, on The evolution and present development of the turbine pump, 279  
 Ingham, Edw., on Flue-gas explosions, 454  
 "Interested" on Various records in in central stations, 73; on Index to articles in the technical press, 317; on Figures indispensable to municipal electricity works, 883  
 Jackson, J. W., on Notes on power station working, 695  
 Johnson, George, on Proposed bankruptcy regulations, 720  
 Kapp, Prof. Gisbert, on Magnetic apparatus for testing endurance, 49  
 Kershaw, J. B. C., on Copper: its present position as regards production and price, 732  
 Kingsbury, A. Neave, on Notes on central-station practice, 362  
 Lackie, W. W., on Tariffs for electrical energy, 522  
 Lees, S., on Packing armatures for rail conveyance, 181; on The fetish of "boiler insurance," 329  
 Leese, John S., on Notes on cleaning Babcock & Wilcox boilers, 526; on Electric ignition in internal-combustion engines, 611  
 Leigh, John Geo., on Electric power for the Panama Canal, 45, 116, 124, 282  
 Long, F. M., on The cooking load from the supply point of view, 1034  
 Lustgarten, J., on High-tension porcelain line insulators, 776  
 Maceall, W. T., on The inter-relation of capacity in three-phase three-core cables, 996  
 Macfarlane, J. C., and H. Burge, on The supply and transmission of power in self-contained road vehicles and locomotives, 534  
 Mackenzie, J. D., on Illumination: production, calculation, measurement, 873  
 Manktelow, W., on Wood and concrete poles in electrical service, 193, 203; on Birds and high-tension lines, 943  
 Matthews, R. Borlase, on Some second thoughts on publicity, 693; on Electric cooking and the I.M.E.A., 1036  
 May, J. Horsnell, on Notes on the chemistry of the lead cell, 85  
 Melsom, S. W., and W. H. Eastland, on The behaviour of direct-current watt-hour meters, 914  
 Morgan, J. D., on Dynamos for motor road vehicle lighting, 281  
 Mountain, W. O., on Electric haulages in mines, 537  
 Myers, C., on Electrical furnaces, 696  
 Newland, A., on Highland water power, 874  
 "Outsider, An," on Domestic lighting and heating, 995  
 Pannell, E. V., on The characteristics of copper and aluminium overhead line conductors, 771, 815  
 Parrott, H. L., and C. E. Best, on Brazil: its present conditions and the possibilities for future commercial relations with Great Britain, 83

**AUTHORS—continued.**  
 Pensabene-Perez, N., on An Automatic starting device for asynchronous motors, 26, 49  
 Pohl, Dr. Robert, on Notes on standards for electrical machinery, 37  
 Powell, S. M., on Wireless telegraphy in horology, navigation and cartography, 564; on A direct-reading wave meter, 945  
 Rankin, R., on Automatic reversible battery boosters, 402  
 Rapier, C. V., on Copper buying and drawing: the economy of the draw-bench, 884  
 Rawlings, W. R., on Private house lighting by electricity, 917  
 Rayner, E. H., on High-voltage tests and energy losses in insulating materials, 443  
 Robertson, David, on Electrical meters on variable loads, 916  
 Rogers, Walter E., on Notes on renewing tubes in Babcock & Wilcox boilers, 245  
 Sayers, J., on The use of electricity for the control of railways, 113  
 Schwartz, Prof. A., and R. G. Cunliffe, on The corrugation of rails, 862  
 Scott, E. Kilburn, on Standards for electrical machinery, 77; on Combined irrigation and hydro-electric schemes, 963  
 Seabrook, A. H., on Residence tariffs, 129  
 Sells, Fred. S., on Specifications, 446  
 Shaw, John, on Electric driving in textile factories, 403  
 Solomon, M., on Yellow flame arcs, 819  
 Sower, W. J. U., on The Diesel engine from the user's standpoint, 870  
 Spalding, P. A., on Small electricity supply undertakings, 50  
 Stansfield, Jos. J. H., on National insurance: with special reference to the electrical industry, 615  
 Starr, David D., on Power generation and distribution in the Clyde Valley, 1664  
 Stelling, Adolph R., on The transport of modern large units of machinery, 953  
 Symons, Harold D., and Miles Walker, on Heat paths in electrical machinery, 195  
 Tappley, M., on Electricity supply in London and New York, 163  
 Taunton, H. R., on A lamp-testing board, 7  
 Thompson, H. F. J., on Street lighting, 83  
 Thornton, Prof. W. M., on The ignition of coal-dust by electric flashes, 537  
 Tomlinson, T., on Peat as engine fuel, 483  
 Toone, C., on Volume changes in accumulator electrodes, 481; on The cost of train lighting, 705  
 Turnbull, C., on Reversible boosters, 419  
 Wagner, J., on Rating of cables, 921  
 Walker, Miles, and H. D. Symons, on The heat paths in electrical machinery, 195  
 Walton, J., and A. E. Brewerton, on Wages systems, 981  
 Webber, Harry, on Electricity supply at Keighley, 18  
 "Whistlefield," on Simply made electric heaters and hot cupboards, 7; on The indirect lighting of rooms, 954  
 Wilkinson, George: presidential address, I.M.E.A., 991  
 Willis, R. H., on The mechanical design of electrical plant usually found in collieries, 321  
 Wordingham, C. H., on Some thoughts on publicity, 802  
 "X. Y. Z., on Some considerations of detail in the design of electricity meters, 743  
**Automatic reversible battery boosters**, by R. Rankin, 402  
**Auvert-Ferrand rectifier**, An electric locomotive with the, 859



Auxiliary machinery for internal combustion engines, vessels, by W. R. Cummins, 129  
 "Avenue" Exchange, The new, 102  
 Aviation, Wireless telegraphy and, 698  
 Award, L.C.C., London United Tramways, 427

**B**ABCOCK & Wilcox boilers, Notes on cleaning, by John S. Leese, 526  
 " and Wilcox boilers, Notes on renewing tubes in, 245  
 Baking, Electric, 218  
 Ball, Electrical Engineers', 218  
 " Midlands Electrical Engineers', 107

Bankruptcy legislation, Proposed, by George Johnson, 720  
 " proceedings, 12, 56, 94, 136, 172, 211, 252, 298, 376, 419, 581, 619, 676, 714, 755, 793, 835, 924, 960, 1001, 1043  
 Banks in Germany, Electrical, 107  
 Battery, An electric motor-car with Edison storage, 455  
 " cars for London, Edison, 826  
 " sub-station plant at Hucknall Colliery, A, by G. C. Allingham, 99  
 " The Benkö primary, by W. R. Cooper, 37

Batti-Wallahs' Society, The, 682  
 Belgium, Trade with, 906  
 Benevolent Fund, The B.E.A.M.A. and the Electrical Trades, 551  
 " Institution: Annual dinner of the Electrical Trades, 306, 342, 712  
 " Institution, Electrical Trades, 467, 511, 990

Benkö primary battery, The, by W. R. Cooper, 37

Bequest, Engineering, 891  
 to science, 972

Berlin, Motor-cabs in, 332

Bermondsey Council and the L.C.C., The, 428

Bill, The I.M.E.A., 990

Birds and high-tension lines, by Wm. Manktelow, 943

Board, A lamp-testing, by H. R. Taunton, 7

"Boiler insurance," The fetish of, by S. Lees, 329

Boilers, Big, 27

" Memorandum on steam, 66

" Notes on cleaning Babcock and Wilcox, by John S. Leese, 526

" Notes on renewing tubes in Babcock & Wilcox, 245

Bombay, Electrical engineers in, 402

" Electrical Trade Association, A, 885

Boosters, Automatic reversible battery, by R. Rankin, 402

" Reversible, by C. Turnbull, 412

Bothwell Castle Collieries, The electrical equipment of the Craighead and, 21

Böving water-turbine plants, Some recent, 547

Bradford, Railless traction at Leeds and, 492

Brazil: its present conditions and the possibilities for future commercial relations with Great Britain, by C. E. Best and H. L. Parrott, 83

Brazilian trade and finance, 834

Brewer's novel motor-lorry, A, 208

Briquetting plant, An electrically-operated, 405

British Association meeting, The Dundee, 344, 647

" Electrical and Allied Manufacturers' Association, 106, 238, 341, 551

" E.A.M.A. and the Electrical Trades Benevolent Fund, 551

" Engineers' Association and China, 782

" Insulated Engineering Society, 805

" made cables, 988

" manufacturers in Australia, 414

" trade abroad, 949

" trade with Russia, 11

" foreign plant, 825

Britisher abroad, The desire of the, 410

Building Exhibition, Manchester, 427

Bury, New power station at, 239

Buses, Petrol-electric, 349

Bust of Lord Kelvin to the I.E.E., Presentation of, 845

Buxton Lime Firms' quarries, Electrical plant at the, 59

Buying and drawing: the economy of the draw-bench, Copper, by C. V. Rapier, 884

CABLE, A method of determining the distance of a partial disconnection in a submarine, by Chas. E. Hay, 1063

" A 60,000-volt railway, 208

" and wire manufacturing in Japan, 136

" factories, Woolwich and Gravesend, W. T. Henley's Telegraph Works Co.'s, 800

"

"

"

"

"

"

"

"

"

"

"

"

"

Cable suspension in a coal mine, 467

" Syndicate, Austrian, 793

" The new French telephone, 417

Cables, British and foreign tenders for, 1044

" Rating of, by J. Wagner, 921

" The inter-relation of capacity in three-phase three-core cables, by A. B. Clark, 532; by W. T. MacCall, 996

" when laid, A new method of testing high-pressure, 907

Cabs in Hamburg, 278

Calculator, A vector, by F. Addey, 156

Callender's Hospital Fund, 136

Campaign against labour union tyranny, A, 408

Canada, Business tour through, 756

" Conditions in, 1010

" Engineers' prospects in, 891

" Lighting plants wanted for, 460

" Municipal trading in, 531

" Notes from, 35, 73, 86, 126, 168, 245, 342, 349, 414, 574, 667, 705, 747, 753, 1010

" Rubber-covered wire for, 251

" Trade statistics of, 277

" Trade with, 701

" Western, 1043

Canadian contracts, Tendering for, 172

" market, Wanted: British fairness in the, 242

Canal, Electric power for the Panama, by John Geo. Leigh, 46, 116, 124, 232

Capacity in three-phase three-core cables, The inter-relation of, by A. B. Clark, 532; by W. T. MacCall, 996

" of small air condensers, The, by Chas. E. Hay, 703

Capital, Payment of dividend out of, 491

Carbons for Spain, 136

Cell, Notes on the chemistry of the lead, by J. H. May, 85

Census of production, The, 185

Central London Railway, The Ozonair plant of the, 785

" station practice, Notes on, by A. Neave Kingsbury, 362

" stations, Various records in, by "Interested," 73

Characteristics of copper and aluminium overhead line conductors, The, by E. V. Pannell, 771, 615

Chilian State Railways, Proposed electrification of the, 453

Chemistry of the lead cell, Notes on the, by J. H. May, 85

Chile hydro-electric concession, A, 714

China awake, 43

" The British Engineers' Association and, 782

Chinese cotton mill, A, 143

Cinematograph supplies, Motor-generators for, 704

CITY NOTES—

Aberdeen Suburban Tramways Co., 351, 397

A.E.G. in South America, 812

Airdrie and Coatbridge Tramways Co., 513

Alderley and Wilmslow Electric Supply, 596

Allen, Edgar, & Co., 597

Alley & MacLellan, 386

Allis-Chalmers Co., 147

Altrincham Electric Supply Co., 811

Aluminium Corporation, 1014

Anglo-American Telegraph Co., 183, 596

" -Argentine Tramways Co., 556, 596, 649

" -Portuguese Telephone Co., 685

Arbroath Electric Light and Power Co., 651

Aron Electricity Meter, 1017, 1051

Ascot District Gas and Electricity Co., 351

Auckland Electric Tramways Co., 768

Austria, 471, 766

Austrian Bergmann Works, 764

" Manufacturing Works, 855

Babcock & Wilcox, 596, 651

Barnsley and District Electric Tramways Co., 1014

Bastian Meter Co., 352

Bath Electric Tramways, 311, 353

Belgium, 187, 351, 471, 651, 687, 723, 793, 814, 1052

Berlin Elevated and Underground Railway, 553

Birmingham and Midland Tramways Co., 934, 974

Blackpool and Fleetwood Tramroad Co., 147

Bombay Electric Supply and Tramways Co., 1016

Bournemouth and Poole Electricity Supply Co., 309, 397, 472

Brazilian Amalgamation, 1055

Brisbane Electric Tramways Investment Co., 724, 765, 851

Bristol Tramways and Carriage Co., 223, 309

British Aluminium Co., 515, 555

" Columbia Electric Railway Co., 109, 648

" Electric Traction Co., 109, 648, 974, 1015, 1054

" Electric Transformer Co., 894, 435

" Engine, Boiler and Electrical Insurance Co., 309, 897

" Insulated and Helsby Cables, 430, 475, 553

" L. M. Ericsson Manufacturing Co., 303, 351

" Thomson-Houston Co., 723, 808

CITY NOTES—continued.

British Westinghouse Electric and Manufacturing Co., 724, 765, 810

Bromley (Kent) Electric Light and Power Co., 514

Brompton and Kensington Electricity Supply Co., 309, 431, 472

Browett, Lindley & Co., 515

Bude Electric Supply Co., 594

Bruce Peebles & Co., 268, 309, 354

Calcutta Electric Supply Corporation, 269, 431, 513, 686, 725, 714, 811, 935

" Tramways Co., 649, 726

Callender's Cable and Construction Co., 553, 684, 765

Cambridge Electric Supply Co., 268, 434

Canadian and American Westinghouse Companies, 648

" General Electric Co., 442, 554, 975

Cape Asbestos Co., 894

Carlisle Electric Tramways Co., 594

Castner-Kellner Alkali Co., 852

Central Electric Supply Co., 223

" London Railway Co., 186, 227, 270

Charing Cross, West-End and City Electricity Supply Co., 895, 433

Chatham and District Light Railways Co., 186, 809

Chelsea Electricity Supply Co., 270, 355, 392

Chile Telephone Co., 69

Chiswick Electricity Supply Corporation, 853

City and South London Railway Co., 109, 147, 186

" Electric Light Co. (Brisbane), 688

" of Buenos Ayres Tramways Co. (1904), 223, 269, 311, 724

" of Birmingham Tramways Co., 809

" of London Electric Lighting Co., 309, 395, 474

Cleveland and Durham County Electric Power Co., 1052

Clontarf and Hill of Howth Tramroad Co., 188

Colombo Electric Trams and Lighting Co., 725

Commonwealth Edison Co., 513

Companies struck off the Register, 1052

Company registrations in 1911, 223

Consolidated Gas, Electric Light and Power Co., of Baltimore, 935

Continental, 386

Cork Electric Tramways and Lighting Co., 597, 727

County of Durham Electrical Power Distribution Co., 386, 475, 554

" of London Electric Supply Co., 355, 396, 434

Craigpark Electric Cable Co., 724, 807

Crossley Bros., 268, 309

Cuba Submarine Telegraph Co., 724, 806

Cuban Telephone Co., 433

Davis & Timmins, 386

Delhi Electric Tramways and Lighting Co., 852

Deutsch-Atlantische Telegraphen Gesellschaft, 724

Diesel Engine Co., 474, 557

Direct Spanish Telegraph Co., 434, 513

" United States Cable Co., 147, 597, 1014, 1052

Dorman, Long & Co., 809

Doulton & Co., 895

Dublin and Lucan Electric Railway Co., 310

" United Tramways, 109, 188, 268

Dudley, Stourbridge and District Electric Traction Co., 764

Dundee and Broughty Ferry and District Tramway Co., 147

East London Railway Co., 109

Eastern Extension, Australasia and China Telegraph Co., 724, 808, 1054

" Telegraph Co., 764, 767, 849

Edmundson's Electricity Corporation, 186, 1015, 1051

Egypt, 934

Electric and General Investment Co., 975, 1017, 1052

" Construction Co., 146

" Supply Corporation, 766, 807

Electrical Distribution of Yorkshire, 270

Evered & Co., 515

Falkirk Electric Construction Syndicate, 355

Farnham Gas and Electricity Co., 269

Felton & Guillaume Co., 895

Fife Tramway, Light and Power Co., 269

Financial transactions on the Continent, 386

Folkestone Electricity Supply Co., 514, 695

France, 69, 471, 511, 553, 619, 651, 687, 854, 974

Freemantle (W.A.) Tramways and Electric Lighting Board, 29

French and Italian Thomson-Houston Companies, 854

" Compagnie Générale d'Electricité, 109

Galloways, 475, 866

Gateshead and District Tramways Co., 435, 513

General Electric Co., 1053

" Electrolytic Parent Co., 312

German electrical companies, 515, 650, 725, 844, 933

CITY NOTES—continued.

German-Netherlands Telegraph Co., 650

Germany, 69, 514, 727, 854, 974, 1052

Giant's Causeway and Portrush Electric Tramway Co., 355

Globe Electric Co., 1050

" Telegraph and Trust Co., 386, 975, 1014

Glover, W. T., & Co., 435

Great Northern and City Railway Co., 190, 223

" Telegraph Co., of Denmark, 595, 724, 764, 810



## CITY NOTES—continued.

National Telephone Co., 29, 68, 434  
 Neuhansen Aluminium Industry Co., 725  
 New General Traction Co., 934  
 Newcastle and District Electric Lighting Co., 471, 554  
 " upon-Tyne Electric Supply Co., 856, 471, 557  
 Newmarket Electric Light Co., 474  
 North Metropolitan Electric Power Supply Co., 695  
 " Metropolitan Electrical Power Distribution Co., 352, 392  
 " of Scotland Electric Light and Power Co., 512  
 " Wales Power and Traction Co., 69  
 Northallerton Electric Light and Power Co., 397  
 Northampton Electric Light and Power Co., 269, 355  
 Northwich Electric Supply Co., 809  
 Norwegian Hydro-Electrical Nitrate Co., 188  
 Notting Hill Electric Lighting Co., 358, 431  
 Official announcements *re* companies, 355, 595, 186, 855  
 Oldham, Ashton and Hyde Electric Tramway Co., 811  
 Oriental Telephone and Electric Co., 556, 650, 726  
 Oxford Electric Co., 355, 471  
 Paisley District Tramways Co., 271, 351  
 Para Electric Railways and Lighting Co., 808, 394  
 Paris Metropolitan Railway, 895  
 Parsons Marine Steam Turbine Co., 188  
 Penarth Electric Lighting Co., 894  
 Pennsylvania Water and Power Co., 271  
 Peterborough Electric Traction Co., 687  
 Potteries Electric Traction Co., 515, 555  
 Provincial Tramways Co., 1014  
 Puebla Tramway, Light and Power Co., 514, 556  
 Pullford Bros., 1055  
 Rand Mines Power Supply Co., 515  
 Rangoon Electric Tramway and Supply Co., 687, 767  
 Reading Electric Supply Co., 595  
 Rees Roturbo Manufacturing Co., 430  
 Rio de Janeiro Tramway, Light and Power Co., 29, 513, 852, 1052  
 River Plate Electricity Co., 687, 767  
 Robey & Co., 518  
 Rothesay Tramways Co., 513  
 Russian A.E.G. Co., 227  
 Ruston, Proctor & Co., 896  
 St. James' and Pall Mall Electric Light Co., 147, 227, 269  
 Salisbury Electric Light & Supply Co., 475, 513  
 Sao Paulo Tramway, Light and Power Co., 355, 436  
 Scarborough Electric Supply Co., 308, 432  
 Shanghai Electric Construction, 806, 845, 855  
 Shawinigan Water and Power Co., 29  
 S. & H. Co., in Russia, 855  
 Siemens and Schuckert companies, The, 110  
 " Bros. & Co., 975  
 Slough and Datchet Electric Supply Co., 431  
 Smithfield Markets Electric Supply Co., 187, 226, 268  
 South London Electric Supply Corporation, 227, 481, 473  
 " Metropolitan Electric Light and Power Co., 227, 809, 351, 392, 430, 557  
 " Metropolitan Electric Tramways and Lighting Co., 895  
 " Staffordshire Tramways (Lessee) Co., 808  
 " Wales Electrical Power Distribution Co., 473  
 Southport Tramways Co., 554  
 Spanish and General Wireless Trust, 855  
 Stewarts & Lloyds, 432, 852  
 Stock Exchange notices, 29, 69, 109, 147, 187, 227, 270, 310, 356, 386, 435, 515, 556, 597, 686, 725, 764, 855, 895, 935, 975, 1014, 1053  
 Stone, J., & Co., 935  
 Stratford-on-Avon Electricity Co., 807  
 Submarine Cables Trust, 850  
 Sunderland District Electric Tramways, 29, 1014  
 Swedish telephone companies, 975  
 Switzerland, 69, 351, 649, 687, 854, 894  
 Telegraph Construction and Maintenance Co., 272, 354, 432  
 Telephone Co. of Egypt, 651  
 Traction and Power Securities, 935  
 Trafford Power and Light Supply, 1055  
 Tramways and General Works Co., 726  
 Tynemouth and District Electric Traction Co., 649  
 Tyneside Electrical Development Co., 308  
 " Tramways and Tramroads Co., 911  
 Underground Electric Railways Co. of London, 69, 189, 271, 350, 473, 553  
 United Alkali Co., 356  
 " Electric Tramways of Montevideo, 976, 1016  
 Urban Electric Supply Co., 188, 224, 351, 513, 851, 893  
 Vera Cruz Electric Light, Power and Traction Co., 430, 515, 551

## CITY NOTES—continued.

Vickers, 435, 514  
 Victoria Falls and Transvaal Power Co., 518, 687, 894, 935  
 Vulcan Boiler and General Insurance Co., 369, 1014  
 Waste Heat and Gas Electrical Generating Stations, 853, 395  
 Waygood, R., & Co., 1017, 1052  
 Wemyss and District Tramways Co., 513  
 West African Telegraph Co., 765, 854  
 " Coast of America Telegraph Co., 811  
 " India and Panama Telegraph Co., 764, 853  
 " London and Provincial Electric Supply Co., 764, 854  
 Western Electric Co. (U.S.A.), 227  
 " Telegraph Co., 386, 433, 764, 853, 975  
 Westinghouse Electric Co. (U.S.A.), 1055  
 Westminster Electric Supply Corporation, 186, 308, 392  
 White, J. G., & Co., 1014  
 Windermere and District Electricity Supply Co., 650  
 Windsor Electrical Installation Co., 435, 557  
 Winnipeg Electric Railway Co., 473, 1052  
 Woking Electric Supply Co., 976  
 Wolverhampton District Electric Tramways, 766  
 Yorkshire Electric Power Co., 226, 350  
 " (West Riding) Electric Tramways Co., 146, 1014  
 Civil Engineers' Appointments Board, The, 306  
 Civils and the consulting engineer, The, 201  
 Cleaning Babcock & Wilcox boilers, Notes on, by John S. Leese, 526  
 Clerk—a study in relative values, The engineer and the, by H. E. Goody, 905  
 Clock installations, Electric, 692  
 Clocks, Electric, 968  
 " for Southport, Public, 669  
 " Hotel with 200 electric, 621  
 " Synchronome, 172  
 Club for Manchester, Engineers', 1011  
 Clyde Valley, Power generation and distribution in the, by David A. Starr, 1064  
 Coal-dust by electric flashes, The ignition of, by W. M. Thornton, 537  
 " -mine, Gas direct from the, 571  
 " strike, The, 342, 369, 882, 419, 429, 450, 461, 489, 569, 930  
 " supply, Electricity and, 891  
 " supply, L.C.C., 168  
 Coalite, 571  
 Coating iron with lead, 540  
 Coefficient and resistivity, Temperature, 27  
 Collieries, The electrical equipment of the Craighead and Bothwell Castle, 21  
 " Electricity in Westphalian, 733  
 " The mechanical design of electrical plant usually found in, by R. H. Willis, 321  
 Colliery, A battery sub-station plant at Hucknall, by G. C. Allingham, 99  
 " explosion, 841  
 Colonial references, by "Colonial," 501  
 " tariffs on electrical goods, Foreign and, 120, 200, 487, 527, 568, 739, 948  
 Combined irrigation and hydro-electric power schemes, by E. K. Scott, 903  
 Combustion-engined vessels, Auxiliary machinery for internal, by W. R. Cummins, 129  
 Commercial co-operation, 161  
 " men, Foreign languages for, 671  
 Commission, International Electro-technical, 305  
 Commutator machines, Flashing-over in, by W. W. Frith, 484  
 Company? Council or, by "Change-Over," 459  
 Compass, A radio-telegraphic, 912  
 Compensation money, The waste of, 990  
 Competition, Agricultural machinery, 567  
 " in Germany, 870  
 " Prize, 25  
 Completion of works in time, 944  
 Compulsory arbitration in trade disputes, 409  
 " working of patents, The, 571  
 Concentration in Germany, 703  
 Concrete poles in electrical service, Wood and, by W. Manktelow, 193, 203  
 Condensation in steam cylinders, Initial, 23  
 Condensers in series with metal-flament lamps, by A. W. Ashton, 983  
 " on alternating - current lighting circuits, The use of, by A. W. Ashton, 928  
 " The capacity of small, by Chas. E. Hay, 703  
 Condensing plant, 55  
 Conditions of contract, 242

Conductivity of dielectrics, On the power-factor and, by J. A. Fleming and G. B. Dyke, 736  
 Conductors, The characteristics of copper and aluminium overhead line, by E. V. Pannell, 771, 815  
 Congress of Applied Chemistry, International, 908  
 Construction and characteristics of the Neon lamp, 231  
 Consular notes, 91, 135, 211, 251, 713, 833, 884, 957  
 Consulting engineer, The Civils and the, 201  
 " engineers and etiquette: a dead letter, 122  
 " Engineers, The Association of, 41, 67, 82, 141, 144, 184, 201  
 Consumer, The domestic, 490  
 " The I.E.E. and the domestic, 411  
 Continuity of supply, Means for securing liability and maintaining, by Frank Ayton, 992  
 Continuous-current motors with commutating poles and cast-iron magnets, by J. W. Burleigh, 4  
 Contract conditions for Pretoria, 220  
 " Conditions of, 248  
 " L.C.C. conditions of, 184  
 " prices without the engineers' certificate, Recovery of, 817  
 " to supply motive power in New South Wales, A, 202  
 Contractor and the Municipality, The, 326  
 Contractors' Association dinner, Dublin Electrical, 259  
 " Association (Inc.), The Electrical, 1011  
 " Fair play for, 327  
 " in Germany, Installation, 1049  
 Contracts and labour clauses, Foreign, 211

## CONTRACTS (CLOSED)—

Aberbeeg (Mon.), 178  
 Aberdare, 509  
 Accrington, 216, 586, 929, 556  
 Admiralty, 645  
 Altrincham, 304  
 Ashford, 1048  
 Ashton-under-Lyne, 304, 340, 465, 586, 645, 799, 841  
 Atherton, 586  
 Australia, 105, 140, 178, 257, 425, 509, 586, 679, 760, 799, 841, 929, 1005  
 Aylesbury, 679  
 Bacup, 304, 491  
 Barking, 929  
 Barnsley, 140, 966, 1005  
 Barrow, 65, 140, 586  
 Batley, 718  
 Battersea, 258, 546, 761  
 Bedford, 65, 586, 841, 966, 1006  
 Belfast, 381, 545, 718, 966  
 Belgium, 24, 216, 304, 340, 381, 425, 929, 966, 1006, 1048  
 Bermondsey, 304, 466, 591, 761  
 Bexhill-on-Sea, 760  
 Binsley Colliery, 140  
 Birkenhead, 426, 591, 1006  
 Birmingham, 216  
 Blackburn, 426, 591  
 Bolton, 65, 216, 545, 718, 929  
 Bootle, 591, 760, 966  
 Bradford, 105, 257, 545  
 Bransby, 966  
 Bridlington, 718  
 Brighton, 381, 1048  
 Bristol, 216, 257, 341, 760, 799  
 British Columbia, 341  
 Broadstairs, 204  
 Bromley (Kent), 381, 465  
 Buenos Ayres, 65  
 Burnley, 65, 178, 216, 426, 760  
 Burton-on-Trent, 257, 760  
 Bury, 426  
 Buxton, 799  
 Cannock, 760  
 Cape Town, 65  
 Chester, 890  
 Chesterfield, 105, 465  
 City, 381  
 Clacton-on-Sea, 645  
 Clayton-le-Moors, 65  
 Cleckheaton, 799  
 Clifton, 799  
 Colchester, 258  
 Constantinople, 718  
 Coventry, 381, 890  
 Croydon, 65, 465, 509, 645, 718  
 Dartford, 216, 966  
 Derby, 24, 718, 929  
 Devonport, 591, 799  
 Dewsbury, 24, 258  
 Douglas, 216  
 Dublin, 381  
 Dundalk, 304  
 Dundee, 760  
 East Ham, 966  
 Eastbourne, 381, 929  
 Eccles, 881  
 Edinburgh, 929  
 Epsom, 545, 1048  
 Erith, 1048  
 Eton, 178  
 Falkirk, 929  
 Faversham, 140  
 Felixstowe, 65, 966  
 Fleetwood, 645  
 France, 465, 679  
 Frankton (N.Z.), 304  
 Fremantle, 178  
 Fulham, 304, 466, 1006  
 Galway, 929  
 Germany, 24, 966  
 Gibraltar, 304  
 Glasgow, 65, 178, 258, 881, 591, 646, 718, 760, 799, 929, 971, 1006, 1048

## CONTRACTS CLOSED—continued.

Gloucester, 591  
 Government contracts, 140, 34, 465, 920, 841, 1045  
 Gravesend, 718, 799  
 Grays Thurrock, 261  
 Great Yarmouth, 465  
 Greenwich, 645  
 Grimsby, 929  
 Halifax, 24, 509, 718  
 Hammersmith, 15, 178, 426, 929, 1045  
 Haslingden, 24, 381  
 Hastings, 571  
 Hereford, 253  
 Hertford, 841  
 Hindley, 1066  
 Hornsey, 304, 466  
 Horsham, 381, 941  
 Hounslow, 929  
 Huddersfield, 718  
 Hull, 718, 760, 1043  
 Ilford, 545  
 India, 841  
 Ipswich, 178  
 Irlam, 24  
 Isle of Thanet, 616  
 Islington, 341, 929  
 Keighley, 331, 466  
 Kingston-on-Thames, 381  
 Kirkcaldy, 591  
 Leeds, 509  
 Leek, 890  
 Lerdon and Winstree, 426  
 Leyton, 381, 545, 760, 929  
 Liverpool, 426, 761, 929  
 Llandaff and Dinas Powis, 1043  
 London, 65, 105, 140, 178, 216, 253, 304, 341, 381, 426, 466, 509, 545, 591, 646, 680, 719, 761, 799, 841, 890, 929, 971, 1006, 1043  
 " County Council, 140, 217, 304, 331, 466, 546, 719, 841, 1006, 1043  
 Londonderry, 646  
 Louth, 216  
 Lowestoft, 105, 646  
 Manchester, 426  
 Mansfield, 890, 1005  
 Marylebone, 105, 466, 761  
 Mersey, 216  
 Merthyr Tydfil, 509  
 Montevideo, 971  
 Morley, 971  
 Neath, 381  
 New South Wales, 509  
 Newcastle-on-Tyne, 761  
 " -under-Lyme, 761, 799, 971  
 Newport (Mon.), 105, 341, 426  
 North Riding, 719  
 Northampton, 216, 546, 679, 930  
 Norway, 341  
 Norwich, 105, 304, 1043  
 Nuneaton, 799, 930  
 Ocker Hill power station, 341  
 Pacific Cable Board, 591  
 Perth, 216, 679  
 Plymouth, 304, 1043  
 Pontypridd, 680  
 Poplar, 141, 217, 545, 890, 1043  
 Portsmouth, 173, 719  
 Post Office, 217  
 Preston, 173  
 Queensland, 586  
 Raasay iron mines, 341  
 Rand, The, 930  
 Rawtenstall, 304  
 Reigate, 65  
 River Plate, 253, 841, 890  
 Rochdale, 258  
 Rotherham, 258, 799  
 Roumania, 680  
 Royal Mail Steam Packet Co., 1043  
 Rugby, 341  
 Runcorn, 1006  
 St. Pancras, 680, 799  
 Salford, 24, 381, 592, 719, 930  
 Sheffield, 65, 253, 426, 646, 761, 971  
 Shoreditch, 304, 466, 761, 930  
 Siam, 719  
 Slough, 381  
 South Africa, 24, 381, 466, 592, 930, 1048  
 " Australia, 257  
 Southampton, 217, 381, 466, 646, 680, 719, 841, 890, 1006  
 Southend-on-Sea, 341, 509, 680, 890, 1048  
 Southwark, 105, 178, 509, 799, 841, 959  
 Stafford, 646  
 Staffs., 217  
 Stalybridge, 24, 178, 341, 719  
 Stepney, 217, 304, 591, 719, 1018  
 Stockport, 65, 646, 761  
 Stoke Newington, 1043  
 Stoke-on-Trent, 258, 381, 761  
 Stoker contracts, 890  
 Stretford, 592  
 Sunderland, 304, 546  
 Sunningdale, 680  
 Swansea, 141, 592, 680  
 Swindon, 217, 680  
 Swinton and Pendlebury, 304  
 Sydney, 105, 509, 586, 841  
 Tasmania, 178  
 Taunton, 890, 1043  
 Tonbridge, 761  
 Torquay, 426, 799  
 Trim, 1048  
 Tunbridge Wells, 592  
 Victoria, 586  
 Walsall, 65, 646, 799, 971, 1006  
 Walthamstow, 719, 890  
 Warrington, 546  
 Waterloo, 466  
 Watford, 258, 592, 971  
 Wednesbury, 105, 646  
 West Bromwich, 304, 646, 799, 1006  
 " Ham, 341, 799, 971, 1043  
 " Hartlepool, 183, 592, 719  
 Whitby, 1006  
 Whitehaven, 466, 799  
 Wigan, 719



## CONTRACTS CLOSED—continued.

Wimbledon, 258, 761  
Winchester, 217  
Wolverhampton, 426, 680, 890  
Woolwich, 381, 509, 680, 799  
Worcester, 341, 381, 592  
Workshop, 178, 1006  
Worthing, 761  
Wrexham, 24, 546  
Yarmouth, 1048  
York, 24, 546, 761

## CONTRACTS (OPEN)—

Aberdare, 256, 803, 339, 380  
Aberdeen, 585  
Accrington, 424, 928  
Admiralty, 798  
Africa, 64  
Aldershot, 339  
Alford (Lines.), 965  
Ashton-in-Makerfield, 717  
" under-Lyne, 17, 177, 508, 585, 624  
Australia, 17, 98, 140, 177, 215, 256, 303, 339, 380, 424, 461, 508, 545, 585, 624, 679, 717, 759, 798, 840, 928, 1005, 1048  
Austria, 64, 98, 140, 177, 215, 425, 585, 624, 798, 965  
Barlborough (near Chesterfield), 717, 1048  
Barnes, 889  
Barrow-in-Furness, 339  
Batley, 464  
Battersea, 216, 257, 760  
Beckenham, 177, 215  
Bedford, 624, 965  
Bedlington, 840  
Belfast, 140, 177, 203, 380, 798, 889  
Belgium, 17, 64, 98, 140, 177, 215, 380, 425, 624, 759, 840, 928  
Belgrade, 98  
Bermondsey, 140  
Bethnal Green, 425  
Bettws-y-Coed, 798  
Birkenhead, 140, 177, 679, 1005  
Birmingham, 17, 303, 340, 380, 464  
Blackburn, 140, 1005  
Bohemia, 759  
Bolwar, 840  
Bolton, 215, 585  
Bosnia, 585  
Bournemouth, 177, 215, 257, 303  
Bradford, 257, 965  
Bray, 380, 585  
Brazil, 340, 380, 508, 1005  
Bridgend, 1048  
Bridlington, 965  
Brighouse, 380  
Brighton, 718  
Bristol, 64, 140, 177, 215, 257, 425, 679, 840  
British Columbia, 928  
Briton Ferry, 928  
Buenos Ayres, 840, 889  
Bulgaria, 64, 98, 140, 340, 508  
Burma, 464  
Burnley, 17  
Burton-on-Trent, 64  
Bury, 928, 1048  
Caerphilly, 508  
Canada, 257, 303, 340, 380, 425  
Cape Town, 425, 464, 586, 679  
Cardiff, 177, 215, 257, 425  
Carlisle, 380  
Cheltenham, 98  
Chichester, 1048  
Clacton-on-Sea, 965  
Cleckheaton, 840  
Constantinople, 679, 718  
Coventry, 215  
Croydon, 17, 215, 257, 928  
Darlington, 965  
Dartford, 17  
Derby, 718, 1048  
Devonport, 257, 798, 889  
Dewsbury, 718, 889, 965  
Dover, 303, 340  
Dublin, 17, 64, 98, 215, 257, 303, 508, 718, 928  
Dumfries, 840  
Dundalk, 1048  
Dundee, 303, 340, 679  
Edinburgh, 425, 718, 759, 965  
Edmonton, 340, 380  
Egypt, 840, 798  
Epsom, 140, 798  
Exeter, 64  
Exminster, 965  
Falkirk, 645, 679  
Felxstowe, 586  
France, 340, 380, 425, 508, 718, 798, 928  
Fulham, 178, 798  
Germany, 257, 380, 545, 759, 889  
Gillingham, 380, 1005  
Glasgow, 177, 340, 645, 679, 840, 1005  
Gloucester, 257, 718  
Govan, 425  
Gravesend, 645  
Grays, 928  
Great Central Railway, 303  
Greece, 380  
Grimsby, 17, 679, 965  
Hackney, 645, 798  
Halifax, 64, 98, 177, 215, 425, 718, 1005  
Hammersmith, 17, 178, 216, 586, 760, 966  
Heston and Isleworth, 257, 645  
H.M. Office of Works, 215, 425, 509  
Hopfgarten, 105  
Hornsey, 17, 64, 257, 340, 840  
Hoylake and West Kirby, 303, 340, 645, 889  
Huddersfield, 718, 840  
Hull, 966  
Hungary, 215, 257, 303, 340, 508, 798, 928, 1005  
Ilford, 215  
Ipswich, 178, 215  
Islington, 17, 798, 966  
Italy, 64, 178, 586, 645, 760, 889  
Japan, 645

## CONTRACTS OPEN—continued.

Keighley, 840  
Kensington, 425  
Kimberworth, 718  
Kingston-upon-Hull, 380  
Kirkcaldy, 216  
Krakau, 508  
Lancaster, 679  
Leeds, 105, 216, 257, 545  
Leicester, 718  
Leigh, 718  
Leith, 380, 966  
Limerick, 465  
Lincoln, 586  
Lisbon, 586  
Liverpool, 380, 840  
London, 17, 64, 105, 140, 178, 216, 257, 303, 340, 380, 425, 465, 508, 545, 586, 645, 679, 760, 798, 840, 889, 928, 966, 1005, 1048  
" County Council, 64, 105, 140, 303, 380, 425, 509, 545, 679, 1005, 1048  
Manchester, 17, 140, 178, 216, 257, 303, 340, 509, 679, 718, 760, 798, 840, 889, 966, 1048  
Margate, 303, 840  
Marylebone, 303  
Melbourne, 17, 98, 140, 177, 215, 256  
Merthyr Tydfil, 340, 380  
Metropolitan Asylums Board, 465  
" Water Board, 465  
Middletown, 889  
Morocco, 105, 178  
Neath, 1005  
New South Wales, 17, 98, 585, 759, 798, 1005, 1048  
" Zealand, 17, 140, 178, 216, 257, 303, 340, 381, 425, 1005  
Newcastle-on-Tyne, 679, 928, 966, 1005  
" under-Lyne, 679  
Newport, 257, 303, 340  
Norway, 803, 465  
Nottingham, 303, 340, 465  
Nuneaton, 17, 718  
Oldham, 257, 889  
Penrhiwceiber (Glam.), 889  
Pilsen, 509  
Partick, 465  
Pembroke, 718  
Plymouth, 17, 966  
Pontypridd, 216, 889  
Poplar, 178, 257, 840, 889  
Portsmouth, 178, 966  
Portugal, 105  
Prague, 17, 105, 509  
Queensland, 425, 464  
Radcliffe, 17  
Rawtenstall, 509  
Rhodesia, 216, 340, 425  
Rhonda, 966  
Rhyll, 105  
River Plate, 889, 966  
Rochdale, 178, 303, 340, 760, 798, 928  
Rosario, 425  
Rosslynlee, 465  
Rotherham, 17, 64, 718, 760, 966, 1005, 1048  
Roumania, 24, 65, 140, 340  
Rugby, 216  
Russia, 425, 545, 889  
St. Pancras, 216, 465, 928  
Salford, 303, 381, 425, 586, 760, 889, 1005  
San Francisco, 586  
Serbia, 65  
Shanghai, 465  
Sheffield, 216, 340, 966  
Shoreditch, 140  
Siam, 24, 340  
South Africa, 381, 586, 799, 1048  
" Australia, 425, 464, 798, 840, 928, 1005, 1048  
" Shields, 340  
Southampton, 303  
Southend-on-Sea, 140, 178, 586  
Southwark, 340  
Spain, 65, 105, 340, 381, 465, 509, 545, 679, 760, 799, 840, 889, 966, 1005, 1048  
Stepney, 64, 257, 966  
Stockport, 840  
Stoke-on-Trent, 178, 1048  
Sunderland, 303, 966  
Swansea, 24, 303  
Sweden, 340, 889, 966  
Swindon, 303, 928  
Swinton (near Manchester), 465, 966  
Tasmania, 140, 545  
Taunton, 303  
Tonbridge, 425  
Tunbridge Wells, 65  
Turkey, 24, 545, 889  
Twickenham, 799  
Uruguay, 760  
Victoria, 256, 303, 339, 464, 508, 545, 624, 679, 717, 798, 840  
Vienna, 509  
Wallasey, 140  
Walsall, 509  
Walthamstow, 178, 881, 718, 799, 889  
Warlingham, 216  
Warrington, 257, 966  
West Ham, 65, 304, 718, 841, 966  
" Hartlepool, 425, 509  
Western Australia, 303, 339, 350, 425, 464, 759, 1005, 1048  
Weymouth, 1048  
Wigan, 425, 586  
Wolverhampton, 340  
Woolwich, 380  
Workshop, 799, 966  
Worthing, 966  
Wrexham, 257, 799  
York, 65, 465, 841

Contracts, Tendering for Canadian, 172  
Control of railways, The use of electricity for the, by J. Sayers, 113  
Convention, The Radio-Telegraphic, 909  
" 1912, The I.M.E.A., 260, 867, 991, 1032

## Conversations of the Arc Works Engineering Society, 762

The Royal Society, 784  
Cooker, The trouble with the electric, by H. E. Goody, 604  
Cookery demonstration, Electric, 460, 512  
Cooking and electric cooking apparatus, Electric, by H. H. Holmes, 1033  
" and heating, Electric, 81, 81  
" and the I.M.E.A., Electric, by R. Borlase Matthews, 1036  
" at Earl's Court, Electrical, 754  
" Economy of electric, 66  
" load from the supply point of view, The, by F. M. Long, 1034  
Co-operation, Commercial, 161  
Co-partnership, 866  
" The successes and failures of profit-sharing and, by Frank Broadbent, 452  
Copper, 219, 257, 428, 453, 510, 530, 593, 682, 870, 972  
" and aluminium, 783  
" and aluminium overhead line conductors, The characteristics of, by E. V. Pannell, 771, 815  
" buying and drawing: the economy of the draw-bench, by C. V. Rapier, 884  
" clad iron wire, The uses of, 940  
" extraction works, Electrical, 107  
" : its present position as regards production and price, by J. B. C. Kershaw, 732  
" market, The present position of the, 823  
" trade forecast, A, 533  
Cornwall, Electrical exhibition in, 342

## CORRESPONDENCE—

Advertising electricity, On, by F. W. Willcox, 745  
" methods, by "Disgusted," 865  
Applications for appointments, by "Anti-Canvasser," 305  
Arc lamp lowering gear, by "N. D. W.," 127; by The North-Western Electrical Appliance Co., 247  
Architects and engineers, by "Fair Play," 669  
Association of Consulting Engineers, The, by "Merely a Paying Member," 9; by Faithfull & Owen, 86; by "F. G. C.," 127; by W. Duddell, 165  
Bonus system, by "A. G. H.," 1037  
Branch office costs, by "Costissima," 48  
Capital and labour, by W. J. Webb, 48, 126; by "A Conscientious Worker," 86; by "Capitalist," 127; by "Assistant," 167  
Central station engineer, The, by "A. K.," 540  
Chilean concession, A, by Preece, Cardew & Snell, 786  
" railway electrification, by Enrique Cuevas, 512  
City and Guilds examinations and Easter holidays, by "d'Auvergne," 706  
Coal strike and tramways, by J. Pringle, 1038  
"Cole" code, The, by C. H. Cole, 47  
Colonial references, by "Near East," 612; by "Justice," 612; by "Rand," 786; by "Ex-Contract Men," 865; by "M.I.E.E.," 866  
Commercial Assistant, The, by "A Qualified Applicant," 787  
Constantinople telephone system, by S. J. Goddard, 498  
Cooking and heating, Electric, by Percy Good, 128  
Diesel engine trials, by Mirrlees, Bickerton & Day, Ltd., 498  
" engines, by A. J. Ryan, 48  
Disconnecting boxes, Cheap, by Arch. J. Howard, 128  
Domestic load, The, by "Onlooker," 745  
" uses of electricity, by W. E. Burnard, 865  
Drawn-wire tungsten lamps, by F. W. Willcox, 414  
E.A.C. automatic solenoid starter, by Frank Broadbent, 865  
Earthed concentric system, by "Earthed Outer," 126; by "C. H. W.," 166, 208; by Donald S. Munro, 166  
Earthing mains, by "Inquirer," 372, 498  
Economy of electric cooking, The, by G. C. Allingham, 87, 167; by R. Borlase Matthews, 167; by "F. R. O.," 167, 246; by C. Silver, 207; by Percy Good, 246  
Education of the engineer, The, by "A Mere Irishman," 575; by L. M. Jockel, 746  
Electric cooking and heating, by J. W. Meares, 972; by Percy Good, 467  
" cranes and hoists, by H. H. Broughton, 166; by "The Reviewer," 166  
" signs, by The Franco-British Electrical Co., 994  
" vehicle, The, by Harry E. Winter, 166; by The Electromobile Co., 206

## CORRESPONDENCE—continued.

Electrical profession as it is, The, by "Diogenes," 168, 332; by W. Ellerd-Styles, 208, 291; by "Inquirer," 247  
Electricity direct from the coalmine, by W. Geipel, 669  
" in the home, by J. W. Meares, 48  
" in the textile industries, by "Textiles," 48  
Engineer and the clerk, The, by "P. H.," 920  
Fraudulent tests, by "Modulus," 614; by "Pluto," 667; by "R. S. T. V.," 668  
Fuel economy and bonuses, by "A Central Station Manager," 427  
Gas tar as fuel, by Wm. C. Bexon, 540  
Gott v. Veritys, Ltd., by Ansell and Ashford, 613  
Ideal House, Olympia, by R. C. Fry, 706  
I.E.E. students and the new articles, by H. D. Steers, 706, 786; by Wm. T. Taylor, 721; by Adolf R. Stelling, 746; by "Struggling Stud., I.E.E.," 746  
"Imperial Telegraphic Communication," by Charles Bright, 47  
Indirect lighting, by "Resident Engineer," 995; by J. R. Parkinson, 1039; by J. H. Asdell, 1039  
Institution of Electrical Engineers, The, by "A.M.I.E.E.," 9  
Irish peat, by "Simon," 575  
Justice to Ireland, by E. N. Allan, 512  
Kingston Diesel engines, by "Your Correspondent," 247  
Large current at high frequency, by W. H. F. Murdoch, 498  
Limerick appointment, A, by "In the Know," 954  
Melbourne railways electrification, by "A Looker-On," 762  
Midland Electrical Exhibition, by Howard Foulds, 669; by A. Bruce Anderson, 746  
Minimum wage for electrical engineers, A, by P. Booker, 920  
"National Code" in Canada, The, by "Canuck," 995  
New articles of the I.E.E., by C. C. Garrard, 669  
Notes from Canada, by "W. H. B.," 614  
" on rheostats, by "D. C.," 872  
Objectionable clause, An, by "Fair-play," 920, 1038; by Percy D. Collins, 964, 1039; by W. J. Webb, 995  
Official returns, by the General Electric Co., Ltd., 127  
Old carbon ends and lamp caps, by "H.," 9; by J. H. Runnett, 87; by W. G. Mayer, 165  
Opal shades, by F. W. Willcox, 331  
Our progressing manufacturing firms, by "N. D. G.," 247, 372; by "Central Station," 332; by "Representatives," 372  
Preservation of poles, by Richard Wade, Sons & Co., 127  
Prevention of "steamy" shop windows, The, by A. Preston, 128  
Printing "Transactions," by A. J. Makower, 165  
Professional opening for talent, by "Engineer," 291  
Review of "Electric Mains," by J. R. Dick, 668; by "Your Reviewer," 668  
Small electrical exhibitions, by "R. H.," 46  
Some thoughts on "Some thoughts on publicity," by G. C. Law, 614  
Street lighting and pole construction, by P. J. Pringle, 872  
Strikes in Australia, by A. C. F. Webb, 871  
Suggestion to tramway managers and others, A, by L. J. Lepine, 165  
Tariffs for electrical energy, by A. J. Bridge, 540  
Telephone service, The, by R. B. Verney, 247  
Tests of metal-filament lamps, by F. W. Willcox, 575; by L. W. Wild, 613  
Trade with Canada, by W. E. Philbrow, 786; by T. W. Fairhurst, 1039  
Transformer design, by C. Franklin Tubbs, 126; by Alfred Hay, 414  
Wakelin Bros., Re, by Pinkerton and Sneddon, 342  
Want of co-operation in pushing electricity, The, by "Warwickshire," 745  
Warning to inventors and patentees, by Archibald J. Howard, 747  
Corrugation of rails, The, by Prof. A. Schwartz and R. G. Cunliffe, 862  
Cost of train lighting, The, by C. Toone, 705  
Council or company? by "Change-Over," 459  
Covenant, The restrictive, 702  
Craighead and Bothwell Castle Collieries, The electrical equipment of the, 21  
Crossley Bros.' dividend and labour troubles, 371  
Crucible work, Electricity for, 44  
Cultivation, Electrical method of, 521  
Curative properties of radium, 947  
Currents, Magnification of electric, 27  
Curtis turbo-alternator, 5,000-kw., 607  
Cylinders, Initial condensation in steam plates, 23



Cylinders, The temperature of gas-engine, 617

**D**AMPER for the prevention of telephone disturbances, A, 721  
Darkest Africa, In, (Johannesburg tenders), 881

Davis Electrical Co., 731

Dead letter, Consulting engineers and etiquette: A, 122

Degradation of accumulative energy, The, by A. G. Collis, 861

Denmark, Trade openings in, 1044

Deposit by transformer oils, The formation of, by P. N. Hooper, 275

Depreciation, 502

Design of electricity meters, Some considerations of detail in the, by "X. Y. Z.," 743

Desire of the Britisher abroad, The, 410

Dessau-Bitterfeld single-phase railway, The, 846

Detection of icebergs, 891

Development in industrial areas, Electrical, by L. Crouch, 74, 117

Developments in steam turbine practice, Recent, by K. Baumann, 317, 359

Notes on recent electric railway, 404

Dielectrics, On the power factor and conductivity of, by J. A. Fleming and G. B. Dyke, 736

Diesel engine from the user's standpoint, The, by W. J. U. Sowter, 870

engine manufacture, 341

engine, Notes on maintenance of the, 657

engine test, Long non-stop, 488

engines, 135, 870

engines, Light-weight, 784

oil engine and its industrial importance, particularly for Great Britain, by Dr. Rudolph Diesel, 655

plant at Kingston-on-Thames, New, 169

works at Ipswich, 1044

Dinner, Institution of Electrical Engineers: Annual, 219

Northampton Institute, 468

Staff, 26

The Electrical Trades Benevolent Institution annual, 306

The General Electric Co.'s annual, 258

to Prof. Unwin, Old students', 106, 296

to the Engineer-in-Chief of the Post Office, 681

Dinners, Annual, 343, 511

Direct-current on the series system, The transmission of electrical energy by, by J. S. Highfield, 985, 1021

watt-hour meters, The behaviour of, by S. W. Melsom and W. H. Eastland, 914

reading wave meter, A, by S. M. Powell, 945

Director and general manager, 123

Disconnection in a submarine cable, A method of determining the distance of a partial, by Chas. E. Hay, 1063

Dissolutions and liquidations, 13, 56, 92, 136, 386, 875, 461, 505, 681, 619, 713, 755, 833, 923, 1000, 1042

Distribution from metallic filament lamps, Improving the light, 904

Disturbances, A damper for the prevention of telephone, 721

Dividend out of capital, Payment of, 491

Domestic applications of electricity, The, 382

consumer, The, 490

consumer, The I.E.E. and the, 411

electricity, 427, 579, 697, 779

lighting and heating, by "An Outsider," 995

ménage, Electricity in the, 451

Dominions, Electrical law in the British, 244, 289, 830, 496, 562, 604

Drawing: the economy of the draw-bench, Copper buying and, by C. V. Raper, 884

Driving in a Keighley Mill, Electric, 1007

Dublin Electrical Contractors' Association dinner, 259

Duchy lighting monopoly, A, 564

Duddell-Mather wattmeters for measuring dielectric losses at 30,000 volts, 78

Dutch electrical exhibition, A, 486

Dynamos for motor road vehicle lighting, by J. D. Morgan, 291

Educational notes, 26, 891, 551, 682, 722, 763, 828, 842

Efficiency of accumulators, On the, by W. Hibbert, 6

Egypt, 1911, Trade statistics of, 907

Electric arc, A novel use of the, 382

baking, 218

ignition in internal-combustion engines, by John S. Leese, 611

lighting in the House of Commons, 540

lighting, Loans for, 141

power in a Japanese shipbuilding yard, 439

supply publicity, 67

vehicle, The, 121

Electrical development in industrial areas, by L. Crouch, 74, 117

driving of rolling mills, The, by C. A. Ablett, 235, 486, 577

engineer wanted, 287

engineering laboratory at the Heriot-Watt College, Edinburgh, by Prof. F. G. Baily, 50, 114

engineers and State employment in Germany, 663

Engineers' Sports, 891

furnaces, by C. Myers, 696

industry in the U.S.A., The, 114

industry: National insurance: with special reference to the, by Jos. J. H. Stansfield, 615

invention? An, 562

irrigation, 142

laboratories of Manchester University, New, 349

law in the British Dominions, 244, 331, 562, 605

machinery, Notes on standards for, by Dr. R. Pohl, 37

machinery, Standards for, by E. Kilburn Scott, 77

method of cultivation, 521

plant at the Buxton Lime Firms' quarries, 59

profession, The, 163

scheme for Melbourne: an important proposal, 440

Trades Benevolent Institution, 467, 511, 712

Trades Union, 382

Electrically-operated briquetting plant, An, 405

Electricians' trade movement, London, 842

wages, 540

Electricity and plant growth, 157

Domestic, 579, 697, 779

Escaping, 783

for crucible work, 44

for ship propulsion, 650

for the control of railways, The use of, by J. Sayers, 113

in agriculture, 106

in mines, 344

in the domestic ménage, 451

meters, Some considerations of detail in the design of, by "X. Y. Z.," 743

Popularising, 490

Rural and domestic applications of, 882

supply at Keighley, by Harry Webber, 18

supply at Mexborough, 685

supply in London and New York, by M. Tappley, 163

supply undertakings, Small, by P. A. Spalding, 50

to railway cab signalling, Application of, by W. H. Dammond, 1061

Works Table, Our, 1031

Electrification, Railway, 82

Electrifying the world, 491

Electro-Harmonic Society, 467

Harmonic Society, Manchester, 184, 418, 593

Electrodes, Volume changes in accumulator, by C. Toone, 481

Electrolytic sterilising plant, An, 692

Elevator regulations in South Africa, The new, 243, 248

Emergency plant on steamships, 720

Employers and the Insurance Act, 225

and tuberculosis, 826

Association, London Industrial, 67

Endurance, Magnetic apparatus for testing, by Prof. G. Kapp, 49

Energy, Natural sources of, 529

The degradation of accumulative, by A. G. Collis, 361

Tariffs for electrical, by W. W. Lackie, 522

Engine and its industrial importance, particularly for Great Britain, The Diesel oil, by Dr. Rudolph Diesel, 655

Notes on maintenance of the Diesel, 657

The importance of the internal combustion, 609

Engineer and the clerk, A study in relative values, The, by H. E. Goody, 905

as arbitrator, The, 930

-in-Chief of the Post Office, Dinner to the, 681

-in-Chief to the Post Office, New, 387

in the mine (South Africa), The, 241

Engineering trades agreement, 632

works, The rating of, 66

Engineer's certificate, Recovery of contract prices without the, 817

Club for Manchester, 1011

Engineers, Examinations for electrical, 305

in Bombay, Electrical, 402

Postal, 27

prospects in Canada, 691

Engines, Electric ignition in internal combustion, by J. S. Leese, 611

for driving small generators, Oil, 653

for electrical installations, Internal combustion, 625

Escaping electricity, 783

Etiquette: a dead letter, Consulting engineers and, 122

Examinations for electrical engineers, 305

Exchange, The new "Avenue," 102

Exhibition, A Dutch electrical, 486

A report on Olympia, 25

and Conference, Smoke Abatement, 412, 495

Glasgow Smoke Abatement, 218

"Ideal Home," 673

in Cornwall, Electrical, 342

in Spain, 156

in the Midlands, An electrical, 286

International Smoke Abatement, 429, 467, 512, 576, 618

Manchester, Building, 427

North-Eastern Counties Electrical, 805

Olympia, 1911, Electrical, 25, 681

The Physical Society, 9, 52, 89

Tramways, 993

Exhibitions and lectures, 773

Mining, 106

The importance of, 382

Explosion, Colliery, 341

Gas, 66

Explosions, Flue-gas, by E. Ingham, 454

Exports and imports during 1911 and previous years, Electrical, 152

and imports of electrical goods during December, 1911, 151

and imports of electrical goods during January, 1912, 401

and imports of electrical goods during February, 1912, 428, 519

and imports of electrical goods during March, 1912, 593, 691

and imports of electrical goods during April, 1912, 899

Electrical imports and, 66

Extraction works, Electrical copper, 107

FACTORIES, Electric driving in textile, by John Shaw, 403

Factory steam whistles, 1050

Failures of steel plates, 23

Fair play for contractors, 327

False pretences: sentence, Under, 656

Faraday Society, 578, 860

Fatalities, Electric shock, 107, 168, 185, 220, 306, 342, 468, 551, 761, 805, 931, 1012, 1048

Fault, The earth, by A. T. Bullen, 159

Felten & Guillaume, Carlswerk, A.G., Mulheim-on-the-Rhine, 12

Fetish of "boiler insurance," The, by S. Lees, 329

Figures indispensable to municipal electricity supply works, 833

Finland, Electrical trade in, 959

Water-power in, 932

Finsbury Technical College O.S.A., 107, 217

Fire Brigade competition, 805

Firemen's Congress in St. Petersburg, 344

Fires, 619, 805

in U.S.A., Causes of, 973

Fittings, Local authorities and the supply of electrical, 325

5,000-kw. Curtis turbo-alternator, 607

Flame arcs, Yellow, by M. Solomon, 819

Flashing-over in commutator machines, by W. W. Frith, 484

Flue-gas explosions, by E. Ingham, 454

Football club's German tour, A, 720

Foreign and Colonial tariffs on electrical goods, 120, 200, 487, 527, 563, 739, 948

plant, British r., 825

Formation of deposit by transformer oils, The, by P. N. Hooper, 275

France, German enterprise in, 528

Manufacturing in, 999

Frauds, Electric lamp, 681

Fraudulent tests, 533, 573

French telephone cable, The new, 417

Fuel, Peat, 451, 610, 1023

Peat as engine, by T. Tomlinson, 483

Furnace, A novel electrical steel, 549

Furnaces, Electrical, by C. Myers, 696

"GARDENER Electrician" again, The, 823

Gas direct from the coal mine, 571

-engine cylinders, The temperature of, 617

-engines, The Johannesburg, 704

explosion, 66

mantle variations, 972

General Electric Co.'s annual dinner, The, 253

General Electric developments. New fan works and central stores, 967

Generating station, An auxiliary oil-burning, 721

Generation and distribution in the Clyde Valley, Power, by D. A. Starr, 1065

German electrical industry in 1911, The, 630

enterprise in France, 528

enterprise in South America, 992

lamp exports and imports, 923

tour, A football club's, 720

wire lamp prices, Reduction in, 26, 53

works in Russia, 751

Germany, Competition in, 870

Concentration in, 703

Electric railway working in, 122

Electrical banks in, 107

Electrical engineers and State employment in, 663

Federal State monopoly in, 27

Installation contractors in, 1049

Price increase in, 885, 910

The monopoly question in, 327



Imports of electrical goods during January, 1912, Exports and, 401  
 „ of electrical goods during February, 1912, Exports and, 428, 519  
 „ of electrical goods during March, 1912, Exports and, 593, 691  
 „ of electrical goods during April, 1912, Exports and, 899  
 Incandescent lamps, Recent progress in the manufacture of, 842  
 Index to articles in the electrical press, by "Interested," 317  
 India, Electrical engineers in, 870  
 „ Machinery for, 155  
 „ The King's visit to, 40  
 „ Trade statistics of British, 482  
 Indian notes, 784, 905  
 „ railway administration, 911  
 „ wiring rules, 427  
 Indicator approved, 253  
 Indirect lighting of rooms, The, by "Whistlefield," 954  
 Indo-China, The trade-prospects of, 92  
 Industrial affairs, American, 931  
 „ areas, Electrical development in, by L. Crouch, 74, 117  
 Industry, Electrical, 1066  
 „ in the U.S.A. The electrical, 144  
 „ in 1911, The German electrical, 530  
 „ National insurance, with special reference to the electrical, by Jos. J. H. Stansfield, 615  
 Injuring cable, 931  
 Installation at the new Whitehall Club, Electrical, 218  
 „ contractors in Germany, 1049  
 Institute of metals, The, 280  
 Institution and lecture notes, 26, 67, 107, 143, 185, 219, 259, 306, 343, 383, 429, 469, 512, 552, 593, 647, 682, 721, 762, 806, 842, 891, 932, 972, 1012  
 „ notes, 1050  
 „ of Electrical Engineers: Annual dinner, 219  
 „ of Electrical Engineers' articles, 50, 661, 781  
 „ of Electrical Engineers, Newcastle Local Section Address, 56  
 „ of Electrical Engineers, The, 864  
 Institutions reforming, 286  
 Insulated wire, New tests for, 720  
 Insulating materials, High-voltage tests and energy losses in, by E. H. Rayner, 443  
 Insulators, High-tension porcelain, by J. Lustgarten, 775  
 „ New, 25  
 Insurance Act, Employers and the, 285  
 „ Act, Parliament and the, 904  
 „ Act, 1911, National.—Advisory Council, 184  
 „ Bill, The, 756  
 „ National, 859  
 „ National: with special reference to the electrical industry, by Jos. J. H. Stansfield, 615  
 „ The fetish of boiler, by S. Lees, 329  
 Internal combustion engined vessels, Auxiliary machinery for, by W. R. Cummins, 129  
 „ -combustion engine, The importance of the, 609  
 „ -combustion engines, Electric ignition in, by J. S. Leese, 611  
 INTERNAL COMBUSTION ENGINES FOR ELECTRICAL INSTALLATIONS, 625  
 Anderston vertical gas engines, 636  
 Aster engine, The, 638  
 Beardmore, William, & Co., 633  
 Bituminous gas producers, 636  
 Blackstone oil engines, 636  
 Boulton & Paul, Ltd., 635  
 British oil engine, 634  
 Britannia oil engines, 643  
 Brooke petrol sets, 638  
 Browett, Lindley & Co., 635  
 Campbell gas engines, 641  
 Coates, J. F., & Co., 637  
 Cross oil engine, The, 639  
 Electric lighting sets by Chas. Price and Son, 629  
 Fielding gas engine, 631  
 Gardner electric lighting sets, 630  
 G.H.H. four-cycle engine, 631  
 Hick-Diesel engines, 632  
 Hindley gas engine, 639  
 Italian 1,000-H.P. Diesel engine and generator, An, 643  
 Kelvin engine, 629  
 Korting gas engine, 625  
 Kynoch gas engines, 641  
 Lighting of a Scottish village, The, 645  
 Lillieshall Co.'s engines, 634  
 M.A.N. engines, 643  
 Marmot heavy-oil engine set, 629  
 Maschinenfabrik Thyssen & Co., 640  
 Mirrlees-Diesel oil engine, 626  
 Parsons motors, 628  
 Premier gas engines, 626  
 Reavell oil engines, 628  
 Running costs of the Diesel-engined ship, 634  
 Russell, Newbery & Co., 637  
 Ruston "complete combustion" crude-oil engine, 633  
 Silvertown petrol-electric sets, 631  
 Thornycroft motors, 635  
 Turner oil engines, 628  
 Utilisation of waste heat from gas engines, 636

## INTERNAL COMBUSTION ENGINES—continued.

Westinghouse gas engines, 642  
 Willans-Diesel oil engines, 627  
 International Electrotechnical Commission, 303, 841  
 Inter-relation of capacity in three-phase three-core cables, The, by A. B. Clark, 532  
 Invention? An electrical, 562  
 Inventors' Institute, 106  
 „ Poor, 722  
 Irish electricians, 533  
 Iron and steel works, Hardanger, 143  
 „ mines in Norway, The Sydva-ranger, 345  
 „ ore, Electrical smelting of, 292, 468  
 „ wire, The uses of copper-clad, 940  
 Ironmongers and municipal trading, 972  
 „ Electrical training for, 184  
 Ironworks in Norway, New electrical, 143  
 Irrigation and hydro-electric power schemes combined, by E. K. Scott, 903  
 „ Electrical, 142  
 Italy, Trade statistics of, 860

## JAMAICA, Trade statistics of, 699

Japan, 91, 755  
 „ Cable and wire manufacturing, in, 136  
 „ Electrical manufacturing in, 211  
 „ Rubber manufacture for electrical purposes in, 999  
 Japanese shipbuilding yard, Electric power in a, 439  
 Johannesburg, Electrical trade at, 931  
 „ gas engines, The, 704  
 „ tenders (In darkest Africa), 881  
 „ The Union Co., at, 504  
 „ tramcar contracts, 220

## KEARNEY high-speed railway, The, 1011

Keighley, Electricity supply at, by Harry Webber, 18  
 „ mill, Electric driving in a, 1007  
 Kelvin lecture, The, 736  
 „ to the I.E.E., Presentation of a bust of Lord, 845  
 Kent, Electric power in South-East, 261  
 King's English, The, 990  
 „ visit to India, The, 40  
 Kingston-on-Thames, New Diesel plant at, 169  
 Kitchen in Marylebone, An electric, 456  
 Koss water-railway, The, 260

LABORATORIES of Manchester University, New Electrical, 349  
 Laboratory at the Heriot-Watt College, Edinburgh, The electrical engineering, by Prof. F. G. Bailey, 50, 114

Labour clauses, Foreign contracts and, 211  
 „ problems, 371  
 „ questions, Australian, 663  
 „ troubles, Messrs. Crossley Bros.' dividend and, 371

Lake Coleridge power plant, N.Z., The, 670

Lamp, Construction and characteristics of the Neon, 231  
 „ duties, Revised Russian, 682  
 „ Electric miner's, 192  
 „ frauds, Electric, 681  
 „ imports and exports, German, 923  
 „ prices, 18  
 „ prices, Reduction in German, 26, 53  
 „ standards, Artistic street, 451, 479  
 „ testing board, A, by H. R. Taunton, 7  
 „ tests, Tungsten, 307  
 Lamps, A photometric investigation of mercury-vapour, 441  
 „ New Osram, 253  
 „ on alternating current, Tungsten, 342  
 „ Recent progress in the manufacture of incandescent, 842

Languages for commercial men, Foreign, 671

Large turbines, 490

„ turbo-dynamos, 683  
 „ units of machinery, The transport of modern, by Adolf. R. Stelling, 953

Largest turbines in the world, The, 525

Laundry on board ship, Electric, 137

Law and the profits, The, 783

„ cases, 930

„ in the British Dominions, Electrical, 244, 289, 331, 496, 562, 600

Lead cell, Notes on the chemistry of the, by J. H. May, 85

„ Coating iron with, 540

Lecture notes, Institution and, 26, 67, 107, 145, 185, 219, 259, 306, 343, 383, 429, 469, 512, 552, 593, 647, 682, 721, 762, 806, 842, 891, 932, 972, 1012

Lectures, Exhibitions and, 773

Leeds and Bradford, Railless traction at, 492

## LEGAL—

Accumulator Industries, Ltd., v. Vandervell & Co., 579  
 Action against a lampmaker, 418  
 Alldays & Onions v. F. S. Lister, 366  
 Amalgamated Radio-Telegraph Co., 1066  
 Attorney-General v. Sheffield Corporation, 250, 292, 363  
 Avebury v. The National Telephone Co., 87  
 Bailey v. Wendon, 567  
 Baxter & Caunter v. Perfecta Seamless Tube and Conduit Co., 711  
 „ v. Mountstephen, 249

Beaumont v. Underground Electric Railways Co. of London, 459

Braulik v. Mitchell & Co., 1025

British, Foreign and Colonial Automatic Light-Controlling Co. and Gunning v. Metropolitan Gas

Meters, Ltd., 1025

Campbell v. Oban Council, 546

Capel v. Dudley, 958

Cavehill and Whitewell Tramway Co., 171, 260

Charge against a traveller, 418

City of London Electric Lighting Co. v. E. W. Rudd, Ltd., 208

Clague v. Burnley Corporation, 249

Claim for "open-contract" work, A, 384

Coal Mines Regulations Act, 500

Compensation claim, 754

Consolidated Electric Works and Appliances, Ltd., 7

Cooper v. L.C.C., 567

Cubey v. Olympia Skating Rink Co., Seddon and Hall, 295

Damage to tramway track, Alleged, 580

Davis Electrical Co., 87, 250

Dean v. Hackney Borough Council, 367, 374

Diesel Engine Co. v. Crittall Manufacturing Co., 957

Disputed electricity account, 711

Edinburgh tramcar guards, 367

Electric and Ordnance Accessories Co. v. Handcock, 919

„ light company fined, 373, 580

Electrical engineering company's affairs, 790

Electricity in mines, 134

Electrobus litigation, Echo of the, 172

Ellis v. Oldham Corporation, 366

„ v. Osram Lamp Works, 790

Ferguson Superheaters, Ltd., v. Askern Coal and Iron Co., 833

Fleetwood Estate Co. v. Blackpool and Fleetwood Tramroad Co., 171

Foster v. L.C.C., 580

Fraudulent use of electricity, 418

General Electric Co. v. Great Western Railway Co., 367

Gott v. Veritys, 546, 647

Illegally abstracting electricity, 510

Jackson v. Western Electric Co., 171

Jacobs v. Newbold, 134

Johannesburg gas plant litigation, 470

Kingham v. Ellis & Ward, 171

London and South-Western Railway Co. v. British Vacuum Cleaner Co., 374

Lot's Road appeal, The, 1050

Marconi v. Siemens Bros. & Co. and Alfred Holt & Co., 208

Martin v. Dublin United Tramways Co., 374

Mechanical stoker patent appeal, 573

Metalite, Ltd., 711

Morris, Herbert, Ltd. v. Richard Miles, 1025

Musker (1901), Ltd. v. Bessemer & Co., 295

National Telephone arbitration, 142, 171, 500, 958, 1025, 1066

„ Telephone Co.: debenture-holders' action, 373

Newberry v. Bristol Tramways and Carriage Co., 1067

Northern Light, Power and Coal Co., 417

Nuisance by electric motor, Alleged, 106

Osram Lamp Works, Ltd., v. "Z" Electric Lamp, Co., 367, 427, 672, 706, 752, 787, 829, 879

Pilkington v. Edinburgh School Board, 881

Reduction of capital, 958

Reid Newfoundland Co. v. Anglo-American Telegraph Co., 172

Sackletval v. Miller, Wilson and Pegg, 873

Sale v. Manchester Corporation, 1067

Salford Corporation and South Lancs. Tramways Co. v. Eccles Corporation, 546

Schwartz v. The India-Rubber, Gutta-Percha and Telegraph Works Co., 499

Shrimpton v. Northern Light, Power and Coal Co., 580

Simpson v. Lord and others, 1025

Smoke nuisance prosecution: appeal, 711

South-Eastern Railway Co. and The S.E. and C. Ry. Co.'s Managing Committee v. The London Electric Railway Co., 919

Southport Engineering Co., v. Taylor, 580

Spitting in tramcars, 790

Stoke Newington Borough Council v. Lane & Co., 296

Tramcar accident claims, 107, 248, 250, 374, 458, 500, 711, 1025, 1066

## LEGAL—continued.

Tramway Co. and Lanark County Council, 867

„ or railway?—Important rating appeal, 248

Tramways and heavy traffic, 790

Tuchy, Patrick, v. Belfast Corporation, 295

Underground Electric Railways Co. and omnibuses, 418

United Lighting and Maintenance Co. v. Wm. Liesegang, 418

Urban Electric Supply Co., 418

Verney v. Glenville & Osmond, 26

Webb v. Booker, 619

West Ham Corporation v. Shiels, 919

White v. East Ham Borough Council, 373

„ v. L.C.C., 171

Wilson v. Lancashire United Tramways Co., 790

Wood v. Connolly Bros., 378

Workmen's Compensation Act, Decision under the, 107, 790

Young v. S. Shields Corporation, 249, 427

Legal query column, 87, 160, 199, 251, 296, 334, 415, 525, 822, 914, 1027

Letter to ourselves, A New Year, 3

Libel, Newspapers and the law of, 680

Lift, A new electric, 913

Light distribution from metallic-filament lamps, Improving the, 904

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784

Lighting and heating, Domestic, by "An Outsider," 995

„ -weight Diesel engines, 784



## LIGHTING AND POWER NOTES—continued.

Carlisle, 298  
 Carnarvon, 421  
 Castleford, 174  
 Chatham, 56, 505  
 Cheam, 1002  
 Cheltenham, 14, 94, 212, 254, 377, 462, 542, 757, 795, 1002  
 Cheshire, 254  
 Chester, 174, 886, 886, 960  
 Chesterfield, 91, 299, 542  
 Chile, 94, 174, 462, 542  
 China, 462, 960, 1045  
 Christchurch, 621, 925  
 City, 1045  
 Clacton-on-Sea, 254, 621, 1002  
 Clayton-le-Moors, 621  
 Colchester, 254, 582, 1002  
 Colne, 377  
 Colombia, 863  
 Congleton, 254  
 Cornwall, 622, 925  
 Coventry, 174, 715, 795, 836  
 Cresswell (Derbyshire), 757, 837  
 Crewe, 254, 795, 962  
 Croydon, 56, 462, 542, 582, 757, 837  
 Cuba, 377, 421, 506  
 Dartford, 213, 757  
 Dartmouth, 95  
 Darton, 174  
 Darwen, 213, 377, 421, 521, 542, 887, 925  
 Dendraeth, 506  
 Denmark, 187, 505  
 Derby, 14, 715, 925  
 Devonport, 254, 622  
 Dewsbury, 337, 677  
 Dominica, 582  
 Donaghadee (Co. Down), 795  
 Doncaster, 421, 582  
 Douglas, 137, 622, 837  
 Dover, 57, 137, 254, 421, 962  
 Dublin, 213, 582  
 Dudley, 877  
 Dundee, 95, 174, 299, 377, 421, 506, 622, 715, 837, 925, 962, 1002  
 Dunoon, 95, 299, 337, 422  
 Ealing, 95, 1002  
 Easington, 462  
 Eastbourne, 377, 582, 757, 925  
 East Ham, 962  
 Eccles, 14, 213, 377, 542  
 Edinburgh, 95, 337, 715, 795  
 Egypt, 542  
 Ellesmere Port, 542  
 Epsom, 254, 377, 542, 1045  
 Erith, 138, 715, 887, 1045  
 Eton, 57  
 Exeter, 925  
 Exhall, 377  
 Falkirk, 14, 138, 174, 213, 299, 337, 677, 962, 1008, 1045  
 Farnborough, 506  
 Farnham, 925  
 Farnworth, 254, 506, 925  
 Felixstowe, 795, 962  
 Feltham, 962  
 Festiniog, 837  
 Fife, 174, 582, 715, 887  
 Finchley, 506, 715, 1045  
 Fleetwood, 138, 1045  
 Formby, 254  
 France, 94, 137, 212, 377, 421, 506, 676, 757, 795, 836, 925, 962, 1002, 1045  
 Frome, 422  
 Fulham, 378, 462, 837, 1003  
 Gellygaer, 95  
 Germany, 14, 95, 212, 299, 421, 462, 542, 795, 925, 962, 1045  
 Glasgow, 14, 174, 377, 622, 757  
 Glastonbury, 795, 1002  
 Gloucester, 254  
 Golborne, 506, 677  
 Goole, 58, 95, 299, 542  
 Govan, 462  
 Grantham, 462  
 Gravesend, 95, 462, 716, 795  
 Gt. Missenden, 506  
 " Yarmouth, 299, 462  
 Greece, 94, 757  
 Greenock, 506, 582, 622, 1002, 1045  
 Greetland (near Halifax), 14  
 Grimsby, 378, 462  
 Hackney, 57, 337, 422, 462, 506, 837  
 Haiti, 582  
 Halifax, 57, 213, 254, 925, 1045  
 Hammersmith, 57, 800, 422, 583, 677, 837, 925, 1045  
 Hampstead, 96, 677  
 Harrogate, 95  
 Haslingden, 57  
 Hastings, 299, 757, 925, 962, 1045  
 Haverfordwest, 378, 622  
 Hayle, 138  
 Hayward's Heath, 925  
 Hazelgrove and Bramall, 95, 254, 462, 583, 795, 1045  
 Headington, 213  
 Heckmondwike, 95  
 Hereford, 583, 1002  
 Heston and Isleworth, 175, 716  
 Heywood, 583, 795, 925  
 Higham Ferrers, 57  
 Highbridge, 836, 1003  
 Hipperholme, 1003  
 Holland, 94, 676, 925  
 Holmfirth, 757  
 Holyhead, 175  
 Hornchurch and Upminster, 864  
 Hornsey, 138, 299, 422, 962  
 Horsham, 83, 837  
 Huddersfield, 299  
 Hull, 57  
 Hungary, 95, 377, 715, 887, 1002  
 Iceland, 422  
 Ilkeston, 542  
 India, 175, 542, 716, 887  
 Ipswich, 462, 795  
 Irthlingborough, 138  
 Isle of Wight, 422  
 Islington, 378, 462, 837, 963, 1045  
 Italy, 715, 795, 1002  
 Itchen, 422

## LIGHTING AND POWER NOTES—continued.

Japan, 795, 1003  
 Keighley, 337, 887, 925  
 Kenmare, 57, 837  
 Kensington, 57, 378, 716  
 Kilmarnock, 618, 1003  
 King's Lynn, 1003  
 Kingston-on-Thames, 175, 220, 378, 962  
 Kirkburton, 622  
 Kirkcaldy, 254  
 Kirkheaton (near Huddersfield), 138  
 Knaresborough, 95  
 Kopea, 963  
 Lagos, 378  
 Lambeth, 542  
 Lanark, 622  
 Lancashire, 299, 462  
 Lancaster, 213, 878, 422, 887  
 Launceston, 14, 95, 1003  
 Ledbury, 1003  
 Leeds, 57, 95, 583, 1003  
 Leicester, 36  
 Leigh, 963  
 Leith, 254, 583  
 Lewes, 963  
 Lewisham, 1003  
 Lexden and Winstree, 838  
 Leyton, 542  
 Limerick, 588  
 Lincoln, 57, 254, 583, 1045  
 Linthwaite, 887  
 Littleborough, 925  
 Liverpool, 95, 213, 337, 622, 925  
 Llandaff and Dinas Powis, 175  
 Llandudno, 175, 677, 837  
 Llanfairfechan, 422, 795  
 Llangollen, 57  
 Llanhedr (near Barmouth), 14  
 Llantwit Fardre (Glam.), 716  
 London, 57, 96, 138, 213, 254, 299, 300, 337, 378, 422, 462, 506, 542, 583, 677, 716, 757, 795, 837, 887, 925, 963, 1003, 1045  
 Loughborough, 213, 422, 463, 925, 1045  
 Lowestoft, 96, 463, 622, 837  
 Luton, 14, 254  
 Luxembourg, 621  
 Lytham, 96, 338, 543, 583, 716, 758  
 Macclesfield, 963  
 Maidenhead, 254  
 Maidstone, 213  
 Maldon, 888  
 Malling, 422  
 Malvern, 254, 622  
 Manchester, 378, 463, 543, 583, 677, 837  
 Mansfield, 57, 716, 795, 1003  
 Marazion (Cornwall), 96  
 Marylebone, 96, 299, 422, 462, 677, 757, 837  
 Merthyr Tydfil, 14, 506, 622, 1045  
 Mexborough, 838  
 Mexico, 14  
 Nelson, 422, 963, 1003  
 New Zealand, 15, 96, 175, 213, 338, 583, 925, 1003  
 Newcastle-on-Tyne, 14, 758  
 " under-Lyme, 254  
 Newport (Fife), 96  
 " (Mon.), 338, 422, 758  
 Newton-in-Makerfield, 57  
 Newton (Lancs.), 963  
 North Berwick, 138, 213, 795  
 " Cray, 96  
 " Wales, 583  
 Northants, 796  
 Norway, 94, 622  
 Norwich, 463, 543  
 Nottingham, 254, 758, 838, 925  
 Nuneaton, 96, 422, 583, 738  
 Oldham, 57, 96, 506, 887  
 Oswaldtwistle, 796  
 Oswestry, 57, 422  
 Oulton Broad, 838  
 Paisley, 96  
 Pelton, 800  
 Penistone, 926  
 Penmaenmawr, 254  
 Perth, 175, 254, 583, 677, 887, 963  
 Peterborough, 338, 506, 583, 716, 887, 1045  
 Plymouth, 57, 255  
 Pontefract, 300  
 Poplar, 138, 300, 543, 716  
 Port Glasgow, 338, 378, 887  
 Portishead, 15  
 Portrush, 338, 887  
 Portugal, 506, 582, 677  
 Preston, 1046  
 Prestwich, 622  
 Queensbury, 15, 57  
 Radcliffe, 138, 255, 300, 796  
 Rangoon, 1046  
 Rawdon, 1003  
 Rawtenstall, 300, 506, 716, 1003, 1046  
 Reading, 175, 963  
 Reddish, 58, 255  
 Reeth, 138  
 Reigate, 213  
 Rhyl, 96  
 Richmond, 300  
 Rochdale, 213, 300, 422, 583, 716, 796  
 Rothesay, 716  
 Rugby, 887  
 Rugeley, 838  
 Runcorn, 58, 422, 463, 796, 963  
 Russia, 95, 212, 421, 462, 622, 757, 795, 1045  
 St. Anne's, 255, 338, 796, 963  
 " Helens, 378, 422, 583  
 " Pancras, 463, 677  
 Salford, 300, 338, 378, 716, 926  
 Salisbury Plain, 213  
 San Domingo, 1046  
 Scarborough, 300  
 Sevenoaks, 543, 622, 660  
 Shanklin, 58  
 Sheffield, 255, 422, 796, 963  
 Sherborne, 96  
 Shipley, 214, 758, 796  
 Shrewsbury, 255  
 Sicily, 836  
 Sidmouth, 96

## LIGHTING AND POWER NOTES—continued.

Skegness, 96, 523  
 Skelton, 15  
 Skelton and Brotton, 378, 622, 732, 963  
 Slough, 338, 878  
 Smethwick, 378  
 South Africa, 15, 58, 175, 255, 298, 506, 743, 583, 622, 677, 796, 838, 1003  
 " Molton, 622, 1003  
 " West Africa, 463  
 Southampton, 96, 214, 743, 716  
 Southend-on-Sea, 506, 758  
 Southern Nigeria, 40  
 Southgate, 214  
 Southport, 887  
 Sowerby Bridge, 963  
 Spain, 95, 212, 377, 462, 542, 622, 757, 925, 1045  
 Stafford, 1003  
 Stalybridge, 15, 743  
 Stanwix, 622  
 Stapleton (Bristol), 175  
 Stepney, 213, 300, 378, 462  
 Stirling, 58, 138, 1046  
 Stockport, 255, 301, 888  
 Stoke-on-Trent, 214, 758  
 Stourbridge, 801, 887  
 Stourport, 422  
 Stow-on-the-Wold, 939  
 Stretford, 255, 422, 963  
 Sunderland, 214, 301, 506  
 Surbiton, 1003  
 Sutton Coldfield, 1003  
 Swansea, 138, 175  
 Sweden, 337  
 Swindon, 96, 255, 422, 887  
 Swinton, 301, 838, 1003  
 Tadcaster, 758  
 Tasmania, 138, 463  
 Taunton, 175, 214, 301, 716, 887, 1003  
 Teignmouth, 96, 175  
 Thurstonland, 15, 378  
 Tonbridge, 963  
 Torquay, 301, 422, 463, 583, 796  
 Tripoli, 758  
 Tunbridge Wells, 58, 175, 716, 758, 796, 963, 1046  
 Turkey, 582  
 Turton, 423  
 Twickenham, 838  
 United States, 138, 926  
 Uruguay, 175, 423, 583  
 Venezuela, 583  
 Wadebridge, 796  
 Wakefield, 58, 214, 255, 758, 1003  
 Walkden, 301  
 Wallasey, 583, 963  
 Walsall, 255, 623, 796, 871, 963  
 Walthamstow, 175  
 Warrington, 743, 926  
 Waterloo, 796  
 Watford, 506, 963  
 Wednesbury, 214, 423  
 Wellingborough, 463  
 West Bromwich, 301, 623, 926  
 " Ham, 338, 796  
 " Hartlepool, 96, 796, 887  
 West Ham, 378  
 Weymouth, 463  
 Wheatley, 378  
 Whitechurch, 1046  
 Whitefield, 506  
 Whitehaven, 96, 301, 463  
 Whitwood Mere, 1003  
 Whitworth, 214  
 Widnes, 96  
 Wigan, 301  
 Willesden, 338  
 Wimbledon, 58, 423, 963  
 Winchester, 96, 423  
 Windermere, 533  
 Wolstanton, 926  
 Wolverhampton, 423, 796, 963  
 Woolwich, 254, 378, 796  
 Wootton, 15  
 Worcester, 58, 301, 1003  
 Worksep, 338, 758, 838, 963  
 Worthing, 583, 926  
 Wrexham, 15  
 Yarmouth, 175, 963, 1046  
 York, 743, 926, 1003

## Lighting by electricity, Private house,

by W. R. Rawlings, 917  
 " circuits, The use of condensers on alternating-current, by A. W. Ashton, 328  
 " Dynamos for motor road vehicle, by J. D. Morgan, 281  
 " House of Commons, 592  
 " of machine shops, The, 348  
 " of railway trains, The, 428  
 " of rooms, The indirect, by " Whistlefield," 954  
 " Standards for, 917  
 " Street, by H. F. J. Thompson, 33

## Lightning, Observatories and, 26

Liquidations, Dissolutions and, 13, 56, 93, 137, 173, 211, 252, 296, 336, 375, 420, 461, 505, 541, 581, 619, 675, 713, 755, 793, 833, 886, 923, 960, 1000, 1042

## Loans for electric lighting, 141

Local authorities and the supply of electrical fittings, 325  
 Localising ore deposits, 1050  
 Locomotive with the Auvert-Ferrand rectifier, An electric, 859  
 London and New York, Electricity supply in, by M. Tappley, 163  
 " Chamber of Commerce, 646  
 " County Council coal supply, 158  
 " County Council conditions of contract, 184  
 " Industrial Employers' Association, 67  
 " street traffic obstruction, 826  
 " United Tramways award, 427  
 London's congested streets, 123

Long distances, Quantitative investigations on wireless telegraphy over, 824

Lorry, A brewer's novel motor, 298

Loss of the *Titanic*, 662

Losses in insulating materials, High voltage tests and energy, by E. H. Rayner, 443

Lowest tender, The ethics and economics of the, 741

MACHINE shops, The lighting of, 348

" Tool Association, The, 92

Machinery for India, 165

" Heat paths in electrical, by H. D. Symons and Miles Walker, 196

" Notes on standards for electrical, by Dr. R. Pohl, 37

" Standards for electrical, by E. Kilbarn Scott, 77

" The rating of, 123

Magnetic apparatus for testing endurance, by Prof. G. Kapp, 49

" properties of alloys, 300

Magnification of electric currents, 27

Maintenance of the Diesel engine, Notes on, 657

Malingera and the Workmen's Compensation Act, 950

Manager and scientist, 722

" Director and general, 123

Manchester Electro-Harmonic Society, 184, 418, 593

" University, New electrical laboratories of, 349

Manufacture of incandescent lamps, Recent progress in the, 842

Manufacturers' Association, The British Electrical and Allied, 106, 238, 341

Manufacturing in France, 999

" in Japan, Cable and wire, 136

" in Japan, Electrical, 211

Marconi extensions in the U.S.A., 512

Marylebone, An electric kitchen in, 456

Measurement, Illumination: production, calculation, by J. D. Mackenzie, 873

Medical Electrology and Radiology, Congress of, 947

Meeting of creditors, 55, 675, 947

Melbourne: an important proposal, Electrical scheme for, 440

" suburban railway electrification, 902

Memorial to Prof. Ashcroft, 275

Mercury-vapour lamps, A photometric investigation of, 441

Metal-filament lamps, Condensers in series with, by A. W. Ashton, 963

Metallic-filament lamps, Improving the light distribution from, 904

Metals, The Institute of, 281

Meter would not mete, Why the, 143

Meters approved, 904, 1045

" Morley-Fricker electricity, 336

" on variable loads, Electrical, by D. Robertson, 916

" Some considerations of detail in the design of electricity, by "X. Y. Z.," 743

" The behaviour of direct-current watt-hour, by S. W. Melsom and W. H. Eastland, 914

" Tramcar, 327

Metric system, 1001

Metropolitan Association of Electric Tramway Managers, 260

Mexborough, Electricity supply at, 665

Mexico, The A.E.G. in, 581

" Trade statistics of, 1060

" Trade with, 944

Microthermometer, Location of icebergs by a recording, by Prof. H. T. Barnes, 917

Midlands, An electrical exhibition in the, 286

" Electrical Engineers' Ball, 107

Mill, A Chinese cotton, 143

" Electric driving in a Keighley, 1007

Mills, Electric power in textile, 179

" The electrical driving of rolling, by C. A. Ablett, 235, 577

Mine, Cable suspension in a coal, 467

" (South Africa), The engineer in the, 241

Miner's lamp, Electric, 172

" strike, The, 369. (See also under "Coal Strike")

Mines, Electric haulages in, by W. C. Mountain, 537

" Electricity in, 244, 972

" The Daily Mirror on haulage in, 689

Minimum—and after, The (coal strike), 569

" wage, The illusion of the, 449

Mining Electrical Engineers, Association of, 321

" exhibitions, 106

" in Norway, Electricity for, 65

Monopolies in Germany, Federal State, 27

Monopoly, A Duchy lighting, 564

" question in Germany, The, 326

Monument, A steam turbine, 617

Mortier system of telegraphing pictures, The, 463

Motor, A tough, 675

" cabs in Berlin, 332

" car with Edison storage battery, An electric, 455

" cars, London, 805



Motor-generators for cinematograph supplies, 704  
 .. road vehicle lighting, Dynamos for, by J. D. Morgan, 231  
 .. Tests of a new A.C., 323  
 Motors, An automatic starting device for asynchronous, by N. Pensabene Perez, 36, 49  
 .. Improvement of power factors by synchronous, 932  
 .. with commutating poles and cast-iron magnets, Continuous current, by J. W. Burleigh, 4  
 Municipal electricity supply works, Figures indispensable to, by "Interested," 883  
 .. employment, 712  
 .. trading in Canada, 591  
 .. trading, Ironmongers and, 972  
 .. works in Germany, The transfer of, 567  
 Municipality, The contractor and the, 326  
 Museum of safety appliances, 704

NATIONAL Physical Laboratory, 469  
 .. Telephone Journal, The, 184  
 Natural sources of energy, 529  
 Neon lamp, Construction and characteristics of the, 231

NEW COMPANIES—  
 Aberdare Electrical Engineering Co., 722  
 Anderson & Munro, 843  
 Anglo-Argentine General Electric Co., 594  
 .. Swedish Electric Welding Co., 933  
 A. T. Speedometer Co., 385  
 Automatic Manufacturing Co., 633  
 Barker Patents Syndicate, 108  
 Bill, S., & Co., 470  
 Boddy, G. M., & Co., 303  
 Brilliant Arc Lamp and Engineering Co., 221  
 British and Overseas Engineering Syndicate, 268  
 .. Arc Welding Co. (Mersey), 470  
 .. Economical Lamp Co., 892  
 .. Engineers' Association, 723  
 .. Union Lamp Works, 723  
 Broit, 23  
 Brompton and Kensington Accessories Co., 470  
 Caledonian Telephone (New System) Co., 723  
 Callender's Share and Investment Trust, 764  
 Cantie Switch Co., 308  
 Churton, T. Harding, & Co., 844  
 Cirencester Electric Supply Co., 892  
 Clarke, T., & Co., 28  
 Collings-Bishop, 470  
 Constant Vacuum Carburetter Syndicate, 28  
 Cubey, T. H., 764  
 Danks, Fred, 1013  
 Dubilier Electrical Syndicate, 722  
 Electric Appliances Co., 594  
 .. Blasting Apparatus Co., 594  
 .. Hammer, 723  
 .. Lamp Regenerators, 470  
 .. Marine Propulsion Co., 683  
 .. Speller, 935  
 Electrical and Industrial Investment Co., 933  
 Electro-Chemical Developments, 633  
 Finch & Wheeler, 1013  
 Fletcher, Jackson & Co., 221  
 Fletcher's Electric Fittings, 385  
 Foreign Construction Syndicate, 470  
 Fox, 221  
 Fuller, John C., & Son, 385  
 Furse, W. J., & Co., 723  
 Galsworthy Otovacum, 764  
 Hallamshire Electric Co., 470  
 High Peak Magneto Co., 29  
 Homer Earphone Co., 221  
 Honiton and District Electric Supply Co., 308  
 Hydro-Electric Lift and Crane Co., 221  
 .. -Electric Power and General Trust, 723  
 Imeson, Finch & Co., 385  
 Institute of Wireless Telegraphy, 844  
 Intenso Patentees and Manufacturers, 892  
 Isaria, 933  
 Louis F. Light Syndicate, 1013  
 Martyn, S. W., & Co., 1013  
 Massey, B. & S., 594  
 Meadows, W. A., & Co., 933  
 Mirfield Garage and Electric Works, 108  
 Modern Kitchens, 585  
 M.R.W. Syndicate, 385  
 National Carbide (1911), 28  
 Naylorgraph, 268  
 No Cell, 1013  
 Noel, Edwin, 108  
 Opalyte, 933  
 Orford Electric Light and Power Co., 764  
 Parana Corporation, 28  
 Perak Hydro-Electric Power Syndicate, 594  
 Pintsch's Electric Manufacturing Co., 108  
 Power Syndicate of South America, 843  
 Rayner, W. H., & Sons, 28  
 Reynolds, W. R., 594  
 Rushmore Lamps, 843

NEW COMPANIES—continued.  
 "Safetee" Controlling Appliances Co., 683  
 Scientific Treatments, 1013  
 Sheffield Electrical Engineering Co., 843  
 Spanish and General Wireless Trust, 308  
 Standard Woodwork Co., 843  
 Stoffels Electric Switch Co., 308  
 Super Heat Furnace Co., 1013  
 Talgarth Electric Supply Co., 892  
 Tampico Electric Light, Power and Traction, 933  
 Telephone Accessories Co., 221  
 .. Duplicating Recorder Co., 145  
 Thursfield, C. J., & Co., 385  
 Titan Lift Co., 385  
 Tomellin Syndicate, 1013  
 Tramways (M.E.T.) Omnibus Co., 145  
 Turner, A. Richmond, & Co., 308  
 Universal Accumulators, 28  
 Variable Speed Gear, 933  
 Vaughton, Walter S., 723  
 Venner's Signs, 221  
 Whisperphone Syndicate, 28  
 Wilkeston Fuel, Light and Power Co., 308  
 X.L. Electric Co., 844  
 Yorkshire Waste Heat Co., 892

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—  
 "Adams Igranic" multiple toggle-joint lever starter, 659  
 .. Igranic" semi-automatic machine starters, 89  
 Alabaster bowl fittings, 457  
 Alu-Sol flux and solder for aluminium, 134  
 Arc lamp lowering gear, 89  
 .. lamp winch, 209  
 Automatic solenoid starter, 748  
 Ball-bearing line-shafting hangers, 734  
 "Barrow" street lighting fittings, 734  
 "Belenus" electric boiler, 53  
 Belling's electric geysers, 956  
 Bell-push fire alarm, 133  
 Benjamin reflector fittings, 867  
 Boiler-feed disk water meters, 332  
 Bosch force feed lubricator, 322  
 B.T.-H. fan motors, 918  
 Cinematograph resistance, 416  
 Composite telegraph poles, 878  
 Controller, A large, 458  
 Cord-pull switch and ceiling rose, Combined, 674  
 "Cracone" solid bitumen cables, 407  
 Crypto transformer, 39  
 D. & G. reading lamp, 53  
 Dowsing cooking range, 89  
 Drum type star-delta starters, 407  
 .. type starters for induction motors, 878  
 E.A.C. lift-control gear, 660  
 .. starter, 39  
 .. switch-fuses, f00  
 Earthing clip, New patent, 90  
 Ediswan electric fans, 791  
 .. lighting accessory, An, 539  
 "Efesca" electric grill, 748  
 Electric lamps for the police, 659  
 E.M.B. grid resistances, 134  
 "Ezyfix" two-part lampholder, 877  
 Fan, Combination electric, 918  
 "Field plug," The, 417  
 "Flotteur" sight-feed lubricator, The, 867  
 G.E.C. griller, New, 733  
 .. instruments, New, 415  
 .. rotary converter with booster, 1027  
 "Gem" electric twin sweeper, 406  
 .. lamp, A new, f60  
 "Glareguard," The, 323  
 Henley wiring system, 919  
 High-lift centrifugal pumps, 333  
 .. -pressure direct-current instruments, 1027  
 Household reflector, 918  
 Hydraulic sluicing plant, 333  
 Inspection tee, New, 749  
 Insulator, New, 735  
 Joint-box for circuit work, 170  
 "Korfund" foundation plates, 90  
 Lamp remover, 918  
 "Leuconium" lamps of low candle-power, 133  
 Loxley H.V. patent ceiling rose, 674  
 Lundberg development in two-way wiring, 39  
 Magnetic clutches on plate-edge planers, 877  
 Mazda traction lamps, 322, 334  
 "M.E." printing motor equipment, 39, 134  
 "Mego meter" insulation testing set, 415  
 "Metallic" fuseboards, 867  
 Moulded steatite, 735  
 Multiple-switch motor starters for large n.c. motors, 416  
 "Mumps" lampholder, The, 749  
 "Omega" testing set, The, 406  
 Organ-blowing equipment, An electric, 322  
 Pape electric safety lamps, 170  
 Patent tilting and rise-and-fall fitting, 791  
 "Peel-Conner" intercommunication telephones, 53  
 Portable drying oven, A, 539  
 Rectifier for converting A.C. to D.C., 673  
 Reflector stove, Electric, 674  
 Reflectors, Steel, 407  
 Reid's patent time switches, 539  
 "Reyrolle" 10-ampere mining circuit-breaker, 91  
 Rhadoonit, 673

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—continued.  
 Rubbing-contact electric bell, 332  
 Self-oiling plummer blocks, 209  
 Sign projector, A, 39  
 Signs, Electric, 54  
 Simplex combination cooking outfit, 877  
 .. egg boiler, 735  
 .. electric toaster, 456  
 .. hand lamp, 323  
 .. heating apparatus, 956  
 .. irons for laundries, 538  
 .. radiator, New, 383  
 "Slipon" shade carrier, 823  
 Sloan insulators, 90  
 Solid (keyless) muff coupling, 867  
 Split-seconds chronograph, 736  
 Sulphalium, 170  
 Tee connection, 39  
 Tesla steam turbine, 132  
 Theatre dimmer, 919  
 .. electric sign, 209  
 Thermo-electrical combustion calorimeter, 790  
 Travelling crane, A new design of, 748  
 Tube-bending machine, A new, 334  
 Universal conduit boxes, 406  
 Vickers adjustable reamer, 406  
 .. D.C. motor control panel, 417, 458  
 W. E. combined telephone signal lamp and relay, 1027  
 .. instrument protector, 791  
 White electrical instruments, 735  
 Wiring system, New, 133  
 Witton-Kramer D.C. portable drills, 1068  
 .. -Kramer electro-magnetic clutches, 673  
 .. -Kramer fatigue tester, 1026  
 Woodhouse steel casing, 209  
 Yacht lighting accumulators, 1068  
 "Zed" fuse distribution boards, 467

New electric lift, A., 918  
 .. South Wales, A contract to supply motive power in, 202  
 .. Year letter to ourselves, A, 3  
 .. Year, The, 1  
 .. York, Electricity supply in London and, by M. Tappley, 163  
 .. Zealand, 66  
 .. Zealand, Electrical progress in, 982  
 .. Zealand new Patents Act, 154  
 .. Zealand, Wages and prices in, 551  
 Newcastle Chamber of Commerce (Electrical Section), 930  
 Newspapers and the law of libel, 680  
 Nitrate production from the raw material of aluminium, 931  
 Northampton Institute dinner, 463  
 Norway, A large electrical project in, 218  
 .. Electricity for mining in, 66  
 .. New electrical ironworks in, 143  
 .. The Sydvaranger iron mines in, 345  
 Novel electrical steel furnace, A, 549  
 .. use of the electric arc, A, 382

## OBITUARY—

Bennett, Frederick, 28  
 Benyon, W. B., 1050  
 Brodie, P. M. S., 221  
 Case, B., 683  
 Cour, Paul de la, 806  
 Day, Charles, 722  
 Delaunay-Belville, Louis, 308  
 Festing, Major-General E. R., 843  
 Gibbs, John D., 430  
 Gouraud, Col. G. E., 344, 385  
 Gray, John, 722, 763  
 Haynes, W., 145  
 Hislop, Laurence M., 68  
 Holdron, J., 344  
 Hose, Charles T., 108  
 Hudson, Robert, 683  
 Johnson, S. W., 108  
 Jones, S. Mansel, 892  
 Kerry, Ellis, 267  
 Lawson, David, 843  
 Measures, R. H., 1050  
 Norman, R. Douglas, 722  
 Oakley, Sir Henry, 267  
 O'Dowd, C. J., 108  
 Pacinotti, Antonio, 512  
 Parsons, Hindsell, 722  
 Pritchett, G. E., 344  
 Probert, Isaac, 308  
 Reynolds, Dr. Osborne, 344  
 Rosser, David, 267  
 Sancton, E. K., 28  
 Sassoon, Sir Edward Albert, 892  
 Souttar, Robinson, 594  
 Turnbull, Robert, 68  
 Wall, L. J. B., 806  
 Weller, Thos., 68

Observatories and lightning, 26

OFFICIAL RETURNS—  
 Ackroyd & Best, 145, 594  
 Acton Lamp Co., 893, 1013  
 Allen, West & Co., 221  
 Alliance Electrical Stores, 350  
 Altrincham Electric Supply, 892  
 Aluminium Corporation, 386  
 Anchor Cable Co., 108  
 Anglo-Norwegian Aluminium Co., 108, 386, 893  
 Aron Electricity Meter, 594  
 Auxiliary Electrical Co., 470  
 Balchin, Schulz & Co., 386  
 Bankfoot Power Co., 145, 221  
 Blackpool and Garstang Electric Light Railway Co., 221

OFFICIAL RETURNS—continued.  
 Blackpool, St. Anne's and Lytham Tramways Co., 386  
 Bright's Light and Power, 594  
 British Colombia Electric Railway Co., 723  
 .. L.M. Ericsson Mfg. Co., 723  
 .. Mica Co., 898  
 Brush Electrical Engineering Co., 221  
 Bryant Trading Syndicate, 892  
 Buenos Ayres Port and City Tramways, 350  
 Campbell & Isherwood, 1013  
 Cantie Switch Co., 470  
 Cape Electric Tramways, 350  
 Carlsbad Electro-Thermal Baths, 594  
 Casella, C. F., & Co., 145  
 Central Electric Supply Co., 594  
 Chichester Electric Light and Power Co., 596  
 Church Stretton Electric Supply Co., 470  
 Concordia Electric Wire Co., 850  
 Consolidated Signal Co., 145  
 Corona Lamp Works, 145, 892  
 Costa Rica Electric Light and Traction Co., 385  
 County of Durham Electrical Power Distribution Co., 893  
 Crystal Palace Kearney High-Speed Railway Syndicate, 893  
 Dennison, Kett & Co., 221  
 Douglas Southern Electric Tramways, 350  
 East India Tramways Co., 350  
 Egham and Staines Electricity Co., 145  
 Electrical Advertising Co., 386  
 Electrical Engineer, 108  
 Electrical Installations, 221, 386  
 .. Power Storage Co., 145  
 Electromobile Co., 108, 145, 386, 723, 892  
 Ellis & Ward, 893  
 Engineering Instruments, 145  
 English Electrical Co., 108  
 Everett, Edgumbe & Co., 893  
 Evershed & Vignoles, 145, 221, 350  
 Fletcher Jackson & Co., 470  
 Folkestone Electricity Supply Co., 893  
 Follert, Max, & Co., 108  
 Foots Cray Electricity Supply Corporation, 893  
 Foreign and Colonial Lighting Co., 723  
 Frankenberg, I., & Sons, 893  
 Frinton-on-Sea and District Electric Light and Power Co., 145  
 Furse, W. J., & Co., 893  
 General Electric Co., 108, 145  
 Globe Electric Co., 145  
 Hart Accumulator Co., 108  
 Hartford, Samuel, & Co., 892  
 Hendon Electric Supply Co., 723  
 Hill, Harding & Co., 723, 892  
 Holsworthy Gas and Electric Supply Co., 350  
 Hong Kong Tramway Co., 145, 1013  
 Hove Electric Lighting Co., 593  
 Incandescent Heat Co., 893  
 India-Rubber, Gutta-Percha and Telegraph Works, 471  
 Johnson & Phillips, 723, 892  
 Kent Electric Power Syndicate, 471  
 Kesnor, Thomas, & Co., 145  
 Kilowatt Publishing Co., 386  
 La Plata Electric Tramways Co., 386  
 Lechdale Electric Light and Power Co., 723  
 Liverpool Electric Cable Co., 385  
 Lobito, Benguella and Catumbella Electric Light and Power Co., 145, 723  
 Londonderry Movable Electric Railway Syndicate, 471  
 Madras Electric Tramways (1904), 893  
 Marse, J., & Co., 385  
 Mather & Platt, 893  
 Metalite, 386, 1013  
 Middleton Electric Traction Co., 145  
 Midget Electric Lamp Manufacturing Co., 145  
 Milnes, Voss & Co., G. C., 146  
 Minehead Electric Supply Co., 892  
 Mirfield Garage and Electric Works, 1013  
 Morris & Lister, 350  
 Musselburgh and District Electric Light and Traction Co., 108  
 Nairobi Electric Power and Lighting Co., 108  
 National Conduit and Cable Co., 108  
 Newcastle and District Electric Lighting Co., 893  
 .. -upon-Tyne Electric Supply Co., 893  
 Newtons, 886  
 Novelty Construction Co., 1013  
 Oriental Telephone and Electric Co., 892  
 Oswestry Electric Lighting and Power Co., 145  
 Ozonair, 385  
 Pacific and European Telegraph Co., 108  
 Paignton Electric Light and Power Co., 471  
 Peto & Radford, 1013  
 Pontelec Welding Patents, 386  
 Pritchett & Gold, 893  
 Rangoon Electric and Supply Co., 471  
 Reading Electric Supply Co., 594  
 Reason Manufacturing Co., 145, 723  
 Robinson, M. E., & Co., 1013  
 Royce, 892  
 Rugby Lamp Co., 594  
 Rural Electricity Supply Co., 221  
 Sheerness and District Electric Power and Traction Co., 108, 1013  
 South American Light and Power Co., 145  
 .. Metropolitan Electric Light and Power Co., 594



## OFFICIAL RETURNS—continued.

Spagnoletti, 885  
Sunbeam Lamp Co., 108  
Sykes, W. R., Interlocking Signal Co., 148  
Telephone Co. of Egypt, 386  
Thursfield, C. J., & Co., 723  
Tramways (M.E.T.) Omnibus Co., 723  
Underground Electric Railways Co. of London, 723  
Willans & Robinson, 145  
Woking Electric Supply Co., 145  
Yarmouth (I.W.) Electricity Supply Co., 103  
"Z" Electric Lamp Manufacturing Co., 145, 723, 892

Ohm, "a new unit, The "Thermal, 43  
Oil-burning generating station, An auxiliary, 721  
" engine and its industrial importance, particularly for Great Britain, The Diesel, by Dr. Rudolph Diesel, 655  
" engines for driving small generators, 658  
Oils, The formation of deposit by transformer, by P. N. Hooper, 275  
Olympia Exhibition, A report on, 25  
" 1911, Electrical Exhibition, 681  
Omnibuses, Tilling-Stevens, 169  
One-break system, The, 793  
Opal shades, 275  
Open specifications, 951  
Optical Convention, 1006, 1060  
Ore deposits, Socialising, 1050  
" Tool steel direct from the, 455  
O.S.A. Smoking Concert, 646  
Osram lamps, New, 253  
Ozonair plant of the Central London Railway, The, 785

**P**ACKING armatures for rail-conveyance, On, by S. Lees, 181  
Panama Canal, Electric power for the, by John George Leigh, 45, 116, 124, 232

## PARLIAMENTARY—

Agricultural light railways, 426  
Birmingham Corporation Tramways, 671  
Board of Trade Electricity Orders, 977  
Bognor electric lighting, 792  
Bradford Corporation Trolley Vehicles, 891  
Brighton tramway projects, 25, 486, 498, 1041  
Canvey Dock and Railway, 751  
Edgware and Hampstead Railway Bill, 487  
Electric Lighting Provisional Order (No. 1) Bill, 738  
" Lighting Provisional Order (No. 2) Bill, 738  
Electrification of the East London Railway, 25  
Glasgow tramways, 292  
Government department contracts, 335  
House of Lords' Bills, 292  
Keighley Corporation Bill, 737, 1042  
Kidderminster Local Government Board Order, 997  
Kingston-on-Hull Corporation Tramways, 25  
L.C.C. tramways, 997  
Light Railways Bill, 749, 791  
Lighting of the House of Commons, 1042  
London and N.W. Railway Bill, 838, 422, 751  
" Electric Railways Bill, 486  
Metropolitan District Railway Bill, 499  
" Electric Tramways Bill, 427  
" Railway Bill, 738  
Midland and London and Tilbury Railways Bill, 738  
National Electric Construction Co., 292  
Newton-in-Makerfield U.D.C. Electrical Supply, 997, 1042  
North Ormesby, South Bank, Normanby and Grangetown Railless Traction Co., 1041  
Petitions, 292, 335  
Railless trolley schemes, 792  
Railway electrification in London, 25  
Second readings, 335, 382, 499, 551, 738, 997, 1042  
Southall and Hounslow railless traction, 292, 487  
Standing Orders, 292  
Stockport railless traction scheme, 793  
Tarbert Harbour, 738  
Third Readings, 843, 997, 1042  
Trackless trolley systems, 385  
Tramway Provisional Orders, 891  
Tramways and electricity estimates, 79

Passenger transport, 572  
Patent application, 164, 753  
" notices, 210  
" restoration, 159  
Patents Act, New Zealand new, 154  
" report, 1911, The, 531  
" The compulsory working of, 571  
Paths in electrical machinery, Heat, by H. D. Symons and Miles Walker, 195  
Peat as engine fuel, by T. Tomlinson, 483  
" fuel, 451, 610, 1028  
" fuel in Russia, 291  
Peru, Trade statistics of, 119  
Petrol-electric 'buses, 349  
" -electric car for the G.C. Railway Co., Westinghouse, 664  
" -electric sets for wireless telegraphy, 901

Petroleum in England, by W. H. Booth, 527  
Photometric Investigation of mercury-vapour lamps, A, 411  
Physical constants of aluminium, The, by Dr. F. J. Brislée, 37  
" Society, 578, 875  
" Society Exhibition, The, 9, 52, 88  
Pictures, The Mortier system of telegraphing, 468  
Plant, British v. foreign, 825  
" growth, Electricity and, 157  
Platinum, Russian, 56  
Poles in electrical service, Wood and concrete, by W. Manktelow, 193, 203  
Police hand lamps, 217  
" lanterns, 980  
Popularising electricity, 490  
Porcelain line insulators, High-tension, by J. Lustgarten, 775  
Possibilities for future commercial relations with Gt. Britain, Brazil: its present conditions and the, by C. E. Best and H. L. Parrott, 83  
Postal engineers, 27  
Post Office telegraphs and telephones, 552  
Power factors by synchronous motors, Improvement of, 982  
" for the Panama Canal, Electric, by John Geo. Leigh, 45, 116, 125, 232  
" generation and distribution in the Clyde Valley, by D. A. Starr, 1065  
" Highland water, by A. Newlands, 874  
" in self-contained road vehicles, The supply and transmission of, by J. C. Macfarlane and H. Burge, 535  
" in South-East Kent, Electric, 261  
" in textile mills, Electric, 179  
" monopoly, Uruguayan electric, 66  
" plant, N.Z., The Lake Coleridge, 670  
" station at Bury, New, 239  
" station working, Notes on, by J. W. Jackson, 695  
" Sun, 66  
" Wireless, 931  
Preservative for timber, Aczol: a new, 1059  
Presidential address, The I.M.E.A., 989, 991  
" election, The I.E.E., 662  
Press, Index to articles in the technical, by "Interested," 817  
Pretoria, Contract conditions for, 220  
Price increase in Germany, 885, 910  
Prices, Advance in, 298, 502, 621, 674  
" Effect of foreign, 960  
" Lamp, 13  
" Publication of (Ne sutor ultra crepidam), 869  
Primary battery, The Benkö, by W. R. Cooper, 37  
Printing proceedings, 83  
" works by electricity, Illumination of, by Justus Eck, 874  
Private arrangement, 252, 419  
" house lighting by electricity, by W. R. Rawlings, 917  
" meetings, 13, 297, 504, 675, 793, 886, 923, 1001  
Prize competition, 25

## PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—

Accumulative energy, The degradation of, by A. G. Collis, 361  
Alloys, The magnetic properties of, 860  
Aluminium, The physical constants of, by F. J. Brislée, 37  
Arcs, Yellow flame, by M. Solomon, 819  
Articles, Institution of Electrical Engineers, 50  
Association of Mining Electrical Engineers, 321  
Asynchronous motors, An automatic starting device for, by N. Pensabene Perez, 36, 49  
Automatic reversible battery boosters, by R. Rankin, 402  
Auxiliary machinery for internal-combustion engine vessels, by W. R. Cummins, 129  
Benkö primary battery, The, by W. R. Cooper, 37  
Boosters, Automatic reversible battery, by R. Rankin, 402  
Brain as an electrical organ, The, by Dr. W. D. Butcher, 822  
Central-station practice, Notes on, by A. Neave Kingsbury, 362  
Clyde Valley, Power generation and distribution in the, by D. A. Starr, 1065  
Coal dust by electric flashes, The ignition of, by Prof. W. M. Thornton, 587  
Collieries, The mechanical design of electrical plant usually found in, by R. H. Willis, 321  
Combustion engine vessels, Auxiliary machinery for internal, by W. R. Cummins, 129  
Commutator machines, Flashing over in, by W. W. Frith, 484  
Condensers in series with metal-filament lamps, by A. W. Ashton, 983  
Conductivity of dielectrics, On the power factor and, by J. A. Fleming and G. B. Dyke, 736  
Control of railways, The use of electricity for the, by J. Sayers, 113

## PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—continued.

Corrugation of rails, The, by Prof. A. Schwartz and R. G. Cunliffe, 862  
Degradation of accumulative energy, The, by A. G. Collis, 361  
Developments in steam turbine practice, Recent, by K. Baumann, 317, 359  
Dielectrics, On the power factor and conductivity of, by J. A. Fleming and G. B. Dyke, 736  
Diesel engine from the user's standpoint, The, by W. J. U. Sowter, 870  
" oil engine and its industrial importance, particularly for Great Britain, The, by Dr. Rudolph Diesel, 655  
Direct-current on the series system, The transmission of electrical energy by, by J. S. Highfield, 985, 1021  
" -current watt-hour meters, The behaviour of, by S. W. Melsom and W. H. Eastland, 914  
Domestic electricity, 579, 697, 779  
Dynamoes for motor road vehicle lighting, by J. D. Morgan, 281  
Electrical driving of rolling mills, The, by C. A. Ablett, 235, 486, 577  
" engineering laboratory at the Heriot-Watt College, Edinburgh, by Prof. F. G. Baily, 50, 114  
" furnaces, by C. Myers, 696  
" machinery, Notes on standards for, by Dr. R. Pohl, 37  
Electricity, Domestic, 579, 697, 779  
" for the control of railways, The use of, by J. Sayers, 113  
" supply undertakings, Small, by Percy A. Spalding, 50  
Endurance, Magnetic apparatus for testing, by Prof. G. Kapp, 49  
Energy, The degradation of accumulative, by A. G. Collis, 361  
" Tariffs for electrical, by W. W. Lackie, 522  
Factories, Electric driving in textile, by John Shaw, 403  
Faraday Society, 578, 860  
Flashing-over in commutator machines, by W. W. Frith, 484  
Fuel, Peat as engine, by T. Tomlinson, 483  
Furnaces, Electrical, by C. Myers, 696  
Haulages in mines, Electric, by W. C. Mountain, 537  
Heriot-Watt College, Edinburgh, The electrical engineering laboratory at the, by Prof. F. G. Baily, 50, 114  
High-frequency currents, by W. Duddell, 862  
" tension porcelain line insulators, by J. Lustgarten, 775  
" -voltage tests and energy losses in insulating materials, by E. H. Rayner, 443  
Highland water-power, by A. Newlands, 874  
Icebergs, by a recording microthermometer, Location of, by Prof. H. T. Barnes, 917  
Ignition of coal dust by electric flashes, The, by Prof. W. M. Thornton, 587  
Illumination: production, calculation, measurement, by J. D. Mackenzie, 873  
" of printing works by electricity, The, by Justus Eck, 874  
Institute of Metals, The, 280  
Institution of Electrical Engineers, The, 864  
" of Electrical Engineers' articles, 50  
" of Electrical Engineers, Newcastle Local Section Address, 36  
Insulating materials, High-voltage tests and energy losses in, by E. H. Rayner, 443  
Insulators, High-tension porcelain line, by J. Lustgarten, 775  
Internal combustion engine vessels, Auxiliary machinery for, by W. R. Cummins, 129  
Laboratory at the Heriot-Watt College, Edinburgh, The electrical engineering, by Prof. F. G. Baily, 50, 114  
Lighting by electricity, Private house, by W. R. Rawlings, 917  
" Dynamoes for motor road vehicle, by J. D. Morgan, 281  
Losses in insulating materials, High-voltage tests and energy, by E. H. Rayner, 443  
Machinery, Notes on standards for electrical, by Dr. R. Pohl, 37  
Magnetic apparatus for testing endurance, by Prof. G. Kapp, 49  
" properties of alloys, The, 850  
Measurement, Illumination: production, calculation, by J. D. Mackenzie, 873  
Metal-filament lamps, Condensers in series with, by A. W. Ashton, 983  
Metals, The Institute of, 280  
Meters on variable loads, Electrical, by D. Robertson, 916  
" The behaviour of direct-current watt-hour, by S. W. Melsom and W. H. Eastland, 914

## PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—continued.

Microthermometer, Location of icebergs, by a recording, by Prof. H. T. Barnes, 917  
Mills, The electrical driving of rolling, by C. A. Ablett, 235, 577  
Mines, Electric haulages in, by W. C. Mountain, 537  
Mining Electrical Engineers, Association of, 321  
Motor road vehicle lighting, Dynamometer, by J. D. Morgan, 281  
Motors, An automatic starting device for asynchronous, by N. Pensabene Perez, 36, 49  
Oil engine and its industrial importance, particularly for Great Britain, The Diesel, by Dr. Rudolph Diesel, 655  
Organ, Brain as an electrical, by Dr. W. D. Butcher, 822  
Peat as engine fuel, by T. Tomlinson, 483  
Physical constants of aluminium, The, by F. J. Brislée, 37  
" Society, 578, 875  
Porcelain line insulators, High-tension, by J. Lustgarten, 775  
Power factor and conductivity of dielectrics, On the, by J. A. Fleming and G. B. Dyke, 736  
" generation and distribution in the Clyde Valley, by D. A. Starr, 1065  
" Highland water, by A. Newlands, 874  
" in self-contained road vehicles and locomotives, The supply and transmission of, by J. C. Macfarlane and H. Burge, 535  
" station working, Notes on, by J. W. Jackson, 695  
Primary battery, The Benkö, by W. R. Cooper, 37  
Printing works by electricity, Illumination of, by Justus Eck, 874  
Private house lighting by electricity, by W. R. Rawlings, 917  
Pump, The evolution and present development of the turbine, by Dr. Edward Hopkinson and A. E. L. Chorlton, 279  
Rails, The corrugation of, by Prof. A. Schwartz and R. G. Cunliffe, 862  
Railways, The use of electricity for the control of, by J. Sayers, 113  
Residence tariffs, by A. H. Seabrook, 129  
Reversible battery boosters, Automatic, by R. Rankin, 402  
Road vehicles and locomotives, The supply and transmission of power in self-contained, by J. C. Macfarlane and H. Burge, 535  
Rolling mills, The electrical driving of, by C. A. Ablett, 235, 486, 577  
Röntgen Society, The, 37, 485  
Series system, The transmission of electrical energy by direct-current on the, by J. S. Highfield, 985, 1021  
Small electricity supply undertakings, by Percy A. Spalding, 50  
Specifications, by Fred. S. Sells, 446  
Standards for electrical machinery, Notes on, by Dr. R. Pohl, 37  
Starting device for asynchronous motors, An automatic, by N. Pensabene Perez, 36, 49  
Steam turbine practice, Recent developments in, by K. Baumann, 317, 359  
Supply and transmission of power in self-contained road vehicles and locomotives, The, by J. C. Macfarlane and H. Burge, 535  
Tariffs for electrical energy, by W. W. Lackie, 522  
" Residence, by A. H. Seabrook, 129  
Testing endurance, Magnetic apparatus for, by Prof. G. Kapp, 49  
Tests and energy losses in insulating materials, High-voltage, by E. H. Rayner, 443  
Textile factories, Electric driving in, by John Shaw, 403  
Transmission of electrical energy by direct current on the series system, The, by J. S. Highfield, 985, 1021  
Turbine practice, Recent developments in steam, by K. Baumann, 317, 359  
" pump, The evolution and present development of the, by Dr. Edward Hopkinson and A. E. L. Chorlton, 279  
Variable loads, Electrical meters on, by D. Robertson, 916  
Water power, Highland, by A. Newlands, 874  
Watt-hour meters, The behaviour of direct-current, by S. W. Melsom and W. H. Eastland, 914  
Yellow flame arcs, by M. Solomon, 819  
Proceedings, Printing, 83  
Production, The Census of, Profession, The electrical, 163  
Profit-sharing, 67  
" and co-partnership, The successes and failures of, by Frank Broadbent, 452  
Profits, The law and the, 783  
Prospects, Electrical engineering trade, 13



## PROSPECTUSES—

Alabama Traction, Light and Power Co., 386  
 Alby United Carbide Factories, 386  
 Bolton, Thomas, & Sons, 935  
 British Columbia Telephone Co., 855  
 " L. M. Ericsson Manufacturing Co., 355  
 Burmeister & Wain (Diesel System) Oil Engine Co., 553  
 Callender's Share and Investment Trust, 855  
 Canadian - British Engineering Co., 1055  
 Coal Substitute, 355  
 Compania Hidro-Elctrica de Tucuman (Argentina), 686  
 Consolidated Cities Light, Power and Traction Co., 1055  
 " Diesel Engine Manufacturing Co., 553  
 County of London Electric Supply Co., 475  
 Empire District Electric Co., 724  
 Hydro-Electric Power and Metallurgical Co., 686  
 Kentucky Traction and Terminal Co., 386  
 Letters Patent Insurance Co., 1014  
 Lytham Electric Light and Power Co., 188  
 Mexican Midland Light and Power Co., 686  
 Nagpur Electric Light and Power Co., 855  
 New York Telephone Co., 894  
 Newcastle and District Electric Lighting Co., 651  
 Portland Railway, Light and Power Co., 355  
 Rose Automatic Target Co., 855  
 Scottish Tube Co., 651  
 Sudd Fuel (Suddite), 355  
 Tramways (M.E.T.) Omnibus Co., 147  
 Vancouver Power Co., 188  
 Victoria Falls and Transvaal Power Co., 764  
 Western Canada Power Co., 514

Publication of prices (Ne sutor ultra crepidam), 869  
 Publicity, Some second thoughts on, by R. Borlase Matthews, 693  
 " Some thoughts on, by C. H. Wordingham, 602  
 " Electric supply, 67  
 " literature, 467  
 Pump, The evolution and present development of the turbine, by Dr. Edward Hopkinson and Mr. A. E. L. Chorlton, 279  
 Pumping, Water economy and electric, 951

QUANTITATIVE investigations on wireless telegraphy over long distances, 384  
 Quarries, Electrical plant at the Buxton Lime Firm's, 59

RADIO-telegraphic compass, A, 912  
 " -Telegraphic Convention, The, 909, 1040  
 Radium, Curative properties of, 947  
 " in Austria, 247  
 " in hot springs at Bath, 466  
 Railless traction at Leeds and Bradford, 492  
 " tramways, 204  
 Rails, The Corrugation of, by Prof. A. Schwartz and R. G. Cunliffe, 862  
 Railway administration, Indian, 911  
 " cab signalling, Application of electricity to, by W. H. Dammond, 1061  
 " cable, A 60,000-volt, 208  
 " developments, Notes on recent electric, 404  
 " electrification, 82, 1012  
 " electrification, Melbourne suburban, 902

## RAILWAY NOTES—

Argentina, 58, 143  
 Australia, 338, 507  
 Austria, 15, 138, 214, 463, 964, 1004, 1046  
 Belgium, 758, 797  
 Canada, 507, 543, 758, 927  
 Chile, 15, 507, 887  
 Colwyn Bay, 301, 678  
 Denmark, 138  
 East Kent, 507, 926  
 " London Railway, 97  
 France, 97, 379, 423, 507, 584, 678, 758, 797, 887, 964  
 Germany, 16, 197, 176, 423, 463, 743, 584, 623, 797  
 Italy, 16, 301, 926, 964  
 Japan, 16, 464  
 Korea, 964  
 Lancashire and Yorkshire Railway electrification, 379, 507  
 London, 176, 379, 423, 464, 507, 544, 584, 678, 797, 838, 1004  
 " and S. W. Railway electrification, 579  
 " -Southend electrification, 964  
 Madagascar, 302, 584  
 Mexico, 63, 802, 964  
 New Zealand, 759, 797  
 North-Eastern Railway, 214  
 Norway, 379  
 Russia, 15, 544, 964  
 Sierra Leone, 58  
 Spain, 423, 463, 964  
 Sweden, 623  
 Switzerland, 63, 97, 463, 797, 964  
 Tasmania, 302

## RAILWAY NOTES—continued.

Turkey, 463, 1004  
 Tyrol, The, 879  
 United States, 16, 189, 888  
 Venezuela, 98, 585  
 Railway rates on electric heating stoves, 49  
 " The Dessau-Bitterfeld single-phase, 846  
 " The Kearney high-speed, 1011  
 " working in Germany, Electric, 122  
 " workshops, Important South African, 714  
 Railways, Proposed electrification of the Chilian State, 453  
 " The use of electricity for the control of, by J. Sayers, 113  
 Rand, Electric winding on the, 388  
 " industries, 744  
 Rating of cables, by J. Wagner, 921  
 " of engineering works, The, 66  
 " of machinery, The, 123  
 " of tramways, 243  
 Records in central stations, Various, by "Interested," 73  
 Recovery of contract prices without the engineer's certificate, 817  
 Rectifier, An electric locomotive with the Auvert-Ferrand, 859  
 References, Colonial, by "Colonial," 501  
 Reforming, Institutions, 286  
 Regulations in South Africa, The new elevator, 243, 248  
 Reliability and maintaining continuity of supply, Means of securing, by Frank Ayton, 992  
 Rescue, An electric light, 144  
 Residence tariffs, by A. H. Seabrook, 129  
 Resistivity, Temperature coefficient and, 27  
 Restrictive covenant, The, 702  
 Resuscitation from electric shock, 142  
 Reversible battery boosters, Automatic, by R. Rankin, 402  
 " boosters, by C. Turnbull, 412

## REVIEWS—

Alternating Current Design, by Julius Frith, 561  
 Application of Hyperbolic Functions to Electrical Engineering Problems, The, by A. E. Kennelly, 901  
 Boiler Draught, by H. K. Pratt, 562  
 Commerce of Cape Town, 92  
 Dynamo and Motor Attendants and their Machines, by F. Broadbent, 943  
 Electric Cranes and Hoists, by H. H. Broughton, 76  
 " Mains and Distributing Systems, by J. R. Dick and F. Fernie, 601  
 " Propulsion of Ships, The, by H. M. Hobart, 77  
 " Railway Engineering, by C. F. Harding, 900  
 " Traction for Railway Trains, by E. P. Burch, 520  
 Elements of Electrical Transmission, The, by O. J. Ferguson, 266  
 Engineers' Year Book, The, by H. R. Kempe, 375  
 Four-Place Tables, by E. V. Huntingdon, 253  
 Glover's Vade Mecum, 18  
 Induction Motor, The, by B. F. Bailey, 941  
 Introduction to the Study of Fuel, An, by F. J. Brislee, 657  
 Konstruktionen Elektrischer Maschinen, by W. Peineke, 901  
 Law Relating to Engineers, The, by L. W. J. Costello, 29  
 Liquid Fuel and Its Apparatus, by W. H. Booth, 657  
 Machine Tools, by J. W. French, 561  
 Magnetic Circuit, The, by V. Karapetoff, 182  
 Manual of Electrical Undertakings and Directory of Officials, by E. Garcke, 755  
 " of Wireless Telegraphy, by S. S. Robison, 942  
 " of the Telephone, by W. Aitken, 267  
 Modern Locomotive, The, by C. Edgar Allen, 253  
 Motor Manual, The, 336  
 Motors and Motoring, by Prof. H. J. Spooner, 336  
 Power House Design, by J. F. C. Snell, 390  
 Practical Electrician's Pocket-Book and Diary, 1912, 173  
 Radio-Telegraphist's Guide and Log-Book, by W. H. Marchant, 942  
 Report on British Standard Heads for Small Screws, 137  
 Revolving Vectors, by G. W. Patterson, 601  
 Rubber, by Philip Schidrowitz, 561  
 " Industry, The, 92  
 Russian Year-Book, 1912, 210  
 Schutzvorrichtungen der Starkstromtechnik gegen Atmosphärische Entladungen, by G. Renischke, 76  
 Selbstanschluss und Wahlereinrichtungen im Fernsprechnetze, by A. Kruckow, 266  
 Sell's Directory of Registered Telegraphic Addresses, 1912, 210  
 Ship Wiring and Fitting, by T. M. Johnson, 137  
 Sixty Years of Progress and Fiscal Policy, by Earl Brassey, 793  
 Small Switches and their Circuits, by W. Perren Maycock, 460  
 Spon's Architects' and Builders' Pocket-Book, 375

## REVIEWS—continued.

Steam Turbine Design, by John Morrow, 104  
 Willing's Press Guide, 1912, 56  
 Yellowsands, by A. Gowans Whyte, 739  
 Rheostats, Notes on, by "B. K.," 315  
 Rifle club, Electrical, 647  
 " league, Electricity supply, 417, 762, 931  
 " range, 391  
 Road vehicles and locomotives, The supply and transmission of power in self-contained, by J. C. Macfarlane and H. Burge, 535  
 Rolling mills, The electrical driving of, by C. A. Ablett, 235, 486, 577  
 Röntgen Society, The, 37, 485  
 Rooms, The indirect lighting of, by "Whistlefield," 954  
 Royal commission on Imperial trade, 593  
 " Society conversazione, 784  
 " visit to Aldershot, A, 871  
 Rubber manufacture for electrical purposes in Japan, 999  
 " New source of, 930  
 " Synthetic, 1029  
 Russia, 104, 833  
 " British trade with, 11  
 " Electrical progress in, 656  
 " German works in, 751  
 " New telephone works in, 1037  
 " Peat fuel in, 291  
 Russian lamp duties, Revised, 682

## SAFETY appliances, Museum of, 704

St. James's Electric Athletic Club, 106  
 Scientist, Manager and, 782  
 Selandia, The, 371  
 Series system, The transmission of electrical energy by direct current on the, by J. S. Highfield, 985, 1021  
 Shades, Opal, 275  
 Sheffield Corporation and its wiring work, The, 1031  
 Shipbuilding yard. Electric power in a Japanese, 439  
 Ships' telegraph apparatus, A new electrical, 205  
 Shock, Resuscitation from electric, 142  
 " 20,000-volt, 682  
 Short-sighted economy, 783  
 Shut-down—from a legal standpoint, A, 26  
 Siemens Bros. Dynamo Works, Extensions at, 960  
 Signalling, Application of electricity to railway cab, by W. H. Dammond, 1061  
 Signs as advertising media, Electrical, by G. A. Cooper, 911  
 "Silvertown" and the electrical industry, 827  
 Simply made electric heaters and hot cupboards, by "Whistlefield," 7  
 Single-phase railway, The Dessau-Bitterfeld, 446  
 Slingo, Mr.: new engineer-in-chief to the Post Office, 887  
 Small electricity supply undertakings, by Percy A. Spalding, 50  
 " generators, Oil engines for driving, 658  
 Smelting in Sweden, Electric, 347  
 " of iron ore, Electrical, 292, 468  
 " tin, Electric, 521  
 Smoke Abatement Conference and Exhibition, 412, 429, 467, 495, 512, 576, 618  
 " nuisance, 1049  
 " nuisance and the remedy, 1012  
 " nuisance in Australia, To prevent, 313  
 Social events, 106, 219, 298, 510, 552, 682  
 South Africa, The engineer in the mine in, 241  
 " Africa, The new elevator regulations in, 243, 248  
 " Africa, Trade statistics of, 946  
 " African contract, 656  
 " African railway workshops scheme, Important, 714  
 " America, German enterprise in, 892  
 Southport, Public clocks for, 669  
 Spain, Carbons for, 136  
 " Exhibition in, 156  
 " Wireless telegraphy in, 824  
 Specifications, by Fred. S. Sells, 446  
 " Open, 851  
 Sports, Electrical Engineers', 891  
 Stamp cancelling, Electric, 468  
 Standards, Artistic street lamp, 451, 479  
 " for electrical machinery, by F. Kilburn Scott, 77  
 " for electrical machinery, Notes on, by Dr. Robert Pohl, 37  
 " for lighting, 907  
 " Some notes on table, 573  
 Starting device for asynchronous motors, An automatic, by N. Pensacoe-Perez, 36, 49  
 State employment in Germany, Electrical engineers and, 663  
 " monopoly of electrical enterprises in Uruguay, 143  
 Statistics of the Straits Settlements, 1910, Trade, 195  
 Steam turbine practice, Recent developments in, by K. Baumann, 317, 359  
 Steamships, Emergency plant on, 720  
 Steel direct from the ore, Tool, 455  
 " furnace, A novel electrical, 549  
 " plates, Failures of, 23  
 " works at Swansea. New, 212  
 Sterilising plant, An electrolytic, 692  
 Sterling telephone works, Dagenham, Essex, The, 587

Stoves, Railway rates on electric heating, 49  
 Straits Settlements, 1910, Trade statistics of the, 195  
 Stratford-on-Avon, Electrical developments in, 287  
 Street lamp standards, Artistic, 952  
 " lighting, by H. F. J. Thompson, 33  
 Strike at Earl's Court, Electrical, 646  
 " Coal, 342, 869, 382, 419, 429, 450, 461, 489, 569, 930  
 " Electrical workers', 184, 267, 843  
 Summer meeting of the I.E.E., 244, 1023  
 " meetings, 911  
 Sun power, 66  
 Sunbeam Lamp Co., 947  
 Supply and transmission of power in self-contained road vehicles and locomotives, The, by J. C. Macfarlane and H. Burge, 535  
 " of electrical fittings, Local authorities and the, 325  
 " works, Figures indispensable to municipal electricity, 883  
 Swansea, New steel works at, 212  
 Sweden, Electric smelting in, 347  
 Sydvaranger iron mines in Norway, The, 345  
 Synchronous motors, Improvement of power factors, by, 932  
 Synthetic rubber, 1029  
 Systems, Wages, by J. Walton and A. E. Brewerton, 981

## TABLE, Our Electricity Works, 1031

" standards, Some notes on, 673  
 Tariff, The Australian, 66  
 Tariffs for electrical energy, by W. W. Lackie, 522  
 " on electrical goods, Foreign and Colonial, 120, 200, 487, 527, 568, 739, 948  
 " Residence, by A. H. Seabrook, 129  
 Technical press, Index to articles in the, by "Interested," 817  
 Telegraph apparatus, A new electrical ship's, 205

## TELEGRAPH NOTES—

Admiralty wireless stations, 508  
 All-red route, 215  
 American Trust Law, 119  
 Australia, 16, 19, 176, 256, 424, 508, 585, 678, 717, 965  
 Austria, 16, 965  
 British Gold Coast, 717  
 Cable communication with Canada, 585  
 " rates, 16  
 " record, 927  
 " repairs, 64  
 Cables and the Spanish-American War, 759  
 " interrupted, 139  
 Canada, 176, 965  
 " -Spain, 176  
 Cheaper cables, 339  
 Chile, 176, 839  
 Colonial wireless telegraph stations, 544  
 Communication with Australia, 98  
 Compulsory wireless telegraph system, 424  
 Congo State, 139, 339, 624  
 Directive wireless telegraphy, 678  
 East Africa, 339  
 Effects of the storm, 139  
 Ferro-concrete poles, 177  
 France, 624, 717  
 German Colonies, 1005  
 Germany, 16, 624, 678, 965  
 Glass poles for telegraph work, 888  
 High-frequency machine, 927  
 Imperial wireless telegraph system, 424, 888  
 India, 64  
 International Radio-Telegraphic Conference, 888, 928, 1005  
 Italy, 624  
 Japan, 624  
 Liverpool, 928  
 Marconi House, 464, 839  
 " patents upheld in U.S.A., 508, 1047  
 " Telegraph shares, 139  
 " wireless telegraphy in the U.S.A., 678  
 Memorial to wireless operator, 965  
 Morocco, 717  
 Nauen station wrecked, 544  
 New cables, 64, 177, 256, 717  
 " German cables, 177  
 " Zealand, 302, 759  
 Night telegraph letters, 17, 888  
 Pacific cable, 544  
 Panama Canal, 717  
 Peru, 759, 965  
 Portugal, 339, 888  
 Post Office estimates, 839  
 " Office servants, 678  
 Postal employees' grievances, 17  
 " Servants' Conference, 585  
 Press telegrams, 1047  
 Radio-telegraphic Convention, 17, 234, 759, 918, 1047  
 Right to strike, The, 928  
 Russia, 17, 302, 585  
 South Africa, 215  
 " African cable rates, 256  
 " America, 339  
 Spain, 177  
 State-owned cables, 339  
 Submarine cable, 757  
 Sweden, 256  
 Switzerland, 177  
 Telegraph clerks, 624  
 " mechanicians, 98  
 Telegraphic addresses, 302



## TELEGRAPH NOTES—continued.

Telegraphic error, 177  
 Telegraphists' hours, 339  
 Telephone numbers as telegraphic addresses, 880  
 Telewriter progress, 302  
 Trans-Atlantic wireless telegraph service, 759  
 Turkey, 139, 678, 759  
 Underground telegraph cables, 717  
 United States, 98, 585, 888, 965  
 Uruguay, 17, 64, 98, 177, 215, 339  
 Venezuela, 928, 965  
 West Africa, 965  
 " Indies, 424  
 Wireless at sea, 678, 838, 928, 965  
 " fog-signalling, 624  
 " in warfare, 98  
 " ocean post, 424  
 " rescue, 585  
 " Telegraph Conference, 98  
 " telegraph patents, 717, 1047  
 " telegraphy, 17, 98, 139, 177, 302, 339, 380, 464, 585, 1047  
 " telegraphy and aircraft, 624, 798  
 " telegraphy and deep-sea fishing, 880  
 " telegraphy at sea, 717, 759  
 " telegraphy in German Colonies, 717  
 " time transmission, 177, 464  
 Wires cut by meteorite, 215  
 World's cables, The, 424

Telegraphing pictures, The Mortier system of, 458  
 Telegraphs and telephones, Post Office, 552  
 Telegraphy, Trans-Atlantic, by Charles Bright, 563  
 Telephone cable, The new French, 417  
 " disturbances, A damper for the prevention of, 721

## TELEPHONE NOTES—

Anglo-Dutch telephony, 215  
 " French telephone service, 423  
 " German telephony, 176  
 Attendance at telephone exchanges, 423  
 Australia, 16, 424  
 Austria, 16, 797, 927  
 Automatic telephone equipment, 544  
 " telephony, 839  
 Belgium, 464  
 Canada, 302, 965  
 Chile, 839  
 Coastguard telephones, 176  
 Congo State, 139, 339  
 Durban, 888  
 East Africa, 839  
 Effects of the storm, 139  
 Germany, 1047  
 Guernsey, 424  
 Hull, 339, 965  
 Hythe, 678  
 Japan, 508, 797, 888  
 London, 464, 544  
 Mexico, 302  
 Motor-cars and telephone line maintenance, 797  
 New exchange in the City, 64  
 Overhead lines, 177  
 Paris telephone service, 302  
 " Madrid, 17  
 Phantom circuits, 177  
 Police telephones, 535  
 Post Office estimates, 839  
 " Office factories, 177, 215  
 Reporting by telephone, 256  
 Russia, 177, 302  
 Signalling to trains, 1047  
 Switzerland, 177  
 Telephone assessments, 215  
 " factory, 203  
 " rates abroad, 424  
 " service, 215, 256, 302, 339, 759, 797, 1005  
 " transfer, 17, 544  
 Telephones and infection, 424  
 Trunk call deposits, 64  
 Turkey, 424  
 Village telephones, 928  
 Wireless telephony, 17, 98, 928

Telephone service, The, 202, 218  
 " works, Dagenham, Essex, The Sterling, 587  
 " works in Russia, New, 1037  
 Telephones, The transfer of the, 2  
 Temperature coefficient and resistivity, 27

" of gas-engine cylinders, The, 617

Tender, The ethics and economics of the lowest, 741

Tenders, Arc lamp, 743  
 " for cables, British and foreign, 1044

Test, Long non-stop Diesel engine, 488  
 " results on Zoelly steam turbines, 890

Testing endurance, Magnetic apparatus for, by Prof. G. Kapp, 49  
 " high-pressure cables when laid, A new method of, 907

Tests and energy losses in insulating materials, High-voltage, by E. H. Rayner, 443

" for insulated wire, New, 720

" Fraudulent, 533, 573

" of a new A.C. motor, 323

" Tungsten lamps, 807

Textile factories, Electric driving in, by John Shaw, 403

" machinery, The electric driving of, 469

" mill driving, The Joint Committee on, 931

" mills, Electric power in, 179

" Thermal Ohm," A new unit—the, 43

Thomas transmission and the Dewar Trophy, The, 218

Thoughts on publicity, Some, by C. H. Wordingham, 602

Three-core cables, The inter-relation of capacity in three-phase, by A. B. Clark, 632; by W. T. MacCall, 996

Tilling-Stevens omnibuses, 169

Timber, Aczol: a new preservative for, 1059

Tin, Electric smelting of, 521

Titanic, The loss of the, 662

Track, A new tramway, 218

Trade abroad, British, 949

" at Johannesburg, Electrical, 913

" disputes, Compulsory arbitration in, 409

" prospects, Electrical engineering, 13

" prospects of Indo-China, The, 92

" Royal Commission on Imperial, 593

" statistics of Australia, 154

" statistics of British India, 482

" statistics of Canada, 277

" statistics of Egypt, 1911, 907

" statistics of Italy, 860

" statistics of Jamaica, 699

" statistics of Mexico, 1059

" statistics of Peru, 119

" statistics of South Africa, 946

" statistics of the Straits Settlements, 1910, 195

" with Belgium, 906

" with Canada, 701

" with Mexico, 944

Trades Union, Electrical, 136

Traffic, London street, 826

Trafford Park factories, 12

Train lighting, The cost of, by C. Toone, 705

Trains, The lighting of railway, 428

Tram accidents in London, 'Bus and, 546

Tramcar meters, 327

Tramway companies, A question important to, 202

" companies and their employees, Australian, 694, 747, 906, 959

" Congress, An International, 1012

" Managers' Association, Scottish, 848

TRAMWAY NOTES—

Aberdeen, 58, 96, 623, 963

Accrington, 378, 926

Acton, 507

Aldershot and Farnborough, 677, 963

Algeria, 338, 407, 581

Alsace-Lorraine, 963

Ardley, 15, 1046

Argentina, 96, 176, 255, 584, 677, 963

Ashton, 96, 176

Asiatic Turkey, 743, 887

Australia, 176, 214, 338, 507, 796, 926, 1004

Austria, 15, 97, 507, 926

Ayr, 623, 926, 963

Baildon, 338

Barking, 507

Belfast, 15, 97, 138, 301, 507, 623, 677, 758, 796, 838, 926

Belgium, 133

Bexhill-on-Sea, 838

Bingley, 255, 838

Birkenhead, 423, 678, 758

Birmingham, 15, 255, 963

Birtley, 838

Blackburn, 176, 338, 378, 716

Blackpool, 15, 58, 214, 256, 507, 716, 743, 796, 963

Bolton, 584, 838

Bournemouth, 256, 796

Bradford, 58, 97, 423, 507, 584, 678, 743, 796, 838, 837

Brazil, 423, 758

Brighouse, 338

Brighton, 97, 176

Budapest, 544

Burnley, 463

Burton-on-Trent, 423, 796

Bury, 507, 584

Canada, 423, 543, 758

Cardiff, 678, 716

Carshalton, 758

Clayton-le-Moors, 963

Clydebank, 58

Colwyn Bay, 463

Coventry, 338, 964

Cowes (I. of W.), 138

Cowling (Yorks.), 138

Crewe, 97, 423

Croydon, 139, 838, 1046

Darlington, 964

Darwen, 758

Denmark, 423

Doncaster, 97, 176, 838

Dover, 139

Dudley, 926

Dundee, 97, 423, 464, 623, 838, 964

East Ham, 176

Eccles, 759

Edinburgh, 16, 97, 176, 464

Elland, 927

Exeter, 684

Falkirk, 379

Farnborough, 838

Fife, 16, 97, 584

Finchley, 1046

France, 63, 301, 463, 507, 716, 758, 838, 887, 926, 964

Gateshead-on-Tyne, 927, 1046

Germany, 138, 379, 716, 797, 1004

Glasgow, 58, 176, 256, 379, 584, 623, 716, 759, 797, 927, 964, 1004, 1046

Greenock, 339, 464, 716, 838

Grimsby, 797

Halifax, 584, 887, 927

Hammersmith, 301, 838

Haslingden, 379, 716, 797

Hastings, 379, 464

Haxby-Brandsby, 797

Heywood, 256

Holland, 188, 1046

## TRAMWAY NOTES—continued.

Hove, 301  
 Huddersfield, 139, 339, 507  
 Hull, 16, 176, 214, 801, 544  
 Ilford, 839  
 Ilkeston, 507, 544, 584  
 Ipswich, 797  
 Italy, 97, 138, 214, 301, 579, 423, 463, 926, 964, 1046  
 Jamaica, 584  
 Japan, 139, 887  
 Jarrow-on-Tyne, 97  
 Keighley, 16, 716, 964  
 Kilmarnock, 1004  
 Lanarkshire, 176, 423, 1004  
 Lancashire, 1004  
 Lancaster, 716, 887  
 Leeds, 16, 63, 97, 678, 964, 1004  
 Leicester, 214  
 Leith, 964  
 Leyton, 544  
 Lincoln, 1046  
 Lisbon, 1004  
 Little Hulton, 964  
 Liverpool, 58, 256, 507, 584  
 Llandudno, 63  
 London, 139, 301, 339, 423, 507, 544, 623, 716, 838, 927, 964, 1004, 1046  
 " County Council, 301, 716, 839, 1046  
 Lowestoft, 97, 214  
 Luton, 1004  
 Lytham, 214  
 Maidstone, 888  
 Manchester, 139, 423, 507, 584, 678, 839, 964  
 Mansfield, 139  
 Marple, 256  
 Mexico, 544  
 Middlesex, 176, 888  
 Milnrow, 879  
 Morecambe, 1046  
 Morley, 16  
 Mountsorrel, 1047  
 Nelson, 584, 678, 797  
 New Zealand, 678, 797, 888, 1004  
 Newcastle-on-Tyne, 16, 256, 339, 508, 584, 927, 1047  
 Northampton, 16, 879  
 Nottingham, 302, 839, 927  
 Nuneaton, 97, 214  
 Oldbury and Blackheath, 215  
 Oldham, 214, 379, 544  
 Oxford, 302  
 Paisley, 97, 623  
 Perth, 16, 508, 888  
 Plymouth, 63, 302  
 Port Glasgow, 139  
 Portugal, 926, 1046  
 Preston, 16, 339, 716  
 Quarry Bank, 759  
 Radcliffe, 839  
 Ramsbottom, 97, 139, 214  
 Rawtenstall, 139, 176, 508, 716  
 Reading, 215  
 Renfrew, 623  
 Rhondda, 888  
 Ripponden (near Halifax), 256  
 Rochdale, 16, 623  
 Rotherham, 214, 594, 717  
 Rothesay, 508  
 Roumania, 758  
 Russia, 63, 256, 379, 423, 584, 623, 758, 964  
 Sale, 1004  
 Salford, 256, 964  
 Scarborough, 215  
 Sheffield, 63, 759, 964  
 Sicily, 797  
 South Africa, 64, 176, 380, 964  
 " Shields, 888  
 Southend-on-Sea, 759, 888  
 Southport, 839, 964  
 Spain, 379, 623, 1046  
 Stalybridge, 97, 139, 302, 339, 797, 839, 964, 1004  
 Stockport, 759  
 Stretford, 215, 464, 584  
 Sunderland, 176, 215  
 Sutton, 717  
 Swinton and Pendlebury, 97  
 Switzerland, 379, 623  
 Tasmania, 464, 584, 797  
 Todmorden, 215  
 Tramway accident inquiries, 16  
 Turkey, 301, 839, 758, 1004  
 Twickenham, 97  
 United States, 584, 1004  
 Uruguay, 256  
 Usworth, 508  
 Victoria, 302  
 Walsall, 64, 256, 423, 797  
 Warrington, 927  
 Watford, 1004  
 West Bromwich, 508, 544, 927  
 " Ham, 423  
 " Hartlepool, 585, 623, 678, 1047  
 Western Australia, 927  
 Westhoughton, 964  
 Wolverhampton, 64, 423, 964  
 Worsborough, 1004  
 Worsley, 624  
 Worthing, 139  
 Yarmouth, 964  
 York, 98, 339

Tramway Officers' Association, The

Australian, 939

track, 218

Tramways Exhibition, 993

" Managers, Metropolitan Association of Electric, 260

" Railless, 204

" The rating of, 243

Transactions, Weighty, 327

Trans-Atlantic telegraphy, by Charles Bright, 563

Transfer of municipal works in Germany, The, 567

" of the telephones, The, 2

Transformer oils, The formation of deposit by, by P. N. Hooper, 275

Transmission of electrical energy by direct current on the series system, The, by J. S. Highfield, 955, 1021

Transport of modern large units of machinery, The, by Adolph R. Stelling, 933

" Passenger, 572

Trophy, The Thomas transmission and the Dewar, 215

Trouble with the electric cooker, The, by H. E. Goody, 604

Tuberculosis, Employers and, 826

Tubes in Babcock & Wilcox boilers, Notes on renewing, by Walter E. Rogers, 245

Tucuman hydro-electric undertaking, 550

Tonbridge Wells electricity department, 125

Tungsten lamps on alternating current, 342

Turbine monument, A steam, 617

" plants, Some recent Boving water, 547

" practice, Recent developments in steam, by K. Baumann, 317, 359

" pump, The evolution and present development of the, by Dr. Edward Hopkinson and A. E. L. Chorlton, 279

Turbines in the world, The largest, 525

" Large, 490

" Test results on Zoelly steam, 890

Turbo-alternator, 5,000-kw. Curtis, 607

" Dynamos, Large, 683

UNION tyranny, A campaign against labour, 408

Unit—the "Thermal Ohm," A new, 43

United States, The electrical industry in the, 144

Unwin, Old students dinner to Prof., 106, 296

Uruguayan electric power monopoly, 66, 143

VARIABLE loads, Electrical meters on, by D. Robertson, 916

Vector calculator, A, by F. Addey, 156

Vehicle, The electric, 121

Vehicles in America, Commercial electric motor, 185

Victoria Falls Power employees, 931

Volume changes in accumulator electrodes, by C. Toone, 481

WAGE, The illusion of the minimum, 449

Wages and prices in New Zealand, 551



# INDEX TO PUBLISHED SPECIFICATIONS OF PATENTS.

## 1910.

**ALLGEMEINE** Elektrizitäts Ges. (27,993), 603

**BAYLES**, A. E., and British Insulated and Helsby Cables, Ltd. (24,084), (26,591), 324

Berry, H. F. (21,665), 160  
Billington, A. M., and W. H. Johnson (19,075), 824

Bottone, A. E. R. (28,612), 80  
Bowen, H. E., and Steel, Peech & Tozer (30,075), 200

British Insulated and Helsby Cables, Ltd., and A. E. Bayles (24,084), (26,591), 324

Brook, P. S., and J. A. Hirst (29,339), 160  
Brougham, F. J. (30,024), 160

Brown, Boveri, Akt.-Ges. (25,397), 80  
" S. G. (29,833), 388  
" T. H., J. S. Goodwin and J. A. J. Haslop (28,618), 80

**CLIMENT**, P. (29,685), 200

Creese, H. (28,881), 80

**DAVY**, H. C. (28,799), 80

Dinsmoor, J. L. (30,319), 200

**EVERSHED & Vignoles, Ltd.**, and R. Evershed (24,278), (29,980), 368

**FEHR**, E. (29,410), 80

**GES.** für Maschinen und Metall Industrie (27,942), 80

Goodwin, J. S., J. A. J. Haslop and T. H. Brown (28,613), 80

Gott and Heurtley (3,402), 80

Graham, E. A. (23,742), 324

**HASLOP**, J. A. J., T. H. Brown and J. S. Goodwin (28,613), 80

Hay, M. M., J. Templeton and C. J. Ogden (28,129), 80

Heurtley and Gott (30,402), 80

Hirst, J. A., and P. S. Brook (29,339), 160

Hope, V. (29,122), 324

**JACKSON**, F., and G. E. Pearson (29,441), 80

J. L. Manufacturing Co. and T. L. R. Reed-Cooper (27,419), 200

Johnson, W. H., and A. M. Billington (19,075), 824

Joyce, V. F., and Spagnoletti, Ltd. (22,270), 80

**KAMPERDYK**, P. J. (28,419), 80

Kirby, F. (30,313), 200

**LEDOC**, P. L. L. (29,304), 80

Leitner, H. (27,385), 568

**MATHYS**, A. (29,296), (29,297), 80

Mershon, R. (28,352), 80

Midgley, C. A., and A. H. Vandervell (29,493), 700

**OGDEN**, C. J., M. M. Hay and J. Templeton (28,129), 80

**PEARSON**, G. E., and F. Jackson, (29,441), 80

**RAY**, A., (23,225), 80

Reed-Cooper, T. L. R., and J. L. Manufacturing Co. (27,419), 200

Reid, F. T. (25,607), 608

Round, S. (28,555), 80

Russell, R. (28,986), 80

**SIEMENS** Bros. & Co. (30,292), 200

" Bros. Dynamo Works (28,081), (29,168), 80

Soldatencow, B. (14,659), 284; (14,658), 483

Squier, G. O. (30,003), 200

Spagnoletti, Ltd., and V. F. Joyce (22,270), 80

Steel, Peech & Tozer, Ltd., and H. E. Bowen (30,075), 200

**TAYLOR**, R. (27,312), 200

Templeton, J., C. J. Ogden and M. M. Hay (28,129), 80

Tepins, A. (29,714), 200

Thomas, J. G. P. (29,734), 160

Thompson, H. H. (29,052), 80

Trumpler, W. E. (30,201), 80

**VANDERVELL**, A. H., and C. A. Midgley (29,493), 700

Varley, F. H. (20,585), 80

**WESTERN** Electric Co. (24,995), 200

White, T. H. (28,720), 80

## 1911.

**ACHENBACH**, J. A. E., and H. P. R. L. Porcke (10,859), 408; (9,944), (9,945), (9,946), 448; (10,264), 608

Accles, R. (12,127), 821

Addenbrooke, G. L. (9,077), 700

Aitken, W., and British Insulated and Helsby Cables, Ltd. (15,508), 740

Aktiebolaget Elektrometall (25,862), 700

" L. M. Ericsson & Co. (21,924), 940

Albion Motor Car Co. and R. B. Murray (188), 120

Allen, C. R. (5,427), 368

" West & Co. and R. Moggridge (16,870), 160; (16,871), 240

Allgemeine Elektrizitäts Ges. (1,942), 240; (6,557), 368; (6,493), 700; (4,632), 740; (20,409), 1,028

Allmanna Svenska Elektriska Aktiebolaget (19,903), 120

Alsacienne de Construction Mecaniques, Soc. (1,252), 824

Alston, F. H., and B. Brooks (16,875), 608; (16,878), 988

Anderson, J. S., and G. B. Burnside (16,187), 80

Andronikoff, P. Z. (10,116), 324

Angold, A. E., and H. Hirst (13,477), 780

Anschutz & Co. (16,440), 1,068

Archer, C. H., and E. G. Byng (28,779), 780

Ardill, W., and Electric Safety Boiler Cleaner, Ltd. (9,567), 700

Arnesen, O., B. Sixer and R. Bull (8,236), 740

Association des Ouvriers en Instruments de Precision (15,126), 448

Austin, G. (3,779), 408

Automatic Electric Block Signalling Co. and R. P. Brousson (14,148), 868

**BACHELET**, E. (9,573), 700

Balachowsky, D., and P. Caine (7,062), 80

Bale, W., and L. H. Hopkins (1,360), 528

Balsillie, J. G. (7,749), 740

Banks, A., William Beardmore & Co. and A. Bremberg (6,017), 200

Barbour, R. A. (24,977), 528; (16,361), 608

" R. H. (14,032), 988

" S. (8,489), 608

Barker, G. (25,962), 948

Barlow, F., and A. W. Penrose & Co. (1,335), 324

Barnard, T., and C. Edwards (4,191), 488; (4,190), 868

Barnes, C. F., and R. Stafford (18,036), 740

Barton & Sons, Ltd., and A. J. Harper (12,860), 608

Baum, F. G. (19,760), 448

Bayley, J., and S. Wood (13,266), 700

Beardmore, William, & Co., A. Bremberg and A. Banks (6,017), 200

Beaver, C. J., and E. A. Claremont (9,523), 40

Beck, H. (25,916), 740

" S., W. Krauss and R. Wirth (18,879), 368

Belfitt, F. (18,479), 324

Belin, E. (25,158), 608; (9,556), 740; (25,157), 868

Bell, C. G. (683), 240; (684), 284

" F. G., and Sterling Telephone and Electric Co. (11,237), 700

Bellini, E., and A. Tosi (10,266), 160

Benko, S. (9,649), 908

Bennett, C. G. M. (585), 284

" C. G. M., and Simplex Conduits, Ltd. (19,847), 368

Berdon, A. E. (15,149), 740

Bernochi, R. de (8,417), 408

Berry, A. E. (5,190), 568

" A. E. (1,074), 488

" J. G. (12,784), 740

Betulander, G. A. (19,661), 700; (19,553), 948

Lhisey, S. A. (12,135), 1028

Bigge, H. F., and F. R. Butt (22,547), 868

Blake, G. C. (22,660), 740

Bleichert, M. A., and M. P. (13,573), 528

Bloch, A. (1,707), 80

" S. (16,230), 160

Bloxam, A. G. (28,518), 608

Boddam, E. M. T. (8,356), 948

Boardman, F. R., R. V. and F. (11,872), 448

Boirre, C. (28,506), 868

Booker, H. J., R. C. A. Reinecke and A. Ogilvy-Webb (46), 240

Boothby, F. L. M., H. G. Paterson and M. F. Sueter (3,334), 284

Bosch, Robert (17,438), 40; (13,705), 240; (20,623), 868; (29,368), (20,899), 488; (25,880), (9,840), (26,928), 608; (26,929), 740; (21,169), 908

Boult, A. J. (13,026), 408

Bowden, F. H., and E. F. M. Branson (16,894), 780

" J. H., and H. F. J. Thompson (2,238), 408

Bowell, G. B., and Bowell (8,039), 740

Bowen, H. E., and Steel, Peech and Tozer, Ltd. (8,951), 448

" H. V., and Electric and Ordnance Accessories Co. (9,856), 324

Boyd, R. (19,160), 908

Bradley, R., and Siemens Bros. & Co. (3,322), 284

Brandenburg, E. (21,001), 448

Branson, E. F. M., and F. H. Bowden (16,894), 780

Bray, Markham & Reiss, Ltd. (19,365), 740

Breeze, J. F., R. Macdonald and Gwynnes, Ltd. (594), 240

Bremberg, A., A. Banks and William Beardmore & Co. (6,017), 200

Brewerton, H. E., and Wolsley Sheep Shearing Machine Co. (9,176), 824

British Insulated and Helsby Cables, Ltd., and W. Aitken (15,503), 740

" Insulated and Helsby Cables, Ltd., and P. Bucher (21,912), 160

" Insulated and Helsby Cables, Ltd., and J. B. Redfern (15,502), 700

" Pneumatic Railway Signal Co., and J. P. O'Donnell (2,887), 40; (25,343), (25,344), 448; (25,345), 488

" Thomson-Houston Co. (7,104), 80; (5,166), (5,993), 120; (6,095), 160; (6,188), (7,669), (7,896), 200; (10,254), (711), 240; (10,549), (11,140), 408; (5,620), 448; (20,829), 488; (13,124), (15,322), 528; (12,580), 608; (15,841), 700; (12,579), (16,960), (17,060), 740; (11,350), 908; (11,349), (11,351), (18,989), 988; (19,583), 1028

" Thomson-Houston Co. and J. M. Wallace (12,919), 528

" Thomson-Houston Co. and E. B. Wedmore (3,764), 408; (13,571), 608; (3,877), 988

" Thomson-Houston Co. and F. R. Whittaker (12,918), 448

" Thomson-Houston Co. and N. Wise (8,238), 568

" Thomson-Houston Co. and A. P. Young (13,650), 780

" Westinghouse Electric and Manufacturing Co., K. C. Randall, S. W. Farnworth and C. L. Fortescue (20,659), 368

Brook, P. F., and J. A. Hirst (2,926), 448; (11,045), 908

Brookhouse, F. G., and Bruce Peebles and Co. (28,682), 740

Brooking, A. W., and A. N. Nicholson (12,118), 408; (8,899), 448

Brooks, B., and F. H. Alston (16,875), 608; (16,878), 988

" J. B., and W. Holt (15,508), 988

" J. W., and A. E. Read (1,699), 240

Brousson, R. P., and Automatic Electric Block Signalling Co. (14,148), 868

Brown, A. A. (2,667), 80

" Beveri et Cie, Akt.-Ges. (4,915), 528

" H. (1,566), 824

" H. W. (20,452), 948

" J. E. (10,364), 908

" S. G. (957), 324

Bruce Peebles & Co. and F. G. Brookhouse (28,632), 740

Brull, K. (8,738), 780

Brunner, W. (18,778), 160

Bryant, H. S., and Third Hand Patents, Ltd. (23,937), 488

Bucher, P., and British Insulated and Helsby Cables, Ltd. (21,912), 160

Buckham, G. T., and Sir A. T. Dawson (10,539), 908; (11,019), 948

Bull, R., O. Arneson and B. Sixer (8,236), 740

Bullers, Ltd., and E. H. Chambers (18,680), 780

Burnham, R. E. (25,211), 740

Burnside, E. E., and R. S. Wright (8,063), 608

" G. B., and J. S. Anderson (16,187), 80

Bussey, L. E. (9,652), 608

Butt, F. R., and H. F. Bigge (22,547), 868

Byng, E. G., and C. H. Archer (28,779), 780

" E. G., and J. H. Collings (5,418), 284

**CADMAN**, W. H., and J. T. Niblett (10,436), 528

Caine, P., and D. Balachowsky (7,062), 80

Canfield, H. R. (20,534), 1028

Carrick, J. H., and Greenwood & Batley, Ltd. (8,589), 528

Celst, L. van (11,738), 780

Chamberlain & Hookham, Ltd., and S. James (5,654), 80

Chambers, E. H., and Bullers, Ltd. (18,680), 780

" F. J. (4,488), 448

Chapman, N., and R. Hirst (8,375), 240

Chase, S. (15,564), 528

Chemische Fabrik Griesheim-Elektron (22,441), 40; (12,040), 488

Chetwynd, H. W. P., F. W. Clark and Kelvin and James White, Ltd. (9,347), 780

Chiger, S. (8,585), 780



700  
 Randall, K. C., S. W. Farnworth, C. L.  
 Fortescue and British Westing-  
 house Electric Manufacturing Co.  
 (20,659), 368  
 Ransford, R. B. (15,052), 608  
 Rawlings, V. R. (10,318), 408  
 Read, A. E., and J. W. Brooks (1,699),  
 240  
 Recklinghausen, M. von (6,759), 700  
 " M. von, V. Henri and  
 A. Helbronner  
 (8,157), (8,158), 160  
 Redfern, C. B. (19,252), 740  
 " J. B., and British Insulated  
 and Helsby Cables, Ltd.  
 (15,502), 700  
 Redsamen, N. (15,690), 40  
 Regal, A. (10,363), 488  
 Reinhardt, O. (18,955), 528  
 Renner, M. (24,531), 700  
 Rennert, O. (8,151), 740; (12,485), 1068  
 Reynolds, W. S. (18,693), 324  
 Reinecke, R. C. A., A. Ogilvy-Webb  
 and H. J. Booker (46), 240  
 Rheinische Gummi-warenfabrik and  
 F. Clouth (13,678), 160  
 Riber, C. R., and Siemens Bros. & Co.  
 (14,683), 948  
 Richardson, G. F., and R. J. Crowley  
 (6,066), 608  
 " S. (643), 281  
 Rickets, W. J. (4,282), 80  
 Ritter, A. (12,369), 240  
 Rittershausen, A. (27,849), 740  
 Roach, H. F. (27,940), 658  
 Robin, J. T. (6,856), 700  
 Robinson, E. E., and Sir O. J. Lodge  
 (8,806), 780  
 Rochling'sche Eisen und Stahlwerke  
 Ges. and W. Rodenhauser (10,231),  
 160  
 Rodenhauser, W., and Rockling'sche  
 Eisen und Stahlwerke Ges.  
 (10,231), 160



Rogers, W., and G. Rowe (26,551), 740  
 Roose, H. E. R., and W. Finlay (13,601), 740  
 Rosenberg, E. (13,099), 448  
 Rosenfeld, M. S. (18,447), 334  
 Rosing, B. (5,259), 40; (5,486), 568  
 Rouse, E. E. (7,386), 780  
 Rowe, G., and W. Rogers (26,551), 740  
 Royer, E. G. (3,541), 488  
 Royston, E. R. (11,643), 988  
 Rubel, W. (12,483), 284  
 Ruhmer, E. (5,549), 700  
 Russell, J. T., and C. S. Saunders (12,941), 700  
 Ryan, M. B. (11,794), 948

**S**T. HELENS Cable and Rubber Co. and H. Evans (3,996), 408  
 Salmon, J. (10,788), 908  
 Sandrini, A., and C. Sanguineta (9,528), 80  
 Sandycroft Foundry Co. and T. M. Dutton (680), 284  
 Sanguineta, C., and A. Sandrini (9,528), 80  
 Saunders, C. S., and J. T. Russell (12,941), 700  
 Schaffer, W., and A. Heimann (25,586), 284  
 Schaffler nekte Glössl and D. Weiss (15,219), 700  
 Schaller, O. (16,195), 488  
 Scheitlin (18,804), 160  
 Schepeler, H. A. (17,978), 528  
 Schieferstien, G. (12,978), 1068  
 Schiff, M. P. (17,630), 80  
 Schrage, H. K. (25,358), 608  
 Schuer, N., and H. Haddrell (8,013), 80  
 Schultz, N. (7,097), 284  
 Schupp, E., and Siemens Bros. Dynamo Works, Ltd. (18,575), 740  
 Schwab, K. (20,380), 284; (20,224), 740  
 Schwager, R. (15,818), 284  
 Schweitzer, R., and S. Conrad (6,443), 448  
 Schwerin, V. B. (27,931), 528  
 Seal, W. (452), 240  
 Seibt, G. (26,709), 608  
 Shardlow, Ambrose, & Co., and W. Moore (13,191), 80  
 Shears, C. (9,475), 608  
 Shoemaker, J., and N. Wilson (2,456), 80  
 Siemens & Halske Akt.-Ges. (19,185), 80; (19,187), (21,873), 240; (19,186), (19,231), 324  
 „ Bros. & Co. (15,129), 408; (21,164), (22,060), 528; (26,717), (26,830), 608  
 „ Bros. & Co. and R. Bradley (3,322), 284  
 „ Bros. & Co. and W. H. Grinstead (23,910), 284  
 „ Bros. & Co. and E. A. Petithory (22,397), 284  
 „ Bros. & Co. and C. R. Riber (14,683), 948  
 „ Bros. Dynamo Works, Ltd. (2,794), 40; (24,105), (17,869), 240; (28,263), 368; (16,907), (17,040), 740; (27,212), 1028  
 „ Bros. Dynamo Works, Ltd., and E. Schupp (18,575), 740  
 „ Geb. & Co. (13,817), 40  
 „ Schuckertwerke Ges. (13,877), 80; (20,031), 284; (17,046), 528; (20,986), 608; (24,744), 700; (20,995), 740; (27,699), 908  
 Silica Syndicate, Ltd., H. A. Kent and H. C. Lacell (14,589), 608  
 Simplex Conduits, Ltd., and C. G. M. Bennett (19,347), 368  
 Sixer, B., A. Bull and C. Arnesen (8,236), 740  
 Slater, J. M. L. (2,530), 80  
 Smith, H. C. H. (12,011), 324  
 „ J. (10,219), 700  
 „ J., and Henry Milward & Sons, Ltd. (1,573), 40  
 „ Major and Stevens, Ltd., C. G. Major and G. Kennard (12,828), 824  
 Soc. Anon. Francaise Dite Banque du Radium (15,010), 240  
 „ Electro-Industrielle et Anciens Etablissements Mathieu Reunis (23,828), 740  
 „ Rene Gillet et Cie (9,948), 528  
 Stafford, R., and C. F. Barnes (18,036), 740  
 Stait, E. S., and R. Edwards (6,996), 740  
 Starcke, H., and K. Walseck (20,987), 568  
 Steel, Peech & Tozer, Ltd., and H. E. Bowen (8,951), 448  
 Steels, N. (18,997), 608  
 Stein, N., and R. Steinert (1,619), 740  
 Steinert, R., and N. Stein (1,619), 740  
 Sterkel, O. (17,441), 448  
 Sterling Telephone and Electric Co. (21,913), 1028  
 „ Telephone and Electric Co. and F. G. Bell (11,237), 700; (12,145), 740  
 Stevens, M. (933), 284  
 Stevenson, J. H. J. A. (25,683), 608  
 Stewart, R., and N. Stoodley (2,690), 200  
 Stille, C. (13,648), 948  
 Stobie, V. (572), 240; (674), 284  
 Stoodley, N., and R. Stewart (2,690), 200  
 Sueter, M. F., F. L. M. Boothby and H. G. Paterson (3,834), 284  
 Suman, R. W. (19,047), 488  
 Sykes, W. R., Interlocking Signal Co. and G. H. Sykes (11,711), 488  
 „ W. R., Interlocking Signal Co., J. C. Sykes and R. W. Tarrant (14,615), 700

Szendeffy, A. de (14,471), 608  
 Sypor, Z. (26,842), 740

**T**ARRANT, R. W., W. R. Sykes' Interlocking Signal Co., and J. C. Sykes (14,615), 700  
 Taylor, J., and H. F. Joci (6,257), 700  
 Telefon and Telegraphenbau - Ges. (26,516), 608  
 Tellier, E., and Compagnie Anon. des Allumeurs Extincteurs du Gaz a Distance Systeme Gote (20,402), 700  
 Thiel, H. (16,078), 80  
 Third Hand Patents, Ltd., and H. S. Bryant (23,937), 488  
 Thomas, O. V. (3,446), 488  
 Thompson (18,230), 284  
 „ H. F. J., and J. H. Bowden (2,283), 408  
 „ J. W., and J. Finnigan (1,295), 40  
 „ W. P. (18,231), 408; (25,490), 608; (22,948), 740; (25,491), 908  
 Thomson, W. (8,846), 780  
 Tistchenko, T., Plausen and N. Zsvetaeff (10,858), 740  
 Toppin, W. A. (5,309), 80  
 Tosi, A., and E. Bellini (10,266), 160  
 Trist, A. R. (17,140), 1028  
 Truchetet, J. B., and L. V. Grillet (17,419), 780  
 Tschörner, L. (27,474), 740  
 Tucker, R. (14,110), 240  
 Turner, A., and C. Wilkinson (18,469), 80  
 „ K. M. (8,982), 160

**U**NITED STATES Light and Heating Co. and W. E. Lake (14,233), 988  
 Unterberg and Helmle (21,785), 868

**V**ANDERVELL, C. A., and A. H. Midgley (15,039), 448; (9,112), 608; (2,158), (15,038), 740  
 Van Raden & Co. and M. Metz (3,549), 368  
 Veritys, Ltd., and H. Fletcher (22,021), 80  
 „ Ltd., and P. A. Hirsch (14,812), 40  
 Vickers, Ltd., and B. E. Ellison (7,882), 740  
 Vigneault, J., and J. A. H. Herbert (13,483), 1028  
 Vlamincq, F. (20,298), 528  
 Voelker, A., and V. Meurer (19,649), 908  
 Vogler, A., and Deutsch-Luxemburgische Bergwerksund Hutton Akt.-Ges. (27,400), 988  
 Volkers, E. (28,715), 908

**W**ALKER, A. (14,140), 528  
 „ Horrocks & Co., and J. H. Harpin (3,794), 80  
 „ S. (7,582), 488  
 Wallace, G., and J. E. Graham (6,863), 700  
 Walmisley, F. A., and J. A. Ward (3,911), 408  
 Walseck, K., and H. Starcke (20,987), 608  
 Walter, C. E. H. S. (12,177), 1028  
 Walton, F. J. (11,699), 1068  
 Ward, J. A. W., and F. A. Walmisley (2,911), 408  
 Ware, A. J. (3,165), 448  
 Waterhouse, L. M. (7,161), 700  
 Watkinson, J., and A. E. Payne (12,571), 988  
 Watson, F. A., Morris & Lister, Ltd., and D. K. Morris (3,701), 448  
 Webb, J. J. (26,296), 780  
 Wedmore, E. B., and British Thomson-Houston Co. (3,764), 408; (18,571), 608  
 Wehrlin, H. (25,179), 948  
 Weiss, D., and Schaffler rekte Glössl (15,219), 700  
 „ H. (25,899), 1028  
 Welch, W. H. I. (8,981), 284  
 Welles & Zweitsch (10,238), 908  
 Western Electric Co. (16,075), 284; (18,549), 700  
 Westmancott, R. (3,374), 80  
 Wetter, J. (17,778), 868  
 Whiddington, R. (1,292), 240  
 Whittaker, F. R., and British Thomson-Houston Co. (12,918), 448  
 Wiehl, H. (24,970), 240  
 Wilkinson, C., and A. Turner (13,469), 80  
 Wilson, A. E. (2,914), 608  
 „ D. (18,911), 324  
 „ F., and A. Cole (15,794), 488  
 „ N., and J. Shoemaker (2,456), 80  
 Winter, J. H. (10,375), 908  
 Wirth, R., S. Beck and W. Knauss (18,879), 368  
 Wise, N., and British Thomson-Houston Co. (8,238), 568  
 Wolseley Sheep Shearing Machine Co. and H. E. Brewerton (9,176), 824  
 Wood, S., and J. Bayley (13,266), 700  
 Wright, G. (19,685), 908  
 „ R. S., and E. E. Burnside (8,063), 608

**Y**OUNG, A. P., and British Thomson-Houston Co. (18,650), 780

**“Z”** Electric Lamp Manufacturing Co. and F. Hoge (5,061), 368  
 Zenner, A. G. (17,718), 284  
 Zsvetaeff, N., T. Tistchenko and Plausen (10,858), 740  
 Zweitsch and Welles (10,238), 908

## 1912.

**A**DAMS, C. (2,836), 700  
 Allison, C. A. (2,028), 608  
 Appareillage Gardy (S.A.), (8,121), 700  
 Archer, E. H. (2,319), 780

**B**AGGS, H. G., C. M. Dorman and R. A. Smith (315), 608  
 Batley, G. H., and J. M. Bein (88), 608  
 Bein, J. M., and G. H. Batley (83), 603  
 Bell, A. C. (910), 908  
 Betulander, G. A. (410), 1028  
 Bland, J. P., and E. G. Simester (1,988), 948  
 Bosch, Robert (3,026), 700  
 British Thomson-Houston Co. (6,500), 988

**C**IAREMONT, E. A. (5,871), 908  
 Clement, E. E. (3,947), 740  
 Conrad, F. (87), 408  
 Corwin, E. R. (3,098), 780  
 Crawford, A. (2,896), 948

**D**ERING, A. (1,219), 908  
 Deutsche Gasglühlicht Akt.-Ges. (873), 988  
 Dickson, W. K. L. (957), 948  
 Dorman, C. M., R. A. Smith and H. G. Baggs (315), 608

**F**ESSENDEN, R. A. (346), 408  
 Frunwirth, A., and F. Gruber (579), 948

**G**ES. für Elektrotechnische Industrie (4,588), 780  
 Grohmann, H. (919), 948  
 Gruber, F., and A. Frunwirth (579), 948

**H**ARTMANN & Braunn Akt.-Ges. (2,471), 908  
 Hedgcock, A. J., and W. T. Henley's Telegraph Works Co. (2,649), 908  
 Henley's, W. T., Telegraph Works Co., and A. J. Hedgcock (2,649), 908  
 Huttig, M. (4,127), 908

**J**ENSEN, P. (4,983), (5,876), 908; (4,984), (5,877), 988

**K**ALTSCHMID, K. (2,221), 1028  
 Kapp, G., and H. von Kramer (5,950), 988  
 Korting and Mathieson Akt.-Ges. (4,535), 983  
 Kramer, H. von, and G. Kapp (5,950), 988

**P**APE, S. (728), 528  
 Parfus, A. (128), 608

**R**ECORD, J. W. (1,817), 948  
 Rosenberg, A. (609), 408

**S**IEMENS & Halske Akt.-Ges. (7,467), 908  
 „ Schuckertwerke Ges. (1,250), 608; (3,924), (7,574), 988; (4,165), (5,322), (8,158), 1028  
 Smith, R. A., H. G. Baggs and C. M. Dorman (315), 608

**T**ATTERSALL, T. W. (4,773), 1028  
 Thompson, W. P. (2,769), 908  
 Thorkelin, C. E. G., and A. G. Way (4,365), 908

**“VULKAN”** Maschinenfabriks Akt.-Ges. (3,919), 1028

**W**AY, A. G., and C. E. G. Thorkelin (4,365), 908

ELECTRICAL PATENTS  
EXPIRING IN 1912.

**A**BEL, C. D. (27,890), 823  
 Andreoli, E. (20,206), 779

**B**ASTIAN, C. O. (5,034), 699  
 Batault, E. (121), 699  
 British Thomson-Houston Co. (15,041), 739  
 Brown, S. G. (18,261), 779; (23,750), 823

**C**ASE, F. E. (20,274), 779

Clark, E. J., and S. W. Hart (13,680), 739  
 Clatworthy, W. A., and W. H. A., J. H., L. W. & E. Holmes (9,802), 739  
 Conrad, F., and H. P. Davis (20,440), 780

**D**AVIS, H. P., and F. Conrad (20,440), 780  
 Deri, M. (15,203), 779  
 Dorman, C. M., and R. A. Smith (26,420), 823  
 Dowsing, H. J. (14,127), 739  
 Duddell, W. (5,449), 699

**E**DMUNDS, H. (22,700), 823

**G**RAHAM, A. (591), 699  
 Gunning, J. (1,539), 699

**H**ACKETHAL, L. (24,404), 823

Hart, S. W., and E. J. Clark (13,680), 739  
 Holmes, W. H., A., J. H., L. W., and E., and W. A. Clatworthy (9,802), 739

**I**MRAY, O. (16,129), 779

**K**INGSBURY, J. E. (18,613), 779

**L**AMME, B. G. (19,246), 779  
 Lawton, M. (20,008), 779  
 Leigh, H. H. (11,158), (11,158A), (11,158B), 739  
 Lentschat, G. (7,298), 699

**M**ARCONI, G., and Wireless Telegraph Signal Co. (12,325), (12,326), 739  
 Muirhead, A. (12,731), 789

**O**'KEENAN, C. E. (8,332), 700  
 Oppenheimer, H. (8,274), 700

**P**OLLAK, A., J. Virag and F. Silberstein (16,814), 779  
 Potter, W. B. (20,276), 780; (21,550), (21,759), 823  
 Preston, E. J. (12,431), 739  
 Preston, E. J., and J. Stone & Co. (23,265), 823

**S**HORT, H. L. (22,768), 823  
 Silberstein, F., A. Pollak and J. Virag (16,814), 779  
 Simms, F. R. (7,196), 699  
 Smith, R. A., and C. M. Smith (26,420), 823  
 „ W. S. (11,627), 739  
 Stone, J., & Co., and E. J. Preston (23,265), 823  
 Strowger Automatic Telephone Exchange (809), 699  
 Sturge, W. H. (11,326), 739  
 Sykes, W. (6,034), 699

**T**HOMPSON, E. (20,275), 780  
 „ W. P. (22,545), (24,277), 823

**V**IRAG, J., F. Silberstein and A. Pollak (16,814), 779

**W**ELSBACH, C. A. Ritter von (1,535), 699  
 Weston, E. (6,024), (6,991), (6,991A), 699  
 Wirt, C. (10,291), 739  
 Wisc, W. L. (7,470), (7,471), 700



# THE ELECTRICAL REVIEW.

VOL. LXX.

JANUARY 5, 1912.

No. 1,780.

## ELECTRICAL REVIEW.

## THE NEW YEAR.

Vol. LXX.]	CONTENTS: January 5, 1912.	[No. 1780.	Page
The New Year ... ..	...	...	1
The Transfer of the Telephones ... ..	...	...	2
A New Year Letter to Ourselves ... ..	...	...	3
Continuous Current Motors, with Commutating Poles and Cast-Iron Magnets ( <i>illus.</i> ) ... ..	...	...	4
On the Efficiency of Accumulators ( <i>illus.</i> ) ... ..	...	...	6
A Lamp-Testing Board ( <i>illus.</i> ) ... ..	...	...	7
Simply Made Electric Heaters and Hot Cupboards ... ..	...	...	7
Correspondence:—			
The Association of Consulting Engineers ... ..	...	...	8
Old Carbon Ends and Lamp Caps ... ..	...	...	9
The Institution of Electrical Engineers ... ..	...	...	9
The Physical Society Exhibition ( <i>illus.</i> ) ... ..	...	...	9
British Trade with Russia ... ..	...	...	11
Business Notes ... ..	...	...	12
Electricity Supply at Keighley ( <i>illus.</i> ) ... ..	...	...	18
The Electrical Equipment of the Craighead and Bothwell Castle Collieries ( <i>illus.</i> ) ... ..	...	...	21
Failures of Steel Plates ... ..	...	...	23
Initial Condensation in Steam Cylinders ... ..	...	...	23
Notes ... ..	...	...	25
City Notes ... ..	...	...	29
Market Quotations ... ..	...	...	30
Stocks and Shares ... ..	...	...	30
Share List of Electrical Companies ... ..	...	...	31
Metal Market.—Fluctuations in December ... ..	...	...	33
Street Lighting ( <i>illus.</i> ) ... ..	...	...	33
Notes from Canada ... ..	...	...	35
Proceedings of Institutions:—			
An Automatic Starting Device for Asynchronous Motors ( <i>illus.</i> ) ... ..	...	...	36
Institution of Electrical Engineers ... ..	...	...	36
The Röntgen Society ... ..	...	...	37
The Physical Constants of Aluminium ... ..	...	...	37
The Benkö Primary Battery ... ..	...	...	37
Notes on Standards for Electrical Machinery ... ..	...	...	37
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ... ..	...	...	39
New Patents Applied For, 1911 ... ..	...	...	40
Abstracts of Published Specifications ... ..	...	...	40
Contractors' Column ... Advertisement pages xxiv, xxvi and xxviii	...	...	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE

## UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

## 1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

To the Electrical Industry we wish a happy and prosperous New Year. The familiar words come easily, but the mind, vainly trying to pierce the future, falls back upon the present and the past. It is inevitable to turn from the mysteries of the year that is to come, to the memories of that which has gone.

We are still too near to the old year to judge it fairly. The smoke of battle yet obscures the scene, and, perhaps, our vision is a little blurred. A busy year it has been for most of us, even prosperous for many. Employment has, on the whole, been good in our trade; but, though the output was large, competition was keen, and prices left but a small margin of profit.

The growth of central stations, so seriously checked by the arrival of the metallic-filament lamp, has recommenced in earnest. The older stations are bringing themselves up to modern standards of efficiency by adding exhaust-steam turbines; and that deadly enemy of fuel economy, the stand-by boiler, is being attacked, and will shortly be displaced, by the Diesel engine. Day-loads are developing in response to the quotation of low rates for power and heating.

Power users are beginning to realise the enormous advantage of possessing a reservoir of power upon which they can draw to the full extent of their requirements, without an instant's notice, day or night, paying only for what they use. And the absence of worries about coal supply, boiler inspection, and the smoke nuisance, is a minor factor which is influencing their minds.

Electric cooking and heating are making notable strides in public estimation. It is becoming known that electricity is not wasteful even as a medium for the distribution of heat, when the superiority of the cooking, the saving of weight and improved flavour, and the immense advantages as regards handiness and cleanliness, are taken into account.

One matter to which sufficient attention has not yet been given is the necessity for a hot water supply in the house at all times. The kitchen fire cannot be abolished in favour of the electric oven until the problem has been solved. The warming of rooms by electricity is another branch of the same problem which offers a good field for enterprise.

The general stagnation in the building trade which prevailed two years ago, has given place to a rather better state of employment, and this naturally nowadays calls for the services of the electrical worker. Electricity, of course, always has its best chances in a new district where gas pipes, chain armour, bows and arrows and other obsolete appliances do not require to be scrapped. It must not, however, be supposed that the building trade has "turned the corner," as the improvement in the statistics of unemployment derived from the various Trade Unions is stated as a percentage of total membership. Unfortunately for the figures, the membership has enormously declined;



large numbers formerly employed here in building having drifted into other trades or gone abroad, where, owing to rapid developments, there has lately been a larger opportunity for them to follow their accustomed occupations. It is our opinion that the local rating system, and the local spending system, must be thoroughly overhauled before anything like prosperity can return to this very necessary branch of industry at Home.

Electricity continues to make headway in the department of transport, and the cleanly, speedy, and convenient electric railways which now serve the metropolis are popularising the suburbs and the sub-suburbs, and, incidentally, raising the price of agricultural land to fabulous amounts—from which the persons who have risked their capital in producing the increase get little benefit.

A number of accidents on tramways have shown again the necessity for strict regulation of the service on steep hills and round curves, and the fact that the controlling gear still falls far short of perfection. The absence of "cant" in the rails, owing to the necessity of conforming to the surface of the existing roadway, adds greatly to the danger of curves. The opening of the railless trolley vehicle system in Yorkshire is an outstanding incident of the year, and in all probability 1912 will witness the running of such cars in many other parts of the kingdom.

Perhaps, in looking back over the past year, the labour trouble which has manifested itself in every trade is the most serious fact which indicates the problems of the future. It was largely due, in the first instance, to the great increase in the cost of living.

Some re-organisation of the relation of capital and labour seems to be required; and, to our mind, profit-sharing is the most hopeful of all the remedies available, though, unfortunately, Labour seems to be prejudiced against it. Increase of wages in some form seems inevitable; and if that involve increased cost of production, it is obvious that the cost of the necessities of life must increase too, and the remedy will be worse than the disease, as our power of competing in the export trade will be crippled. Profits cannot be reduced. The margin is already too fine in most trades—particularly the electrical trades—to attract fresh capital. Therefore some scheme which, while raising the weekly takings of the worker, will also increase his productiveness, seems to be an economical necessity. Trade Unionism must be convinced somehow of the truth of this elementary proposition, and brought into line.

Many fine examples of the profit-sharing method might be cited, beginning with the South Metropolitan Gas Co.—all honour to the late Sir George Livesey—and ending with Lord Furness's unsuccessful attempt in the shipbuilding industry.

The increased cost of living, while it does not hurt the very rich, bears, perhaps, almost more hardly on the majority of our readers, the brain-workers of the electrical industry, than on those who work with their hands. Brain work is none too well paid, and the claims on a man in a black coat are heavy. Salaries have a nasty habit of remaining at the same level, even when the price of necessary commodities goes up.

Consulting engineers are having a hard time; and salaried men, whether in the commercial, municipal, or Government service, feel the pinch.

A wider survey is, perhaps, outside the scope of this journal; but we may be permitted to hope that the year now com-

mencing will produce fewer wars, and rumours of war; and that Peace and Goodwill may be brought nearer to the dominance of the world.

Good counsel to this end may be found in Carlyle's "Past and Present." We venture to quote, in conclusion, two verses from his noble translation of Goethe's poem, "The Greatest German Man":—

The future hides in it  
Good hap and sorrow;  
We press still thorow,  
Naught that abides in it  
Daunting us—onward.

\* \* \* \*

Here eyes do behold you  
In Eternity's stillness;  
Here is all fullness,  
Ye brave, to reward you;  
Work and despair not.

## THE TRANSFER OF THE TELEPHONES.

"THE appointed day" has come and gone. The transfer has been completed without any outward ceremony—no drums and trumpets accompanied this overture to 1912. Private enterprise has been merged into State enterprise by effluxion of time and by the wholesale absorption of a working staff. To the mind's eye of the telephone man, 1912 has always been on the horizon, and it has not been always possible to realise that the original horizon has not changed, and that each day has made some progress towards reaching it.

It will not be within the power of all the transferred staff to recall the 31 years which have elapsed since the United Telephone Co., resulting from a fusion of the Bell and Edison interests, obtained in 1880 a licence from the Government to undertake the new work of telephone exchange communication, subject to the proviso that such licence might be determined at the tenth or any subsequent seventh year. It is not within the power of more than a small minority of the staff to recall the early struggles. The later management of Mr. Gaine is to most something more than a memory, but the management of Mr. Morgan is known only to a few, and to most of that few it unhappily results from the terms of transfer that their experience is no longer available to the development of the great enterprise.

The greatness of the enterprise is obvious to-day. Thirty years ago it was the few rather than the many who could realise that the invention of the telephone by Alexander Graham Bell, leading to the subsequent development of the Telephone Exchange system, was a greater accomplishment than any preceding work in applied science. We recall these points lest we should forget the honour due to these pioneers, whether individuals or represented by an incorporated company.

The company has had its times of storm and stress, and recurring periods of uncertainty of existence. The original restrictions in its areas were removed by Mr. Fawcett, thus conferring a benefit on the one hand, which was negated by the encouragement of competition on the other hand. This competition, however, was for a time prevented by the operation of the patent laws.

The State's first participation in telephone work on a large scale came with the purchase of the trunk lines. The wisdom of the sale by the company was questioned in some



quarters, but it was defended by Mr. Forbes at a meeting of shareholders by one of those happy remarks in which he excelled on such occasions. He referred to the reeds and the storm, and to the superior position occupied by the reed which bent over that which broke.

The expiry of the patents naturally led to the formation of other exchange companies, of which the Mutual and the Duke of Marlborough's New Telephone Co. will be best remembered. The inevitable absorption following, there seemed to be some possibility of a period of comparative quiet, hopeful for development, but Mr. Hanbury interposed against the advice of the permanent staff of the Department, and encouraged that municipal competition which has resulted in no public benefit and no technical advance.

The second stage in the State's active participation came with the establishment of the Post Office London system, which brought co-operation rather than competition. Mr. Austen Chamberlain's recognition of the futility of competitive exchanges and the need for monopoly prepared the way for that complete absorption of the National system which has now been accomplished. It would be incorrect to say that the accomplishment gives universal satisfaction or is entirely free from causes of complaint. The dissatisfaction is common to all, or nearly all, State enterprises, and it would be impossible to carry through so great a transfer without some appearance of individual hardship. So far as the staff is concerned, the good-bye of Mr. Franklin and the welcome of Mr. Herbert Samuel are both in admirable taste, and the readiness with which the department, it is understood, has undertaken to remedy any errors in classification, is an indication of the desire to carry out in detail the sentiments expressed by Mr. Samuel in general terms.

From a survey of the past we come to a consideration of the future. Criticism may still be indulged in as to the wisdom of State management of the telephones, but such criticism is useless in effect, and in view of the accomplished fact may be ungenerous in inference. We prefer rather to dwell on the advantages of the situation and to look for the benefits.

For the first time the telephone service of the United Kingdom is free from restrictive influence. The estate has, so to speak, reverted to the freeholder, and covenants impairing progress no longer operate. The trunk service and the local services are in the same hands. Antagonism, real or fancied, no longer exists between the telegraph and the telephone. The co-ordination of the services has been provided for and the State not only controls, but also works all the means of communicating messages within the kingdom. These are important factors tending to development, and we look, therefore, with hopefulness to extensions on a considerable scale and to a rapid increase in the use of the telephone.

*Le roi est mort; vive le roi!*—is a phrase which serves to illustrate the situation. The change of government has been effected without apparent break. The expiring company established at its own risk, and carried on, a great public service under considerable difficulties and with no extravagant rewards to its shareholders. The Department which succeeds it in a difficult occupation is entitled to all the consideration which can be given to it and to all the help that may be afforded towards the development and the smooth working of the system. It must, however, be remembered that the Department has now acquired what we

have called a great engineering enterprise; but the enterprise is capable of enormous expansion, and whilst commercial aptitude must have its effect in this expansion, it must be the province of the engineer to determine the lines of progress and to produce the most economical results. The effect of the engineering on the efficiency of the service and the cost of the service is direct and paramount, and it is therefore to be hoped that the Postmaster-General will lose no opportunity of utilising all the experience which may be available and of giving to the engineering branch of the Department the prominence and authority which it deserves and which are essential to the effectiveness of its work.

#### A New Year Letter to Ourselves.

ONE of the first matters to call for our editorial attention in the early days of this New Year was a grumble from a reader—we should judge quite a new one. No doubt it was decreed that the floods of good wishes that editors receive at such a season should not be permitted to spoil our humility, hence we take our correspondent's chastisement in the best of spirits, feeling certain that it was necessary for our good. While the old year lay a-dying a pen was busy protesting against the publication of "biased political articles" "constantly," and "one-sided political arguments": it tells us that we are "abusive" and "narrow-minded": and that we do not admit that there are two sides to every question: reminds us that "other people besides capitalists read the REVIEW": dares to affirm that "there are a large number of intelligent men in the electrical world": and that these hold "entirely opposite views" to ours: demolishes us with the remark "it is an insult to such men to force these articles down their throats": and after demolishing us, leaves a veritable sword of Damocles suspended above our unworthy heads—or, to be more exact, our circulation.

How *can* we answer such a communication? The temptation is to make merry with such statements, but we will resist it, and try to answer the writer in a few sentences, and we hope that what we have to say will not meet with an unsympathetic reception in the minds of our readers generally. The ELECTRICAL REVIEW is an industrial as well as a technical journal, and when legislative measures or labour disaffection threaten to affect industry adversely, we regard it as our duty to express freely our conscientious opinion, whether *pro* or *anti* the Government of the day. Of course, when our views are different from those held by a reader, we are one-sided—but so is he! But we have no axe to grind, no interests to serve, save those of the industry. If a representative organ of the industry is to take no sides in the discussions of the day, it will be a weak sort of production and will in no sense lead its readers' thoughts.

The mere fact that we take one particular side is an open admission that there is another. Yes—there are among our readers those who are not "capitalists"—ay, very many of them—digressing, some of them have become capitalists because they *have* read us!—but is it only the capitalist who holds the views we express on labour and industrial questions? Far from it. Perhaps our correspondent refuses to recognise that in many respects the interests of the capitalist in industry are identical with those of the "worker." We have always recognised that difference of opinion between us and our readers is inevitable, otherwise we should never have so freely opened our "Correspondence" columns for argument. But abuse is not argument, and still less can anonymous abuse find admission there. We aim at furnishing a variety of matter, both industrial and technical, in each issue—we force nothing upon anybody. The reader will choose for himself what is of service, and matters might work a little more happily and smoothly if he endeavoured to recognise that there may be many who have a taste for what he abhors—even in an electrical journal. If Nonconformist divines can protest, as they have done in the *Times*, that they never preached a political sermon in their lives, surely we can say that we have never published a political article unless it was industrial also.



## CONTINUOUS-CURRENT MOTORS WITH COMMUTATING POLES AND CAST-IRON MAGNETS.

BY J. W. BURLEIGH.

THE writer believes it is generally considered impracticable, commercially, to construct an all-cast-iron magnet system suitable for continuous-current machines having commutating poles. It is, however, a feasible proposition to construct with an all-cast-iron magnet system, and at the same time secure the characteristics usually associated with sound design.

It is proposed in the following notes to describe the technical details of a machine so constructed : also to point

Smaller coefficients can, doubtless, be obtained, but it must be remembered that a small output coefficient does not always indicate minimum cost of total material. It frequently happens, particularly in small machines, that the armature dimensions may be increased for a given output, without affecting adversely the cost, the reason being that armature material is offset by the decrease in field copper due to the lessened density in the armature teeth and air-gap.

The ventilation of the new design is a great aid towards the use of an all-cast-iron magnet system. For a given temperature rise, it is found that the number of armature conductors may be increased from 20 to 30 per cent. This means for any particular output a like decrease in magnetic flux ; nor must it be thought that, by increasing the number of armature conductors, and thereby the resistance, a diminution is effected in efficiency, or that the copper in the main circuit is increased. This is quite obvious, because we have

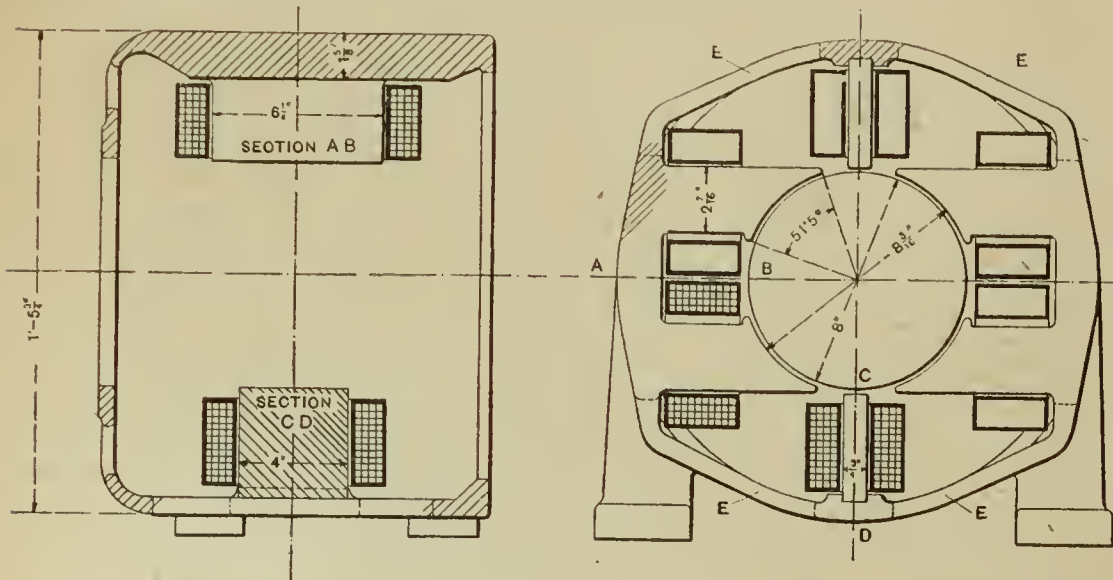


FIG. 1.

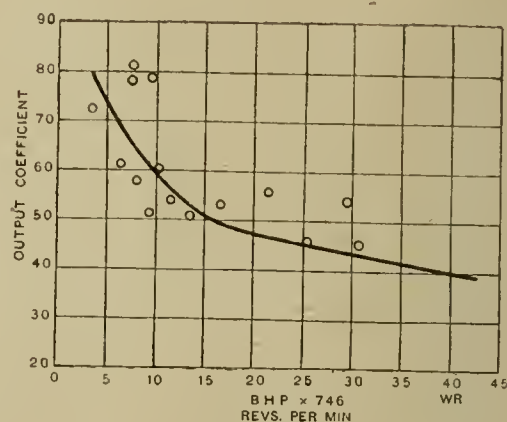


FIG. 2.

out some interesting effects which will show where great advantages accrue.

The construction is based on the magnet system described by the writer in the *ELECTRICAL REVIEW*, dated November 26th, 1909. Stated briefly, the magnets are so arranged that the angle between the axis of a main pole core and the axis of a commutating pole =  $360/N.P.$ , where N.P. equals the number of main poles.

In the interpolar spaces not occupied by commutating poles, the main field coils are brought directly over, and parallel, or nearly parallel, to the armature conductors undergoing commutation. Placing the field coils in this position

saves the loss and copper in two commutating-pole coils ; also there is less iron loss.

A remarkable fact connected with an all-cast-iron design is that the usual leakage coefficient is a negligible factor in the design. Neglecting a leakage coefficient and providing an excitation as calculated in the ordinary manner, will result in a greater magnetic flux than is required.

A reference to figs. 3 and 4 will assist a student in seeing that a reduction in magnetic leakage would be expected with the coils in the particular position of this design. Exactly why such a big effect is obtained in practice is rather difficult to realise.

As will be expected, the length of mean turn of field winding is greater than in the ordinary construction. The increased length, however, is very little, and is more than compensated for by the reduced excitation.

In diagram fig. 5 the full line represents the mean length of turn for the new design for outputs up to an equivalent



FIG. 3.

FIG. 4.

lessens magnetic leakage, and reduces the amount of copper required for the commutating poles.

Portions E E, fig. 1, being required only to carry the commutating flux, are cut away, leaving large ventilating spaces.

For comparative purposes, we will, first, consider the output coefficient of armatures. This output coefficient is usually expressed as follows :—

$$D^2 L = W_r \times C,$$

where  $D$  = diameter of armature in inches,  $L$  = length of armature in inches,  $W_r$  = watts generated per revolution per minute, and  $C$  = output coefficient. In the case of motors,  $W_r = \text{B.H.P.} \times 746/\text{R.P.M.}$

The curve shown in fig. 2 represents, I believe, the maximum coefficient required for the new type of machine. The small circles are for armatures by different designers, and are selected at random. It will be noticed that the curve shows an average value, and that even with all-cast-iron magnets, it is not necessary to increase the armature dimensions, as one might think would be necessary on first thoughts.

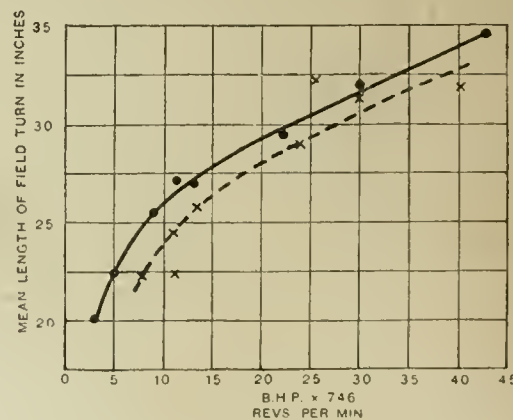


FIG. 5.

of 40 B.H.P. at 700 revolutions. The dotted line shows approximately the mean turn required for ordinary construction.

In fig. 6 the full and dotted lines represent respectively the ampere-turns per pole required for the new and for the ordinary construction.

Big differences of opinion will naturally occur as regards value of the mean length of turn and excitation, and probably for the ordinary and the improved design better figures



may be obtained. The writer believes, however, the figures given represent fair values for comparative purposes.

As is well known, the weight of field copper can easily be calculated by the following formula :—

$$\text{Net weight in lb. per coil} = \frac{(\text{A.T.S.})^2 \times \pi^2}{W \times C},$$

where A.T.S. = ampere-turns per coil,  $\pi$  = mean length of turn,  $W$  = watts per coil,  $C$  = a constant value 3,800,000.

We can now compare the field copper required for a motor with an output of, say, 10 B.H.P. at 1,000 R.P.M., having a  $w_r$  of  $10 \times 746/1,000 = 7.46$ . Referring to the curves for ordinary construction, we find the mean length of turn to be 22.25 in., and the excitation 2,400 ampere-turns.

Allow, say, a loss of 50 watts per coil. From the above formula the net weight of copper for the four poles is 60 lb.

With the new design the length is 25 in. The excitation required is 1,900 ampere-turns. With the same watt loss the net weight of copper required is 47.5 lb.

It will be noted that in spite of the fact that cast-iron is used for the magnets the cost of field copper is not increased, nor is there a greater loss in excitation watts.

The following data relate to a reversible motor, which was tested for one hour at 10 B.H.P., 870 R.P.M., 460 volts, and also tested for six hours at 6 B.H.P., 920 R.P.M., 460 volts :—

**Armature.**—8 in. diameter, length over laminations  $6\frac{1}{2}$  in.; 1 vent, .287 in. wide; 46 slots, 1 in.  $\times$  .26 in.; number of wires, 1,918; size of wire, 18 B.W.G.; weight of wire, 18 lb.

**Commutator.**—Diameter,  $6\frac{3}{4}$  in.; number of sections, 137; brush,  $\frac{7}{8}$  in.  $\times$   $\frac{1}{2}$  in.

**Field Magnets.**—Material, ordinary cast-iron in one casting; bore,  $8\frac{3}{8}$  in.

**Field Windings.**—

25 S.W.G.; 4.2 lb. net weight; turns, 1,914 } 4,317 turns  
26 S.W.G.; 4.42 „ „ „ 2,403 } per coil.

8.64 lb. per coil.

**Interpoles.**—Material: Wrought iron, 4 in.  $\times$   $\frac{7}{8}$  in.; bore,  $8\frac{3}{8}$  in.

**Interpole Winding.**—196 turns; 11 B.W.G. 11 lb. (net) each coil.

Weights.		Effective areas.		Length of magnetic path.
Cast-iron...	220 lb.	Armature	69 sq. cm.	6 cm.
(including feet)		Teeth	37.8 „	2.54 „
Armature copper	18 lb.	Gap	116 „	.239 „
Field copper	34½ lb.	(effective)		.261 „
Interpole copper...	22 lb.	Field	98.5 „	10.75 „
Effective disks	39 lb.	Yoke	116 „	7.62 „

Weight of complete motor, 510 lb.

Test at 460 volts, 10 B.H.P., 870 R.P.M.; temperature rise after 1 hour's run: armature, 54° C.; field coils, 32° C.; interpole coils, 47° C.; commutator, 39° C.

Test at 460 volts, 6 B.H.P., 920 R.P.M. :—

Time.	Volts.	Armature amperes.	Shunt current.	Revolutions per min.
8.45	460	11.2	.50	840
9.45	„	11.2	.434	880
10.45	„	11.3	.42	900
11.45	„	11.2	.413	910
12.45	„	11.3	.408	915
1.45	„	11.3	.405	920
2.45	„	11.3	.405	920

Temperature rise after 6 hours' run at 6 B.H.P. :—Armature, 30° C.; field coils, 42° C.; interpole coils, 33° C.; commutator, 25° C. Armature current when running light = .6 ampere.

The loss in iron, bearings, windage, and commutator friction, is 276 watts. From this figure it will be apparent that the use of solid pole pieces is quite satisfactory.

I should like to point out that it is not at all necessary to use such a large number of commutator sections as embodied in the above design. It was done simply because 137 sections happened to be the nearest available commutator in stock. Moreover, a less number of slots could easily be used in this armature; the output could then be increased about 20 per cent.

Fig. 7 is a magnetisation curve taken from this machine. Selecting a flux of, say, .75 megaline or 125 English lines, we find the excitation required is 1,880 ampere-turns. The following figures represent the various densities and excitation required, calculated on the ordinary lines, and neglecting a leakage coefficient :—

	Density.	Ampere-turns.
Armature ...	10,850	40
Teeth ...	19,800	230
Gap... ..	6,460	1,300
Field ...	7,620	452
Yoke ...	6,460	204
Total ...		2,226

From these figures we gather that the calculated ampere-turns required for the iron path = 2,226 — 1,300 = 926, whereas only 1,880 — 1,300 = 580 were required.

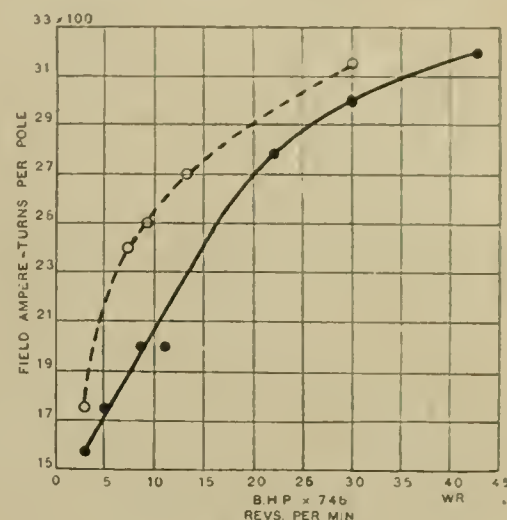


FIG. 6.

The reactance voltage at 6 B.H.P. = 5.6 volts. To neutralise this a density of 2,800 lines would be required in the interpole gap in a machine having one commutating pole per main pole. It would therefore be expected that double this density would be required if half the number of commutating poles only were used. This is not so, however, in the new design, as a density of 2,800 lines per sq. cm. was found ample for sparkless commutation.

The weight of the cast-iron magnet system is very little different from that of an all-steel magnet system of the ordinary type. Naturally, the areas are greater, but this is very

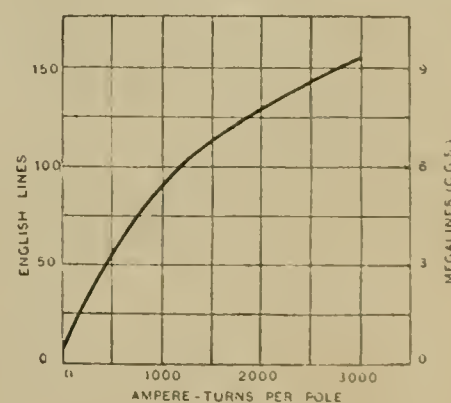


FIG. 7.

nearly off-set in consequence of the mean length of path for main magnetic flux being reduced to a minimum in the new design.

The new type of construction greatly lessens the machining required, minimises stock, and will not only effect a larger output from a given size of works, but will substantially reduce the prime cost.

The efficiency is quite equal to that of steel construction, and the commutating properties are such that in a number of four-pole machines so far constructed, it was found that even with two consecutive rows of brushes lifted, at full load, there was only very slight sparking, and in some instances none.

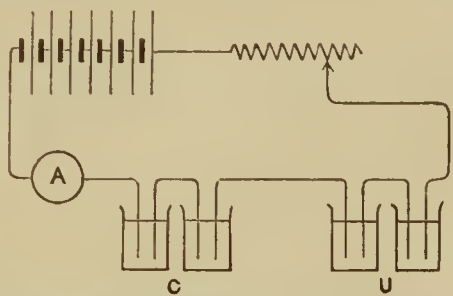
In the machines so far constructed the cast-iron has been of quite an ordinary grade and worked at an apparent density of about 7,800 lines per sq. cm. up to 12 B.H.P. output. It will probably be found in the larger sizes that even an apparent density of 10,000 lines may not be too high.



## ON THE EFFICIENCY OF ACCUMULATORS.

By W. HIBBERT.

If the efficiency of an accumulator is compared with an engine or dynamo, it seems to be low. The difference is not so pronounced if the operations of charge and discharge are of small duration and follow each other at once. But where a discharge runs on for seven or eight hours and is then followed by a corresponding charge, the efficiency found is somewhere near 80 per cent. Now, the work done in charge or discharge depends on three factors—volts, amperes and



Cells marked U were treated in ordinary way, acid was unchanged. In those marked C, the acid was changed twice every cycle.

FIG. 1.

hours—and under favourable conditions a good battery will return almost as many ampere-hours as were put into it. The loss in the quantity of electricity will not be more than 3 or 4 per cent.

This is only another way of saying that the chief factor in determining efficiency is the difference of voltage during charge and discharge. During charge, the average volts are nearly 2.2, while during discharge the average figure is about 1.95 volts. This factor alone, therefore, would determine an efficiency of about 88 per cent. It is evident that any appreciable improvement in efficiency must arise from a closer approximation between the charge and discharge voltage. The latter must be raised or the former diminished. The terminal voltage of a cell has the value  $v = E - c R_i$  during discharge, and  $v + c R_i$  during charge. If we assume that  $E$  and  $c$  have the same value in the two equations, the terminal voltage in discharge must be  $2 c R_i$  below that observed in charge, and for any given current must depend on the internal resistance of the cell. At first glance, this difference might be thought to account for the low efficiency, but an examination of actual cells and the volts lost by internal resistance, shows that this is not the case. Resistance accounts for less than half of the 12 per cent. loss in volts. It may be responsible for about 5 per cent. of the total. That it does not cover the whole loss is shown by the fact already mentioned, that short cycles (a few seconds charge or discharge) show improved efficiency, although they are afflicted with the  $2 c R_i$  loss quite as much as are the longer cycles.

To account for the unallotted balance, we must go to the fact that the electromotive force  $E$  is also different in the charge and discharge, and the question arises whether there is any chance of diminishing this difference. Since the researches of Dr. Gladstone and the present writer it has generally been admitted that changes in E.M.F. depend on differences in acid strength in the pores of the plates, and the known effects of electrolysis enable us to see how such differences arise.

During discharge the acid is abstracted from the liquid in the pores, which is therefore necessarily weaker. During charge, the electrolytic wandering of the ions makes the acid stronger in the pores of the positive plate, where it is most efficacious in raising the voltage. (See fig. 7, page 431, *Journal I.E.E.*, 1892.)

In thinking of these things it occurred to the writer that this source of loss might be lessened by the following device. The efficiency of two similar cells was determined by charging the plates in weak acid and discharging them in stronger. In other words, at the end of a charge the plates were lifted from a box containing weak acid and put into another containing strong acid. At the end of a charge the reverse transfer was made. The current was kept at a predetermined value, and the potential difference read on a sensitive voltmeter.

At the end of a cycle the readings of the voltmeter were plotted against ampere-hours in the usual way, and the work

put in during charge and that given out during discharge obtained from the enclosed areas.

It was thought that it would be too laborious to go through the usual repetition of cycles until constant results were obtained, and the early results were therefore compared with two similar cells in which the acid remained unchanged. In the final result, however, the experiments were repeated often enough to show that constant figures were being obtained.

All the cells were charged and discharged in series, so that the ampere-hours were the same for all. The voltage limits laid down were 2.4 for charging and 1.8 for discharging, as shown by the ordinary cells.

Fig. 1 indicates the general arrangement, and fig. 2 indicates the difference in voltage observed. By the change in acid, a lower voltage sufficed to charge, this advantage being somewhere about 0.06 volt. Similarly, a higher voltage was obtained in discharge, though the advantage here was only about 0.02 volt. The net result was of such an order that the efficiency was raised by about 5 per cent., say, from a value of 85 to one of 90 per cent. This is not quite so large as theory would suggest, but the reason is soon found. The method adopted is able to change the strength of the acid in the body of the cell at the appropriate times, but it is the liquid in the pores of the active material which determines the E.M.F., and this is changed merely by the slow process of diffusion. Hence the mechanical changing of the acid only partly accomplishes what was proposed, and so far fails to give the full effect desired.

We are brought once more to see what was asserted in Gladstone and Hibbert's paper, that an increase in the rate of diffusion would help. If diffusion could be so expedited that the acid in the pores could never differ much from that outside the plates, the charging voltage would not exceed the discharging value by more than  $2 c R_i$ . As a matter of fact, there is no chance of making diffusion take place rapidly enough, but as its rate increases with rising temperature, some efficiency cycles were taken at 30° or 40° C.

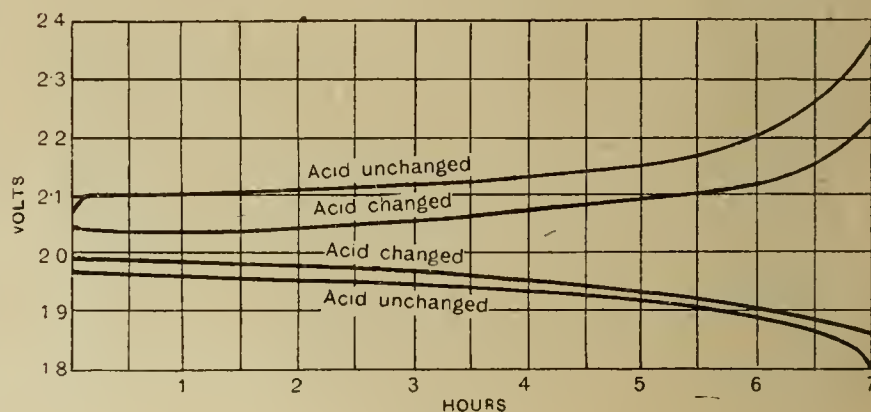


FIG. 2.

Two cells were placed in a water bath kept at about 37°, and placed in series with two similar cells standing in the ordinary air at an average temperature of 19° (July). Many cycles were taken, and gave practically the same result. (In these experiments the acid had the same strength in all four cells: temperature was the only difference.) The following short table shows the general nature of the results:—

Effect of temperature on the efficiency of an accumulator. Discharge current, 1.5 amperes; charge, 1.3 amperes:—

		Ordinary Temperature.	37° C.
Discharge watt-hours	...	14.0	14.84
Charge	" "	17.16	16.67
Efficiency	...	81.5	89.0

The average voltage of the warm cells exceeded that of the cold cells by about 0.07 volt. During discharge the difference was small.

The net result of these experiments shows that the efficiency of accumulators can be increased by two distinct methods. Both of these methods depend on the same theory, and, so far, they afford additional verification of the theory.

Whether either of the methods is capable of being used in practice is a moot question. Changing the acid twice in every cycle is an impracticable process. Keeping the temperature up is comparatively easy, but before it could be seriously proposed, the effect on "life" would have to be



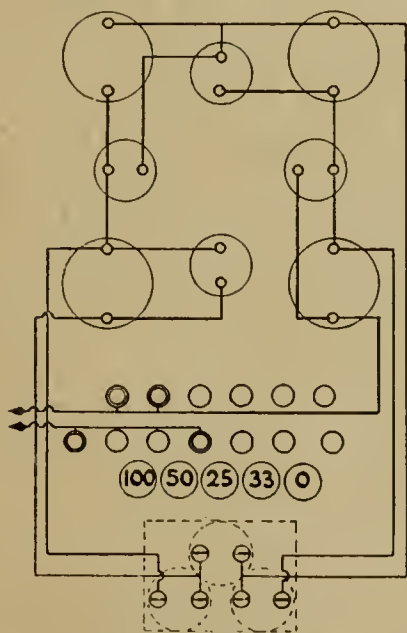
considered. Such evidence as is already to hand indicates that local action increases rapidly with temperature, and, therefore, that disintegration of the positive plates would probably be accelerated. Such a result would more than counterbalance any good accruing from increased efficiency. For the moment we must be content to look on the foregoing results as interesting demonstrations of the losses arising in accumulators. We are confronted by the facts that an increased rate of diffusion increases capacity and efficiency, but if it depend on higher temperature it will probably shorten the life of the cells.

### A LAMP-TESTING BOARD.

By H. R. TAUNTON.

TESTING lamps on receipt and before despatch is an absolute necessity in these days of metal filaments. To any firm of contractors handling quantities of these lamps, particularly if they are of the varying voltages consequent on a country-house connection, a simple lamp testing board is indispensable. In a crude and clumsy way its place is easily filled by, for instance, half a dozen different pieces of flex connecting varying numbers of lampholders in series. To make up a simple, neat, fool-proof apparatus is another matter, and presents an interesting little problem.

Let it be required, for example, to design a lamp-testing board for a 100-volt circuit, so that four B.C., or four S.B.C., lamps can be tested either four in parallel, four in series, three in series, or two twos in series. It will be found that they can be connected up with suitable switches in quite a number of ways to give the desired result. It is difficult, however, to avoid the possibility of a combination of switches causing a dead short-circuit between poles; and, this pitfall dodged, to guard against the probability of the switches being so manipulated that lamps may be damaged by excessive voltage, as, at the best, it will be found that not less than two two-way, and three one-way, switches will be required.



LAMP-TESTING BOARD: DIAGRAM OF CONNECTIONS.

If the puzzle be attacked on the lines of using wall plugs to effect the necessary combinations, there is a gain in apparent simplicity, due to the double break afforded by the two-pin connectors; four plugs, or even—in one way—three plugs, will serve to do all that is necessary. A fatal defect, however, of such a board is that in certain combinations the pins of the connectors are unavoidably alive, and at different potentials. Besides, the possibility of mistakes on the part of the tester is still present.

The solution of the problem here given reduces the necessary gear, including the eight batten holders, to the compass of a standard six-way block; effects all the required combinations with a single simple fitting; and eliminates the chance of a mistake by anybody who is not either blind or mentally deficient.

The diagram shows the general arrangement and the con-

nections. The eight lampholders are shown fixed on the upper two-thirds of a six-way block. (The S.B.C. holders can be placed between the B.C. holders, as, of course, the two types of lamps will never be tested simultaneously.) The remaining third of the block is occupied by two rows of small holes, about an inch apart. The single circles are dummy holes bored through the block, and taking a connector pin easily. The four double circles are holes having screwed into them, counter-sunk, the sockets taken from a couple of wall-plugs, the original terminals being attached to the ends projecting at the back.

The other essential part of the device is a special "six-pin plug." This is simply made up of three bases, complete with pins and terminals, taken from standard two-pin connectors, and screwed to a vulcanite block (about  $2\frac{1}{2}$  in.  $\times$   $2\frac{1}{2}$  in.  $\times$   $\frac{1}{2}$  in. deep), so that the four pins in the bottom row are equally spaced and in alignment with the two pins in the upper row, as indicated on the diagram by dotted lines. The centres of the pins, of course, must coincide with those of the holes in the teak block.

Suitable wireways being provided in the vulcanite base, lengths of twin flexible are brought out at its two opposite ends and led through bushed inlets in the sides of the teak base, where they should be knotted, so that there is only just sufficient play to allow the "six-pin plug" to be moved in either direction to the extreme positions, and no further. This will prevent it being put in upside down, or otherwise effecting undesired combinations.

The various inter-connections having been made, and a pair of leads taken through the side of the block to the source of supply, the back is sealed up, or otherwise protected from the possibility of damage: small labels are fixed as shown, and an arrow mark is made on the flat top of the "plug" to serve as a pointer. The board is then ready for use.

As will be seen, the four lamps, whether in the B.C. or the S.B.C. holders, are placed successively in parallel, in series of four, in two series of two, and—one being cut out—in series of three, by moving the "plug" one hole at a time towards the right. A further move puts the "plug" into dummy holes entirely. The same principle can obviously be easily extended to a board suitable for a 200-volt supply, so that 25 and 33-volt lamps can be tested, as well as 50, 66 and 100-volt lamps.

Such a board is all that any contractor requires for testing lamps for defects. There are no loose, live ends; no possibility of arriving at a dead short-circuit; and—with the labels—no chance of the most freakish store boy making a mistake in the voltage, as each change is made by a single, simple movement.

### SIMPLY MADE ELECTRIC HEATERS AND HOT CUPBOARDS.

By WHISTLEFIELD.

THE heating properties of carbon lamps can be usefully employed, and at least one firm of manufacturers uses a carbon lamp as the heating element of a guinea bedwarmer.

There are a number of small heaters which can be easily made and for which lamps form very suitable heating elements, the bedwarmer is probably the best example. All that is required is a tin about 8 in. long and 5 in. diameter obtainable from any grocer; a hole is made in the bottom of the tin and finished off with a file to  $1\frac{1}{2}$  in. diameter; the lamp end of a cord-gripholder is inserted into the opening from the outside and the tin is gripped by means of the shade carrier ring.

A 5-c.p. lamp in the holder in the tin, and a length of flexible connected to the cord-gripholder and ending in an adaptor or plug, completes the apparatus.

A flannel bag large enough to slip over the tin and provided with a neck which can be drawn together by means of a tape, like a brush or sponge bag, gives it a more finished appearance, as well as making it more pleasant to the touch.



When the lamp is switched on, heat is given to the tin by the lamp at a uniform rate, and the temperature of the warmer will rise till it reaches a point at which the tin radiates the heat as fast as it receives it from the lamp; when this point is reached the temperature of the tin will not increase any more, no matter how long the current is left on.

A 5-c.p. lamp will maintain the temperature of a tin of the dimensions given at a comfortable heat all night among the bed clothes without the least danger of scorching; and since it consumes 20 watts only, will run for 50 hours before consuming 1 unit. If a much larger tin is used, a larger lamp may be required; but since the lid of the tin only has to be taken off to change the lamp, it is not a difficult matter to alter the heating element.

Another useful piece of apparatus of a similar nature is an electrically-warmed footstool.

A flat biscuit tin with a cord grip-holder fixed to a hole in the side of the tin by means of the shade carrier ring, completes the warmer; the bottom and sides of the tin should be lagged with sheet asbestos on the inside to prevent radiation at these places, and the lid alone should be allowed to give off heat; by doing this the radiating surface of the tin is reduced and a high temperature can be maintained by means of a smaller lamp than if the whole surface of the tin were unlagged.

The top of the tin should be very slightly padded, and the whole covered with a suitable cloth in keeping with the style of the carpet.

An 8-c.p. lamp will be found to give an appreciable warmth to the top of such a footstool, which, of course, is not meant for use with heavy outdoor boots, but only for the thin slippers which are usually worn in the house.

If desired, a switch can be attached to the side of the tin by means of a couple of  $\frac{1}{8}$ -in. bolts and nuts, and operated by the foot when the temperature needs regulating.

When a switch is used the flexible wire must be carried into the tin through a hole suitably bushed; a thin board, long enough to reach from one side of the tin to the other, is inserted and firmly fixed in position to leave about 1 in. space between the board and the side of the tin where the wire enters. A batten holder is attached to this board and wired in circuit with the switch. The board can be kept in place by driving a few sprigs into the end of the board through the tin.

Anyone who has to study in the early morning before any fires are available will find that a footstool like the one described, supplemented by a rug to keep the knees and legs covered will keep him very comfortable at a current consumption of 30 watts (8-c.p. lamp), or 33 hours' use can be got from such a footstool for the cost of 1 unit.

Another useful piece of apparatus for the house is a hot cupboard.

Again recourse has to be made to the family grocer for a suitable box, which should be about 24 in. by 30 in. by about 15 in. deep. The inside of the box is carefully covered by thick brown paper to make it quite air-tight, and over this is tacked thick sheet asbestos; strips of ordinary capping or thin wood are nailed over the asbestos along the edge of the box where the door will be fitted, to prevent the edge of the door fraying away the asbestos.

The door consists of one or more pieces of wood fastened together to make an overall size equal to the overall size of the box, and is covered with brown paper and asbestos sheet also, and strips of wood about 1 in. square are nailed along the inner side of the door at such a distance from the edge that it will fit tightly into the opening of the cupboard, and thus make a tightly closing door; a pair of hinges and a hook and eyelet for keeping the door closed complete the cupboard. A strip of casing long enough to reach from one side of the cupboard to the other, and having six batten holders attached to it is fixed along the back of the cupboard near the bottom so that the lamps lie horizontally. Two switches fastened on the outside of the box to control two lamps and four lamps each, will enable the user to get three heats—120-watt, 240-watt, or 360-watt—with 16-c.p. lamps.

A grid shelf just above the lamps, and another about the middle of the box, will give two shelves 12 in. high  $\times$  15 in.  $\times$  24 in., which is large enough for all practical purposes.

A small hot cupboard similar to this fitted with one 16-c.p. lamp, will keep baby's food hot right through the night, and available at any time at a cost which is trifling, especially when compared to the convenience.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Association of Consulting Engineers.

At the first blush the Association of Consulting Engineers appear a truly admirable institution, the only fear being that, when the great Gabriel himself is asked to be President, he may feel unable to live up to the high standard of the rules of conduct. We seem to have heard something of these rules before, and we can only be thankful that admission to the charmed circle does not demand first a remission by the high priesthood of the order, of the sins of omission and commission, of which candidates may have been guilty in the past, else had the membership been confined to the galaxy of stars, who, by virtue of their self-election to the high priesthood, have pardoned their own transgressions. But let us not labour this point too severely. Doubtless from the high plane to which they have attained they see more clearly from the hilltops the folly of breathing those valley fogs through which they themselves gasped and gulped with such avidity.

But when an outsider looks upon our various engineering associations, with the knowledge of years thrust upon him, he must be dull indeed does he not receive a mental impression of the order you dimly indicate. One and all, for no distinction is necessary, appear to be run purely for the special benefit of the galaxy. Just as bodies of financial people ring the changes in their boards of directors, so do we see rings and groups of names ever kaleidoscopically shifting in the galaxy. A certain few appear to glide with facility into positions—by merit raised to that bad eminence—to become the objects of back-patting and buttered speeches at dinners and other functions, and these attentions are invariably mutual within the ring. Now, is it not a fact that all the advantages that can be claimed for the new Association ought to be, and might be, brought about by the existing institutions? Will not the new Association be simply another full-page advertisement to which all members will equally contribute, but which will blazon only the names of the galaxy of stars? Many of us have suffered from the advantages that have accrued to the galaxy by virtue of their position and the hidden influences unfairly brought to bear in their favour.

When Smith & Co. called for plans of a small power plant, what happened? Smith's freeholders were the Company of Charitable Bounders, and one of the firms who tendered for the work, told Smith that they had influence with the company, one of their men having been a Charitable Bounder, and they could easily override the stringent clauses of the freeholders. But they promised strong obstruction should any other firm get the work. How can the new society put a stop to such practices? We all know that they exist. The high priests know it. But did any one of us ever know any one of the Institutions ever to make the slightest move to protect the weak against the strong: to pillory those who break, not only the rules of the profession, but of common decency? Will a seat at the Council Board of the new Association convert a wolf into a watchdog? A fresh association is but overlapping a novel venture on a confessed failure. In present-day politics it is not all-round insurance to which the public really object. It is to overlapping.

The expenditure of the Poor Law is more than sufficient for the new arrangements to render the Poor Law unnecessary. But the old expenditure remains and the new overlaps it.

Before any new association is formed professing to do good to the profession, let the profession first convince itself that it is something more than a machine to exalt the few. Let



them ask the few how they are going to make a success for the members generally? And, if success is possible, why has it not been made with the older institutions? A secession from the older institutions could be understood, a casting away of the loaves and fishes of office and the Egyptian flesh-pots. No great movement of reform has ever been carried through by men who have worked from inside a charmed circle; and no reform of the engineering profession can ever emanate from those who are in the ring, either fairly or unfairly. Until the various professional institutions are differently governed, they will continue in their present useless courses.

Council membership should be more frequently changed. The Council should be elected on a wider basis, and should cease to be a sort of freehold. The highest eminence in the profession should not even be held to entitle any man to remain on the Council beyond the limit. Nor should the Council at any time contain more than a very few men who have previously been members, and fewer still who have been contemporary members. The Council might occasionally become a bit of a bear-garden, but better a bear-garden than a smugly complacent group of the elect, who take care that criticism of their actions is howled down by a subservient few followers as disloyalty to the Council—such subserviency being usually regarded as a bid for a place in the sun. If members would kick a little and insist on a real reform they might get it, but only by refusing to cast the Councils in stereo.

As to the new rules, they are simply a humorous piece of humbug from such a source.

It may fairly be granted that any new member of Council may enter full of good intentions. But the position of any new member in the midst of any old-standing body is, at best, somewhat invidious. The well known insolence of the House of Commons to new members, whose rights are as great as those of older members, is a case in point.

This side of the situation would be relieved were a Council to consist always of a larger leaven of new members. Experience stands for much, 'tis true, but it has its qualifying disadvantages, not the least of which is the habit so quickly engendered of regarding the public park as a private preserve. As in politics, so in other phases of life, the permanent servant puts on the airs of the master and begrudges his master the smallest voice in affairs. I think the foregoing fairly describes the attitude of mind so far as has been revealed to me, who am

Merely a Paying Member.

Westminster.

#### Old Carbon Ends and Lamp Caps.

I shall be glad to know if any reader can suggest a use for old arc lamp carbon ends, both solid and mineralised.

Also to know what is the value of the platinum in an ordinary 32-C.P. metallic-filament lamp, and the average price paid at home for old lamp caps.

H.

Straits Settlements,  
November 30th, 1911.

#### The Institution of Electrical Engineers.

The ELECTRICAL REVIEW for November 10th, 1911, containing references to the proposed new Articles of Association of the Institution of Electrical Engineers, has just reached here, and I write this by return mail, hoping that it may arrive in time for someone to take up the case of the members *residing abroad*.

With regard to the rearrangement of the membership, it is scarcely possible for all members residing abroad to be asked for their opinions, but with respect to the proposed alterations in the matter of annual subscriptions, some effort should certainly be made to ascertain the views of these members.

The unfairness of a *country* member having to subscribe the same amount as a *town* member was referred to both in your leader and by Mr. Solomon, but no one appears to have looked at the question from the point of view of the *abroad* members, the majority of whom do not visit England more

than once in five years or so, and many at less frequent intervals even than that.

It would seem to be ridiculous that these members, who cannot avail themselves of the benefits to be derived from the proposals, as noted by Mr. Hammond, to inaugurate lectures by specialists, to hold summer meetings, &c., should be expected to subscribe annually the same amount as a member resident in London, and, up to the present, the subscription for an "abroad" member has, very properly and very naturally, been of a smaller amount.

Mr. A. Campbell suggested that not more than two guineas a year should be asked from Associate Members and Associates residing presumably in London, and I would further suggest that the subscription for the same classes of members resident abroad should be certainly not more than one guinea and a-half, as heretofore, and preferably not more than one guinea, this appearing to me to be a perfectly reasonable sum for a member who receives, in the matter of lectures, &c., nothing but his copy of the *Journal*, most of the contents of which, by the way, can be read in the weekly electrical papers—such as the ELECTRICAL REVIEW, &c.

The suggested one guinea may appear perhaps to be rather on the low side, but it would seem to be the best plan to fix some such amount as the annual subscription and to make, in addition, a further charge of, say, three guineas or so, as a visiting fee, this amount being paid by an "abroad" member when home on leave for his use of the Institution library, &c., during that time.

I trust this letter will catch the eye of some "abroad" member at present on leave, and that he will have the opportunity of taking part in the discussion from the point of view indicated herein.

Failing any individual taking this matter up, I should think that many members resident abroad would be glad if the ELECTRICAL REVIEW would do so, should this be possible.

One other point strikes one at the first perusal, and that is, "the Council may require candidates for Associate Membership to pass an examination, *or in their discretion grant exemption therefrom*" (the italics are mine). This rule would surely be very difficult of application.

A.M.I.E.E.

Straits Settlements, December 5th, 1911.

#### THE PHYSICAL SOCIETY EXHIBITION.

(Continued from page 1060, Vol. 69.)

FOSTER INSTRUMENT CO.

An interesting item of this exhibit was the Foster patent "strain-meter," for the direct observation of strains. This device can be attached to any member of a ship, crane or other structure

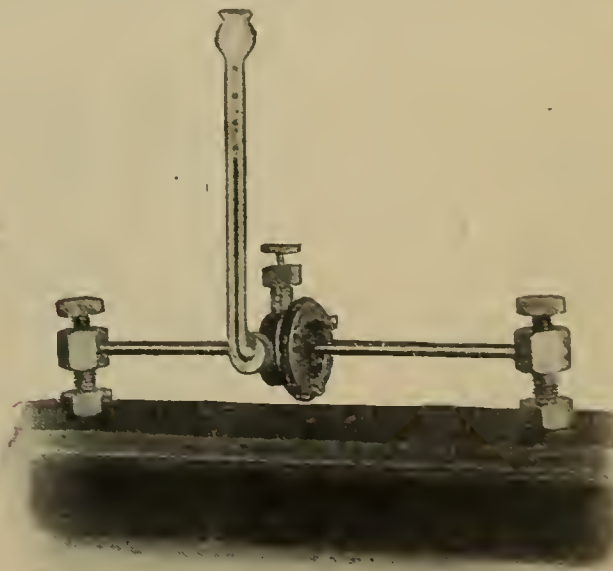


FIG. 2.—FOSTER STRAIN-METER.

and shows the strain due to any stress applied to the part under observation. It consists of two clamps carrying steel rods, one ending in a metal chamber provided with a glass gauge tube, and the



other bearing against a flexibly mounted diaphragm which closes the chamber. The latter is filled with coloured liquid, and when the slightest increase or decrease occurs in the strain to which the support is subjected, the movement is shown to a greatly magnified scale by the liquid in the gauge-tube—the increase being about 500 : 1. The device is applicable to a great variety of uses, and is extremely sensitive, measuring elongations to  $\frac{1}{10000}$  in. The Hoskins "base metal" thermo-couples of nickel and chromium, which develop a large E.M.F., and can be used up to 1,360° C., and the Foster fixed-focus pyrometer were other exhibits.

#### EVERSHED & VIGNOLES, LTD.

This firm showed the "Ducter potential ohmmeter," for rapidly measuring resistances from 10 microhms to 5 ohms; this was fully described in our issue of March 31st, 1911. Another exhibit was a speed indicator, consisting of a magneto generator in a water-tight cast-iron case, connected with a moving-coil voltmeter. We illustrate the former, which is of special design and construction. The armature runs in Hoffmann ball bearings, and the magnets are well aged to secure permanence and constancy. The armature commutator consists of substantial copper segments with air insulation, no mica being used between them, and the brushes are carbon blocks

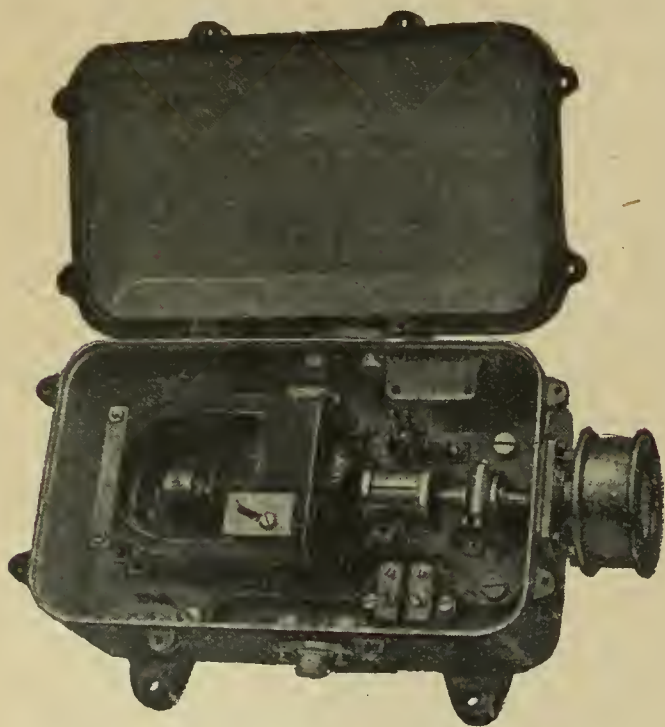


FIG. 3.—GENERATOR OF SPEED INDICATOR.

supported on wires stretched by springs; they are pressed on the commutator by rubber rods, to ensure perfect contact under the worst conditions of vibration. An adjustable magnetic shunt is provided to regulate the E.M.F. in the event of accidental variation in the magnetic field. The driving pulley is supported on ball bearings quite independent of the armature bearings, so that the strain of the driving belt is borne by the case and not transmitted to the armature shaft. Any of the firm's standard voltmeters can be arranged for use with the generator, and calibrated in revolutions per minute.

#### CROMPTON & CO., LTD.

The Crompton potentiometer, which has been developed into a beautiful example of high-class design and workmanship, various switchboard instruments, and the Crompton road-wear measuring machine, as used by the Road Board, were shown, as well as the

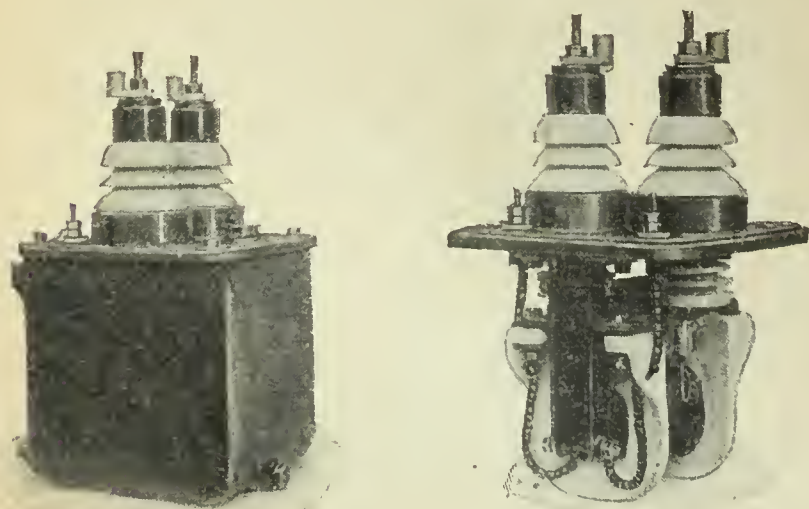


FIG. 4.—HIGHLY INSULATED SERIES TRANSFORMER.

battery switch and series transformer, which we illustrate herewith. The special feature of the latter is the provision of exceptionally substantial insulation between the primary and secondary windings, so as to render the device suitable for use on extra-high-pressure systems. The primary coil, as shown, is wound

on a porcelain bobbin of high quality, which is so attached to the frame that no strain can be put on the bobbin; the transformer is enclosed in a cast-iron case, and the joint between the case and the cover (to which the transformer body is attached) is made with lead packing. The automatic switch is intended for battery charging; it closes the circuit when the dynamo voltage exceeds that of the battery by a pre-arranged amount, and opens the circuit when the current is zero or reverses. There are no permanent magnets in the construction, so that the switch cannot become reversed, and it is held definitely off or on when the battery or the dynamo voltage is in excess. It will be seen from the diagram, fig. 5,

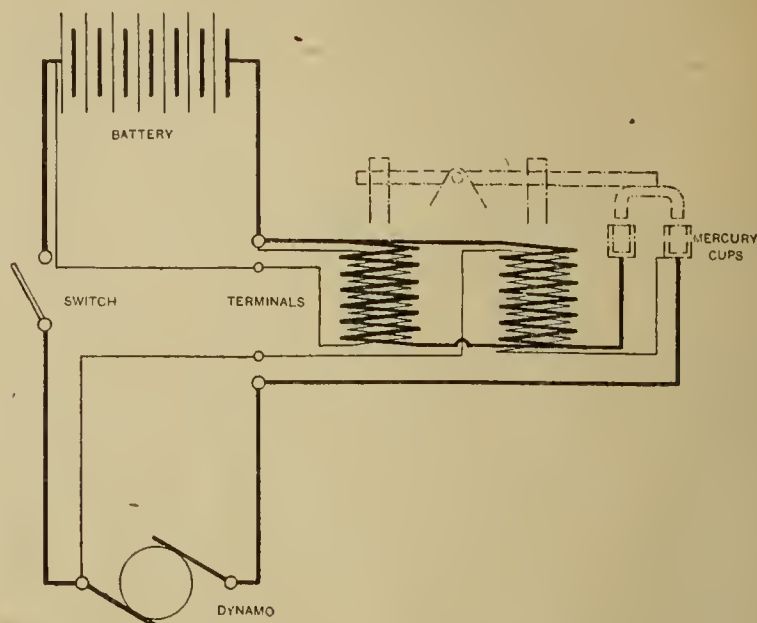


FIG. 5.—DIAGRAM OF CONNECTIONS OF AUTOMATIC BATTERY SWITCH.

that there are two shunt and two series coils, acting on a pivoted lever, which carries a bridge piece above two mercury cups. When the dynamo voltage exceeds that of the battery, the lever is tilted and the main circuit closed through the mercury cups; the charging current then holds the switch closed. If the current diminishes, the electromagnet nearer the mercury cups is weakened and the other strengthened, until, as the current approaches zero, the lever is tilted and opens the circuit. The switch is made up in a form suitable for switchboard use, and the shunt coils are wound for the full voltage.

#### THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS Co., LTD.

The India-Rubber Co. showed a novel form of Wheatstone bridge of the decade form, embodying some radical departures from the ordinary type. In this instrument the usual method of construction has been reversed, and instead of the various resistance coils being

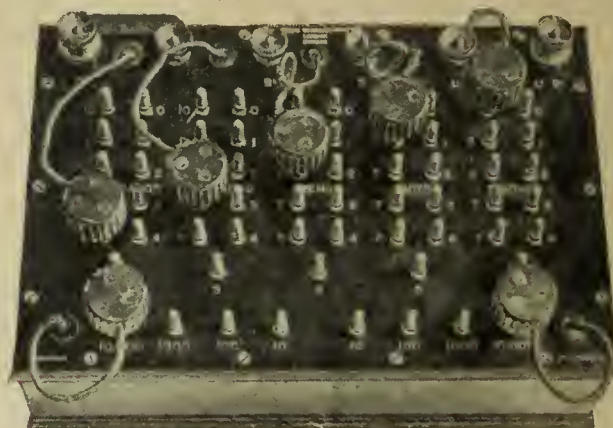


FIG. 6.—NEW TYPE OF WHEATSTONE BRIDGE.

joined to closely contiguous brass blocks, which are connected as desired by loose pegs, as in the ordinary form, the resistances are connected to fixed pegs projecting from the top of the ebonite slab, connection being made by ebonite-headed socket plugs attached to short flexible leads of low resistance. By this arrangement, the various contact parts fixed on the ebonite slab are much more widely separated than in the ordinary form, thus providing longer leakage paths and better insulation; in addition, the contact parts themselves and the insulating surfaces between them can be much more readily cleaned. All know the difficulty of cleaning the small ebonite surfaces in the confined spaces between the brass blocks of an ordinary bridge or resistance box, and the trouble and time required to keep the contact holes clean. The instrument exhibited had five sets of resistances, comprising 10 coils each of 1, 1, 10, 100 and 1,000 ohms respectively, together with four pairs of ratio coils, or a total of 58 coils. In the ordinary form of such a decade bridge there would be 63 holes to be cleaned, whereas in the new form there are only seven plug sockets, and these, being attached to the ends of flexible leads, can be turned about and held in the hand, so that the cleaning is much easier. As regards the plugs, the cleaning of these in either form of instrument presents no difficulty. In the new design there are no loose plugs to be lost or mislaid; and although this may not be thought a great advantage in a laboratory instrument, yet for a portable instrument, and for use in street work, &c., it is undoubtedly of importance.



This firm also showed three types of Mr. E. Raymond-Barker's two-tone vibrating transmitters for conductive and inductive signalling. One of these types was the latest improved form; it was generally similar to the instruments previously exhibited, which have been described in our columns, but the construction of the sending keys and of the vibrating tongues had been greatly simplified.

NALDER BROS. & THOMPSON, LTD.

This firm exhibited a portable standard ammeter and voltmeter of the "precision" type, on the dynamometer principle, suitable for D.C. and A.C. and free from error due to frequency, wave-form and temperature changes; an insulation tester for high-pressure circuits, also on the dynamometer principle, and used in conjunction with a transformer for measuring the insulation resistance of a combined 600 and 3,000-volt system at pressures 50 and 100 per cent. above normal in each case; the N.C.S. Telethermometer, the Ohmer, and other standard instruments and apparatus for portable and switchboard use. A circuit-breaker which the firm has just

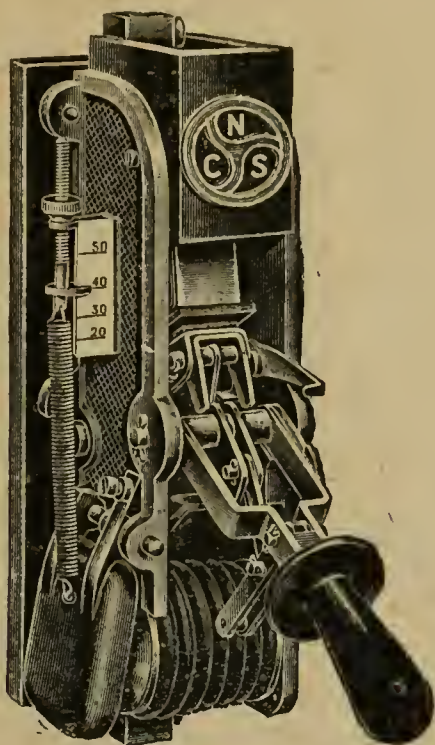


FIG. 7.—N.C.S. CIRCUIT-BREAKER.

introduced was also exhibited, and is illustrated herewith (fig. 7). This device is of neat and compact design, and of specially robust construction; it is fitted with magnetic blow-out and loose handle, but can be made with carbon breaks if desired, and is arranged in various forms, either for overload (with or without time limit), reverse current, or both combined, or with overload and no-voltage release. Special attention has been given to the tripping mechanism, which is entirely novel; the effort required to release the breaker is extremely small, so that there is no uncertainty about the operation of the device, but there is no possibility of its opening acci-

dentally. It will be remembered that in essence the system consists of a millimeter movement of the moving-coil type, which is held deflected against the control of a hair-spring by a very small current; this current traverses a number of little thermo-piles, which are situated in the rooms to be protected. Should any one of the thermo-piles be slightly warmed, the added E.M.F. increases the current, and, therefore, the deflection of the indicator, bringing a light iron disk within the range of a magnetised iron pole-piece, which attracts it into firm contact, and sets the fire alarm bell ringing. Similarly, if a break occurs anywhere in the circuit, or if the battery runs down, the pointer falls back and makes contact with another magnetised stop, ringing a "trouble" alarm bell and attracting attention to the matter. As the permanent current required is only about 3 milliamperes, an ordinary dry cell serves to maintain it for a year or more. Leakage across the circuit, or a dead short-circuit, would also cause a bell to ring—either the fire or the trouble bell, according to the position chosen for the battery. The system is extremely sensitive; breathing on one of the thermopiles, or warming it with the hand, is quite sufficient to set up an alarm, as we have proved; but, on the other hand, a gradual change of temperature due to normal causes has no effect. Fig. 8 shows a complete board for two circuits, with adjusting resistance, testing devices, &c.

(To be continued.)

## BRITISH TRADE WITH RUSSIA.

THERE can be no doubt that trade with Russia requires a considerable effort and a more than ordinary display of adaptability, but if this effort is made and this adaptability is practised, the results accruing will certainly be good. It has been suggested that, fortunately, the United Kingdom can afford to ignore a market that requires so much effort, but there can be no doubt that in the larger goods the trade is worth considerable energy. The Russian market would have done without a large number of things in which there is now a big trade had it not been for energetic selling on the part of our competitors. This selling has been largely carried out by extensive organisation, and it is by such organisation that British firms should endeavour to secure trade.

In a recent report Mr. Blakey, the British Vice-Consul at Kharkoff, who is himself a keen trader, points out that the establishment of what he describes as a purchasing agency would be a very useful institution. Comparatively easy to organise, and of considerable utility, it could be established on a purely commercial basis, with offices in London. It would have one or more experienced British travellers in Russia who would be in touch with manufacturers of machinery, chemicals, &c. It would issue lists or catalogues, supervise the shipping of goods and arrange for credit where necessary. If managed as a commission agency taking, say, from  $\frac{1}{2}$  to  $3\frac{1}{2}$  per cent. on the value of the purchase, it would bring down prices to a level that would ensure the support of the Russian purchaser. This could be done because British manufacturers are in the habit of quoting to London merchants lower prices than to foreign firms inquiring direct. There are several London and Birmingham merchants who have connections with Russia; but the trade is not looked after by them, they merely accept orders that happen to come their way. To be a success, this agency must concentrate its energy in Russia.

The scheme above outlined is interesting, and if properly carried out, would doubtless be of very great use. The whole crux of the position seems to us to lie in the statement in italics above (the italics are ours). We have no wish to attempt to depreciate the usefulness of the merchant. His value chiefly lies in the fact that he is in a position to finance small exporters, who would otherwise not be in a position to carry on an export trade, particularly in countries where the giving of credit is almost essential. It is a very illuminating fact, however, that in countries where the merchant system of trading operates, British trade has not advanced with anything like the same rapidity as it has in countries where trade is done direct. This can be safely said to be due chiefly to the fact that "the trade is not looked after by them, they merely accept orders that happen to come their way." If, however, they would direct their attention exclusively either to one particular market, or to one particular line of goods, there would not be the slightest reason why the trade should not expand as much under the merchant system as without it. Unfortunately, however, the merchant in most cases does not take the slightest trouble to find out what is wanted; the orders which he receives without any particular effort are sufficient to bring in a satisfactory total of commissions. But more important than this he has no particular reason, in most cases, for placing his orders exclusively with British firms, and is prepared to buy wherever suits his own purpose best. It consequently follows that if an institution on the lines of that suggested by Mr. Blakey were established, its practical good to British trade, if carried on on right lines, might be enormous, and if properly capitalised, it could exercise the same financial functions as are now exercised by the merchant.

In a previous report referred to in the ELECTRICAL REVIEW, Mr. Blakey showed the possibilities of the establishment of sale branches either for separate engineering firms or for a group of manufacturers. A dependent branch requires the services of experienced men and considerable financing, but in the long run it should give better results than can be expected from wholesale dealers or agents, however reliable or pushing, because an agent

E



Two-circuit complete board with automatic device for giving signal in case of broken wire.

FIG. 8.—REICHEL TWO-CIRCUIT FIRE-ALARM BOARD.

dentially. The switch cannot be held in on an overload, on account of the loose handle; it can be tripped by hand, so that it can serve the purpose of a switch.

The latest pattern of the Reichel automatic fire alarm was shown; we described this instrument in our issue of December 2nd, 1910. It has the advantage that it automatically gives warning of any derangement of the circuits, and of the exhaustion of the battery.

The instrument in its earlier form was not provided with the



cannot be tied down to put all his work and capital into British goods, and is free to trade in what is most profitable to himself.

In the heavy engineering, and more particularly in electrical engineering, the Germans have shown more enterprise than the British. They have branch offices in their own management with experienced engineers at the head, a staff of suitable men and branch factories in Russia to supply parts of contracts that cannot profitably be imported. They have thus established a reliable trade, while the British remain dependent upon the good will of their agents. The trade in electrical machinery and in semi-portable engines is entirely in their hands. Mr. Blakey is fully assured that the British manufacturer could well compete if he were as well served by a sales department in Russia as is his German rival, but entrance into this market, in face of the well-established German trade, is no easy task, and in the engineering section of the electrical trade it is particularly difficult. His remarks are not meant as an all-round condemnation of British enterprise in Russia. The returns of British exports to Russia prove that trade is carried on, in spite of considerable odds, but he considers that the volume of the trade is capable of considerable increase.

## BUSINESS NOTES.

**Bankruptcy Proceedings.**—BERT NEWMAN (trading as B. Newman & Co.) electrician, 4, Cranbrook Road, Ilford, Essex.—The following are creditors herein:—

Gilbert Arc Lamp Co. . . . .	£14
Goodwin, A. F., & Co. . . . .	44
National Telephone Co. . . . .	17
Newman, F. . . . .	715
Partington Advertising Co. . . . .	12
Tolmage, G. . . . .	19

THOMAS TOPPING, electrical engineer, &c., 361, Lord Street, Southport, Lancashire.—The first meeting of creditors herein was held on Thursday, December 28th, at the Official Receiver's offices, 35, Victoria Street, Liverpool. The statement of affairs disclosed unsecured liabilities £359 and net assets £144, leaving a deficiency of £215. The debtor attributed his failure to loss on contracts and bad trade. The debtor commenced business in August, 1910, with £30 capital, his savings as a foreman electrician. The only books he had kept were an imperfect cash book and a debtors' ledger. He stated that he only became aware of his difficulties a month before filing his petition. The household furniture and effects were stated to have been purchased by the debtor's father-in-law, and given to his wife before their marriage in 1889. The debtor executed an assignment for the benefit of his creditors on December 4th, but the deed was not registered. With the exception of £83 for banker's overdraft, the whole of the liabilities are ordinary trade debts. The Official Receiver remains trustee.

**Trafford Park Factories.**—We have received the following notes regarding the progress of Trafford Park during 1911. Though not directly electrical, we think that they will be found of interest:—

THE SOUTHERN COTTON OIL CO., OF GREAT BRITAIN, whose parent company have 280 cotton seed oil works in America, opened new works in Liverpool last year. The company have now found the advantages of Trafford Park so considerable that they are erecting extensive premises in Trafford Park to turn out 2,000,000 lb. of lard per week, and they intend to scrap the new Liverpool works.

Another and yet larger concern that has come to Trafford Park is ANNEXE, LTD., a company having an exceedingly strong financial backing. Finding Trafford Park to be the best location in the country for their purpose, they are building a large works which will operate more than 50,000 tons of grain per annum.

MESSRS. JOHN GREENWOOD & SONS, of Blackburn, have just completed the erection of their large new flour mill in Trafford Park, on a site where they obtain direct communication with the Manchester Ship Canal Co.'s grain elevator. They will commence operations early in the New Year.

THE CO-OPERATIVE WHOLESALE SOCIETY have just made provision for extending their flour mill in Trafford Park, which is already one of the largest mills in the country.

THE MANCHESTER SHIP CANAL CO. have established a warehouse in Trafford Park for the storage of cotton. It is interesting to note that this is the only warehouse controlled by the Canal Co. in the Port of Manchester, which combines all the advantages of being within 6d. per ton rail haulage of every ship in the docks, of being directly connected with all the trunk railroads, and also of being situated on the Bridgewater Canal.

THE ENGLISH TEXTILE MANUFACTURING CO. have acquired extensive premises in Trafford Park, where they will shortly commence to manufacture cloth from paper materials by the Clavier process.

THE FORD MOTOR CO., of America, have recently chosen Trafford Park as the best location for their English factory, and have established extensive works.

Works are about to be erected in Trafford Park for the BROTHERS CHEMICAL CO., of Rawtenstall, who are moving to Trafford Park to secure the exceptional railway and shipping facilities.

MESSRS. A. BLAKE & CO., motor carriage builders, of Liverpool, have rented a small factory in Trafford Park for the manufacture of motor accessories.

THE BRITISH REINFORCED CONCRETE CO., LTD., are now building works in Trafford Park, where they will manufacture wire cloth for reinforcement, fencing, &c., under the Clinton patents, which are so successful in America.

MESSRS. JOHN DEWAR & SONS, LTD., the whisky firm, are building an extensive bottling and distributing depot in Trafford Park.

THE DRAKE STREET PRINTING CO. are erecting a printing works in Trafford Park.

THE BRITISH DYEWOOD CO., of Bury, have just taken premises in Trafford Park.

THE DAHLSTROM METALLIC DOOR CO., of America, have rented a factory in Trafford Park.

**Willans & Robinson, Ltd.**—The first annual dinner of MESSRS. WILLANS & ROBINSON'S drawing office staff took place recently at the Grand Hotel, Rugby. Invitations extended to the

general staff met with a hearty response, both from Rugby and branch offices, and Mr. E. R. Briggs (chief) presided over a numerous company, including Mr. F. R. Davenport, Mr. A. F. Bennett, Mr. H. F. Hemmings, &c. Mr. Davenport, in responding for the directors, complimented Mr. Briggs for initiating the gathering, and observed that it coincided with a period of increasing confidence as exhibited by an increasing order book. An outstanding feature of the latter was the cabled news recently to hand from Australia intimating that the New South Wales Government were accepting the company's tender for plant connected with electric railways and tramways, to the extent of some 40,000 H.P. The D.O. motto "Always Merry and Bright," hanging upon the dining room wall, displayed a cheerful optimism, which he thought might well apply to all departments. The dinner had been arranged partly to cement the feeling of friendly co-operation that existed amongst the departmental staffs, and he expressed the opinion that if that feeling was sustained there was nothing to prevent them from retaining their position in the first rank of engineering firms. A most successful evening was largely assisted by an extensive musical programme carried out by members of the staff.

**Felten & Guilleaume, Carlswerk, A.G., Mulheim-on-the-Rhine.**—We are informed that at a board meeting on December 23rd, the agreement concerning the fusion of the mines and blast furnaces of Jules Collart & Co., in Steinfort, Luxemburg, with the Carlswerk, was approved. By extending the existing blast furnace plant and erecting a steel plant, this undertaking will be increased to such an extent that it will be large enough to cover the requirements of the Carlswerk in steel. The Luxemburg firm will be transformed into a limited company, whose shares will be transferred to the Felten & Guilleaume, Carlswerk, A.G. It is as yet not intended to increase the share capital of the Felten & Guilleaume, Carlswerk, A.G., as the funds at the disposal of this company are sufficient for carrying out the transaction.

**Calendars and Catalogues.**—From the ELECTRICAL POWER STORAGE CO., LTD., of 4, Great Winchester Street, London, E.C., we have again received an exceedingly useful desk-pad with left-hand diary interleaved with blotting. Monthly card strips with the days and dates are fixed along the top edge of the pad. The usual accident insurance is included.

MESSRS. THERMIT, LTD., of 27, Martin's Lane, Cannon Street, London, E.C., has sent us one of their pocket note-books, with calendars for 1912 and 1913. The opening pages, as usual, are occupied with a good deal of illustrated information respecting the application of the "Thermit" system in tramway and other work.

THE WESTERN ELECTRIC CO., LTD., North Woolwich, London.—A neat, stout calendar has been received from this firm. It has monthly tear-off slips, and is intended either for desk use or for hanging.

THE BERRY CONSTRUCTION CO., LTD., 29A, Charing Cross Road, London, W.C.—Readers requiring copies of the 1912 "Tricity" cooker lists, with improved discounts, are desired to communicate at once either with the company, or with the sole wholesale agents, Messrs. Gillespie & Beales, Amberley House, Norfolk Street, Strand, W.C.

MR. JOHN WHITELAW, of 15A, Duncan Street, Edinburgh, has issued a calendar for 1912, with monthly slips fixed beneath a charming reproduction in colour of a painting, "Little Sister," by A. J. Elsey.

THE FOREST CITY ELECTRIC CO., of Collier Street, Greengate, Salford, are circulating a hanging calendar with large tear-off monthly sheets, each of which bears illustrations, with brief notes, of different types of their rail bonds and other specialities.

THE "ATTRACTA" ELECTRICAL CO., 75, Fetter Lane, E.C.—Circular giving illustrations, brief descriptive particulars, and prices of their electric illuminated signs—projecting for exterior service and shop-window signs for indoor use, also illuminated wood letters, portable flash signs, and other devices.

MESSRS. FIELDING & PLATT, LTD., Gloucester.—Large postal card illustrating their "Fielding" suction gas engines (52 and 60 H.P.), electric lighting type, and briefly indicating working costs and design features.

MESSRS. NEALE & WILKINSON, LTD., 32, St. Mary Axe, London, E.C.—Wall calendar with weekly tear-off slips. Valuable information, arranged in tabular form above these slips, indicates the time in important parts in the world when it is noon at Greenwich, and gives the time occupied in conveying goods and mails. Copies will be sent to applicants.

From the UNIVERSAL ELECTRICAL MANUFACTURING CO., of 14, Station Parade, Queen's Road, Peckham, we have received a useful pocket-book with diary spaces and squared memoranda pages. Illustrated particulars of the company's various manufactures in switchboards, switchgear, and street lighting fittings, together with a number of tables and curves, are sandwiched between these two sections. Calendars for 1912 and 1913 are given. The arrangement of the book admits of the addition of other pages as issued.

THE KORFUND CO., 47, Victoria Street, London, S.W.—Twelve-page catalogue relating to their "Korfund" cork plates for engine and other foundations.

THE BRAULIK ENGINEERING CO., 8, Lambeth Hill, Queen Victoria Street, London, E.C.—Thirty-two page illustrated catalogue and price list of electric specialities, including porcelain spider leading-in heads, aerial cut-outs, insulator switches, branch-off terminals for open-air cables, cone couplings, cellar and stable switches, the Sigma insulating box, the "Perkeo" electric barrel torch, electric press iron for shoes and other manufactures. A separate leaflet gives particulars and prices of the "Spider" triple switch and ironclad house service fuses.



MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—24-page catalogue prepared in excellent style with effective half-tone illustrations, and entitled "Accumulators, Ignition Coils and Dynamos for Houses, Cars and Vehicles." It contains descriptive particulars, with tabulated sizes, capacities, charge and discharge rates, prices, &c., of accumulators for various purposes—testing, small motor running, medical work, small lighting installations, traction, motor-cars, motor-cycles. The "De Luxe" type cycle accumulator: accumulators specially adapted for abroad: accumulator parts and plates; ignition coils; and the dynamo method of car lighting, are also fully dealt with.

MESSRS. DRAKE & GORHAM, LTD., 1, Felix Street, Westminster Bridge Road, London, S.E.—Illustrated pamphlet containing an illustrated description of the "D.G." adjustable reading lamp with revolving shade.

THE WALSALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall.—New catalogue of 40 pages, containing good illustrations, brief descriptive particulars and tabulated prices of their various manufactures in the way of switchboards for different classes of service, accessories, and meters. The company have just booked a large contract for meters (8,000), and they are extending the works to cope with the order, but their regular output will not be interfered with at all.

MESSRS. NALDER BROS. & THOMPSON, LTD., of 34, Queen Street, London, E.C., have issued a calendar for 1912, with monthly tear-off slips, in the same convenient size and style that has been found of service by us and others for many years past.

The standing desk calendar issued by MESSRS. STEWART AND LLOYDS, LTD., of Glasgow, Birmingham and London, is a white and gold production, and is quite different from anything else received. Monthly date sheets behind a transparent celluloid protection are changed by opening the back in the same way as with an ordinary portrait frame.

MESSRS. JOHNSON & PHILLIPS, LTD., of Victoria Works, Charlton, have once more prepared for their friends an extremely neat gilt-edged vest pocket engagement book for 1912, with ample daily space—two days per page.

MESSRS. A. EMANUEL & SONS, LTD., 7—13, George Street, Manchester Square, London, W.—Catalogue of 40 pages, giving illustrations and prices of a variety of electric light accessories, wires and cables, cords, conduits, casing, insulators, lampholders, "Kwik-Fix" ceiling roses, different types of switches, distribution boards, wall plugs, arc and metal-filament lamps, candle fittings, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A large mining calendar for wall service has been received from this firm. There is a separate sheet for each month of the year, and a distinctly useful feature is the printing at the top, on the right hand and left respectively, of the dates of the past month and the coming month, so that each sheet really represents a quarter of the year.

THE DUSSEK BITUMEN CO., of Canal Bank, Deptford, London, S.E., have sent us a handy self-opening pocket diary for 1912, with ample daily note space and cash account columns, also a few pages of general information. This is the only diary so far received this year containing that useful detail, the £1,000 accident insurance coupon.

**"Wotan" Lamps.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, now have upon the market a complete range of their "Onewatt" lamps ranging up to 250 volts, and up to 600 C.P., made in the usual grades with filaments of pure drawn tungsten wire. Hitherto they have only placed upon the market certain candle-powers in certain voltages of this type of lamp, owing to the congestion at the works due to the demand for tantalum lamps. Extensions of the works and the acquisition of fresh stores have enabled them to accumulate a sufficient stock of "Onewatt" lamps to justify placing them upon the market, and immediate delivery can now be given of the full range of lamps shown in their new pamphlet. The name of the lamp has this week been changed from "Onewatt" to "Wotan," and these lamps will in future be known as the "Wotan" (Onewatt) lamps. Fresh literature embodying these alterations is being prepared for the trade.

**Lamp Prices.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, announce that as from January 1st they have made various alterations in the prices of tantalum lamps, the most important of which affects the high-voltage lamps of 16, 25, 32 and 50 C.P., the prices of which are being reduced from 3s. to 2s. 6d. each. Other less important alterations are also given in a list which has been issued. We are informed that fresh types of advertising matter are being issued, and the firm will be pleased to supply quantities of literature free of charge to any member of the trade requiring same. We understand that the present reductions are not to be considered as a "price-cutting move," as there is now the same difference between the price of high-voltage tantalum lamps and of high-voltage tungsten lamps as existed previous to the reduction of tungsten lamps which took place last November.

**Dissolutions and Liquidations.**—AFRICAN TRANS-CONTINENTAL TELEGRAPH CO., LTD.—A meeting of creditors is called for January 8th, at 2, London Wall Buildings, E.C.

HASTE PUMP CO., LTD.—A meeting will be held on February 1st at Crown Buildings, Crown Court, Old Broad Street, E.C., to hear an account of the winding-up from the liquidator, Mr. H. B. Clark.

BOHM LENS LAMP CO., LTD.—This company is winding-up voluntarily with Mr. E. S. Neave, 15, Great St. Helens, E.C., as liquidator. A meeting of creditors is to be held on January 9th. Claims should be sent to Mr. Neave.

RAWORTH'S TRACTION PATENTS LTD., late Cooper Street, Manchester.—In pursuance of the provisions of the Companies' (Consolidation) Act, 1908, a meeting of the creditors of the above was called for Tuesday last, at 113, Wool Exchange, Coleman Street, E.C. A meeting of the shareholders of the company had previously been held under the presidency of Mr. Thomas Browett, when a resolution in favour of voluntary liquidation was passed, with Mr. R. J. Riches as liquidator. The company had been in existence for a number of years, and at one time substantial profits were made. The present position has been brought about by litigation, in which the concern became involved. The only available assets are the patent rights, the value of which is not definitely known. There are debentures registered, and these form a first charge on the assets. Only a limited number of firms are interested as creditors, and the unsecured indebtedness is stated to amount to only a comparatively small sum. The voluntary liquidation of the company is being continued, with Mr. Riches as liquidator.

**Electrical Engineering Trade Prospects.**—MR. WILLIAM BULLOCK, of the Electric Construction Co., Ltd., Bushbury, near Wolverhampton, stated to a Press representative, in reply to inquiries respecting the prospects of the electrical engineering trade for 1912, that there is a fair volume of business passing, but that many of the prices at which orders have to be taken still prove unremunerative. Purchasers, he said, seem to put off their requirements till the last moment, and all machinery is required to be made and delivered in a desperate hurry. The consequence is that there is not a great amount of work ahead of manufacturers. The prospects of the new year are, added Mr. Bullock, fairly encouraging.

**Trade Announcements.**—THE ARMORDUCT MANUFACTURING CO., LTD., have taken additional premises at 9, Farringdon Avenue, E.C.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., inform us that owing to the continued increase of their business in all classes of supplies, they have again had to extend their premises at 39, Upper Thames Street, E.C. Extra space was taken about a year ago in the adjoining building, 38, Upper Thames Street, to enable them to carry a larger stock of tantalum and "Onewatt" lamps, but this has already proved insufficient. Their accommodation for stock is now more than double what was available in 1910, the new floors being chiefly occupied by "Zed" cartridge fuses, "Zed" distribution boards, arc lamp carbons, and accessories.

MESSRS. HARRY WITTUSEN & CO. have engaged as their London representative Mr. A. Griffin, formerly representative of Messrs. Johnson & Jorgenson, Ltd.

MR. J. STEVENS, electrician, of Upper Eglinton Road, Plumstead, S.E., has opened new showrooms at 31, New Road, Woolwich.

MESSRS. HANS RENOLD, LTD., have opened an office in Glasgow at 86, St. Vincent Street (Tel. 2454, Central), and have appointed Mr. F. M. Lawson, who has for some time held a leading position with the firm, as resident engineer for Scotland.

**Private Meetings.**—A. WARD & CO., LTD., 1, Endell Street, Long Acre, W.C., electrical engineers, &c.—The creditors interested in this matter met together a few days ago, when a statement of affairs was presented, showing liabilities of £3,250, all of which were due to unsecured creditors. The net assets stand at £2,278, or a deficiency as regards creditors of £973. The company was registered at the beginning of April, 1910, with a nominal capital of £3,000 in £1 shares. It was formed to take over an existing business, which was then carried on at 85, Shaftesbury Avenue, W.C., but shortly after the conversion the offices and showrooms were removed to Endell Street. The first directors of the company were Mr. A. V. Ward and Mr. C. L. Kirkpatrick, but since that time three other directors had joined the board. A suggestion was made that a joint liquidator should be appointed to act with Mr. P. E. T. Thomas, the liquidator appointed by the shareholders. A resolution to that effect was, however, defeated by a large majority, and the creditors decided to confirm the voluntary liquidation of the company, with Mr. Thomas as sole liquidator.

CARBURATION, LTD., 25, Mount Pleasant, W.C., manufacturers of carburettors.—A meeting of the creditors interested in this matter was held on December 30th at Bush Lane House, Cannon Street, E.C., having been convened by the liquidator, Mr. A. E. Watts. No formal statement of affairs was presented, but it was stated that the unsecured liabilities were under £200, while the assets if realised under a forced sale might produce £50. The appointment of Mr. Watts as voluntary liquidator was confirmed, and a Committee of Inspection, to act with Mr. Watts, consisting of Mr. Shepherd, of Langer, Shepherd & Co., the largest creditors, was resolved upon.

**Book Notices.**—*Glover's Vade Mecum*, 1911. Manchester: W. T. Glover & Co. Price 12s. 6d.—This handbook, which Messrs. Glover's are issuing to their friends, is a valuable compilation of information relating to the manufacture, laying and jointing of cables, the maintenance and testing of cable networks, colliery installations, overhead lines and interior wiring installations, with a variety of useful tables, data and official regulations. In the first section the usual types of insulated cable are briefly described and discussed, and the improved system of armouring patented by the company is shown. In the second section, trench-work and reinstatement, the handling of cable, and the accepted methods of laying cable direct, solid and drawn-in, are admirably described, with an abundance of practical wrinkles obtainable only from long experience. The third begins with the statement that joints are the weak spot in cable work, and gives clear directions



for arranging cables in manholes, jointing them in various ways, insulating the joints, finishing cable ends, and applying joint boxes. Similarly, methods of testing cables and localising faults are lucidly explained, useful notes on colliery work are given (together with the Home Office Special Rules), the design and construction of overhead lines are treated of (with the Board of Trade Regulations appended), a short section is given on interior wiring (with the Home Office Rules for Factories, and the I.E.E. Wiring Rules), and a variety of tables and data follow, winding up with the Board of Trade Regulations, and a general index. The book—which is not a catalogue or price list—is extremely interesting, and should be found a valuable companion to mains engineers and contractors, as well as a handy book of reference to all engineers who have to do with cables and conductors.

We have received an advance copy of the "Annual Trade Review" of the Chamber of Commerce *Journal* dealing with trade and industry in 1911 and the prospects for the year just begun.

"Transactions of the Illuminating Engineering Society." Vol. VI, No. 8. November, 1911. Easton, Pa.: The Society. Price 75 cents.

"The School of Mines Quarterly." Vol. XXXIII, No. 1. November, 1911. New York: Columbia University. Price 50 cents.

"Boletín de la Sociedad de Fomento Fabril." Vol. XXVIII, No. 11. November, 1911. Santiago de Chile: The Society.

"The Stereophagus Pump and Special System of Pumping." By the Hon. R. C. Parsons. London: From the Author.

"Ship Wiring and Fitting." By T. M. Johnson 1911. London: Constable & Co. Price 1s. net.

"The Electrical Engineers' Diary, 1912." London: S. Davis and Co. Price 2s. 6d.

"Science Abstracts." Sections A and B. Vol. 14, part 12, December 27th, 1911. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net, each.

**A Brimsdown Souvenir for Smokers.**—From the BRIMSDOWN LAMP WORKS we have received a very acceptable New Year souvenir in the form of an aluminium tinder-box with igniting pencil, which, when we have filled in the necessary benzine, will considerably reduce our consumption of Editorial matches. We expect to find that one filling of the reservoir with benzine will suffice for three or four weeks' use.

## LIGHTING and POWER NOTES.

**Atherton (Lancs.).**—The B. of T. has formally sanctioned the application of the U.D.C. to place overhead wires for the supply of electrical energy to premises outside the area of supply under the Atherton Electric Lighting Order, 1901. The electrical engineer has been directed to carry out the work.

**Bacup.**—As an evidence of the extension of the electrical undertaking, a sub-station is being constructed in Lee Mill district by the Corporation to serve the extension at Lee Quarries, and another sub-station is to be constructed at Waterbarn for the Stacksteads Quarries, the quarrying industry of the district employing 1,000 hands. The electrification of the quarries will expedite the output greatly.

**Belfast.**—The Corporation has recently acquired an Argyll 15-H.P. petrol motor-car for the use of its electricity department. The vehicle is to be employed in connection with the repair of electric cables, and for this purpose is being equipped with the necessary instruments for locating faults, and with the tools for carrying out repairs.

**Cheltenham.**—The T.C. has received the consent of the L.G.B. for the unexpended balance of £4,509, of a loan sanctioned in 1903, being utilised for mains (£2,103) in place of a loan of £2,000 sanctioned in May, 1910, and the balance towards the cost of works in respect of a loan of £6,548 sanctioned in July, 1904. Sanctions for the loan of £2,000, and £2,562 from the loan of £6,548, are to be cancelled.

**Continental Notes.**—BELGIUM.—La Compagnie Electrique d'Anvers et du Limburg is the name of a new concern which has just been formed in Antwerp with a capital of £30,000 to establish and work central electric lighting and power stations and to acquire a certain area of land at Beersse.

A new electric power plant of 5,000 kW. capacity is being installed at the iron and steel works of the Société La Brugeoise, at Bruges.

GERMANY.—The Electricitäts Gesellschaft Colonia is the name of a new concern which has lately been formed in Cologne with a capital of £20,000 to manufacture electrical plant of all kinds.

**Derby.**—With reference to the application of the T.C. for consent to supply current in the parish of Quarndon, the B. of T. has replied that, having regard to the demand for current, a prov. order should be applied for to enable the Council to give a general supply. The Electricity Committee has recommended the Council to undertake to apply in 1912 for a prov. order to include the parishes of Kedleston and Quarndon in the Council's area of supply, and to seek the consent of the B. of T. to give a supply in the meantime.

**Eccles.**—The borough electrical engineer has been instructed to visit the electricity works of a number of towns where mechanical stokers are in use, and to report thereon.

The consideration of the question of providing a showroom in the borough and of advertising the electricity undertaking has been adjourned.

The Health Committee is to be recommended to charge occupiers of the Corporation's houses in and near Lewis Street for the supply of electricity in the same manner as for the houses in Corporation Road.

**Falkirk.**—The T.C. has agreed to proceed with the work of extending the buildings and plant at the burgh electricity works, at an estimated cost of £5,800.

**Glasgow.**—A special report on the Corporation electricity department states that it continues to show progress. With improved trade conditions the set-back due to the introduction of the metal-filament lamp has been more than overcome. The department sold last year 40,823,000 units, being an increase of 4,344,000 over the previous year. The outstanding point in these sales is the large number of units sold for power purposes. These amounted to 23,523,000, an increase over the previous year of 4,000,000. No additional plant has been installed, and the amount of plant available continues to be 72,000 H.P. between the tramways and the electricity departments. The tramways department, however, has arranged for the installation of a Richardsons-Westgarth combined impulse-reaction turbo-generator of 7,000 H.P., and it has also erected a new sub-station in a more suitable situation in Partick, transferring the plant from the old sub-station with the addition of up-to-date switchgear. Applications to the number of 1,677 have been received during the year, bringing the total number of consumers up to 21,166. As previously stated, the demand for power purposes continues to grow, the number of such consumers added during the year being 308, representing 524 motors with a horsepower of 3,913. The total horse-power of motors in use is now 36,831.

**Greetland (near Halifax).**—The U.D.C. has decided to petition the B. of T. for a provisional order authorising it to supply electricity within the district, and further authorising the transfer of the order when obtained, to the Electrical Distribution of Yorkshire, Ltd.

**Launceston.**—The electric light was inaugurated on Saturday evening last, and very generally admired. The Launceston Electric Supply Co., Ltd., which controls the works, has acquired the quarry joining the London and South-Western Railway station. Mr. M. Willy is the resident manager, while Messrs. J. and W. Purves, of Exeter, are the consulting engineers.

**Llanhedr, near Barmouth.**—The Parish Council has decided to light the village with electricity. The power will be supplied by the River Artro.

**Luton.**—The T.C. has adopted a scheme for the extension of the electricity undertaking, and to meet the cost a loan of £17,000 is to be applied for. The Council has also decided, subject to a seven years' agreement, to supply current for power (600 kW.), to the Electric Furnaces and Smelters Co., Ltd., and has sanctioned mains extensions at a cost of £184.

**Merthyr Tydfil.**—The T.C. has approached the Merthyr Electric Traction and Lighting Co. with a view of ascertaining whether it is prepared to sell the whole of its undertaking to the Corporation. The borough engineer has also been instructed to make inquiries relative to the advantages of adopting the railless system of electric traction in the surrounding districts.

**Mexico.**—In the province of San Luis Potosi an English company has secured a concession to erect a hydro-electric station on the Verde River. Construction works are about to be commenced, and it is expected that 40,000 H.P. will be generated. A waterfall 260 ft. high allows of the utilisation of a head of 400 ft. The water level above the falls varies from 5 ft. to 25 ft. A good agricultural district lies around the falls, but the company intends to supply the towns of San Luis Potosi, Matehuala, Tampico, &c., with current, and, on the acquisition of other water rights, the city of Monterey also.—*Elektrotechnik und Maschinenbau.*

**Newcastle-on-Tyne.**—Mr. Glynn Marston, of the National Electric Light Association, of New York, visited Newcastle-on-Tyne on December 20th, in pursuance of an inquiry into the supply of electricity by the large companies in municipal areas. He stated, according to the *Newcastle Chronicle*, that the tendency in America was for municipal electric plants to be handed over to the large power supply companies, and, understanding that a good deal of this kind of thing was being done in Britain, he had been commissioned by his association to discover the terms of the contracts, and to discover the extent to which the power companies were taking over the municipal undertakings. Mr. Marston said that he found that the Newcastle Electric Companies could supply power cheaper than the collieries could generate it with their own coal, for that reason companies in the Newcastle district were supplying some 52 collieries. The explanation was that the big power companies were able to handle the waste heat problem economically, whereas the small companies and the municipalities could not do so. Mr. Marston also pointed out the necessity for the demand for current spreading over the whole day if the generating were to be done cheaply. In Newcastle that condition prevailed, but in America the National Electric Light Association, to bring that condition about, had had to encourage the use



of electric vehicles. He could give no explanation of the fact that such vehicles were unknown on Tyneside, except that the power companies had not found it necessary to seek this class of business.

**New Zealand.**—A proposal to borrow £12,000 for the extension of the electric lighting and power works at New Plymouth has been approved on a poll of the ratepayers of the borough.

**Portishead.**—The Portishead and District E.L. Co. has secured from the Bristol T.C. a site in Gas Lane on which to erect a generating station, the building to cost not less than £1,000.

**Queensbury.**—The Halifax T.C. has informed the U.D.C. that it cannot entertain the question of supplying current in bulk to Queensbury.

**South Africa.**—The estimates for the municipal year ending July 31st, 1912, have just been published by the Durban T.C., and show a surplus towards which electric light provides £11,601; tramways, £14,838; telephones, £4,000. Of the electric light revenue, private lighting will give £31,900; power, £5,840; Corporation Departments, £5,927; street lighting, £7,410; tramway supply, £14,524; and Government supply, £3,125. The electric light expenditure is put down at £68,726, of which interest amounts to £12,479; renewals, £9,210; contribution to rates, £11,601; sinking fund, £2,234; and the construction account amounts to £70,447.

The tramway revenue is shown at £119,193, and expenditure £104,355, while out of renewals account £9,970 is set aside for relaying West Street track and the construction account amounts to £45,473 for extensions of track to Overport, Prospect Road and Bath Road, being a total length of 1.4 miles.

One of the features of the estimates was the announcement of the reduction of the price of electric supply which came into operation on December 1st, being 6d. per unit, as against 7d. previously. This is subject to a discount of 10 per cent. for all accounts paid within seven days, so that the net price is about 5½d. A day rate of 1d. per unit is also introduced, with a minimum charge of 5s. per month, the 1d. rate applying only between the hours of midnight and 6 p.m. This applies to a certain class of consumer, while a day rate of 2d. per unit applies to another class of consumer. For motive power the charges are from 2d. to ½d. per unit as heretofore, depending on the units consumed, but the minimum charged is £3 per H.P. per annum up to 20 H.P., which charge was previously a standing charge in addition to the cost of current consumed.

The tender of the Municipality of Muizenberg and Kalk Bay for the supply of electric energy, having been accepted by the Wynberg Municipality, the sanction of the ratepayers of Muizenberg and Kalk Bay was required to the raising of a loan of £4,500 for overhead mains, &c. Strong opposition was raised to the scheme by some of the ratepayers, and a poll was taken on December 11th, with the result that the proposal was rejected. The Wynberg Municipality is consequently advertising for fresh tenders for street lighting and supply to private consumers.

**Skelmorlie.**—On the evening of December 28th Lady Montgomerie inaugurated the electric lighting supply in the Skelmorlie district of Ayrshire. The plant installed some years ago by Dr. Philp to light the Wemyss Bay Hydropathic, and extended afterwards by Mr. R. V. Farnham to give electricity to several neighbouring houses, is now owned by a private limited company which, after obtaining a B. of T. order, has erected and equipped a power station with plant for the day and night service of the whole district. The gas engines (two of 100 H.P. each and one of 35 H.P.), are supplied from three suction gas producers—one "Crossley," one "National," and one designed by Mr. R. V. Farnham. The dynamo and booster are by the Electric Construction Co., the storage battery by the Tudor Co., the switchboard by Kelvin & James White Ltd., lamp-posts by the Edison & Swan Co., and the public and private lighting cables by Messrs. Callenders. The running plant alone can supply 5,500 25-c.p. lamps. Mr. John M. M. Munro is the consulting engineer. Following upon the inauguration the company met at the Hydropathic for dinner, where felicitous speeches were made. Mr. J. H. Montgomerie, chairman of the County Council District Committee, said the company had been most generous in its charges for public and private lighting. The season for public lighting—and the charge would only begin then for the first time—was to be from August 1st until April 30th, instead of from September 16th till March 31st, as formerly, whilst cottagers requiring a room and kitchen lit, were to be supplied at the rate of 10s. per light, or £1 per annum. He defied any gas company to give light at the price.

**Stalybridge.**—It was decided, at the monthly meeting of the Stalybridge Joint Tramways and Electricity Board, to make application to the L.G.B. for sanction to a loan of £16,850 for additional plant at the generating station at Stalybridge. The extensions include new turbines, pipework, boilers, mechanical stokers, &c., and £5,000 will be set apart for the purchase of transformers and switchgear during the next three years.

**Thurstonland.**—The U.D.C. is taking steps with a view to securing a supply of electricity for public lighting.

**Wootton.**—The P.C. has resolved to approach the E.L. Co. on the question of introducing electricity into the parish for lighting and power.

**Wrexham.**—The T.C. on December 29th adopted a revision of charges for electric supply to dwelling houses. In future house consumers may pay a minimum of 12½ per cent. of the

rateable value of their premises, in return for which 48 units will be allowed for every 20s. paid of the minimum figure, the charge after the consumption of this quantity per 20s. being 1½d. per unit, less ½d. per unit discount. Councillor Sauvage (chairman of the Electricity Committee) said he used the electric light in his house, and found it infinitely cheaper than any other illuminant. The output of the E.L. department during November was 73,675 units, or nearly 10,000 more than in the corresponding month last year.

## TRAMWAY and RAILWAY NOTES.

**Ardsley.**—The B. of T. has informed the U.D.C. that it is inexpedient to grant the application of the Wakefield and District Light Railway Co. for cesser of powers in respect of unconstructed portions of the lines authorised by the order, with the exception of a short length in Horbury. The Board has, therefore, extended the time for the completion of the lines for a year, and expresses the hope that in the interval, capital will be found to complete the work.

**Belfast.**—At a special meeting of the Tramways and Electrical Committee last Friday, the report of Mr. Andrew Nance, general manager, was read *re* the proposed extensions of the tramway system authorised by the recent Act of Parliament and the Act of 1904. After discussion, the city surveyor and the electrical engineer were instructed to prepare plans and specifications and forms of tender, and do other matters requisite, in order that tenders may be obtained. Work is to commence about March 1st, and will terminate early in the summer. The general manager was instructed to take measures to increase the stock of cars from 250 to 300, in order to provide additional cars for the new routes. A dépôt is also to be built at Ardoyne. It is understood that the estimated cost of the permanent way and the electrical equipment will be about £115,000, and of the new cars about £36,000, or a total of £151,000.

**Blackpool.**—It is proposed to relay at the earliest possible moment the tramway track along the entire length of the Promenade at North Shore. The estimated cost of the work is £10,000, and the Finance Committee has decided to apply for sanction to borrow this amount.

**Birmingham.**—As from January 1st, the Corporation entered into possession of the whole of the tramways in the Greater Birmingham area. The sections affected are those controlled by the B.E.T. in Aston Manor, and portions of the Selly Oak and Sparkhill routes; the company's interests are to be purchased for £151,000.

**Chile.**—The Ferrocarril Eléctrico de Santiago a San Bernardo is to construct various sections of electric railway. The work must be commenced within six months and completed within one year.

**Continental Notes.**—**AUSTRIA.**—The preliminary studies for the construction of electric tramways have been officially sanctioned at Schwechat, in Lower Austria, and between Ried and Frankenburg, in Upper Austria. Similar authorisation has been accorded for an electric railway line to connect the curative resort of Bad Gastein with Hof Gastein. Authorisation has also been accorded for the electrification of the Mori-Arco-Riva line, on Lake Garda, and for the construction of an extension to Sacco and Rovereto; also for the conversion of the Pirano to Portorose line into a normal electric railway.

Some interesting particulars were given of the projected electrification of the Austrian State Railways at a recent meeting of the Railway Consultative Council. A closer study of the conditions of the line from Opicina to Trieste has shown that the financial advantages are not on the side of electrification, and in consequence it has been decided not to proceed with this conversion. The inquiry into the Arlberg line is still proceeding. The preliminary work in connection with the Attnang-Steinach-Irdning line is almost completed, the detailed scheme having been drafted, and only the political aspects remaining for consideration. The mode of the provision of capital has also been decided upon. The electrification of the section Selzthal-Attnang-Puchheim has, for technical reasons, been abandoned.—*Elektrotechnische Zeitschrift*.

It is reported that a service of electric motor-omnibuses is about to be started in Vienna.

**RUSSIA.**—A Conference was recently held at Wladikawaka to consider the question of building an electric railway and tunnel through the Caucasus. At the Conference were present eminent Russian and foreign engineers, among the latter being Chief Engineer Zoellinger, who was associated with the building of the Simplon Tunnel, and Prof. Hannings, the builder of the Albula Tunnel. It is estimated that the building of the tunnel will take eight years, and will cost 100,000,000 roubles. The tunnel will have two galleries; the mountain streams can supply over 13,500 H.P. for traction purposes.—*Zeitschrift des Oest. Ingenieur und Architekten Vereins*.

**GERMANY.**—As previously announced, the Bavarian Government has given the contract to the Bergmann Co. for the construction of the electric railway from Garmisch to Partenkirchen, through the Mittenwald to the Austrian frontier (Griesen). This line is 40 km. long, and is regarded as an experiment. If it proves a success, it will cause the electrification of the Munich-Partenkirchen line, now



worked by steam. These two lines will create an electric main line connection between Munich and the Austrian frontier (Griesen), whose continuation to Innsprach on Austrian territory will be effected by the projected Mittenwald electric railway, which is about to be constructed with the co-operation of the Austrian Creditanstalt. These several lines will form the shortest route for tourists through Germany to the Brenner Alps. The power station for the Bavarian section will be erected on the shores of Lake Walchen.

A scheme has been drawn up by the A.E.G. and Siemens concerns for the construction of an electric railway between Cologne and Düsseldorf.

ITALY.—A concession has been granted to the Società Anonima Agnone-Pietrabbondante-Pesciolanciano for the construction and working of an electric railway in Agnone.—*Elektrotechnik und Maschinenbau*.

**Edinburgh.**—Mr. Hall Blyth, chairman of the Cable Tramway Co., had something to say relating to the cost of cable traction at the annual dinner of the employes. They had 14 main routes on the system; the cables varied in length, the shortest being 4,500 ft. long, and the longest 33,600 ft. long, and the total length of all the cables was 293,000 ft. The cost of the cables was £10,000 each year; but with the breakdowns that took place, the actual cost for last year was £17,166. The lives of the cables, of course, varied, from 92 days on certain routes to 415. These were the lives guaranteed by the makers. The actual average for the whole system was 267 days. They had in addition to 14 main cables 12 auxiliary cables, and their life was about 57 days each. They specified the particular life which was required for each particular cable, and if their cables did not come up to the life specified, the makers had to make up the difference. If the cable lasted more than the probable life, the profit was divided between the maker and the Tramway Co.

**Fife.**—Although some points have still to be adjusted between Lochgelly T.C. and the Tramway Co. as to the route of the proposed line to Lochore, it is expected that a start will be made with the extension in a few weeks. There will be a double line of rails to the end of the burgh boundary at Grainger Square.

**Hull.**—The tramway men recently sent to the Corporation Committee demands for a new time-table and for an advance of wages in certain sections. A deputation of the tramway men waited on the Committee, as a result of which the Committee drew up a revised time-table involving an additional cost of about £1,200. These terms have not been accepted, and at a mass meeting of the men it was decided to draw up a scheme for double shift duty with a reduction of hours, which the tramway manager states would represent an additional cost of £4,000 or £5,000. The executive of the Tramworkers' Union does not favour a stoppage, and thus there are hopes of the grievances being adjusted. At a meeting of the Tramway Committee on Wednesday, it was decided to defer the commencement of the revised time-table till after January 18th, which was the date proposed. The tramway men are asking for a reduction of hours from 54 to 48.

**Japan.**—One of the largest, if not the largest, railway bridges in the world is about to be built in Japan to give transit facilities to an electric railway and an electric tramway. The bridge is to be built across the Straits of Shimonoseki to the Island of Kiushu, and will be of a length of 1,140 metres, with a height of 51 metres above sea-level. It will thus allow the biggest ocean steamer to pass under it. It will be laid with a double line of rails, the one for the railway and the other for the street tramway. Its estimated cost is 15,000,000 yen. The plans will shortly be the subject of an international competition.—*Zeitschrift des Oest. Ingenieur und Architekten Vereins*.

**Keighley.**—The Corporation has included in its Parliamentary Bill for next Session application for powers for a scheme of electric tramway service embracing a large area, inclusive of many important manufacturing townships. The promoters of the project look with considerable favour on the success of the railless trolley systems on trial in Leeds and Bradford, and it is quite likely that if powers are obtained, the railless system will be adopted.

**Leeds.**—Two or three important matters have recently been engaging the attention of the Corporation Tramways Committee. It has been decided that the whole of the cars shall be fitted with side life-guards. A trial is to be given to the "queue" system of loading cars, and the place chosen for a commencement is near the Market Hall in Kirkgate. Although in Leeds there are, perhaps, none of the undignified "rushes" for tramcars, which are to be noticed in many other large cities and towns—such, for instance, as on the most-frequented route in Bradford—the passengers' difficulty in boarding cars is increased by the lack of order. The Traffic Sub-Committee has refused an application for permission to drivers and conductors to wear the badge of the Union on their uniforms.

**Morley.**—The approval by a B. of T. Inspector of the route from the centre of Morley to Leeds marks the completion of a large electric tramway extension scheme, which in its entirety connects Morley by tramway with Leeds, and almost, though not quite, with Bradford by way of Drighlington. The extensions which have just been completed by the Morley Corporation have been leased to the city of Leeds.

**Newcastle-on-Tyne.**—At a meeting of the Tramways Committee, on December 28th, the wages of all men who had completed eight years' service were increased by 1s. per week. On the motion of the chairman, the salary of the general manager was

increased by £100, to be increased by a further £100 at the end of 12 months, which will eventually make his salary £1,000. A motion by Mr. Teags that the wages of the men in the sheds who had less than 25s. per week should be increased by 1s. a week, was lost.

**Northampton.**—The borough accountant has been directed to give formal notice of objection to the new valuation list, showing an increased assessment of the tramway undertaking in the borough, which has been deposited by the overseers.

**Perth.**—The Corporation Tramway Committee is to acquire meters for the cars with a view to checking the consumption of electrical energy.

**Preston.**—At the T.C. meeting on December 28th, the chairman of the Tramways Committee said some difficulty had been experienced in regard to securing borrowing powers for £3,000 to extend the car-shed and purchase three cars of a special build. The town clerk said his view, personally, was that they had no power to borrow this money because these particular borrowing powers were exhausted. Some provision would have to be made in an omnibus Bill. The chairman said that, under the circumstances, they had no option but to take the money from the reserve fund. Any further extensions would have to wait until they could obtain an Act of Parliament.

**Rochdale.**—The receipts on the Corporation tramways from the commencement of the financial year to December 16th totalled £52,386, or £6,950 more than in the corresponding period of last year. The car-miles run were 1,052,647, or 130,905 more than in the same period of 1910. All sections show increased takings, notably on the Bacup route, the advance being £4,350, due to the extension and through running.

**Tramway Accident Inquiries.**—In connection with the fatality caused by the running away of an L.C.C. car backwards down Lordship Lane, on November 29th last, the driver attributed the occurrence, in the first place, to a circuit-breaker coming out. An L.C.C. witness considered that owing to the fog the driver might not have realised at first that the car was moving backwards. In connection with the collision which occurred between two Rawtenstall cars on a hill in Accrington recently, Lieut.-Col. Drutt, of the B. of T., found that the cause of the accident was the fusing of a shunt-coil on one of the motors—regenerative control was in use on the car. The driver could not suspect the real cause of the trouble. Lieut.-Col. Drutt suggests that in order to prevent a repetition, such cars should only be run on level routes, or else precautions must be taken to prevent the fusing of shunt-coils. A footnote to this report, by Mr. A. P. Trotter (B. of T.), is as follows:—"The termination of a shunt-winding in a fine wire is a defect of construction. Both at the inner and at the outer end of the fine wire a stout wire strong enough to stand handling and cleaning should be carefully jointed. This stout wire should be wound three or four times round the magnet before bringing out. It is not likely that the shunt-wire was fused, unless part of the shunt-winding was short-circuited, or unless very high voltage had been produced by regeneration. The wire is likely to corrode where it leaves the magnet, and may have sparked on breaking, and may thus have shown signs of fusion."

**U.S.A.**—Plans and surveys are being made by the Pennsylvania Railroad for improvements of the Pittsburg terminals to cost \$50,000,000. These plans call for the electrification of the main line between the Union station in Pittsburg and Pitcairn, 15 miles east of that city, the terminus for local trains. Subways will be built to abolish grade crossings at many points; yards will be extended and electric locomotives and new rolling stock will be added.—*Electric Traction Weekly*.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The Commonwealth Parliament has voted a sum of £600,000 to be paid into a trust fund on account of telegraph and telephone works. It was explained that experience showed that much money was lost through lack of continuity in work, and the fund would be expended as required.

**Austria.**—Considerable expenditure is contemplated by the Austrian Post and Telegraph Department. In the Budget for 1912, 9,000,000 kronen were ear-marked for telephone extension. A further 20,000,000 kronen for postal purposes is also to be spent, about 11,000,000 of which is allocated to telephone and telegraph extensions, &c.—*Der Elektrotechniker*.

**Cable Rates.**—In a notice announcing the reduction on January 1st of cable rates to the British Dominions and the United States to half the usual rates, for telegrams in plain language, subject to a delay of 24 hours, as previously explained, the Postmaster-General includes India and South Africa, which were excluded from the preliminary announcement.

The Commercial Cable Co. has also announced a reduction on similar lines to North America and Australasia.

**Germany.**—From January 1st the German Post Office accepts plain-language telegrams at half rates for the German Colonies, the United States, China, and many British Colonies, subject to a delay of up to 24 hours.



**Night Telegraph Letters.**—The experimental service between London and Aberdeen and Belfast came into operation on Monday last. The charge is 6d. for 36 words, and 1d. for every three words beyond 36. Telegrams must be handed in (prepaid) at the head offices, or telephoned or posted to those offices. If they are posted, the envelopes must bear only the words "Telegraph Letter."

**Postal Employés' Grievances.**—The Committee of Inquiry promised by the Postmaster-General will sit in the spring of this year, and will consider proposals relating to wages (involving an increased expenditure of about a million sterling) and hours of labour. The last revision took place in 1908, and was expected to hold good for many years. It is stated that London telegraphists demand a maximum salary of £230 a year, instead of £161 as at present; provincial telegraphists ask for £200, and women in London and the provinces claim £130 and £120 a year respectively. Engineering and stores employés demand to be put on the established staff, and to be employed continuously.

**Radiotelegraphic Conference.**—The British Government has announced that the Conference will meet in London on June 4th, 1912.—*Journal Télégraphique*.

**Radiotelegraphic Convention.**—The Belgian Government has adhered to the Convention on behalf of the Congo State, as from January 1st, 1912.—*Journal Télégraphique*.

**Russia.**—The Government has decided to erect wireless stations on the coasts of the White Sea and Kara Sea for the assistance of ships bound for the mouths of the Obi and Yenisei, on Vaigatch Island, at Vaidaran Bay, and on the Ugorski Shar Strait. *Board of Trade Journal*.

**Uruguay.**—The Government has been empowered to spend a sum of nearly 2,000,000 fr. on the improvement of the State telegraph network.—*Elektrotechnik und Maschinenbau*.

**The Telephone Transfer.**—The transfer of the undertaking of the National Telephone Co. to the State took place without in any way affecting the existing service or organisation of the business, except as regards the head officials, to the number of 11. The transaction involved the transfer of 1,578 exchanges, and 549,976 stations, served by 18,000 employés. A sum of £3,000,000 is to be paid to the company on account. The Postmaster-General addressed a letter of welcome to the employés, pointing out the advantages they would derive from the change, and expressing his intention to secure equality of treatment between transferred and existing officers so far as was possible. A valedictory letter was also issued by Mr. G. Franklin to the company's staff, commending the zeal and fidelity of the employés and their loyalty to the board of directors, and offering them his personal thanks and sincere wishes for their prosperity in the service of the State. On Saturday night the Metropolitan day staff assembled at the Holborn Restaurant to celebrate the occasion by a dinner, dance and concert. Over 1,000 were present, about half the number being female operators. Mr. C. B. Clay, superintendent of the Metropolitan district, presided at the dinner, and Mr. G. Franklin, president of the company, was present. Similar functions took place at other centres.

A meeting of the company will take place on January 9th to pass the necessary resolutions for the liquidation of the concern and the payment of the debenture-holders, followed by an extraordinary general meeting to appoint Mr. Franklin liquidator, and to continue the powers of the directors in dealing with the purchase by the Post Office. The inventory of the company's assets, which has been in progress for many months, is approaching completion, and it is expected that the company's statement of claim will be presented to the Postmaster-General early this year. Almost certainly the matter will have to be taken before the Railway and Canal Commission for the final settlement of terms.

At a meeting of the Glasgow employés of the company on Thursday last week, a resolution was passed protesting against the conditions of service under the classification proposed by the Postmaster-General.

Last week the subscribers connected with the National "Westminster" exchange were transferred to the Post Office "Victoria" Exchange, and those on the "Harlesden" Exchange to "Willesden." The "Bank" subscribers will shortly be transferred to the new "Avenue" exchange, the equipment of which presents some novel features tending to the avoidance of delay in answering calls. Several other National exchanges have been closed.

**Paris - Madrid.**—On Monday the telephone service between Paris and Madrid was successfully inaugurated. The distance is about 1,000 miles.

**Wireless Telegraphy.**—The new station at Port Said, in connection with Lloyd's monopoly of wireless telegraphy in Egypt, has been brought into use.

The first case under the new United States law requiring passenger steamers to carry a wireless outfit is now pending, the ss. *Templemore* being charged with a breach of the regulation.

The station on Spitzbergen is now completed, and messages have been exchanged with Poldhu, in Cornwall, and with Ingoc, in Norway.

**Wireless Telephony.**—A German engineer named F. Kiebitz is reported to have effected important improvements in wireless telephony by means of earth waves of high frequency, and it is stated that the Western Electric Co. has developed a water-cooled microphone for use in wireless telephony, which can deal with much larger currents than the ordinary type.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—January 24th. Three Lancashire boilers and two 1,500-kw. turbo-alternators, for the Corporation. See "Official Notices" to-day.

**Australia.**—N.S.W. GOVERNMENT RAILWAYS.—January 22nd.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

January 9th.—Accumulators, booster, switchboard and accessories, for the Subiaco Council. Town Clerk's office. Deposit of £100.

**MELBOURNE.**—January 9th. Three tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" December 22nd.

February 7th.—The Prahran and Malvern Tramways Trust, Melbourne, are inviting tenders for 1,272 tons of tramway rails. Specifications and forms of tender, £2 2s. (returnable), from J. Coates & Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C.

February 19th.—Wire-testing machine, for the Postmaster-General's Department in Tasmania. See "Official Notices" to-day.

**Belgium.**—January 18th. The municipal authorities of St. Gilles-lez-Bruxelles are inviting tenders for the supply and installation of two electric motors at the Baths, 38, Rue de la Perche, St. Gilles.

**Birmingham.**—January 8th. (a) Supply, delivery and erection of 50 electric tramway cars; (b) 1,700 tons of improved steel girder rails, and 3,500 pairs of fishplates. Mr. A. Baker, general manager, Tramway Offices, Corporation Street, Birmingham.

**Burnley.**—Lighting battery at the Workhouse, for the Guardians. See "Official Notices" to-day.

**Croydon.**—January 29th. Mixed-pressure turbine plant, for the Corporation. See "Official Notices" to-day.

**Dartford.**—January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" December 15th.

**Dublin.**—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

**Grimsby.**—January 15th. Metal-filament lamps for a year, for the Corporation. See "Official Notices" to-day.

**Hornsey.**—January 11th. One steam dynamo set (either reciprocating or turbine), for the T.C. See "Official Notices" December 8th.

**London.**—HAMMERSMITH.—January 10th. Arc lamps for the B.C. See "Official Notices" December 29th.

ISLINGTON.—February 2nd. Electrical and engineers' stores for a year, for the B.C. See "Official Notices" to-day.

**Manchester.**—January 9th. (a) Steel girder tramway rails; (b) steel tie-bars for tramway rails. For (a) deposit of £1 1s. required. Specifications and forms of tender from Mr. J. M. McElroy, general manager, Corporation Tramways.

**New Zealand.**—March 7th. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

**Nuneaton.**—January 24th. One 500-kw. mixed-pressure turbo-generator, with condensing plant, pipework, &c., for the Corporation. See "Official Notices" to-day.

**Plymouth.**—January 20th. Stores for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" to-day.

**Prague.**—January 31st. Supply of two turbo-generators, of a normal capacity of 3,600 kw., with accessories. Particulars, plans, &c., from Städtischen Kanzlei der Elektrizitätzentrale, Prague VII, and tenders to Haupteinreichungsprotokolle der Elektrischen Unternehmungen, Altstädter Markthalle, Prague.

**Radeliffe.**—January 13th. Electrically-driven centrifugal or turbine pump for the U.D.C.'s sewage disposal works. W. L. Rothwell, surveyor.

**Rotherham.**—January 10th. One 500-kw. rotary converter, for the Corporation. See "Official Notices" December 29th.

(Continued on page 24.)



## ELECTRICITY SUPPLY AT KEIGHLEY.

By HARRY WEBBER, A.M.I.E.E., Borough Electrical Engineer.

ELECTRICAL driving in textile mills can now be said to have passed beyond the experimental stage, and it is the purpose of this article to give an outline of what has recently taken place in this direction at Keighley, with special reference to the worsted trade.

Perhaps one of the most interesting examples in this country of an electrically-driven weaving shed is to be found at the West Lane Mills of Messrs. J. H. Binns & Co., everything being driven by three-phase motors, whilst the whole mill is lit throughout by electricity, the supply being obtained from the public mains of the Corporation.

This firm only manufactures the highest class of goods such as suitings and best quality dress material. There are some 130 looms, each driven by a separate motor; the "jacquard" looms which are used for material with fancy patterns are fitted with motors of  $1\frac{1}{2}$  B.H.P., but the looms for the plain work only require from  $\frac{3}{4}$  to 1 B.H.P.

The whole mill is scrupulously clean and well ventilated, and to pay a visit there after coming out from one of the old type, with steam power and belt drive, fully convinces everybody that, from the workers' point of view, electrical driving is ideal.

Messrs. Binns removed from an old steam-driven mill into new premises, so that they have had an opportunity to compare the results obtained with both methods of working, and they have no reason to regret their decision in favour of electricity.

A supply of electrical energy at cheap rates gives power users a much greater latitude in the choice of a site for new works, and this fact alone will have great influence with manufacturers in deciding whether to take a supply from the public mains or to install their own plant.

In Keighley, several firms who own large mills let these out on what is termed "room and power." The charge varies, but for spinning, the power is sold at from 3s. to 4s. per annum per spindle, according to the type, whether it is a "cap" or a "flier." An average spinning frame takes 5 to 6 H.P. to drive it, and the price for power is generally about £3 10s. to £4 per I.H.P. per annum.

As will be seen from the above figures, a public supply must be offered at very low rates in order to secure this particular class of customer. However, there is one firm in Keighley who are taking a supply for a portion of their mills (let out in the above manner) from the public supply mains of the Corporation. For worsted spinning of this description, the load factor is very high, reaching 80 to 85 per cent. during the working day from 6 a.m. until 5.30 p.m. I find that, in order to give satisfaction in both weaving and spinning sheds, the frequency must be kept within a quarter of a period on either side of the declared number of cycles per second.

At the beginning of the three-phase extra-high-pressure supply in Keighley a motor-generator was used, driven from the existing D.C. bus-bars at 460 volts, and producing a three-phase 6,600-volt supply on the high-tension feeders. This arrangement, however, is not satisfactory, as a motor-generator driven in this manner is far too sensitive, and I found that even quite small squirrel-cage motors without graduated starters caused most serious fluctuations in the frequency, which affected the looms more particularly.

Naturally, manufacturers desire to produce as much work from their machinery as possible, and the looms are set to work at the maximum speed beyond which the smaller parts are liable to break, so that only a slight increase of speed is necessary to create a considerable loss in a weaving shed. On the other hand, most of the weavers are employed on the piece-work system, and they soon complain if the machinery is running slow.

The writer has no hesitation in saying that wherever a supply is being given, or in contemplation, with motor-generators in a similar manner to that described above, it will not give satisfaction if the demand is for driving textile machinery.

Immediately the supply was available from turbines the constant series of complaints ceased at once. Owing to

various adjustments required by the new plant, it was necessary to revert to the motor-generator occasionally, but in each instance the complaints began to re-appear on the first day that the change was made.

An astonishing figure would result if it were possible to add up the total amount of power wasted in driving some of the more antiquated and complicated mills in Lancashire and Yorkshire alone. There are still plenty of mills working to-day with cross-shafts and bevelled gearing, whilst the maze of belting is bewildering to the eye.

To quote some actual figures taken recently off a length of shafting with all the belts on the loose pulleys, the shafting alone took 5 H.P. to drive it, and when all the work which was done from this line was set in motion, it was found that the consumption of power only reached a little over 8 H.P. This, of course, is an extreme case, but it is quite usual to find the shafting taking 25 per cent. of the total power required.

The writer has found, when negotiating with prospective consumers, that they will stick to the indicated horse-power, as shown on their possibly antiquated engine, and divide that figure into the amount of money spent by them in order to arrive at a comparison between the present cost, and what it would be if taking energy at a fixed rate per unit (covering all charges) from a public supply. When it is realised that possibly over 50 per cent. of the horse-power (as shown on an indicator diagram) is being wasted in one direction or another, which would be entirely eliminated by a properly thought-out electrical scheme of driving, it will be obvious that this method of comparison is not a fair one.

There are plenty of millowners to-day waiting to let other people take the risk of what they consider an experiment with electrical driving when energy is being taken from a public source, and I am constantly being approached by people who state that they have machinery which requires, say, for example, 250 H.P. to drive it (as shown by their indicator cards), and ask whether the Corporation would guarantee to run this for a lump sum per annum.

This clearly shows that millowners appreciate the beauty of electrical driving, but they want to be on the safe side, and when you have to tell them what 1 H.P. would cost per annum on the lowest rate charged for electrical energy, estimated on the working hours and the load factor of the mill in question, it generally results in their saying that they can do it themselves for at least 20 per cent. less cost. It requires a lot of talking to persuade a man who has always relied on an indicator diagram that this method does not represent the actual amount of useful work that is being done in his mill.

It is a pity in some senses that an offer cannot be made to drive mills of this description for a lump sum per annum, as I am certain that a great deal more business could be secured in this way at a profit.

The rates in force in Keighley at the present time are very attractive, considering the smallness of the undertaking. Extra-high-pressure three-phase energy can be obtained in bulk at £3 per kW. of maximum demand, plus  $\frac{1}{4}$ d. per unit, the account being paid monthly, and subject to a 5 per cent. discount; a condition attached to this extremely cheap rate is that a consumer must supply a proper fireproof house, and build a suitable cubicle of stoneware for the reception of the Corporation's meter equipment and automatic knock-out switch, and also supply his own transformers.

The energy is metered on the high-pressure side, and a consumer may use it in any manner he thinks fit, but with certain limits as to the size of squirrel-cage motors installed without graduated starting switches.

The cables are looped into the premises, and thus effect a duplicate arrangement, the meter and switch handle being mounted on a panel outside the transformer house (which is kept under lock and key), thus obviating any reason for continually going in and out of the high-pressure chamber. Six small sub-stations of this description are now equipped, and they give every satisfaction.

Besides doing a large business in connection with the worsted trade, Keighley has a great variety of other thriving industries, some of which only require about 40 H.P. They are scattered all over the area of supply, and consequently the only system available for these very desirable small-power users is the old direct-current network.



Several methods of charging were tried, but without success; the sliding scale based on quantity did not come out cheap enough, and the hourly contract system resulted in such a variety of prices per unit, that it had to be abandoned owing to the bad feeling created. It was decided to adopt a method which has proved a great success, and is as follows:—Providing a consumer signs a five years' agreement, and guarantees a minimum payment of £40 per annum, a flat rate of  $\frac{3}{4}$ d. per unit is charged without any restricted hours.

This method has become very popular, and fresh applications are coming in every week. Owing to the large diversity factor due to a number of small power users, the load factor as shown on the daily load chart is steadily improving, and at the present rate of increase, the number of units sold this year will be double what it was last year.

Having briefly described how the use of electrical energy is developing amongst all grades of power consumers, it will not be out of place to outline the class of plant which has been installed to meet the demand.

turbo-alternators running at 3,000 revolutions per minute, each set having its own condenser, which is of the Körting multi-jet ejector type. The steam for these generators is produced by two Babcock & Wilcox water-tube boilers, of their well-known standard land type.

The boilers are fitted with integral superheaters, and

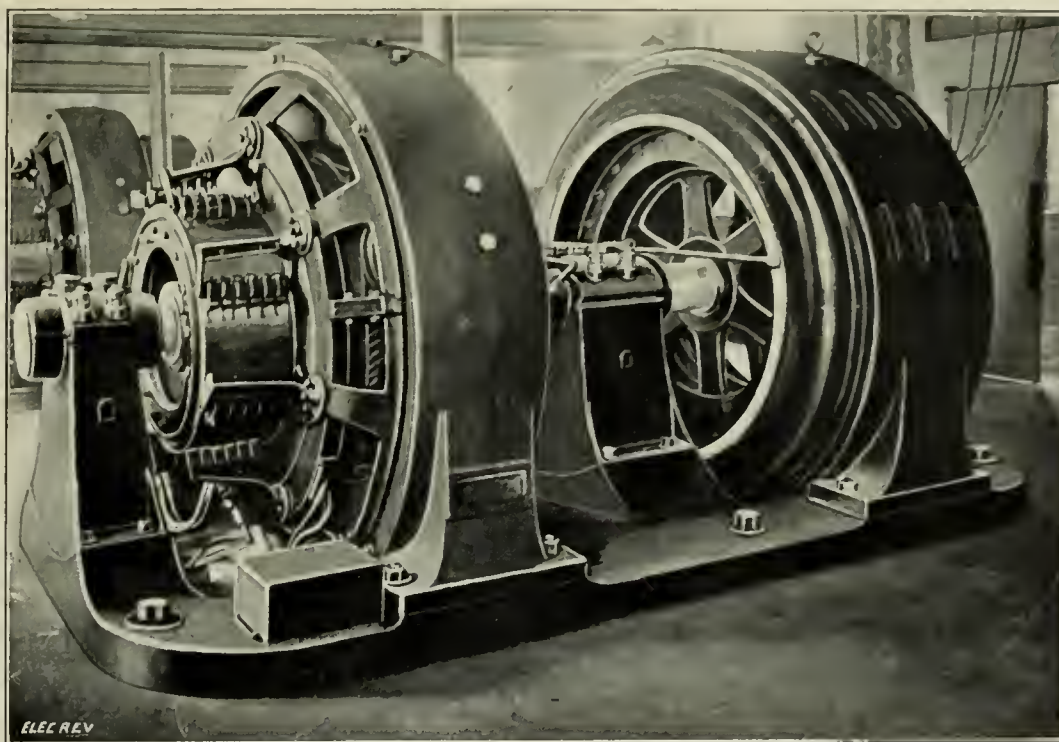
patent mechanical chain grate stokers, the heating surface of each boiler being 1,560 sq. ft., of the superheater 990 sq. ft., and the chain grate area 108 sq. ft. Each boiler is capable of evaporating 20,000 lb. of water per hour under normal conditions, but it is possible to increase this amount to 25,000 lb. for short periods without unduly forcing the boiler to any dangerous extent.

A new chimney 150 ft. high has been erected, and the necessary flues constructed of sufficient area to effectively

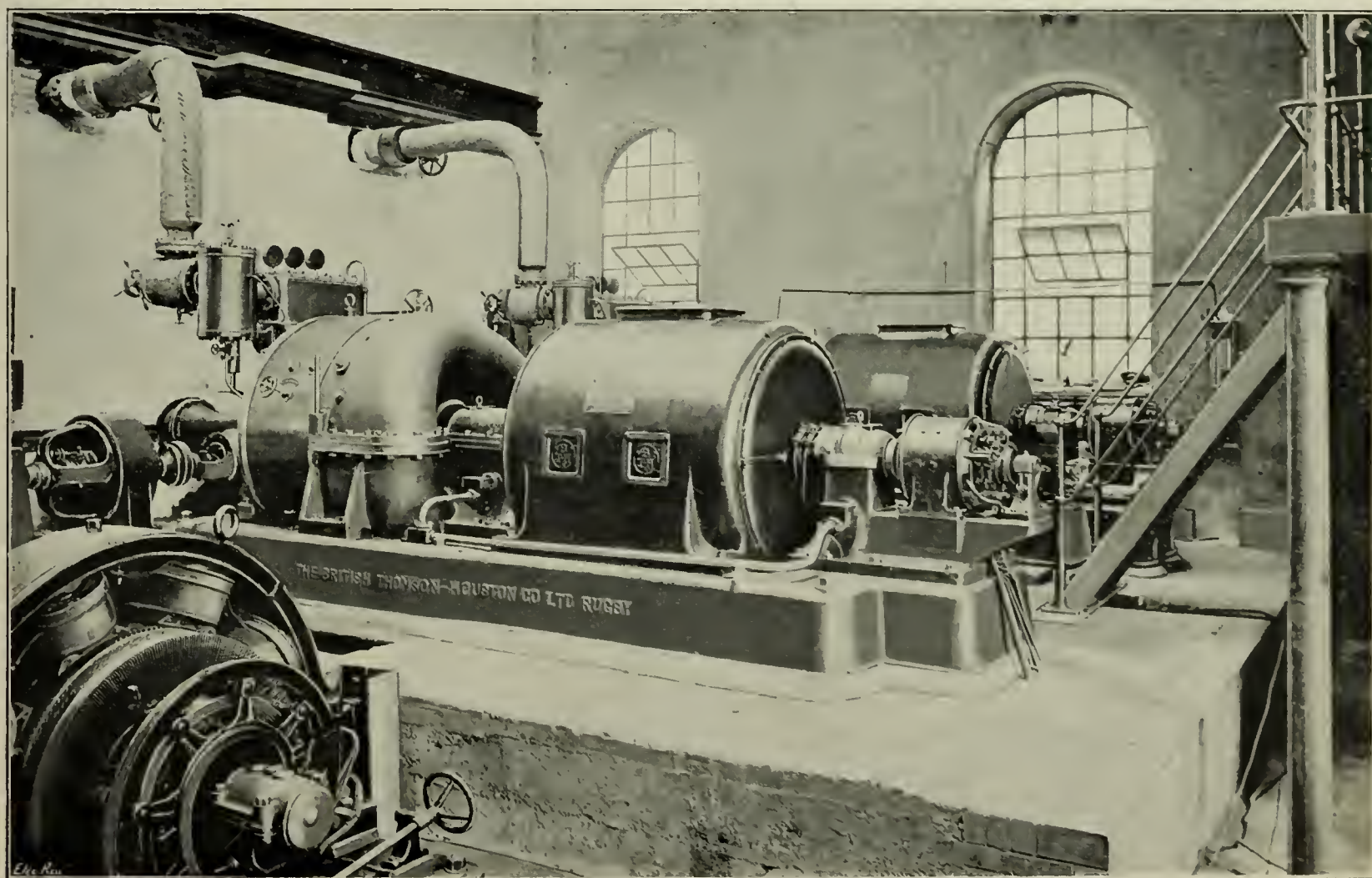
deal with the gases from four other boilers similar to the two installed.

A first instalment of economiser tubes is fitted, and available space for further sections provided.

A pair of double-acting vertical feed pumps, each capable of delivering 2,500 gallons of water per hour against 165 lb.



500-KW. MOTOR-GENERATOR PLANT, KEIGHLEY.



INTERIOR OF THE KEIGHLEY POWER STATION, SHOWING B.T.-H. TURBO-ALTERNATORS.

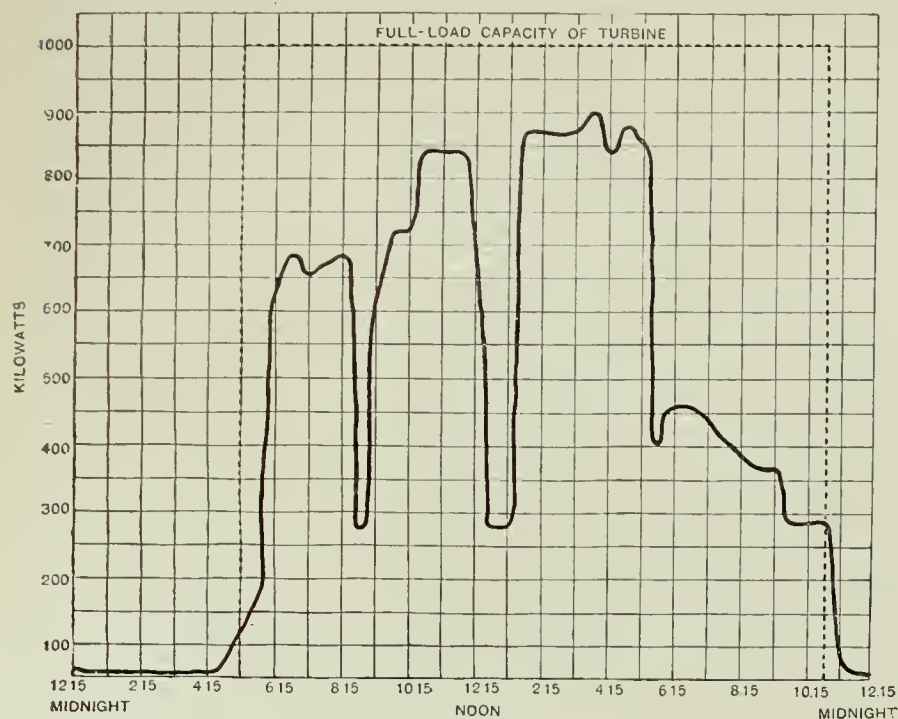
In January, 1910, all negotiations were finally settled and everything was in order to proceed with the installation of a complete extra-high-tension three-phase power plant, but it was not until the August following that any actual construction work was commenced.

The complete installation consists of two 1,000-kw. Curtis

pressure, are included in the boiler house equipment. These pumps were made by a firm whose name is not generally known to central station engineers, namely, F. Friedenthal & Son, of Preston. Although the pumps caused some slight trouble to begin with, they are working very satisfactorily, considering the small initial cost.



The British Thomson-Houston Co., Ltd., were the main contractors for the whole of the generating plant, and also supplied one of their well-known extra-high-tension remote-control switchboards, the high-tension portion being entirely enclosed with either expanded metal grids or sheet-iron doors, and so arranged that anybody can walk all round both back and front without taking any dangerous



LOAD CURVE, DECEMBER 7TH, 1911.

risks whatever. It was decided not to extend the building for the reception of this extra plant, and the result is that it is somewhat crowded.

In order to give an immediate load for one turbine, two motor-generators have been purchased, one of 500 kW. capacity and the other of 300 kW. By this means, the existing demand, namely, the traction load and the D.C.

November, 1910, but owing to late delivery of switchgear and various other parts of the equipment, the supply last winter had to be carried out under very inefficient conditions. The turbine was running with little more than one-quarter load, and all the old plant had to be run as well. At the present time, one turbine is fully loaded up, and runs from 4 a.m. until 12 p.m. generating the entire output with the exception of about one hour when the power and lighting loads overlap. I have found the Curtis turbines (which in this case are of the horizontal type) to be in every way satisfactory. -

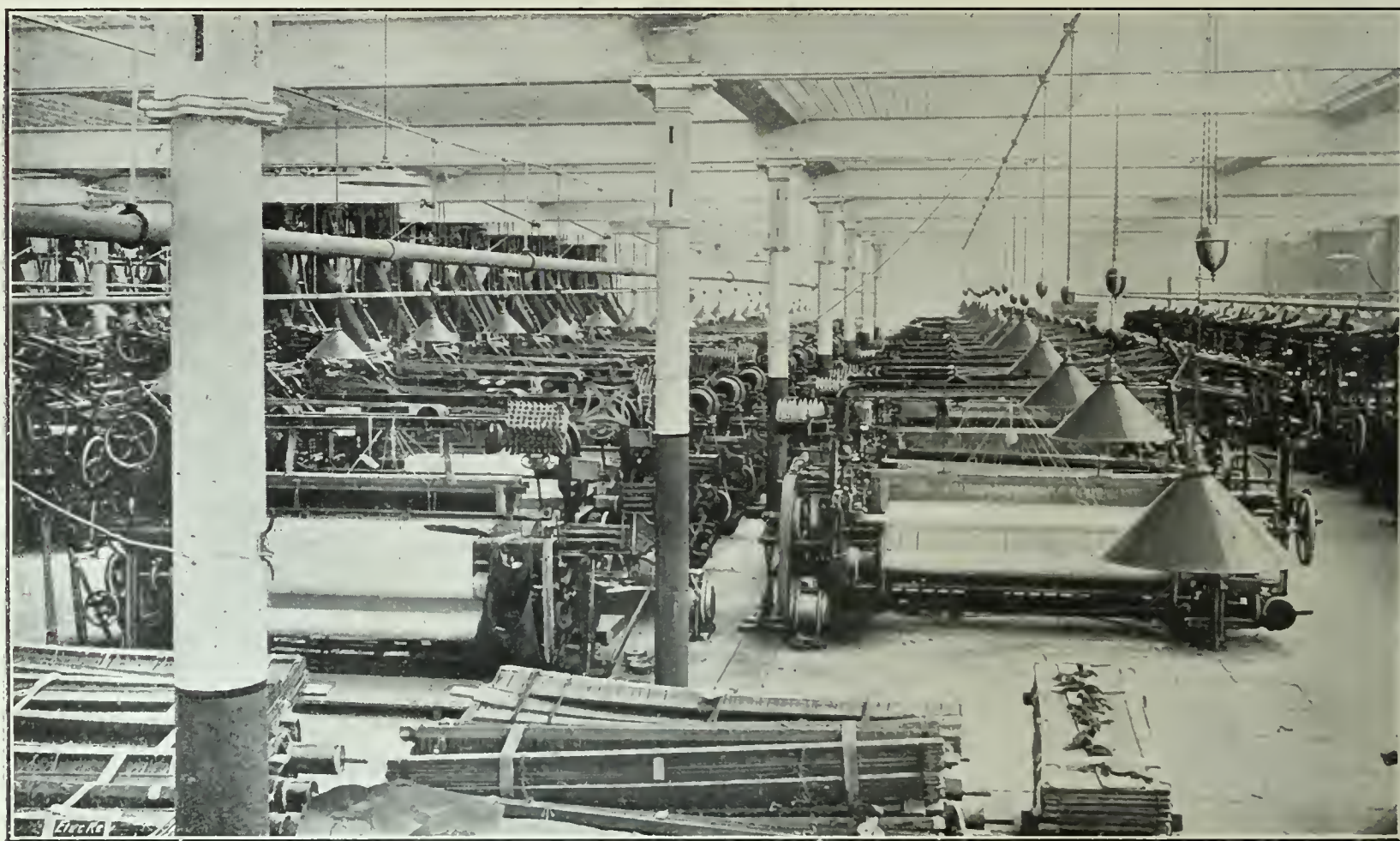
There is a Tirrill regulator fitted on the switchboard, but owing to good governing and a remarkably steady load, it has not been found necessary to couple this up. There have been the usual small troubles incidental to all new machinery, but these have been overcome.

Respecting the Körting condensers, they have fully come up to their guarantee for the specified vacuum, namely, 28 in. on full load, with the temperature of inlet water not exceeding 65°, and the barometer standing at 30 in. of mercury.

With a combination of water-tube boilers and turbines, where there is no internal lubrication, the writer would prefer a surface condenser, so that the hot distilled water discharged from the air pump can be returned to the boilers direct. With an installation of this description, providing that glands and safety valves are not leaking, it requires very little make up water to obtain the whole of the feed necessary to keep a correct water level in the boilers.

At Keighley, the water supply is taken from an extremely dirty stream, and with an ejector type of condenser where the circulating water mixes with the condensed steam, the pure distilled water is necessarily discharged into the river and dirty river water used for feeding the boilers.

Naturally, opinions differ on this point, and there is no doubt that the first cost of an ejector condenser equipment is considerably lower than a surface plant of a similar capacity, but I think that any engineer who has handled both types when used in conjunction with turbines, would decide in



WEAVING SHED OF MESSRS. BINNS, KEIGHLEY, CONTAINING 150 LOOMS INDIVIDUALLY DRIVEN BY SCHORCH MOTORS ON THE CORPORATION SUPPLY.

lighting and small-power load, can be effectively dealt with at a lower cost per unit generated than would have been the case if this portion of the demand had still been supplied from the old existing plant driven by small reciprocating engines.

The first turbine was put on commercial load during

favour of the surface condenser, owing to the fact that it eliminates two-thirds of his boiler house troubles. If you add the costs of purifying and softening plant to the cost of the ejector condensers, I think the first cost would then be in favour of a surface equipment. At Keighley, owing to the extremely cold water available, it is possible to maintain



a vacuum within 1 in. of the barometer up to approximately full load of the turbines.

Before concluding the description of plant installed, I should like to mention the type of extra-high-tension cables used, and the method of laying them.

A start was made with duplicate feeders through the most promising district from an industrial aspect. These cables are three-core, paper-insulated, and lead covered with a complete copper earth-sheet immediately beneath the surface of the lead. Each core is .15 sq. in. sectional area, and they are drawn into four-way Sykes ducts supplied by the Albion Clay Co.

The Western Electric Co. were the contractors for the complete contract, including jointing, and they gave a three years' maintenance on the work. Some smaller feeders, the cores being .05 sectional area, have since been laid by the same firm. All the feeders are protected by automatic knock-out switches, with a time-limit for overload, but instantaneous release should a large earth develop.

The Keighley Corporation is to be congratulated upon now possessing the nucleus of what promises to become a really important power station for the town and district, and, even at the present time, a complete failure in the supply would affect nearly every class of industry.

Besides textile mills and tramways, a supply is given for the following power purposes:—The manufacture of looms, spinning frames, machine tools, castings of every description, boots and shoes, electrical apparatus, hosiery, washing machines, sewing machines, cabinet making and joinery, stone sawing and building work, laundry work, and a large variety of smaller domestic commodities.

In conclusion, taking into consideration that the population only amounts to about 45,000 inhabitants, the adoption of electricity is remarkable, and it seems likely to continue.

The electricity department has to fight against a gas department, also owned by the Corporation, who are in the happy position of having turned the corner many years ago, and can consequently not only offer gas at very low prices, but also hand over a substantial profit towards the relief of the rates every year, and it is the hope of equalling these good results in the near future which is partly responsible for the energetic policy of business getting which has been adopted.

The illustrations show the new turbines in course of erection, the interior of Messrs. Binns's weaving shed, the large motor-generator and a load diagram taken quite recently.

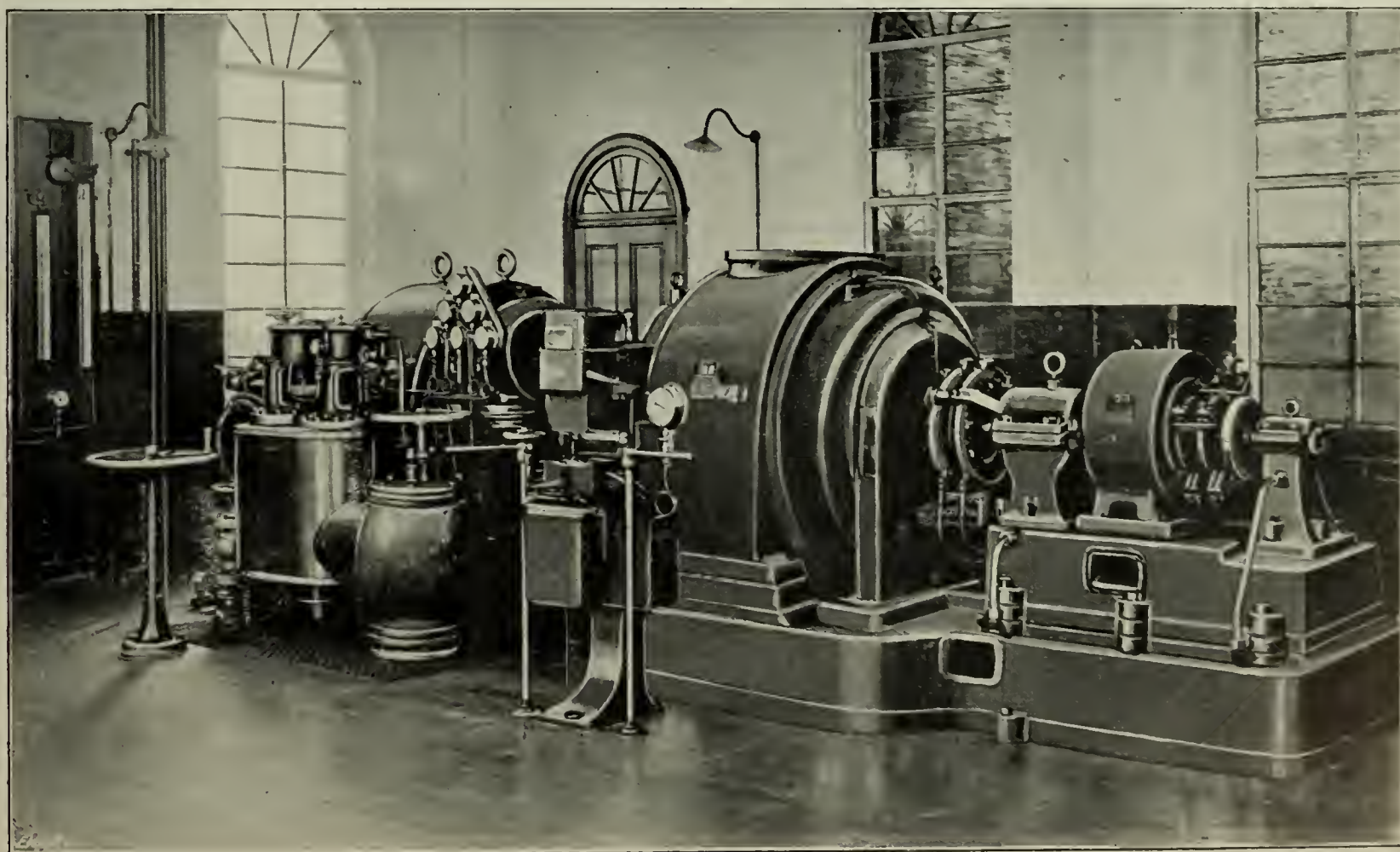
## THE ELECTRICAL EQUIPMENT OF THE CRAIGHEAD AND BOTHWELL CASTLE COLLIERIES.

THESE collieries have been established about 30 years, and are, therefore, amongst the oldest in Scotland. They are



6,000-VOLT OVERHEAD TRANSMISSION LINE, CRAIGHEAD.

situated at Bothwell Castle, near Glasgow, and are owned by Messrs. William Baird & Co., one of the first firms in Scotland to use electricity for underground mining work.



WESTINGHOUSE 300-KW. MIXED PRESSURE IMPULSE TURBO-ALTERNATOR, BOTHWELL CASTLE COLLIERY.



Their experience has been such that they are one of its firmest advocates at the present time.

The power house is at present situated at the Bothwell Castle Colliery; a portion of the output is transmitted at a pressure of 2,200 volts to Craighead Colliery, about a mile away, and may, at a later date, be transmitted to other collieries in the same way.

The power unit at present consists of a mixed-pressure straight-flow turbine of the Westinghouse impulse type, direct coupled to a 300-kw. 500-550-volt three-phase 50-cycle turbo-alternator, with coupled exciter. The turbine takes exhaust steam from two engines, one driving a fan, and the other a haulage. The amount of steam thus available is 115-180 kw., and when this supply is insufficient to carry the load, live steam is taken from the boilers at 60 lb. per sq. in. pressure, regulation being effected by an automatic device.

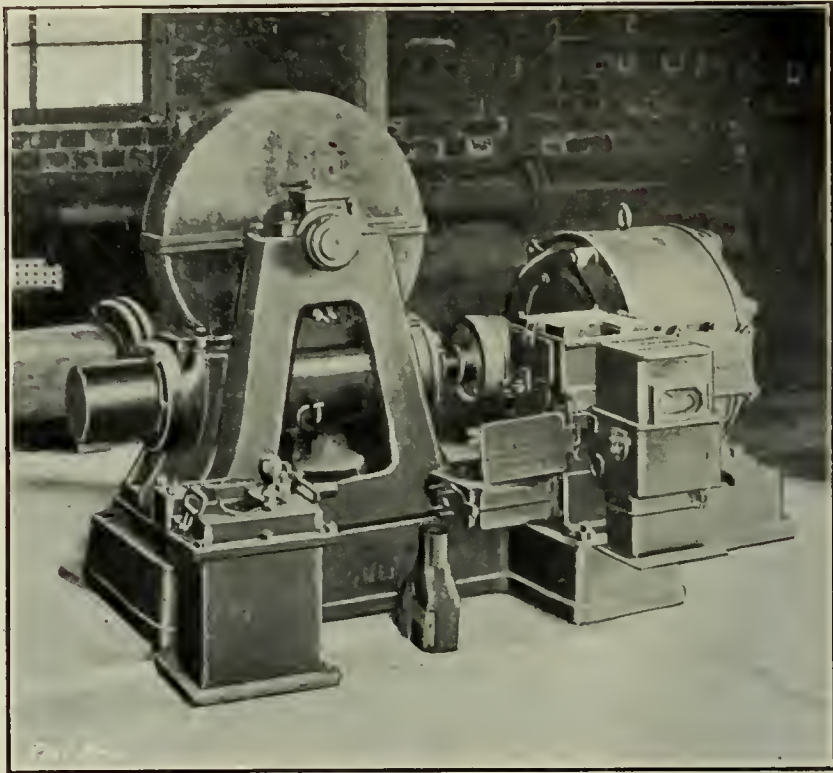
The condensing plant, which has an average duty of 12,000 lb. of steam per hour, is of the Westinghouse-Leblanc multiple jet type, and is capable of maintaining a vacuum of between 27½ and 28 in. of mercury at full load, the air and circulating pump being driven by a squirrel-cage motor rated at 47 B.H.P. at 720 R.P.M. This motor, which, with the condenser, is situated in the basement, is controlled from the engine room by a mining type control pillar comprising oil switch, oil-immersed controller, and ammeter; the water and vacuum gauges are also mounted on this pillar, the whole forming a complete and accessible control system.

The current generated is used at terminal pressure at Bothwell Castle, on motors both above and below ground, but is transformed to 2,200 volts for transmission to Craighead. The line is designed for working later at a pressure of 6,600 volts, but as all the electrical machinery has not yet been erected, the lower voltage is quite sufficient for the small amount of power at present being transmitted.

A six-panel black enamelled slate switchboard controls the generator and outgoing feeders, and comprises one high-pressure and five low-pressure panels.

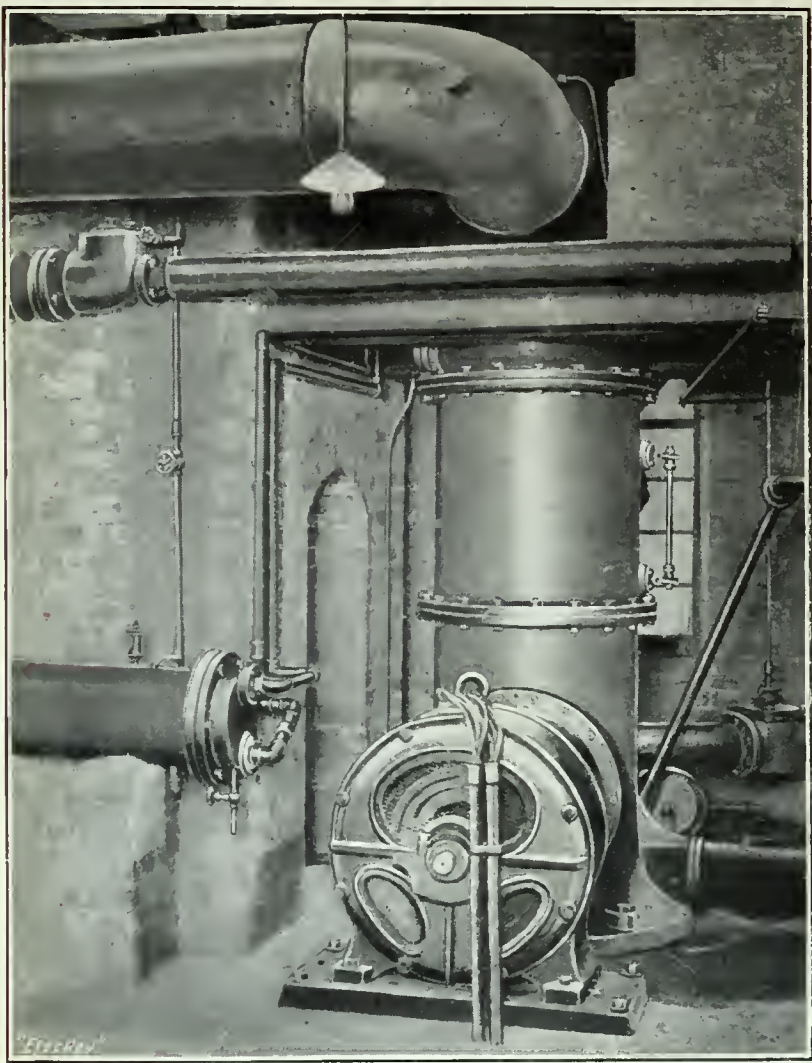
Current is taken from the high-pressure bus-bars and led

River Clyde at a point where it is 210 ft. wide. The line was tested at 11,000 volts to meet the Board of Trade requirements, and was found perfectly satisfactory in every way. It is composed of three aluminium cables, each consisting of three No. 10 s.w.g. wires having no joint from end to end,



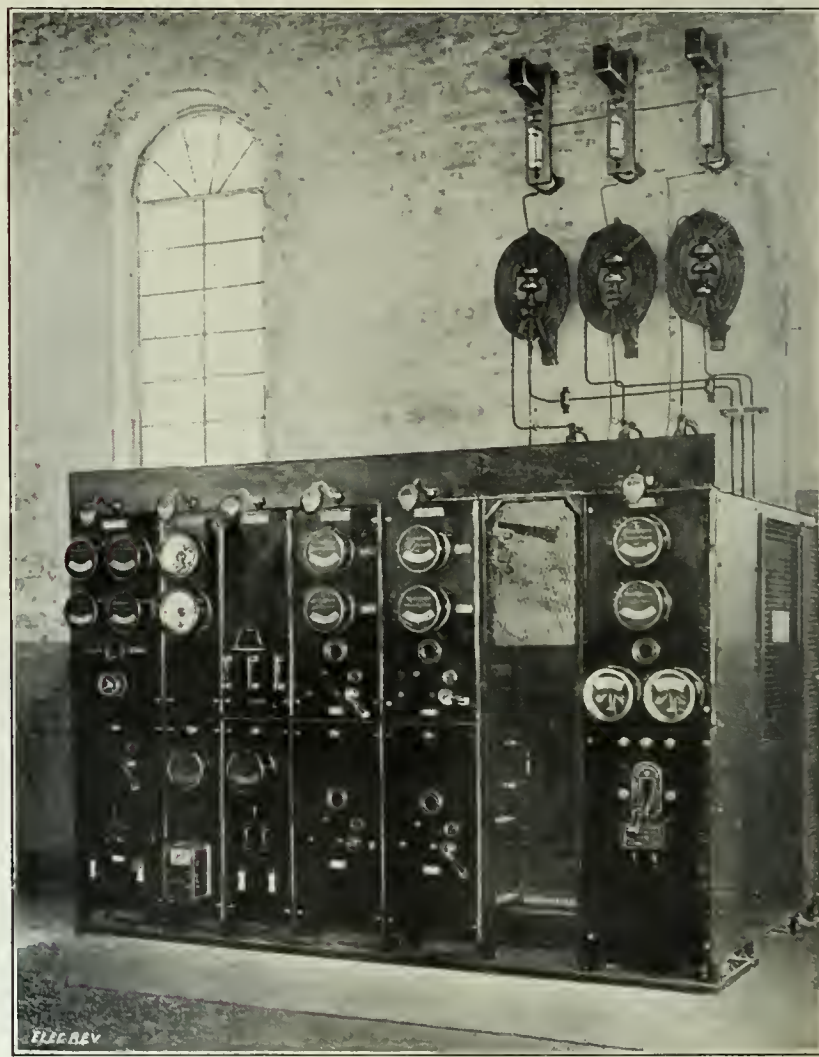
VARIABLE SPEED SQUIRREL-CAGE MOTOR AND WORM DRIVE FOR HAULAGE, BOTHWELL CASTLE COLLIERY.

fastened to brown porcelain insulators (tested to 22,000 volts) by aluminium clips. At the Clyde, steel guard wires are fixed underneath the lines for the double purpose of taking the pull, and preventing the lines from falling in the event of a break. A high-pressure telephone line connects the two mines, and is mounted on the same poles as the power lines.



WESTINGHOUSE-LEBLANC CONDENSING PLANT

underground by a three-core, paper-insulated, lead-covered cable to a point clear of the Bothwell Castle Works, and thence by an overhead aluminium line, supported at intervals of about 50 yd. on wooden poles to Craighead, where it is stepped down to 500 volts for use. This line is led across country over roads and through woods, finally crossing the



MAIN SWITCHBOARD, POWER STATION.

Although the pressure is stepped down to 500 volts for use at Craighead, it should be mentioned that high-pressure current will be used direct on large motors, and will also be used for transmission to other collieries where the supply will be a direct high-pressure one to the motors. At Bothwell, Nos. 1 and 2 Pits, 500-volt A.C. only is used. At



present there are five motors in use at the former and seven at the latter, all of the squirrel-cage type. One of these is a 7-H.P. motor used for driving a winding equipment for hauling men up a 25-ft. blind pit.

At the Bothwell Castle and Craighead Pits some very neat haulages are in use, motive power being furnished by two-speed squirrel-cage motors operated by oil-immersed controllers and mining-type oil switches. The drive is by worm gear, and the motors, which are rated at 10.5-H.P., run at a speed of 970-480 R.P.M. This variation is effected by a controller which makes the different connections of the stator winding, so as to vary the number of poles.

This plant was installed under the supervision of Messrs. Stevenson & McGuffie, of Glasgow, consulting engineers to Messrs. William Baird, the British Westinghouse Co. being responsible for the entire electrical equipment.

## FAILURES OF STEEL PLATES.

THE memorandum of the chief engineer of the Manchester Steam Users' Association for the year 1910 contains information of vital importance upon those failures of steel plates and angles to which it is usual to allot the word mysterious. "Mysterious" in all science and art really means that there are gaps in our knowledge; just as the gaps in the orderly arrangement of the elements in Mendeleef's theory may be held to indicate, and already have indicated, the existence of elements not yet isolated, so do the mysterious failures of steel indicate the presence of some undetected influence. Phosphorus and sulphur have long been tracked down. The influence of carbon, manganese, tungsten, chromium, and other metals has been fairly well mapped out. But more recently gaseous elements have become suspect, and this report has gathered together so many examples of bad steel and good steel that the badness and goodness can be set alongside of the new factor, nitrogen, to which seems fairly to have been brought home the crime of being a prime agent of unreliable qualities.

An investigation of both German and British steels made by basic and acid processes with open-hearth and Bessemer furnaces, discloses that if the percentage of phosphorus in a steel be added to five times the percentage of nitrogen in the sample, the resulting sum will form a sort of datum from which may be inferred the reliableness of the steel in question. The sum will be more or less than 0.080. If this figure is exceeded, the steel is over the danger line, and becomes worse as the figure is further departed from; if less than 0.080, the safety of the steel becomes greater as the sum grows less. Nitrogen makes for tenacity, and we are not told that a little of it is not good. But in no case should the figure 0.080, as above derived, be exceeded. The report goes on to show that of a number of safe and unsafe steels, those which were really the *worst* passed *best* the ordinary mechanical tests, and it becomes important that both chemical and mechanical tests should combine to indicate reliableness.

It is really an art, this mechanical testing of steel plates, for it is found that if a plate is thicker than  $\frac{5}{8}$  in., the edges of a test piece must be planed, or the pieces will break with the least bending, no matter if the material is good or bad. But again, if the thickness is under  $\frac{5}{8}$  in., and the edges are planed, they may be bent nearly double before breaking, no matter whether good or bad. Thus, an unreliable steel will pass a very severe test by bending, and may be put into a boiler and fail on hydraulic test—or subsequently, which may mean disaster.

We need not follow the report into the question of ageing further than to say that samples laid aside and tested appear to get worse if bad, and to improve if good.

A rather important point disclosed by a series of blue heat tests was that generally the good—i.e., sound—steels best endured working at a blue heat, and bad steels did badly. A moral to be drawn so far is that safe tenacity is obtained by carbon and silicon, which are not factors of unreliability, and that tenacity obtained by phosphorus, and especially by nitrogen, is obtained at the expense of safety. Thus one

steel might safely be worked at 9.4 tons where a nitrogen steel was doubtful at 4.1 tons. Yet present testing would condemn the strong, safe steel, and encourage the weaker and shifty material. These facts, and others given in this memorandum, are most valuable, and have a special interest for power station men. A nitrogen steel or a phosphoric steel plate might slip undetected into a boiler shell. No doubt many have done so, and some have produced disaster. The man in charge of a power station should never take the stand of Midshipman Easy's nurse and lightly regard a small failure in a plate. If a steel plate cracks along a line but an inch in length, this line may suddenly run round the circle of a drum end and convert the drum into a steam gun or rocket. No trust can be placed in bad steel. Bad iron was much safer, for one knew the extent of its badness and discounted its weakness. Strong steel gains no safety from its strength, and if unreliable in quality fails badly by reason of its very virtue of homogeneity.

## INITIAL CONDENSATION IN STEAM CYLINDERS.

It has been necessary several times to comment upon the theory of a Manchester school regarding the missing quantity of steam as shown by the indicator at the beginning and end of the stroke. Clark, Hirn and others seem to us to have given satisfactory proofs of this phenomenon, and, rightly, to have explained it as an effect of cylinder condensation. We believe Hirn's experiments were made with pistons and valves in good and tight order. The new school would have us believe that there is little or no cylinder condensation, but a great deal of leakage, and this view has again been put forward by Prof. Mellanby, who is a faithful follower of Prof. Nicholson.

Prof. Mellanby read his latest paper before the Institution of Engineers and Shipbuilders of Scotland. His reasoning is based on assumptions made from thermometer readings taken from instruments placed midway up the cylinder wall. From the apex of this pyramid we are asked to build up to a wide spreading base. Perhaps the most ingenious twisting of observed facts to fit a preconceived conclusion is the use of the reduced evaporation in a jacketed cylinder to show that there is least evaporation in the hotter cylinder. A jacket, if it serves its purpose, will reduce the amount of condensation, and there must be less water to evaporate on the exhaust stroke. One of the author's critics pointed out very aptly that before water could be evaporated it must be present. This simple and obvious truth appears to have lain outside the author's horizon. Evaporation of dew from a cylinder wall must be very rapid when the pressure is relieved by the exhaust opening, and it must of necessity chill the cylinder surface. Since the molecules of steam have a velocity of nearly, or fully, 2,000 ft. per second, the cooled surfaces must be very quickly heated to steam temperature when the inlet valve opens. Even when a fourth of the steam which enters is thus condensed, this does not imply an unreasonable temperature range in the very thin inner skin. We fail entirely to see how the mean temperature at the middle thickness of the cylinder can show anything at all of the range of temperature in this thin skin. Should the mean cylinder temperature be, say, 250° F., may not this be caused by a skin temperature ranging from 240° to 260°? And may it not equally be the result of a range between 200° and 300°?

While apparently denying transfer of heat to the cylinder, the author appears to claim that the cylinder is hotter than the steam, an effect, if true, that simply proves that there must have been condensation—or whence the heat?

But if all the supposed cylinder effects are only leakage effects, how is it that we do not hear of piston leakages? Why should steam creep furtively past the valve, and be unable to make its way past the piston?

It is probable that the mean temperature of the cylinder metal has very little influence on the initial condensation, though as between jackets and no jackets there must be, in the former case, always an inward flow



of heat, and in the latter case certainly a mean outflow of heat. The author must be singularly immersed in his theory so to read or misread the figures of reduced evaporation when the jackets are in use. With highly superheated steam, and cylinder walls almost unworkably hot, there is no re-evaporation at all; the steam which finishes dry will be still further heated during exhaust, though owing to the diathermanous nature of dry steam gas there is not much absorption of heat by it. Under ordinary conditions not only do the cylinder walls lose heat to the water and steam in contact with them, but the water in suspension in the steam will absorb heat radiated from the walls and will increase the heat losses of the surfaces. To enter the field with a new theory and support it by mere assertions seems almost to admit defeat. And yet past experiments are put forward in this paper as though they were admittedly proved facts. Much more convincing arguments will be called for before engineers will believe that cylinder wall temperature in presence of wet steam will have so narrow a range as the author of this paper asks us to believe is the case.

## CONTRACTS OPEN.

(Continued from page 17.)

**Roumania.**—January 14th. Tenders are being invited by the municipal authorities of Pitesti, for the concession for the electric lighting of the town.

The municipal authorities of Craiova have just invited tenders for the construction of a system of metre-gauge electric tramways in the town, and for the construction and equipment of the generating station required in connection with the same.

**Siam.**—BANGKOK. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kW. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

**Swansea.**—January 6th. Water-tube boilers, superheaters and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" December 15th.

**Turkey.**—Tenders will be received at the "Ministère des Travaux Publics," Constantinople, up to 2 p.m. on February 20th, for a concession for the supply of electric light and power to the town of Adalia, which has a population of some 30,000. For particulars see this column December 22nd.

## CLOSED.

**Belgium.**—Seven concerns (five Belgian and two German) submitted tenders to the Belgian General Direction of Roads and Bridges in Brussels for the establishment and equipment of a sub-transformer station on the Ghent Canal at Terneuzen, the lowest being that of M. A. Sarrens, of Brussels.

**Derby.**—The T.C. has accepted the tender of Messrs. Taylor, Whiting & Taylor for the electric light installation at the new schools in Reginald Street, at £188.

**Dewsbury.**—The Corporation has accepted the tender of the Union Cable Co. to supply  $1\frac{1}{4}$  miles of cable, at £182.

**Germany.**—The Allgemeine Electricitäts Gesellschaft, of Berlin, has secured a contract from the Schlesische Electricitäts und Gas Gesellschaft, of Gleiwitz, for a 16,000-kW. steam turbine and alternator.

**Halifax.**—The tender of the Brush Electrical Engineering Co., Ltd., for the supply and fixing of 20 top covers to ars, at £92 each, has been conditionally accepted.

**Haslingden.**—The Corporation has placed the order for electric lighting of the municipal offices and Council chamber with Mr. A. M. Cramp, at £104. The same contractor carried out the lighting of the free library and public hall.

**Irlam.**—The announcement was made some little time ago that the British Westinghouse Electric and Manufacturing Co., Ltd., had secured the order from the Partington Steel and Iron Co., Ltd., of Irlam, for four large turbine blowers for blast-furnace work, and also turbo-generating machinery. We now learn that they have also secured the contract for the supply of all motors, with their control gear, &c., for the equipment of the new large works in question.

**Salford.**—The T.C. has accepted the tender of Messrs. Willans & Robinson, Ltd., at £10,780, for the supply and erection of two 1,000-kW. Willans-Siemens turbo-generators.

**South Africa.**—The South African Union Government has just placed an order with the International Time Recording Co., of London, for 68 international Rochester card time recorders. We are informed that this is the largest single order for time recorders ever placed in Great Britain, and it was keenly competed for.

**Stalybridge.**—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has accepted the tender of Messrs. Tinker, Shenton & Co., Ltd., for the supply of three boilers.

**Wrexham.**—The following tenders were received by the Electricity Department for main switchboard:—

Whipp & Bourne	£736
Bertram Thomas	762 (accepted)
Siemens Bros. Dynamo Works, Ltd.	773
Electric and Ordnance Accessories Co., Ltd.	788
Spagnoletti, Ltd.	1,003
A. Reyrolle & Co., Ltd.	1,058
Crompton & Co., Ltd.	1,137
General Electric Co., Ltd.	1,197
Walsall Manufacturing Co., Ltd.	1,305
Ferranti, Ltd.	1,385
Electric Construction Co., Ltd.	1,438
Johnson & Phillips, Ltd.	1,465
British Westinghouse Manufacturing Co., Ltd.	1,525
Electrical Engineering and Agency Co.	1,744

No tender has been accepted for the motor-generator panel.

**York.**—The Tramways Committee of the T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for four tramcars, at £550 10s. each.

## FORTHCOMING EVENTS.

**Association of Engineers-in-Charge.**—Saturday, January 6th. At St. Bride's Institute, E.C. Social. Dance.

Wednesday, January 10th.—At 8 p.m. At St. Bride's Institute, E.C. Paper on "Notes on Hand-Firing *versus* Mechanical Stoking," by Mr. F. F. Evans.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, January 8th. At 8 p.m. Paper on "Oil Engines," by Mr. G. R. Dalkin.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, January 8th. At 7.30 p.m. At the Armstrong College, Newcastle. Discussion on "The Localisation of Faults in High and Low-Tension Cables," to be opened by Mr. B. A. M. Cooper.

**Institution of Electrical Engineers (Scottish Local Section).**—Tuesday, January 9th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Illumination," by Mr. J. D. MacKenzie.

**Institution of Electrical Engineers (Birmingham Local Section).**—Wednesday, January 10th. At 7.30 p.m. At the University, Birmingham. Paper on "Dynamometers for Motor Road Vehicle Lighting," by Mr. J. D. Morgan.

**Institution of Electrical Engineers (Yorkshire Local Section).**—Wednesday, January 10th. At 7.15 p.m. At the University, Sheffield. Paper on "Some General Principles Involved in the Electrical Driving of Rolling Mills," by Mr. C. A. Ablett.

**Association of Mining Electrical Engineers (London Branch).**—Thursday, January 11th. At 8 p.m. At the Junior Institution of Engineers. Paper on "Electricity in Connection with Explosives" to be discussed.

**Institution of Electrical Engineers (Dublin Local Section).**—Thursday, January 11th. At 8 p.m. At the New Royal College of Science, Dublin. Paper on "Peat as Gas-Engine Fuel: New Developments," by Mr. T. Tomlinson.

**Institution of Electrical Engineers (London).**—Thursday, January 11th. At 8 p.m. Paper on "Some General Principles Involved in the Electrical Driving of Rolling Mills," by Mr. C. A. Ablett.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued:—

Monday, January 8th.—"A" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Tuesday, January 9th.—"B" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Thursday, January 11th.—"C" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Friday, January 12th.—"D" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Saturday, January 13th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) J. H. S. PHILLIPS, Major,  
For Officer commanding L.E.E.

**Annual Festivities.**—The annual staff frivolities of the ST. HELENS CABLE AND RUBBER CO., LTD., took place on December 23rd, in Warrington. The dinner was held at mid-day in the works dining hall, and dealt mainly with turkey and plum pudding. Afterwards, advantage was taken of the presence of lady members of the staff to institute parlour games, in which forfeits involved the time-honoured use of mistletoe. The whist drive, supper, and dance, at the Winmarleigh Rooms, was attended by about 100, and went with a swing.



## NOTES.

**A Shut-Down—From the Legal Point of View.—**

Our legal contributor writes as follows regarding the article entitled, "Nearly a Shut-Down," which appeared in the REVIEW of December 29th:—

"The article suggests an interesting question from the lawyer's standpoint. A perusal of that article, though it bids fair to confuse a mind which scarcely appreciates the difference between the lighting peak and a rheostat, makes it plain that it is only by providing for the unexpected that the breakdown can be avoided. But what is the liability of an electricity supply authority in this regard? Suppose the town or district is plunged in darkness owing to a breakdown, what are the consequences? An accurate appreciation of their legal liabilities appears to be important, inasmuch as enormous sums are obviously spent in duplicating sets, and in making provision to deal with emergencies. Lulled into a sense of security, it is possible that those who are responsible to shareholders as well as consumers, might be tempted to effect a saving by omitting to renew or keep their stand-by plant in repair.

"If reference be made to the Acts which deal with the supply of electricity for lighting purposes, it will be found that the possibility of accident has been specially provided for. The Electric Lighting Clauses Act, 1899, provides that whenever the undertakers make default in supplying energy in accordance with the terms of the Board of Trade Regulations, they shall be liable to such penalties as are prescribed in the Regulations in that behalf. These penalties may be recovered summarily. The effect of the clause which provides for them is to impose a duty on every electric lighting company to keep up a constant supply. But they are not to be held liable in every case of stoppage. Thus there is a proviso to the effect that the penalties to be inflicted on the undertakers must in no case exceed in the aggregate the sum of £50 in respect of any defaults not being wilful defaults on the part of the undertakers for any one day, and provided also, that in no case shall any penalty be inflicted in respect of any default, if the Court are of opinion that the default was caused by inevitable accident or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply.

"What, then, is inevitable accident? There are few cases on the subject; but it may be presumed that a stoppage due to the negligence of one of the servants of the lighting authority would not come under this head. In the case of *Sun Insurance Co. v. Dublin Corporation* (December 9th, 1899) a cable which had been laid down proved to be defective; and the supply of electricity accordingly broke down. This failure was held to have been caused by inevitable accident. This case, however, does not completely establish the proposition that a burning out is an inevitable accident. It is presumed that the Court would make inquiry into the cause of the burn-out. Thus, if a company, with a view to saving the expense of a new cable were to deliberately overload an old one, an accident arising from this cause could scarcely be looked upon as inevitable. Again, suppose that a large addition was made to the list of consumers so that the machinery at the generating station might occasionally be taxed to its utmost capacity, a breakdown resulting from such a cause could hardly be regarded as inevitable.

"With regard to *force majeure*, this is a legal phrase which relates to the happening of something for which the company could not reasonably be held liable, e.g., a flood, an earthquake, or a subsidence sufficiently violent to sever the cables.

"As to a breakdown due to an increase in the number of consumers, there is only one case and this throws a somewhat doubtful light on the subject. I refer to *Marylebone Vestry v. Metropolitan Electric Supply Co.*, which was heard in January, 1900. The company were summoned for making default in supplying energy to the workhouse and Vestry offices on certain days. They admitted the default, but pleaded, in extenuation, that their inability was due to inevitable accident caused by a great demand for electricity, which had exceeded all expectations. The case was adjourned for three months, and was not heard of again.

"In *Shaddick v. London Electric Supply Corporation* (May 8th, 1900), the keeper of a licensed house at Deptford summoned the London Electric Supply Corporation for failure to supply his premises. The default was admitted, but the defence was *force majeure*, it being contended that, the supply of electricity having become deficient owing to unavoidable causes, it became essential that some part of the district of the company should be cut off, and that Deptford was selected as causing the least public inconvenience. The full penalty of 40s. was inflicted in each of the seven cases, with 20 guineas costs in the first case and 2s. costs in each of the others."

**Prize Competition.**—The Société Industrielle de Mulhouse is offering prizes for:—(a) A new process or application of electricity to the bleaching, dyeing, and printing of textiles; (b) the electrical driving of a machine of very variable speeds by a three-phase motor. The results and power factors must equal or exceed those of the motors previously premiated by the Society, but great importance is attached to the simplicity of the motor and accessory apparatus and to continuous working; (c) a comparative study of the electrical and mechanical working of a textile factory, showing their respective advantages and disadvantages, based on the results of actual experience; (d) a study of the use of electricity in textile operations carried out in the worker's home, whether it induces an increased output, its social consequences, and its effect on the work of the factory.—*La Revue Electrique*.

**Parliamentary.—BRIGHTON TRAMWAY PROJECTS.—**

No fewer than four Bills have been deposited in the Private Bill Office for extending the tramway facilities at Brighton, chiefly in the form of the construction of railless traction systems. The Brighton Corporation has put in the following estimates: For purchase of lands, sheds and buildings, &c., £35,170; for overhead equipment, shelters and miscellaneous equipment, £23,230; for trolley vehicles, £46,000; and for the running of omnibuses, £30,000. The Bill provides not only for running in Brighton, but also in the borough of Hove and the urban districts of Portelade, Southwick and Shoreham, and power is taken for agreements with neighbouring authorities as to leasing, running powers, &c. The Hove Corporation Bill is on very similar lines to that of the Brighton Corporation in respect to the districts to be worked, but Clause 36 gives authority for the appointment of a joint Committee for working the system. The estimates also are very similar, viz.: Land for generating station, &c., £4,000; erection of generating station and other necessary buildings, £20,000; overhead equipment, &c., £29,000; provision of trolley vehicles, £24,000; and motor-buses, £24,000. The third Bill is that of the Brighton, Hove and Preston United Omnibus Co., Ltd., whose proposals are rather wider, as they propose constructing a railless route to Worthing. They also seek power to purchase the Hove, Worthing and District Tramways undertaking of the British Electric Traction Co. Lastly, the Brighton District Tramways Bill incorporates a company with a capital of £75,000 to take over the Hove and Worthing tramways of the British Electric Traction Co., and George Balfour and Andrew Henry Beattie are named as the first two directors.

**RAILWAY ELECTRIFICATION IN LONDON.**—The text of the Bill for next session deposited by the London and North-Western Railway Co. gives full details of the proposed electrifications of the North London Railway and railways in the south-western portions of London. The company take power to lay down electric mains on (1) the North London Railway; (2) the North and South-Western Junction Railway; (3) so much of the London and South-Western Railway as lies between (a) the North and South-Western Junction Railway at South Acton Junction and Gunnersbury Station; and (b) the North and South-Western Junction Railway at Kew East Junction and New Kew Junction, together with the siding situated on the north side of the London and South-Western Railway between the said New Kew Junction and Chiswick Junction. By Clause 35 the London and North-Western, the Midland, the London and South-Western and the Metropolitan District, or any two or more of them, may enter into agreements with respect to the adoption of their railways, or any portion of them, for electrical working, and with respect to the supply of electrical current. Clause 37 gives the company power to supply electricity to manufactories on the route of the railway, but not unless the consent of the authorised supplier of the district is given.

**ELECTRIFICATION OF THE EAST LONDON RAILWAY.**—Full powers are being asked for by the Great Eastern Railway Co. in their Bill to be brought before Parliament next session for the electrification of the East London Railway, and by Clause 39 the Joint Committee is authorised to enter into agreement with the Metropolitan District Co. and the London Electric Railway Co., or any other company or authority or person authorised to supply electrical energy, for a supply of the necessary energy. The Great Eastern Co. is further empowered to issue £90,000 4 per cent. debenture stock for such electrification.

**KINGSTON-ON-HULL CORPORATION TRAMWAYS.**—The Bill of the Kingston-on-Hull Corporation, which has been deposited in the Private Bill Office, contains the following estimates of the cost of works proposed to be undertaken:—Construction of tramways, £28,000; generating station and equipment, £55,000; additional lands and buildings for tramway purposes, £12,000.

**New Insulators.**—H.M. Consul at Philadelphia, U.S.A. (Mr. W. Powell), has furnished a report on a new material, manufactured by a secret process, and stated to be a substitute for hard rubber, cork, horn, &c. The manufacture is claimed to be simple and cheap. The material is made mostly of anything that contains vegetable fibre. It is claimed that it can be turned out, with a profit, at 4½d. per lb. Exhaustive tests made in the United States show, it is stated, that electrically it is equal, if not superior, to hard rubber, fibre, porcelain, cork, horn, &c., and would take the place of these materials in several of their uses. Its power of resisting heat is said to be almost if not quite equal to that of asbestos, and it is extremely tough and very difficult to break. In its first stages of manufacture, being perfectly plastic, it can be moulded into any shape desired. The report, together with particulars of the results of tests of the material made in the United States of America, may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade.

It is reported that a London chemist has succeeded in producing from seaweed an entirely new composition having high insulating properties, and capable of being used instead of vulcanite or leather; it is waterproof and fire-proof, and is unaffected by acids and oils. It is suggested that it is well adapted for the insulation of deep-sea cables. A company is being formed for its manufacture on a large scale, under the name of "Seagumite."

**A Report on Olympia Exhibition.**—A deputation sent by the Electricity Committee of the Bradford Corporation to visit the Electrical Exhibition at Olympia recently issued their report, in which they state that the principal feature of the Exhibition was the display of electric heating and cooking apparatus and of drawn-wire filament lamps, and that, on the whole they were rather disappointed.



**Staff Dinner.**—At the Hotel Richelieu, Oxford Street, W., on Saturday last, the first staff dinner of Messrs. Krupka and Jacoby, of Queen Victoria Street, E.C., was held. From the principals down to the juniors the whole staff was present, whilst the visitors were represented by Mrs. Jacoby, Miss Loeffler, Mrs. W. E. Pott, Mrs. L. Hermes and Mrs. F. W. Fifield. The chair was occupied by Mr. Jacoby, who was supported by Mr. Krupka, Mr. W. E. Pott (manager), Mr. J. Stevenson (secretary), together with Messrs. F. Burland, L. Hermes, F. W. Fifield, L. Evans, G. H. Band, and E. F. Maas, the firm's representatives for the British Isles. The arrangements were left in the capable hands of Miss Dawson, and an excellent banquet was presented and thoroughly enjoyed.

After the loyal toast had been drunk, "The Firm" was toasted by Mr. W. E. Pott in a spirited speech, in which he dwelt on the whole-hearted and genial disposition of both partners, their accessibility to the staff, and the interest they took in the welfare of all their employes. This toast was heartily endorsed, and was responded to by Mr. Krupka. Mr. J. Stevenson proposed the toast of "The Staff," and paid a special compliment to the manager, Mr. Pott. His remarks were seconded by Mr. Hermes. Mr. F. W. Fifield, in felicitous mood, proposed the toast of the evening, "The Visitors," and Mrs. Jacoby returned thanks on behalf of the ladies.

Immediately after the toasts the principals handed, through Mrs. Jacoby, a useful gift to everyone present in commemoration of the occasion. During the evening very many references were made regarding the "Graetzin" metal-filament lamp, for which Messrs. Krupka & Jacoby are the sole agents for the British Isles, and its progress. Other gentlemen to say a few words during the evening were Mr. Burland, the firm's oldest representative, and Mr. Moody, the storekeeper, who had been with the firm since they started.

The musical and humorous programme of the evening included some improvised verses by Mr. Maas, on the Graetzin lamp. "Auld Lang Syne," with New Year wishes, and the singing of "God Save the King," brought the proceedings to a close.

**Observatories and Lightning.**—M. J. Vallat, in the *Comptes Rendues de l'Acad. des Sciences*, gives the results of his investigations on the protection of observatories situated at a great height from lightning. From observations made at two of the observatories on Mont Blanc, the author concludes that if the earth line connecting the lightning conductor with the rock is long, the observatory cannot be effectually protected. On the other hand, the Observatory des Boues is extremely well protected (it has never been struck) in the following manner:—Four conductors with multiple points are fixed on the roof and connected together by wires. From each conductor a 5-mm. iron wire descends to the rocks and ends in a spiral among the gravel. The whole observatory is also clad with thin copper sheets, in metallic contact with the conductor, the iron wires and the ground. The electric discharge thus finds a large, highly conductive surface to spread itself over, the points of contact being made as numerous as possible. The stove pipe is also in contact with the copper envelope. Thus equipped, the observatory forms a complete Faraday cage.—*La Revue Electrique*.

**Legal.**—*VERNEY v. GLENVILLE & OSMOND.*—An important point was raised in cases at Bacup Petty Sessions on Wednesday, last week, brought by H.M. Inspector of Factories against Glenville and Osmond, cinematograph owners, of the Bacup Public Hall, in which the defendant firm were summoned for breaches of the Factory Act on October 26th.

Mr. Brother, of Manchester, H.M. Inspector of Factories, who appeared on behalf of Mr. Verney, said that when the latter visited the defendants' premises, Burnley Road, Bacup, he found generating plant for electricity for the lighting of the Public Hall, and he found there was no abstract of the Factory Acts affixed at the premises in which electricity was generated. Ten years ago electricity generating stations were included in the term "factory" by the 1901 Act. The defendants were also summoned for not having the fly-wheel of the gas engine, 8 ft. in diameter, and other dangerous machinery fenced.

Mr. Evans, solicitor, Haslingden, for the defence, contended that the electrical stations contemplated by the Act were those where electricity was generated in considerable bulk for public supply or for trading or manufacturing purposes, and not for a place of that sort, where it was only for an entertainment. A cinematograph hall was not a public place, and the public had no right there. It has been held that a workhouse was a public building, but that was different from either a theatre or a cinematograph show. Mr. Brother had not given them a single case where a cinematograph show had been held to be a factory. In the case of a workhouse, where there was considerable electricity generated and there was considerable plant, it was quite different. The cinematograph exhibition was not an industrial undertaking, and he thought the Bench ought not to say it was a factory.

He called Mr. Clay, defendants' manager, who said he had been connected with such concerns for 18 years, and had never seen an Abstract of the Factory Act exhibited in any of them.

Mr. Brother said they were not concerned, for the purposes of the Act, with either the kind or extent of the trade that was carried on in the building, but only with the fact that electricity was generated there for light for the Public Hall. If their Worships wished to have a case decided on all fours in the High Court, they could do so, if they would go to the cost, but he could assure them that such places were factories, and they had only to deal with the part of the premises where the electricity was generated. There had been cases decided on the point with regard to merry-go-rounds. The extent of the business had nothing to do with it.

The Bench found that it was a factory within the meaning of the Act, and imposed a penalty of 1s. and costs for not fencing the machinery, and costs for failing to affix the Abstract.

**Inquiries.**—The makers of an electrical vulcaniser for motor-car tires are inquired for; also makers of Shaw's patent Liverpool lightning arresters.

**Faraday House Old Students' Association.**—The annual smoking concert of this Association will be held at the Holborn Restaurant, Council Room, on Friday, January 19th, at 8.30 p.m. sharp. Mr. H. H. Perry, M.I.E.E., president, will be in the chair. Tickets and all particulars may be obtained from the Honorary Secretary, Faraday House, Southampton Row, London, W.C.

**Fancy Dress Ball.**—The annual fancy dress ball of the Robertson & Osram Social and Athletic Club will take place at Brook Green Works, Hammersmith, on Saturday, January 13th, at 7 p.m.

**Reduction in German Wire Lamp Prices.**—A general reduction in the prices of metallic-filament lamps has taken place in Germany. The initiative was taken by the Deutsche Gasglühlicht (Auer) Gesellschaft, who were quickly followed by the A.E.G. and by Messrs. Siemens & Halske. The last firm, in the course of a further communication, explains the attitude of the principal makers. The company remarks that both the tantalum and the tungsten lamp were made with drawn-wire filaments from the beginning. As a result of obtaining licences, the construction of tantalum lamps was undertaken by American factories on a large scale some years ago. The favourable experience gained with this lamp, and the circumstance that the Siemens & Halske Co. succeeded in drawing wire for the tungsten lamp three years ago, caused further experiments to be made in this direction. Eventually the Americans were successful in devising improved methods for the manufacture of drawn tungsten wire, although they were dependent upon the German company's patented process for winding the wire in a single length on a frame. An understanding was thereupon arrived at between the Siemens & Halske Co. and the American company with regard to the mutual exchange of patents concerning tungsten lamps. The arrangement, as a result of existing agreements, was simultaneously extended to the A.E.G. and the Deutsche Gasglühlicht (Auer) Gesellschaft, so that both these companies are authorised to manufacture according to the patents in question. Presumably all makers who are debarred from using the patents for mounting the filaments will find it extremely difficult to compete with the other makers of drawn-wire lamps under the altered circumstances.

**Educational.**—*UNIVERSITY COLLEGE.*—The work of the Second Term begins on Tuesday, January 9th. Among the Special and Advanced Courses which have been arranged in the Faculty of Engineering are "Illumination and Photometry," by Mr. W. C. Clinton, on Wednesdays, at 6.30 p.m., beginning January 10th; and "Water Supply, Sewerage and Lighting," by Mr. R. E. Middleton, on Thursdays, at 9 a.m. and 4 p.m., beginning January 11th, at 4 p.m. Particulars may be obtained from the Secretary of the College.

**Institution and Lecture Notes.**—*NATIONAL ELECTRIC LIGHT ASSOCIATION, U.S.A.*—The Association, which in July, 1909, had a membership below 3,000, now numbers over 10,000 members.

*INSTITUTION OF MINING ENGINEERS.*—At a meeting in Newcastle, two mining managers, who had been charged with the duty of testing the Ralph gas-testing lamp, reported that, while the lamp acted admirably with coal gas, it completely failed to indicate the presence of fire-damp in a pit. This result was totally unexpected, as no one had foreseen a difference in the behaviour of the gases. Prof. Bedson stated that, in the case of the combustion of marsh gas, there were three stages, in none of which was sufficient heat developed to produce the reaction which enabled the platinum to indicate the presence of coal gas. He thought the discovery would enable the inventor to proceed on lines which would lead to the desired end.

*AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.*—At the December meeting of the board of directors a new policy was adopted, the proceedings of the governing body being made public. According to the report in the *Electrical World*, a resolution was passed expressing the desirability of the more general use of the metric system, and directing that in all publications of the Institute measures expressed otherwise than in the metric system should be accompanied by the metric equivalents in parentheses. This practice is already followed by some of the leading American engineering societies. It was decided also to open communications with foreign electrical engineering societies with reference to the mutual establishment of visiting-member privileges, so that members of the Institute when visiting a foreign country might, upon the presentation of credentials, have the privilege of temporary membership of the society in that country, and *vice versa*.

There are only two grades of membership in the Institute, 10 per cent. being Members, and 90 per cent. Associates, and this anomaly has led to a proposal to reorganise the membership in three grades, the names suggested being "Fellow," "Member," and "Associate." It appears that these classes will correspond roughly with the classes of Member, Associate Member, and Associate of the British Institution. The proposal was provisionally adopted.



On January 17th a party of members of the Institute will leave New York for a trip to the Isthmus of Panama, joining a party from New Orleans at Colon on January 25th. After visiting the Canal works, the party will return on February 8th.

**SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.**—The annual dinner took place on December 8th, Mr. J. H. Rider, president, being in the chair. Mr. Rider, in responding to the toast of the Institute, said that until quite recently, the electrical engineers on the mines suffered under the disability of not being officially recognised by Government. The Government had now introduced new regulations, and recognised the electrical engineer, and had authorised him to become certificated, and, indeed, as far as the regulations were concerned, had put him on a level with the mechanical engineer. He hoped that the mechanical and electrical engineers would all work together for one common end—the benefit of their employers. The future of the Institute, he said, was well assured.

**Federal State Monopolies in Germany.**—A Bill was recently introduced in the Diet of the Grand Duchy of Gotha to authorise an agreement which has been arranged between the Government and the A.E.G. with regard to the establishment of an overland central station and the construction of light electric railways in the Grand Duchy. The agreement provides that the company shall erect a station capable of supplying all parts of the Duchy, and that the undertaking shall be independent of the company's other enterprises, and have headquarters in Gotha. The company is to be authorised to use and cross over all roads for the installation of overhead or underground cables for the transmission of energy, while, on the other hand, a payment is to be made to the State amounting to from  $\frac{1}{2}$  per cent. to 1 per cent. of the gross receipts. During the first four years of the agreement the company has to make provision for supply to 34 communes in addition to the seven towns in the Duchy, and similar arrangements in relation to the remaining communes have to be made in the succeeding period of four years. The first light railway to come into consideration will be between Gotha and Friedrichroda, which will have branches to Waltershausen and Grosstabarz. At the request of the Ministry, the company will construct other lines specified in the agreement, which will serve localities which have not been provided with railway connections owing to the conservative policy of the Prussian Railway authorities, who apprehended that the lines would prove unprofitable. It is expected that the agreement, which is for a term of 50 years, will be sanctioned by the Diet without any opposition, as it will meet requirements which have been recognised for a long time past. The way towards an electrical monopoly is also being paved in the Grand Duchy of Hessen, where the Rhenish Schuckert Co. is constructing an overland central station for Rhenish-Hessen. In addition, the Ministry is in negotiation with the company with regard to the lease of the State works to be erected near Wolfersheim, and the company is said to be also associated with other schemes in the Duchy.

**Temperature Coefficient and Resistivity.**—As the result of experiments at the Reichsanstalt, Mr. St. Lindeck finds that the average density of 63 samples of copper is 8.89, and that there is a constant relation between the resistivity and the temperature coefficient of copper, such that the product of these values, at 15° C., is  $6.8 \times 10^{-5}$ , with a variation rarely exceeding 1.5 per cent. From this datum it is possible to determine the resistivity of copper in a form which prevents the direct measurement—for example, a wound bobbin—as the temperature coefficient can easily be ascertained, though the dimensions of the conductor cannot. According to the measurements of Dellinger, the resistance of copper between 10° and 100° C. varies with temperature according to a linear relation; the product of resistivity and temperature coefficient is, therefore, practically constant for different values of the temperature, and need only be measured at one temperature. Thus, to find the resistivity of copper of any quality at a temperature  $t_2$ , when it is known at a temperature  $t_1$ , it is only necessary to determine the value of  $(t_1 - t_2) 6.8 \times 10^{-5}$  and to deduct it from the latter. Similar results have been found for aluminium and iron. Mr. Lindeck points out that Mathiessen and Vogt found the constancy of this product in the course of their experiments, in another form, but that it passed completely unnoticed.

**Big Boilers.**—The Delray station of the Detroit Edison Co., says the *Electrical World*, contains turbines aggregating 75,000 kW., including four 14,000-kw. sets. These are fully loaded only during the peak hours, and show the highest efficiency in the neighbourhood of 8,000 kW. The large boilers used in conjunction with them have a similar efficiency curve; they are of the double-fired Stirling type, and each has a normal output of 7,000 kW., but they have been run up to 11,000 kW. for short periods. Five have been erected—in addition to smaller boilers—and five more are about to be installed. The dimensions of one of them are 31 ft. wide  $\times$  36 ft. high  $\times$  28 ft. deep; heating surface, 23,654 sq. ft. There are 1,564  $\frac{3}{4}$ -in. tubes, one 54-in. and two 48-in. steam drums, and two 48-in. mud drums. The boilers are fired from both ends, three with Roney stokers and two with Taylor underfeed stokers. The grate area of the former is 453 sq. ft., and of the latter 300 sq. ft. The boilers work at 205 lb. pressure, and are provided with superheaters giving a superheat of 150° F. Forced draught is used. The boilers were constructed by the Babcock & Wilcox Co. The combined efficiency of boiler and furnace (of either type) is said to be 80 per cent. at the nominal rated load, falling to 76 per cent. at double rating.

**Postal Engineers.**—The Postmaster-General has announced that the Treasury has sanctioned a revision of the engineering department of the Post Office. According to the *Daily News*, the future classification and rates of pay, minimum and maximum, are to be as follows in the superintending branch:—

	Salary.	London allowance.
Superintending and staff engineers	£520 to £700	£50
Assistant do. ... ..	420 to 500	40
Executive engineers ... ..	315 to 405	30
Assistant do. ... ..	150 to 300	20
Chief inspectors ... ..	150 to 200	20

Where the rates of pay are fixed by the week the scales are as follows:—

	London.	Provinces.
Senior inspectors ... ..	57s. to 65s.	52s. to 60s.
Inspectors ... ..	30s. to 55s.	30s. to 48s.
Skilled workers (I)... ..	39s. to 47s.	37s. to 45s.
" " (II)... ..	26s. to 38s.	24s. to 36s.

Skilled men not on the establishment are to be paid at the rate of 6 $\frac{1}{4}$ d. to 7 $\frac{3}{4}$ d. per hour in London and 5d. to 7d. per hour in the provinces. The pay of boys and youths in London ranges from 2 $\frac{1}{2}$ d. to 4 $\frac{1}{2}$ d. per hour, and in the provinces from 2d. to 3 $\frac{1}{2}$ d.

The present distinction between the maintenance and construction staff is not to be maintained, and the whole of the adult force below the rank of inspector will be divided between skilled and unskilled classes. Fifty per cent. of the skilled workmen will be brought on the establishment, with the result that about 1,100 newly established posts will be created to be filled from the unestablished maintenance and construction ranks.

From January 1st the Post Office factories have ceased to exist as a separate department, and have become part and parcel of the stores department. The post of Controller of Post Office Factories is also abolished.

**Magnification of Electric Currents.**—At a meeting of the National Academy of Sciences held in New York, Prof. M. I. Pupin gave a preliminary account of a theoretical and experimental investigation of the problem of magnifying the feeble electric currents used in cable telegraphy and telephony. As a result of experimental work conducted during the past five years, Prof. Pupin has developed and built an induction-type generator, by means of which feeble currents in a circuit can be magnified to any desired extent, the generator acting locally somewhat as an energy relay. The feeble current is passed through the primary circuit of the generator, the secondary of which consists of a small disk of copper driven by external power. On account of the self-excitation of the machine and the reaction between the primary and secondary currents, the current in the primary is enormously augmented. In the early experiments, considerable difficulty was encountered by reason of an inherent tendency of the machine to become excited automatically to an excessive degree. In a machine recently completed, these difficulties have been overcome, and the theory of its operation, which was worked out by Prof. Pupin some years ago, has been thoroughly verified. Prof. Pupin has announced his intention of describing both the theory and the machine in detail in a paper to be presented before the American Institute of Electrical Engineers.—*Electrical World*.

**Appointments Vacant.**—Assistant junior demonstrator in the electrical engineering and applied physics department of the Northampton Polytechnic Institute; dynamo and switchboard attendant, for the Bethnal Green B.G. (32s.); mains superintendent, for the Municipality of Port Elizabeth, South Africa (£250). See our advertisement pages to-day.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. L. G. HARRIS, assistant resident engineer, Chester Street generating station of the Birmingham Corporation, who is resigning his present position for an appointment with Messrs. Vickers, Son & Maxim, Manchester, was on December 29th presented with a travelling bag as a token of esteem by the staff and employés.

MR. G. DEARLE, assistant mains superintendent at Derby, has resigned, and the T.C. has appointed Mr. T. BING and Mr. H. C. MITCHELL as district inspectors of mains.

MR. FRED TYRRELL, charge engineer to the Leatherhead and District Electric Co., Ltd., has been appointed assistant electrical engineer to the Ascot Gas and Electricity Co.

MR. RAYNER, engineer-in-charge at the York Corporation electricity works, has resigned.

MR. J. G. THAW has been appointed chief assistant engineer to the Stratford-on-Avon Electric Light and Power Co., Ltd. Mr. Thaw was previously engaged at Gloucester for seven years as charge engineer.

MR. H. L. COTTAM, shift engineer at Dewsbury Corporation electricity works, has obtained an appointment Colchester.



MR. R. H. CAMPION, borough electrical engineer at Dewsbury, has resumed his official duties after having been seriously ill for several months.

The Tramways Committee of Salford T.C. has appointed Mr. H. WESTON to be overhead equipment superintendent. The Electricity Committee has promoted Mr. F. BARLOW to the position of superintendent of the electrical testing and high-motor department.

**General.**—NEW YEAR HONOURS.—The list of honours announced this week includes the following. To all of these gentlemen the ELECTRICAL REVIEW tenders its congratulations:—

SIR FRANCIS J. S. HOPWOOD, formerly Permanent Under-Secretary of the Board of Trade, is to be sworn a Privy Councillor.

MR. R. COLLINGWOOD FORSTER, who recently gave £30,000 for the new Chemical laboratories at University College, is made a baronet.

MR. THOMAS SKINNER, founder of the *Stock Exchange Year Book*, and chairman of the Halifax and Bermudas Cable Co., Ltd., and a director of the Commercial Cable Co., also receives a baronetcy.

PROF. W. F. BARRETT, F.R.S., M.I.E.E., who has just retired from his position as Professor of Experimental Physics at the Royal College of Science, Dublin, receives the honour of knighthood.

MR. JOSEPH BEECHAM, a director of the Lancashire United and other electric tramway companies, is made a knight.

MR. J. MACKENZIE DAVIDSON, M.B., C.M., whose researches in X-ray work are so well known, and who is consulting surgeon to the X-ray departments at the Charing Cross and Royal London Ophthalmic Hospitals, also receives the honour of knighthood.

MR. A. B. KEMPE, D.Sc., F.R.S., treasurer of the Royal Society, and a distinguished mathematician, is made a knight.

PROF. H. A. MIERS, D.Sc., F.R.S., Principal of the London University, is knighted.

Among those receiving the "C.B." are MR. W. F. MARWOOD, assistant secretary of the Board of Trade in the Railway Department, and MR. A. M. J. OGILVIE, one of the assistant secretaries of the G.P.O.

MR. W. B. COWNIE, formerly general manager and secretary of the National Electric Construction Co., Ltd., has been appointed managing director of the company, the old title, therefore, falling into disuse. Mr. Robert Watson, formerly accountant, has been appointed secretary of the company.

Out of 49 applicants, MR. N. J. YOUNG, Bristol, has been appointed general manager of the Newport, Mon., electricity and tramways undertaking at a salary of £400. Mr. Young, who commences his duties on March 1st, is 34 years of age, and has had 13 years' experience with the Bristol Tramways and Carriage Co., Ltd. He was clerk to the tramways traffic manager at that town for five years, and is at present assistant to the managing director and secretary.

MR. SCAIFE, of Stockport, has been appointed chief electrician at Stanlow Works, Ellesmere Port.

MR. H. B. RENWICK, formerly general manager and secretary of the County of London Electric Supply Co., Ltd., has been elected to a seat on the board and appointed managing director. MR. F. C. MCQUOWN, formerly assistant secretary, has been appointed secretary to the company.

MR. A. W. BLAKE, consulting engineer, announces that his address has just been changed to "Sketty," Swansea, where he will continue to devote himself more especially to the electrical and mechanical equipment of works and collieries, and to electric lighting schemes for public purposes.

MR. G. E. WRIGHT, M.I.E.E., electrical engineer to the North-Western Railway, Lahore, India, will be in England on furlough in March.

The *Australian Mining Standard* states that a sum of £750 has been put in the Commonwealth Estimates for the purpose of enabling one or more officers of the Postmaster-General's Department to go abroad and study the latest developments in similar departments in other countries, and there is a probability that, as regards telegraphic and telephonic improvements, the choice will fall on MR. JOHN HESKETH, the departmental electrical engineer.

MR. E. C. BEMAN, who has filled various important positions with the Edison & Swan Co. (head office), both in an indoor capacity and as outdoor representative, his total period of service extending over more than 12 years, has just severed his connection with the company in order to take up an appointment with the Brush Electrical Co., Kingsway (Supplies Department).

**Tramway Officials.**—The Tramways Committee of the Newcastle Corporation on Thursday last week decided to increase the salary of the manager, Mr. ERNEST HATTON, by £100, and he will receive £100 advance 12 months hence, making his salary £1,000 per annum.

**Obituary.**—MR. F. BENNETT.—The death occurred on December 26th, at Portsmouth, of Mr. Fredk. Bennett, chief inspector of the National Telephone Co., Ltd. He was 53 years of age.

MR. E. K. SANCTOR.—The death occurred, on December 26th, of Mr. E. K. Sanctor, director of Messrs. Fraser & Chalmers, Ltd., electrical and manufacturing engineers, of Erith and London. The deceased gentleman, who was 71 years of age, was for some years superintendent of the Erith works of the firm, and on his retirement about a year ago he was appointed local director. Prior to coming to Erith he was associated with the Dickson Manufacturing Co., of Scranton, Penn.

## NEW COMPANIES REGISTERED.

**Parana Corporation, Ltd.** (119,233).—This company was registered on December 19th, with a capital of £50,000 in 48,000 preferred ordinary shares of £1 each and 40,000 deferred ordinary shares of 1s. each, to carry on the business of constructors, financiers and managers of railways, engineering and electrical works, tramways, docks, factories, buildings, &c., and to adopt an agreement with the Inter-Continental Contractors, Ltd. The subscribers (with one share each) are:—H. M. Morrison, Highfield, Leckhampstead, Newbury, Berks., electrical engineer; N. H. Boyns, 20a, John Street, Bedford Row, W.C. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Gush, Phillips & Co., 3, Finsbury Circus, E.C.

**Constant Vacuum Carburettor Syndicate, Ltd.** (119,250).—This company was registered on December 20th, with a capital of £3,000 in 10s. shares, to carry on the business of mechanical, electrical and general engineers, electricians, machinists, tube makers, manufacturers of electric apparatus, founders, &c., and to adopt an agreement between F. Edwin and E. J. Smallpage, for the acquisition of certain patents governing carburettors. The subscribers (with one share each) are:—F. Edwin, 11, Market Street, Paddington, engineer; L. A. B. Shipment, 256, Portsdown Road, Maida Vale, N.W., cashier. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. A. W. Hoale is the first secretary. Registered office, Market Street, Paddington.

**National Carbide (1911), Ltd.** (119,203).—This company was registered on December 18th, with a capital of £10,000 in £1 shares, to carry on the industrial, experimental and commercial exploitation of any chemical or electrochemical processes, including particularly the manufacture and sale of carbide of calcium and products thereof and primary materials therefor, and to adopt an agreement with National Carbide Co., Ltd. The subscribers (with one share each) are:—E. K. George, The Brackens, Ascot, gentleman; S. C. K. George, 41, Courtfield Road, S.W., gentleman. Private company. The number of directors is not to be less than two or more than seven; the first are S. K. George and S. C. K. George. Registered office, 11, Queen Victoria Street, E.C.

**W. H. Rayner & Sons, Ltd.** (119,268).—This company was registered on December 20th, with a capital of £4,000 in £5 shares, to carry on the business of electrical and general engineers at 166, London Road, Nottingham. The subscribers (with one share each) are:—J. H. Rayner, Winthorn, Radcliffe Road, West Bridgford, engineer; G. Rayner, Brooklyn, Radcliffe Road, West Bridgford, engineer; W. H. Rayner, 48, Holme Road, West Bridgford, engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. H. Rayner, G. Rayner and W. H. Rayner (all permanent); qualification, £200. Registered by Charles Doubble, 14, Serjeant's Inn, E.C.

**Brolt, Ltd.** (119,248).—This company was registered on December 20th, with a capital of £15,000 in £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers of and dealers in electrical machinery, plant, fittings and apparatus of all kinds, &c., and to adopt agreements with B. Brooks and W. Holt. The subscribers (with one share each) are:—B. Brooks, Blackwell Court, near Bromsgrove, director; A. C. Johnson, Napier Villa, Wyde Green, director. Private company. The number of directors is not to be more than five; the first are B. Brooks and A. C. Johnson (both permanent). Registered by Waterlow Bros. & Layton, Ltd., Birch Lane, E.C.

**High Peak Magneto Co., Ltd.** (119,281).—This company was registered on December 21st, with a capital of £1,500 in £1 shares, to carry on the business of electricians, electrical engineers, electrical instrument manufacturers, manufacturers of electrical and other magnets and batteries, machinery, apparatus and devices, &c. The subscribers (with one share each) are:—F. Burks, Capstone, Mellor, Derbyshire, electrical engineer; S. Livesey, 18, Illingworth Road, Preston, traveller; R. Hogg, Infirmary Road, Blackburn, manager. Private company. The first directors are F. Burks, S. Livesey and R. Hogg; qualification, £100; remuneration as fixed by the company. Registered office, Torr Top Street, New Mills, Derbyshire.

**Whisperphone Syndicate, Ltd.** (119,330).—This company was registered on December 22nd, with a capital of £1,000 in £1 shares, to take over the invention known as the "Whisperphone," and to adopt an agreement with C. F. Killar. The subscribers (with one share each) are:—J. C. Grove, 82-3, Fenchurch Street, E.C., tea merchant; C. F. Killar, 82-3, Fenchurch Street, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. C. Grove and C. F. Killar; qualification, 100 shares. Registered office, 82-3, Fenchurch Street, E.C.

**T. Clarke & Co., Ltd.** (119,351).—This company was registered on December 23rd, with a capital of £15,000 in £1 shares (5,000 preference), to take over the business carried on at 129, Sloane Street, S.W., as "T. Clarke and Co.," and to carry on the business of electricians, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—W. H. Jee, 39, Pepys Road, S.E., chartered accountant; E. G. White, Ormesby, West Heath Drive, Golden Hill, N.W., articled clerk. Private company. The number of directors is not to be less than two or more than five; the first are W. D. Clarke, E. J. Clarke and H. J. de C. Moore, each of whom may retain office while holding five shares. Registered office, 2, Gresham Buildings, Basinghall Street, E.C.

**Universal Accumulators, Ltd.** (119,327).—This company was registered on December 22nd, with a capital of £5,000 in 4,850 ordinary shares of £1 each and 3,000 founders' shares of 1s. each, to take over from H. de Martis the benefit of certain patents, inventions, processes and apparatus relating to the production, treatment, storage, application, distribution and use of electricity, &c. The subscribers (with one share each) are:—P. F. D. Brockman, 17, Victoria Street, S.W., barrister; W. H. Molesworth, 14, Howick Place, Westminster, S.W., civil engineer; E. H. Woods, 110, Cannon Street, E.C., civil engineer. Private company. The number of directors is not to be less than two or more than five; the first are P. F. D. Brockman, W. H. Molesworth and E. H. Woods; qualification, £5 founders' shares or £200 other shares; remuneration as fixed by the company. Registered office, 17, Victoria Street, S.W.

## REVIEWS.

*The Law Relating to Engineers.* (A course of six lectures delivered before the Society of Engineers (Incorporated), and the Junior Institution of Engineers (Incorporated)). By L. W. J. COSTELLO, M.A., LL.B. With an introduction by the RIGHT HON. LORD JUSTICE FLETCHER MOULTON, M.A., F.R.S. Published by the above-named Societies, London. 1911. Price 5s.

When, and in what circumstances, does the electrical engineer find it necessary to have some acquaintance with the law? If he can afford it, he employs his lawyer when



any question of difficulty perplexes him; but expert legal assistance is not always cheap or readily available. Lord Justice Fletcher Moulton, in his introduction to the above volume, has put forward a strong plea for the study of the law by the engineer himself.

"In countries where law is embodied in codes, it is both easy and customary for the various classes of the professional and commercial world to know almost by heart the portions which directly relate to their calling. But in England, where we prefer the elasticity of principles to a servile adherence to any verbal embodiment of them, the task is more difficult and less frequently accomplished; and yet the English system of case law is, in my opinion, easier and safer for the sensible layman than a codified system would be. With a little care he can familiarise himself with the principles on which our Courts act, which are wide-reaching, and rest for the most part on the obvious necessities of the case viewed generally, though the consequences may be strange, and even hard, when applied to some particular and unusual state of facts. He will find himself more at home in applying principles such as these than in speculating on the interpretation which a Court will place on the specific language of a clause in a code which was probably drafted without any reference to such a case as that to which it is to be applied, and to which its language must at any cost be made to fit." The Lord Justice then proceeds to recommend the engineer to familiarise himself with the reports of decided cases by the aid of a volume like that which is now before us. How many engineers will have sufficient time on their hands to obey these precepts? The man to whom legal knowledge would be really valuable must at the present moment have his head full of much else besides the lore of the engineer. He should have a knowledge of finance, he must be a master or a leader of men. He requires a keen insight into human nature, and if his labours include dealing with town or borough councils, he must be familiar with local politics and the multifarious cranks and whims of each local Bumble. In these circumstances he may well ask: In which mental pigeon-hole shall I have room for legal knowledge?

To him who is willing and anxious to learn, the perusal of Mr. Costello's lectures should be useful.

In his second lecture he adopts the description of an engineer's duties, which is to be found in "Hudson's Building Contracts." He says, "An engineer under an engineering contract usually acts, it would seem, in several distinct capacities. He is, first of all, merely a designer or draughtsman, then, when he has received instructions to get tenders and have the work executed, he becomes an agent for the employer, and from time to time during the progress of the work he assumes the rôle of quasi-arbitrator between the employer and the contractor, and finally he may have to act in a fully judicial capacity under the terms of the contract appointing him arbitrator between the parties in the event of a dispute."

Not the least important part of the work is that which relates to the engineer's duties as arbitrator. He will often be required to act in this capacity; and some knowledge of legal principles is essential if justice is to be done between the parties. It may not be generally known, however, that it is competent for an arbitrator to employ a lawyer to help him to settle the terms of his award. This is a wise precaution where a case is complicated.

Mr. Costello appears to have collected and commented on all the important cases down to the most recent. His work should prove useful to those for whom it is intended.

**O. C. Hawkes, Ltd.**—The directors have declared the usual dividend of 5 per cent. per annum on the preference shares for the six months ended December 31st.

**Rio de Janeiro Tramway, Light and Power Co., Ltd.**—A dividend of 1½ per cent. on the issued capital stock has been declared, payable on February 1st.

**Hadfield's Steel Foundry Co., Ltd.**—The directors have declared a dividend on the 4½ per cent. preference shares for the half year.

## CITY NOTES.

### Sunderland District Electric Tramways, Ltd.

AN extraordinary general meeting of the shareholders of the above company was held on Thursday, last week, at Winchester House, Old Broad Street, E.C., Mr. H. R. Hogg presiding.

The CHAIRMAN moved the following resolution:—

That the articles of association be altered in manner following:—(a) Article 55 shall be cancelled; (b) that the following article shall be substituted for Article 55, that is to say: "The directors may from time to time, at their discretion, raise or borrow or secure the payment of any sum or sums of money for the purposes of the company, but so that the amount at any one time owing in respect of moneys so raised, borrowed or secured, shall not, without the sanction of a general meeting, exceed the sum of £250,000. Nevertheless, no lender or other person dealing with the company shall be concerned to see or inquire whether this limit is observed. The directors may raise or secure the payment or repayment of such sum or sums in such manner and upon such terms and conditions in all respects as they think fit, and in particular by the issue of debentures or debenture stock of the company, charged upon all or any part of the property of the company, both present and future, including its uncalled capital for the time being."

He said that the object of the alteration was to enable the debts owing for overdue interest to be consolidated and capitalised. Such a course was clearly to the advantage of the shareholders, otherwise they could not get any moneys paid to them for interest until the whole of the back debts had been paid in cash out of the company's income. The proposal was to get the debts consolidated and put into capital, and to do that it was necessary to increase their borrowing powers.

MR. R. TAYLER seconded the resolution, and it was carried unanimously.

### Fremantle (W.A.) Tramways and Electric Lighting Board.

—The *Australian Mining and Engineering Review* states that the report for the year ended August 31st shows that the income for the 12 months totalled £41,079—an increase of £3,037 on the previous year's receipts. The gross profits on the year's operations were higher than those of any previous year, amounting to £10,918, being an increase of £758. Of this sum interest on loans absorbs £5,930, while £2,642 has been allocated to sinking fund, and £1,938 to depreciation reserve, leaving a surplus of £409. The increase in the number of passengers carried during the year amounted to 341,728. A fresh agreement covering a period of five years has been entered into with the Fremantle Harbour Trust for the supply of power required to operate the pumping plant in connection with the Fremantle dock, and the additional lighting required by the trust.

**Stock Exchange Notices.**—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 Deferred Ordinary Stock; £200,000 Preferred Ordinary Stock; and £200,000 5 per cent. Cumulative Perpetual Preference Stock.

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 33,325 Ordinary shares of £1 each, fully paid, Nos. 466,676 to 500,000.

**National Telephone Co., Ltd.**—The directors on December 28th resolved to recommend at the meeting to be held on January 9th, 1912, the following dividends for the half-year ending December 31st, 1911, after payment of the dividends on the preference shares:—At the rate of 6 per cent. per annum on the preferred stock; at the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases. The transfer books will be closed from January 1st to 9th, 1912, inclusive, and the dividend warrants will be posted on the latter date.

The directors in their report for the half-year ended December 31st, 1911, dated December 30th, state that the inventory is nearing completion. It is expected that the company's claim will be ready for presentation in the early part of the year, and, in default of settlement, will, as soon as possible thereafter, be submitted to the Railway and Canal Commission, the arbitrators appointed to settle disputes in connection with the matter, between the Postmaster-General and the company. Under the heads of arrangement referred to the Postmaster-General has agreed, when required by the company, to advance £3,000,000, in order to enable the company to satisfy the claims of its debenture-stock holders. These claims should be met as early as possible, and for that purpose it is necessary for the company to go into liquidation. The board have accordingly issued notices for an extraordinary general meeting of the company, to be held immediately after the ordinary general meeting, for the purpose of passing the requisite winding-up resolutions. The procedure thus indicated does not allow sufficient time for the preparation and issue of the accounts of the company for the half-year, in accordance with its former practice. The board feel, however, that the shareholders will desire to have their usual dividends at as early a date as practicable, and, having satisfied themselves that the profits of the company for the half-year fully justified the payment of a dividend at the same rate as in recent half-years, they recommend, as stated above. The accounts for the half-year will be sent to the shareholders early in February.

**Shawinigan Water and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent. for the quarter to the 31st ult., being at the rate of 5 per cent. per annum, on the common shares.



MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 3rd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. "	22/-	..
a " Oxalic .. .. "	28/-	..
a " Sulphuric .. .. "	5/6	..
a Ammoniac Sal .. .. "	42/-	..
a Ammonia, Muriate (crystal) .. per ton	£29	..
a " " " " " " " "	£30	..
a Bleaching powder .. .. "	£5 10	..
a Bisulphide of Carbon .. .. "	£18	..
a Borax .. .. "	£16	..
a Ferro-Silicon (50 %) .. .. "	£11 10	..
a Copper Sulphate .. .. "	£20	..
a Lead, Nitrate .. .. "	£25 10	..
a " White Sugar .. .. "	£22 15	..
a " Peroxide .. .. "	£32	..
a Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks .. per lb.	3½d.	..
a Potash, Caustic (75/80 %) .. per ton	£20	..
a " Chlorate .. .. per lb.	3½d.	..
a " Perchlorate .. .. "	4½d.	..
a Potassium, Cyanide .. .. "	7d.	..
a Shellac .. .. per cwt.	68/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. "	£6 10	..
a " Recovered .. .. "	£5 10	..
a " Lump .. .. "	£5 6	..
a Soda, Caustic (white 70 %) .. .. "	£11	..
a " Chlorate .. .. per lb.	3½d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
a " Cyanide (basis 100 %) .. .. "	7d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£63	..
b " Wire, in ton lots .. .. "	£102	..
b " Sheet, in ton lots .. .. "	£120	..
p Bablitt's metal ingots .. .. "	£98 to £145	..
c Brass (rolled metal 2" to 12" basis) .. per lb.	8d.	½d. inc.
c " Tube (brazed) .. .. "	10½d.	½d. inc.
c " " (solid drawn) .. .. "	8½d.	½d. inc.
c " Wire, basis .. .. "	7½d.	½d. inc.
c Copper Tubes (brazed) .. .. "	10½d.	½d. inc.
c " " (solid drawn) .. .. "	10d.	½d. inc.
g " Bars (best selected) .. per ton	£79	..
g " Sheet .. .. "	£79	..
g " Rod .. .. "	£79	..
e " (Electrolytic) Bars .. .. "	£67	£2 inc.
e " " Sheets .. .. "	£84	£2 inc.
e " " Reds .. .. "	£72	£2 inc.
e " " H.C. Wire .. per lb.	8½d.	½d. d.c.
f Ebonite Rod .. .. "	5/8	..
f " Sheet .. .. "	4/9	..
n German Silver Wire .. .. "	1/11	..
h Gutta-percha, fine .. .. "	5/- to 7/-	..
h India-rubber, Para fine .. .. "	1/4	½d. inc.
i Iron Pig (Cleveland warrants) .. per ton	50/6½	11d. inc.
i " Wire, galv. No. 8, P.O. qual.	£14	..
g Lead, English Pig .. .. "	£15 17 6 to £16	..
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£8	2/6 dec.
d Mica (in original cases) small .. per lb.	6d. to 2s.	..
d " " " medium .. .. "	2/6 to 4/-	..
d " " " large .. .. "	4/6 to 8/6	..
p Phosphor Bronze, plain castings .. "	11d.	..
p " " rolled bars & rods .. .. "	1/0½	..
p " " rolled strip & sheet .. .. "	1/1	..
o Platinum .. .. per oz.	185/-	..
e Silicon Bronze Wire .. .. per lb.	9½d.	..
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. "	£150 to £192 nom.	£12 dec.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/4	1d. inc.
p White Anti-friction Metals .. per ton	£45 to £150	..
k Zinc, Sh't (Vicille Montagne bnd.) .. "	£31 2 6	..

Quotations supplied by—

a G. Boor & Co.	/ Bolling & Lowe.
b The British Aluminium Co., Ltd.	& Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	/ Richard Johnson & Nephew, Ltd.
d F. Wiggins & Sons.	m W. T. Glover & Co., Ltd.
e Frederick Smith & Co.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g Jsmcs & Shakspeare.	p
h Edward Till & Co.	r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE New Year has opened in more promising style than its predecessor ended. Domestic politics have been mollified by the clearing of the labour situation in the North, where the troubles appear to be working in the direction of a settlement. In the Stock Exchange there is a gamble going on, fast and furious, in the stocks and shares of the London traction companies, and speculation is following upon the wake of investment in the market for Latin-Canadian power undertakings.

Close upon the heels of the sensational boom in London General Omnibus stock there have come big rises in the issues of the Underground Electric Income bonds, and District Ordinary stock, in Central London Deferred, and Metropolitan Consolidated. So great is the interest taken in this movement that a rise of a shilling in Spiers & Pond shares evoked the sarcastic inquiry whether the company was to come into the London Electric Railway agreement or to amalgamate with Marconi's.

Underground Electric Incomes have enjoyed another big rise since last we wrote. The price touched 82, reverting to 78, which gave an advance of five points on balance. District Ordinary gained ¾, and the 6 per cent. Debenture stock promptly recovered 2 points of the interest deducted at the end of the year. A boomlet in Metropolitan Consolidated lifted the price 3. More striking than any of these, however, has been the jump of 7 in Central London Deferred, to which tardy attention was directed by the consideration that whatever benefits will accrue to the other underground systems are likely to advantage the Central London as well. But probably the spirit of gambling has a good deal to do with the rise, coupled with the fact that the market in this stock is a narrow one at all times. And, of course, the company's prospects are good enough to encourage buying when the general market is strong.

City and South London is not yet noticed; Great Northern and City Preferred remain at 22s. 6d., and for a sheer gamble may make a useful counter. East London hardened to 6½, causing a little demand for the company's Debenture stocks.

Pending distribution of the new issues, British Electric Traction Ordinary and Preference quotations are removed from the Stock Exchange Official List, but the company's Debenture issues remain, and the 5 per cent. stock is a point higher at 94½. London United Trams have improved, the Preference shares putting on ¼, while the Debenture stock at 74½ *ex* dividend is 4 points higher, with hardly any stock offering here and none at all in Bristol. Underground Electric Railway shares are a strong feature with a rise of no less than 12s. 6d. to 3½.

English Electricity Supply descriptions are quiet and steady; the few changes in the list this week are due mostly to *ex* dividend markings, and there are no features.

Congratulations to Mr. H. B. Renwick, and to the County of London Electric Supply, upon his acceptance of a seat upon the board, and of the position of managing director of that company. County Ordinary showed the biggest rise of any of the metropolitan shares last year, and—at all events from the Stock Exchange point of view—this is the most satisfactory result that management can achieve in an industry which has to depend so much upon faith, hope and patience.

Calcutta Light Ordinary rallied a further 2s. 6d., and it is now supposed that the transference of the seat of the Government to Delhi has had its full influence upon timid shareholders, and that the recovery will make further progress. Mexican Light and Power Common is a good market, with a 1½ points gain, while the Preference hardened to a lesser extent. Mexican Trams have gone up 3, things Mexican being in favour all round upon the assumption that the whole country is settling down, after its recent political ferment, to peace and prosperity under the new President.

Sao Paulo Trams have risen 9, Rio Trams put on 2½ over and above the dividend and rights, while this section exhibits pronounced strength. The long-continued absorption of the various companies' bonds is being followed, as mentioned above, by a quickening of speculative interest, and operators for the rise are devoting a good deal of attention to this section. British Columbia Electric Railway Preferred is harder.

Other improvements worthy of notice are those of ¼ in Brisbane Tramways Investment Ordinary, and of ¾ in United Electric Trams of Monte Video Preference. These two instances, taken in conjunction with those named in the preceding paragraph, give a good idea of the wide-spread nature of the field covered by the demand for shares.

The feature amongst manufacturing shares is the rise of a sovereign in Telegraph Constructions, which is the first step towards recovery since the slump that followed the passing of the dividend on the Ordinary shares. The Preference, *ex* their 5s. dividend, are actually ¼ better, the gain, therefore, on the week being 10s. Castner-Kellners rose ½ and Babcock Ordinary advanced to 6½. Brush second Debenture at 39½ is *ex* dividend, and this makes the return on the money look remarkably high.

Marconi's compete with West India and Panama Telegraphs and London General Omnibus for pride of place in public interest. Marconis have had another big rise, the Ordinary gaining ¾, and the Preference ¾. The latter, it is well known, take 7 per cent. cumulative dividend, then the Ordinary get 10 per cent. (when times allow), and after this the profits are divided, *pari passu*, between the two classes. There are half a million Ordinary shares issued, out of an authorised £750,000, and 227,011 Preference out of £250,000 authorised. If the Ordinary are worth their present price of 65s., it would appear that the Preference are greatly undervalued at 51s. 3d. Dealings in Canadian Marconi go on quietly on the basis of 17s. 6d. per share.

National Telephone Deferred has lost 1 on balance, the report and dividend disappointing some people who had looked for a more liberal distribution of the big profits. Dealings continue to take place, in spite of the transference effected last Sunday midnight. The position and rights of the Third Preference shares continue to excite lively discussion. The Telegraph and Telephone Mark-1 remains very steady, with prices inclining to the higher side.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividend for	Closing Quotations Jan. 2nd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations Jan. 2nd.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½ 5½	7½—8½	..	6 5 9	Kensington & Knightsbridge, Ord.	5	9 8½	6½—7½	..	6 4 2
Do. 4½ % Pref.	10	4½ 4½	8½—9½	..	4 12 4	Do. 4 % Deb.	Stock	4 4	9½—96	..	4 3 4
Do. Second 6 % Pref.	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb.	Stock	4½ 4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock	Stock	4½ 4½	10½—102 xd	..	4 8 3	London Electric, Ord.	3	2 2	1½—2	..	3 0 2
Brompton & Kensington, Ord.	5	10 9½	7½—8½	..	5 19 4	Do. 6 % Pref.	5	6 6	4½—4½	..	6 3 1
Do. 7 % Cum. Pref.	5	7 7	7½—8	..	4 7 6	Do. 4 % First Mort. Deb.	Stock	4 4	87—90 xd	..	4 8 11
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	98—101	..	3 19 3	Metropolitan	5	5 4½	3½—4	..	6 5 0
Charing Cross, West End & City	5	5 5½	3½—4	..	6 5 0	Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½ xd	..	4 17 4
Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½	..	4 12 4	Do. 4½ % First Mort. Deb.	Stock	4½ 4½	99—104 xd	..	4 6 7
Do. "City Undertaking" }	5	4½ 4½	3½—4½ xd	..	5 9 1	Do. 3½ % Mort. Deb.	Stock	3½ 3½	84—87 xd	..	1 0 6
Do. 4½ % Cum. Pref. }	100	4 4	93—96 xd	..	4 3 4	Midland Electric Corporation }	100	4½ 4½	94½—96½ xd	..	4 13 3
Chelsca, Ord.	5	5 4½	4—4½	..	5 11 1	Do. 4½ % First Mort. Deb.	5	4 4½	3½—4	..	5 0 0
Do. 4½ % Deb.	Stock	4½ 4½	97—100 xd	..	4 19 0	Do. 5 % Pref., Non-Cum.	5	5 5	4—4½	..	5 11 1
City of London, Ord.	10	7 6½	12½—13½	..	5 6 8	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5 5	99—102	..	4 18 0
Do. 6 % Cum. Pref.	10	6 6	12—13	..	4 12 4	Notting Hill, 6 % Non-Cum. Pref.	10	.. ..	9½—10½ xd	..	..
Do. 5 % Deb.	Stock	5 5	117—121 xd	..	4 2 8	Oxford	5	7½ 6½	6½—6½	..	5 9 5
Do. 4½ % Second Deb.	100	4½ 4½	100—103 xd	..	4 7 5	St. James' and Pall Mall, Ord.	5	10 10½	8—8½	..	5 17 4
County of Durham, 5 % First Mort. Deb.	Stock	5 5	87—89 xd	..	5 12 4	Do. 7 % Pref.	5	7 7	6½—7½	..	4 19 1
County of London, Ord.	10	5 4½	8½—9½	..	5 6 8	Do. 8½ % Deb.	100	3½ 3½	85—87 xd	..	4 0 6
Do. 6 % Pref.	10	6 6	11—11½	..	5 4 4	Smithfield Markets, Ord.	5	Nil ..	1½—1½	..	Nil
Do. 4½ % Deb.	Stock	4½ 4½	105—108 xd	..	4 2 4	South London, Ord.	4	5 ..	2½—3½	..	6 3 1
Do. 4½ % Second Deb.	Stock	4½ 4½	100—103	..	4 7 5	Do. 5 % First Mort. Deb.	100	5 5	98—101 xd	..	4 19 0
Edmundson's, Ord.	5	Nil Nil	3—5	..	Nil	South Metropolitan, 7 % Pref.	1	7 7	1—1½	..	6 4 5
Do. 6 % Cum. Pref.	5	Nil Nil	2—2½	..	Nil	Do. 4½ % First Deb. Stock	100	4½ 4½	95—98	..	4 11 10
Do. 4½ % First Mort. Deb.	100	4½ 4½	84—87	+1	5 3 6	Urban, Ord.	5	5 ..	1—1½	..	..
Folkestone	5	6 6½	4½—5	..	6 0 0	Do. 5 % Cum. Pref.	5	5 ..	2—2½	..	..
Do. 5 % Cum. Pref.	5	5 5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb.	100	4½ 4½	86½—88½	..	5 1 3
Do. 4½ % First Deb.	100	4½ 4½	95—98	..	4 11 10	Westminster, Ord.	5	10 10½	7½—8½	..	5 19 5
Hove	5	9 8½	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref.	5	4½ 4½	4½—5½	..	4 7 10

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6 6	5½—5½	..	5 1 4	Monterey Rly. Light & Power, }	100	5 5	91—93	..	5 7 6
Calcutta, Ord.	5	8½ 7½	6½—6½	+½	6 8 4	Do. 5 % 1st Mort. Deb.	5	5	196—200	..	3 10 0
Do. 5 % Pref.	5	5 5	5—5½	..	4 15 3	Montreal, Lt., H. and Power	\$100	7 8	39—41	..	12 3 10
Calgary Power, 1st Mort. Bds.	100	5 5	94—96 xd	..	5 4 2	Northern, Lt., Power and Coal,	\$500	5 ..	235—245	..	4 1 8
Canadian Gen. El. Com.	\$100	7 7½	110—115	..	6 1 9	Do. 4½ % Per. Deb.	Stock	10 ..	104—110	..	5 9 1
Do. 7 % Pref.	\$100	7 7	118—122	..	5 14 9	Do. 5 % Deb. Stock	Do.	5 5	100—102 xd	..	4 18 0
Cordoba Lt., Power and T., Ord.	1	3 3½	7—1	..	3 0 0	Roy. Elec. Co., Montreal, 4½ % }	100	4½ 4½	99—101	..	4 9 1
Do. 5 % Deb.	100	5 ..	94—97	..	5 3 1	Do. 1st Mort. Deb.	5	5	126—128	+1	3 2 6
Elec. Lt. and P. of Cochabamba, }	100	6 6	91—93	..	6 9 0	Do. 5 % Con. 1st Mort. Bonds	\$100	4 5½	105—107 xd	..	4 13 6
Do. 6 % Bonds	100	6 6	82—85 xd	..	5 17 8	Do. 4½ % Per. Deb.	Stock	4½ 4½	102½—104½	..	4 6 2
Elec. Supply Victoria, 5 % 1st }	100	5 5	91½—93½	..	5 6 11	Toronto Power, 4½ % Deb.	Do.	4½ 4½	98—100	..	4 10 0
Do. Mort. Deb.	\$500	5 5	101—103 xd	..	4 17 1	Vera Cruz Lt., P. and T., 5 % }	100	5 5	91—93 xd	+1	5 7 6
Eleo. Dev. Ontario, 5 % 1st }	10½	Nil ..	2½—3½	+ 1½	Nil	Do. 1st Mort. Deb.	1	Nil 11½d.	1½—1½	..	..
Do. Mort. Bonds	1	6 6	2½—3½	..	8 0 0	Victoria Falls Power, Pref.	1	Nil 11½d.	1½—1½	..	..
Kalgoorlie Elec. P. and L., Ord.	10½	6 6	101—103 xd	..	4 17 1	West Kootenay Power and Lt., }	100	6 6	106½—108½	..	5 10 7
Do. 6 % Pref.	1	6 6	98—100 xd	..	5 0 0	Do. 1st Mort. 6 % Gold	100	6 6	106½—108½	..	5 10 7
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	86—88 xd	..	5 13 8						
Madras, Ord.	5	.. ..	89—91	+1½	4 7 11						
Melbourne, 5 % 1st Mort. Deb.	100	5 5	108—110	+½	6 7 3						
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	95½—97½	..	5 2 7						
Mexican Lt. & Power, Common	\$100	7 7	..	..	..						
Do. 7 % Cum. Pref.	\$100	7 7	..	..	..						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	..	..	..						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4½ 7—7½	..	..	Monte Video Telephone, Ord.	1	6 6	1½—1½	..	5 12 11
Do. 5 % Deb. Red.	Stock	5 5	98—100 xd	..	5 0 0	Do. 5 % Pref.	1	5 5	1½—1½	..	5 6 8
American Telep. & Telep., Cap.	\$100	8 8½	140—142	—2½	5 12 8	National Telephone, Pref.	Stock	6 6½	105—107	+1	5 12 1
Do. Collat. Trust	\$1000	4 4	93—95 xd	..	4 4 3	Do. Def.	Do.	6 6½	130—132	—1	4 10 10
Anglo-American Telegraph	Stock	3½ 3½	66½—68½	..	5 9 6	Do. 6 % Cum. 1st Pref.	10	6 6	93—10½	..	5 14 3
Do. 6 % Pref.	Do.	6 6	111—112	+½	5 7 2	Do. 6 % Cum. 2nd Pref.	10	6 6	93—10½	..	5 14 3
Do. Def.	Do.	30½ ..	26—26½	+½	5 13 2	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½—6	..	4 3 4
Anglo-Portuguese Tel., 5 % }	100	5 5	101—103	..	4 17 1	Do. 3½ % Deb.	Stock	3½ 3½	95½—101½	..	3 9 4
Do. Mort. Deb.	5	7 ..	7—7½	..	4 16 7	Do. 4 % Deb.	Do.	4 4	95½—101½	..	3 18 10
Chili Telephone	5	4 4	86—88 xd	..	4 10 11	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	101—102	+½	4 8 3
Commercial Cable, Stlg. 4 % Deb.	Stock	10 6	93—10½	..	5 14 3	Oriental Telep. and Elec.	1	8 ..	1½—1½	..	4 18 6
Cuba Telegraph	10	10 10	17—18	..	5 11 1	Do. 6 % Cum. Pref.	1	6 6	13½—13½	..	4 13 8
Do. 10 % Pref.	10	10 10	84—84	..	5 14 8	Do. 4 % Red. Deb.	Stock	4 4	87—89 xd	..	4 9 11
Direct Spanish Telegraph, Ord.	5	4 4½	100½—102½	..	4 7 10	Pacific and European Tel., 4 % }	Do.	4 4	98½—100½ xd	..	3 19 7
Do. 10 % Cum. Pref.	5	10 10	7½—8	..	5 12 6	Do. Guar. Deb.	8	5 5½	83—91	..	4 6 6
Do. 4½ % Debs.	50	4½ 4½	98½—100½ xd	..	4 9 7	Reuter's	Cert.	6 6	130—133	..	4 10 3
Direct United States Cable	10	4½ ..	138—141	+½	4 19 3	Submarine Cables Trust	100	4½ 4½	98—100 xd	..	4 10 0
Direct W. India Cable, 4½ % }	100	4½ 4½	83½—85½	+½	4 1 7	Telephone Co. of Egypt, 4½ % }	Stock	4½ 4½	102½—104½	..	4 6 8
Do. Reg. Deb.	100	4½ 4½	101—103	+½	3 17 8	Do. Deb. Red.	5	8 8	7½—7½ xd	..	5 6 8
Eastern Telegraph, Ord. Stock	Stock	7 5½	101—103	+½	3 18 1	United River Plate Telephone	5	5 5	5½—5½ xd	+½	4 8 11
Do. 8½ % Pref. Stock	Do.	8½ 8½	134—134	..	5 1 10	Do. 5 % Cum. Pref.	2½	2½ 2½	1½—1½	..	4 15 3
Do. 4 % Mort. Deb.	Do.	4 4	100½—102½	..	3 18 1	Do. 4 % Debs., 1 to 1,500 }	100	4 4	98½—100½ xd	+1½	3 19 7
Eastern Extension	10	7 5½	99—101	..	3 19 3	Do. guar. by Braz. Sub. Tel.	10	1½ 1½	3½—8½	+½	3 5 4
Do. 4 % Deb.	Stock	4 4	103—11½	..	5 6 8	Do. 6 % Cum. 1st Pref.	10	6 6	10½—10½	+½	5 12 11
East and S. Africa Tel. 4 % }	25	4 4	12½—13½	..	4 10 9	Do. 6 % Cum. 2nd Pref.	10	6 6	93—10½	..	5 17 1
Do. Mt. Db. Mauritius Sub.	10	6 6	32—33 xd	..	5 9 1	Do. 5 % Debs.	100	5 5	101—103 xd	..	4 17 1
Globe Telegraph and Trust	10	18 5½	56—58	..	5 12 1	Western Telegraph, Ltd.	10	7 6½	13½—13½	..	5 0 11
Do. 6 % Pref.	10	18 5½	80—83	—3	6 0 6	Do. 4 % Deb.	Stock	4 4	99—101 xd	..	3 19 3
Great Northern Telegraph	25	13 5½	69—72	—3	5 11 1	Western Union Tel., 4 % Bnds. A	\$1000	4 4	106—109	..	3 13 5
Indo-European Telegraph	\$100	5 5½	3½—3½	+½	..	Do. 4½ % Fdg. Bonds	\$1000	4½ 4½	100—103	..	4 7 5
Mackay Companies Common	\$100	4 4	2½—2½	+5/6	..						
Do. 4 % Cum. Pref.	\$100	4 4	..	..	..						
Marconi's Wireless Telegraph	1	5 ..	..	..	..						
Do. 7 % Cum. Partic. Pref.	1	16 ..	..	..	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 2nd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 2nd.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. . . . .	1	Nil Nil	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub> xd	..	Nil	Metropolitan Railway Consol. . .	100	1 <sup>1</sup> / <sub>2</sub> 2 <sup>1</sup> / <sub>2</sub>	46 <sup>1</sup> / <sub>2</sub> —46 <sup>1</sup> / <sub>2</sub>	+3	2 18 10
Do. 5 % Pref. . . . .	1	5 5	7 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub> xd	..	7 5 6	Do. Surplus Lands . . . . .	100	2 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub>	66—68	..	4 0 11
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	80—85	..	5 5 11	Do. 8 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub>	91—93	+1	3 15 3
Brit. Elec. Trac., Ord. . . . .	10	Nil Nil	..	..	..	Do. 3 <sup>1</sup> / <sub>2</sub> % Pref. . . . .	100	3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub>	86—88	..	3 19 7
Do. 6 % Pref. . . . .	10	1 <sup>1</sup> / <sub>2</sub> 1 <sup>1</sup> / <sub>2</sub>	..	..	..	Do. 3 <sup>1</sup> / <sub>2</sub> % Con. Pref. . . . .	100	3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub>	85—87	+1	4 0 6
Do. 5 % Deb. . . . .	100	5 5	93—96	+1	5 4 2	Metropolitan District Ord. . . .	100	Nil ..	34 <sup>1</sup> / <sub>2</sub> —35 <sup>1</sup> / <sub>2</sub>	+ <sup>3</sup> / <sub>4</sub>	Nil
Do. 4 <sup>1</sup> / <sub>2</sub> % 2nd Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	79—83	..	5 8 5	Do. 6 % Deb. . . . .	100	6 6	144—146xd	+2	4 2 2
Central London Railway, Ord. . .	100	3 3 <sup>1</sup> / <sub>2</sub>	68—70	+1	4 5 9	Do. 4 % Deb. . . . .	100	4 4	95—97xd	..	4 2 6
Do. Pref. . . . .	100	4 4	84—86	..	4 13 0	Do. 4 % Prior Lien . . . . .	100	4 4	100—102	..	3 18 5
Do. Def. . . . .	100	2 ..	57—59	..	3 18 5	Do. 4 <sup>1</sup> / <sub>2</sub> % First Pref. . . . .	100	3 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	91—93	+2	3 10 0
Do. 4 % Deb. . . . .	100	4 4	103—105	+1	3 16 2	Do. 3 <sup>1</sup> / <sub>2</sub> % Gtd. . . . .	100	3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub>	76—78	+1	4 9 9
City & South London, Ord. . . .	100	1 <sup>1</sup> / <sub>2</sub> 1 <sup>1</sup> / <sub>2</sub>	30 <sup>1</sup> / <sub>2</sub> —31 <sup>1</sup> / <sub>2</sub>	..	4 15 3	Metropolitan Elec. Trams, Ord. .	1	5 <sup>1</sup> / <sub>2</sub> 5 <sup>1</sup> / <sub>2</sub>	27—31	..	5 12 4
Do. 5 % Pref., 1891 . . . . .	100	5 5	108—110	..	4 11 0	Do. Def. . . . .	1	Nil ..	32 <sup>1</sup> / <sub>2</sub> —33 <sup>1</sup> / <sub>2</sub>	..	Nil
Do. Do. 1896 . . . . .	100	5 5	104—106	..	4 14 4	Do. 5 % Pref. . . . .	1	5 5	32 <sup>1</sup> / <sub>2</sub> —33 <sup>1</sup> / <sub>2</sub>	..	5 3 1
Do. Do. 1901 . . . . .	100	5 5	103—105	..	4 15 3	Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	100—102xd	..	4 8 3
Do. Do. 1903 . . . . .	100	5 5	103—105	+1	4 15 3	Do. 5 % Deb. . . . .	100	5 5	101—103	..	4 17 1
Do. 4 % Deb. . . . .	100	4 4	101—103	+1	3 17 8	Potteries, Ord. . . . .	1	2 ..	5 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub>	..	..
Dublin United Trams, 6 % Pref. .	10	6 6	11—12	..	5 0 0	Do. 5 % Pref. . . . .	1	6 5	5 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub>	..	6 19 3
Great Northern & City, Pr.f. Ord	10	Nil ..	1—1 <sup>1</sup> / <sub>2</sub>	..	Nil	Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	91—94	..	4 15 9
Hastings Trams, 6 % Pref. . . .	5	Nil 3 <sup>1</sup> / <sub>2</sub>	3—3 <sup>1</sup> / <sub>2</sub>	— <sup>1</sup> / <sub>2</sub>	Nil	South Metro. Trams, 6 % Pref. .	1	6 ..	8 <sup>1</sup> / <sub>2</sub> —8 <sup>1</sup> / <sub>2</sub>	..	6 17 2
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	73—78	..	5 14 8	Do. 4 % Deb. . . . .	100	4 4	70—75xd	..	5 6 8
Isle of Thanet Trams, 5 % Pref. .	5	2 <sup>1</sup> / <sub>2</sub> 2 <sup>1</sup> / <sub>2</sub>	23—27	..	4 6 11	Underground Elec. Railways . .	10	.. ..	23 <sup>1</sup> / <sub>2</sub> —25 <sup>1</sup> / <sub>2</sub>	..	..
Do. 4 % Deb. . . . .	100	4 4	75—80xd	..	5 0 0	Do. 4 <sup>1</sup> / <sub>2</sub> % Bonds . . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	100—102	..	4 8 3
Lancashire United, 5 % Deb. . .	100	6 5	76 <sup>1</sup> / <sub>2</sub> —79 <sup>1</sup> / <sub>2</sub> xd	..	6 5 9	Do. 6 % Income . . . . .	100	1 1 <sup>1</sup> / <sub>2</sub>	77—79	+5	1 5 4
London Elec. Railw'ys, 4 % Deb. .	100	4 4	97—99xd	..	4 0 10	Do. Power House Debs. . . . .	100	4 4	98—100xd	..	4 0 0
London United Trams, 5 % Pref. .	10	Nil ..	3—3 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	Nil	Yorkshire (West Riding), Ord. .	5	Nil ..	1 <sup>1</sup> / <sub>2</sub> —3 <sup>1</sup> / <sub>2</sub>	..	Nil
Do. 4 % Deb. . . . .	100	4 4	72—77xd	+4	5 3 11	Do. 6 % Pref. . . . .	5	Nil ..	2 <sup>1</sup> / <sub>2</sub> —2 <sup>1</sup> / <sub>2</sub>	..	Nil
						Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	78—83xd	..	5 8 5

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . .	5	5 5 <sup>1</sup> / <sub>2</sub>	41 <sup>1</sup> / <sub>2</sub> —53 <sup>1</sup> / <sub>2</sub> xd	..	4 16 5	La Plata Elec. Trms, Prf. . . . .	1	6 6	32—1	..	6 0 0
Do. 2nd Pref. . . . .	5	5 5 <sup>1</sup> / <sub>2</sub>	41 <sup>1</sup> / <sub>2</sub> —41 <sup>1</sup> / <sub>2</sub> xd	..	5 6 8	Lisbon Elec. Trams, Ord. . . . .	1	5 <sup>1</sup> / <sub>2</sub> 6 <sup>1</sup> / <sub>2</sub>	1—1 <sup>1</sup> / <sub>2</sub>	..	4 8 0
Do. 4 % Deb. . . . .	100	4 4	93—95xd	..	4 4 3	Do. 6 % Pref. . . . .	1	6 6	1—1 <sup>1</sup> / <sub>2</sub> xd	..	4 16 0
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	99 <sup>1</sup> / <sub>2</sub> —101 <sup>1</sup> / <sub>2</sub> xd	..	4 8 8	Do. 5 % Deb. . . . .	100	5 5	96—100	..	5 0 0
Do. 5 % Deb. . . . .	100	5 5	99—101	..	4 19 0	Madras Elec. Tr. (1904), Deb. . .	100	5 5	92 <sup>1</sup> / <sub>2</sub> —96 <sup>1</sup> / <sub>2</sub> xd	..	5 3 8
Auckland Trams, 5 % Deb. . . .	100	5 5	102—105xd	..	4 15 3	Manaos Trams & Lt., 1st Deb. . .	100	5 5	90 <sup>1</sup> / <sub>2</sub> —92 <sup>1</sup> / <sub>2</sub> xd	— <sup>1</sup> / <sub>2</sub>	5 8 1
Bombay Elec. S. & Trams, Pref. .	10	6 6	10 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	..	5 5 6	Manila Elec. R. and Ltg., Bonds	\$1000	5 5	100 <sup>1</sup> / <sub>2</sub> —102 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	4 17 7
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	96—98xd	..	4 11 10	Mexico Trams Com. . . . .	\$100	7 7 <sup>1</sup> / <sub>2</sub>	124—126	+3	5 11 1
Do. 5 % 2nd Deb. . . . .	100	5 5	96 <sup>1</sup> / <sub>2</sub> —98 <sup>1</sup> / <sub>2</sub> xd	..	5 1 6	Do. Gen. Con. 5 % Bonds . . .	..	5 5	98 <sup>1</sup> / <sub>2</sub> —100 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	4 19 6
Brisbane Trams Invt., Ord. . . .	5	8 8 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub> —8 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>4</sub>	4 10 2	Do. 6 % Bonds . . . . .	100	6 6	100 <sup>1</sup> / <sub>2</sub> —102 <sup>1</sup> / <sub>2</sub> xd	+ <sup>1</sup> / <sub>2</sub>	5 17 1
Do. 5 % Pref. . . . .	5	5 5	4 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	4 15 3	Para Elec. Rlys. & Lt., Ord. . .	5	10 10 <sup>1</sup> / <sub>2</sub>	6 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub>	..	6 18 0
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	101—104xd	..	4 1 7	Do. 6 % Pref. . . . .	5	6 6	6 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	6 4 4
B. Columbia Elec. Rly., Def. . .	100	8 8 <sup>1</sup> / <sub>2</sub>	136—141	..	5 13 6	Do. 5 % 1st Deb. . . . .	100	5 5	97 <sup>1</sup> / <sub>2</sub> —99 <sup>1</sup> / <sub>2</sub>	..	5 0 6
Do. Pref. Ord. . . . .	100	6 6	118—122	+1	4 18 4	Perth (W.A.) Elec. Tr., Ord. . .	1	2 <sup>1</sup> / <sub>2</sub> ..	1 <sup>1</sup> / <sub>2</sub> —1xd	..	2 10 0
Do. 5 % Pref. . . . .	100	5 5	109—112	..	4 9 3	Do. 5 % 1st Deb. . . . .	100	5 5	99—101xd	..	4 19 0
Do. 4 <sup>1</sup> / <sub>2</sub> % 1st Mort. Deb. . . .	40	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	100—103	..	4 7 5	Rangoon El. Tr. & Sup., Pref. . .	5	6 6	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub> xd	..	5 9 1
Do. 4 <sup>1</sup> / <sub>2</sub> % Vancouver Deb. . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	104—106	..	4 4 11	Do. 4 <sup>1</sup> / <sub>2</sub> % 1st Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	96—99xd	..	4 11 10
Do. 4 <sup>1</sup> / <sub>2</sub> % Con. Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	102—104	+ <sup>1</sup> / <sub>2</sub>	4 6 7	Rio de Janeiro Trams . . . . .	\$100	4 <sup>1</sup> / <sub>2</sub> 5 <sup>1</sup> / <sub>2</sub>	116 <sup>1</sup> / <sub>2</sub> —117 <sup>1</sup> / <sub>2</sub> xd	..	3 16 7
Calcutta Trams, Ord. . . . .	5	6 ..	5 <sup>1</sup> / <sub>2</sub> —6 <sup>1</sup> / <sub>2</sub>	..	5 4 4	Do. 1st Mort. 5 % Bonds . . .	..	5 5	100 <sup>1</sup> / <sub>2</sub> —101 <sup>1</sup> / <sub>2</sub> xd	..	4 18
Do. 5 % Pref. . . . .	5	5 5	4 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub> xd	..	4 17 7	Do. 5 % Mort. Bonds . . . . .	100	5 5	97 <sup>1</sup> / <sub>2</sub> —98 <sup>1</sup> / <sub>2</sub>	+1	5 1
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	100—103xd	..	4 7 5	Sao Paulo Tram, Lt. and P. . .	\$100	10 10 <sup>1</sup> / <sub>2</sub>	193—197	+9	5 1
Cape Electric Trams . . . . .	1	Nil 2 <sup>1</sup> / <sub>2</sub>	7—7	..	4 0 0	Do. 5 % 1st Deb. . . . .	\$500	5 5	101 <sup>1</sup> / <sub>2</sub> —103 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	4 16
City Buenos Aires Trams (1904)	5	5 5	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	4 5 1	Singapore Trams, 5 % Deb. . .	100	5 5	81—84	—1	5 19 1
Do. 4 % Deb. . . . .	100	5 5	95—98xd	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5 5	95 <sup>1</sup> / <sub>2</sub> —97 <sup>1</sup> / <sub>2</sub>	..	5 2 7
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5 5	93—98	..	5 2 0	Un. Elec. Trams Monte Video . .	5	6 7	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub> xd	..	5 2 2
Havana Elec. Rly., 5 % Bonds	\$1000	5 5	102—105	..	4 15 3	Do. 6 % Pref. . . . .	6	6 6	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	5 10 4
Kalgoorlie Elec. Trams . . . . .	1	Nil ..	3 <sup>1</sup> / <sub>2</sub> —3 <sup>1</sup> / <sub>2</sub>	..	Nil	Do. 5 % 1st Deb. . . . .	100	6 5	99—102	..	4 18 0
Do. 5 % A Deb. . . . .	100	5 5	91—94	..	5 6 5	Winnipeg Elec. Rly., 4 <sup>1</sup> / <sub>2</sub> % Deb.	100	4 <sup>1</sup> / <sub>2</sub> 4 <sup>1</sup> / <sub>2</sub>	104—106	..	4 4 11
Do. 6 % B Deb. . . . .	100	5 6 <sup>1</sup> / <sub>2</sub>	58—62	..	8 1 4						

## MANUFACTURING COMPANIES.

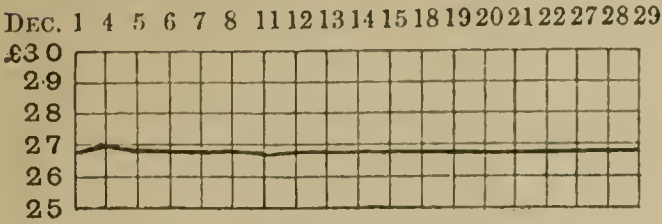
Aron, Ord. . . . .	1	Nil	6	—	3	..	..	Dick, Kerr .. . . .	1	5	..	—	..	5 14 3
Do. 6 % Pref. . . . .	1	9	6	—	3	..	7 2 2	Do. Pref. . . . .	1	6	6	—	1	5 12 11
Babcock & Wilcox . . . . .	1	26	24	6	—	6	4 3 2	Do. Deb... . . . .	100	4	4	92	—	4 14 3
Do. Pref. . . . .	1	6	6	13	—	13	4 0 0	Edison & Swan, A, £3 paid	5	Nil	..	—	3	Nil
B.I. & Helsby Cables . . . . .	5	10	8	6	—	7	7 0 4	Do. fully paid .. . . .	5	Nil	..	—	2	Nil
Do. Pref. . . . .	5	6	6	5	—	6	4 16 0	Do. 4 % Deb. . . . .	100	4	4	70	—	5 8 1
Do. Deb... . . . .	100	4	4	101	—	103	4 7 5	Do. 5 % Second Deb.	100	5	5	77	—	6 5 0
British Thomson-Houston, Deb.	100	4	4	94	—	97	4 12 9	Electric Construction ..	2	Nil	2	—	7	..
British Westinghouse, Pref. . .	3	Nil	..	4	—	4	Nil	Do. Pref. . . . .	2	7	7	13	—	7 9 4
Do. Deb... . . . .	100	4	4	54	—	57	7 0 4	Greenwood & Batley, Pref.	10	7	7	7	—	8 5 8
Do. 6 % Prior Lien . . . . .	100	6	6	100	—	102	5 17 8	Do. Deb... . . . .	100	5	5	94	—	5 4 2
Browett, Lindley, Ord. . . . .	1	Nil	..	1/6	—	2/	Nil	General Electric, Pref. . .	10	5	5	8	—	5 8 1
Do. Pref. . . . .	1	Nil	..	5/	—	6/	Nil	Do. Deb... . . . .	100	4	4	85	—	4 8 11
Brush, Ord... . . . .	2	Nil	..	0	—	0	Nil	Henley's, Ord. . . . .	5	15	10	11	—	5 18 10
Do. 7 % Pref. . . . .	2	Nil	..	0	—	0	Nil	Do. Pref. . . . .	5	4	4	4	—	4 5 11
Do. 4 1/2 % Deb. . . . .	100	4	4	56	—	61	7 7 7	Do. Deb... . . . .	100	4	4	104	—	4 4 11
Do. 4 1/2 % Second Deb. . . . .	100	4	4	37	—	42	10 14 4	India-Rubber, G. & T. . .	10	10	10	10	—	..
Callender's Cable... . . . .	5	15	10	9	—	9	7 13 10	Do. Pref. . . . .	10	5	5	94	—	4 17 7
Do. Pref. . . . .	5	5	5	5	—	5	4 15 3	Telegraph Construction..	12	20	10	34	—	6 13 4
Do. Deb... . . . .	100	4	4	99	—	101	4 9 1	Do. Deb... . . . .	100	4	4	99	—	3 18 10
Castnor-Kellner . . . . .	1	17	20	8	—	3	4 13 4	Willans & Robinson . . .	1	Nil	..	1	—	Nil
Do. Deb... . . . .	100	4	4	104	—	108	4 3 4	Do. Pref. . . . .	5	Nil	..	1	—	Nil
Crompton & Co. . . . .	8	Nil	Nil	8	—	8	Nil	Do. Deb... . . . .	100	4	4	53	—	7 2 10
Do. Deb... . . . .	100	5	5	58	—	68	7 7 1							



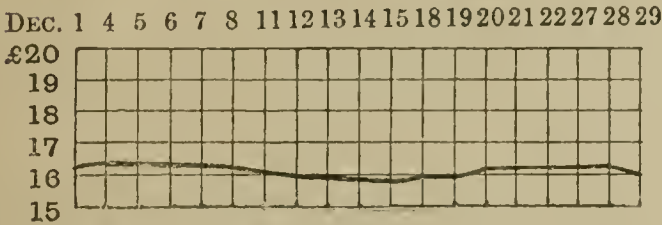
METAL MARKET.

Fluctuations in December.

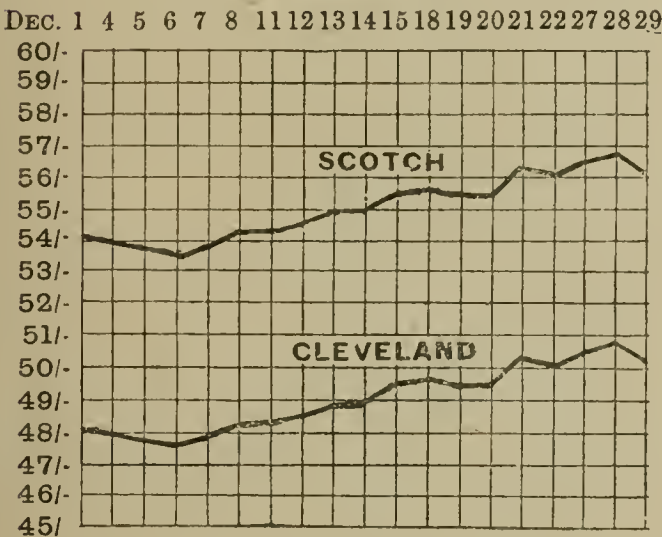
SPELTER (G.O.B's.).



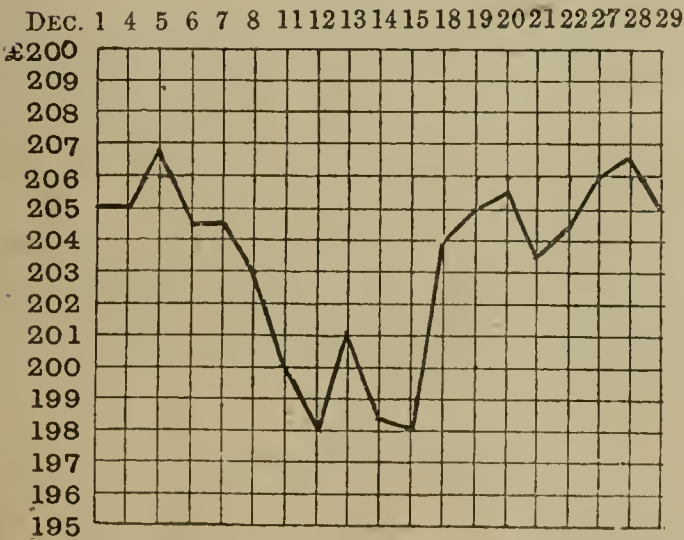
LEAD (ENGLISH).



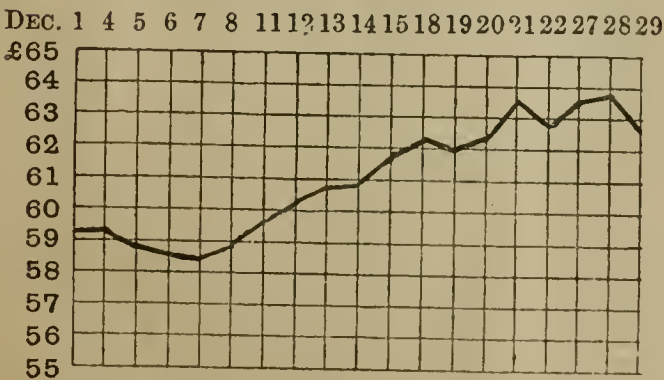
IRON.



TIN.



COPPER (G.M.B's.).



STREET LIGHTING.

By H. F. J. THOMPSON, Chief Assistant Engineer, Battersea Borough Council Electricity Department.

THE question of public street lighting is usually viewed either from the standpoint of an advertisement for the type of illuminant used, or from that of mere utility. The gas companies, when they get the opportunity to light an important thoroughfare, almost invariably consider it a question of advertisement, but it has been suggested that that is to make up for their sins in the side streets. However, whether that is correct or not, it is certainly advisable to have a good light in the main streets, where pedestrian and vehicular traffic is the densest, and as the tradespeople often follow the lead, a well-lighted street results, which has the effect of producing prosperity, as the purchasing community are always attracted by a good light.

In the case of electricity, the scheme decided upon usually depends on the feeling of the authority controlling the particular streets. If they decide on an advertisement, they must, of course, have a high degree of illumination, in fact, excessive lighting, and yellow chemical flame arc lamps, with dioptric globes, are then generally used. On the other hand, if they wish only to light the streets sufficiently for all practical purposes, the metallic-filament lamp meets all requirements.

The principal streets of most large towns have for some time been lighted by means of the old open type white arc lamp, and, therefore, it is only a question of conversion to either flame arc lighting, or metallic-filament lamps; as the tendency at present appears to be towards the latter method, the writer proposes to confine his remarks to that class of lighting.

In districts supplied with direct current from a three-wire system, it is usually found that the arc lamps are arranged in series of 10 connected across the outer conductors of the system. In that case the easiest method of conversion is to arrange for one high-candle-power, or a group of low-candle-power, low-voltage lamps on each post, and to run these posts in series in the same manner as the arc lamps. This system, however, has many drawbacks when compared with a group of high-voltage lamps on each post, arranged in parallel between the outers and middle wire of the system. With the series method it is found that it is a difficult matter to maintain an equal pressure across the supply terminals at all the posts connected in series, due to the varying resistances of the lamps, and also some automatic device has to be provided to cut in a substitutional resistance or spare lamp in case of lamp failures. When a group of small lamps on each post is decided upon, in preference to one large lamp, in order to prevent a post being in darkness, the automatic device usually only takes care of one lamp, and then in the event of a further failure an increased pressure is put on the remaining lamps on that post, often resulting in their destruction, and the extinction of the circuit.

It therefore appears to be advisable to connect the lamps in simple parallel, although this obviously necessitates the provision of a service to each post from the neutral conductor, but this is compensated for by the advantage of being able to fuse each post separately and thus have only one post affected, instead of the whole series of lamps, in the event of a fault occurring above ground.

It is assumed that the metallic lamps are to take the same amount of power as the arc lamps, and it will, therefore, be necessary to feed the old arc lighting circuits in the middle, if the current density in the underground public lighting mains is to be kept the same as hitherto. This is also advisable in order not to increase the number of switching points. This arrangement has the advantage that a faulty section of the cable can be cut out and all lamps kept in lighting in case of a fault on the underground mains. The suggested arrangement of connections is shown in fig. 1 (p. 34), where the full lines represent the original arc lighting cables, and the broken lines the additional services, &c. A D.P. fuse-box suitable for fixing in each post and provided with a looping-in terminal on one pole, so that a faulty cable can be disconnected, is shown, as well as the complete gear for the new switch posts.

**Horsham Lighting.**—The U.D.C. has decided to light the Oakhill district by means of electric lamps.

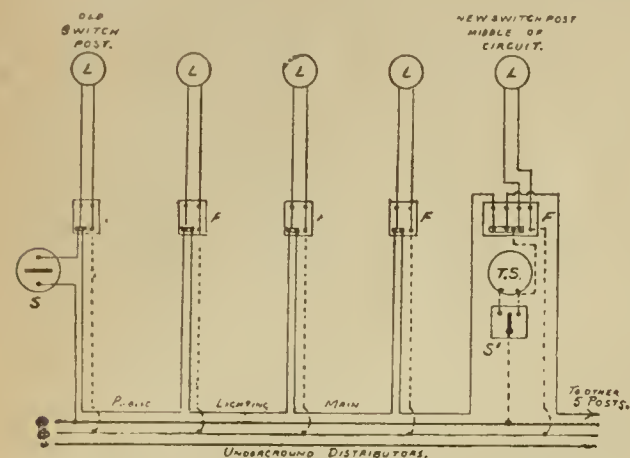
A Committee has been appointed to consider the advisability of erecting a refuse destructor at the electricity works.



The question as to the type of lantern to use should also receive very careful consideration, and doubtless most

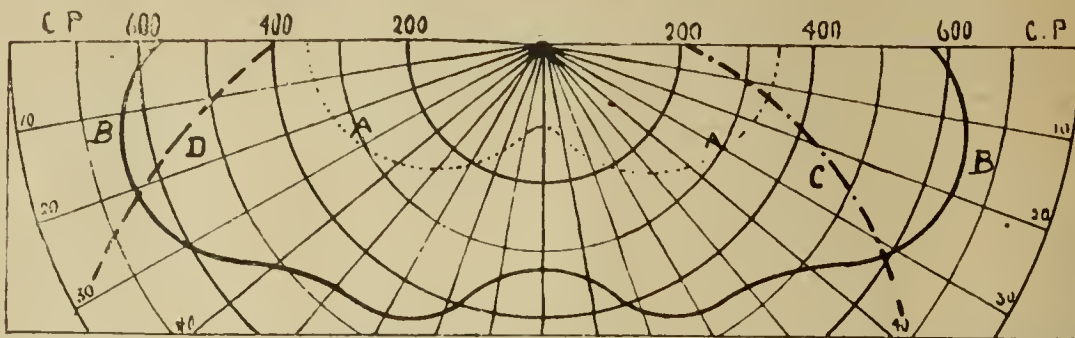
this switch is that the commutator is moved only when the supply is off, and therefore any possibility of sparking is eliminated.

The four lamps are fixed to a frame supported by an insulated anti-vibrator, and when the lamps are removed from the holders the case of the lantern can easily be lowered to inspect the automatic switch and wiring.



L, Lanterns; F, Fuse boxes in posts; S, Old circuit switch and fuse; S', New hand switch; T.S., time switch.

FIG. 1.



A, C.P. of four tungsten lamps, 450 watts; B, C.P. of four tungsten lamps in Harrison lantern; C, C.P. of 500-watt open arc lamp; D, C.P. of 350-watt flame arc lamp.

FIG. 3.

engineers will specify the minimum illumination to be obtained on the street surface with lamps of specified wattage and efficiency, in addition to the general construction of the lanterns. The type of lantern adopted at Battersea, which has given a very good illumination, is shown in fig. 2. It is of Mr. Haydn Harrison's standard type, with slight modifications, and is arranged to take four lamps, two of which are automatically switched out at midnight by means of a special switch placed in each lantern. This enables the candle-power of each post to be reduced to half at midnight,

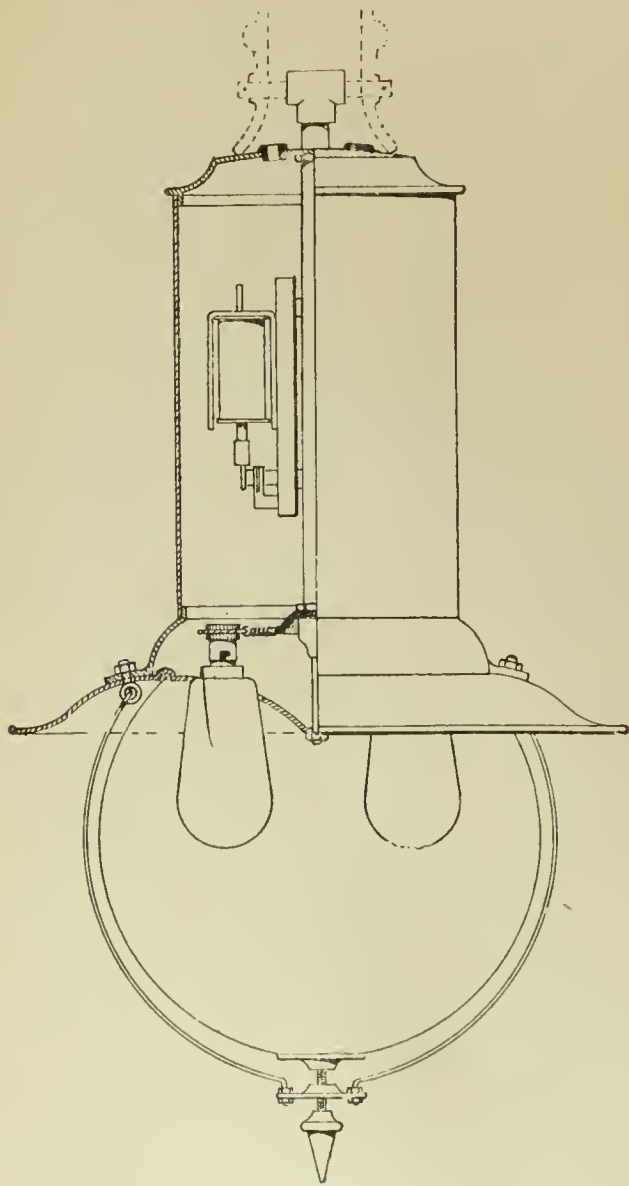


FIG. 2.

without laying special switch wires; this is certainly preferable to extinguishing alternate posts, which was the practice with the old arc lamps.

This special automatic switch, shown in detail in fig. 4, is operated by arranging for the time switch controlling the circuit to flick off the supply at midnight. The coil A through which the supply to the two all-night lamps passes and which holds up the core B, now allows it to fall, and in doing so it moves the commutator switch C and cuts out the two half-night lamps, so that when the supply is resumed only two lamps come into lighting. A distinct feature of

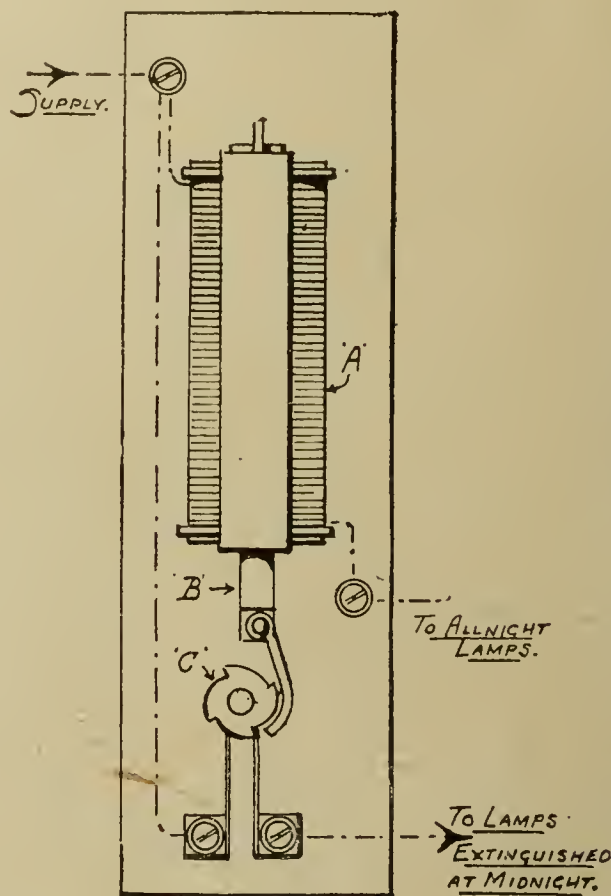


FIG. 4.

Curve B, fig. 3, shows the illumination produced by the reflectors fixed to these lanterns, and it will be seen that, for street lighting purposes, it is a distinct improvement on Curve C given by the open-type arc lamps.

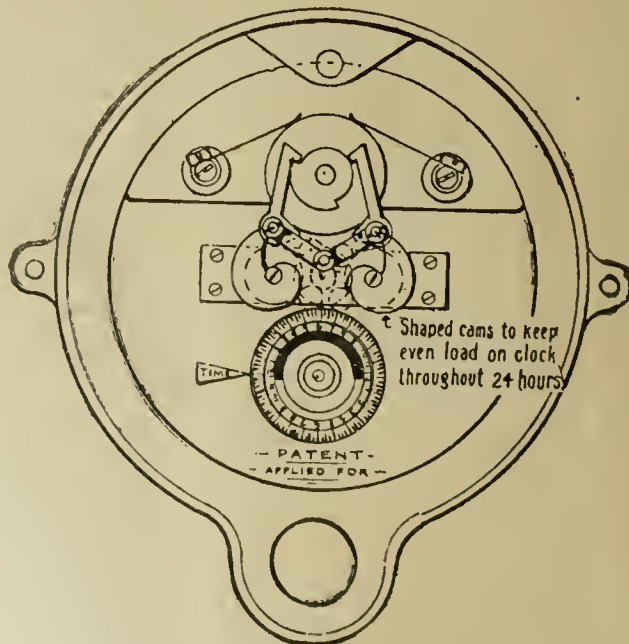


FIG. 5.

The question whether the switching of the circuits shall be effected by hand or automatically depends on local circumstances; but where the district is extensive, it undoubtedly pays to adopt the latter method. These time



switches are usually operated by clockwork and can be rewound, from the outside of the case, by the lamp cleaners on their periodical rounds just as they doubtless wind their own domestic clocks; but the writer has found that it is not advisable to arrange for these men to do the setting for switching "on" and "off," and in any case this would have to be done at least once a week, and then a variation of approximately 15 minutes would occur from the actual time the lights are required. To obviate the necessity for the expense of sending a skilled man to do this periodical re-setting, a simple and inexpensive automatic arrangement has been devised, which merely consists of toothed wheels positively driving the operating mechanism, and it effects the switching on at sunset and off at sunrise every day. The only attention necessary is to move a small lever once every six months. The general arrangement of a small switch of this type is shown in fig. 5, but the automatic setting gear can be attached to any type of time switch.



FIG. 6.

By converting arcs to metallics on the above lines, it will be found that the saving effected in attendance and maintenance costs will, in most instances, repay the cost of conversion in less than two years, and therefore, where open-type arc lamps are still in use—due to the lighting authority probably waiting until the flame arc lamp has reached finality—it would appear to be advisable to change to metallics forthwith, especially as it would be an easy matter to revert to arc lighting in the main thoroughfares, if desired, when the cost of conversion has been repaid.

The whole of the 432 open-type arc lamps which were in use for lighting the main streets of Battersea have now been converted in the above manner (a typical example being shown in fig. 6), and the improved lighting is giving general satisfaction. It was therefore thought that the above notes might be of interest to other engineers who were contemplating alterations in their public lighting.

**Leicester Electricity Supply.**—The T.C. has been recommended to reduce the charge for electricity for cooking and heating purposes to 1d. per unit.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

CANADA'S water powers are not by any means limited to the southern portion of the Dominion. An address was given before the Conservation Commission of Canada a short time ago, by Lieut.-Colonel Wood, in which the following occurs:—

Most of Labrador is a rocky tableland, still rising from the depths, with some old beaches as much as 1,500 ft. above the present level of the sea. The St. Lawrence seaboard is famous for its rivers and forests. The Atlantic seaboard has the same myriads of islands, is magnificently bold, is pierced by fjords unexcelled in Norway, and crowned by mountains higher than any others east of the Rockies. Hamilton inlet runs in 150 miles. At Ramah the cliffs rise sheer 3,500 ft. and more. The Four Peaks, still untrodden by the foot of man, rise more than twice as high again, and the coloration of every splendid line adds beauty to the grandeur of the scene. Inland there are lakes up to 100 miles long, big rivers by the score, deep cañons and foaming rapids, to say nothing of the countless waterfalls, of which the greatest equals two Niagaras.

This vast country is accessible by sea on three sides, and will soon be accessible by land on the fourth. It lies directly halfway between Great Britain and our own North-West, and is 1,000 miles nearer London than New York is. Its timber, mines and water-power will be increasingly exploited.

Labrador is about eleven times as large as England.

The North-Western regions on the Peace and Mackenzie Rivers have water-power, too, and plenty of it. Twelve falls are said to be capable of yielding 300,000 H.P. Two falls, on the Hay River, about 2 miles apart, are reported to be larger than Niagara.

A statement certainly at variance with most people's notions on the subject has recently been made by the Conservation Commission, to the effect that at Niagara Falls there is now available only about one million more horsepower, and that most of this is already leased.

Some details are now available of the water-powers which Manitoba will possess under the new boundary limits. The head of water at various points varies from 96 ft. down to 10.6 ft., and the power from 1,290,000 to 147,000 H.P.

The total H.P. available is estimated at 6,779,000.

At Bassano, in Alberta, the C.P.R. is building a large dam across the Bow River, and an electric railway is to be built from the dam to the town of Bassano. The dam is intended for irrigation purposes, and, incidentally, the town expects to obtain all the power it needs from that available at the dam.

It is amusing to see reported, from time to time, in the English electrical papers, the views which are expressed on the subject of glass screens in front of tramcar drivers. They always seem to be considered dangerous, and, in snowy weather, liable to obstruct the drivers' view. In Canada it would be impossible for the drivers of tramcars to perform their duties in winter time unless they were protected from the weather.

The fronts of all cars here are completely closed in, and have glass all round above a height of about 2 ft. 6 in. The motorman, instead of being frozen to death, is practically inside the car, and besides not having to face the weather, he gets the additional comfort of some heat from the coal stove, which is another necessary adjunct in all cars here in the cold weather.

The glass very seldom gets broken, and as to snow—the driver keeps a broom handy, and whenever the accumulation of snow on the glass obstructs his view he steps outside and brushes it off, which is a very simple, cheap and effective way of getting over the difficulty.

The new Dominion Government appears to be favourably inclined towards the improvement of Toronto's Harbour facilities, and, if present expectations be fulfilled, it will not be a great while before large ocean-going vessels come straight to this busy and rapidly-growing city, whose importance as a trade centre will thereby be greatly enhanced.

**"Hilo" Lamps.**—It may interest some of our readers to learn that the private cabin of the Princess Royal on the ill-fated ss. *Delhi* was equipped with economical ("Hilo") turn-down lamps, which were supplied by Messrs. W. Geipel & Co.



## PROCEEDINGS OF INSTITUTIONS.

## An Automatic Starting Device for Asynchronous Motors.

By N. PENSABENE-PEREZ, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Birmingham, December 13th, 1911.)

SUPPOSE a suitable arrangement of resistances and moving contacts, controlled by centrifugal forces, cutting out the resistances from the phases of the motor while the latter increases in speed at starting. Assume that by providing a sufficient number of contacts, the resistances are cut out gradually, and that the centrifugal forces moving the contacts are opposed by the action of a spring, which brings back the contacts, and thus inserts all the resistances in circuit, as soon as the speed falls below a certain minimum value.

The author shows that, in order to keep the rotor, and, in consequence, the stator current constant in the starting period, the resistance of the starter must be varied according to a certain relation.

In other words, there must be equilibrium between the centrifugal forces, the tension of the springs, and the friction for any position corresponding to a certain resistance and speed given by the above-mentioned formula. The difficulties in the way of the proper solution of this problem are greater than would appear at first sight.

The following is a device, designed by the author, which would fulfil the above conditions. The resistances for a three-phase wound rotor consist of flat strips wound as three separate independent discs and insulated with asbestos paper. These three discs are clamped together with two cast-iron end discs, on the periphery of which is pivoted a bar carrying three arms with three contacts sliding along the polished face of the resistance discs. We may earth the inner extremity of these three resistances and connect the three rotor phases to the other extremity, so that when the contacts move outwards they gradually cut out the resistances; in this case the weight of the arms can be used to help the motion of the contacts. When the rotor phases are connected to the inner rings, of course, this weight will oppose the motion; this arrangement is preferable, as will be seen later. It is this case we will consider in the following:—An auxiliary weight is provided which, through a variable ratio gear, as shown in fig. 1, produces by centrifugal force the motion of the arms against the tension of the spring.

The shape of the gear is shown in fig. 2. The fingers A B engage at normal running conditions, and the ratio being thereby increased, the speed can go down to any prearranged value before any backward motion can take place.

When experimenting with the apparatus described, serious faults were found to exist, and were at first very difficult to explain and eliminate. As soon as the primary switch was closed, the stator

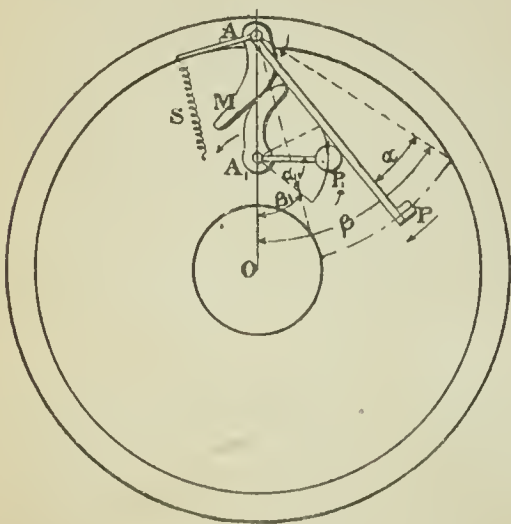


FIG. 1.

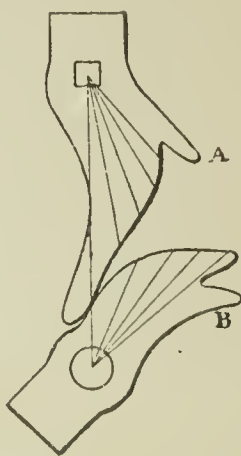


FIG. 2.

current reached the maximum calculated, but this gradually went down considerably below the constant value prearranged, after which, if the load exceeded a certain value, the motor stopped accelerating, and if the load was reduced, the motor suddenly went up to full-load speed after a considerable rush of current. To understand what was taking place, we must introduce another factor—that is, the difference between the static and dynamic friction, or what can be termed the sticking action.

In order to reduce the increase of speed necessary to overcome the difference between static and dynamic friction, the ratio between the spring tension and the static friction must be as large as possible. As soon as the motion is initiated, the friction drops to the dynamic value, and there is an excess of motive effort, and, in consequence, acceleration until the contacts have assumed that position in which the spring balances the action of the centrifugal forces. In this position the contacts stop again. We may assume that the time taken by the contacts to move and stop again is so small as to warrant our considering the speed of the motor constant in this period. The position, then, the contacts are going to take can be easily fixed, being the position for which there is equilibrium

at such a speed in the case of dynamic friction. The process continues in the same way. Now, it is obvious that, while the contacts are stationary on the disks, and the speed increases, the current and the torque of the motor go down, and may fall to such a value as to reach the magnitude of the load torque, in which case the motor stops accelerating.

When the increase in speed necessary to overcome the static friction exceeds a certain limit, it is obvious that the acceleration of the contacts and arms, &c., may be so great as to store enough kinetic energy in the system as to make the contacts overstep the angle of equilibrium corresponding to the speed of the motor. Near synchronism this danger is more pronounced, and large kicks of current were observed, showing that all the resistances were cut out too soon. All these troubles have been practically eliminated by reducing the friction as much as possible and increasing the spring tension.

The time necessary for starting a motor depends on the magnitude of the accelerating torque (that is, the difference between the motor torque and the load torque) and the kinetic energy stored in all the masses driven by the motor at full speed. In any motor controlled by an ordinary starter, the current and the torque fluctuate between a maximum and a minimum value, and this fluctuation is the greater the smaller the number of contacts in the starter. In the case of the automatic starter, the number of steps being very great, the current would drop to 80 per cent. or 75 per cent. of the maximum allowed, and then remain practically constant until the machine reaches full speed. For this reason, the time taken by the automatic starter, as described, is much less than the time taken by a motor controlled by an ordinary commercial starter. Moreover, the losses in the resistance are less. It is to be noted that besides the asbestos paper between turns of the spiral German silver strip no other insulating material is used. This can only be achieved by making the outside cast-iron rings, which clamp each resistance ring, the neutral of the starter, which, therefore, is earthed. The inside rings of the disks are connected to the end of the rotor phases. The weights of the contacts and arms act against the motion. Although this is an inconvenience, the little disadvantage is amply repaid by the simplicity and soundness of the construction.

In the case of a 300-H.P. induction motor made by the Electric Construction Co., Ltd., fitted with a self-contained automatic starter, and designed to start the motor against one-third of full-load torque, this starter is fixed on the arms of the spider, and, the three phases being connected to the outside of the disks, the contacts move outwards. A starter of this description is specially suitable for high-voltage induction motors, as it entirely avoids any danger of large rush of current at starting due to carelessness in cutting out the starting resistance. These large fluctuations of current, as is well known, are very often responsible for surging effect, producing breakdown in the high-tension windings.

## Institution of Electrical Engineers.

## NEWCASTLE LOCAL SECTION.

ON December 11th, MR. C. S. VESEY-BROWN delivered his address as chairman of the Section. He expressed a hope that the proposed new rules, which, amongst other matters, would have to be considered during the present session, would be approached in that spirit which should animate everyone who desired to see the Institution strengthened, and the object for which it was established safeguarded. He regretted that Students did not take a more prominent part in the discussions at Newcastle, but he was pleased to say that arrangements had been made to form a students' section.

Turning to the progress which had been made locally in connection with the supply of electricity, he pointed out that in the short space of 10 years the capacity of generating plant in public power stations had risen from 14,600 to 137,000 kW., the output in units had increased from 4½ millions to 225 millions, and the capital invested had grown from £660,000 to £5,000,000.

During the last 10 years a prophecy of his own, viz., that £10,000,000 would be spent in electrical plant during the following 10 years had been fulfilled, when one considered the amount spent by the various manufacturing interests represented in the railways, shipyards, collieries, &c. He could not hold out the same hope of a million a year for the next 10 years. He could, however, foresee large increases in the direction of railway electrification, and electrochemical and metallurgical processes, which required a cheap and reliable source of supply. Turning to the training of the electrical engineer, he drew attention to the extraordinary number of subjects upon which an electrical engineer might be called to express an opinion, some of them quite alien to the application of electrical science. The subjects ranged from a knowledge of law and accounts to giving an estimate of the annual cost of energy used by an electric motor driving a brickyard as against suction gas with anthracite coal supplied at "next to nothing" per ton. The average man, outside the electrical engineering profession, had not the faintest idea as to the educational training that most electrical engineers had to go through.

The electrical engineer ought necessarily to occupy himself with nearly all questions involved in mechanical engineering, in order to be able to follow the profession of an electrical engineer.

The first element of an electrical engineer's training should be a sound general education, with some knowledge of one or more modern languages, and a good grounding in mathematics.

The student was usually taken from school at 16 to 18 years of



age, and put to either a technical college or a workshop. Having finished a two or three years' course at either of these establishments, he was then launched on the world as a budding electrical engineer. During the whole period of this training, however, little or no attention could be given to what one might term the general knowledge of business requirements, which would be found so necessary later on. He pleaded for a longer period of training, say, not less than four years, and he thought that the remedy for the overcrowded state of the profession was in the hands of those who were in it now.

With regard to examinations, he thought that little or no account could be taken in them of the student's ability to express his ideas in writing. An examination for any particular purpose was not a final test as to a student's ability. Another important qualification was that of being able to express one's self in such terms, in connection with electrical nomenclature, that the ordinary lay mind could, as a rule, grasp the meaning. Ability either to buy or sell, depending upon the direction in which his energies were employed, was an important factor, and another was ability to be able to deal with his fellow man according to the circumstances of the case. The real education of an engineer only commenced when he received the fruit of his first week's work, and his whole career was one long process of training and development.

DR. W. M. THORNTON, proposing a vote of thanks to Mr. Vesey-Brown, strongly advised students not to take up electrical work too early, but to get a thorough grounding in mechanical engineering. Examinations could not be avoided altogether, but nowadays a man was rated not only on the results of written examinations, but on the work which he had done throughout the session, and the results of his practical work in the laboratory. It was usual for the written papers to carry about 40 per cent. of the total marks for the session, so that a man whose course and practical work were perfect would probably have to do very badly indeed in the written papers not to pass.

### The Röntgen Society.

AT the meeting on December 5th a lecture was delivered by PROF. W. H. BRAGG, of Leeds University, on "The Energy of the X-ray." He pointed out that many of the phenomena of light appeared to fit better into the corpuscular theory than into the wave theory, and this was equally true of the X-rays. It was the function of the X-rays to produce ionisation in the air through which they passed, and to excite swiftly moving electrons in the material upon which they struck. When the ions were made by the passage of rays in a gas, the electrons went away from the atoms with comparatively small speed, like fruit dropping from a tree which had been struck. On the other hand, electrons caused by the X-rays impinging on a solid substance were possessed of great speed and had the power of causing phosphorescence. He regarded the X-ray as something which kept its energy to the end, which did not spread in transmission, and which, on striking an atom, imparted the whole of its energy to one electron. It was this electron and not the X-ray—an electron within and belonging to the human body in the case of a radio-therapeutic application—which did the work.

In the course of the subsequent discussion, Mr. W. Duddell said that if he understood Prof. Bragg aright, he regarded the transference of energy by means of the X-rays, not as a general radiation out into space so that the energy fell off at any point according to the "square" law, but as a form of transmission in which, by putting energy in at one end, practically the whole of the energy came out at one point at the other end. It was necessary, therefore, to imagine the transmission of energy through the ether along a definite line without any sideway loss, and the difficulty was to understand what possible mechanism there was in the ether to transmit energy in that form.

### The Physical Constants of Aluminium.

THE FARADAY SOCIETY finished their session on December 6th with a very full programme of papers; of these, some two or three were of general technical interest. Dr. J. A. Harker, F.R.S., was in the chair.

DR. F. J. BRISLEE, of the British Insulated and Helsby Cables, Ltd., gave an account of his recent determinations of the density and coefficient of expansion of aluminium. It may seem strange that these physical constants of so important a metal as aluminium should still remain uncertain, but it is largely accounted for by the fact that earlier determinations were made on specimens of doubtful purity and unknown composition, while the present measurements were made on the remarkably pure commercial brands now supplied by the British Aluminium Co., Ltd., and the Société Electrometallurgique Française. The samples used in these measurements contained about 99½ per cent. aluminium; the impurities were chiefly iron and silica, of which about ½ per cent. of each was present.

The specific gravity was determined upon the cast metal, upon hard-drawn ⅜-in. rod, soft annealed ⅜-in. rod, and also upon remelted aluminium, and the measurements were made both by the ordinary method of weighing in air and water, and by the displacement method, which was employed for fine wire. The corrected results of a large number of determinations averaged 2.708 for cast metal, metal on which a large amount of work had not been done, and 2.705 for hard-drawn rod. It is strange that the value for hard-drawn rod should be lower than for the cast metal, but some few measurements on metal which had been worked

gave a value as high as 2.72. The density of remelted aluminium was found to be 2.68. This drop in density on remelting was stated in the discussion to be due to absorption of gases, either nitrogen or hydrogen. It is well known that many molten metals absorb gases and retain them in rapid cooling, but it is not usually realised how disastrous the presence of a small quantity of gas may be in many instances. Dr. Seligman pointed out that there had recently been quite an epidemic of over-heated aluminium on the market, carrying quantities of gas, and Dr. Harker stated that the National Physical Laboratory, realising the importance of the matter, was carrying out experiments on the absorption of gas by aluminium. It seems probable that the low value for the density usually given in the text-books, namely, 2.65 to 2.67, is to be ascribed to the presence of gases in the samples tested, so that Dr. Brislee's figures are seen to be of real importance.

The density of rolled sheet, which is of great technical importance, does not appear to have been determined by Dr. Brislee, but it was given by Dr. Seligman, as a result of his own determinations, as 2.727.

The coefficient of linear expansion was measured directly by determining the increase in length of a rod of the metal, about 1 metre in length, when heated from 10° C. to 100° C. For details of the apparatus used, and of the corrections allowed for, reference must be made to the original paper; it will suffice here to give the formulae from which variations in length at any temperature can be calculated:—

$$\begin{array}{ll} \text{Hard-drawn aluminium.} & \text{Annealed aluminium.} \\ L_t = L(1 - 0.00002432t). & L_t = L(1 - 0.00002454t). \end{array}$$

### The Benkö Primary Battery.

SOME of the latest types of this battery were exhibited at the meeting of the FARADAY SOCIETY by MR. W. R. COOPER. Its original form was described in our issue of June 2nd, 1911, and it will be remembered that its essential feature is the use of a porous carbon electrode, through which the electrolyte (sodium bichromate) flows under pressure, thus reducing polarisation to a minimum.

In the new form of cell exhibited, the electrolyte passes through the carbon by diffusion, very concentrated electrolyte being introduced into the outer, and water into the inner compartment; or fairly strong sulphuric acid may be used in the outer and strong bichromate solution in the inner compartment. In either case the solution round the zinc is only very slightly acid, and a zinc efficiency of 90 per cent. is claimed.

The diffusion type of cell cannot be used to give current continuously like the pressure type. A cell weighing 5 lb. (excluding electrolyte) and measuring 6¼ in. long, 1½ in. wide and 6¼ in. high gave a current for 8 hours daily as follows:—

1st day ...	...	...	...	0.25 to 0.24 amp.
2nd " ...	...	...	...	" " " "
3rd " ...	...	...	...	fell to 0.22 "
4th " ...	...	...	...	" " 0.20 "
5th " ...	...	...	...	fell off seriously.

A current of 0.25 ampere is regarded as normal for the size of cell, in which the electrolyte amounts to about 200 c.c. and contains 170 grs. of sodium bichromate and 250 c.c. of sulphuric acid per litre. By using a more concentrated electrolyte the E.M.F. (2 volts) can be maintained longer.

The pressure type of cell, in the case of a unit weighing 10 lb., gives a steady current up to about 25 amperes at 1.5 volts.

The diffusion cells are likely to prove very useful in telegraphy, motor-car lighting, and for hand-lamps. Probably, too, a successful miners' lamp will be produced, capable of burning for two periods of eight hours each on consecutive days. This has already been accomplished in the laboratory, but it remains for such lamps to be put into actual use.

### Notes on Standards for Electrical Machinery.

By DR. ROBERT POHL, M.I.E.E.

(Discussion on paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Leeds, December 6th, 1911. For abstract of the paper, see ELECTRICAL REVIEW, December, 29th, 1911.)

MR. WALTER EMMOTT said that Dr. Pohl's speeds, outputs and sizes of machines agreed pretty well with those of manufacturers with whom he had no hesitation in placing orders. Something should be done as early as possible. Their competitors in Belgium, France and Germany had a lower standard of output and lower rating all the way through. If they had a British standard specification on the lines suggested the difficulty would be gone.

MR. H. H. WRIGHT said he thought an organisation already existed which could undertake this question of standardisation—viz., the British Electrical and Allied Manufacturers' Association. Unless they could get all the manufacturers to take it up, standardisation was worth nothing. The German specification as to the commutation of continuous-current machines was too lenient. He was glad to see that Dr. Pohl recommended a flash test of 1,500 volts as a maximum for line voltages not exceeding 500; he had noticed in many cases that 2,000 was specified. Although the machine might actually stand a flash test of 2,000, there was danger of perforating the insulation, and if there was such a weak place it might break down in working a few months afterwards. The standardisation of brushes, from the point of view of the station engineer who might have a great many motors on hire, was of great importance. He did not think there would be any great benefit in reducing the



period of test for small machines, but it might be an economy with larger sizes. At the same time, he did not think it would be advisable to run a machine for mechanical reasons much less than five or six hours.

MR. EUSTACE R. CONDER (communicated) said that Dr. Pohl did not mention a flash test between phase windings in A.C. machines. He considered it very desirable, because it was not uncommon for the insulation to break down between phase windings. Some reputable makers put less insulation between phases than to earth; yet with the system completely insulated, or the neutral point earthed, there was a greater pressure between phase windings than to earth.

MR. LLEWELLYN FOSTER (Manchester) said that now there were so many "intermittently" rated motors, it was essential there should be a sub-division of that particular class. Coal-cutter motors were intermittently used, and were subject to very severe strains; in his opinion they were quite wrongly rated at the present time. A coal-cutter motor of standard make was run for three hours at its full rated load, and its temperature rise was as follows: Armature,  $152^{\circ}$ ; magnet coils,  $151^{\circ}$ ; and the commutator,  $98^{\circ}$  F. As these figures were taken by a thermometer on the surface, it was certain that the inside of the windings was very hot indeed. The question of rating this class of machine was particularly important. He quite agreed that the output of a motor for "intermittent" working should be the output at which, with suitable attention, it could work from week-end to week-end intermittently with the specified load factor. This load factor might with advantage be standardised as  $\frac{1}{2}$ ,  $\frac{1}{4}$  and  $\frac{1}{8}$ . All motors should be clearly marked to indicate whether intended for continuous or intermittent working. The author suggested that there should be practically no sparking; he would rather say no sparking, and also omit any reference to the brushes, which should be fixed. An overload capacity of 25 per cent. and even 50 per cent. was often called for; this must be quite unnecessary. If a bigger machine were wanted, why not ask for it? The method of ascertaining the efficiency should be clearly specified. With regard to a temperature of  $257^{\circ}$  F. as a limit, it seemed to him that the insulation (such as was generally used in the construction of an armature) would be very dry and brittle in quite a short time, if subjected to such a temperature or anywhere near it. The insulation between magnet coils and the frame should be as good as possible, and every care should be taken to make sure that no relative movement took place between the wound coil and the pole. On all motors connected to a three-wire system, there was always one-half the supply voltage between copper and iron, and so between the windings and the earthed frame, ready to break down the insulation. He agreed that the standard temperature of the surrounding atmosphere when making a test might with advantage be increased from  $25^{\circ}$  to  $35^{\circ}$  C. Something might be done in the way of standardisation in arriving at a conclusion as to a suitable allowance for "watts per square inch dissipating surface," for partially and totally enclosed machines. A large manufacturer allowed 3 watt per square inch of total radiating surface, for quite small machines. For larger machines over 5 kW. and under 20 kW., 45 to 5 watt if a fan was used on the armature—these figures to be multiplied by two if the machine were totally enclosed. For large machines, the usual figure appeared to be 2 sq. in. per watt. Regarding the duration of tests, the suggestion made by Dr. Pohl was, to his mind, a good one. "Standardisation of pressures, frequencies, outputs and speeds," was perhaps the most important part of the paper, and nothing would please him better than to see the machines properly standardised. There seemed to be a tendency for the voltage to become lower rather than higher, due to the adoption of the lower-voltage metal-filament lamps.

MR. H. E. YERBURY said it would be to the advantage of the user if some standard could be framed and adopted for the mechanical as well as the electrical design of machines. A standard ratio of bearing surface to diameter of shaft could readily be adopted. Many engineers were unfamiliar with the existing British standards, and it was regrettable to find that some manufacturers ignored the British standard specifications, even when specified by engineers. Whatever standards were adopted, excellence of design and efficiency would still be the predominant factors when orders were being placed. Some of the recommendations of the author were so important that he hoped the Institution, together with the British Manufacturers' Association, would see their way to form a committee and investigate these points and compare them with foreign ratings. The author's remarks re temperature rise and methods of taking it were extremely important, and his suggestion of an internal thermometer was more suitable for general use than the resistance method. Many years ago he experimented with asbestos-covered wires for motor field coils, and the results proved so satisfactory that it was now standard. These coils, of course, were unimpregnated, and they could be worked at a very high temperature without disastrous results.

MR. WILSON HARTNELL said the thickness of the commutator segments must not only be sufficient for reasonable wear, but sufficient to leave a margin of transverse strength when the commutator was worn out. The question of overload capacity from a commercial point of view seemed to have been forgotten by the scientific men, but not by Dr. Pohl. No manufacturer wanted a motor except as a necessary means to an end. In these competitive times the business man wanted to pay a minimum price for the power he had decided to be necessary. The manufacturer should be offered what he demanded, with a nominal margin. In the competition of the world their foreign friends had an advantage, because they specified and made motors to do the working load named, but not to do much more. If we get an inquiry from Japan or South Africa, and used the English specification, the chances

were that the purchaser only perceived that we were dearer than Europe or America. If we were to compete in the business of the world, we must be somewhere in line with the Continental markets. With reference to the temperature rise, the limits must in practice vary with the conditions of service. From many years' experience with repairs of various makes of dynamos and motors, he concluded that the failure of a shunt coil from high internal temperature under ordinary working conditions was very rare.

MR. W. E. FRENCH (Leeds University) said that a one hour test for intermittent working was not a proper test at all. Anyone who had dealt with the testing of motors for intermittent service or traction work would agree with Dr. Pohl that the machine thus tested was far too big for the purpose. With regard to the introduction by Dr. Pohl of flame-proof machines, the adoption of standards appeared somewhat premature. He had investigated this point and found that in very few instances had any reliable tests been made by the manufacturers when adopting the flame-proofing on their machines, and where it had been adopted, they had done so entirely on the German basis. The German tests which had been carried out in Bochum were incomplete; all the tests had been carried out entirely in still atmosphere and not in the presence of coal dust. The velocity of the surrounding atmosphere had a great bearing on the matter, and as they invariably had to deal with considerable velocities in mines, it was very likely that apparatus found safe in the German tests might fail in experiments that were about to be made. Sparklessness was a question that should also be standardised. He could not agree with the first part of the German specification with regard to shift of brushes, but he thought the second part was fair and acceptable, viz., that they limited the outputs of a machine for which the brush position was to remain unaltered from  $\frac{1}{4}$  load to full load; that was all that need reasonably be expected from a machine. That the brush should remain untouched was entirely on the supposition of using commutating poles. The insulation of a machine should be tested hot, or at its final temperature. One minute was somewhat long; half that time was sufficient to show any defects in the insulation, and longer periods only tended to weaken the insulation unnecessarily. In the A.C. system, twice the voltage for the flash tests might meet the case. The author's scheme and tables of speed, &c., were excellent and met the designer's view to the fullest extent, at the same time giving the users a very free choice in speeds and outputs.

MR. T. HARDING CHURTON said the first step that was necessary in order to bring about general standardisation of electrical machinery was the reduction, as far as possible, in the variety of electrical supply systems; so great a variety was unfavourable to the production for stock of machinery such as motors. One difficulty in the way of the adoption of certain standard outputs for motors was that it might tend to impede progress in the design and manufacture of such machines. For example, a motor that at present gave 10 B.H.P. under certain conditions, might, by the use of improved material or ventilation, be made to develop 11 or 12 H.P. Why should the manufacturer be precluded from rating the motor at its true value, in the event of this not happening to correspond with an arbitrary standard? It was most urgently necessary for the Engineering Standards Committee, or the Institution, to take in hand the revision of the Report on the rating and testing of electrical machinery, already too long delayed.

DR. R. POHL, in reply, said he was confident that consulting engineers would ultimately agree that the adoption of standards which had been evolved by consideration of a representative body such as the Institution or the British Standards Committee, was in the interest of all parties concerned. Mr. Emmott's remarks fully bore this out. He was particularly anxious to avoid standardisation where it might impede progress, and for this reason he disagreed with the suggestion of standardising brushes and other mechanical parts. Special machines need not be considered in lists of standard machines. Mr. Foster was one of the few engineers who realised the absurdity of the requirements as to overload capacity to be found in most British specifications. Mr. Hartnell pointed out very clearly that what was wanted was a motor to do certain work, and that it was foolish to specify, say, 25 per cent. overload for a great length of time, or even continually. If they wanted a 10-H.P. motor to run at 25 per cent. overload continuously they might as well call it a 12-H.P. machine. He was fully in agreement with Mr. Foster that no sparking should be permitted which would prevent the commutator from forming and maintaining a bright surface. He agreed with Mr. French's statement that it was very difficult to get constant brush position without interpoles, but nowadays it was out of the question to expect people to move the brushes when the load came on. Where they did not wish to employ commutating poles, there was no alternative but to use a larger machine. In his view the flash pressure to earth should also apply between phases where these phases were insulated from one another under working conditions, for instance, in the case of two-phase windings. For theoretical and practical reasons, however, a different test should apply for windings permanently joined at one or more points, such as three-phase windings. For such machines, he suggested that an insulation test between phases might be carried out by raising the speed and over-exciting the field so as to obtain a pressure between the terminals 50 per cent. above the highest working pressure. It was proved conclusively by the experiments at the National Physical Laboratory, that  $125^{\circ}$  C. was the safe limit for cotton. According to his suggestion, this temperature would only be approached in the central parts of field coils, where they had not to deal with presspahn, but only with cotton. In all modern machines the field coils were thoroughly impregnated after being dried in vacuum, which made them capable of standing a higher temperature than ordinary cotton. He was certain this specification



was quite safe, considering that the external parts of the coils, where they had presapahn and other insulating materials, were, of course, at a much lower temperature. There were numerous machines, the field coils of which had an internal temperature above 125° C., which had been running for 20 years or more, and they were entirely satisfactory. This proved conclusively that the internal temperature suggested was within the limits of safety. Mr. French's statements on the effects of carbon dust on the explosion pressure confirmed the view he had held all along, that the long-joint type of flame-proof motor was greatly superior as regards safety to the grid type. It was a fallacy to believe that standardisation of outputs and minimum performance meant stagnation, otherwise he would oppose it strenuously.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### E.A.C. Starter.

In cases where an ordinary shunt regulator is used in connection with remote control of a variable-speed motor some difficulty arises if the speed variation covers a wide range; if no special device is used, and the regulator has been set for a fairly high speed, there will only be a weak field for starting purposes.

If the shunt regulator is provided with an interlock, so that full field is ensured on starting, the regulator must be operated by hand before the motor can attain the speed it had before last shutting down.

The automatic starter is sometimes provided with an interlock giving full field while starting, and cutting in the resistance in one step after the armature resistance is cut out; this, however, is not advisable where the possible variation of speed on the shunt has more than a small value.

In the automatic starter and shunt regulator, manufactured by THE ELECTRICAL APPARATUS CO., of South Lambeth Road, S.E., this limitation is overcome by cutting this resistance in a number of steps. These steps are cross-connected to the shunt regulator

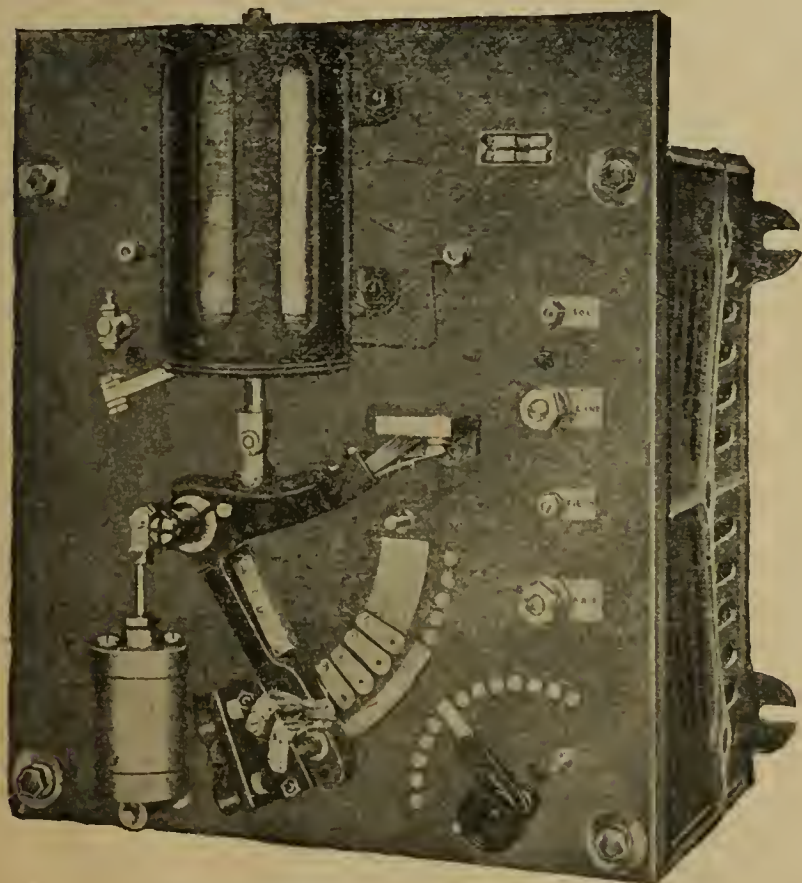


FIG. 1.—E.A.C. AUTOMATIC STARTER.

proper, which is mounted on the same base as the automatic starter. The wiring is such that the motor accelerates in a perfectly steady manner to the speed for which the regulator is set.

The automatic starter proper is of the firm's well-known patented type, in which the main switch and starting lever are operated by the same solenoid; the former always makes and breaks the main circuit with a snap; the latter speeds up the motor at a rate that can be adjusted on the dash pot. The whole forms a self-contained piece of apparatus, which is useful for a wide variety of applications, including the control of printing presses.

### A Sign Projector.

We are informed by MESSRS. SIEMENS BROS. DYNAMO WORKS LTD., Dalston, N.E., that they have taken up the sole selling agency for the United Kingdom for the sign projector described on page 1087 of our last issue, and that it will be known as the "Witerite" sign.

### A Lundberg Development in Two-way Wiring.

MESSRS. A. P. LUNDBERG & SONS, of Liverpool Road, Islington, whose versatility in small switch work is well known, point out that one of the uses of their standard two-way "Tripin" combination is to give two-way control from its own switch and from another, on the fitting in a flexible circuit.

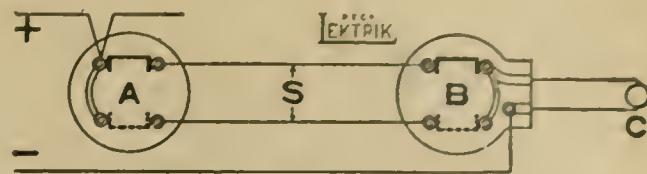


FIG. 2.

Fig. 2 shows at B the modified "Tripin" combination, and at A a fixed "pivot" two-way switch. Between A and B "pivot intermediate" switches may be connected to give additional control points. C is the portable lamp or other current-consuming device, and S the two-way strapping wires.



FIG. 3.

When C is a non-luminous heater, a small pilot lamp P, fixed near B or A (or anywhere else), may be connected, as shown in fig. 3, or P may be a fixed lamp in parallel with the portable one in fig. 2.

### Tee Connection.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have introduced some new porcelain interiors for use with their standard fittings. No. 5,434 fits into a circular box and provides for connections to a switch point and lamp point without severing

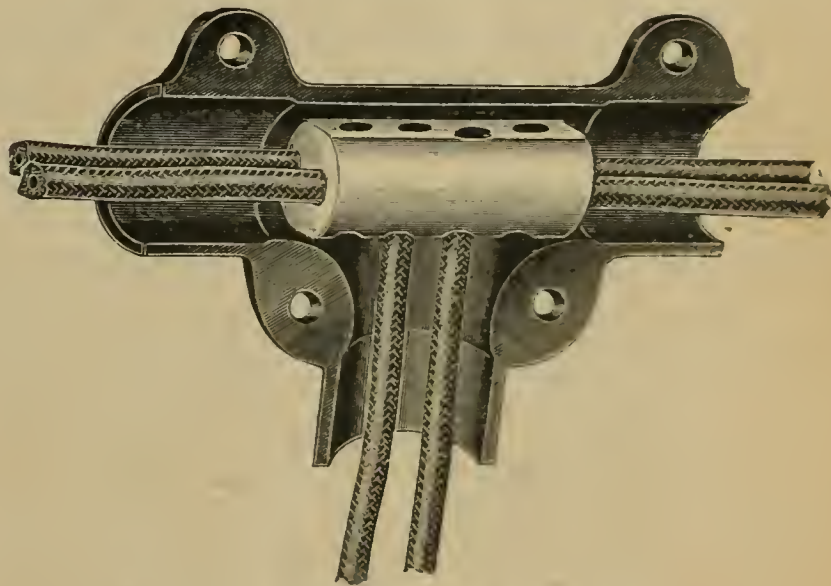


FIG. 4.—SIMPLEX TEE-CONNECTION INTERIOR.

the main wires, which drop into slotted terminals. No. 5,435 is designed for tee connections between small wires, and can be used inside the 3-in. split tee pieces, as shown in fig. 4. A third interior is made S.P., D.P. and three-way, and fits into a 2-in. circular box.

### "M.E." Printing Motor Equipment.

We are informed that this device, though called a "slipping clutch," is really regenerative, supplying current to the mains whenever there is a difference in speed between the motor and the driving pinion. This being so, the system is highly efficient, and the remarks at the end of our note of December 22nd do not apply to it.

### Crypto Transformer.

THE CRYPTO ELECTRICAL CO., of 149, Bermondsey Street, S.E., have introduced a small machine for converting D.C. to A.C. for generating ozone, stepping up to high voltage for insulation testing, &c. It consists of a D.C. motor mounted in the same case with an alternator giving from 100 to 2,000 watts at any voltage from 50 to 250 volts, and any frequency between 40 and 60 with four poles, or between 80 and 125 with eight poles. The motor can be wound for any voltage up to 480, and can also be used as an exciter for the alternator when, in the absence of a supply of electricity, the latter has to be driven by mechanical power.



## NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 28,420. "Miners' safety lamp electric light fitting." D. MORRISON. December 18th.
- 28,425. "Electric drive of machine tools." F. GREENHALGH. December 18th.
- 28,431. "Power systems with electric transmission for operating machinery in factories and other workplaces." N. J. PORTER. December 18th.
- 28,459. "Electric conductors." M. KALLMANN. (Convention date, December 16th, 1910, Germany.) December 18th. (Complete.)
- 28,488. "Electric door operators." T. NAKAHARA. December 18th. (Complete.)
- 28,506. "Holders for articles to be treated by electro-deposition." C. BOIRRE. December 18th. (Complete.)
- 28,511. "Electric incandescent lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 18th.
- 28,576. "Manufacture of metallic-filament incandescent lamps." DEUTSCHE GASGLÜHLICHT AKT.-GES. (Auer Ges.) (Convention date, July 19th, 1911, Germany.) December 19th. (Complete.)
- 28,581. "Electrical driving of ring-spinning and doubling frames." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke, G.m.b.H., Germany.) December 19th.
- 28,610. "Electrical time switches." W. HAMILTON and FERRANTI, LTD. (Addition to 13,704, 1910.) December 19th.
- 28,633. "Multiple grasping ball." E. DUCASSON & Co. (Convention date, December 19th, 1910, Belgium.) December 19th. (Complete.)
- 28,634. "Witness post with automatic regulator of radiation for emitter of Hertzian waves." E. DUCASSON & Co. (Convention date, December 19th, 1910, Belgium.) December 19th. (Complete.)
- 28,635. "Integrator receptor of Hertzian waves with telebolometer and rythmograph." E. DUCASSON & Co. (Convention date, December 19th, 1910, Belgium.) December 19th. (Complete.)
- 28,636. "Isocymogenic apparatus permitting the emission of steady waves in time and space." E. DUCASSON & Co. (Convention date, December 19th, 1910, Belgium.) December 19th. (Complete.)
- 28,668. "Hoisting gear for arc lamps and other uses." F. S. WORSLEY. December 20th.
- 28,682. "Apparatus for lifting the brushes and short-circuiting the rotor windings of alternating-current dynamo-electric machines." BRUCE PEEBLES AND Co., LTD. (Incorporated, 1908) and F. G. BROOKHOUSE. December 20th. (Complete.)
- 28,711. "Electricity controlling switches." Soc. H. LAPIPE and CH. WITTMANN. (Convention date, December 20th, 1910, France.) December 20th. (Complete.)
- 28,715. "Method and device for polarising magneto electrical machines." E. VOLKERS. (Convention date, January 3rd, 1911, Germany.) December 20th. (Complete.)
- 28,720. "Electric heating apparatus for grilling or for other heating purposes." J. LAWRENCE. December 20th.
- 28,747. "Voltage regulators for electric generators." A. H. OLMSTED. (Convention date, December 23rd, 1910, France.) December 20th. (Complete.)
- 28,749. "Electric safety lamps suitable for use in mines." W. H. LOWE. December 20th.
- 28,750. "Dynamo-electric machines." A. JUSTON. (Convention date, December 27th, 1910, Germany.) December 20th. (Complete.)
- 28,751. "Illuminated signs for use with arc lamps." W. J. BEVILLE. December 20th.
- 28,757. "Process for sterilising water or other liquids by means of ultra-violet rays produced in a quartz lamp and apparatus therefor." W. P. THOMPSON. (Ozonges, m.b.H., Germany.) December 10th. (Complete.)
- 28,766. "Dynamo-electric machines." J. LECOCHÉ. December 21st.
- 28,779. "Electrical heating apparatus." E. G. BYNG and C. H. ARCHER. December 21st. (Complete.)
- 28,782. "Electric purifiers for use in purifying flour, grain, rice and other substances." J. L. LAWSON. December 21st. (Complete.)
- 28,787. "Detachable contrivance for telephone mouthpieces or transmitters." W. CARTLEDGE. December 21st.
- 28,808. "Electric batteries." L. FIEDLER and C. HEINRICHSBORFF. December 21st. (Complete.)
- 28,817. "Brush gear for dynamo machines." H. LEITNER. December 21st.
- 28,837. "Wall plugs or other couplings for electrical purposes." V. C. H. GIBSON. December 21st.
- 28,858. "Storage battery separators." W. TAYLOR. December 21st. (Complete.)
- 28,859. "Storage battery separators." W. TAYLOR. December 21st. (Complete.)
- 28,867. "Secondary or storage batteries." VE DE KARAVODINE. (Divided application on 2,493/1911, August 31st.) December 21st. (Complete.)
- 28,868. "Electrical distribution systems." BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. (Addition to 11,979/1908.) December 21st.
- 28,869. "Electric resistance material." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 21st.
- 28,872. "Electric fuses." O. L. PEARD. December 21st.
- 28,879. "Alternating-current apparatus." H. W. SULLIVAN. December 22nd.
- 28,899. "Electrical equipment of roundabouts, scenic railways and the like." L. A. HACKETT and E. W. WHATTAN. December 22nd.
- 28,909. "Protective devices for electric lamps." W. E. PERRY and S. DAVIES. (Addition to 23,781/1911.) December 22nd. (Complete.)
- 28,913. "Electric regulating or equalising apparatus." R. RANKIN and CHLORIDE ELECTRICAL STORAGE CO., LTD. December 22nd.
- 28,942. "Electric switches." P. DRUSEYDT. December 22nd. (Complete.)
- 28,962. "Process and apparatus for the transformation of alternating current into continuous current." J. HERMAN and A. KISS. December 22nd. (Complete.)
- 29,025. "Arrangement for electro-magnetically shifting the points of electric tramways or railways." A. M. WYLIE, JUN. December 23rd.
- 29,027. "Intercommunication telephone systems." G. H. NASH and WESTERN ELECTRIC CO., LTD. December 23rd.
- 29,035. "Electric arc lamps." G. E. TATE. December 23rd.
- 29,062. "Switches for mono-rail telpher tracks and the like." R. DENSTIER AND SONS, LTD., and W. MITTON. December 23rd.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

- OVERHEAD ELECTRIC TROLLEY WIRES. J. W. Thompson and J. Finnigan. 1,295. January 18th.
- APPARATUS FOR THE ELECTROPLATING OF CROCHET-HOOKS AND THE LIKE. Henry Milward & Sons, Ltd., and J. Smith. 1,573. January 21st.
- METHODS OF REGULATING THE FREQUENCY OF ELECTRIC CURRENTS PRODUCED BY ROTARY FIELD GENERATORS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 2,794. February 3rd. (Patent of Addition not granted.)
- ELECTRIC ALARM FOR INCUBATORS AND THE LIKE. A. J. Gaunt and Dairy Outfit Co. 4,580. February 23rd.
- ELECTRICAL TELESCOPY AND THE LIKE. B. Rosing. 5,259. March 2nd.
- TWIN OR MULTICORE ELECTRIC CABLES. C. J. Beaver and E. A. Claremont. 9,523. February 19th.
- ELECTRIC ARC LAMP ELECTRODES. Firm of Geb. Siemens & Co. 13,817. June 8th. (June 29th, 1910.)
- MEANS FOR SUPPORTING FIRE EXTINGUISHERS, BATTERY CELLS AND THE LIKE. R. Macgregor. 14,586. June 22nd.
- ELECTRICAL CIRCUIT-BREAKER. Veritys, Ltd., and P. A. Hirsch. 14,812. June 26th.
- ELECTRICALLY-ACTUATED SEWING MACHINES. N. Redsamen. 15,690. July 6th.
- APPARATUS FOR ELECTRIC COOKING AND HEATING. B. Nightingall. 15,899. July 8th.
- PROCESS FOR MAKING ELECTRIC CONDENSERS. Firm of Robert Bosch. 17,438. July 31st. (October 3rd, 1910.)
- METHOD OF USING ELECTRIC BATTERIES FOR SUPPLYING LAMPS. Chemische Fabrik Friesheim-Elektron. 22,441. October 9th. (May 24th, 1911. Addition to No. 15,447 of 1911.)

## The King's Visit to India.—THE ILLUMINATIONS.—

An Indian correspondent has furnished us with the following particulars of the scheme and plant employed for the illumination of the Great Indian Peninsula Railway Co's Administrative Offices, Victoria Terminus, Bombay, on the occasion of the King's visit:—

"The scheme, being the largest attempted in Bombay, was carried out in the following colours:—White, red, green, and purple. The total number of lamps used was about 6,200, made up as follows: 2,450 5-C.P., 2,500 8-C.P., and 900 16-C.P. carbon-filament lamps; and 350 50-C.P. metal-filament lamps; also eight flame-arc lamps, four 12-ampere, and four 9-ampere, which were used to light the interior of the Dome to show up the large stained glass windows. Two 6-ampere enclosed arcs, with red globes, were used under the centre porch.

"As far as possible the architectural lines of the building were followed, mostly in white, and all the windows were lit up from inside by hidden lamps and screens placed directly behind the windows, red and green lamps being used. Red lamps were arranged with shades and screens in such a manner as to hide the lamps and give a red reflection through the fretted balustrade, and also for outlining the pillars and arches of the verandahs. From the mouths of the 100 odd gargoyles were hung one or more 50-C.P. metal-filament lamps dipped purple, enclosed in frosted or opalescent globes, and over the central clock was fixed a fine scroll device of illuminated crystal, bearing the inscription, 'Hail, Emperor.'

"Advantage was taken of the opportunity to utilise some of the plant which had come over for the Jhansi workshops. Two 250-KW. sets were erected temporarily behind the offices, the steam for these being obtained from two large locomotive boilers at 180 lb. pressure. The switchboard was made up especially for illumination purposes, and consisted of two generator and eight feeder panels. Over the latter was fixed an illuminated plan of the building, which was arranged to indicate the position controlled by each feeder, and which lit up as the switch was closed. About 20 miles of wire were used, and the total load was over 212 KW.

"The whole of the frontage and south side were illuminated. The scheme was an undoubted success, and both the Viceroy and the Governor of Bombay, Sir George Clark, expressed their appreciation.

"Other buildings which were illuminated by gas or oil were far from being a success. Many lights were out, and the lighting looked very dull compared with those lit by electricity.

"Most of the material for the railway company's offices was supplied locally by Messrs. Greaves, Cotton & Co. The premises are the finest railway offices in the world."

A London visitor who was in Bombay at the time, writes to us commenting in terms of high praise upon the general effect of so beautiful a scheme, from a spectator's point of view. He says:—"I was fortunate enough to see all the illuminations in London at the time of the Coronation, but the finest work there falls into insignificance at the grandeur and originality of this masterpiece of electric illumination. In my opinion, no such attempt has ever been made before, and certainly no attempt has ever met with such absolute success. I hardly think the true beauty of the scheme lies so much in the blaze of light with which one is greeted, as the perfect harmony in the blend of colour, the general effect being such as to leave nothing to be wished for—no regret to be expressed.

"I think it impossible that Mr. A. Dixey, who was responsible for the whole work, can have received half the praise which is his due, and it is for that reason that I confidently ask you to kindly include these few lines in the columns of your paper."

**Southern Nigeria.**—Provision is made in the estimates for 1912 of the Southern Nigeria Government for a plant to utilise the water power of the Kwa Falls in the generation of electrical energy for lighting and power purposes at Calabar.



# THE ELECTRICAL REVIEW.

Vol. LXX.

JANUARY 12, 1912.

No. 1,781.

## ELECTRICAL REVIEW.

Vol. LXX.]

CONTENTS: January 12, 1912.

[No. 1781.

Page

The Association of Consulting Engineers ... ..	41
A New Unit—the "Thermal Ohm" ... ..	43
China Awake ... ..	43
Electricity for Crucible Work ( <i>illus.</i> ) ... ..	44
Electric Power for the Panama Canal.—I. ( <i>illus.</i> ) ... ..	45
Correspondence :—	
Small Electrical Exhibitions ... ..	46
Imperial Telegraphic Communication ... ..	47
The "Cole" Code ... ..	47
Electricity in the Textile Industries... ..	47
Diesel Engines ... ..	48
Branch Office Costs ... ..	48
Electricity in the Home ... ..	48
Capital and Labour ... ..	48
Proceedings of Institutions :—	
An Automatic Starting Device for Asynchronous Motors (discussion) ... ..	49
Magnetic Apparatus for Testing Endurance ... ..	49
Institution of Electrical Engineers ... ..	50
Small Electricity Supply Undertakings ... ..	50
The Electrical Engineering Laboratory at the Heriot-Watt College, Edinburgh ( <i>illus.</i> ) ... ..	50
The Physical Society Exhibition ( <i>illus.</i> ) ( <i>continued</i> ) ... ..	52
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ... ..	53
Business Notes ... ..	54
Electrical Plant at the Buxton Lime Firms' Quarries ( <i>illus.</i> ) ... ..	59
Notes ... ..	66
City Notes ... ..	68
Stocks and Shares ... ..	69
Electric Tramway and Railway Traffic Returns... ..	70
Share List of Electrical Companies ... ..	71
Various Records in Central Stations ... ..	73
Notes from Canada ... ..	73
Electrical Development in Industrial Areas ... ..	74
Reviews ... ..	76
Standards for Electrical Machinery ... ..	77
Duddell-Mather Wattmeters for Measuring Dielectric Losses at 30,000 Volts ( <i>illus.</i> ) ... ..	78
Parliamentary ... ..	79
New Patents Applied For, 1911 ... ..	80
Abstracts of Published Specifications ... ..	80
Contractors' Column... ..	Advertisement pages xxiv and xxvi

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume. CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly's).

1912 EDITION IN  
PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.

## THE ASSOCIATION OF CONSULTING ENGINEERS.

THE inaugural meeting of the Association of Consulting Engineers is to be held next Monday afternoon in the Lecture Hall of the Institution of Electrical Engineers, to which we understand all practising consulting engineers are invited.

It may be remembered that when the proposals to form such an Association were first made we took strong exception to the condition that a member must be a corporate member of the Institution of Civil Engineers, and also of the Institution representing the particular branch of the profession in which he practises. This condition has now been withdrawn, so far as compulsory membership of the Civils is concerned, and other conditions of a negative character have been introduced, to which we offer no objection. These are to the effect that a member must not be connected with any contracting or manufacturing firm, company, or business with whom he may have occasion to deal on behalf of his clients; he must not be connected with any engineering insurance business; nor with any company or business which advertises or canvasses for consulting work.

Among other restrictive conditions to which no serious exception can be taken are those which prohibit members from advertising for consulting work, or replying to advertisements for consulting engineers; and the receiving of royalties on any patented article used on the work for which he is acting as consultant, without first having the clients' permission to do so.

Some of the rules might, at first sight, appear to suggest that the Association disapproved of its members taking out patents, or of having any interest in a trading concern; but when we recall the fact that the honorary secretary himself has taken out several patents in connection with wiring systems, and if we are not mistaken, is a director of a contracting company which undertakes wiring work in connection with schemes in which he is interested; and other prominent members of the council are patentees of, and are interested in, the manufacture of apparatus such as electricity meters, it is clear that such a narrow interpretation of the spirit of the rules in an incorrect one. Indeed, such a restriction would have excluded men like the late Lord Kelvin and Prof. Ayrton, and would exclude such living celebrities as Edison, Tesla, Marconi, Sir Oliver Lodge, and quite a number of our most eminent professors of electrical engineering.

Again, the rule as to advertising, and replying to advertisements, is perhaps subject to an occasional exception, for we remember that no less important a municipality than Johannesburg advertised for a consulting engineer, and that a partner of the firm of consulting engineers who were appointed is a member of the council of the new Association. That there is no inherent objection to publicity is evident from the beating of the big drum which has accompanied the formation of the Association.



We mention these points lest some of the younger members of the profession might be deterred from joining on account of the apparent stringency of the code of etiquette.

And what, after all, is the object of the newly formed Association? According to some of the inspired articles which have appeared in the daily Press, the chief object would appear to be the "protection of the British public from serious risks of commercial fraud."

We note that "an eminent consulting engineer," interviewed by the *Standard*, said "this will afford a much-needed protection for the public, particularly for the humble ratepayer in progressive municipalities."

The amount of claptrap of this kind which has appeared in the public Press, obviously inspired from headquarters, is almost enough to create a prejudice against, or aversion to, the Association in the mind of the consulting engineer who is imbued with the true professional spirit, with its distaste for self-advertisement.

The *Times* puts the matter a little more soberly when it says, "there can be no harm done to the general public by this action of a number of well-intentioned consulting engineers who choose to set themselves apart by subscribing to rules governing the manner in which they elect to do their business." It goes on to utter a word of warning to those who contemplate joining the Association, and points out that those benighted specialists who may not be eligible for membership under the present rules may resent this presumption of a monopoly in the consulting business.

For our part, we see no objection whatever to any body of men joining themselves together in an association such as is proposed, if by so doing they think they can be of mutual assistance in protecting their particular interests. We could only object—and we certainly should do so most strongly—in the event of the Association seeking to arrogate to itself a monopoly, and to conduct its operations in such a manner as to be injurious to the interests of properly-qualified engineers who are not members of the Association. To put the matter quite frankly, we look upon the Association as a sort of trade union formed for the sole object of advancing the interests of its members, and this is the light in which it will be regarded by those who are considering the advisability of joining it. If, incidentally, as its promoters claim, "it affords a much-needed protection for the public," so much the better, but it is no use pretending that anyone will join the Association with this object, and it is the veriest cant and hypocrisy to put forward the idea that this is the principal object of the Association.

The fact is that what has in the past been regarded as the special preserve of the consulting engineer has now become the happy hunting ground of poachers, among whom may be counted the engineers of machinery insurance companies, contractors and manufacturers, public supply company and municipal engineers, and the free-lances who are to be found in every industry. The new Association hopes to be able to retrieve the lost ground, and claim it as the monopoly of its members, and to warn off all trespassers, who are to be considered as poachers. A point which may need some elucidating is as to what means are to be taken to prevent them practising as consulting engineers.

We cannot seriously contemplate a group of consulting engineers in immaculate top hat and frock coat picketing the offices of a Borough Council or a factory in order to prevent by "methods of peaceful persuasion," or otherwise, a non-society consulting engineer from carrying out his legitimate work, for which he may be more qualified than the pickets themselves. We at once dismiss this method as in the highest degree improbable. There is another method by which the Association may seek to prevent non-members obtaining employment, and that is by circularising his prospective employers. This is the method which is foreshadowed in the notices which have already appeared, and this view is borne out by the official documents issued by the Association's honorary secretary. We gather that one of the first duties of the Association will be to compile a list of members and circulate this freely among public and business institutions. The list will no doubt be accompanied by a note warning the recipient against the employment of any professional engineer whose name does not appear on the list.

To do this would be to follow the ill-advised precedent

established by the Institution of Electrical Engineers, but we think it is a somewhat dangerous course to take, to say nothing as to its lack of conformity with the rules as regards advertising. In point of fact, if we cared to be hypercritical we should say that one of the avowed objects of the Association is to advertise its members *en bloc* whilst forbidding them to advertise individually. We have no doubt that the Association would consider itself justified in sending a list of members to anyone who advertised for a consulting engineer, although individual members must not reply to such advertisements. We wonder if the rules would permit of the secretary underlining the names of those members who specialise in the class of work advertised for. If one reflects for a moment on this aspect of the matter quite a number of interesting possibilities suggest themselves, for after all consulting engineers are human beings.

We suggest that this method of picketing by circularising is a dangerous one, for if a non-member could show that his lawful business had suffered, if, for example, he could show that he had lost a client, or a prospective client, as a direct result of the action of the Association, he would surely have a very strong case in a legal action for damages. A single individual would be at a disadvantage in fighting an association, so that a natural sequence to the methods proposed, would be the formation of a rival association of consulting engineers to combat the tactics and influence of the one in question. This we know has been already suggested, but we sincerely hope that this multiplication of antagonistic sectional associations will be avoided.

It is an open question whether or not this Association has come too late to effect the objects aimed at. If there existed a proper *esprit de corps* in the electrical industry, such an Association would never have been proposed. We can appreciate and sympathise with the hard lot of the consulting engineer, who, trying to adhere to a strict code of professional etiquette, finds himself in competition with others whose only code is to get work by any means whatever, quite regardless of whether they are competent or not to carry it out. This kind of competition, however, is not confined to consulting engineering. What has happened in this department has happened in all the others, and the formation of the Electrical Contractors', the Cable-Makers' and the Manufacturers' Associations, are similar attempts to departmentalise the industry with a view to the prevention of unfair and ruinous internal competition and the poaching on each others preserves. All these things are the result of the lack of recognition of the community of interests which ought to exist between the various sections of the industry, and it is this which is making what ought to be a great and profitable industry into one in which it is scarcely possible to make a profit, and one of which, in consequence, capital fights shy.

The electrical contractors when they formed their Association found that they were too late to prevent the manufacturers dealing directly with the buyer, and giving to practically everybody the best trade terms. The best mutual arrangement that could be effected was that manufacturers should only give trade terms to buyers who had their own engineering departments. In practice, all this amounts to is that, if a buyer has a handy man who can erect a bit of cable or a motor, he is entitled to the very best trade terms, and neither a contractor nor a consulting engineer is afforded the slightest preference. The difficulty is that the various sections of the industry do not appreciate that it would be to their mutual advantage, and to the advantage of the industry generally, to recognise and acknowledge that every employer who earns his living in any department of the industry, contracting, manufacturing or consulting, is in the trade, and therefore entitled to better treatment than is accorded to an outsider who, being in a different trade, is, no doubt, amply protected by his fellow tradesmen, and cannot expect the electrical trade to protect him as well.

Until this community of interest is recognised, we shall go on as at present, in a spirit of antagonism and ruinous competition between not only the members of each section, but between the members of different sections.

This may be considered somewhat of a side issue, but it is not; it is the root cause of the whole movement towards the formation of groups for the purpose of self-protection.



This movement, whilst it has, like all trade unionist systems, its good points, has also its pitfalls, one of which is the desire to boycott, coerce or intimidate a recognised member of the industry because he does not happen to be a member of this or that group. We condemn this kind of thing when it occurs in workmen's unions, and we cannot therefore consistently applaud it in Associations of Employers. So long as a man plays the game, he is none the less entitled to consideration if he prefers to remain what one might—for lack of a better expression—term a non-unionist. On the other hand, if an Association is to be of real benefit to the class for which it is intended, it is essential that it should have the loyal co-operation of all who are eligible for membership.

#### A New Unit—the "Thermal Ohm."

COMMENCING with a pertinent comment on the different attitude assumed by the average engineer as regards the output and efficiency of his machines and his brain—so that, though he will cavil at small wastages in the former, he is content to use many cumbersome methods of calculation—Mr. Carl Hering has recently discussed the direct and indirect advantages of the decimal and absolute systems of units, and shows how, by the adoption of a unit for a quantity hitherto expressed by no unit, a certain class of thermal calculation can be greatly curtailed and simplified. The adoption of "home-made" units for various quantities—differing according to the views, needs and ability of various writers—has already led to endless confusion and loss of time, but the present "thermal ohm" appears to be wholly useful.

For the expression of static amounts of heat energy there are many units in vogue (large and small calorie, B.T.H.U. and so on), but the important calculations concerning heat transmission by conduction, convection, and radiation have no definite units. There is no definite unit of thermal resistance to heat transference by conduction: usually the reciprocal quantity "conductance" has been employed, but most practical cases involve a number of materials in "series," and contact resistances to heat conduction are often of prime importance (as in boiler tubes, for instance, where the "skin" heat resistance is far more important than that of the tube metal itself).

If the bodies concerned are in "multiple," their heat conductance is a more convenient quantity than their heat resistance, which should, however, be used in all cases of bodies in "series." Taking into account the various heat, area, and length units now in every-day use, there are at least 72 fairly rational units of thermal conductivity.

In endeavouring to mend this state of affairs, Mr. Hering works from the C.G.S. units, since these avoid all but decimal conversion factors in their relation to absolute units. The absolute unit of transmission of energy is 1 erg per second, and the practical unit, the watt, =  $10^7$  ergs/sec. Now, 1 watt = 1 joule per sec., and if all thermal constants were reduced to joules, the complexity of heat calculations would at once vanish. This suggestion is too revolutionary for immediate adoption.

Heat flow may be calculated according to a thermal Ohm's Law, viz.,  $w = T/R$ , where  $w$  = heat flow;  $T$  = temperature drop, and  $R$  = thermal resistance. Measuring  $T$  in degrees Centigrade (in the absence of absolute units), and  $w$  in watts,  $R$  is to be expressed in such units that the coefficient of the above equation is unity; i.e., unit thermal resistance is that which allows 1 watt flow per  $1^\circ$  C. temperature drop.

For electric furnace and similar work, no better system could be desired, and even in other cases, it is simpler to work in thermal ohms and watts, merely converting the final result to the old unit desired.

Heat resistivity being tabulated for various bodies in thermal ohms per cm. cube or per inch cube, the total resistance of a block of material is  $R = r \cdot L/s$  thermal ohms, where  $r$  = specific resistance;  $L$  = length;  $s$  = section (cm. or inches being consistently used throughout). In innumerable cases, the new system saves much time and labour

in designing or comparing simple or composite heat-insulating walls.

A thermal ohm based on C.G.S. units is suitable for international adoption, and, as such alone, would be invaluable. The (gm.-calorie, Centigrade, cm. cube) unit is not absolute, for there is no heat unit in the absolute system.

In *Metallurgical and Chemical Engineering* for December, 1911, Mr. Hering gives the thermal resistivity of about 150 substances in thermal ohms; the values range from 0.24 to 3.0 for metals; 25 to 180 for bricks and stones; and 250 to 5,000 for granular and fibrous materials, and are thus of convenient magnitude.

#### China Awake.

THE Westernising movement in China, to which we have made allusion here on several occasions, when discussing possibilities for future British engineering and electrical trade in that part of the world, has spread with a rapidity which is almost astounding to those who have been watching the course of events for some years past. That a vast awakening was taking place, and that it was improbable that the Chinese nation would ever again be able to throw off Western influences, has been recognised, but few of us expected to see so complete an upheaval as the past few months have brought. The Republican Manifesto issued by President Sun Yat Sen, at Shanghai, under date January 5th, contained a pronouncement of such sweeping alterations that are to take place if the present ambitions of the revolutionaries are realised, that we really have to rub our eyes to see whether we ourselves are awake or only dreaming. China has had her revolutions again and again on an enormous scale, millions have been slaughtered for this cause or for that, and the experienced student is sceptical as to what the actual state of affairs will be when the country has emerged from this latest upheaval. But one thing which seems to distinguish the changes of 1911 and 1912 from previous contests is that the controlling force has been the increased influence of Western civilisation. With the causes of the change and the day-to-day news concerning the course of events, we, as a journal, have little concern, but we have a very direct interest in the fact that the position of affairs has been materially altered from an industrial standpoint. We need indulge in no flights of the imagination to put before our readers the vastness of the opportunities that ought, when order has issued out of chaos, speedily to present themselves for the attention of industrial nations, and especially of those that have specialised, as we have done in engineering and electrical schemes and undertakings. If Sun Yat Sen succeeds in his present aspirations, his party "will remodel the laws, revise the civil, criminal, commercial and mining codes, reform the finances, abolish restrictions on trade and commerce, and ensure . . . the cultivation of better relations with foreign peoples . . . than have ever been maintained before." The Republic cherishes the hope of co-operating "in the great and noble task of building up the civilisation of the world." The Manchus, says the President in his record of their misdeeds, "have retarded the creation of industrial enterprises," and "rendered impossible the development of natural resources." To the Republican party, then, so long as it remains in the ascendant, will fall the task of encouraging the development of industrial enterprises, and the utilisation of natural resources, and in the execution of so colossal a task, the engineer will, of necessity, be greatly in demand. In view of the present position, we think that British firms and British engineers and financiers should read again the half-dozen articles that have been published in the ELECTRICAL REVIEW during the past three or four years discussing affairs both from the purely electrical and the general development points of view. We have reason to know that a number of leading British engineering firms have taken preliminary steps which should enable them to take advantage of the new condition of things before long, if only the difficulty of financing large undertakings can be met, but there are many others who would do well to devote a few hours' serious study to the subject of their own position in relation to the future of British engineering and electrical trade in China.



## ELECTRICITY FOR CRUCIBLE WORK.

IN connection with metallurgical processes, the purity of product which is obtainable by the use of electric heat has been a great incentive to experimenters to develop

venting undue radiation when the current is switched on. By means of the regulating switch the current, as first switched on, is not at full strength; it is gradually increased as the melting proceeds, the amount of regulation necessary depending on the material which is being dealt with. For example, in working with lead or brass, which

are comparatively easily melted, a low degree of heat only is needed, and, therefore, the current strength through the crucible need only be of fairly low intensity. It must, however, be increased for tin, zinc, copper, iron and steel, and also for silver and gold, while in dealing with materials such as platinum, quartz, glass, enamel, &c., a very high degree of heat indeed is necessary. It may here be said that with these furnaces it has been found possible to melt quartz most efficiently at a high intensity of current.

A useful point with regard to this type of apparatus is that the principle holding mechanism only covers the melting vessel on the edge of the container, so that the contents can be quite easily observed at any time, and facilities are given for adding to the vessel, as required, further material, and for stirring the contents. This is especially valuable when alloying operations are in progress. After a few minutes of connection with the circuit the vessel, acting as an ohmic resistance, glows, and the contents melt, and this, while taking place under the immediate observation of the attendant, can be observed without any annoyance due to heat radiation or gas fumes. This

is valuable inasmuch as the process of melting can be placed under critical observation with the greatest ease, and the exact instant can be noted for making additions to the fusion without disturbing the process. In order to protect the graphite crucibles from undue injury, they are coated with

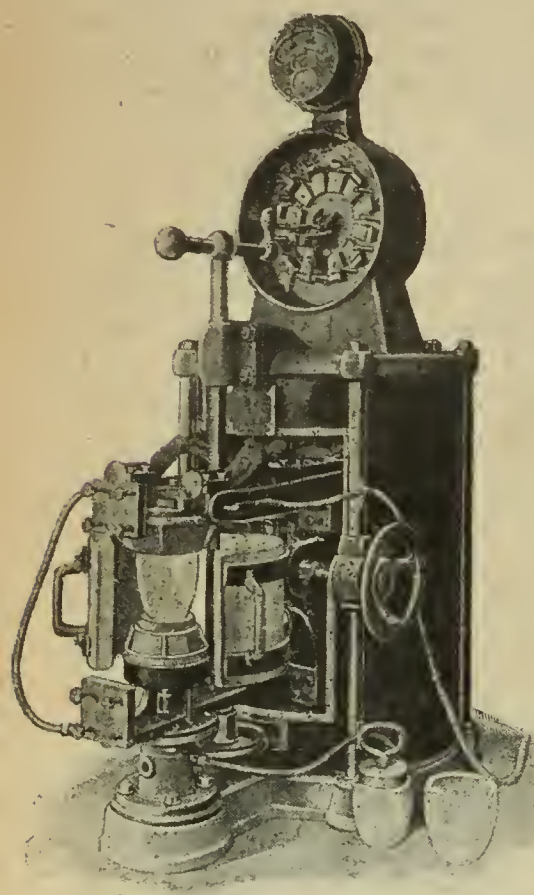


FIG. 1.—LABORATORY TYPE.

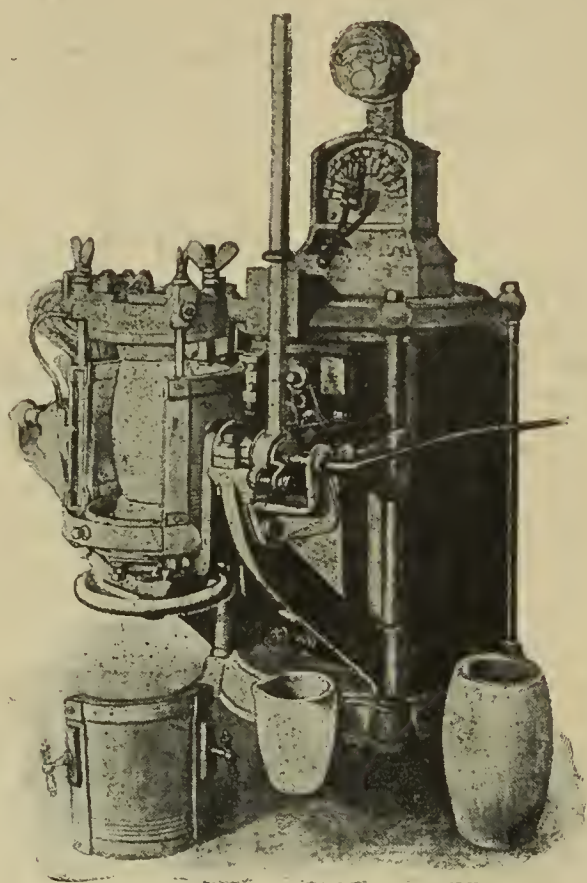


FIG. 2.—INDUSTRIAL TYPE.

HELBERGER CRUCIBLE FURNACES.

this side of electrical engineering to a very large extent, and within a comparatively recent period some most remarkable advances have been made. We are already accustomed to the utilisation of the inductive effect in some of the large furnaces which are now built for the working of iron and steel and their alloys with other metals, but although the value of the resistance furnace has never been questioned, there has been in some quarters a tendency to regard these not as useful for conducting experimental work but for the larger processes demanded in actual manufacture. That this is an altogether mistaken view, especially in connection with metals which are non-ferrous, will be found by considering a new furnace which, although comparatively recently introduced, has obtained for itself a very considerable degree of attention both in Germany and in America. This is the transformer crucible furnace made by Hugo Helberger, of Munich, one type of which is shown in fig. 1. This, it may be mentioned, is one of the smaller forms suitable for laboratory research, either in the factory or in technical or similar institutions, but it will be shown later that the same principle can be applied on a much larger scale.

The apparatus is composed of an alternating-current transformer which may be operated either on single-phase or polyphase circuits as arranged, and on any of the usual voltages and frequencies. Connected to the secondary or low-tension side of the transformer are two specially designed holding mechanisms equipped with water-cooling devices, which grip the plumbago or graphite crucible as shown in the illustration. The actual contact is made on carbon surfaces. It will, therefore, be seen that the transformer and the furnace formed by the crucible form one compact piece of apparatus; and, moreover, the necessary measuring instruments and switchgear are also combined on the same stand, so that the furnaces can be planted down in any position which is most suitable for the laboratory or foundry requirements, the only thing necessary being to lead the cables to it. In working the apparatus, the melting vessel is placed between the holding mechanisms, and the upper one is clamped down firmly on to the crucible by means of the hand-wheel or lever shown. Encircling the crucible will be seen two doors of fireclay which, when closed, completely surround the active circuit, and thus conserve the heat, pre-

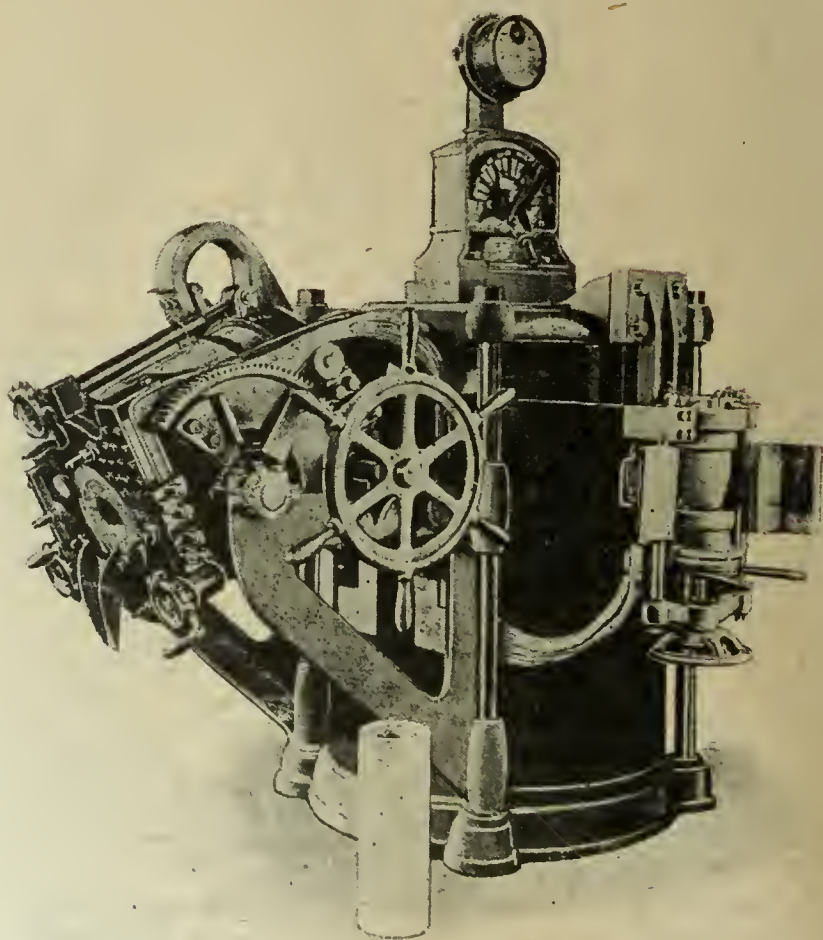


FIG. 3.—STEEL-WORKS TYPE.

a special preparation, the formula for which is supplied by the maker of the apparatus upon installation of the plant, and in this way the ordinary crucible of commerce can be utilised, thus making working expenses very low. Figs. 2 and 3 show some of the larger furnaces of this type,



the third being interesting inasmuch as two sizes of furnace are combined, the one for large melts under ordinary commercial conditions, and the smaller one for experimental work or preliminary investigations. This type of furnace is useful for steel works in which alloys for special purposes have to be dealt with. Such furnaces can be set up in any place even where there is a wooden floor, and evidently it is not necessary for a chimney to be erected as would happen if the ordinary coal, gas, or oil-fired furnace were adopted. The management of the furnace is extremely simple, and temperatures of more than 3,000° C. can be obtained. Special care has been taken to eliminate any complication of parts in order to render the furnace safe and durable in working. The individual parts are of exceedingly strong dimensions, and those parts which are liable to wear and tear are easily changed. The chief factor of expense is, of course, the transformer, and in this of course, the question of wear does not come into consideration. The Helberger furnace, therefore, presents a useful solution of some of the most difficult problems in metallurgy, and is interesting to the electrical engineer as being an extremely ingenious and practical application on a commercial scale of the resistance principle.

## ELECTRIC POWER FOR THE PANAMA CANAL.—I.

By JOHN GEO. LEIGH.

DURING the past twelve months rapid and, indeed, phenomenal progress has been made towards the completion of the great maritime highway destined to unite the two oceans yet separated by the narrow isthmus of Panama. To the salient features of this splendid enterprise, it may be remembered, it has already been my privilege to direct attention in the pages of the ELECTRICAL REVIEW.\*

On the basis of the work accomplished during 1911, the canal, so far as excavation is concerned, might be com-

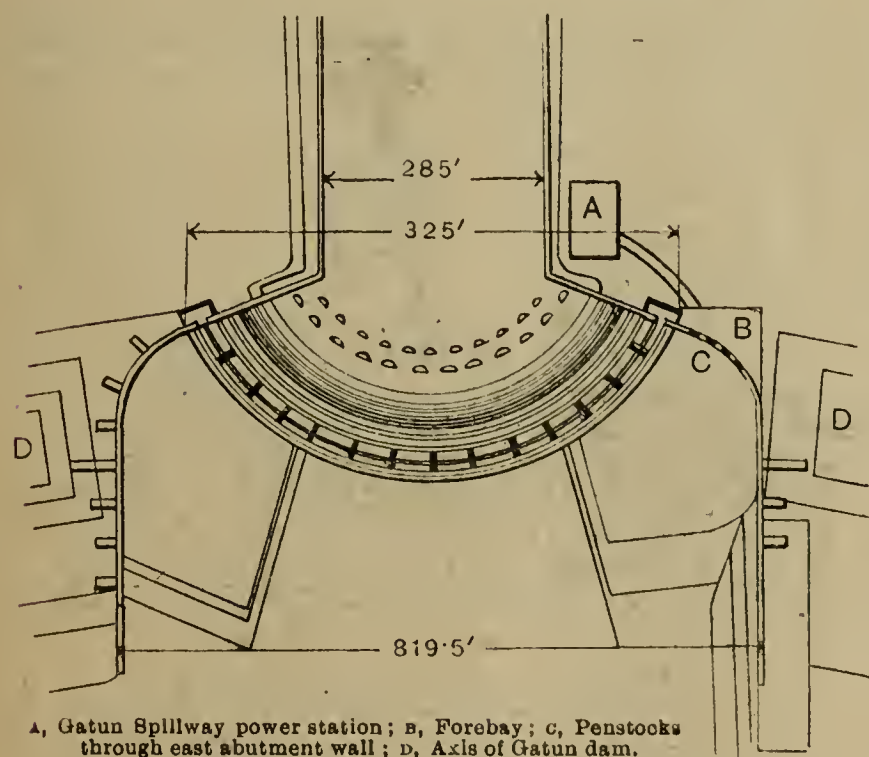


FIG. 1.—GATUN SPILLWAY DAM, SHOWING POSITION OF POWER STATION.

pleted, without undue pressure, during the early months of next year. From all divisions other than the Culebra Cut, the amount of earth and rock to be removed by steam shovels and dump trains is but slightly over 3 million cb. yards, while that to be dealt with by dredgers working from the two terminals has been reduced to about 18 million cb. yards.

At the north end of the Culebra Cut, for about a mile, the excavation is practically completed, and by May next

work in this section will be confined mainly to the 3 miles between Las Cascadas and Cucaracha, where there will remain to be excavated about 11 million cb. yd. Owing to the limited space in which the steam shovels have to work in the lower levels, a noticeable decrease of output must henceforth be anticipated. Nevertheless, there is every reason to

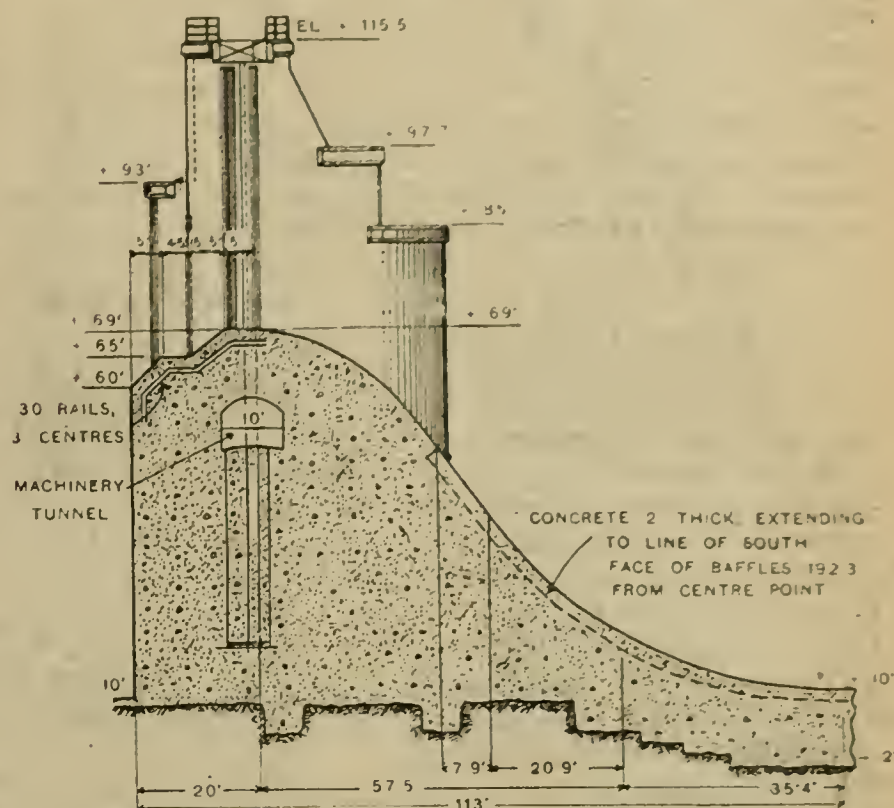


FIG. 2.—GATUN SPILLWAY DAM. SECTION, SHOWING RELATION OF ADJACENT PIER TO THE DAM.

believe that by July, 1913, the only digging required in the Culebra Cut, or elsewhere than at the canal entrances, will be the small amount called for after removal of the steam shovels.

Conclusions equally favourable to the prospects of canal completion long before the period commonly anticipated may be derived from consideration of the present condition of the constructional works. As regards the locks, three-fourths of the concrete is already in place, the amount laid at the close of the year being over 3,150,000 cb. yd.; and reports no less satisfactory are forthcoming respecting the conditions of work on the spillway at Gatun, the Gatun, Pedro Miguel and Miraflores dams, and the breakwaters and new docks at the Atlantic and Pacific terminals.

Under these circumstances, and having regard to the continued rapid delivery and erection of the lock gates and similar structures, and the forward condition of the contracts for the supply and installation of the machinery and electrical equipment required for the operation of the canal, it is not surprising that the Commission have felt justified in revising very drastically their former estimate concerning the approximate date when the highway will be ready for use. Based upon the report of a specially convened board, composed of the engineers charged with the execution of the various works in progress and contemplated, a conclusion has been arrived at that, subject to certain reservations, the Canal will be in condition on July 1st of next year to permit the safe passage of any shipping that may then require its use.

The more closely the Canal is studied, the more conspicuous will appear the triumph of electricity in relation to it. In the construction of the locks, electrical energy has been exclusively employed, and there can be no doubt that to this fact must be attributed in very large measure the rapid and uninterrupted progress of the work. The same power is being used extensively in connection with the erection of the ponderous gates and other structural steel adjuncts to the locks, and, so far, with uniform success. Most important, however, is the fact that, with one quite minor exception, all the operating machinery of the canal—the heaviest and most elaborate equipment of its kind ever designed—will be motor driven. In this connection, the forthcoming visit to the Isthmus of 120 or more members of the American Institute of Electrical Engineers is not without significance. The party will arrive at Colon on the 25th inst., and leave for the United States on February 1st; the midwinter meeting of the Institute will be held during the interval, and informal discussions take place on the

\* "Electricity and the Panama Canal." ELECTRICAL REVIEW, November 4th and 25th, 1911.



voyages to and fro. A more fitting time for such a visit could not have been selected, for not only will the gathering synchronise with the inauguration of what may be described fairly as the final stages of canal construction, but also with that of work pre-eminently of interest to electrical engineers.

During the ensuing rainy season it will be necessary to impound in what was heretofore the valley of the Lower Chagres, but must henceforth be known as Gatun Lake, considerable volumes of flood water. This will involve an appreciable rise in the surface of the lake, and consequently demand ample precautionary measures to safeguard the important constructional work now in progress at the spillway entrance. Up to a recent date operations at this point were confined mainly to the construction of the concrete dam, in ogee form with crest on the arc of a circle in place, which separates Gatun Lake from the concrete lined spillway situated between the east and west portions of Gatun dam. During the past few months, however, the work has been considerably expedited, with the result that, at the end of December the substructure and the lower portions of the crest piers outside the channel of flow, and of the abutments and wing and approach walls, were completed. As indicated in the accompanying illustrations, the dam is 808 ft. long on the crest line across the channel, 93 ft. wide from heel to toe, and rises 69 ft. above sea level. On it will be built piers and the lake regulating works, and between the former will be installed 14 gates, with sill elevation at 69 ft., which will, it is believed, give absolute control of the lake under all possible conditions.

The great importance attached by the Commission to an early completion of the works at this point is evidenced by the very precise programme which has been prepared in relation to subsequent stages. It is proposed to close the sluice gates on or about May 1st, so that by August 1st the lake may reach elevation + 50 ft. During May it is hoped to place all the concrete and bulkhead closures needed to force the flood flow over the central portion of the dam at this elevation, as well as the racks, pipes, control gates, &c., in the power-house forebay, adjacent to the east abutment. From August 1st to the close of the year the concrete-laying force will, it is anticipated, be employed mainly in the construction of the hydro-electric station. This work will be followed, during the first three months of 1913, by the completion of the machinery tunnel and the upper portions of the crest piers, and, after April 1st, by the placing of the last concrete in the sluiceways, the installation of the permanent machinery, and the completion of the dam. It is anticipated that, with normal flow, the lake will rise gradually from + 50 ft. on April 30th to + 69 ft. on August 1st. By the use of the curved crest line much of the velocity of the water passing over the dam will be destroyed, and, with a view to the preservation of the concrete lining of the spillway, additional positive check is provided in the form of masonry baffles set up immediately below the dam.

Brief reference must here be made to the method of raising and lowering the regulating gates which are to be installed in the Gatun and Miraflores spillway dams. All these gates, 22 in number—built up of steel sheathing on a framework of girders—are identical in size and construction, travel on roller trains placed in deep niches in the sides of the piers, and are equipped with sealing devices to make them watertight. Each will be 48 ft.  $3\frac{1}{2}$  in. long and 18 ft. high, weigh  $42\frac{1}{2}$  tons complete, have a range of vertical motion of 23 ft., and be capable of sustaining a maximum head of 18 ft. At each spillway, the operating machinery will be placed in a tunnel 10 ft.  $\times$  8 ft., extending the whole length of the dam. A chain will be attached to each side of the top of a gate, and thence travel over a sheave on the top of the pier into a pit in which will hang a guided counterweight. As the counter-weights on a set of two piers will practically balance the weight of a gate, the operating machine need only overcome the frictional resistance. Each weight will be connected with its chain by a bronze screw, which will be operated vertically by a worm-wheel nut, motor-driven by a worm—the resulting movement being to raise or lower a gate in about two minutes. The several motors will be placed on bedplates midway between the screws, and be coupled direct to the driving shafts. A limit switch, geared to each driving shaft, will prevent over-travel at the two ends of the travel of the screw, and also

allow the motor to be reversed at the ends of travel or at any intermediate point. For freeing the counterweight pits periodically from seepage water, portable pumping units will be employed. Each of these will consist of a vertical centrifugal pump, driven by a vertical induction motor, the two rigidly connected so that the motor may operate under water up to a 30-ft. head.

(To be continued.)

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Small Electrical Exhibitions.

With reference to the leading article in your issue of December 29th, to my mind it is of little use beating the big drum and advertising generally by Publicity Committees, &c., the use of electricity for domestic purposes, until it is the rule, and not the exception, for supply authorities to charge their customers for the energy used on a basis which will be at the same time both economical to the customer and on business lines to the supply authority. In other words, a load factor system of charging for energy for domestic purposes is essential if this class of demand is to be developed to anything like its possible dimensions.

I agree with you when you say that the essence of the matter, as far as the personal view of the consumer is concerned, is, "I will consult some of my neighbours who have tried it." This is, indeed, the pith of the matter.

Do the supply authorities do anything at all worth mentioning towards extending the uses of electricity to consumers already on their mains who, in the main, are lighting consumers? Even with existing apparatus, expensive to buy, in many cases primitive in design, the potential demand is quite sufficient to very materially improve the load factor, and certainly the financial positions of most supply authorities.

The biggest obstacle to the development of domestic electric supply to-day, for purposes other than purely lighting, is the method of charging adopted by the majority of supply undertakings in this country.

Take my own case as a consumer. I know of many devices which I would immediately put to work in my own house if the supply authority were willing to supply me on a business-like basis, both as regards their own revenue and my own desire to use current-consuming devices, where such are commercially possible. I pay now 6d. per unit, and, in addition to my lights, I have one or two other current-consuming devices, such as kettles, electric iron, and so on, which, even at the price of 6d. per unit, are worth the cost of energy for the convenience they provide.

I apply to the supply authority to put me on a load factor basis in order that I can use other devices, such as for cooking and heating, and they come along with the ridiculous proposition that I should pay them at the rate of £12 10s. per year per kW., and 2d. per unit up to the first 500 units, and 1d. afterwards.

This is bad enough in itself, but, instead of assessing the kW. demand at my actual demand, they take the demand on the actual apparatus installed. When I point out to them that I never use all my lights and all my other apparatus at one and the same time, and, therefore, my maximum demand is not my installed demand, their reply is that if I wish to take advantage of their load factor system of charging I must remove or reduce the number of points and apparatus installed.

As this is one of the companies who are very prominent on the Publicity Committee, and who forward me from time to time price lists of electricity consuming apparatus, I ask you, in the name of common sense, what is the good of exhibitions, either by manufacturers or supply authorities, if this is the sort of attitude adopted by supply authorities? I think if you would address your leaders to the supply authorities to adopt reasonable and businesslike methods of



charging, you would not find either the manufacturers of meters or of current-consuming apparatus behindhand in supplying the requisite apparatus at reasonable prices.

To show the sort of thing that supply authorities are "up against," as the Americans say, the Gas Light and Coke Co. have offered to install gas pipes in my house and fit in stoves, and the whole job works out at about 15s. per point, and if I do not choose to buy the gas stoves, I can hire them for a matter of from 3s. per stove per year. They, the gas company, send stamped reply postcards and envelopes to ensure a reply to their business-getting letters. They also send capable and polite representatives to interview one, and, in a word, they make it easy for the prospective consumer to take a supply from them. Alas! that our electric supply authorities think it beneath their notice to take a leaf out of their competitors' book, and do likewise.

R. H.

#### "Imperial Telegraphic Communication."

Your reviewer ("R. M. H.") of the above book says: "As explained in the preface, the author has made large use of reproductions of addresses and articles contributed to the British Association, the London Chamber of Commerce, and various periodicals, extracts from speeches on the subject and Blue Books. With the help of these, and the promulgation of his own views, he certainly makes his case to read justly." Anyone reading this sentence might naturally infer that the addresses and articles alluded to were somebody else's rather than my own, and this is possibly your reviewer's notion, though I should have thought he would have known differently, as he says he is "one of those interested in the subject." Certainly, I do not state in so many words in the preface that each of the separate parts which go to make up the book are reproductions of my own work, but the references are in each case given; and to reproduce another's work without mention of the author would be so unusual and distasteful, that I should have thought—in the absence of a specific statement of authorship in each instance—it might be fairly assumed that I was the author.

I will not quarrel with "R. M. H." for finding it "a difficult book to review" (though certainly it has been reviewed at considerable length by others), but he further states "it is difficult to foresee who will read it," whilst also remarking "there are some, but they cannot be many, who are interested in such a subject. Those who are interested would naturally read the book on their own initiative without any suggestion from a reviewer." Taking these sentences in reverse order, does not the last remark practically apply to any book? That which precedes it, seems to me to be tantamount to saying that very few people are interested in important Imperial subjects and problems. And with regard to the first "difficulty," I cannot, of course, profess to know who will read my book any more than "R. M. H.," but, in so far as the sales of a volume are any indication of it being read, the number of readers must be considerably more than your reviewer pre-supposes.

However, the main purpose of this letter is to disown the very unusual act that your reviewer has apparently attributed to me. Many a book is made up of a series of reproduced addresses and papers of various dates on the same subject by the author; but it would be very unusual to make use of other peoples' work in such a collection, and I certainly am not guilty of that little peculiarity!

When one has laboured for a cause more or less assiduously and continuously for a number of years, it is naturally not quite in keeping with one's ideas to be accused—even if only by inference—of using other peoples' work for the purposes of a book.

Charles Bright.

Caxton House, Westminster,  
January 2nd, 1912.

#### The "Cole" Code.

I should be glad if you can insert the following remarks upon your notice of the "Cole" Code, which might convey a wrong impression to those readers who have not seen the book in question.

The price is 15s., as advised you on October 21st.

"The code provides what is difficult to find in others" refers doubtless to commercial, technical and engineering phrases represented by half a code-word. It does not "lessen" the value of these to include other half code-words which represent a single word only. The most commonplace but highly necessary words are also not to be found in other codes and have therefore to be cabled at full price as ordinary words, whereas they are coded from the "Cole" Code with a saving of 50 per cent. Such words combined with phrases in common use permit of messages being cabled economically either verbatim or in a condensed form. Those who use codes have experienced a difficulty in finding ready-made sentences which, when found, only approximately convey the meaning intended.

"Secrecy" is only mentioned *en passant*. No prefix is used.

The "useful matter" not only includes banks and places, but also a variety of words and phrases, combined with variable figures.

Is it a "mistake" to employ groups of pronounceable letters? Certainly millions of such groups are successfully made use of daily, because of the great economy gained thereby. Artificial words are necessarily strange to the eye, but they may be made safe. The cable authorities who sanctioned their use should be the best judges of what they can transmit; the new conditions coming into force give preference in time to code-words.

The five-letter code-words in the "Cole" Code have been carefully considered. They are uniform, viz., they commence with a consonant-vowel-consonant and terminate with a consonant-vowel or vowel-consonant syllable, and are thus pronounceable. There is a two-letter difference in five telegraphically. The total number of words is small, and substitution not at all probable. Assuming three letters correct, the other two may be discovered from the alphabetical arrangement. It is stated that the two-letter difference has not been complied with, as shown by the words "corsi," "sorci," "comip," "pomic," &c. It is evident, though, that to make corsi into sorei, or pomie into comip, a difference in two letters must be made, or an operator must make two errors in five letters. Lastly, if the words were considered objectionable, one's own pet vocabulary could be used with the "Cole" code.

It is stated that the method employed to gain economy is confusing. If this refers to the suggestions for advanced coding in the appendix, this might appear so to an ordinary user. If it refers to the body of the code or to the manner in which a word and group of figures is combined in one code-word, it is misleading. There is no more confusion in representing a phrase by half a code-word and the figures referring to it by another half code-word, than there is in using a full code-word for each, which is usually done, with a loss of 50 per cent. in economy.

But practice is better than theory. An important engineering firm in this country (I enclose name, &c., to verify the assertion) cabled to their representative abroad (who had never before used the "Cole" code) a message that would test to the utmost the reliability of any code. The cable in question was of a technical character, dealt with 90 items, and quoted no fewer than 66 five-figure prices. The message was condensed into 54 words by means of the "Cole" code, effecting a saving of £6 as compared with the numerous codes possessed by the firm in question. On receiving the written confirmation from abroad it was found that not a single error or misunderstanding had occurred. Many highly technical messages have since been exchanged satisfactorily, which proves that the code-words are not unreliable nor the method confusing.

C. H. Cole.

Rugby, December 30th, 1911.

#### Electricity in the Textile Industries.

In your issue of December 29th, 1911, appears the following:—"The Société Industrielle de Mulhouse is organising a number of competitions, amongst which is one for a new application of electricity in the bleaching, dyeing, and textile printing industry."

I shall be glad if you will—either through your paper or



by post—inform me to what extent, in addition to driving power, electricity is used in the above-mentioned trades, in, say, Switzerland or America, where there is plenty of water power to generate electricity. Is it used for singeing, heating drying cylinders, &c.?

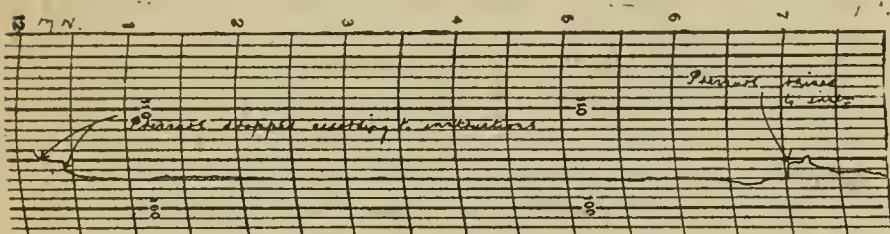
#### Textiles.

January 1st, 1912.

[Perhaps one of our readers will favour our correspondent with a reply.—Eds. E.R.]

#### Diesel Engines.

Having noticed at times that there appears to be some amount of scepticism as to the steady running of Diesel engines, I am enclosing a portion of a voltage chart which may be of interest to some of your readers. This chart was



taken off the main buses here (through a step-down transformer) during the 12 midnight to 8 a.m. shift, the load up to 7 a.m. being practically constant. The only set running during that period was a four-cylinder Mirreles Diesel engine, direct coupled to a three-phase E.C.C. alternator.

A. J. Ryan,

Chief Assistant, Corporation Power Station,

Gillingham, Kent.

January 2nd, 1912.

#### Branch Office Costs.

The life of a filament seems to be one length to the maker and another to the user. Equally so, the "should be cost" of an agency to an employer and the "will be cost" to the agent. At the start of a New Year, when good resolutions are being made to be broken, many firms must be looking back on the battlefield, and in considering the slain during the past 12 months must be wondering whether even some of the victories won in the electrical contract world have not left them poorer than defeat would have done, as well as discontent at results of hard fought battles lost. At these times the brain of a well-meaning managing director reels at the idea of again examining departmental works costs, and turns to the outside ferreting departments. So much has been written about internal management that there seems to have been little time to consider branch offices. Should I close that office or work it direct from the works, shows a saving on paper, only to disappear in fact. Should I run it as an agency or change the branch manager? No! All my branch managers are above suspicion; they, with me, are the only men in the firm not looking for 5 o'clock. To work the district from here is no good. Did I not try it once? An inside man is no use outside. To a commercial mind the reason is obvious. Now, the question comes, what percentage cost should a branch office or agency be worked on? Whether employ agent or servant?

All representatives have a "connection"—on paper. To get a man who knows the ropes is comparatively easy. To get one whose friends are buyers or owners means lifting the percentage cost on all orders obtained. Such a man naturally commands more salary and larger expenses. Do the extra orders warrant it? My chairman (so appointed on account of his technique, be it only whispered) suggests raising prices and pressing "superior manufacture." Branches are notified (in my absence abroad) of change in price lists.

Managers hastily write by return, "Further 5 per cent. off lists not enough to save this month's crop of inquiries that are passing," "Other suggestion admitted on all hands." The typist evidently made a mistake in writing "down" for "up"—probably through habit. On returning to the

works, this trouble is but one of many requiring to be straightened out by me. So the fact is plain, generally speaking, I and managing directors of other firms with me, must rely on price, assuming our men are workers. The question which one certainly does not see asked in print and one which most directors are interested in, is what should be the cost in percentage on orders obtained?

Of course, it will vary with the local conditions of transit, goods and passenger, "cutting," profit obtainable where "specified," loss where there is a fair field and no favour, and also on turnover.

Perhaps some of your readers may have something useful to say on this subject.

Costissima.

#### Electricity in the Home.

The amusing article on page 852 of the ELECTRICAL REVIEW, on "Electricity from the Consumer's Point of View," may be supplemented by the following, which I have received from an old friend living in London—a consumer of the Notting Hill Company, I think. He says:—

"I am much taken with electric cooking, and should like to establish it here. There are two difficulties—the hot-water system and the fire for the servants to sit by in the evenings in the kitchen. It seems to me that, although the electrical cooking may be economical in itself, in practice it amounts to running the kitchen fire as well."

It must be admitted that there is much in this criticism, which comes from a distinguished civil engineer. I have replied giving him some details of the Therol heater from the ELECTRICAL REVIEW, September 10th, 1909, p. 415, but I have received no lists, and do not even know whether that promising device is on the market in useful sizes for a large house. I have also given him data as to radiators. But the moral appears to be this. Why do not those who sell or exhibit cooking apparatus co-operate with those who can help to draw the kitchen fire completely? How is the ordinary consumer to know? And, at present prices, will he install when he *does* know? Surely our industry is very kind to its rival.

J. W. Meares.

Calcutta, December 20th, 1911.

[Certainly, the "Therol" system is on the market. Regarding the difficulties mentioned by our correspondent, the solution adopted by Mr. W. W. Lackie for his own house, noted in a recent issue of the ELECTRICAL REVIEW, may be recalled. Mr. Lackie uses electricity for cooking, &c., and for heating the house and providing hot water he has installed an anthracite stove. An electric boiler capable of supplying the need is described elsewhere in this issue.—Eds. E.R.]

#### Capital and Labour.

As a constant subscriber of your journal, rather a long one, too, I was glad to see your open letter. But your charge against Trade Unionism is such that a protest ought to come from some-one. One always notes in your journal that where the men come into conflict with the employers, the men are always wrong. You condemn, and very strongly, the present lock-out in the cotton trade, and the cause thereof. Yet the other week you had a leader on the attempt, shall we say, of the E.C.A. to force every contractor into their Association. When trade unionists try the same methods, they are wicked agitators. Yet, methinks, I have never seen Mr. Tate described as such in your journal.

But where is the difference? To be fair, you were against the project, but if the principle is rotten for one class of individual, why not for another? You also say that Capital and Labour should go hand in hand, just like little kiddies to school. Very pretty, but what do we find? The E.C.A. in London is very strong, and, therefore, to show that such a pleasing state should exist, is attempting to bring about a standard rate for wiremen that is below the recognised L.C.C. and trade union rate. The latter rate is 9½d. per hour fixed at a joint conference between representatives of the L.C.C., the Electrical Trades Union, and the Contractors of London, over a decade ago, and before the E.C.A. existed. Yet the E.C.A. have a card printed which says the rate of London is 9d. per hour for wiremen. A member



of the Electrical Trades Union, if he is known as such, gets outed by the majority of the employers; not only that, Mr. Editor, but we are faced with an attempt to reduce our wages, even if things, rent, commodities, &c., have, as you truly say, gone up.

I know a case of a man who for more years than he cares to remember has worked for a certain firm. Not, perhaps, a brilliant workman, but a sober and just one, good enough to be paid for years even more than the L.C.C. rate. He became a member of our Union, and after some time a branch official. This became known, and, of course, he had to go. "Nothing in," he was told. Now, this firm are Government contractors, and as such have to pay L.C.C. rates of wages to their wiremen (not the E.C.A. rate he it noted), or else, if found out, go off the list. Now this common wireman has evidence which, he says, can be produced to-morrow, and if placed in the right quarters (the E.T.U.) would, the chances are, mean the pen being put through this firm's name. Government work may or may not pay, but it is an asset at the top of a firm's notepaper.

But this man won't give the information, not for fear of the E.C.A., strong as they are, not for fear of himself, he is not without a pound or two, but for sentimental reasons, and because he thinks his old firm more sinned against than sinning. Yet men like this Trade Union wireman are the scum of the earth, and the employers are the salt. That is where men like myself fear you are the least little bit one-sided; but I will say that the ELECTRICAL REVIEW has always treated my branch with absolute fairness.

Anything of note taking place you always have space for, and, in thanking you for this, I feel that if our employers had more of the same spirit this electrical world of ours would be a far happier place, and, I think, a better paid place for both masters and men.

W. J. Webb.

(*Electrical Trades Union.*)

Fulham, S.W., January 7th, 1912.

[We fully appreciate our correspondent's reference to our treatment of information received relating to his branch of the Electrical Trades Union, and we hope that he will never have any occasion to suggest unfairness on our part. It seems to us that he is in agreement with us that Capital and Labour should go hand in hand. We are not sure whether he suggests that we have called Trade Union wiremen "the scum of the earth," and the employers "the salt." Strongly as our views may have been stated, we are not accustomed to use abuse against either a class or an individual.

If it has happened that we have more often agreed with the employers, it has been because the points in the various quarrels between Capital and Labour have, when duly weighed, convinced us of the terrible danger in which this country must inevitably stand if Industry—call it Capital if you will—is to be taxed up to the hilt, and also continually faced with increasing demands from workers who appear to imagine that there is no limit to the burden which Industry can carry.

If we are one-sided, we are so by conviction, but we recognise, too, the rights of the worker, the dignity of labour, and all its *legitimate* claims—also the *freedom of the individual*—and we hold that these will not be preserved by killing the goose that lays the golden eggs, or by *forcing* men and women into Unions against their inclinations.

Our correspondent uses our leaderette of last week as a peg whereon to hang many things. Let us be content with a reference to his fancy that we deal out one kind of treatment to the E.C.A. and another to the Trade Unions. The former sought to coerce "every contractor into its Association." The latter seek to coerce every worker into their Unions. Wherein has our treatment of the two cases been inconsistent?—Eds. E.R.]

**Railway Rates on Electric Heating Stoves.**—It is announced in the *London Gazette* (January 5th) that application has been made to the Board of Trade by the various railway companies of Great Britain and Ireland to include electric heating stoves in Class 4. Notices of objection, if any, must be made within 31 days from January 8th.

## PROCEEDINGS OF INSTITUTIONS.

### An Automatic Starting Device for Asynchronous Motors.

By N. PENSABENE-PEREZ.

(*Discussion on paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, Birmingham, December 13th, 1911. For abstract of paper see our last issue.*)

MR. A. LINDSAY FORSTER remarked that in designing governors in which the operating weights were on axes parallel to the rotating shaft it was necessary to consider the effect of any change in the rate of motion, because such change affected the equilibrium established between the centrifugal force of the weights and the spring which opposed it. In fig. 1 the weight of the brush arm, while centrifugally opposed to that of the governor weight, acted in unison with it with regard to inertia and momentum. If the direction of rotation was reversed, the effect would be reversed, and it would be interesting to know whether the author found that with a reversible motor he noticed a difference between the performances in the two directions. When starting a machine which offered a constant torque, these effects would not be of as much importance as they might be where the torque was variable, under which conditions the rate of acceleration would also be variable.

DR. C. C. GARRARD said that the invention should find many useful applications, especially where three-phase motors were to be started by totally unskilled people, but he did not think the apparatus would supersede the ordinary starter in large works, where the motors were usually started by a skilled person, and he doubted whether the apparatus was cheaper than slip-rings and a rotor starter. He thought the author had limited the usefulness of the paper by an unnecessarily mathematical treatment. In order to achieve success in any electro-mechanical appliance it was necessary to keep the working forces large in comparison with the friction. With the author's device a certain speed corresponded to a fixed position of the centrifugal arrangement, which put a fixed resistance in the rotor circuit independently of the torque required to drive the load at that speed. It seemed to him that if the starting conditions were very different from those allowed for in the design, complications might arise.

MR. N. PENSABENE-PEREZ, in reply, said that in actual practice variations of speed, owing to the inertia of the motor itself and the machinery driven by it, were too slow, and the stored energy of the moving weight too small to appreciably produce any of the effect mentioned by Mr. Forster. He had recently tried the case of a self-starting motor driving a dynamo fully excited, on which the current was suddenly varied while starting, but no special fluctuation of the motor starting current was observed, owing to this sudden change of load torque. This was found when running in either direction. With the exception of the moving weight, all the weight of the arms, gear, &c., was balanced, and this explained partly why the phenomena mentioned by Mr. Forster were not noticeable in practice. He could not agree with Dr. Garrard that in larger motors handled by skilled persons the usual slip-ring motor and starter could not be superseded by the self-starting motor. It was, of course, only reliability and cheapness which, in time, would decide this point, and from either of these points of view the balance was in favour of the automatic self-starting motor. No unnecessary mathematics were used, and all the formulæ arrived at were necessary for the graphical solution given in the paper. In cases where the load torque expected was smaller than the actual torque to be dealt with, the apparatus described could be easily adjusted by a simple arrangement which would prevent the contacts going all the way back under the action of the spring. By this arrangement only a fraction of the resistance was used for starting, and thus a larger starting torque was obtained.

### Magnetic Apparatus for Testing Endurance.

AT the meeting of the Birmingham Local Section of the INSTITUTION OF ELECTRICAL ENGINEERS, on December 13th, Prof. Gisbert Kapp, Past President, gave a demonstration of his magnetic machine for testing the endurance of steel and other metals. He said that ever since Woehler's time, now half a century ago, it was known that metals become fatigued, that is, their strength is diminished if subjected to rapid repetition of stress. Steel might support quite safely a load of 15 tons to the square inch if continuously applied, but if such a load were repeatedly put on and taken off, the steel would become fatigued and finally break. Machines for putting alternating loads on test pieces were also well known, but in the machine hitherto used the application of the test load was purely mechanical, and could, therefore, only take place at a moderate frequency. If the problem was to find the effect of some millions of applications of stress the process naturally took a very long time. In the machine which was exhibited to the meeting the application of the stress was by means of an electro-magnet energised by an alternating current at the rate of 100 stresses a second, and it was thus possible to subject the test piece to a million stress applications in about three hours. The time required to find out whether or not a material was suitable for machinery where high speed and great mechanical stresses occurred was thus considerably shortened. By testing samples of steel, iron and copper for strength, Prof. Kapp found that in only two samples of common iron could any fatigue be discovered when the stress was kept within the moderate limits of 5 to 6 tons (3 to 4 tons for copper) per square inch, although some of the samples were subjected to as many as 15 million stresses.



If, however, the stresses were raised to the values which prevailed in modern high-speed and lightly-built machinery, the effect of repeated application became very noticeable—in other words, there was fatigue. He showed a test piece of steel, which in a length of 3 in., had under the repeated applications of a stress of only 15 tons to the square inch, lengthened by  $\frac{5}{16}$  in., and if left in the magnetic machine, would, undoubtedly, have broken under that stress. The machine was just stopped in time to prevent actual rupture. Yet only 180,000 stresses had been applied to this test piece. A test piece of the same steel which had not been treated in the magnetic machine broke in an ordinary testing machine with a load of 26 tons to the square inch. It was thereby clearly demonstrated that fatigue was a real danger. If the material were subjected to fairly high and often-repeated stresses of 5 or 6 tons to the square inch, there was practically no change in the strength of the metal, no matter how long it had been in service.

### Institution of Electrical Engineers.

As there appears to be some misapprehension as to what happened at the special meeting of Members, Associate Members and Associates, held at Birmingham on November 22nd, 1911, Mr. H. B. Matthews, hon. secretary of the Birmingham Local Section, has forwarded to us a copy of the resolutions which were passed at that meeting. They are as follows:—

1. Proposed that proposed new Article 12, Sub-Section (D) should be deleted and that Sub-Section (D) of Article 12 of existing Articles should be substituted.

2. Proposed that Article 14 should read as follows: "Every candidate for election or transfer to the class of Associates shall be a person of good education, who, *although not eligible as a Member or Associate Member*, in the opinion of the Council is so connected with the applications of electricity that his admission as an Associate would, in the opinion of the Council, conduce to the interests of the Institution." (Change indicated by italics.)

3. Proposed that new Article 15 and all reference to Licentiates should be deleted.

4. Proposed that new Article 15 should read as follows:—"Subscriptions be not raised to existing members of any class, and that subscriptions of new members of any class joining after July 1st, 1912, or transferring after July 1st, 1913, be according to the new schedule as far as London members are concerned, and at the old rate for members living more than 20 miles from the Institution buildings.

5. Proposed that in new Articles 66 and 69 the clause subject to the sanction of two extraordinary general meetings be inserted.

6. Proposed that the final decision of the Institution should be taken by a postal vote of Corporate Members in the British Isles on the leading points in the proposed new Articles of Association to which exception has been taken.

### Small Electricity Supply Undertakings.

By PERCY A. SPALDING, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, Dublin, December 14th, 1911.)

THE supply of electricity to small towns and villages which has not made much progress since Mr. A. B. Mountain dealt with it eight years ago, is well worthy of further consideration under the improved conditions which now obtain.

Generating plant and mains are now cheaper, and therefore the annual repayments of loans are reduced; working costs are lower, the output is likely to be greater owing to the reduced cost of lighting by metallic-filament lamps, and better profits may be expected. Under present conditions, electricity can be generated locally at a price with which the large supply companies can hardly compete. Except when cheap water-power is available, which is seldom the case in the United Kingdom, the choice of generating plant for an area with a population between 1,000 and 5,000 will usually lie between suction gas plant and Diesel oil engines. Where the capacity of the plant does not exceed 100 B.H.P., the former is at present unquestionably preferable.

A storage battery is indispensable, and the makers, as a rule, will maintain it at its rated efficiency for an annual payment of about  $7\frac{1}{2}$  per cent. of the initial cost. Generally a D.C. two-wire 220-volt system of distribution is suitable, but where the area is very small, 110 volts may be preferable, the extra cost of copper in the mains being set off against the greater cost of a battery having twice as many cells of smaller capacity. With 110 volts the use of bare copper feeders, instead of insulated cables, may be considered. In view of the excessive cost of underground mains to distribute over a thinly populated area, every effort should be made to obtain permission to use overhead mains.

As in most cases the number of lamps in a house will not exceed six, and the average will be about four, small consumers may be profitably supplied at a fixed contract rate per annum, dispensing with meters and saving both capital and working costs. The latter should not exceed 15d. per unit generated, and the total costs, including all standing charges, could be kept at or below 23d. per unit. A flat rate tariff of 6d. per unit should, therefore, yield a profit and satisfy the consumers. The cost of a 16-C.P. metal lamp burning for 1,000 hours per annum will then be 9s. The generating costs will be about 31s. per annum per 100 such lamps connected, and after allowing for distribution, rent, rates

and taxes, management expenses and special charges, the gross profit will be about £30 per annum per 100 lamps. While in the case of larger houses the owners will not accept a contract on the basis of 9s. per annum per 16-C.P. metal lamp connected, it is not difficult to draw up agreements for the supply of large installations, including domestic utensils as well as lamps, on the contract system. The necessary installation work in small houses should be covered, using wood casing, for 8s. or 10s. per point, including switches and ceiling roses; the wiring would remain the property of the undertakers, the tenant being charged a rental in addition to the contract charge for electricity. All payments should be made in advance.

The undertaking should be carried out at the smallest possible outlay, the generating station being on a central site, and the size of the plant being based on the estimated demand for the first two years only.

In the case of small towns, of populations from 5,000 to 15,000, the same principles apply in the main. A fairly large power load may ultimately be developed, but, in the first instance, it is wise to consider only the lighting demand for the first two years. Diesel engines have the advantage that they can be started up and put on full load within two minutes (the author has seen a 100-KW. set started and fully loaded in 28 seconds) and can take an overload of 10 per cent. They are also very economical on light loads: but when the output is less than 100 B.H.P. the balance is in favour of suction gas plant on the score of first cost.

There is little to be gained by the use of the three-wire system at 440-220 volts, unless a reasonably large power load is expected. It is probable that the demand for heating and cooking purposes will increase much more rapidly during the next few years than it has in the past.

A small central station was erected 21 years ago to supply the town of Galway, with two water turbines developing 75 B.H.P. each. The mains consisted of bare copper tubes enclosed in 6-in. sewer pipes, and supported every 6 ft. by earthenware insulators, the pressure being 120 volts. The author recently inspected a number of those tubes, and found them generally in a remarkably good state of preservation.

In 1907-8, three new feeders were installed, consisting of copper tubes carried by porcelain ring insulators in fibre conduit; these have given excellent results. Each conductor carries 200 amperes at 800 amperes per square inch, and the total cost of each feeder averaged about 7s. 6d. per yard of trench, being, therefore, considerably less than that of insulated cables. During the past ten years, four separate batteries have been installed, all of which are maintained by the makers on a 10-year contract, and are in good order. In 1909, the author erected an overhead line to a small sea-side suburb  $1\frac{1}{4}$  miles away, of bare copper cable, costing in all £631. The services cost £127 (exclusive of meters) to 65 consumers, thus averaging £1 19s. 1d. each. The lighting connections aggregate 1,194 equivalent 30-watt lamps, and the heating apparatus  $9\frac{1}{2}$  KW. 49 consumers pay by meter at 5d. per unit, and 19 pay under contract.

The average revenue per 30-watt lamp connected, over 12 months, was 6s. 11d. in the case of the flat rate consumers, and 7s. 10s. in the case of the contract consumers, showing a revenue 13 per cent. higher for the latter than for the former. Similar figures for business premises in the town are 7s. 4d. flat rate, and 10s. contract. A study of published statistics of 51 undertakings in towns having a population of less than 15,000 shows that the average revenue per unit sold should be not less than twice the working costs per unit sold, to ensure a reasonable profit on the working. Of the 51 cases, 26 were municipal undertakings, of which only eight showed a surplus, while 25 of the private undertakings showed a surplus: but the net profits represented only 12 per cent. on the capital, and thus the results did not indicate very satisfactory business. Forty of these undertakings use a three-wire system at 460-230 volts or thereabouts. The power load has made very little headway.

### The Electrical Engineering Laboratory at the Heriot-Watt College, Edinburgh.

By PROF. F. G. BAILY, M.A., F.R.S.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Edinburgh.)

ALTHOUGH the electrical engineering laboratories in the Heriot-Watt College have been in existence for many years, a recent and large increase of space has necessitated a complete rearrangement and reconstruction.

The rooms include an elementary laboratory, separate rooms for direct and alternating current machinery, a photometer room, a room for standardising and testing work, a small room for chemical work, a museum and drawing office, a battery room, a workshop, and a private room for the staff, while another room will be available in the future.

Students work in groups of two, but for many advanced experiments three workers are often able to do better work than two. Text-books for the laboratory are not used. A detailed description that does not fit the apparatus is of little value, and even if the head of the laboratory writes his own text-book, he is thereby restricted from modifying his courses. For the more elementary work, I have cut down the instructions to a single quarto page, of a size to fit the laboratory books. For advanced work, the commercial folder or binder is used.

Three or four kinds of supply are required for the simpler direct current work. These are supplied from three batteries. The first



has five cells of 1,200 ampere-hours output. The second has 60 cells of 350 ampere-hours, and the third has 120 cells of 40 ampere-hours. Also the town supply at 230 volts and 460 volts is on tap at many places.

It was found that with only eight cables 34 steps could be obtained, ranging from 4 to 130 volts. These eight leads are brought into every room. The first three leads give 4, 6 and 10 volts, and are connected to the large cells by heavy metal strips for large currents. The other cells, connected in series with these, distribute through lighter strip, gauged to carry 100 amperes. The material is aluminium strip, 1 in.  $\times$   $\frac{1}{2}$  in., set on edge and supported in the slots of teak bearers hung from the ceiling or fixed in the walls. The slots are insulated by troughs of micanite. Connection to switchboards is made by copper strip bolted to the aluminium.

The small battery of 120 cells distributes by a multiple telephone cable of 23 wires, feeding the photometer-room and the special room for standardising work, research, and elaborate bench experiments. To connect this to its fuseboard, thick lead wire is soldered to the lugs and rises, supported by insulators, well above both tiers of cells. Single No. 18 lead-covered wire is soldered to the lead wire, and the joint is protected by a sleeve of india-rubber tubing, sealed at both ends with acid-resisting paint (fig. 1). To allow of continuous use of a uniform voltage this battery is charged in two halves, and either half can be independently charged, leaving the other for use

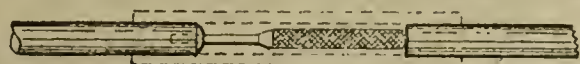


FIG. 1.

up to 120 volts. The batteries are charged through lamp resistances from the town mains, but as the five large cells are more extensively used, they are given a periodic special charge from a low-voltage dynamo. The cells are all charged in series, and no doubt some get overcharging; but as the last battery endured for 10 or 12 years under a system no less severe, it is clear that no great saving could be obtained by any device, no matter how uniformly it caused the cells to be worked. It is well to use cells with plenty of lead in the positive, and I find that for this purpose the pattern with a solid centre grooved at the sides lasts much longer than any fancy pattern or plugged type.

In all necessary rooms, four wooden straps were carried round all the walls, which serve for attaching switchboards, either permanent or temporary, galvanometer stands, brackets, or any appliance anywhere. A 12-in. board forms a complete belt for the attachment of cable to the switchboard.

Practically the only furniture is worktables and cupboards. As these may be moved into new places, they have been made of standard size. All movable tables are four-legged with one leg adjustable, to provide against inequalities on the floor.

I have endeavoured to standardise terminals, using three sizes—voltmeters, 5-ampere size, and 50-ampere size. To a large extent three sizes of cable are used to correspond with the terminals, voltmeter wires being V.I.R. flexible, and current wires being the braided flexible used for brush connections on dynamos. These are finished with brass ends to fit the terminals. The cable ends are very cheap, being merely a short piece of brass rod driven a little way into a short piece of brass tube. The stranded wires are sweated into the tube, and a short piece of india-rubber tube, previously slipped over the cable, is drawn down over the brass tube to prevent the brading from coming loose (fig. 2).

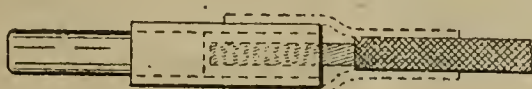


FIG. 2.

The elementary room was required to accommodate some 50 students, or 25 benches.

Most of the instruments employed are of the wall pattern, and it has been found very convenient to use them as such. Down the centre of the tables runs a partition of two stiff beams, and at short intervals on the upper beam are pairs of pins at standard centres. All instruments are mounted on wooden boards, with holes corresponding to the pins, and india-rubber pads at the back. With this inexpensive arrangement an instrument can be set in place or changed at once, the bench is kept more clear, and the scales are in the proper position for reading. The instruments are compactly stored in the cupboards by pushing the boards vertically into racks or slots along the shelves, and the range of the instrument being painted on the edge, any one can be picked out quickly. Heavy leads of aluminium strip or bare copper rods, No. 6 S.W.G., run along the top of the partition. On each bench below is fixed a switch with two flexible leads which reach to the rods and clamp to them.

Tables at the end of the room are fitted with both current and potential leads, and a 230-volt supply to allow for special experiments. In setting out dynamos and motors, to simplify wiring and to permit of variety of function, a combination of permanence and flexibility is required. Many years ago I set out the dynamo room at the then University College of Liverpool with two long parallel

pairs of slotted rails, set flush with the floor in beds of concrete, and all slide rails were made with bolt centres to fit them. Any machine could be set down anywhere in line with, or parallel to, any other for direct coupling or belt drive. After trying other arrangements and seeing many laboratories, I decided that nothing was better than the flush rails, and I have gone back to this system. There are three rows of machines; two rows are set on the slotted rails, and the third row consists of permanently fixed sets, but on occasion these can drive or be driven by machines on the centre row by a belt.

The machines in the direct-current room are of various sizes, from a 2½-H.P. motor, mostly used for beginners and for donkey work, up to a 60-H.P. motor and dynamo. They include a 10-H.P. four-pole motor for 460 volts, by Bruce Peebles, with two commutating poles and skewed main poles; a 10-KW. two-pole dynamo by Siemens; a 27-H.P. motor used for driving dynamos; a direct-coupled 20-H.P. set by the Electric Construction Co., each wound for 460 volts; a 60-H.P. motor for 460 volts, and a 40-KW. dynamo for 230 volts, also made by the Electric Construction Co., to show the properties of high-speed machines, at 2,000 R.P.M.; a British Westinghouse 15-H.P. machine for 460 volts, capable of working up to 25 H.P. for half an hour; and a 25-H.P. British Westinghouse traction motor of normal kind complete with gearing.

The permanent driving motors in both direct-current and alternating-current rooms are supplied with current from the town mains. For a given motor all the controlling apparatus may be strictly allocated, and I screw them all up on a flat board and fit them all with front terminals. The student has to connect everything up, even to the "no-voltage" coil on the starter, but he finds them so arranged that when connected up they form a reasonable switchboard, with switches and instruments in convenient places. Leads to the machine are led under the floor, and rise by an iron stand-pipe to terminals on the machine. By this means all trailing wires are avoided.

The main switchboard may be taken as a type of all the others. On the board are the live terminals of the eight battery leads, the 230-volt leads and the 460-volt leads of the town mains. On the table below are two pairs of flexible cables to every machine, one for armature currents and one for shunt currents. It is a general principle of all the switchboards that the terminals on the upright slate are the suppliers of current, and are liable to be live whether ostensibly in use or not. All wires on the table are dead, if not connected to any terminals. For alternate-current working, to maintain some standard co-ordination, all machines are arranged to be under normal conditions of magnetisation with a pressure of 10 volts per period, this applying to star connections in three-phase machines and the primaries of transformers. Frequency variation without change of magnetisation is obtained on the speed of the direct-current driving motors, and change of magnetisation is performed on the exciting circuits of the alternators. The usual upper limit of voltage is 600 at 60 periods, and I prefer working at 300 volts, 30 periods, though one single-phase machine will give 1,000 volts at 100 periods for testing purposes.

There are three alternators—two of 30 KW., by Vickers, Maxim and Co., for either three-phase or single-phase supply, and an old one of 10 KW. for single-phase. The 30-KW. machines are designed for exhaustive testing.

The two machines are connected, one at each end, to a 55-H.P. motor, one through a flange coupling, the other through a Ravensworth magnetic clutch, kindly presented by Electric Clutches, Ltd. By means of this clutch the machine can be released at full speed for determining losses by the slowing-down method, and the clutch permits of mechanically coupling the machines with any required phase difference. When connected in parallel the effects of circulating currents round the two armatures can thus be studied under known conditions. Also two currents of any required phase difference can be produced for experimental work.

Other machines are a 15-H.P. six-phase rotary converter, by Crompton & Co., with removable damping grids and sundry search coils, and a 15-H.P. induction motor, by the British Westinghouse Co., with a wound rotor and a squirrel-cage rotor, both with slip-rings for search coils. There are also two 7-H.P. induction motors.

The method originally used at the Board of Trade and adopted by the National Physical Laboratory for measuring an alternating difference of potential is used as a standard, that of a Kelvin multicellular voltmeter, and telescope or spot of light. A Nernst lamp produces a large spot of light on a scale set 6 ft. 6 in. high on a horizontal half-circle some 10 ft. in diameter, and the observer stands inside. The actual scale is about 11 ft. long, reading from 0 to 170 volts, with good separation from 40 volts onwards. Each volt is therefore about 1 in. long, and tenths can be read with great ease. Multiples are arranged by a potentiometer resistance up to 1,360 volts in multiples of 2—i.e., 170, 340, 680, 1,360, which give plenty of overlap between steps.

For the measurement of extra-high voltage the method proposed is to use a very high resistance across the terminals, and to tap off a small proportion for measurement on an electrostatic voltmeter.

The resistance is based on a method described some years ago by one of the staff of the National Physical Laboratory, in which solution of potassium iodide dissolved in amyl alcohol is enclosed in a glass tube with cadmium electrodes. I propose a set of 30 tubes of some 3 mm. bore, each 1 metre long. Each tube has electrode at the ends, so that all bends for connecting tube and tube are made with wires and not with glass.

For a maximum range of 170 volts on the instrument and possible maximum of 80,000 volts on the resistance, the tapping has a resistance of 200,000 ohms. The capacity of the electro-meter does not exceed 0.0001 microfarad, so that at a frequency of 100 the reduction of the resistance is not more than one part in 5,000. The total power absorbed at 80,000 volts is 43 watts. The



tubes will lie horizontally one above another, supported by two strips of ebonite or micanite, which will be held out from the wall by teak bearers. The whole set of tubes will occupy a space of  $1 \times 1\frac{1}{4}$  metres, placed well out of reach, with the high-potential terminal at the top. Even if an accident occurs and a tube breaks, no continuous live conductor can fall down.

For current standards Lord Kelvin's balances are used.

(To be concluded.)

## THE PHYSICAL SOCIETY EXHIBITION.

(Continued from page 11.)

R. W. PAUL.

A variety of instruments was shown by Mr. Paul, many of them being improved forms of apparatus which we have previously described. Among the exhibits was an enclosed tapper key, fig. 9, provided with platinum contacts, so arranged that they cannot be subjected to undue hammering. These contacts have a rubbing action, and are, therefore, always clean. The working parts are enclosed

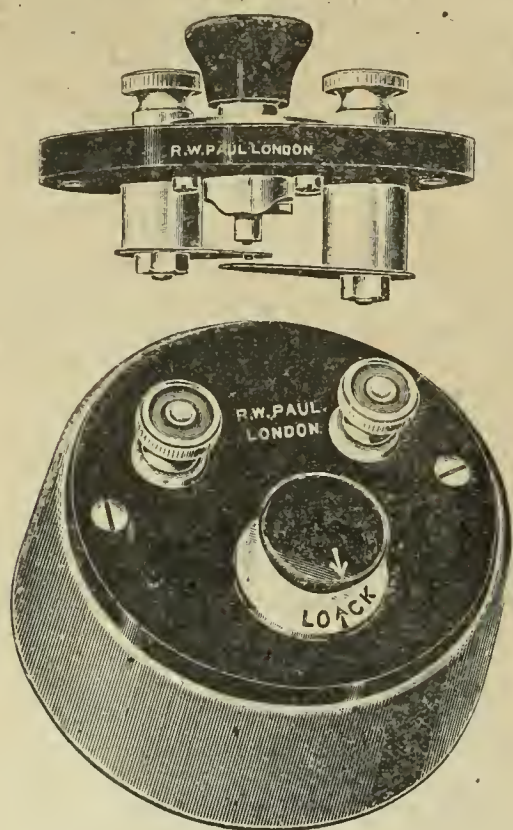


FIG. 9.—ENCLOSED TAPPER KEY.

in such a manner as to be readily accessible by the removal of two screws. The key may be locked in the "on" position by rotating the knob into the marked position, thus enabling it to be used as a switch.

Another item was the Campbell inductometer bridge fig. 10, which has been specially developed as a convenient self-contained

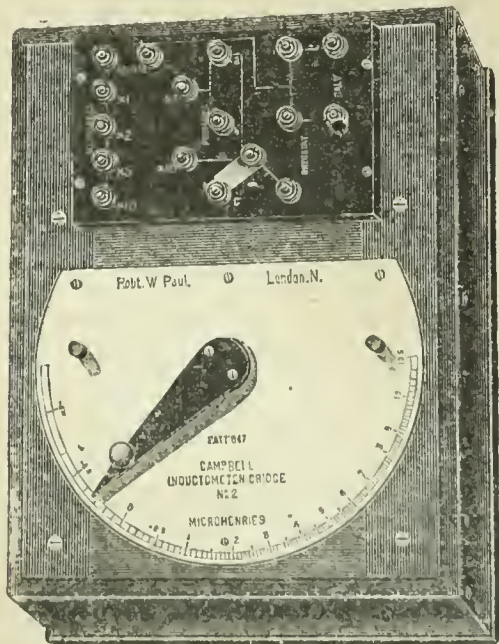


FIG. 10.—CAMPBELL INDUCTOMETER BRIDGE.

apparatus for the measurement of small inductances by the Maxwell bridge method. It contains a simplified form of the well-known Campbell variable mutual inductance incorporated

with the ratio coils, so that the apparatus is ready for use when connected up to any source of alternating current, a telephone, which is used as a detector of the null point, and a non-inductive rheostat. The scale of the instrument, which is about 30 cm. long, gives a range from 0.1 to 10 microhenries, and the readings are extended by means of internal primary and secondary multipliers up to 1 millihenry. The bridge is thus capable of measuring self-inductances up to 2 millihenries with an accuracy of about one part in 500. The instrument is simple and compact, and the internal connections are plainly marked on the ebonite terminal plate.

A third item of interest was a cheap form of slide potentiometer, which, while not pretending to compete with expensive forms of the instrument, nevertheless is thoroughly practical and attains to a high degree of precision. The double-pole selecting switch is so arranged as to provide a convenient means of reversing the polarity if the connections to the terminals have been wrongly made, and balance to standard cell can be checked at any time without moving either switches or slider, by simply pressing a key. There are 17 potential points on the switch dials,

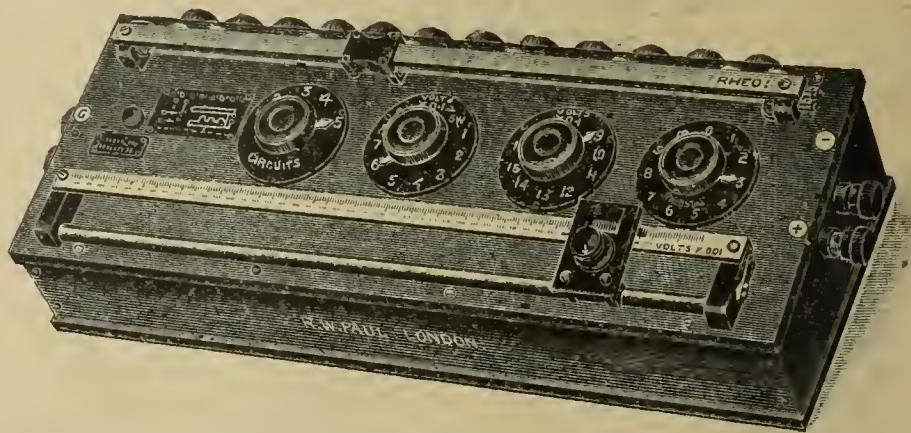


FIG. 11.—SLIDE POTENTIOMETER.

giving, with the slide wire, a range up to 1.8 volts. The coils are adjusted to a standard value, and the slide wire is adjusted to the same value by means of an internal shunt; the switch zero point is tapped off on this shunt, giving a very sharp zero on the wire and making a mechanically sound job. The fine adjustment rheostat is of a much improved pattern giving reliable contact, and all the coils are of manganin.

ELLIOTT BROS.

Besides a variety of switchboard and portable instruments, the latest patterns of the Wimpey recording accelerometer and of the "Century" standard testing set were shown, as well as the C.W. triple-testing set—an ammeter, wattmeter, and voltmeter in one portable case, covering a wide range of measurements, both A.C. and D.C.

The new "Century" testing set, electrically, is identical with the older pattern, but many important improvements in the design have been effected.

The two smaller shunts for the ammeter are packed in the lid of the instrument, and the two larger ones for 150 and 500 amperes are in a separate receptacle, which can be attached to the main case so as to form one unit, or if the larger shunts are not required, these can be left behind, thus considerably reducing the weight to be carried.

Changes of range on the voltmeter are obtained by a multi-way switch. This switch is so arranged that the lid of the case cannot be closed unless the switch is left on the highest range, i.e., 750 volts. This does away, to a very great extent, with the danger of the instrument getting burnt out, due to a high voltage being put on to a low range.

F. HARRISON GLEW.

Mr. Glew showed a number of interesting experiments in connection with radio-activity. By means of spirals coated with radium, he demonstrated the transmission of electricity through the air from a charged body to an electroscope several feet away, the latter becoming charged with electricity of the same sign. He showed also the rapid decay of the emanation from actinium with the aid of his "actinium lamp," and conducted other experiments with pure radium bromide and pure mesothorium.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD.

Perhaps the most interesting exhibit of this company was a Duddell permanent magnet oscillograph, specially designed and developed for use on 50,000-volt electrical circuits. Owing to the high sensitivity of this instrument, it is possible to employ non-inductive high resistances without having to dissipate a large amount of electrical energy. Thus the true wave form of the current supply is always obtained with certainty, the use of transformers with their risk of wave distortion being unnecessary. The outfit was shown working on the ordinary A.C. mains of the College.

Another interesting exhibit was the Paschen galvanometer (fig. 12). This instrument is of the moving-magnet astatic type, in which the magnets are arranged in two groups and the coils are arranged in pairs, as in the Thomson galvanometer. The coils are designed to secure the maximum effect for a given resistance of copper, by winding with different sizes of wire, beginning with the smallest size and winding each layer so that it lies within the surface, the polar equation of which is  $r^2 = d^2 \sin \theta$ , when  $r$  is the length of



the radius making an angle  $\theta$  with the axis of the coil, and  $d$  the value of  $r$  when  $\theta = 90^\circ$ . Following Paschen's designs, the coils have been wound with six sizes of wire on an elliptical former, which shape permits the use of the greatest number of magnets, and at the same time produces a field, the shape of which is more efficient, the result being a very high degree of sensitivity.

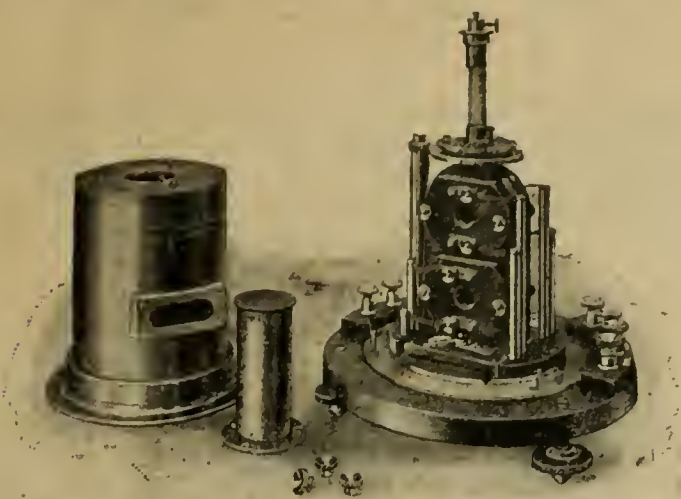


FIG. 12.—PASCHEN GALVANOMETER.

The Paschen thermopile, a modified form of that designed by H. Rubens, the material and the arrangement of the consecutive junctions being taken from the Rubens model, was also shown. In this device the heat capacity of the system is greatly diminished; the temperature increase due to radiation is 98 per cent. in 2 seconds, and practically complete in four.

An improved laboratory chronograph, a cathetometer, and the Rosenhain and Melsom portable potentiometer, were shown, and lastly, we may mention the Whipple-Féry radiation pyrometer, a modification of the standard pattern of Féry radiation pyrometer, for measuring extremely high temperatures in salt baths, crucibles of molten metal, &c. Fig. 13 illustrates a portable outfit. The working depends on the radiation of heat; the blind end A is made of quartz, fireclay, plumbago or steel, &c., and is inserted in the source of heat to be measured. The part C is a steel tube, bolted at D to the pyrometer "head" E, in which is fixed a small thermocouple and mirror. The heat of the end A radiates up the tube, and striking on the mirror, is brought to a focus at the point where the thermocouple is fixed. A millivoltmeter, attached to the leads as shown, indicates the actual temperature. A valuable feature of the Whipple-Féry pyrometer is that, should the blind end A break, due to any cause, it can be quickly and easily renewed with



FIG. 13.—WHIPPLE-FÉRY PYROMETER.

cheapness and without fear of the calibration of the instrument being altered.

#### INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS Co., LTD.

Referring to the new form of Wheatstone bridge described in our last issue, we are informed that this was designed by Mr. A. Dittmar, of Shooter's Hill, and is known as the "Dittmar pattern bridge or resistance box."

(To be continued.)

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### "Peel-Conner" Intercommunication Telephones.

The GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street E.C., have introduced a special "auto-reset" type of intercommunication telephone for wall and desk use; one of the latter patterns is shown in the accompanying illustration, fig. 1. The novel feature of this instrument is the automatic movement which



FIG. 1.—"AUTO-RESET" DESK TELEPHONE.

enables the telephone to be answered at any time, without the necessity of returning the switch to the "home" position. The new type can be used equally well for either central or local battery working. Standard sizes are made for from 5 to 20 lines. A number of other new telephones are described in the new list Section K, just issued by the company.

### The D. & G. Reading Lamp.

We illustrate in fig. 2 the D. & G. adjustable reading lamp which is being supplied by MESSRS. DRAKE & GORHAM, LTD., 66, Victoria Street, Westminster, S.W. It is useful for a variety of positions—on the desk, as a reading lamp, a piano lamp, and as a table lamp. It has, as its most important feature, a revolving shade by which



FIG. 2.—THE D &amp; G. READING LAMP

the light can be projected to any angle and concentrated wherever desired; all direct rays can be prevented from reaching the eyes. The lamp can be adjusted at any angle without taking out any screws or bolt. The reflector is a perfect parabola and small holes are arranged round the reflector base, permitting the heat to escape, and preventing blackening of the lamp. A number of illustrations showing the adaptability of the lamp appear in a booklet recently issued by the firm.

### The "Belenus" Electric Boiler.

Referring to a remark in our leader last week regarding the need of an electrical substitute for the kitchen boiler MESSRS. EASTMAN AND WARNE, of 241 and 243 Acton Vale, W., have brought to our notice their "Belenus" boiler, which is designed to give an unlimited supply of hot water for household purposes.

The apparatus consists, as shown in section in fig. 3, of a cast-iron cylinder provided with corrugations in the interior to give a large heating surface, and with deep grooves on the exterior in which the heating elements, of the metallic type, are embedded. As many as 18 circuits taking 500 watts each can be used, and these can be connected up by switches in any desired combination,

**German Lamp Prices.**—To correct a possible misapprehension, we wish to point out that the note on this subject in our last issue related to a reduction which took place about the same time as that which was effected in this country; there has been no reduction in Germany since then. The note was inserted mainly on account of the interesting explanation which it contained with respect to the relations of the various manufacturers regarding patent rights.

**Life of an Ediswan Lamp.**—With reference to the results recently published of tests carried out by a large municipal supply station on Royal Ediswan metal (tungsten) filament lamps, the company have just received the following letter from the engineer of one of the principal supply authorities: "With further reference to the life test made on a 35-watt 105-volt 'Royal Ediswan' metal-filament lamp . . . the lamp gave out after burning continuously for 6,970 hours."



taking only 30 watts when all are in series. The usual arrangement is to employ four or five switches giving a range from 500 watts to 9 kW. A smaller heater takes from 20 watts to 3 kW. The water to be heated passes through the interior of the cylinder, and cannot come into contact with the heating elements, which are surrounded by an air jacket to prevent waste of heat.

In the ordinary way the boiler is connected up to a hot-water tank as shown in fig. 4, exactly as the kitchen boiler is connected, so that the water automatically circulates through the heater and

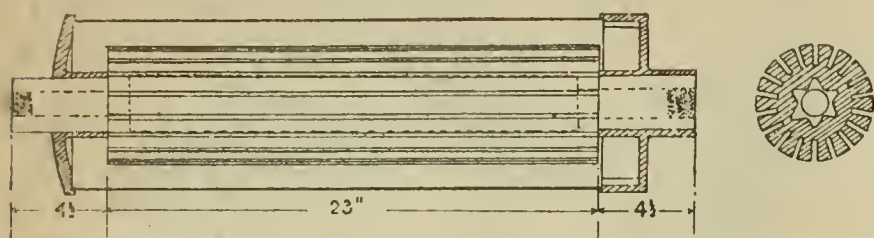


FIG. 3.—SECTION OF "BELENUS" ELECTRIC BOILER.

is stored in the tank. In practice the heater would not usually be fixed (as shown) in the bath-room, but in the kitchen or scullery, or in a convenient cupboard out of the way. As many as six bathfuls of hot water have been drawn off from a 40-gallon tank fitted with one of these heaters, the water, when the heater is working at maximum consumption, being heated almost instantaneously; the efficiency, according to a member of the staff of the electrical department of a Metropolitan Borough, who has installed one in his private house, is almost 88 per cent. over all.

Where an electric oven is also in use, it is convenient to arrange the connections so that when a moderate but uniform heat is required in the oven, all the oven elements are used, in series with the boiler, thus utilising the surplus energy to heat water; this is preferable to turning on only one of the oven elements, which

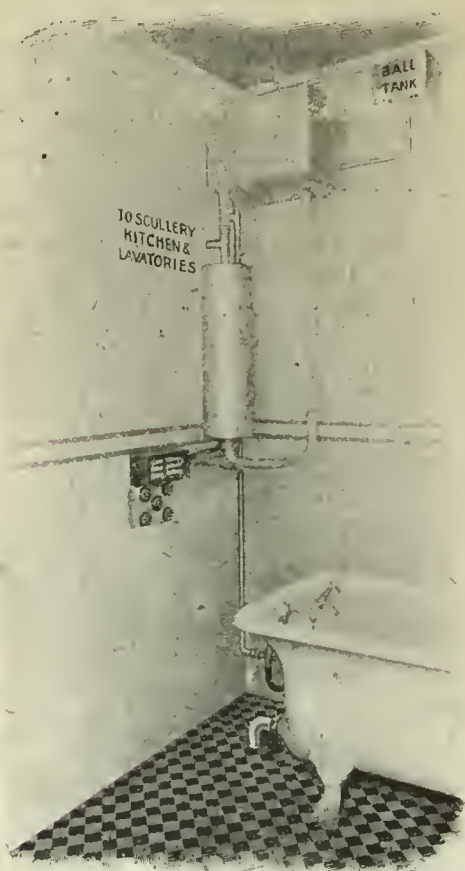


FIG. 4.—METHOD OF COUPLING THE "BELENUS" BOILER.

gives a local heat instead of a uniform heat throughout the oven. It will be noticed that the heating elements of the boiler can never rise much above a temperature of 212° F., as water is always present inside the heater.

The elements in this boiler are arranged on the same principle as those in the "Hot-point" flat-irons of the same makers. They consist each of a strip of chemically and electrically inert material about 1 in. in width, wound with heavy-gauge wire in close turns. In the heater illustrated each element is 24 in. long, and carries a maximum loading of 500 watts. The loading is therefore at the very low rate of but little more than 10 watts per square inch of surface. The elements are embedded in the slots shown in section in figure 3, the slots being previously lined with pure mica.

Another useful device of similar construction is a branding-iron for meat, &c., which can be kept red-hot for days together without suffering any injury.

#### Electric Signs.

The sign shown in fig. 5 is one selected from a number intended for different classes of service, and shown in the new list of the "ATTRACTA" ELECTRICAL CO., of 75, Fetter Lane, London, E.C. It

is a shop-window reflector sign for inside use, and is claimed to give a good illumination without glare. The sign front is made of hammered copper (reponssé), and the lettering is pierced out and



FIG. 5.—AN "ATTRACTA" SIGN.

backed up with opal glass. The lamps burn horizontally. Two sizes are listed, one measuring 3 ft. x 4 in. to take four incandescent lamps, and the other 4 ft. 6 in. x 12 in. to take six lamps. The firm's other advertising signs include the "Reflex" sign, made of wood with gilt lettering and with enamelled roof reflector, and the rigid glazed-box sign, both of these being for outside service.

## BUSINESS NOTES.

**Slide Rule for Shippers.**—We have received from MESSRS. SCHOLEY & CO., LTD., of 151, Queen Victoria Street, E.C., a slide rule for shipping measurements which they are issuing for the use of firms engaged in the export trade. The usual convention in ascertaining shipping "weight" is to reckon 40 cb. ft. per ton, and therefore it is necessary to determine the volume of a packing case in terms of this unit. This is easily accomplished with the aid of the slide rule, which has three scales marked in feet and inches, and a fourth graduated in "cubic tons" and tenths. The length, breadth and depth of the package being known, two motions of the slide rule at once give the number of "cubic tons" contained in the case. The scale has a range from 0.5 to 50 "cubic tons," and can be used to deal with packages up to 40 ft. in length; it ought to prove extremely useful to shippers, saving much calculation and reference to tables.

**Willans & Robinson, Ltd.**—We understand that among recent turbine orders received by MESSRS. WILLANS AND ROBINSON, are the following:—

**New South Wales Government.**—Three 7,000-kw. turbines, and one 5,000-kw. turbine, coupled to Dick, Kerr alternators, and provided with surface condensing plants, all in connection with suburban railway electrification.

**Warwick Coal Co.**—Two 750-kw. mixed-pressure turbines, coupled to G.E.C. alternators, to be supplied with Willans jet condensing plants.

**Lethbridge Corporation (Canada).**—One 1,500-kw. turbine, coupled to Siemens alternator, and provided with surface condensing plant.

**Ipswich Corporation.**—One 1,000-kw. turbine, coupled to Siemens D.C. generators, and provided with surface condensing plant. (Repeat order.)

**Frank Smith Diamond Estates, South Africa.**—One 1,200-kw. turbine, coupled to Vickers three-phase alternator, and provided with surface condensing plant.

**Salford Corporation.**—Two 1,000-kw. turbines and condensing plants.

A large number of Diesel engine orders have also been secured, including the following:—

**The Tata Hydroelectric Supply Co., Bombay.**—Three 100-H.P. engines for driving alternators.

**Whitehead Torpedo Co.**—One 100-H.P. engine for driving a D.C. generator.

**Messrs. Macadam & Co., for Buenos Ayres.**—One 200-H.P. engine for driving a D.C. generator.

**Messrs. Mitrovitch Bros.**—Three 50-H.P. engines for driving crushers.

**Commercial Lectures.**—The London School of Economics and Political Science, Clare Market, Kingsway, W.C., has issued a list of short courses of lectures on commercial subjects that have been arranged for the Lent term. They include six lectures on "The Trade, Industry and Finance of the British Empire" by Mr. Ben Morgan on Wednesday afternoons, beginning January 24th; an elementary course of 11 lectures on "The Organisation of English Foreign Trade," by Mr. A. J. Sargent, on Thursday afternoons, beginning January 18th; three lectures by Mr. C. K. Hobson on "The Export of Capital"; 10 lectures on "The Economics of the Distribution of Goods," by Mr. W. Calvert; two lectures on "The Economics of the Iron Trade," by Mr. Harold Jeans; and various other subjects. Copies of the complete announcements can be obtained from the Hon. W. P. Reeves, director, at the School as above.



**Condensing Plant.**—The following three important contracts for condensing plant have recently been received by the MIRRLEES WATSON CO., LTD., of Glasgow :—

*Glasgow Corporation Tramway Power Station, Pinkston.*—One set of surface condensing plant for 5,000-kw. alternator. The condenser is of direct flow type, having 10,200 sq. ft. cooling surface. The air pump is of the Mirrlees-Leblanc rotary type, and, together with the water-extracting pump and centrifugal circulating pump, is driven direct from an auxiliary steam turbine running at 2,000 R.P.M. The plant is designed to deal with 72,000 lb. of steam per hour, giving a vacuum of 28 in. with water at 70° F. This is the seventh set supplied by the firm for the Pinkston power station.

*Liverpool Corporation.*—Two sets of surface-condensing plant for Lister Drive No. 1 power station. These condensers work in connection with 3,500-kw. turbo-alternators by the British Thomson-Houston Co. The condensers are of circular type, having 11,000 sq. ft. of cooling surface, and are fitted with Mirrlees-Edwards three-throw air pumps, motor-driven. This is the eighth set supplied by the firm to the Liverpool Corporation.

*Manchester Corporation.*—One set of barometric jet condensing plant for the Stuart Street station. This plant will work in conjunction with a 4,000-kw. exhaust-steam alternator, supplied by Messrs. Jas. Howden & Co., and will be capable of dealing with 137,500 lb. of steam per hour, giving a vacuum of 27½ in. with water at 80° F.

**Calendars and Catalogues.**—MESSRS. MCCLURE AND WHITFIELD, of the Mersey Dynamo Works, Adswold, Stockport, have again sent us a very serviceable Letts's pocket diary and note-book for 1912. A £1,000 accident insurance coupon will be found in the pocket.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—Sixteen-page catalogue giving tabulated sizes and prices, accompanied by small and neat illustrations, of light and heavy-gauge conduits and fittings, conduit couplings, elbows and bends, conduit boxes, switch and ceiling-rose boxes, special cast boxes, earthing clips, water-tight fittings, china connections, conduit bender, a special joint box for power work, wireman's tools, and sundries.

MESSRS. WM. WADSWORTH & SONS, Thynne Street Works, Bolton.—Several attractively produced publications regarding the firm's manufactures. One very fully describes and illustrates the "Wadsworth" electric lift for hotels, hospitals, warehouses, &c. Another contains numerous views of runways and transporters fitted up for different classes of buildings and works, also travelling chain blocks, pulley blocks, &c. Two smaller pamphlets give names of representative firms using the Wadsworth electric goods lifts.

THE DOWSING RADIANT HEAT CO., LTD., 105, Great Portland Street, London, W.C.—A new 12-page pamphlet (List B) has been prepared containing illustrations and prices of a number of their electric cooking appliances. Our readers hardly need to be told that the firm's experience in the manufacturing of electric heating apparatus dates back a very long time. As long ago as 1902 Mr. H. J. Dowsing was demonstrating to public audiences the possibility of using electricity for cooking purposes. The manufactures shown in this list include frying pans, combined grill, toaster and hot-plate, electric toasters, soldering irons, kettles, milk sterilizers, hot-water jugs, flat-irons, bronchitis kettles, electric heating pads, an electric cooking range, and, of course, luminous electric radiators.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, London, E.C.—Two new brochures are just being issued—one concerned with the "Mazda" lamp, and the other with the new "Gem" lamp. The "Mazda" booklet, by means of fetching little illustrations, shows how to use lamps properly, and secure the best illumination, and it contains a concise description of lighting by Mazdaliers—the name given to a complete lighting set, consisting of a Mazda lamp with a properly-designed reflector and gallery to hold the reflector in correct position. The list is produced in pleasing colours. A supply can be obtained, with contractor's name and address over-printed, on application to the Publicity Department of the company at the above address. The "Gem" lamp pamphlet is also attractively printed, and it summarises the merits and advantages of the "Gem" lamp. Copies are now being distributed, and contractors can also obtain these with their name and address over-printed, on application to the B.T.H. Publicity Department.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—New List, Section K, eleventh edition, consisting of 80 pages of illustrated descriptions, with prices, &c., of various telephones and telephonic accessories, fire alarms, water-level apparatus, and electric clocks. The compilers of the list have endeavoured to keep the number of instruments at a minimum, and to standard the apparatus both with regard to parts and details. A number of improvements have been effected and new designs introduced. From among the variety of apparatus shown we may select the following for mention:—Direct-working telephones specially suitable for private house installations; battery call telephones, with induction coils; intercommunication telephones; magneto-call telephones; "Strongphone" telephone; iron-case magneto-waterproof telephones; telephone brackets. Several pages are occupied with diagrams of connections.

MESSRS. POOLEY & AUSTIN, 25, Victoria Street, London, S.W.—40-page catalogue devoted to illustrated (art paper) descriptions, and fully tabulated price information, of the "Panda" country house and other electric lighting plant. Combinations of plant under different circumstances and in various forms are given. The contents include the following:—Petrol-electric, paraffin-electric, high-grade petrol-electric, high-grade paraffin-electric generating sets; Thorncroft-Mawdsley generating sets; crude-oil generating

sets; horizontal direct-coupled or belt-driven paraffin generating sets; Bruston automatic plants; switchboards for direct running and for accumulators; complete lighting plants; Mawdsley "Zone" dynamos and motors; motor-starters and panels; direct-coupled gear pumps. The firm have supplied a large number of country house sets, and they have had actual experience with all the types contained in this booklet. The information is set forth in a form which, it is hoped, will save some trouble in the preparation of estimates.

MESSRS. KRIPKA & JACOBY, 11, Queen Victoria Street, London, E.C.—We have received several priced leaflets from this firm regarding the "Graetzin" metal-filament lamps.

MESSRS. ENGINEERING AND ARC LAMPS, LTD., Chingford, Essex.—Twelve-page booklet, containing attractively set-out information respecting their "Beacon," "Sunrae," "White Star," Gilbert enclosed, Davy enclosed, and "Cullinan" arc lamps. A number of copies of this booklet will be forwarded to contractors on application. A separate leaflet gives particulars of the "Attractor" electric advertising sign, with flasher and tapper—a device which attracted a good deal of attention at the recent Olympia Electrical Exhibition.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, London, E.—We have once more been favoured by this company with one of their serviceable desk blotting pads with top pocket.

From MESSRS. W. H. WILCOX & CO., LTD., of 23, Southwark Street, London, S.E., we have received one of their usual date remembrancers for the current year. It has monthly slips on each of which illustrations of some of the firm's engineering stores appear.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Users of the G.E.C. Daily Reminder have been supplied with a set of refills for this very convenient desk engagement record, for the current year.

MESSRS. VENNER & CO., of 6, Old Queen Street, London, S.W., have sent out to their friends a handy little souvenir in the form of a leather visiting card case which, being less bulky than the ordinary pocket case, occupies just as much space as such a necessity should in one's dress suit pocket. Messrs. Venner have only a few left, but they invite regular recipients of their souvenirs whom they may have inadvertently overlooked, to communicate with them.

MESSRS. MAYOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Hanging calendar for 1912, with bold figuring on monthly tear-off slips, above which are illustrations of the firm's electric motors.

From MESSRS. J. W. BROOKE & CO. LTD., Adrian Works, Lowestoft, there has come to hand a neat desk memoranda book.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 13 and 14, Blomfield Street, London, E.C.—We have received a hanging calendar for 1912, with daily slips, each of which has a thought from the poets. Neat illustrations of the firm's fuse-boxes appear in colour on the card.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Pamphlet No. 2,247, just issued by this company contains an interesting set of photographs typical of some of the applications of the B.T.H. electric drive to widely varying conditions in the cotton, flax, jute and woollen branches of the textile industry. The views are each accompanied by a few sentences of descriptive information, and the installations covered are those at the following works: Braidwater Spinning Co., Ballymena, Ireland; the English Sewing Cotton Co., at Skipton; J. & P. Coats, Ferguslie, Paisley; J. Orr & Sons, Castleton, Manchester; Joshua Whiteley & Co., Ltd., Huddersfield; J. Faulkner, Ltd., Walkden; Convoy Woollen Co., Convoy, Donegal; James Scott & Sons, Dundee. We understand that the B.T.H. Co. have installed electrical plant in textile mills in the United Kingdom to the extent of upwards of 30,000 H.P., and in addition they are able to place at clients' disposal experience obtained by the installation of over 400,000 H.P. in textile mills, dating back over many years.

MESSRS. POPE'S ELECTRIC LAMP CO., of Hythe Road, Willesden, have issued a calendar for 1912 in quite a novel form. A stout card is cut to the shape of a lighthouse (many of our readers will recall the firm's exhibit at Olympia) with a Pope British-made metal lamp in the tower showing "a light-way to a lighthouse." It is in appropriate colouring, and the month, day and date are shown, through openings, by revolving card disks fixed behind. Readers applying on their business paper to the company will receive one of these calendars, which is made to either stand or hang as required.

MR. CHAS. H. BLUME, The White Building, Fitzalan Square, Sheffield.—Wall calendar for 1912 with monthly slips above which appears a list of some uses for which the firm's varnishes, enamels, and other specialities are adapted.

THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, London, E.C.—New 12-page list (No. G 1,112) in which are given particulars with illustrations and prices of the "Gral" metal-filament lamps, candle lamps, train-lighting lamps, battery lamps, auto-transformers, shock absorbers, reflectors, "Gral-arc" fittings for interior and exterior lighting, metal lamp shades, "Holophane-Benjamin" steel reflectors, and Holophane reflectors.

**Meeting of Creditors.**—JOHN MUSGRAVE & SONS, Bolton.—The *Financial Times* contains a report of a meeting of the creditors of this well-known company, which was held at Bolton on the 4th inst. Mr. Harold Mather, the voluntary liquidator, presided. The business is one of the oldest in Bolton, and was registered as a company in 1897. "For the past three years profits were made, but owing to the state of trade during the last two years and five months, the company had sustained heavy losses. The authorised capital is £200,000, in £10 shares, of which £8 per share has been paid up, according to a return dated September 20th,



1911, while there were mortgages and charges which required registration under the Companies' Act, 1907, of £115,000 at that date. The total assets as a going concern, exclusive of uncalled capital as at December 8th, 1911, showed a substantial surplus over all liabilities. After hearing the liquidator's report, the creditors, to the number of about 150, agreed unanimously to continue Mr. Mather as liquidator. It appears that the receiver and manager, Mr. Arthur Kirkham, who was appointed by the Court on behalf of the debenture-holders, is running the business, and it is understood that a scheme for reconstruction is being formulated which, it is hoped, will be successfully carried through, as the firm have a long and honourable record, and are large employers of labour."

**Dissolutions and Liquidations.**—**ERNEST SCOTT AND MOUNTAIN, LTD.**—A meeting of creditors is called for January 18th at the Station Hotel, Newcastle-upon-Tyne. The resolution to wind up was passed at a meeting held on December 29th, and Mr. J. L. Oliver, 32, Grainger Street West, Newcastle-on-Tyne, was appointed liquidator.

**NORTH BRITISH ELECTRIC POWER SYNDICATE, LTD.**—A meeting will be held on February 13th at 695, Salisbury House, London Wall, E.C., to hear the liquidator's account of the winding up.

**Bankruptcy Proceedings.**—**C. A. SMITH** (trading as C. J. Smith, electrician, 23, King Street, Regent Street, London).—Application for debtor's discharge is to be heard on January 23rd, at Carey Street, W.C.

**Aluminium in Italy.**—Negotiations are in progress between the Italiana Società Alluminio and the French aluminium-producing companies with a view to making a Franco-Italian trust in opposition to Swiss producers.—*Giornale dei Lavori Pubblici*.

**Book Notices.**—*Willing's Press Guide, 1912.* London: James Willing, jun., Ltd. 1s.—This very handy directory has reached its 39th year. It is all that it claims to be—a concise and comprehensive index to the Press of the United Kingdom, arranged both alphabetically and geographically. It also contains a list of some colonial and foreign journals.

"*Proceedings of the American Society of Civil Engineers*," Vol. XXXVII, No. 10. December, 1911. New York: The Society.

"*L'Annuaire du Bureau des Longitudes, 1912.*" Paris: Gauthier-Villars. Price 1 fr. 50 c.

**For Sale.**—The Paisley Corporation electricity department has for disposal one 300-kw. Ferranti steam alternator, five Ferranti rectifiers, and about 200 Wright's maximum-demand indicators. The Tunbridge Wells electricity department has for disposal two Ferranti rectifiers, 20 rectified A.C. arc lamps, and 25 open-type A.C. arc lamps. See our advertisement pages to-day.

**Trade Announcements.**—**THE CRYPTO ELECTRICAL CO.** have opened a branch office at 77, Victoria Street, Bristol, where they will hold a large stock of their standard pattern dynamos, A.C. motors, A.C. to D.C. transformers, engine sets, &c.

Owing to the increased demand for their Moscicki condensers, Giles valves, and other specialities, **MESSRS. ISENTHAL & CO.** have very largely extended their manufacturing facilities, and have now transferred the whole of their plant to new works situated at 83, Denzil Road, Neasden. All correspondence should, however, as hitherto, be directed to 85, Mortimer Street. The firm are at the present time exceedingly busy filling important contracts for Moscicki condensers for wireless work for the Admiralty, the War Office, and the Imperial Japanese Navy; and also for Moscicki condensers and accessories for line protection for a number of British, South African, and South American, power supply companies.

**THE ADAMS MANUFACTURING CO., LTD.**, announce that as they have now appointed sole selling agents for London and district, they have given up their showrooms and offices at 106, New Bond Street, and have transferred their offices to Balfour House, Finsbury Pavement, London, E.C., to which address all communications regarding "Adams" cars should be directed.

**Electrical Trades Union.**—A demonstration of Lundberg's system of control will take place on Tuesday evening, January 16th, at 9 o'clock p.m., at Bush Hotel, Shepherd's Bush Green, W. All who may be interested are invited to be present, and those wishing to join should communicate with Mr. W. J. Webb, 98, Coomer Road, Fulham, S.W.

**Sisson Engines.**—We learn that during the 12 months ending December 31st last, **MESSRS. W. SISSON & CO., LTD.**, of Gloucester, have constructed about 450 I.H.P. of marine machinery, about 2,100 B.H.P. of Sisson enclosed self-lubricating engines, 590 I.H.P. of open auto engines, and three sets of steam machinery for main line railway motor-coaches. The work on hand includes 140 I.H.P. of marine machinery, and about 1,100 B.H.P. of Sisson enclosed engines.

**Russian Platinum.**—It is announced that the Russian Ministry of Commerce has placed before the Duma a Bill which aims at the regulation of the production of, and trade in, platinum. At present the trade is in the hands of foreign firms, although Russia is the only country which produces the metal in noteworthy quantities. It is now proposed to register the whole of the production, and sales will only be able to be effected on the basis of special certificates. The export of crude platinum is to be prohibited, it being stipulated that the metal must be refined in the country.

## LIGHTING and POWER NOTES.

**Accrington.**—The Electricity Committee has had under consideration estimates submitted by the electrical engineer for the installation of the necessary mains and plant for the supply of current within the area of Altham and Clayton-le-Moors, and has resolved that application be made to the L.G.B. for sanction to borrow the following sums, viz.: Low-tension distributors for compulsory area, £3,250; high-tension feeder cable, £1,900; normal future extensions, £1,000; high-tension switchboard extension, £600; making a total of £6,750.

The Corporation at the meeting on January 8th decided to apply to the L.G.B. for power to borrow £33,750 in connection with the electricity undertaking. Of this sum, £27,000 is required for the proposed scheme of replacing the steam plant by gas-driven plant. The remaining £6,750 involved in the application is referred to above.

**Ayrshire.**—The plans of a refuse destructor, the contract for which has been placed with Messrs. Heenan & Froude, were before Largs T.C. on Friday last. An amendment of the plans was ordered.

**Bedford.**—Owing to the small revenue from current used through prepayment meters, the T.C. has decided to discontinue the allowance of discounts on sums collected at the rate of  $\frac{1}{2}$ d. per unit.

The T.C. has decided that the E.L. at the Institute and Free Library extensions shall be carried out by the electrical engineer.

On January 4th a L.G.B. inquiry was held respecting the application of the T.C. for a loan of £22,837 for electricity purposes. The inspector, Mr. T. C. Ekin, said the Board would not grant the application in its present form; it would allow sufficient for mains, meters, and services for three years, but definite plans must be given as to the machinery and buildings required. The loan applied for was thereupon reduced to £8,400 for mains, services, meters, transformers, and public lighting. To this there was no opposition.

**Belfast.**—Amongst the extensions which it is stated that the well-known shipbuilding firm of Messrs. Workman, Clark and Co., Queen's Island, will carry out this year are the erection of new gantries of the overhead type, which will enable the firm to build much larger ships than any they have heretofore constructed. The gantries will be electrically equipped.

**Bexley.**—The U.D.C. has decided to support the Bill of the I.M.E.A. seeking wiring and other powers for local authorities.

**Birkenhead.**—The T.C. has been recommended to install the E.L. in the new King Edward Memorial Clock Tower at a cost of £49, and to light the clock at an annual charge of £12 10s.

**Birmingham.**—The City Council is bringing forward various proposals for the efficient development of electricity supply in the enlarged city area. It is understood that the Aston and Handsworth generating stations will be eventually converted to sub-stations, as the Birmingham H.T. supply is understood to be cheaper than direct generation. New sub-stations are proposed at Harborne and Greet for the supply of King's Heath, Yardley, &c., and an expenditure of £15,000 is involved.

**Bootle.**—The T.C. at its meeting on January 3rd had before it a recommendation of the Electricity Committee with regard to the extension of the electricity works, outlined in the report of the borough electrical engineer submitted to the Council on December 6th, 1911. The proposal includes the purchase of land at £6,500, and the total cost of the scheme is estimated at £41,255, which amount the Committee recommends should be obtained by loan or out of reserve funds of the Corporation. It is explained that one of the objections to the site near the present works was the foundations, and on the proposed new site borings had been taken with satisfactory results. It is, however, not proposed to abandon the existing works or plant, but to use them as a supplementary station. An extension was imperatively called for, owing to the increasing demands for energy, and the Committee submitted the scheme in the hope that its hands would be strengthened so as to enable it to supply electricity as cheaply as other towns and induce manufacturers to come to Bootle. After discussion the following motion was agreed to: "That before the Council approve the scheme an independent electrical engineer be appointed to criticise the scheme, such person to be a practical engineer in charge of an electric works giving a public supply, and to be appointed by the president of the Municipal Electrical Association."

**Braunton.**—The E.L. and Power Co. expects to supply current early in February for lighting by meter, the charge will be 5d. per unit; by contract 8s. per annum for each 32-c.p. lamp used, and 4s. per annum per bedroom lamp of 16 c.p.; for motors and heating, 2½d. per unit.

**Chatham.**—An E.L. installation to cost £2,000 is being carried out at the Empire Theatre.

**Croydon.**—The Guardians have instructed the surveyor in consultation with Mr. Cramb, the borough electrical engineer, to prepare the necessary specifications in order to obtain preliminary quotations from certain expert firms for the electrification of two lifts at the infirmary.



**Dover.**—The D.C. has decided to obtain quotations from local contractors for wiring the laboratories at Dover College for the E.L.

**Eton.**—After an animated discussion, the Guardians have decided to adopt electric lighting in place of gas for the workhouse and infirmary.

**Haslingden.**—The new electricity supply was discussed at the last meeting of the Council, and Councillor Russell expressed the hope that the gas lamps in the main thoroughfares would not be done away with until the electric light was made thoroughly satisfactory. The chairman of the Electricity Committee, he thought, would agree that the light was not as good as might be expected. Councillor Waddington replied that the intention was to allow the old lamps to remain until they had passed the "experimental" stage of electric lighting. His strong opinion was that the electric light in the main thoroughfares was a decided improvement upon incandescent gas, but he was also of opinion that the electric light could be improved if the Lighting Committee were prepared to pay more money.

**Halifax.**—The T.C. has been recommended to adopt a new scale of charges for current for power in the case of large consumers on the following sliding scale, based on quarterly accounts:—Accounts under 200 H.P., 2d. per unit; 200 to 250, 1½d.; 250 to 300, 1¼d.; 300 to 350, 1¼d.; 350 to 450, 1d.; 450 to 550, ¾d.; 550 and upwards, ½d. This scale is subject to the following discounts:—20 to 30 H.P. demanded, 5 per cent.; 30 to 50, 5 per cent.; 50 to 75, 10 per cent.; 75 to 100, 15 per cent.; 100 to 150, 20 per cent.; 150 to 200, 25 per cent.; 200 and upwards, 30 per cent., with a further discount of 5 per cent. as at present. The special discounts are only operative if a consumer takes 125 units per H.P. demanded. Consumers having a maximum demand of not less than 100 H.P. will be considered as taking a bulk supply, and will be entitled to use current for any purpose, including lighting, at power rates, with the special and ordinary discounts.

**Higham Ferrers.**—The T.C. has decided not to assent to the application for a prov. order for E.L. by the Rushden and District E.L. Co., unless the local authorities concerned have the option of purchasing the undertaking in 30 years.

**Hull.**—The T.C. has referred back to the E.L. Committee a recommendation to support the Bill of the I.M.E.A., and to contribute up to £30 towards the cost. The opposition was on the grounds of municipal trading.

**Kenmare.**—The electric lighting plant at Ashgrove Mills, after lying dormant for some seven years, has been taken over by Mr. Campbell, engineer, and there is every likelihood of the town being lighted in future by electricity. There is a fine opening for both public and private lighting in this town in lieu of the oil lamps at present in use.

**Leeds.**—Last week, Mr. Hooper, of the L.G.B., held an inquiry into an application of the Corporation for sanction to borrow £60,000 (£40,000 for the laying of mains, £10,000 for the equipment of sub-stations, and £10,000 for the laying of sewers) for purposes of electric lighting. Mr. Mitchell, the deputy city treasurer, stated that the city's total indebtedness was £13,139,228, exclusive of loans not taken up, of which there remained £1,684,953. The inspector observed that he found the capital charges were double the cost of production. These charges were 1d. per unit on 14 million units, which absorbed about £60,000 a year, while the cost of production was only about half that sum. He thought their charges stood very high in comparison with other municipal undertakings. They were making a profit of £10,000 a year, and they came to the B. of T. in effect to borrow money to make a contribution to the Leeds rates. It would only cost the city more. The undertaking had a very large surplus revenue, which apparently had been placed altogether to the relief of the rates. A portion of the ratepayers were thus required to contribute largely to the general rates of the whole city. The £60,000 asked for was further to increase the indebtedness of the city and the rates, for they could not borrow that sum without paying for it. Leeds was one of the few cities which were still purchasing meters out of borrowed money. Cheap power was the very life blood of a manufacturing city, and yet £10,000 surplus had been devoted to the relief of the rates. He suggested that in future Leeds should purchase meters out of revenue as others did who were less satisfactorily situated. Meters that once cost £5 to £7 each could to-day be brought for 38s. They had £8,000 in hand of the loan granted in 1903, and which had then to be expended in three years. He recommended that the £10,000 applied for for services be withdrawn until further consideration, which the deputy town clerk said they would do. The inspector then discussed the items for mains and sub-station equipment, and in reply to a ratepayer, he said no portion was intended to be used in competition with electrical traders in the city in the sale of fittings.

For some years it has been the policy of the Corporation to keep the electric supply and tramways generating plants distinct. Recently, however, a move has been made in the other direction, by the decision to feed a new 800-KW. tramway converter at Crown Point from the electricity department's station in Whitehall Road.

**Lincoln.**—Answering an inquirer who wished to know why it was proposed to extend the plant and buildings at the electricity works, Mr. W. S. White, the chairman of the Committee, stated that they were getting so many applications for current that it was absolutely necessary either to refuse them or to extend the plant.

**Llangollen.**—The U.D.C. has decided to defer the further consideration of the E.L. question for six months. The Council is advised that in disposing of the prov. order to the Light and Power Co. it acted illegally, and is still responsible for the supply of electricity. The courses open to the Council are to obtain an amended order, to purchase the E.L. Co., or "to permit matters to go on as at present."

**London.**—KENSINGTON.—The Rota Committee appointed by the Infirmary Committee to consider the question of the electric lighting of the Infirmary has issued a report thereon. It states that at present the Infirmary, with the Administrative Block, the three official residences, operating theatre, and the day and night nurses' quarters, the porter's lodge and the maternity block are lighted by 654 gas lights. By substituting electric light therefor an approximate annual saving of £221 would be made, based on the following figures: Annual cost of energy for 738 lights at 2½d. per unit (the price which the Brompton and Kensington Electricity Supply Co. is prepared to charge), £400; annual renewal of lamps and breakages, £125; annual cost of candles for night work, £15; annual allowance for gas lighting in basement, passages and stove hole, £20; total, £560, as against £781 for gas lighting. The cost of installation is estimated as follows: Wiring at 30s., £1,101 10s.; cables, £250; fittings, fixing same and lamps, £476 8s. 9d.; architects' fees, &c., £92; contingencies, £80; total, £1,999 18s. 9d. The Committee, therefore, recommends (1) that the system of lighting by electricity be substituted for gas in the Infirmary; (2) that proper specifications of requirements be prepared and tenders be invited; and (3) that Siemens cables, which are of English manufacture, and Osram lamps be employed. The Infirmary Committee proposes to adopt such measures as shall enable the scheme to be carried out.

**HAMMERSMITH.**—In connection with the scheme approved by the Council on March 29th, 1911, for the supply on hire to consumers, of wiring and fittings, the Committee expressed the opinion that it was of importance that the Council should offer facilities of this kind in order to meet the requirements of such consumers, and also to cope with the competition of gas supply companies. It was impracticable, the Committee stated, to submit a scheme fixing definitely the amount to be charged for hiring lamps and fittings for the interior of houses, as this would necessarily depend upon the type of fittings required and the extent of wiring necessary. In these circumstances the Committee recommended that the Council approve of the principle of hiring out, on satisfactory terms to be approved in each case. Permission is to be granted to exhibitors in the "Ideal Home" Exhibition desiring to light their own stands by means of their own plant to do so subject to the payment of a royalty of 10s. 6d. per stand for the privilege, without prejudice to the rights of the Council under its contract for the supply of electricity to Olympia.

**HACKNEY.**—The Electricity Committee reports that it has had under consideration the Bill which is being promoted by the National Electric Construction Co., Ltd. The object of the Bill is to meet the decision in the case of the Attorney-General against the Leicester Corporation, that local authorities possessing electricity undertakings have no power to spend money in wiring or fitting up the premises of the consumers. In the case of Hackney, an agreement was entered into with the company in June, 1901. Strong objections had been taken by some of the authorities who had entered into agreements with the company to the ratification of such agreements. The Committee recommends that a petition be presented against the Bill.

**Mansfield.**—The B. of G. has been convinced, according to the report of the Buildings Committee, that the cheaper method of lighting the workhouse by electricity is by the provision of its own plant. The board will, however, favourably consider an offer from the T.C. if the terms for energy are on such a basis as will compete favourably with its own installation.

**Newton-in-Makerfield.**—The U.D.C. has approached the St. Helens T.C. for a supply of energy in bulk, and the matter is being gone into.

**Oldham.**—The Electricity Committee has decided to experiment with electric cookers or stoves, and to allow the users free electricity for a period of three months.

**Oswestry.**—The T.C. has agreed with the E.L. company for the lighting of the Cross Market by electricity.

**Plymouth.**—The T.C. is recommended by a Special Committee not to entertain the proposal for a weekly rest day for the electricity and tramways departments. In the case of the former the cost would be £473 per annum, and in the case of the latter £1,200.

**Queensbury.**—This hill-top township between Bradford and Halifax, commonly known as "The Mountain," is finding some difficulty in its efforts to secure a supply of electricity for public purposes. At a meeting of the District Council, held last week, answers to inquiries for terms were read. Messrs. Foster and Sons, of the famous Black Dike Mills, replied that they were not at present in a position to offer a supply, though they might be able to do so later. The Bradford Corporation stated that it would have to lay a special cable, 2½ miles in length, and it would be necessary to erect a sub-station. The cost would be about £500. If Bradford were to supply the electricity the Queensbury Council would have to guarantee 20 per cent. on the capital outlay. That, however, would be waived if Messrs. Foster would take 100 kw. at a charge of £3 per kw. The Halifax Corporation replied unfavourably, and the Council has, therefore, to consider the subject further.



**Goole.**—On Tuesday an important interview took place between the District Council and the promoters of two schemes for the electric lighting of Goole. The promoters are making application to the Board of Trade for a provisional order. The Electrical Distribution of Yorkshire, Ltd., of Thornhill, propose supplying a considerable area of Goole, and also the parishes of Airmyn, Hook and Rawcliffe. The second scheme is promoted by Mr. James Wm. Speight, electrical engineer, of St. Annes-on-Sea, and the area of supply is confined to Goole only.

**Reddish.**—A number of residents and manufacturers at Reddish have asked the Stockport T.C. to consider the advisability of giving a supply of electricity for lighting and power. A canvass is to be made to ascertain the prospective consumption.

**Runcorn.**—The Castner-Kellner Alkali Co. has notified the R.D.C. of its intention to lay distributing mains for the supply of electrical energy in certain streets of Weston.

**Shanklin.**—The U.D.C. has entered into a contract with the E.L. company for public lighting for a further term of three years, subject to 20 further lamps being converted from 50 C.P. to 100 C.P.

**South Africa.**—The Cape Town Corporation has now made arrangements to take over the assets of the Cape Peninsula Lighting Co. for the sum of £46,500. This company has for many years had a monopoly in the supply of electric lighting to the suburbs of Cape Town, comprising the municipalities of Mowbray, Rondebosch, Claremont and Wynberg. The contracts with these municipalities all expire very shortly, and fresh tenders were recently called for, with the result that the tender of the Cape Town Corporation was accepted by the municipalities of Mowbray, Rondebosch and Claremont, and the tender of the Kalk Bay and Muizenberg municipality was accepted for the electric lighting of Wynberg. Owing, however, to the rejection by the ratepayers of Kalk Bay and Muizenberg municipality of the proposal for a loan for the necessary mains between Muizenberg and Wynberg, tenders are again being called for by the Wynberg municipality.

The Cape Town Corporation proposes to spend £16,000, being the estimated cost of linking up the city system with the suburban lighting works, so as to enable the generating to be done from the Corporation station, and to enable the Council to close down the power station of the Cape Peninsula Lighting Co., at Claremont, and to dispose of the plant there. The City Council will supply consumers in the suburbs on the same terms as those in the city, both as regards lighting and power consumption.

The report of the city electrical engineer on the output and distribution of electric current for the month of September, 1911, compared with 1910, shows the total number of private consumers in Cape Town to be 1,685, as compared with 1,466 in the same month of last year; Woodstock 42, compared with 20; Green and Sea Point 163, compared with 73; and the number of equivalent 8-C.P. lamps in Cape Town 147,789, compared with 129,211; Woodstock 2,768, compared with 1,387; Green and Sea Point 8,472, compared with 4,049; while the H.P. of motors in use in Cape Town increased from 3,235 to 3,868, and in Woodstock from 120 to 157 H.P.; whilst the H.P. of motors in Green and Sea Point increased from 41 to 54 H.P.

The electric lighting scheme for Robertson, Cape Colony, is to utilise a small waterfall, supplemented by oil engines.

**Stirling.**—A proposal to place a refuse destructor at the Corporation electricity station is likely to be opposed by residents who fear that the amenity of the district will be seriously affected, and the valuation of property reduced.

**Tunbridge Wells.**—Unless the borough is struck out the T.C. has decided to oppose the Bill of the National Electric Construction Co., Ltd., which is being promoted to make binding with local authorities, agreements entered into with respect to free wiring.

The T.C. has decided to invite tenders for new switchgear at an estimated cost of £791.

**Wakefield.**—The scheme for extending the supply of electricity to Sandal has been approved. It has been decided to substitute electric lamps for gas lamps in several streets.

**Worcester.**—On the recommendation of the city electrical engineer, the Corporation has decided that the change over from single to two-phase, shall be completed this year instead of during the next three or four years, as originally intended. This course has been adopted owing to the demand for current having considerably exceeded the increase contemplated. It was estimated that at the end of two years there would be, in addition to the £1,300-£1,400 worth of current which Messrs. Heenan & Froude agreed to take, an additional consumption yielding about £300. Already, however, the Committee has secured business to the extent of £750, and negotiations are in progress for the supply of a further £650 worth. The expediting of the change will necessitate some additional expenditure.

**Wimbledon.**—Sanction has been received from the L.G.B. to the borrowing of £2,205 for electric lighting and house services, and £895 for motors. The town clerk reports the cessation of negotiations as to the supply of electrical energy to the Polytechnic Estate, as the trustees are not prepared to accept the Council's offer to purchase the supply cables laid in the Estate. Mains are to be laid in Quintin Avenue, Richmond Avenue, and Chatsworth Avenue, Merton, at an estimated cost of £1,300, in order to supply energy to premises in these roads, owing to the trustees for the debenture-holders of the Polytechnic Estate having given notice to the residents on the Estate that they would not supply energy after March 31st next.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—Following the example of Dundee, Aberdeen is to experiment with a system of railless traction. The Corporation Tramways Committee recommends the T.C. to inaugurate the system in the Footdee district—the only part of the city at present not served by the tramways. The route, it is proposed, should be along the Quay, starting from Market Street, Trinity Quay, York Place, York Street, and terminating at the end of York Street or Pocra Jetty, a distance of over a mile. The service will necessitate the purchase of two cars. The total cost (including the expenses connected with the provisional order) is estimated at £3,050. The total annual expenses (including capital charges) are calculated at £1,442, and the receipts at £1,177. This brings out an estimated loss of £264 per annum, but the working expenses (£1,177) would, Mr. Pilcher believes, be entirely cleared by the revenue.

**Argentina.**—A report is current that negotiations are pending for the purchase of the Otto Francke concession for an electric railway from La Plata to Buenos Ayres. The interested parties are said to be the Port Argentine Co., which has a railway concession at Port of Samborombon. The *Review of the River Plate*, from which we take this information, does not credit the report.

**Blackpool.**—At the funeral of Alex. Hollas, a Blackpool tramway employé, who died in Victoria Hospital last week, a notable innovation was introduced. A start was made from the Corporation depôt, and the body was conveyed to the cemetery in a tramway-car, in which the mourners were also accommodated. The car was effectively draped.

**Bradford.**—The traffic returns of the city tramways for the week ended December 30th, 1911, show total receipts amounting to £5,657, a decrease of £54 as compared with the corresponding period of 1910. The average per car-mile was 12'94d., compared with 12'61d. in the corresponding period. The aggregate receipts for 274 days in 1911 were £216,452, as against £202,473 for 275 days in 1910.

The Tramways Committee recommends that a trial be given to canvass weather screens for car drivers similar to those in use on the Birmingham Corporation tramways. It has been decided to retain the shock absorbers obtained on trial for one of the trackless trolley vehicles, and to equip the second vehicle with similar absorbers at a cost of £20 in each case. The City Council has sanctioned an extension of the tramways from the Wyke terminus to Bailiffe Bridge at an estimated cost of £21,148, and the Tramways Committee recommends that the work be proceeded with as early as practicable, and that tenders be obtained for the rails and other materials.

**Clydebank.**—At a meeting of the T.C. on 8th inst. the master of works was instructed to prepare a survey and plan of the burgh and neighbourhood with a view to considering an extension of the tramway system. The argument was that increased tramway facilities would much better develop the burgh, and that no capital expenditure was involved in the process, as there were facilities in existence to carry it out. Bailie Donald said he had spoken to Mr. Dalrymple, the general manager of the Glasgow T.C. system, whose lines traversed the main street of Clydebank, and that gentleman said he favoured any scheme where there was a chance of business being done.

**Glasgow.**—Glasgow and district shared in the snow-storm on the night of Monday, 8th inst. The tramway system was considerably affected, and on some of the outlying routes the service was practically suspended for a time. With an extensive use of salt over night, the rails were cleared for the next day, but the revenue for Monday showed a falling off of, roughly, £400, compared with that of the same day last week. In Paisley, Vale of Leven, and Stirling, the tramway traffic was much interrupted.

**Liverpool.**—The minutes of the Corporation Tramways Committee, submitted on January 3rd, contained a recommendation for the building of 12 cars, the chairman of the Committee (Ald. F. Smith) explaining that the main reason for the proposal was to provide employment for their own men at the Lambeth Road Works when there were no repairs to be done. Councillor Naylor, a member of the Labour party, opposed the Committee's decision, and moved that the matter be referred back. The amendment was by leave withdrawn, and the Council subsequently defeated by a large majority, a further Labour amendment, by Councillor James Sexton, that the matter be referred to the Tramways Committee, with an instruction to increase the number of cars to be produced in the coming year from 12 to 16. The Committee's recommendation was then approved.

**Sierra Leone.**—It is proposed to electrify the Sierra Leone Government Railway. Messrs. Norton Griffiths are negotiating for the work, but a rival company has already secured the concession for the electric lighting scheme of the municipality, which will probably form part of the more ambitious project.—*African Engineering.*

(Continued on page 63.)



## ELECTRICAL PLANT AT THE BUXTON LIME FIRMS' QUARRIES.

High up in the Peak district of Derbyshire there is carried on one of the most important quarrying industries in Britain—the country for miles round Buxton being justly celebrated for its excellent limestone, which, in various forms is extensively used in connection with the alkali industry, in the production of aerated waters, for road making and for agricultural purposes. Practically, the whole of the industry in this neighbourhood is controlled by the Buxton Lime Firms' Co., which is really an amalgamation of many of the original quarrying firms round Buxton, and at the present time works 20 quarries with an output of 35,000 tons per week.

The firm also works three small collieries, from which fuel is obtained for lime burning—the lime (about 1,000 tons of which per day is produced) is, we understand, the best obtainable, containing 98·8 per cent. of  $\text{CaCO}_3$ .

The working of these quarries is partly let out to contractors, who are paid by the tonnage turned out, and purchase their power for crushing, haulage, &c., from the owning

a good beginning has been made with electrical driving in the case of the group of quarries which cluster round Peak Forest station on the summit of the Midland Railway Co.'s well-known route to Manchester.

In connection with this work, the Buxton Lime Firms' Co. called in Mr. M. I. Williams-Ellis as consulting engineer, and on his advice a three-phase generating station was installed, with overhead transmissions to the various quarries within two or three miles, where practically all the steam engines have now been replaced by the ubiquitous electric motor. As the average quarryman is one of the most conservative of individuals in regard to the plant which he uses, this result is highly satisfactory, although naturally it has not been achieved without some trouble in the early stages of the work.

The power station is a concrete building situated on the side of the railway and equipped with two five drum Ster-

ling boilers. These are fitted with superheaters, and one of them with an underfeed stoker, and supply steam at 140 lb. pressure, superheated to 460° F., to two Belliss high-speed engines.

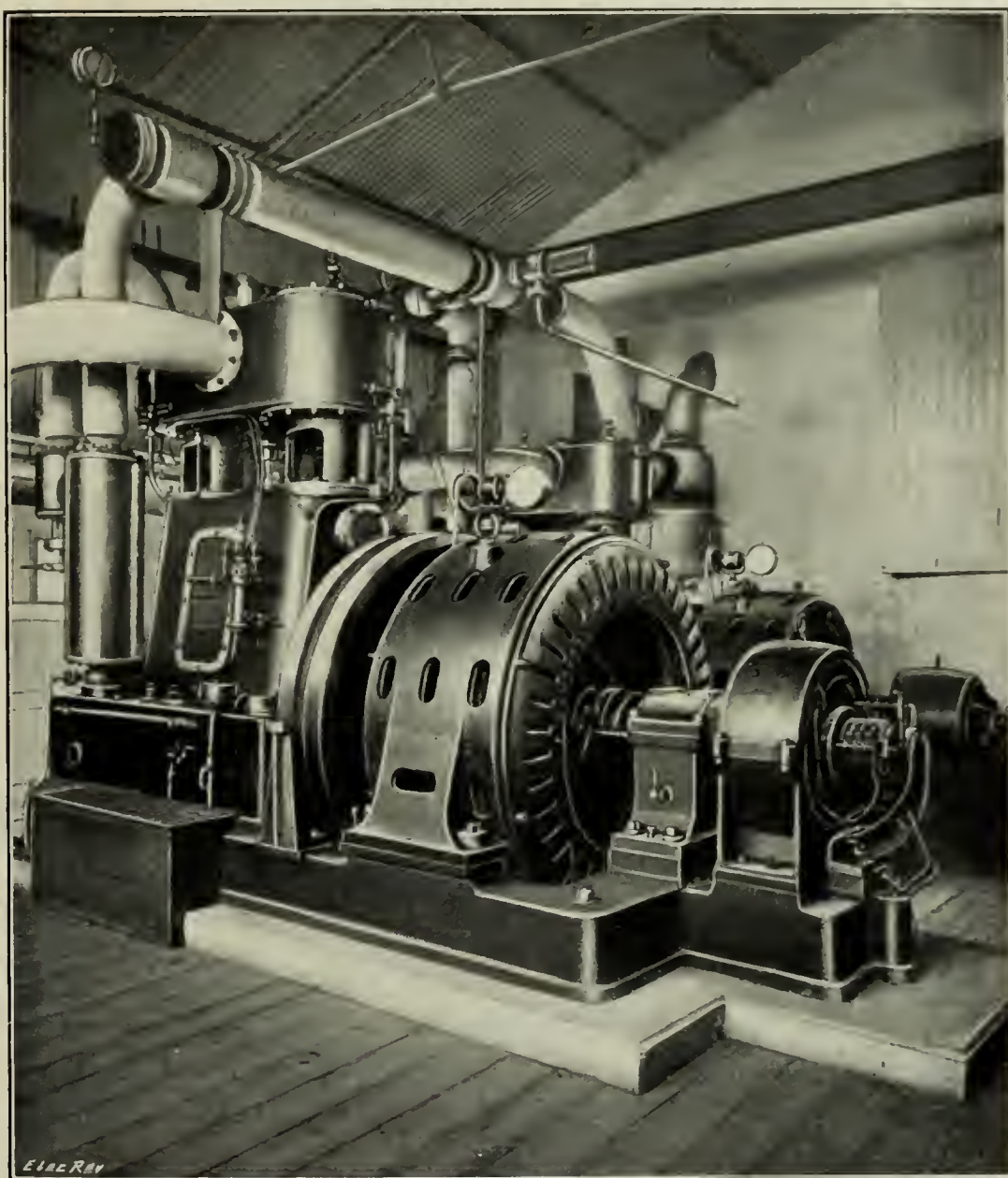


FIG. 1.—INTERIOR OF BUXTON LIME FIRMS' POWER STATION.



FIGS. 2 AND 3.—VIEWS OF THE EXTENSIVE LIMESTONE QUARRIES AT GREAT ROCKS.

concern. Originally all this power was obtained from small steam plants scattered about the various quarries: but within the last few years the company has carefully considered the possibilities of economy in this direction, with the result that

In connection with the underfeed stoker an induced draught fan is provided, driven by a Sandycroft two-speed Cascade motor.

The generating plant at present consists of a 250-KW.



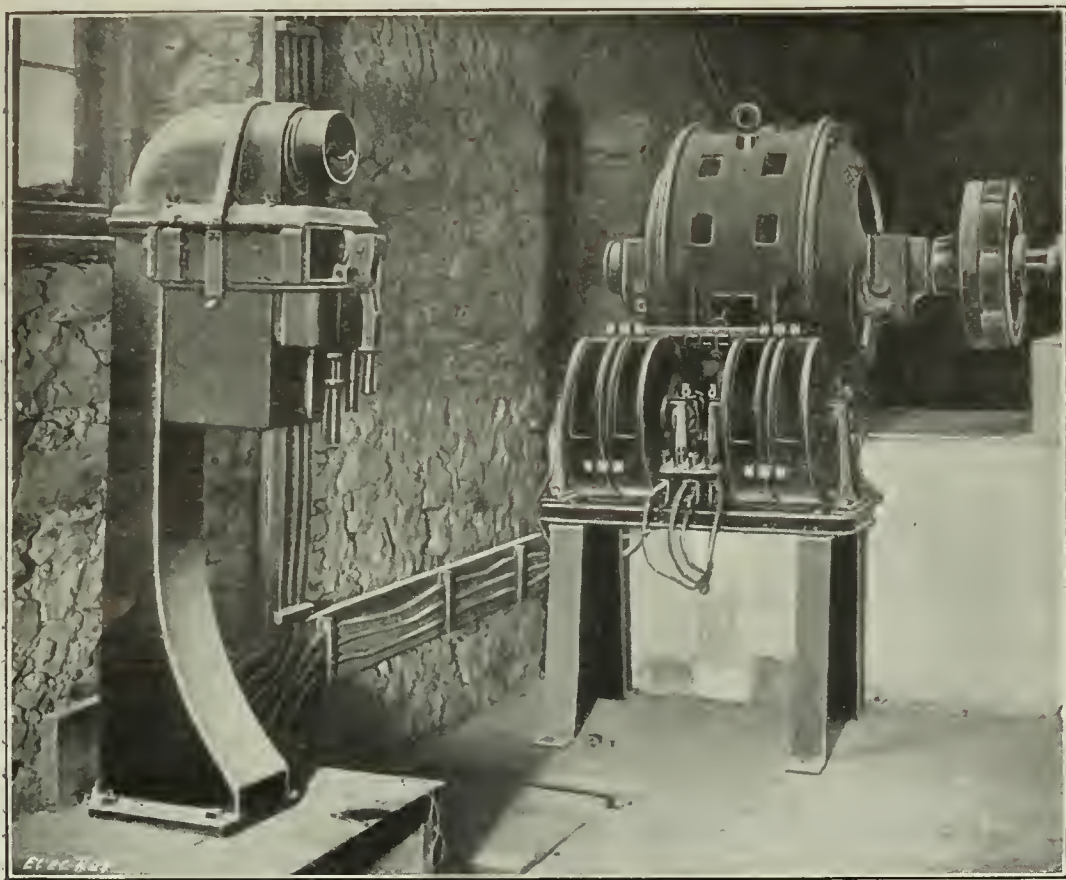


FIG. 4.—SOUTH WORKS; 100-H.P. CASCADE MOTOR—WITH MAIN AND STARTING SWITCHES—DRIVING CRUSHERS AND SCREENS.

Sandycroft set running at 375 R.P.M., which supplies three-phase current at 550 volts and 50 periods, and a similar set of 160 kW. capacity, at 428 R.P.M., but in view of additional motors shortly to be installed, a further 250-kw. set of the same make is being added. Each generator is provided with a 120-volt exciter on the main shaft, and the engines exhaust respectively through Caird and Rayner, and Royle feed-heaters to the atmosphere.

A cheap class of fuel is used in the boilers, costing about 1s. 6d. per ton at the pit, and we understand that the generating cost is under 5d. per unit (exclusive of capital charges), on an average nine-hour day load of 200 kW.

Some 800 H.P. of motors, practically all of the Cascade type, built by the Sandycroft Co., are supplied, and from this it will be gathered that the load is a very intermittent one. The power factor of the whole system is about .8.

The generator output is controlled by Dorman & Smith switch panels, and passes out to 550-volt overhead three-phase transmission lines extending some three miles along the quarries: the transmissions are constructed of from 19/12 to 8 mm. copper wire carried on double-shed insulators bracketed to 25-ft. creosoted poles: a certain number of plain Welsh larch poles have also been used in this work.

The transmissions cross the Midland Railway in several places, and here the wires are insulated, and either suspended

by leather slings from a cable over the lines, or a lead-covered cable in iron pipes is laid across over-bridges.

Some five miles of 120-volt three-wire transmission are also in use for supplying rock-drilling plant, for which energy is supplied from special generating stations.

As previously mentioned, the bulk of the power is used for crushing and hauling, these two operations being closely allied, as it is necessary in most cases to haul the stone from the bottom of open quarries to the crushing plants, through which it gravitates to the railway trucks at a lower level.

A typical crushing plant, situated at the South Works, consists of two 15 in.  $\times$  25 in. stone crushers delivering 500 tons of stone per day to rotary screens, each 30 ft. long, which pass the tailings—used in the alkali industry—direct to storage hoppers over railway sidings, while the smaller stuff which has fallen through the screens is elevated and re-screened and delivered to storage hoppers.

A portion of this material is milled in a special machine to produce cubical gravel, while “chippings” are carried on a band conveyor to an adjacent tar macadam plant, where, after passing through a rotary drier, they are mixed with hot tar.

All the crushing and screening plant is operated by a 100-H.P. (490 R.P.M.) Cascade motor, designed to give 100 per cent. overload, through belt drives on to countershafts. The motor is controlled by an enclosed liquid starter of the Woolliscroft type, which really consists of four switches operated

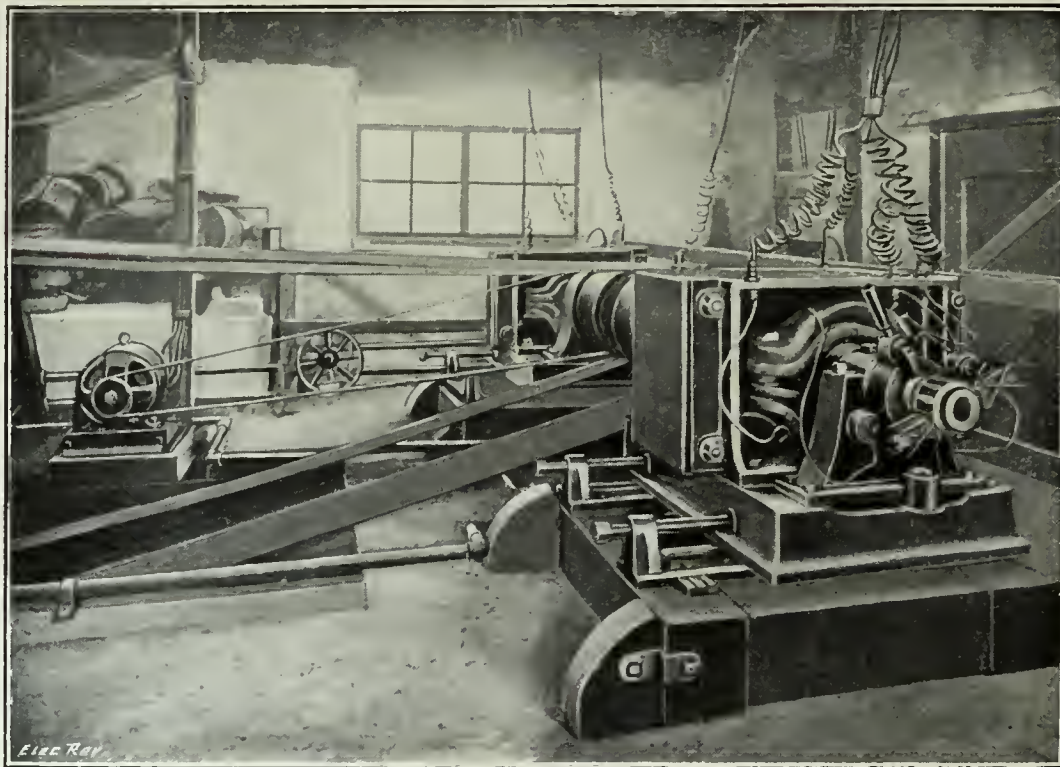


FIG. 5.—MARVIN DRILL GENERATORS AT GREAT ROCKS.

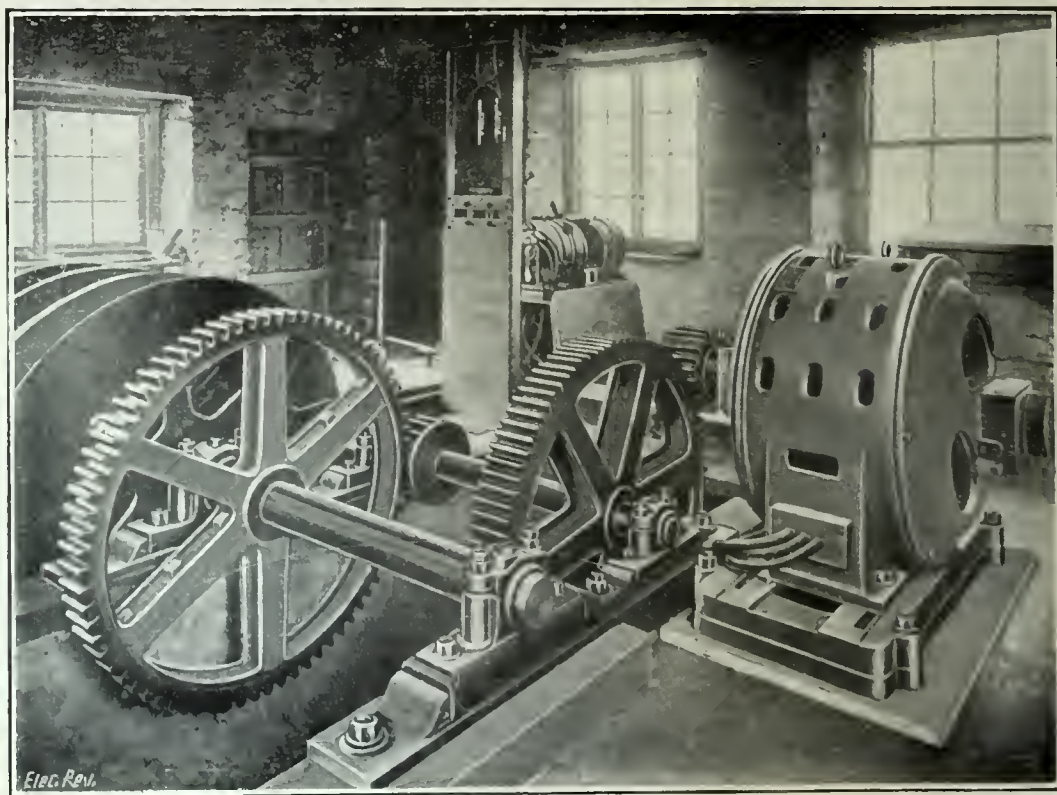


FIG. 6.—50-H.P. CASCADE HAULAGE, PERSEVERANCE QUARRIES.



by one handle, for regulating resistances connected across four pairs of stator tapplings; contacts are also provided for short-circuiting two further pairs of tapplings after the other resistances have been cut out. The main switch is of the B.T.-II. pillar type, and is fitted with a 300-ampere oil switch, with one no-load and two overload releases, and an ammeter on the top, the arrangement being shown in one of our views.

The tar macadam plant will be driven by a 50-H.P. Cascade motor with similar starting and main switches, and a 50-H.P. haulage gear is now being installed between the South Works and an adjacent quarry.

The motor and switches are coupled by braided cables cleated to boards on the wall, and run in wood casing to the top of the terminal transmission pole where they are looped to the wires.

A somewhat similar installation has been made at the Peak Dale crushing plant, where an 80-H.P., 490-R.P.M. Cascade motor, with Woolliscroft starting and B.T.-H. main switches, drives two crushers with an output of from 400 to 500 tons per day, and the necessary screening and elevating plant. A striking feature of these installations is the severe conditions under which the motors operate; the atmosphere is heavily laden with limestone dust, and streams of dust are blown out of the motors when starting—in fact, an east wind and dry weather often means a 100 per cent. overload, for which the motors are, of course, designed. The rock crushers impose a severely fluctuating load on the motors, which, however, do not vary in speed more than  $1\frac{1}{2}$  per cent., a feature which results in as much as 30 per cent. increase in the output of the crushers, as compared with the days of steam-engine driving, owing to the tendency of the engines to pull up under heavy loads.

Coming to the first Cascade haulage, installed about three years ago at Perseverance Quarry, in this case a 50-H.P. Cascade motor is in use, driving through a raw-hide pinion, double reduction and clutches, two drums, shortly to be increased to four. The motor is controlled by a standard Woolliscroft starter, the driver having in front of him a frame panel carrying an ammeter, fuses and main oil and reversing switches.

A view of the haulage is shown in fig. 6. One of the older haulages nearby at Peak Dale, with four drums, is

Here a 70-H.P., 485-volt, 490-R.P.M. Cascade motor drives through the standard double reduction gear and clutches, four cast-iron drums, bushed with phosphor bronze. This installation is shown in figs. 12 and 10, and it includes what



FIG. 7.—MARVIN (ELECTRIC) DRILL IN USE AT GREAT ROCKS QUARRIES.

is now the standard arrangement of switchgear, with an oil reversing switch attached to the liquid starter.

The speed of winding in this and similar cases is  $4\frac{1}{2}$  miles per hour, and the load consists of up to 10 wagons, carrying about 30 cwt. of stone each, running on a roughly built 26-in. gauge tramway; some idea of the nature of the

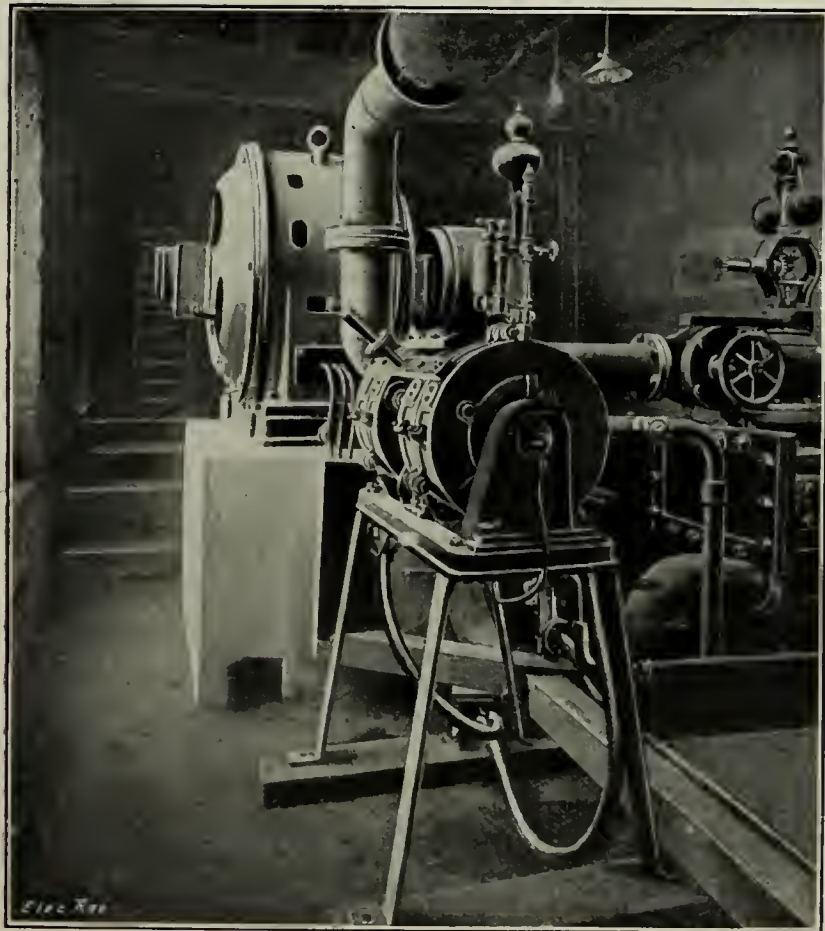


FIG. 8.—80-H.P. CASCADE MOTOR AND STARTING SWITCH; PEAK DALE CRUSHING PLANT.



FIG. 9.—PORTABLE ELECTRICALLY-DRIVEN PUMPING PLANT AT GREAT ROCKS.

equipped with a 50-H.P., 750-R.P.M. slip-ring motor, driving through double-reduction gear, and provided with switchgear similar to that last mentioned.

At the Smalldale quarries one of the most recent haulage plants has been installed in a reinforced concrete building.

gradients which vary from 1 in 3 to 1 in 15, can be gathered from the quarry views (figs. 2 and 3).

For haulages of this kind, the Cascade motor has been found particularly suitable, as owing to its even turning moment at creeping speeds, down to  $1\frac{1}{2}$  R.P.M., it is possible



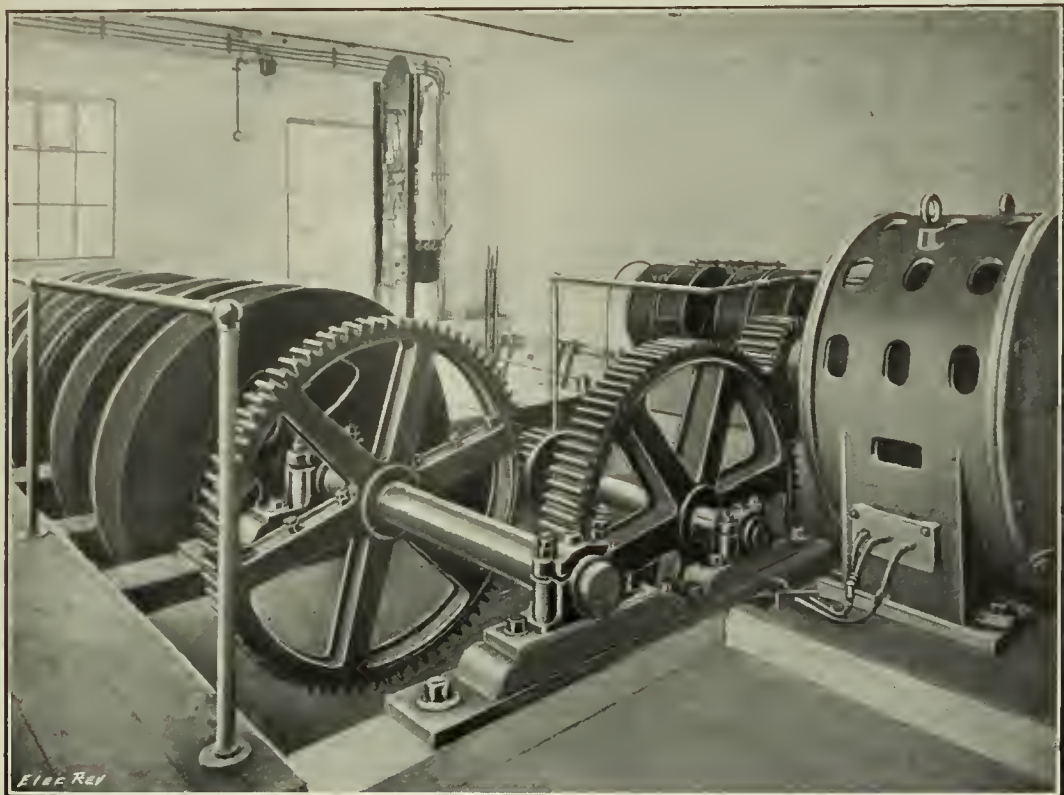


FIG. 10.—70-H.P. CASCADE HAULAGE, SMALLDALE WORKS.

to start and haul over rough roads without shaking out the piled-up contents of the wagons.

In the same building as the above haulage, is an Ingersoll-

common exciter. The Marvin drill, which was described in the ELECTRICAL REVIEW of September 27th, 1907, is of the double solenoid percussive type, operated by a combination of alternating and pulsating currents supplied from the special drill generators, which are of Sandycroft make, and are illustrated in fig. 5.

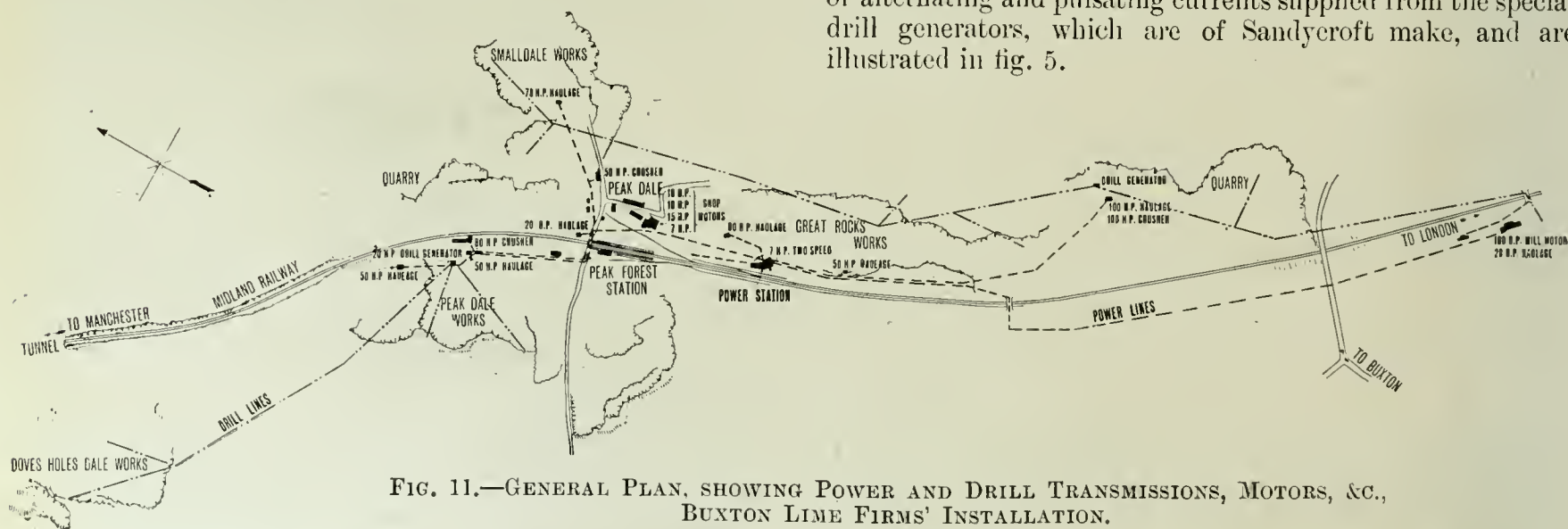


FIG. 11.—GENERAL PLAN, SHOWING POWER AND DRILL TRANSMISSIONS, MOTORS, &amp;C., BUXTON LIME FIRMS' INSTALLATION.

Rand air compressor, driven by a 15-H.P. slip-ring motor, which supplies air through galvanised iron pipes to valveless hammer drills, used for driving headings in the adjacent quarries. The limestone from the latter is dealt with in a 300-ton-per-day crushing plant operated by a 30-H.P. slip-ring motor, the output of which is hauled to the railway by a 20-H.P. motor-driven friction haulage.

Almost identical with the 70 H.P. haulage last mentioned, is an 80-H.P. Cascade haulage plant at Great Rocks quarry, which deals with the limestone required for burning in the Ryan patent and other kilns situated on the railway side. For winding the ash wagons and

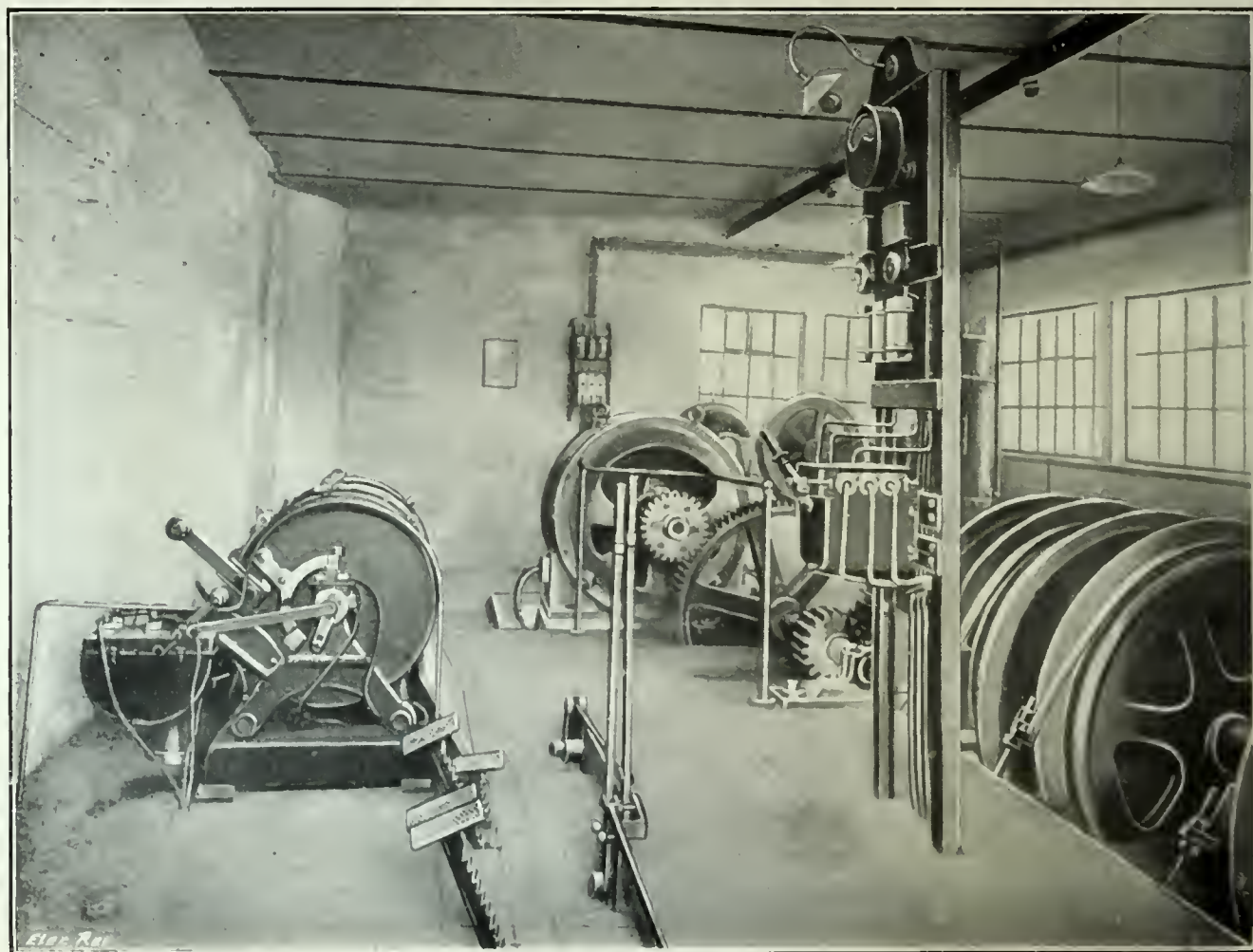


FIG. 12.—STARTING, REVERSING AND MAIN SWITCHGEAR, SMALLDALE HAULAGE.



The drill station feeds about three miles of 120-volt three-wire transmission running through the adjacent quarry, the line being tapped either by means of temporary overhead wires or flexible cable running to a drill wherever it may happen to be placed.

As previously mentioned, the quarries are open, and are worked in lifts or ledges. The drills, several of which are in use, are fixed on the ledges as shown in fig. 7, and bore down vertically for 18 or 20 ft., holes of  $2\frac{1}{2}$  in. to 1 in. diameter, which are subsequently used for blasting.

The firing of any one hole usually brings down 500 to 1,000 tons of rock.

Another Marvin drill generator plant is in use at the Perseverance quarry on the opposite side of the Midland Railway, where a four-drill machine, driven by a 20-H.P. X-type Sandycroft motor and exciter, has superseded a producer gas engine plant.

Another direction in which electric driving has been applied with considerable success, is in the wagon repair shops at Peak Dale, in which plant is installed for dealing with the company's wagon stock, comprising some 3,000 main line wagons and a similar number of narrow-gauge tip wagons used in the quarries. The motors in use vary from 7 to 15 H.P., and are all of the X type mentioned above; the power cost works out at about £1 per week for these shops—a figure equivalent to wages alone with an engine drive.

In view of the exposed transmissions and the severe thunderstorms which occur in the district, G.E.C. lightning arresters are installed practically throughout: the motor frames are all earthed to galvanised zinc earth plates, and where possible the company's water-pipe line along the railway has been used as an earth.

Taken over the whole of the electrically-worked quarries, Mr. Williams-Ellis considered that there had been a saving of nearly 40 per cent. by the substitution of electrical driving for the methods previously in use.

There are still many isolated quarries belonging to the company which rely on steam, gas or oil plants for power, but, needless to add, schemes for electrical working have been under consideration, in view of the success already met with in that connection.

In conclusion, we are indebted to Mr. Williams-Ellis for his courtesy in explaining the many interesting details of this installation, the special features of which, such as the employment of numerous Cascade motors, make it somewhat unique in this country; we congratulate him on the successful outcome of a difficult piece of pioneering in quarry electrification.

**NOTES ON CASCADE AND "X"-TYPE MOTORS.**—The Sandycroft Foundry Co.'s Cascade motor has been previously described in our columns; in the ELECTRICAL REVIEW of October 22nd, 1909, Mr. Williams-Ellis mentioned that the efficiency of a 70-B.H.P. haulage motor of this type, on test, was found to be:—Full load, 88.5 per cent.; half load, 87 per cent.; and  $1\frac{1}{2}$  load, 89 per cent.

The simplest type of this machine has a short circuited rotor without slip rings; speed variation is obtained by means of regulating resistances connected to tappings in the stator winding, and full-load starting torque is obtained with full-load current.

The stator is provided with a single winding of the regular barrel type, and differs only from that of an ordinary motor by having the coils connected to form two parallel groups per phase. From symmetrical points in the winding, tappings are taken equivalent to equalising connections.

The rotor winding is also of the barrel type, with one quarter of the coils omitted. The omission of these bars gives the winding the property of simultaneously producing two magnetic fields, one having a number of poles corresponding to that of the stator winding, and the other with half this number. The second field rotates in the opposite direction to the first, and generates electromotive forces in the stator winding. By coupling pairs of stator tappings paths are formed for the circulation of these currents, and by the use of resistances these currents can be controlled. The windings of the rotor consist of groups of parallel connected coils, so that only very low voltages exist even when standing. In a

50-H.P. motor the maximum voltage does not exceed 12 volts.

In the case of the two-speed motor, which has also been referred to, extra rotor windings are required, and three slip-rings with resistances: with the cutting out of the stator resistances the motor reaches its first efficient synchronous speed, while similarly the cutting out of the rotor resistances gives the second efficient synchronous speed.

The efficiencies at both speeds are high, those of a 100-H.P. motor being 91 per cent. at the first speed and 89 per cent. at the two-thirds speed with the same torque, the corresponding power factors being .93 and .86.

This type of motor develops full-load torque with only 0.7 full-load current, and will give double that torque with 1.4 full-load current.

An article covering the technical design of the Sandycroft Co.'s Cascade motor, by Mr. L. J. Hunt, the inventor, appeared in our issue of May 10th, 1907.

The X-type motor has a high-resistance squirrel-cage winding, provided with low resistance cross-connections having the same pitch as the stator windings. The stator windings are arranged so that when starting they can be connected to give half the number of poles. Under these conditions no difference of potential exists between the low resistance cross-connections, and consequently the high-resistance squirrel cage is alone operative, and the motor starts with a high power factor, taking rather less than twice full-load current for full-load torque.

## TRAMWAY and RAILWAY NOTES.

(Continued from page 58.)

**Continental Notes.**—**RUSSIA.**—A project for the construction of an electric tramway in the town of Minsk is at present under consideration.

**FRANCE.**—The municipal authorities of Vincennes, near Paris, have just put in service a novel electric tramcar. It is a combination hearse and funeral coach, and is designed at one end to carry a coffin in a specially arranged compartment, the mourners being accommodated in the remaining part of the vehicle.

**SWITZERLAND.**—According to the *Feuille fédérale Suisse*, of Berne, a concession has been granted to a syndicate for the construction and working (on an 80 years' lease) of an electric funicular railway from the village of Saint Moritz to Chantarelle-sur-Chaunt. The estimated cost of constructing the permanent way is £10,000.

**Leeds.**—With reference to our paragraph of last week in which it was stated that the whole of the cars were to be fitted with side life-guards, it may be of interest to mention that these life-guards have been invented by members of the staff. The Committee proposes that the patent fees, not exceeding £20, shall be payable by the Corporation on the understanding that it shall have the right to manufacture the guards or to have them manufactured and to use the patent free of royalty.

**Llandudno.**—At the sixth general meeting of the Llandudno and Colway Bay Electric Railway Co., it was stated that the directors were negotiating with a view to obtaining the right to double a further portion of the line.

**Mexico.**—It is stated that the Siemens-Schuckert Works have received an order for the construction of an electric railway in the Mexican city of Pachuca, the length being  $17\frac{1}{2}$  miles. The line is to be equipped for passenger traffic and the transport of ore.

**Plymouth.**—At a meeting of the T.C. on Monday, one of the minutes of the Tramways Committee was a resolution that the tramways manager report as to the estimated cost and probable financial effect of establishing services of cars on the railless trolley system to Laira. Mr. Baker welcomed the minute, and as the route was well known, he hoped the report would not be long delayed. Mr. Stephens said the idea now running in the Committee was to carry lines to Laira, and use the trackless system to Crownhill. Ald. Phillips said that was not exactly so, but as it was to be a matter of report, the Mayor stopped the discussion.

**Sheffield.**—In reply to a communication from the city treasurer, the Tramways Committee has decided to state that £23,334 is the estimated amount of profits from the tramways for the year ended March 25th next, which would be available for the relief of the general district rate. The general manager reports that a compromise had been effected with Overseer's Valuer in regard to the re-assessment of the tramways undertaking and the rateable value of the whole of the tramways had been settled at £30,000.



**South Africa.**—The system of railless electric omnibuses recommended by the Bloemfontein City Engineer has been adopted by the T.C. A loan is to be raised for carrying out the scheme.—*British and South African Export Gazette.*

**Walsall.**—The Tramways Committee reports that it has had one tramcar fitted up with a vestibule for protecting the drivers in inclement weather, and that the Board of Trade has given approval to the fitting of six cars in the first instance with the screens, requesting that after three months' use the Corporation should report to the Board on the matter after obtaining opinions of the drivers as to the merits or otherwise of the screens.

**Wolverhampton.**—The Tramways Committee has decided to purchase an additional motor-bus at an estimated cost of £620, for the service between Wolverhampton and Fallings Park.

## TELEGRAPH and TELEPHONE NOTES.

**Cable Repairs.**—The cable between Coll and Tiree has been restored by the c.s. *Monarch*, after eight weeks' interruption. The *Monarch* is now engaged in similar work on the Arran coast.

**India.**—The radio-telegraph stations at Simla and Delhi, which form the first two in the line of stations to connect Calcutta with Simla by wireless telegraphy, have been completed by the Marconi Co. for the telegraph department.—*Indian and Eastern Engineer.*

**New Cable.**—The Eastern Telegraph Co. has decided to lay a new cable to Egypt from Gibraltar. The cable will touch at Malta and Alexandria. The cost is estimated at £400,000, and will be defrayed by the general reserve fund of the company.—*African Engineering.*

**New Exchange in the City.**—On Friday last, by the courtesy of the Postmaster-General and the Peel-Conner Telephone Works, Ltd., we were enabled to inspect the new Avenue Exchange which has been equipped by the company in Creechurch Lane, to replace the old exchange of the same name in Lime Street. The new plant includes the company's 40-volt switchboards to accommodate 9,000 subscribers, and has been carried out on the most up-to-date lines at a cost of about £160,000. A special feature of the installation is the use of the "ancillary jack" system, in which each subscriber's call is received at three positions simultaneously, and can be dealt with by any one of nine operators (instead of three, as hitherto), thus increasing the rapidity of reply and distributing the work more uniformly amongst the operators. It is hoped that the exchange will be opened to-morrow.

In the course of a brief address to the visitors, Mr. P. P. Kipping, London manager and secretary of the company, thanked the Press for consistently advocating the principle of giving a preference to home productions wherever it was possible, and paid a well-merited tribute to the ability of the technical staff of the Post Office, which, he declared, was not surpassed by that of any telephone administration in the world with which his company had been in touch. He claimed that under the new *régime* the development that would take place would give employment to the telephone industry and a quicker and better service to the public.

Further particulars of the new exchange will be given in a later issue.

**Trunk Call Deposits.**—A correspondent asks:—Will the G.P.O. authorities still demand from telephone subscribers the deposit of £1 as security for trunk call charges? Hitherto, the National Telephone Co. have had the use of a very large sum of money deposited in this way, in view of their obligations to the G.P.O., but now, as the latter will own the whole system, there seems to be no reason whatever, why all deposits should not be returned, and no new ones demanded. It is bad enough to make subscribers pay a whole year's rental in advance, without demanding more.

**Uruguay.**—The Government has decided to install radio-telegraph stations in several districts. The two largest stations will be at Cerrito de la Victoria, near Monte-Video, and at Paso de los Toros, and will be similar to the stations in the Argentine Republic and Brazil.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Africa.**—The *British and South African Export Gazette* states that orders for plant and material for the electric lighting scheme about to be undertaken by the Salisbury, Rhodesia, Municipality will shortly be on offer; also that contracts for the supply of material for the new tramway scheme to be undertaken by the Germiston Municipality, at a cost of £106,000, will shortly be given out.

**Ashton-under-Lyne.**—January 24th. Three Lancashire boilers and two 1,500-KW. turbo-alternators, for the Corporation. See "Official Notices" January 5th.

**Australia.**—N.S.W. GOVERNMENT RAILWAYS.—January 22nd.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th.—A 25-KW. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

February 7th.—The Prahran and Malvern Tramways Trust, Melbourne, are inviting tenders for 1,272 tons of tramway rails. Specifications and forms of tender, £2 2s. (returnable), from J. Coates & Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C.

February 19th.—Wire-testing machine, for the Postmaster-General's Department in Tasmania. See "Official Notices" January 5th.

**Austria.**—KIRCHBICHL.—January 27th. Tenders are invited for the supply of an electrically-driven winding engine and other mining machinery. Particulars, K. K. Bergverwaltung in Kirchbichl.

**Belgium.**—January 29th. The municipal authorities of Vaux-sous-Chevremont (Liège) are inviting tenders for the establishment of a central electric lighting station in the town.

**Bristol.**—The Docks Committee of the T.C. on Monday authorised the engineer to invite tenders for two electric lifts for the Avonmouth Dock new cold storage.

**Bulgaria.**—January 29th. The municipal authorities of Philippopolis are inviting tenders for the concession for the electric lighting of the town.

**Burnley.**—Lighting battery for the Workhouse, for the Guardians. See "Official Notices" January 5th.

**Burton-on-Trent.**—January 27th. One 1,250-KW. turbo-alternator, and other electrical and steam plant for the Corporation. See "Official Notices" to-day.

**Croydon.**—January 29th. Mixed-pressure turbine plant, for the Corporation. See "Official Notices" January 5th.

**Dartford.**—January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" December 15th.

**Dublin.**—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

January 18th.—E.H.P. sub-station switchboards and accessories, for the Corporation. See "Official Notices" to-day.

**Exeter.**—February 2nd. Vulcanised rubber cables, distribution fuseboards, distribution switch and fuseboard, steel conduits and fittings, for the Visiting Committee of the Asylum. See "Official Notices" to-day.

**Grimsby.**—January 15th. Metal-filament lamps for a year, for the Corporation. See "Official Notices" January 5th.

**Halifax.**—February 5th. Stores and materials for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Hornsey.**—January 25th. Extension of Temperley transporter, for the T.C. See "Official Notices" to-day.

**Italy.**—Tenders will be received, within 60 days from December 20th, at the office of the "Presidente del Consiglio Generale dell' Ente Autonomo Volturmo, Piazza Municipio 37," Naples, for the supply and erection of machinery and apparatus, as well as hydraulic, electric and general accessories, required in connection with the central electric generating station in Naples. The upset price is put at 1,230,000 lire (£49,200), and a deposit of 25,000 lire (£1,000) will be required to qualify any tender. Twenty months are allowed for the supply of the material. The power to be generated at the Volturmo Springs and carried into Naples will amount to 12,000 K.V.A., and the plant must have a capacity for the production of a further 12,000 K.V.A., if required. This contract is open to foreign competition, but all documents appertaining thereto must be made out in Italian. Plans and specifications governing the contract may be seen at the above-mentioned office in Naples.—*Board of Trade Journal.*

**London.**—L.C.C.—January 23rd. 3,500 tons of steel girder tramway track rails and fastenings, and 1,500 tons of slot rails and conductor tees. Specifications, forms of tender, and drawings, £2 (returnable), from the Chief Engineer's Department, County Hall, London, S.W.

**STEPNEY.**—January 29th. The B.C. is inviting tenders for one E.H.T. converting plant, suitable for 6,000-volt three-phase A.C. to L.T. D.C., together with E.H.T. and L.T. switchgear, &c., for the Limehouse and Whitechapel stations. See "Official Notices" to-day.

**Nuneaton.**—January 24th. One 500-KW. mixed-pressure turbo-generator, with condensing plant, pipework, &c., for the Corporation. See "Official Notices" January 5th.



**Plymouth.**—January 20th. Stores for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 5th.

**Prague.**—January 31st. Supply of two turbo-generators, of a normal capacity of 3,600 kw., with accessories. Particulars, plans, &c., from Städtischen Kanzlei der Elektrizitätszentrale, Prague VII, and tenders to Haupteinreichungsprotokolle der Electricischen Unternehmungen, Altstädter Markthalle, Prague, Austria.

**Radcliffe.**—January 13th. Electrically-driven centrifugal or turbine pump for the U.D.C.'s sewage disposal works W. L. Rothwell, surveyor.

**Rotherham.**—Tenders are to be invited for the supply of materials for the electrical equipment of the Maltby railless trolley vehicle route, and for the railless cars required.

**Roumania.**—January 17th. The Roumanian State Railway authorities in Bucharest are inviting tenders for the supply of 1,500 metres of electric cable.

**Servia.**—Considerable expenditure is contemplated at Prahovo, in the conversion of the place into an up-to-date port. It is intended to work the harbour plant by electricity, and tenders will shortly be invited for a complete light and power plant. Local representation is advisable.

**Siam.**—BANGKOK. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

**Spain.**—January 22nd. The municipal authorities of Santoyo (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of eight years. Particulars can be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Santoyo (Palencia).

Tenders have just been invited by the municipal authorities of Ribas (province of Gerona) for the concession for the electric lighting of the town.

**Tunbridge Wells.**—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" to-day.

**Turkey.**—February 20th. Tenders will be received at the "Ministère des Travaux Publics," Constantinople, for a concession for the supply of electric light and power to the town of Adalia, which has a population of some 30,000. For particulars see this column December 22nd.

**West Ham.**—January 18th. A.C. house-service wattmeters. Specifications and forms of tender, £1 (returnable), from the Electrical Engineer, 84, Romford Road, Stratford, London, E.

**York.**—Electric shunting locomotive for the Corporation. See "Official Notices" to-day.

## CLOSED.

**Barrow.**—At the T.C. meeting on Monday, the Watch Committee recommended that the tender of Mr. C. Armstrong Lamb for the electric lighting of the new fire station be accepted, at £124.

**Bedford.**—The T.C. has accepted the tender of Messrs. Wilton & Co. for installing the electric light at the isolation hospitals and supplying fittings, at £77, and for similar work at the new convalescent block, at £16.

**Bolton.**—The Tramways Committee has accepted the following tenders:—

Dryers, Ltd.—Insulating plant.  
Edgar Allen & Co., Ltd.—New crossing.

**Buenos Ayres.**—According to the *Review of the River Plate*, the Government has contracted with the Maschinenfabrik Augsburg-Nürnberg, A. G., for the supply of 20 electric cranes for the warehouses in Docks 1 and 2 and North Basin. Cost \$118,621 gold. The total cost, including cable connections of the German Electric Light Co., amounts to \$379,973 paper.

**Burnley.**—The T.C. has accepted the tender of Messrs. Lambourne & Co., of London, for ironwork for the Queensgate carshed extension, at £881.

**Cape Town.**—The tender of Messrs. E. A. Shaw & Co. has been accepted for the wiring of the Alhambra Picture Palace.

**Clayton-le-Moors.**—The D.C. has accepted the tender of Messrs. Wm. Rothwell & Sons, electricians and hardware dealers, of Great Harwood, for the maintenance and repair of the fire-brigade alarm system for the ensuing 12 months.

**Croydon.**—The Guardians have decided to purchase from Messrs. K. Schall & Co., for £53, an X-ray apparatus.

**Felixstowe.**—The U.D.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for a motor fire-siren, at £35.

**Glasgow.**—The Trustees of the Clyde Navigation have accepted the offer of Sir Wm. Arrol & Co., Ltd., which was the lowest satisfactory one, for a 32-ton electric crane for the Rothesay Dock, Clydebank, at £7,953.

**London.**—HAMMERSMITH.—Tenders from the following firms have been accepted by the Electricity Department for the purchase of certain disused plant:—

F. W. Ward, Ltd.—Economisers, superheaters and arc heaters, £40.  
I. Levy & Sons.—Condensers and meters, £229.  
Mr. J. Clark.—Switchboards and arc lamps, £81.  
Mr. J. Hyams.—Arc lamp accessories, £14.  
Mr. E. J. Webster.—Scrap copper, lead, brass and gun-metal, £121.

**Reigate.**—The T.C. has accepted the tender of the Anglo-American Oil Co., Ltd., for fuel oil for the new Diesel engine at the electricity works, for a year, at £2 7s. 9d. per ton.

**Sheffield.**—The T.C. has accepted the following tenders:

Willans & Robinson, Ltd.—Turbo-alternator, £21,767.  
Dewhurst's Engineering Co., Ltd.—Cables, lamps, switchboard, &c., £2,839.  
Browett, Lindley & Co., Ltd.—Electric lighting, sewage works extension, £732.

Messrs. Willans & Robinson have been authorised to sub-let the alternator portion of their contract to Messrs. Dick, Kerr & Co., Ltd.

**Stockport.**—The T.C. has accepted the following tenders:

Wm. Rickard, Ltd., Derby.—Half-mile of 7·18 cable, £14 16s.; half-mile of 7·16 cable, £21 1s.  
United Electric Car Co., Ltd.—Five car top covers and alterations to staircases, £108 each.

**Walsall.**—The T.C. has entered into a contract with Messrs. Richardsons, Westgarth & Co., Ltd., for supplying and fixing a cooling tower at the generating station, at a cost of £600. It has further accepted the tenders of the British Westinghouse Co., Ltd., at £74 and £55, for providing the necessary transformer and switchgear respectively for supplying the sewage works with alternating current.

## FORTHCOMING EVENTS.

**Electro-Harmonic Society.**—Friday, January 12th. At 8 p.m. At the Holborn Restaurant. Smoking concert.

**Midland Electrical Engineers' Ball.**—Friday, January 12th. At the Grand Hotel, Birmingham.

**North-East Coast Institution of Engineers and Shipbuilders.**—Saturday, January 13th. At 7.15 p.m. At the Armstrong College, Newcastle-on-Tyne. Paper on "Wireless Telegraphy for Naval Purposes," by Mr. H. C. Stroud. Meeting at 2.30 p.m. Graduates' visit to the Gateshead works of Messrs. Clarke, Chapman & Co., Ltd.

**Institution of Electrical Engineers (Newcastle Local Section).**—Monday, January 15th. At 7.30 p.m. At the Armstrong College, Newcastle. Lecture by Mr. W. C. Mountain.

**Institution of Electrical Engineers (Manchester Local Section).**—Tuesday, January 16th. At 7.30 p.m. At the University, Manchester. Paper on "Recent Developments in Turbine Practice," by Mr. K. Baumann.

**Illuminating Engineering Society.**—Tuesday, January 16th. At 8 p.m. At the Royal Society of Arts. Paper on "Colour Discrimination by Artificial Light," by Mr. T. E. Ritchie.

**Institution of Electrical Engineers (Students' Section, London).**—Wednesday, January 17th. At 7.45 p.m. Paper on "Some Notes on Central-Station Practice," by Mr. A. N. Kingsbury.

**Institution of Electrical Engineers (London).**—Thursday, January 18th. At 8 p.m. Adjourned discussion on paper on "Residence Tariffs," by Mr. A. H. Seabrook.

**Institution of Mechanical Engineers.**—Friday, January 19th. At 8 p.m. Paper on "The Evolution and Present Development of the Turbine Pump," by Messrs. E. Hopkinson and A. E. L. Chorlton.

**Institution of Civil Engineers.**—Friday, January 19th. At 8 p.m. Students' meeting. Paper on "The Turbo-Blower and Turbo-Compressor," by Mr. G. Ingram.

**Faraday House Old Students' Association.**—Friday, January 19th. At 8.30 p.m. At the Holborn Restaurant. Annual smoking concert.

**Royal Institution.**—Friday, January 19th. At 9 p.m. Discourse on "Heat Problems," by Prof. Sir J. Dewar.

**Junior Institution of Engineers.**—Saturday, January 20th. At 9.30 a.m. Visit to the works of the Western Electric Co., Ltd., Woolwich.

**Association of Engineers-in-Charge.**—Saturday, January 20th. At 7.30 p.m. At St. Bride's Institute, E.C. Discussion on "The Various Systems of Warming Buildings."

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued:—

Monday, January 15th.—"A" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Tuesday, January 16th.—"B" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Thursday, January 18th.—"C" Company. Technical work and musketry instruction (standard tests), lecture by Major Phillips, 7 to 10 p.m.

Friday, January 19th.—"D" Company. Technical work and musketry instruction (standard tests), lecture by Major Phillips, 7 to 10 p.m.

Saturday, January 20th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) J. H. S. PHILLIPS, Major,  
For Officer commanding L.E.E.



## NOTES.

**The Electro-Harmonic Society.**—A smoking concert is to be held at the Holborn Restaurant (King's Hall), to-night, Friday, January 12th, at 8 o'clock. The chair will be taken by Mr. James Swinburne, F.R.S. The artists are as follow:—Vocalists, Signor Lenghi (tenor), and Mr. George Baker (bass-baritone); the boy harpist, Mario Lorenzi; Anglo-French comedian, Mons. Alec Chentrens; humorist, Mr. J. M. Campbell; humorous recitals, Mr. Valentine Hill; modern magic, Mr. Bradley Alexander; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

**Electrical Imports and Exports.**—The foreign trade returns for 1911 are now complete. If we accept the classification followed by the daily Press in its summary of the position, we find that the electrical imports and exports have been as follows:—

<i>Electrical Goods imported</i> in month of Dec., 1910	...	£199,387
" " " " 1911	...	138,581
Decrease	...	£60,806
<i>Machinery Imports</i> for month of Dec., 1910	...	£396,356
" " " " 1911	...	453,718
Increase	...	£57,362
<i>Electrical Goods exported</i> in month of Dec., 1910	...	£605,278
" " " " 1911	...	217,219
Decrease	...	£388,059
<i>Machinery Exports</i> in month of Dec., 1910	...	£2,563,053
" " " " 1911	...	2,650,903
Increase	...	£87,850

The decrease in electrical exports may easily be misunderstood unless it be borne in mind that, in December, 1910, there was one special item of £340,605 for telegraph cable and apparatus under the heading "Madeira, Portuguese Africa and India." There was no corresponding big cable export in December, 1911.

**Economy of Electric Cooking.**—Some interesting figures were given in a recent issue of the *Standard* regarding the use of electricity for cooking in a suburban household of six persons. In 1907 and 1908, the total annual cost for cooking, lighting and hot water supply with gas and coal was £20 9s. 11d. and £17 2s. 2d. respectively; during 1909 the householder was absent, but in 1910 and 1911 the records were resumed, with the difference that a "Tricity" cooker was exclusively used for cooking purposes, and the total annual costs in these years were £22 5s. 3d. and £22 4s. 4d. respectively. A corresponding record of the butchers' bills for the same years showed that in 1907 and 1908 they amounted to £50 7s. 1d. and £54 0s. 9d. respectively; but in 1910 and 1911 the corresponding amounts were £38 10s. 4d. and £33 8s.; yet the quantity of meat consumed at table was practically the same, the economy in cost being due to the lessened wastage of meat cooked in an electric oven. It will be seen that the saving effected was between four and five times the increased cost of cooking. In fact, the saving in the butchers' bill in 1911 was almost sufficient to pay for the whole cost of cooking, heating and lighting for the year.

**Gas Explosion.**—Explosions and fires caused by gas are such ordinary occurrences that we rarely trouble to record them; but a fatal accident of this kind which occurred on Monday at Ilkeston is of exceptional interest. Strange to say, the fatality which accompanied the explosion was the death of a girl by *drowning*. A gas-holder at the Corporation gasworks, of a million cubic feet capacity, exploded, and demolished a street of cottages, while the water from the seal escaped and flooded the streets, doing great damage. Sheets of iron, lumps of coal and cases of beer were flung upon the houses, and many people escaped from their dwellings, which were in a precarious state, by wading through water up to the waist; as snow was falling, and the weather was bitterly cold, great suffering resulted. Fire accompanied the explosion, and was with difficulty subdued. How the explosion was brought about we do not know; presumably by some means an inflammable mixture was present in the gas-holder, but how did it become ignited? Can it have been due to the *fusion of an electric wire*?

**Memorandum on Steam Boilers.**—A correspondent informs us that the Memorandum on which we recently commented favourably, has been "withdrawn," and suggests that the Government thought that the working man would learn too much from it. However that may be, our readers will realise that it is useless to apply to the Government stationers for a copy.

**The Rating of Engineering Works.**—According to the *Times*, at the Liverpool Quarter Sessions last week, the hearing was concluded of the appeal by Messrs. Greenwood & Batley, Ltd., against the rating assessment of their works by the Assessment Committee of the Bramley Union. The gross estimated rental was £10,134, and the rateable value £6,050. It was stated that the Leeds engineering trade was fast declining, and the heavy rating was suggested as a cause. The Recorder, Mr. Tindal Atkinson, K.C., assessed the net value at £4,872, and the appeal was allowed, with costs.

**Electricity for Mining in Norway.**—The Ranen Lead and Silver Works and Mines, which are situated in the North of Norway, not far from the Dunderland Iron Mines, and which have been lying idle for about 40 years, are now to be worked, and the necessary plant is in course of erection. The plant is to be driven by electricity, and is designed with a capacity for treating 40 tons of crude ore per day. Apart from the ordinary concentrating plant, a magnetic separator will also be installed, which is to be connected with an oven for roasting the ore. It is also the intention to build an electrical experimental furnace, for which the necessary energy will be transmitted from the power station at the Waterfall of Holmfossen, which is already completed. The ore in the company's mines is of a somewhat complicated nature, and contains 18 per cent. of zinc in addition to lead, silver, and some other metals.

**The Australian Tariff.**—The Melbourne correspondent of the *Times* says, as a result of an examination of Mr. Tuft's Bill, that the revision of the tariff will be more nominal than real. "Lamps are to pay 30 per cent. instead of 20 per cent., while tanks, which have been free since 1907, are now only so if not exceeding 400-gallon capacity. There is throughout the Bill a strong tendency to penalise parts of machines in the interests of local workshops. Thus, fire engines, sewing machines, typewriters, &c., still come in free, but separate parts no longer do so, but have to pay 25 per cent., and the same duty attaches to separate parts of such machines as are used for hat-making, paper manufacture, and other purposes, while parts of electrical machines are also dutiable. All aluminium articles have hitherto been free, a privilege now confined to kettles and kitchen utensils; electroliers, chandeliers, &c., formerly 20 per cent., are now 25 per cent., or 30 per cent. if not of British manufacture. Gas meters are to be charged 15 per cent., but some parts are still to be allowed in free."

**New Zealand.**—The Borough Council of Misamar, a suburb of Wellington, has decided to adopt an electric power scheme, of which the details are to be put before the ratepayers for their approval at an early date. The Wellington City Tramway Committee is to be approached in regard to the hire of tramcars, the borough to supply the power. Interviewed by a Press representative, the town clerk stated that it was necessary to have a small power station to supply power to the high levels, and for the compressors that work in the ejector station for the sewerage. The consulting engineer to the borough is of opinion that if the power station is increased so as to generate power for the tramway and for lighting—both public and private—a considerable saving could be made, and the scheme would prove a financial success. The output of the proposed power station would be 448,000 units per annum, and the annual cost of running is estimated at £3,039 per annum. The capital cost is put down at £15,275, from which amount a reduction of £5,674 (small power station) is to be made. A saving of £2,025 is estimated if the Wellington City agrees to the hire of cars. If Wellington refuses to hire cars, the borough will be forced to purchase cars of its own, and make arrangements with the City Council for the running of borough cars over the city lines.

**Staff Supper.**—On Tuesday, the 2nd inst., at midnight, the employés of the Llandudno and Colwyn Bay Electric Railway, Ltd., held their second annual supper at the messroom at the car dépôt, Rhos-on-Sea, the room being tastefully decorated with festoons, bunting and Chinese lanterns. The chair was occupied by Mr. J. W. McInnes, the general manager, who, after proposing the loyal toast, announced that the directors had arranged that each man should receive a small Christmas box, whereupon three hearty cheers were given for the directors of the company. Songs were rendered by Messrs. Home, Taylor, Forbes, Jones, Boroughs, Dowell, Leddy, James and Ellis, and selections on the gramophone by Mr. Fletcher. A vote of thanks was accorded to the chairman.

**Uruguayan Electric Power Monopoly.**—The *Financial News*, in referring to the fact that the Uruguayan Government has presented a Bill to the Legislature for the nationalisation of all the electric power houses in the Republic, says:—"These are to be purchased or expropriated and a State monopoly created. At the same time, the Government is authorised to erect power houses in all towns which have not that system of illumination. Bonds to the value of \$4,500,000 gold, bearing 5 per cent. interest, are to be issued. To indemnify the Monte Video municipality for the expropriation of their power house, the Government will take over the service of the Baring loan, which actually costs the municipality \$360,000 a year. The municipality will also have a participation in the profits of the station."

**Sun Power.**—A company named the Sun Power Co. (Eastern Hemisphere), Ltd., has just been formed to exploit an invention of Mr. F. Shuman, which has been tested on a practical scale in Philadelphia. The fundamental principle is the familiar one of heating water by the radiant heat from the sun, with the aid of reflectors, and it is stated that Mr. Shuman's apparatus—which includes a special engine—has been demonstrated in successful operation, pumping 3,000 gallons of water per minute to a height of 33 ft. Prof. V. Boys has become consulting advisory expert to the company, and Mr. A. S. E. Ackermann recently inspected the plant and reported favourably upon it. A 100-H.P. plant is about to be erected in Egypt. The system, of course, can only be used in countries where there is plenty of sunshine and fuel is scarce.



**Association of Consulting Engineers.**—The following announcement regarding the formation of this Association has been sent to us :—

"As announced some time ago in your columns, a meeting of practising consulting engineers representing all branches of the profession will be held on Monday, January 15th, at 4 p.m., in the Lecture Theatre of the Institution of Electrical Engineers, Victoria Embankment, W.C.

"For the purpose of forming an Association of Consulting Engineers a code of rules has been drawn up which, it is believed, will be in the best interests both of the public and of the profession, and it is hoped that all eligible consulting engineers who are able will attend the meeting in order that the subject may receive the fullest possible discussion.

It is inevitable that the rules will require alteration and improvements as experience may dictate, but it is felt that they form a basis on which consulting engineers may associate together in the best interests of the profession.

"In the absence at present of any recognised list, it is obviously impossible to communicate individually with every eligible consulting engineer, and it is hoped that all such will accept this invitation to attend the meeting, on presentation of their card at the entrance.

"As it is sure to occur that a number of those who are in full sympathy with the aims and objects of the Association will find themselves unable to be present at the meeting, it is hoped that they will assist by sending their views in writing to the honorary secretary, Mr. A. H. Dykes, 11, Victoria Street, Westminster, S.W., from whom copies of the Rules and other information may be obtained."

The letter is signed by the following engineers :—

J. S. Alford	C. Lomax	H. Rolfe
H. P. Boulnois	S. R. Lowcock	J. F. C. Snell
W. T. Douglass	E. L. Mansergh	E. H. Stevenson
E. M. Eaton	A. J. Martin	J. Swinburne
R. Hammond	T. L. Miller	A. A. C. Swinton
J. H. Harrison	W. M. Mordey	G. M. Taylor
B. Latham	W. H. Patchell	and A. H. Dykes
	W. Ll. Preece	

**London Industrial Employers' Association.**—To-day at 2.30 p.m. at the Abercorn Rooms, Great Eastern Hotel, E.C., an adjourned meeting of the London and District Industrial Employers' Association is to be held to consider the draft constitution of the Association, and to elect the Executive Council. The provisional Executive appointed at the meeting held last November consisted of the following: Messrs. Alfred Brooks, John Carr, F. C. Hill, L. A. Martin, Alexander Siemens and J. C. Umney. The draft constitution as prepared by this Committee is as follows :—

(a) To promote and further the interests of the members of the Association, and in particular to protect and defend those interests against combinations of workmen seeking by strikes or other action to impose unduly restrictive conditions upon any of the trades included in the Association.

(b) To secure mutual support and co-operation in dealing with demands made, and action taken by, workmen or combinations thereof, on all matters or questions affecting the interests of any members of the Association.

(c) To protect the Association, the trades comprised therein, and the members thereof against strikes or disputes with workmen or against losses incurred by acting in conformity with the decisions or recommendations of the Association.

(d) To give to members of the Association all such assistance, including pecuniary, legal, or other assistance, as to the Association shall appear proper or desirable.

(e) To act jointly, by federation or otherwise, and to co-operate with any association or federation in furtherance of the objects of this Association.

(f) To make provision for the settlement of differences between members of the Association and their workmen, if required.

(g) To watch over all legislative measures which may affect, or tend to affect, the interests of the Association, and the members thereof.

(h) To do all such things as are, in the opinion of the Association, incidental or conducive to the attainment of the above objects or any of them.

**Electric Supply Publicity.**—The Electric Supply Publicity Committee is making a further issue of literature in which cooking is to the fore. There is a good cooking pamphlet entitled "The Economics of Electric Cooking," containing data which should be useful to supply authorities. The data are mainly concerned with the shrinkage of meat. The comparison of the large shrinkage under coal and gas cooking, with the small shrinkage under cooking by electricity, is brought out very forcibly in a diagram, and also in tabulated figures. The figures ought to be convincing, and they are worked out in a manner easily understood by the lay mind. The cooking pamphlet comes at a very opportune moment, when the undertakings are anxious to push this particular use of the supply. There is also a cooking mail-card in colour, which should serve as a continual reminder to consumers of this application of electricity. Another apparatus booklet is also notified, which is a continuation of Apparatus Booklet No. 1 issued some time ago. The present one is of handy size, suitable for enclosure with correspondence, &c. It shows various apparatus which can be used with the supply. There is also included a hair-dressers' circular, fully illustrating and explaining the various uses to which hairdressers can put the supply.

**Institution and Lecture Notes.**—NORTHAMPTON POLYTECHNIC INSTITUTE.—A course of 10 advanced lectures on "Illuminating Engineering" will be commenced on Tuesday next, January 16th, at 7.30 p.m. The subjects and lectures are as follows :—

January 16th.—"The Nature of Light and of Radiation," by S. D. Chalmers.

January 23rd.—"Photometry and the Measurement of Light," by A. C. Jolley.

January 30th and February 6th.—"The Production of Electric Light and its Distribution," by F. M. Denton.

February 13th.—"The Chemistry of Gas Manufacture and Lighting," by S. Field.

February 20th.—"The Use of Shades and Reflectors," by S. D. Chalmers.

February 27th.—"Physiological Factors in Illumination," by W. Ettles, M.D.

March 5th.—"The Practical Use of Arc Lamps," by A. C. Plumtree (Union Electric Co.).

March 12th.—"The Practical Use of Metallic-Filament Glow Lamps," by V. H. Mackinney (Holograph, Ltd.).

March 19th.—"The Practical Use of Gas Lamps," by W. E. Goodenough.

A circular stating the ground to be covered by the different lectures, and the terms for the course, can be obtained on application to the Principal.

**INSTITUTE OF METALS.**—The London meeting of the Institute will be held at the Institution of Mechanical Engineers, Westminster, commencing on Tuesday, January 16th, at 3 p.m., and on January 17th, at 10.30 a.m. On the first day, the president, Sir Gerard Muntz, will present the report of the Council on the work of the Institute during the past year, and other routine business will be transacted. The third annual dinner will be held the same evening. On the second day, the following papers will be read and discussed: "A Metallographic Hygroscopic," by Prof. Dr. Carl A. F. Benedicks; "A Study of the Properties of Alloys at High Temperatures," by Dr. G. D. Bengough, M.A.; "Further Experiments on the Inversion at 470° C. in Copper-Zinc Alloys," by Prof. H. C. H. Carpenter, M.A., Ph.D.; "The Influence of Oxygen on Copper containing Arsenic or Antimony," by Mr. R. H. Greaves; "The Influence of Tin and Lead on the Micro-Structure of Brass," by Mr. F. Johnson, M.Sc.; "A Contribution to the History of Corrosion: The Corrosion of Condenser Tubes by Contact with Electro-Negative Substances," by Mr. Arnold Philip, Assoc.R.S.M., B.Sc.; "The Nomenclature of Alloys," by Dr. W. Rosenhain, B.A.; "The Behaviour of Certain Alloys when Heated in Vacuo," by Prof. T. Turner, M.Sc. Full particulars regarding membership and visitors' tickets for next week's meeting can be obtained from the Secretary, Caxton House, Westminster, S.W.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—The annual dinner and reunion of the Institution will be held at the Hotel Cecil, London, on Thursday, February 1st, 1912, under the Presidency of Mr. S. Z. de Ferranti.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (LONDON BRANCH).**—A meeting was held last night, at 39, Victoria Street, Westminster, Mr. R. Hood-Haggie, M.I.E.E., Branch President, in the chair. Various novel exhibits interesting to mining engineers were shown, and a paper by Mr. E. Kilburn Scott, M.I.E.E., on "Electricity in Connection with Explosives," was read in abstract and discussed.

**Profit-Sharing.**—Sir W. P. Hartley, speaking on Saturday last, said that although he did not claim that profit-sharing was a cure for all labour troubles, the spirit of it was an absolute cure.

**Appointments Vacant.**—Test room assistant for the Leith Corporation Electricity Department (35s.); foreman mechanic for the electrical workshop of the Posts and Telegraph Department, Federated Malay States (£180). See our advertisement pages to-day.

**Inquiries.**—Makers or agents of "Tungsram" lamps, the Zener electric welding apparatus, and Bronsköhl brushes for slip rings, are asked for.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Battersea B.C. has appointed Mr. W. T. MAGRATH as mains assistant.

Mr. W. M. COOK has been appointed canvasser and agent of the Electricity Department of Hammersmith B.C.

Mr. E. J. WALSH, who has been appointed mains superintendent to the Kilmarnock Corporation Electricity Department, was on 6th inst. presented with a gift by the Leith Electricity Works staff, the presentation being made by Mr. Thomson, assistant engineer.



The Electricity Committee of the Bradford T.C. has recommended the appointment of MR. J. H. SCHNAUBER, assistant electrical engineer, as deputy city electricity engineer, at a salary of £250 per annum, rising by £25 a year to £300.

The Electricity Committee of the Manchester T.C. recommends the reappointment for six years of MR. S. L. PEARCE, chief electrical engineer, the salary for the first and second years to be £1,300 per annum, for the third and fourth years £1,400, and for the fifth and sixth years £1,500, Mr. Pearce to agree to remain for six years from February 1st next, and to devote the whole of his time to the duties of the office and in carrying out any electrical extensions or works.

We regret to observe from a Hackney newspaper that MR. L. L. ROBINSON, borough electrical engineer of Hackney, is lying ill with diphtheria.

**Tramway Officials.**—At Tuesday's meeting of the Bradford City Council, a long discussion took place upon a proposal to increase the salary of MR. C. J. SPENCER, the Corporation tramway manager, from £700 to £800 a year, by two annual increments of £50. Mr. C. A. Glyde, one of the Labour members of the Council, in moving that the recommendation be referred back, with an instruction that the advance be not given, sketched Mr. Spencer's career in Bradford from the time when, in 1898, he received an appointment worth £150 a year. He said that within four years Mr. Spencer's salary was advanced £11 per week. Mr. E. Mitchell having seconded, the resolution referring the proposal back was supported by Alderman Land (who said Mr. Spencer had not made any application for an increase) and Alderman Gadie; whilst speaking in favour of the advance being given were Mr. James Hill, Mr. W. Leach, Alderman Peel, Mr. E. J. Smith, Alderman Godwin, and others. Eventually the resolution was adopted, so that the matter will have to come before the Tramways Committee again.

**General.**—The name of the new chief assistant engineer at Stratford-on-Avon is MR. J. G. THAIN, not Thaw, as stated here last week.

The address of MR. F. B. O. HAWES is now 18, Park Mansions, Vauxhall Park, South Lambert Road, London, S.W.

MR. J. W. MCCROSKY, general representative of J. G. White and Co., Ltd., has sailed for the Amazon Valley in connection with important business interests which the company have in that country.

**Obituary.**—MR. T. WELLER.—The death took place on Monday of Mr. Thos. Weller, who had for a long period been in business as an electrical engineer at West Hill Road, Brighton. He was 62 years of age.

MR. R. TURNBULL.—The death has taken place at Chester-le-Street (Co. Durham), of Mr. Robert Turnbull, engineer. After being in business at Chester-le-Street as a maker of colliery engines, he was manager for Messrs. Easton & Anderson, of Erith, and later he accepted a position with Messrs. C. A. Parsons & Co., carrying out the erection of their turbines. He was 68 years of age.

On Saturday last the funeral took place, with Masonic honours, of one of Portobello's best-known citizens, MR. LAURENCE M. HISLOP, electrician.

## CITY NOTES.

### National Telephone Co., Ltd.

THE forty-ninth ordinary general meeting of the shareholders of the above company was held on Tuesday, at Hamilton House, Victoria Embankment, Mr. George Franklin, the president, in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 29), first referred with regret to the loss which the company had sustained in the death, which occurred last November, of Sir Cuthbert Quilter. That gentlemen, he said, had from the very foundation of the telephone enterprise, now more than 30 years ago, been continuously and actively identified with it. By his death the shareholders were deprived of a skilful and watchful worker in their interests and the board had lost a most valued colleague. Proceeding, the chairman said that that meeting had been called somewhat earlier than usual owing to the pressure of existing circumstances. As they knew, the company's licence expired on December 31st last, and as under the purchase agreement of 1905 the sale to the Postmaster-General was provided for, it only remained for the company to arrange for the smooth transference to the Postmaster-General of the assets, to the possession of which he was entitled. He thought it was fitting testimony alike to the good sense of both sides that this gigantic transfer to the State had been accomplished without difficulty and with comparative smoothness. The difficulties with which the company was confronted were at all events anticipated and removed and they got practically a smooth transfer to the Postmaster-General. On December 7th, the terms for dealing with the transfer of the company's assets were embodied under the heads of arrangement and duly signed. Those heads defined the respective obligations of the Postmaster-General and the company. They were to hand over all the assets which were purchasable, and the Postmaster-General had undertaken to advance a sum of money not exceeding 3 millions in order to enable them to satisfy the claims of the debenture-holders. The arrangement also provided for the retention by the company of the services of a certain number of the transferred staff to assist in the pre-

paration of the company's claim and for the use by the company of Telephone House, or such portions of it as might be required, and general provisions for the protection of the company. The Postmaster-General had also agreed that in the event of the whole of the purchase money not being paid within six months of December 31st last, he would pay interest on the amount of purchase money from time to time remaining unpaid at the rate of 5 per cent. per annum, instead of 3 per cent., which was the rate of interest for the first three months. The directors pressed for that alteration in the rate of interest, first, because of the gigantic business which had to be undertaken in order to determine the price of the assets, and next because of the general slothfulness of Government departments in determining the settlement of such questions. Power was given to the Postmaster-General to make further payments on account of the purchase money if he so desired, and he had undertaken that the telephone purchase money was to be paid within 28 days after the determination of the amount. The company had now transferred the assets, together with the whole of the staff, excepting a number of higher officers whose salary was more than £700 a year, to the Postmaster-General. Several of those higher officers had been retained for the purpose of prosecuting the company's claim against the Government. It was to be regretted that some of those officers, who had become specialists in the business, were to be deprived of their offices simply because the Treasury would not permit of their continuing in employment at existing or commercial rates. The company owed much to the enthusiasm and devotion of its staff, from its humblest member upwards. There now only remained to be settled the all-important question of the determination of the price to be paid the company for its business. At recent meetings he had referred to the fact that an inventory was being taken by a joint staff of the company and the Post Office, and that staff which numbered 700, had now been engaged on the work for some 15 months. He had pleasure in stating that the work of enumerating in connection with the inventory was complete; that the final summaries were now in course of preparation; and it was hoped that the company's claim in respect of its plant would shortly be ready for presentation. The first claim upon the assets was secured to the debenture stock-holders, and to those gentlemen there was owing the sum of £3,983,593. During the past year the company had paid to them out of its own resources £802,413, leaving £3,181,180 still to be paid. £1,531,464 was due in respect to the 3½ per cent. debenture stock, and an action was now before the Courts to determine whether that stock was to be paid off at par, as the company had been advised, or at a premium of 3 per cent. Meantime it was proposed, out of the 3 millions to be received from the Postmaster-General, to pay off the whole of the debenture stock during the present month without prejudice to the rights of any of the holders of the 3½ per cent. stock to the premium to which he had referred. As the 3 millions only carried interest at the rate of 3 per cent., while the debenture stock carried interest at 3½ and 4 per cent., the necessity for its immediate repayment was apparent. The facts that the money was now available to pay off the debenture stock-holders, and that there were no profit-earning possibilities open, made it imperative to take steps for the winding up of the company, and that would be done at an extraordinary meeting to follow this one. Before, however, they commenced the winding up proceedings, it was necessary to obtain the authority of the shareholders to the distribution of the dividend for the half-year ended December 31st, and the board recommended payment of those dividends at the usual rates. He was sorry it had not been possible to get the accounts made up in time for that meeting, but the advantages of the present proceedings would, he hoped, be sufficient to compensate for that fact. He had seen it stated that a larger distribution than 6 per cent. per annum should have been made on the deferred stock. The directors had given most careful consideration to that point, and had come to the conclusion that their policy was a prudent one, and to ask the deferred stock-holders to rely, as indeed they must rely, upon the decision of the arbitrators upon the amount of the company's claim. There was no sure ground for any forecast as to the probable result of the arbitration. He had seen speculations indulged in in various quarters, but he wished to say that there were no grounds for such speculations at the present moment. The shareholders might rely upon it that all that was possible would be done to protect their interests and to press forward for adjudication any questions in doubt. Several attempts had been made to arrive at a figure by agreement without arbitration, but in telephones, as in everything else, the ideas of the buyer and the seller materially differed, and it had been found impossible to bridge the gulf which existed in the respective estimates of value made by the advisers of the Postmaster-General and the company respectively. After the purchase money had been ascertained, the Postmaster-General had the right under the purchase agreement to pay three-fourths of the money in terminable annuities. Such annuities would carry interest at the rate of 3 per cent., and would be spread over a period of 30 years. The board had proposed to the Postmaster-General that, instead of those terminable annuities, he should issue 3 per cent. Exchequer bonds, redeemable by annual drawings, and he had promised to do that conditionally upon the company facilitating the transfer. As the company had consistently maintained a friendly attitude towards the Postmaster-General, he thought he might predict that the greater portion of the purchase money would be paid in Exchequer bonds instead of terminable annuities, a security which would not only be more marketable, but which would remove many difficulties from the path of the holder. He hoped it might be possible for such Exchequer bonds to be offered to the shareholders. He had been asked by a shareholder whether it was necessary for the directors to accept these Exchequer bonds or terminable annuities,



and the answer to that was that nothing could be done without an extraordinary resolution, which would require three-fourths of the shareholders to make it effective. The view of the directors was that, if and when they had those bonds to distribute, the right thing would be to come to the shareholders and take counsel with them as to whether they would wish them distributed among the shareholders, or whether they would wish to have them sold and realised and the cash distributed. A number of shareholders had written asking as to what dividends would be payable after this date. It would be evident that the company's business having passed to the Postmaster-General, no income would remain for dividend—indeed, the only income which would be receivable would be for the first six months' 3 per cent. on the amount of the purchase money, which was at present an unknown factor; and as he had told them, after June 30th the interest would be 5 per cent. As against that must be remembered the heavy expenses the company had been, and was being, put to in providing for the completion of its claim and its proper presentation to the Railway and Canal Commission. Therefore, he saw no possible prospect of the payment of future dividends. It was quite impossible to give any indication as to when a distribution of assets to the shareholders would take place. It was hoped by the end of this month that they would be able to clear away the whole of the debenture stock indebtedness with the help of three millions which they were going to get from the Postmaster-General, but any further distributions depended entirely upon the settlement of price and the payments to be made to the company by the Postmaster-General. Having referred to the shares held in other companies, the chairman said he did not think he could conclude upon that interesting occasion—which would probably be the last meeting at which the shareholders would assemble under existing conditions—without referring to the great work which the company had accomplished during the brief period of their existence—some 31 years. They had built up a gigantic business with a revenue of nearly four millions sterling per annum; they had covered the United Kingdom with poles and wires and underground ducts and cables, all radiating from some 1,600 exchanges, for the purpose of affording a telephone service, and to have done that without any legislative sanction, with all their work constructed upon sufferance, with obstruction in the form of a royalty of 10 per cent. upon their gross receipts and 25 per cent. upon their net income; and when it was recalled how much the company had been harassed by Parliament and local authorities on the one hand, and by the British public on the other, the wonder was not that they were able to distribute a dividend of 6 per cent. per annum on the deferred stock, but that there should have been any dividend at all. He thought the company deserved much more generous treatment than they had so far received from the State, which inherited that great business, having done nothing whatever to create it, and much to obstruct and hinder it. The Government now had a great business ready to its hands with all difficulties smoothed out, with a trained staff, highly skilled, an organisation which had been gradually perfected, a plant which had been frequently renewed according to the progress of invention, and a telephone service superior to that of any other country in Europe, with a total of about 560,000 telephone stations, over which there passed nearly sixteen hundred millions of calls in the course of a year. Those, he thought, were facts which the shareholders could dwell upon with pride, and should justify the claim of the company not only to fair, but liberal, treatment at the hands of the State.

MR. S. H. SANDS seconded the motion.

The CHAIRMAN, in reply to questions, said that the reserve fund now amounted to between 4 and 5 millions sterling, and had been built up by the directors with the object of safeguarding and securing the company's capital. It was a liquid asset to the extent that their land and buildings were liquid, and it was represented there by something like one million. The balance was invested in the business—some of it in cash—in the last balance-sheet it stood at something like a million, and the balance was in plant. The company had had to raise money during recent years, and it seemed more profitable to the directors to invest their own money in the business instead of raising money by the issue of shares. He dared say it would be possible to use a portion of the reserve fund to pay a dividend, but it would be very imprudent, having regard to the purposes for which the fund was built up. It stood as a strong safeguard for the shareholders' capital, and he would be very sorry to see it diminished in any way. He had to repeat that there was no ground for hoping for further dividends. It was true they were to receive interest on the amount of the purchase money at 3 per cent. for the first six months, and 5 per cent. thereafter, but as he had told them there would be great expense incurred in prosecuting their claim. The effect of their going into liquidation, which was the only thing they could do in order to make the best possible use of the assets, was undoubtedly to deprive the preference shareholders of their dividend in the meantime, and the only compensation they could promise was that they would do their best to press forward a settlement and give them their capital as soon as they possibly could. With regard to the position of the first, second, and third preference shareholders, some years ago the whole of those questions were discussed, and the opinion of eminent counsel was obtained and circulated amongst the shareholders. The board were still of opinion as given by counsel, but if any considerable body of any class of shareholders would like to have their particular aspect of the case put to the Court, the directors would see that it was done.

The report was then agreed to.

An extraordinary meeting was subsequently held, when on the motion of MR. S. H. SANDS, seconded by LORD BALFOUR OF BURLEIGH, the following resolution was unanimously agreed to:—

"That this company be wound up voluntarily under the provisions

of the Companies (Consolidation) Act, 1908, that Mr. George Franklin, President of the company, be and he is hereby appointed liquidator for the purpose of such winding up, and that the powers of the directors of the company be continued so far as regards all questions relating to the ascertainment of the purchase price to be paid by the Postmaster-General to the company for the plant, property and assets of the company purchased by him until such questions are disposed of, and for all such other purposes connected with the company as are legally consistent with the powers of the liquidator."

The CHAIRMAN, in acknowledging a vote of thanks, said that the thanks of the shareholders were due in an eminent degree to his colleagues on the board, and to the staff, who numbered 18,000. Although most of the latter had been handed over to the Government, they still had a few left. To the staff as a whole, and to those eminent men who were at the head, and who had rendered such faithful services, they owed a debt, which had never been met by the salaries they had received, and a debt which, he was afraid, the shareholders would never be able to repay.

**Helsby Wireless Telegraph Co., Ltd.**—At a meeting held on Wednesday, Col. J. Bernard presiding, a resolution was passed reducing the capital from £20,498 to £10,000.

**Llandudno and Colwyn Bay Electric Railway, Ltd.**—This company held its annual meeting in London on January 5th. Pressure upon our space compels us to hold over our report.

**Chile Telephone Co., Ltd.**—The directors have declared an interim dividend of 3s. per share, less income-tax, for the half-year ended September 30th.

**Underground Electric Railways Co. of London.**—An extraordinary general meeting is called for January 26th to consider the insertion of a new clause in the Articles, enabling the company to run motor-omnibuses. A great deal of attention has this week been directed to negotiations that have been proceeding for the fusion of interests of the London General Omnibus Co. and the tube railway company.

**Stock Exchange Notice.**—Application has been made to the Committee to allow the following securities to be quoted in the Official List: Para Electric Railways and Lighting Co., Ltd.—45,000 additional 6 per cent. cumulative preference shares of £5 each fully paid, Nos. 70,001 to 115,000.

**North Wales Power and Traction Co., Ltd.**—The report, according to the *Financier*, states that the accounts for the year to June 30th, after providing for interest on loans, £2,400, and interest on second debentures from July 1st, 1910, to June 30th, 1911 (accrued due but unpaid), £7,000, show a debit balance of £41,199, to be carried forward.

**Mexican Light and Power Co., Ltd.**—The directors have declared a dividend of 1 per cent. for the quarter ended December 31st on the ordinary shares.

**Mexico Tramways Co.**—The directors have declared a dividend of 1½ per cent. for the quarter ended December 31st, 1911.

**Continental.**—FRANCE.—The balance-sheet of La Société Industrielle des Telephones, of Paris, for the past financial year shows a profit of £61,374, as compared with £67,650 in the preceding 12 months. A dividend of 5 per cent. is being declared.

GERMANY.—The Fabrik Isolierter Draht zu Electricischen Zwecken Gesellschaft (C. J. Vogel), of Berlin, is declaring a dividend of 11 per cent. for the last financial year.

SWITZERLAND.—The Oerlikon Akkumulatorenfabrik Gesellschaft, of Oerlikon, is declaring a dividend of 20 per cent. for the last financial year, the same as for the preceding 12 months.

A MADRID AMALGAMATION.—According to an announcement from Madrid, the three largest electric supply works in Madrid are to be transformed into a company with an ordinary capital of 33,000,000 pesetas. The company will also issue bonds amounting to 14,000,000 pesetas.

## STOCKS AND SHARES.

Tuesday Evening.

BUSINESS there is, and quite a fair amount of it, in the markets round the Stock Exchange. It comes, however, patchily still, and in spasms which apply first to one share and then to another, so that the complaint arises that orders are far from evenly spread, and that it is even more difficult than usual to form clear judgment. In the Latin-Canadian group business is active, and here, at all events, it goes on so steadily day by day that the principal firms certainly cannot complain of neglect. Rubber shares have started mildly booming, and the market has shown a good deal of resistance to steady profit-taking sales.

The Home Railway market continues to occupy a good deal of interest, but remains far from satisfactory to the holders of stock.



In spite of the efforts of Sir George Askwith in connection with the cotton lock-out, prices of the leading issues are still under a cloud, and there are ominous prophecies with reference to a possible coal strike. The Undergrounds are dull, influenced by the depression prevailing elsewhere, and Districts fell  $1\frac{1}{2}$  after their big rise, while Metropolitans marked time at  $46\frac{1}{2}$ . Central London Ordinary put on another point, but Deferred lost a similar amount, and City and South London receded  $\frac{1}{2}$ . The feature in this section is a fresh rise in East London Ordinary which has taken the price up to  $7\frac{1}{2}$ , while the three junior debenture stocks rose substantially upon renewed attention being directed to the prospects of the company when it is electrified upon the sponsorship of its more powerful brethren.

London General Omnibus is still moving about rapidly enough to satisfy the most ardent craving after dramatic movements, and, following these fluctuations, the issues of the Underground Electric Railways Company changed with great rapidity. The company's £10 shares, which not long ago were standing at about 30s., touched 70s. last week, and at the present price of 3 they show a rise of 10s. on the week. The Income bonds, in which there has been so much speculation lately, went to 82, back to 78, and as we write are 80 middle; while the Power House Debentures have recovered the £2 interest recently deducted. In connection with this, a strong demand sprang up for London United Tramways 4 per cent. Debenture stock. There was little floating supply in the London market, nor was Bristol any better off; and as soon as a few hundreds were bought, the price mounted rapidly, showing on the week a further improvement of 3 points, while the Preference shares again rose 2s. 6d. British Electric Traction are quiet, but Metropolitan Tramways Ordinary are  $\frac{1}{16}$  higher, and the Deferred at 3s. 9d. middle are also fractionally better. Public interest in the London Traffic problem continues unabated, and from all quarters brokers receive inquiries from clients asking what should be bought, the sensational rise in Bus stock having so whetted the thirst for speculation and investment in securities connected with the industry. Publication of the proposed agreement between the Underground Electric Railways and the Bus Company, whereby the control of the latter practically passes into the hands of the former, led to a fresh rise in London General stock.

London Electricity shares have fallen upon quiet days again, and the movements are almost negligible. County Ordinary rose  $\frac{1}{8}$  to  $9\frac{1}{4}$  upon the appointment of Mr. H. B. Renwick as general manager, to which reference was made here last week. Cities put on  $\frac{3}{8}$  in sympathy with the steady rise in Counties, but falls of  $\frac{1}{8}$  are to be noted in Charing Cross Preference and in Westminster Ordinary.

In the Telegraph market the grand features have been fresh big rises in Marconi Ordinary and Preference. "The latter," we wrote last week, "are greatly undervalued at 51s. 3d. if the Ordinary are worth 65s." That other people also noticed this is shown by a rise of 15s. in the shares since then, the quotation having risen to  $3\frac{5}{8}$ , the Ordinary being hoisted to 76s. 3d. A huge account now exists in both classes of shares, and although the Ordinary are talked to £5 glibly enough, conservative people are afraid to venture purchases at the present figures. West India and Panama, after their advance of 16s. 3d. last week, are  $\frac{1}{16}$  easier, but it does not appear that the upward movement in these has been more than checked for the time being. The First Preference at  $10\frac{1}{2}$  are again  $\frac{1}{8}$  higher. Anglo-American Telegraph Deferred spurted to the extent of  $\frac{3}{4}$ , and Cuba Telegraphs rose  $\frac{1}{4}$ , these being amongst the main features of this department.

National Telephone Preferred, Deferred and Third Preference gave way on fairly heavy selling, apparently by profit-takers, but this has not stopped all kinds of estimates and guesses as to what prices will be paid by the Government for these issues. Other Telephone stocks are steady, without special feature, the market being absorbed by the attention paid to Marconis and National Telephones.

By an obvious, though no less stupid, slip, it was stated here last week that Telegraph Construction shares had risen 1, being the first step upwards since the selling that followed the passing of the dividend. Of course, what we meant to write was India-Rubber shares, as our price list showed. The Telegraph Construction Company, as everybody knows, is about as likely to pass its dividend as Consols are. But, in spite of the transparent nature of the mistake, we are none the less sorry that it should have been made. Since *qui s'excuse s'accuse*, we will add no more, save our apologies.

Manufacturing shares as a whole are steady enough, Castner-Kellner rising  $\frac{1}{8}$  again and the Debenture stock gaining a point. Edison and Swan at  $\frac{1}{8}$  are nominally  $\frac{3}{16}$  easier, but the market is a very narrow one.

Kalgoorlie Electric Light and Power shares have hardened, and the actual prices are 6s. 9d. for the Ordinary and 14s. 6d. for the Preference. The company is declared to be doing very well, and some people talk of a dividend of 10 per cent. being earned on the Ordinary. In the South American group there is pronounced firmness and a large volume of business. Rio Trams are a feature of strength at  $117\frac{1}{2}$ ; while, of Canadian descriptions, Montreal rose again to 200, Toronto Debenture improved to par, Shawinigan put on a point, and the only issues to show any decline in the group are those of the Mexican Light and Power Company, where the Common and Preference shares have both gone back after their rises of last week. It is worth noticing that River Plate Preference has at last started to move, and the gain of 2 points draws fresh attention to this security as a good investment of its kind. Anglo-Argentine Trams continue in demand for investment account, and the steady way in which the various bonds of this section are being taken for investment by capitalists in the North affords another testimony to the attractions which many of the bonds hold out, even at the present prices.

ELECTRIC TRAMWAY AND RAILWAY

TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Aberdeen .. ..	Jan. 8	3,225	+ 164	31	47,511	+ 2,639	.. ..
Ayr .. .. .	" 6	457	+ 31	34	11,262	+ 128	8 ..
†Bath .. .. .	" 6	754	+ 84	..	..	..	.. ..
Birkenhead .. ..	" 7	2,403	+ 100	40	46,471	+ 1,656	13·7 ..
Birmingham Corp.	Dec. 30	21,329	+ 5,192	39	339,2·7	+ 68,378	56·4 ..
Blackburn .. ..	Jan. 3	2,653	+ 211	40	47,526	+ 3,825	14·6 ..
Blackpool Corp. ..	" 4	1,291	+ 252	..	59,039	+ 7,704	.. ..
Blackpool-Fleetw'd	" 6	747	+ 92	..	..	..	.. ..
†Bolton .. .. .	Dec. 2	2,412	+ 172	36	90,575	+ 6,040	26 ..
Bournemouth .. ..	Jan. 3	3,481	+ 122	40	73,198	+ 20	21·95 ..
Bradford .. .. .	Dec. 30	11,909	+ 128	38	216,462	+ 13,979	56 1·2
Brighton .. .. .	Jan. 7	1,559	+ 119	40½	42,892	+ 2,877	9·5 ..
Bristol .. .. .	" 5	14,580	+ 1,227	..	..	..	.. ..
Brit. Elec. Traction Co.	Dec. 29	542	+ 109	52	11,967	+ 633	3·65 ..
Airdrie .. .. .	" 29	487	+ 27	"	9,710	+ 710	.. ..
Barnsley .. .. .	" 29	652	+ 135	"	16,090	+ 2,429	5·37 ..
Barrow .. .. .	" 29	1,111	+ 103	"	26,681	+ 3,765	8·85 ..
Devonport .. .. .	" 29	2,354	+ 133	"	54,657	+ 2,984	11·25 ..
Gateshead .. .. .	" 29	522	+ 23	"	11,201	+ 392	6·5 ..
Gravesend .. .. .	" 29	1,489	+ 342	"	37,742	+ 6,3·8	7·25 ..
Greenock .. .. .	" 29	562	+ 104	"	14,194	+ 1,562	6·72 ..
Hartlepool .. .. .	" 29	252	+ 2	"	6,043	+ 304	.. ..
Kidderminster .. ..	" 29	390	+ 19	"	9,167	+ 453	.. ..
†Leamington .. ..	" 29	503	..	"	10,957	+ 205	2·9 ..
Merthyr .. .. .	" 29	18,989	+ 1,248	"	457,577	+ 66,881	22 ..
Metropolitan .. ..	" 29	675	+ 47	"	17,640	+ 1,364	8·5 ..
Middleton .. .. .	" 29	10,314	+ 3,974	"	270,283	+ 34,496	.. ..
Mid-Joint Com'tee	" 29	1,233	+ 65	"	30,026	+ 1,245	9·13 ..
Oldham—Ashton ..	" 29	300	+ 24	"	6,706	+ 650	5·31 ..
Peterborough .. ..	" 29	4,744	+ 243	"	103,364	+ 9,154	29 ..
Potteries .. .. .	" 29	83	+ 1	"	10,197	+ 58	2·75 ..
Rotherham .. .. .	" 29	521	+ 4	"	15,578	+ 567	8·17 ..
Southport .. .. .	" 29	1,752	+ 60	"	44,522	+ 2,107	.. ..
S. Metropolitan ..	" 29	2,496	+ 12	"	59,722	+ 3,234	12·5 ..
Swansea .. .. .	" 29	304	+ 20	"	13,143	+ 368	3·75 ..
Tynemouth .. .. .	" 29	56	+ 16	"	8,214	+ 1,036	8 ..
Weston-s-Mare .. ..	" 29	581	+ 8	"	15,264	+ 561	5·75 ..
†Worcester .. .. .	" 29	249	+ 16	"	5,375	+ 315	.. ..
Wrexham .. .. .	" 29	2,595	+ 154	"	55,268	+ 3,692	17 ..
Yorks. Wool. Dist.	" 29	459	+ 29	"	11,760	+ 1,877	.. ..
Miscellaneous .. ..	" 29	..	..	..	..	..	.. ..
Burnley .. .. .	Jan. 6	3,034	+ 266	..	..	..	11·78 ..
Burton-on-Trent ..	" 7	556	+ 7	40	11,719	+ 585	6·62 ..
Bury .. .. .	" 7	2,664	+ 136	40½	52,131	+ 4,256	22·5 ..
Cardiff .. .. .	Dec. 30	5,135	+ 112	39	96,493	+ 6,964	.. ..
Chatham and Dist.	" 31	1,332	+ 110	52	44,722	+ ..	11·98 ..
Cork .. .. .	" 31	723	+ 48	..	26,090	+ 594	9·89 ..
Croydon .. .. .	" 29	3,788	+ 65	52	71,073	+ 4,821	11·9 ..
Darlington .. .. .	" 9	203	+ 15	37	8,201	+ 764	.. ..
Darwen .. .. .	Jan. 5	622	+ 51	40	10,890	+ 779	4·36 ..
Dover .. .. .	Dec. 30	442	+ 25	39	10,285	+ 1,593	4·75 ..
Dublin .. .. .	Jan. 5	9,198	+ 294	..	..	..	54 ..
Dundee .. .. .	Dec. 22	2,212	+ 37	27	52,513	+ 760	15 ..
East Ham .. .. .	Jan. 6	2,257	+ 147	40	44,501	+ 2,453	7·87 1
Exeter .. .. .	" 5	674	+ 42	40	13,599	+ 919	5·5 ..
Glasgow .. .. .	" 6	39,654	+ 321	..	603,009	+ 57,8·7	98 ..
Hastings .. .. .	" 6	1,898	+ 148	..	..	..	.. ..
Huddersfield .. ..	" 6	4,055	+ 193	40	77,656	+ 7,453	29·5 1
Hull .. .. .	" 6	6,362	+ 366	40	118,179	+ 6,373	14·5 ..
Ilkeston .. .. .	" 4	254	+ 10	40	5,310	+ 97	.. ..
Ipswich .. .. .	" 6	796	+ 63	40	18,217	+ 972	10·5 ..
Kilmarnock .. .. .	Dec. 30	319	+ 2	33	6,465	+ 404	4·25 ..
Lancashire United	Jan. 3	3,018	+ 274	52	70,914	+ 2,455	39 ..
Leeds .. .. .	Dec. 30	15,951	+ 821	39	297,569	+ 20,166	50·71 2
†Leicester .. .. .	Jan. 6	5,486	+ 417	..	..	..	.. ..
Leith .. .. .	" 6	1,377	+ 157	33½	22,356	+ 1,764	8·72 ..
Liverpool .. .. .	Dec. 30	25,752	+ 1,274	52	600,166	+ 18,951	116 2·5
†L.C.C. .. .. .	" 27	40,847	+ 1,567	..	1,714,848	+ 66,891	138·4 5·25
London United .. ..	Jan. 6	12,002	+ 249	..	..	..	.. ..
Lowestoft .. .. .	" 6	319	+ 16	14	2,468	+ 40	3·5 ..
Manchester .. .. .	" 6	32,719	+ 819	40	656,197	+ 34,128	183 ..
Newcastle .. .. .	" 6	8,803	+ 561	..	173,747	+ 13,820	14·5 ..
Newport .. .. .	Dec. 30	1,516	+ 32	39	27,972	+ 944	14·5 ..
Oldham .. .. .	Jan. 7	3,973	+ 211	41	80,839	+ 3,695	23·75 6
Poltypridd .. .. .	" 6	855	+ 33	40	16,835	+ 17	5·5 ..
Portsmouth .. .. .	Dec. 30	3,692	+ 29	39	88,715	+ 6,507	15·25 ..
Preston .. .. .	Jan. 3	1,929	+ 140	40	31,798	+ 2,270	.. ..
Rotherham .. .. .	" 4	1,708	+ 16	39½	27,861	+ 2,277	12 ..
Salford .. .. .	" 1	10,282	+ 297	39½	193,998	+ 8,748	.. ..
Sheffield .. .. .	" 9	14,313	+ 609	41	267,237	+ 17,347	40 ..
Southampton .. ..	" 3	2,480	+ 183	40	50,077	+ 5,692	22 ..
Southend-on-Sea ..	" 3	1,017	+ 177	40	28,428	+ 4,292	.. ..
South Shields .. ..	" 6	1,303	+ 129	40	25,501	+ 2,812	.. ..
Swindon .. .. .	" 3	982	+ 64	..	6,525	+ 705	.. ..
Tyneside .. .. .	Dec. 31	779	+ 180	27	13,410	+ 2,158	.. ..
Wallasey .. .. .	" 23	2,118	+ 168	33½	42,791	+ 6,708	.. ..
Walthamstow .. ..	Jan. 6	1,497	+ 142	40	30,530	+ 1,846	9 ..
West Ham .. .. .	Dec. 28	5,856	+ 160	59	106,969	+ 9,289	15·25 ..
Wolverhampton .. ..	Jan. 3	2,302	+ 96	40	69,975	+ 2,104	25 ..
Cen. London Rly. ..	" 6	8,822	+ 1,223	..	..	..	6·82 ..
City & S. Lon. Rly.	" 6	7,229	+ 604	..	..	..	7·26 ..
Dublin-Lucan Rly. ..	" 5	280	+ 9	1	77	+ 11	7 ..
G.N. and City Rly. ..	" 6	3,844	+ 242	..	..	..	3·5 ..
L'pool Overh'd Rly. ..	" 7	2,861	+ 80	..	..	..	6·8 4·8
Llandudno-Col. Bay	" 5	364	+ 59	5½	749	+ 89	.. ..
Lond. Elec. Ry. Co. ..	" 6	28,280	+ 160	..	..	..	21·25 ..
Mersey Railway .. ..	" 6	4,354	+ 57	..	..	..	4·5 ..
Metropolitan Rly. ..	" 7	85,839	+ 405	..	..	..	25·75 ..
Met. District Rly. ..	" 6	24,077	+ 734	..	..	..	24 ..
Anglo-Argentine .. ..	" 7	109,192	+ 897	..	..	..	.. ..
†Auckland .. .. .	Dec. 15	18,028	+ 1,857	6	99,479	+ 8,053	28·81 ..
Bombay (B.E.T.) ..	" 8	8,789	+ 3,242	49	146,254	+ 11,943	.. ..
†Brisbane .. .. .	Dec. ..	24,480	+ 8,105	52	252,100	+ 30,655	.. ..
Brit. Columbia Rly. ..	Jan. 6	11,884	+ 3,330	..	..	+ 2,089	.. ..
Calcutta .. .. .	" ..	..	..	..	..	..	.. ..
Cape Electric T.Ld. ..	" ..	..	..	..	..	..	.. ..
†Kalgoorlie, W.A. ...	Nov. ..	8,165	..	48	87,914	..	20·5 ..
†Lisbon .. .. .	" ..	..	..	..	..	..	.. ..
Madras .. .. .	Dec. 31	1,651	+ 46	52	85,607	+ 2,786	.. ..
†Montevideo .. .. .	Dec. ..	29,093	+ 2,419	2	65,707	+ 4,947	.. ..
Perth (W.A.) .. ..	Jan. 5	4,629	+ 602	..	85,541	+ 17,798	29 ..

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividend for	Closing Quotations Jan. 9th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations Jan. 9th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord.	10	1910. 1911	77-83	..	5 5 9	Kensington & Knightsbridge, Ord	5	1910 1911	82-72	..	6 4 2
Do. 4 1/2 % Pref.	10	4 1/2	82-92	..	4 12 4	Do. 4 % Deb.	Stock	4	91-96	..	4 3 4
Do. Second 6 % Pref.	10	6	102-11	..	5 9 1	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	80-84	..	5 7 2
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	101-102 xd	..	4 8 8	London Electric, Ord.	8	2	1 1/2-2	..	3 0 2
Brompton & Kensington, Ord.	5	10	77-83	..	5 19 4	Do. 6 % Pref.	5	6	42-47	..	6 3 1
Do. 7 % Cum. Pref.	5	7	72-8	..	4 7 6	Do. 4 % First Mort. Deb.	Stock	4	85-91	+1	4 3 0
Central Electric Supply, 4 %	100	4	98-101	..	3 19 3	Metropolitan	5	5	84-4	..	5 5 0
Guar. Deb.	5	5	94-4	..	6 5 0	Do. 4 1/2 % Cum. Pref.	5	4 1/2	42-47 xd	..	4 17 4
Charing Cross, West End & City	5	4 1/2	42-47	-1/2	4 14 9	Do. 4 1/2 % First Mort. Deb.	Stock	4 1/2	99-104 xd	..	4 6 7
Do. 4 1/2 % Cum. Pref.	5	4 1/2	82-42 xd	..	5 9 1	Do. 3 1/2 % Mort. Deb.	Stock	3 1/2	84-87 xd	..	4 0 6
Do. "City Undertaking"	5	4 1/2	93-96	..	4 8 4	Midland Electric Corporation	100	4 1/2	94-96 xd	..	4 13 3
Do. Do. 4 % Deb.	100	4	4-4 1/2	..	5 11 1	4 1/2 % First Mort. Deb.	5	4	82-4	..	5 0 0
Chelsea, Ord.	5	5	97-100 xd	..	4 10 0	Newcastle-on-Tyne	5	5	4-4 1/2	..	5 11 1
Do. 4 1/2 % Deb.	Stock	4 1/2	18-13 1/2	+ 8	5 3 8	Do. 5 % Pref., Non-Cum.	5	5	99-102	..	4 15 0
City of London, Ord.	10	7	12-13	..	4 12 4	North Metropolitan Power Sup-	100	5	99-102	..	4 15 0
Do. 5 % Cum. Pref.	10	6	117-121 xd	..	4 2 8	ply, 5 % Mortgages (Red.)	100	5	99-102	..	4 15 0
Do. 5 % Deb.	Stock	5	100-103 xd	..	4 7 5	Notting Hill, 6 % Non-Cum.	10	..	97-102 xd	..	..
Do. 4 1/2 % Second Deb.	100	4 1/2	87-89 xd	..	5 12 4	Oxford	5	7 1/2	64-66	..	5 9 5
County of Durham, 5 % First	Stock	5	9-9 1/2	+ 1/2	5 5 3	St. James' and Pall Mall, Ord.	5	10	8-8 1/2	..	5 17 4
Mort. Deb.	10	5	11-11 1/2	..	5 4 4	Do. 7 % Pref.	5	7	62-72	..	4 19 1
County of London, Ord.	10	6	106-108 xd	..	4 3 4	Do. 8 1/2 % Deb.	100	8 1/2	85-87 xd	..	4 0 6
Do. 6 % Pref.	10	6	100-103	..	4 7 5	Smithfield Markets, Ord.	5	Nil	12-14	..	NU
Do. 4 1/2 % Deb.	Stock	4 1/2	8-8	..	Nil	South London, Ord.	4	..	22-32	..	6 3 1
Do. 4 1/2 % Second Deb.	Stock	4 1/2	2-2 1/2	..	Nil	Do. 5 % First Mort. Deb.	100	5	98-101 xd	..	4 19 0
Edmundson's, Ord.	5	Nil	81-87	..	5 3 6	South Metropolitan, 7 % Pref.	1	7	1-1 1/2	..	6 4 5
Do. 6 % Cum. Pref.	5	Nil	4-5	..	6 0 0	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	95-98	..	4 11 10
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	42-52	..	4 17 7	Urban, Ord.	5	5	2-2 1/2	..	..
Folkestone	5	6	95-98	..	4 11 10	Do. 5 % Cum. Pref.	5	5	82-88	..	5 1 8
Do. 5 % Cum. Pref.	5	5	62-72	..	6 4 2	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	72-82	-1/2	6 1 2
Do. 4 1/2 % First Deb.	100	4 1/2	..	..	..	Westminster, Ord.	5	10	42-52 xd	..	4 7 10
Hove	5	9	..	..	..	Do. 4 1/2 % Cum. Pref.	5	4 1/2	..	..	..

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 5 % Pref.	5	6	54-53	..	5 4 4	Monterey Rly. Light & Power,	100	5	5	91-93	..	5 7 6
Calcutta, Ord.	5	8 1/2	62-68	..	6 8 4	5 % 1st Mort. Deb.	5	5	198-202	+2	3 9 4	
Do. 5 % Pref.	5	5	6-5 1/2	..	4 15 3	Montreal, Lt., H. and Power	\$100	7	8	39-41	..	12 3 1
Calgary Power, 1st Mort. Bds.	100	5	94-96 xd	..	5 4 2	Northern, Lt., Power and Coal,	\$500	6	..	235-245	..	4 1 8
Canadian Gen. El. Com.	\$100	7	110-115	..	6 1 9	5 % 1st Mort. Bonds	Stock	10	..	106-112	+2	5 7 2
Do. 7 % Pref.	\$100	7	118-122	..	5 14 9	River Plate, Ord.	Do.	6	6	100-102 xd	..	4 18 0
Cordoba Lt., Power and T., Ord.	1	3	7-1	..	3 0 0	Do. 6 % Non-Cum. Pref.	Do.	6	6	99-101	..	4 9 1
Do. 5 % Deb.	100	5	94-97	..	5 3 1	Do. 5 % Deb. Stock	Do.	5	5	127-129	+1	3 2 0
Elec. Lt. and P. of Cochabamba,	100	6	91-93	..	6 9 0	Roy. Elec. Co., Montreal, 4 1/2 %	100	4 1/2	105-107 xd	..	4 13 6	
6 % Bonds	100	6	88-86	+1	5 16 3	1st Mort. Deb.	Stock	4 1/2	102 1/2-104 1/2	..	4 6 2	
Elec. Supply Victoria, 5 % 1st	100	5	91 1/2-93 1/2	..	5 6 11	Do. 4 1/2 % Per. Deb.	Do.	4 1/2	99-101	+1	4 9 1	
Mort. Deb.	\$500	5	1-3 1/2	..	7 13 6	Toronto Power, 4 1/2 % Deb.	100	5	91-93 xd	..	5 7 6	
Elec. Dev. Ontario, 5 % 1st	10/-	Nil	101 1/2-103 1/2 xd	+ 3/2	4 16 7	Vera Cruz Lt., P. and T., 5 %	100	5	106 1/2-108 1/2	..	5 10 7	
Mort. Bonds	1	6	28-32	..	..	1st Mort. Deb.	1	Nil	113d.	1 1/2-1 1/2	..	..
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	98 1/2-100 1/2 xd	+ 1/2	4 19 6	Victoria Falls Power, Pref.	100	6	6	..	..	..
Do. 6 % Pref.	1	6	86-88 xd	..	5 18 8	West Kootenay Power and Lt.,	100	6	6	..	..	..
Kaminstiquia Power, 5 % G. Bs.	\$500	5	87-89	-2	4 10 0	1st Mort. 6 % Gold	..	..	..	..	..	..
Madras, Ord.	5	..	107 1/2-109 1/2	- 1/2	6 7 10	..	..	..	..	..	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	96 1/2-98 1/2	+1	5 1 6	..	..	..	..	..	..	..
Mexican El. Lt., 5 % 1st M. Bds.	..	5	..	..	..	..	..	..	..	..	..	..
Mexican Lt. & Power, Common	\$100	4	4 1/2	..	..	..	..	..	..	..	..	..
Do. 7 % Cum. Pref.	\$100	7	7	..	..	..	..	..	..	..	..	..
Do. 5 % 1st Mort. Gold Bds.	..	5	5	..	..	..	..	..	..	..	..	..

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4 1/2	7 — 7 1/2	..	..	Monte Video Telephone, Ord.	1	6	6	104 — 106 1/2	..	5 12 11
Do. 5 % Deb. Red.	Stock	5	5	98 — 100 xd	..	5 0 0	Do. 5 % Pref.	1	5	5	126 1/2 — 128 1/2	..	5 6 8
American Telep. & Teleg., Cap.	\$100	8	8 1/2	140 — 142 xd	..	5 12 8	National Telephone, Pref.	Stock	6	6 1/2	92 — 102	..	5 12 8
Do. Collat. Trust	\$1000	4	4	93 — 95 xd	..	4 4 8	Do. Def.	Do.	6	6 1/2	92 — 102	..	4 13 5
Anglo-American Telegraph	Stock	8 1/2	8 1/2	67 — 69	+ 1/2	5 8 8	Do. 6 % Cum. 1st Pref.	10	6	6	92 — 102	..	5 14 8
Do. 6 % Pref.	Do.	6	6	111 — 112	..	5 7 2	Do. 6 % Cum. 2nd Pref.	10	6	6	92 — 102	..	5 14 8
Do. Def.	Do.	80/-	..	26 1/2 — 27 1/2	+ 1/2	5 8 1	Do. 5 % Non-cum. 3rd Pref.	5	5	5	52 — 53	- 1/2	4 14 1
Anglo-Portuguese Tel., 5 % } Mort. Deb. }	100	5	6	101 — 103	..	4 17 1	Do. 8 1/2 % Deb.	Stock	3 1/2	3 1/2	98 — 100 xd	..	3 10 0
Chili Telephone	5	7	..	7 1/2 — 7 3/4	+ 1/2	4 15 0	Do. 4 % Deb.	Do	4	4	98 — 100 xd	..	4 0 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 — 88 xd	..	4 10 11	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	101 — 102	..	4 8 3
Cuba Telegraph	10	6	6 1/2	10 — 10 1/2	+ 1/2	5 11 7	Oriental Telep. and Elec.	1	8	..	1 1/2 — 1 1/2	..	4 18 6
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1	Do. 5 % Cum. Pref.	1	6	6	122 — 124	..	4 18 8
Direct Spanish Telegraph, Ord.	5	4	4 1/2	92 — 93	..	5 6 8	Do. 4 % Red. Deb.	Stock	4	4	87 — 89 xd	..	4 9 11
Do. 10 % Cum. Pref.	5	10	10	82 — 83	..	5 14 8	Pacific and European Tel., 4 % } Guar. Debs. }	Do.	4	4	98 1/2 — 100 1/2 xd	..	3 19 7
Do. 4 1/2 % Debs.	50	4 1/2	4 1/2	98 1/2 — 100 1/2 xd	..	4 9 7	Reuter's	8	5	5 1/2	82 — 92	..	4 6 6
Direct United States Cable	10	4 1/2	..	72 — 82	+ 3/4	5 9 1	Submarine Cables Trust	Cert.	6	6	180 — 183	..	4 10 3
Direct W. India Cable, 4 1/2 % } Reg. Deb. }	100	4 1/2	4 1/2	98 1/2 — 100 1/2 xd	..	4 9 7	Telephone Co. of Egypt, 4 1/2 % } Deb. Red. }	Stock	4 1/2	4 1/2	98 — 100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5 1/2	138 — 141	..	4 19 3	United River Plate Telephone	5	8	8	72 — 74 xd	..	5 5 8
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	8 1/2	83 — 85 1/2	..	4 1 7	Do. 5 % Cum. Pref.	5	5	5	62 — 63 xd	..	4 8 11
Do. 4 % Mort. Deb.	Do.	4	4	101 — 103	..	3 17 8	West Coast of America	2 1/2	2 1/2	2 1/2	122 — 124	..	4 15 3
Eastern Extension	10	7	5 1/2	133 — 137	+ 1/2	5 1 0	Do. 4 % Debs., 1 to 1,500 } guar. by Braz. Sub. Tel. }	100	4	4	98 1/2 — 100 1/2 xd	..	3 19 7
Do. 4 % Deb.	Stock	4	4	100 1/2 — 102 1/2	..	3 18 1	West India and Panama Teleg.	10	1 1/2	1 1/2	32 — 33	- 1/2	3 6 8
East and S. Africa Tel. 4 % } Mt. Db. Mauritius Sub. }	25	4	4	99 — 101	..	3 19 3	Do. 6 % Cum. 1st Pref.	10	6	6	104 — 107	+ 1/2	5 11 7
Globe Telegraph and Trust	10	5 1/2	6 1/2	102 — 112	..	5 6 8	Do. 6 % Cum. 2nd Pref.	10	6	6	92 — 102	..	5 17 1
Do. 6 % Pref.	10	6	6	122 — 132	..	4 10 9	Do. 5 % Debs.	100	5	5	101 — 103 xd	..	4 17 1
Great Northern Telegraph	10	18	5 1/2	32 — 33 xd	..	5 9 1	Western Telegraph, Ltd.	10	7	6 1/2	132 — 14	+ 1/2	5 0 0
Indo-European Telegraph	25	18	5 1/2	56 1/2 — 58 1/2	+ 1/2	5 10 2	Do. 4 % Deb.	Stock	4	4	99 — 101 xd	..	3 19 3
Mackay Companies Common	\$100	5	5 1/2	80 — 83	..	6 0 6	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106 — 109	..	3 13 5
Do. 4 % Cum. Pref.	\$100	4	4	69 — 72	..	5 11 1	Do. 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	100 — 103	..	4 7 5
Marconi's Wireless Telegraph	1	5	..	32 — 37	+ 1/2	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	3 1/2 — 3 7/8	+ 1/2	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 9th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 9th.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. ..	1	1910. Nil	1911. Nil	1/2	Nil	Metropolitan Railway Consol. ..	100	1910. 2 1/2	46 1/2—46 3/4	..	2 18 10
Do. 5 % Pref. ..	1	5	5	..	7 5 6	Do. Surplus Lands ..	100	2 3/4	66—68	..	4 0 11
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	80—85	5 5 11	Do. 3 1/2 % Deb. ..	100	3 1/2	91—93	..	8 15 3
Brit. Elec. Trac., Ord. ..	10	Nil	Nil	..	..	Do. 3 1/2 % Pref. ..	100	3 1/2	86—88	..	8 19 7
Do. 6 % Pref. ..	10	1 1/2	1 1/2	..	..	Do. 3 1/2 % Con. Pref. ..	100	3 1/2	85—87	..	4 0 6
Do. 5 % Deb. ..	100	5	5	93—96	5 4 2	Metropolitan District Ord. ..	100	Nil	33—33 1/2	-1 1/2	Nil
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2	79—83	5 8 5	Do. 6 % Deb. ..	100	6	144—146 xd	..	4 2 2
Central London Railway, Ord.	100	8	8 1/2	69—71	4 4 6	Do. 4 % Deb. ..	100	4	95—97 xd	..	4 2 6
Do. Pref. ..	100	4	4	84—86	4 13 0	Do. 4 % Prior Lien ..	100	4	100—102	..	3 18 5
Do. Def. ..	100	2	..	56—58	3 9 0	Do. 4 1/2 % First Pref. ..	100	4 1/2	91—93	..	3 10 0
Do. 4 % Deb. ..	100	4	4	103—105	3 16 2	Do. 3 1/2 % Gtd. ..	100	3 1/2	76—78	..	4 9 9
City & South London, Ord.	100	1 1/2	1 1/2	30—31	4 15 3	Metropolitan Elec. Trams, Ord.	1	5 1/2	32—32 1/2	+1 1/2	5 6 6
Do. 5 % Pref., 1891 ..	100	5	5	108—110	4 11 0	Do. Def. ..	1	Nil	..	+1 1/2	Nil
Do. Do. 1896 ..	100	5	5	104—106	4 14 4	Do. 5 % Pref. ..	1	5	..	..	5 3 1
Do. Do. 1901 ..	100	5	5	103—105	4 15 3	Do. 4 1/2 % Deb. ..	100	4 1/2	100—102 xd	..	4 8 3
Do. Do. 1903 ..	100	5	5	103—105	4 15 3	Do. 5 % Deb. ..	100	5	101—103	..	4 17 1
Do. 4 % Deb. ..	100	4	4	101—103	3 17 8	Potteries, Ord. ..	1	2	..	..	..
Dublin United Trams, 6 % Pref.	10	6	6	11—12	5 0 0	Do. 5 % Pref. ..	1	5	..	..	6 19 3
Great Northern & City, Pr'f. Ord	10	Nil	..	1—1 1/2	Nil	Do. 4 1/2 % Deb. ..	100	4 1/2	91—94	..	4 15 9
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2	7—7 1/2	..	South Metro. Trams, 6 % Pref.	1	6	..	..	6 17 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	73—78	5 14 8	Do. 4 % Deb. ..	100	4	70—75 xd	..	5 6 8
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2	23—24	4 6 11	Underground Elec. Railways	10	..	27—31	+1 1/2	..
Do. 4 % Deb. ..	100	4	4	75—80 xd	5 0 0	Do. 4 1/2 % Bonds ..	100	4 1/2	99—101 xd	-1	4 9 1
Lancashire United, 5 % Deb. ..	100	5	5	76 1/2—79 1/2 xd	6 5 9	Do. 6 % Income ..	100	1	79—81	+2	..
London Elec. Railw'ys, 4 % Deb.	100	4	4	97—99 xd	4 0 10	Do. Power House Debs. ..	100	4	100—102	+2	3 18 5
London United Trams, 5 % Pref.	10	Nil	..	3 1/2—3 1/2	..	Yorkshire (West Riding), Ord.	5	Nil	..	..	Nil
Do. 4 % Deb. ..	100	4	4	76—79 xd	5 1 3	Do. 6 % Pref. ..	5	Nil	23—24	..	Nil
						Do. 4 1/2 % Deb. ..	100	4 1/2	80—85 xd	+2	5 6 0

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	41 1/2—5 1/2 xd	..	4 16 5	La Plata Elec. Trms, Prf, ..	1	6	6	32—1	..	6 0 0
Do. 2nd Pref. ..	5	5	5 1/2	41 1/2—41 1/2 xd	..	5 6 8	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	1—1 1/2	..	4 8 0
Do. 4 % Deb. ..	100	4	4	93 1/2—95 1/2 xd	+ 1/2	4 3 9	Do. 6 % Pref. ..	1	6	6	1—1 1/2 xd	..	4 16 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99—101 xd	- 1/2	4 9 1	Do. 5 % Deb. ..	100	5	5	93 1/2—97 1/2 xd	..	5 2 7
Do. 5 % Deb. ..	100	5	5	101—103	+2	4 17 1	Madras Elec. Tr. (1904), Deb. ..	100	5	5	98 1/2—96 1/2 xd	..	5 3 8
Auckland Trams, 5 % Deb. ..	100	5	5	102—105 xd	..	4 15 3	Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 1/2—92 1/2 xd	..	5 8 1
Bombay Elec. S. & Trams, Pref.	10	6	6	107 1/2—11 1/2	..	5 5 6	Manila Elec. R. and Lt., Bonds	\$1000	5	5	100 1/2—102 1/2	..	4 17 7
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	96—98 xd	..	4 11 10	Mexico Trams Com. ..	\$100	7	7 1/2	124—126	..	5 11 1
Do. 5 % 2nd Deb. ..	100	5	5	96 1/2—98 1/2 xd	..	5 1 6	Do. Gen. Con. 5 % Bonds ..	..	5	5	98 1/2—100 1/2	..	4 19 6
Brisbane Trams Inv't., Ord. ..	5	8	8 1/2	8 1/2—9	+ 1/2	4 8 11	Do. 6 % Bonds ..	100	6	6	101—103	+ 1/2	5 16 6
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2	..	4 15 3	Para Elec. Rlys. & Lt., Ord. ..	5	10	10 1/2	67—7 1/2	..	6 18 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	101—104 xd	..	4 1 7	Do. 6 % Pref. ..	5	6	6	5 1/2—5 1/2	..	5 4 4
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	137—142	+1	5 12 8	Do. 5 % 1st Deb. ..	100	5	5	97 1/2—99 1/2	..	5 0 6
Do. Pref. Ord. ..	100	6	6	120—124	+2	4 16 9	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2	..	1 1/2—1 xd	..	2 10 0
Do. 5 % Pref. ..	100	5	5	109—112	..	4 9 3	Do. 5 % 1st Deb. ..	100	5	5	99—101 xd	..	4 19 0
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	100—103	..	4 7 5	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2—5 1/2 xd	..	5 9 1
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	104—106	..	4 4 11	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	96—99 xd	..	4 11 10
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102—104	..	4 6 7	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	117—118	+ 1/2	3 16 3
Calcutta Trams, Ord. ..	5	6	..	5 1/2—5 1/2	..	5 4 4	Do. 1st Mort. 5 % Bonds ..	..	5	5	101—102 xd	+ 1/2	4 18 0
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2 xd	..	4 17 7	Do. 5 % Mort. Bonds ..	100	5	5	97 1/2—98 1/2	+ 1/2	5 1 6
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103 xd	..	4 7 5	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	194—198	+1	5 1 0
Cape Electric Trams ..	1	Nil	2 1/2	7—8	..	4 0 0	Do. 5 % 1st Deb. ..	\$500	5	5	101 1/2—103 1/2	..	4 16 7
City Buenos Aires Trams (1904)	5	5	5	6 1/2—6 1/2	..	4 5 1	Singapore Trams, 5 % Deb. ..	100	5	5	81—84	..	5 19 1
Do. 4 % Deb. ..	100	5	5	95—98 xd	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 1/2—97 1/2	..	5 2 7
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98	..	5 2 0	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2—5 1/2	..	5 2 2
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	102—105	..	4 15 3	Do. 6 % Pref. ..	5	6	6	5 1/2—5 1/2	..	5 10 4
Kalgoorlie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 5 % 1st Deb. ..	100	5	5	98 1/2—101 1/2	- 1/2	4 18 6
Do. 5 % A Deb. ..	100	5	5	91—94	..	5 6 5	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	104—106	..	4 4 11
Do. 6 % B Deb. ..	100	5	6 1/2	58—62	..	8 1 4							

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	5—5 1/2	..	7 2 2	Dick, Kerr ..	1	5	..	3—3 1/2	..	5 14 3
Do. 6 % Pref. ..	1	9	6	3—3 1/2	..	7 2 2	Do. Pref. ..	1	6	6	1 1/2—1 1/2	..	5 12 11
Babcock & Wilcox ..	1	26	24 1/2	6 1/2—6 1/2	+ 1/2	4 1 6	Do. Deb. ..	100	4 1/2	4 1/2	92 1/2—95 1/2 xd	..	4 14 3
Do. Pref. ..	1	6	6	1—1 1/2	..	4 0 0	Edison & Swan, A, £3 paid	5	Nil	..	..	..	Nil
B.I. & Helsby Cables ..	5	10	8 1/2	6 1/2—7 1/2	..	7 0 4	Do. fully paid ..	5	Nil	..	1 1/2—2 1/2	..	Nil
Do. Pref. ..	5	6	6	5 1/2—6 1/2	..	4 16 0	Do. 4 % Deb. ..	100	4	4	70—74 xd	..	5 8 1
Do. Deb. ..	100	4 1/2	4 1/2	101—103 xd	..	4 7 5	Do. 5 % Second Deb. ..	100	5	5	77—80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	94—97	..	4 12 9	Electric Construction ..	2	Nil	2 1/2	..	..	..
British Westinghouse, Pref. ..	8	Nil	..	..	..	Nil	Do. Pref. ..	2	7	7 1/2	1—1 1/2	..	7 9 4
Do. Deb. ..	100	4	4	54—57 xd	..	7 0 4	Greenwood & Batley, Pref.	10	7	7	7 1/2—8 1/2	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	100—102	..	5 17 8	Do. Deb. ..	100	5	5	94—96	..	5 4 2
Browett, Lindley, Ord. ..	1	Nil	..	1/6—2/6	..	Nil	General Electric, Pref. ..	10	5	5	8 1/2—9 1/2 xd	..	5 8 1
Do. Pref. ..	1	Nil	..	5/-—6/-	..	Nil	Do. Deb. ..	100	4	4	85—90	..	4 8 11
Brush, Ord. ..	2	Nil	..	0—1 1/2	..	Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2—12 1/2	..	5 18 10
Do. 7 % Pref. ..	2	Nil	..	0—1 1/2	..	Nil	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2—5 1/2	..	4 5 11
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	56—61	..	7 7 7	Do. Deb. ..	100	4 1/2	4 1/2	104—106	..	4 4 11
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	37—42 xd	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	10—12	..	..
Callender's Cable ..	5	15	10 1/2	9—9 1/2	..	7 13 10	Do. Pref. ..	10	5	5	94—10 1/2 xd	..	4 17 7
Do. Pref. ..	5	5	5	5—5 1/2 xd	..	4 15 3	Telegraph Constr. Co. ..	12	20	10 1/2	34—36	..	6 13 4
Do. Deb. ..	100	4 1/2	4 1/2	99—101 xd	..	4 9 1	Do. Deb. ..	100	4	4	99 1/2—101 1/2 xd	..	3 18 10
Castner-Kellner ..	1	17 1/2	20	8 1/2—9 1/2	+ 1/2	4 10 6	Willans & Robinson ..	1	Nil	..	..	..	Nil
Do. Deb. ..	100	4 1/2	4 1/2	105—109	+1	4 2 7	Do. Pref. ..	5	Nil	..	..	..	Nil
Crompton & Co. ..	8	Nil	Nil	..	..	Nil	Do. Deb. ..	100	4	4	53—63	..	7 2 10
Do. Deb. ..	100	5	5	58—68 xd	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.



### VARIOUS RECORDS IN CENTRAL STATIONS.

BY "INTERESTED."

In electricity works there always seems to be present an atmosphere of importance. The staff themselves give one an impression that they think their particular station is in some respects ahead of others: they have a pull over other works in one form or another, and unconsciously, perhaps, betray their feelings by their appearance. Almost any member of the staff will enter with obvious zest into a discussion upon competitive working and costs, if you can only manage pleasantly to introduce "shop" into the conversation. There exists a quiet, keen rivalry between stations to beat the figures of others, especially those in the immediate vicinity, or those situated at a distance in which, for various reasons, interest is centred. This spirit of emulation which infuses in others a desire to do their utmost in order to secure good results is to be commended, and should receive from the management suitable reward in the way of increasing salaries and wages, a point, I am sorry to say, intentionally ignored in some quarters. However, that is by the way. Of course, different works have different methods of recording figures or results. Some go far more into detail than others, but all have carefully compiled records, and from the respective figures much may be learned regarding the inner working. Each district or works is distinct from another: there are peculiar interests restricted to each, and though in many instances forms or books similar in pattern can be seen which are almost duplicates of each other, here and there something new and original in the way of keeping figures is to be found. In this short article I propose describing and illustrating one or two forms in use at the present day which appear to me to be somewhat out of the common, and will, I think, appeal more or less forcibly to many readers.

*Feeder Load Register.*—This is essentially a book for the mains department. Here can be seen almost instantly the daily maximum load on all feeders, and likewise the maximum load on each for the week, and in the last column the total maximum demand day by day and week by week. Little time is necessary daily for making

### FEEDER LOAD REGISTER.

Date.	Feeder numbers. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	Daily total demands.
	Daily maximum demands.	
		Weekly maximum.

entries, culled, of course, from the log sheet, but the information set out in the form illustrated will be found valuable for comparison and reference. With this book in use many hours of time may be saved in the way of wading through piles of log sheets or pages of books when business necessarily calls for such figures, an event which, under working conditions, is of frequent occurrence.

*Watch Log Book.*—The title which might properly be given to this book is, Engineers' Personal Log, because the

WATCH LOG BOOK.—(Left-hand page.)

General remarks.	Date.	Shift.	Units metered.	Units generated.	Lb. of coal used.

matter contained therein is for their own personal observation. Referring to the illustration, it will be seen that it forms a summary of certain details on the daily log-sheet, collected in order and so arranged that each line shows the working of each shift. At the end of a watch when the engineer-in-charge makes his entries and works out the figures, his notice is naturally attracted to a comparison of figures.

and any suggested inquiries are passed on to the engineer about to commence duty. In this manner the actual man on the job keeps in close touch with whatever is taking

WATCH LOG BOOK.—(Right-hand page.)

Remarks re oil used.	Lb. of coal per unit metered.	Lb. of coal per unit generated.	Oil.				
	Steaming. Banking.	Steaming. Banking.	Turbine.	Crank chamber.	Cylinder.	Dynamo.	Paraffin.

place under his charge, and is thereby better able to control his men, and at the same time he is thoroughly conversant with details when queries are raised by the chief.

*Trading Account Voucher.*—This one refers more particularly to municipal undertakings, but applies equally well to others where work is done and goods supplied to other departments, &c. Although not a constant occurrence, some of the work carried out under this heading, and also goods occasionally supplied, amount to a considerable sum during the course of a year. The petty repair jobs which the works

### TRADING ACCOUNT ORDER.

Department ..... Estimated cost: £ .....	Date ..... 19 .. Date required ..... Work authorised by.....
---------------------------------------------	--------------------------------------------------------------------

---

<i>Particulars:</i>     	Job order numbers.	Cost.

Works cost ...  
 Supervision, &c. ...

Total ... £ .....

Job passed by .....

are called upon to do in a hurry often interfere with regular work, thereby entailing more expense than the actual cost of time and material used on the job shows, because of proper work being side-tracked to allow the semi-private job to be rushed through. Now that is just where trouble creeps in unless a definite arrangement is made whereby all time worked on trading jobs is carefully booked, a fair percentage of supervision added, and proper authority obtained for the execution of such work. Obviously it is decidedly unfair for the works costs to bear any portion of work such as this, and the above form was introduced purposely to provide against a possibility of loss thus taking place. At the same time engineers-in-charge or station superintendents are given full leave to arrange for the work to be done, as shown at the top of the voucher.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

TRADE prospects in Canada, at the present time, are decidedly bright, at any rate as far as electrical work is concerned. The rapidly increasing prosperity of the country is sufficient to account for this state of affairs. British firms are making themselves better known by advertising and by sending or appointing representatives.

The former method of attracting business is, however, not of much use unless it be followed up or supplemented by the latter. Well educated, gentlemanly men from England who know how to talk, and when, and who are thoroughly acquainted technically with what they try to sell, have a good chance of doing business here now, as they are beginning to be more appreciated. The once all-too-common American type of representative, whose performance



seemed to be in inverse ratio to the number of his words, is less in favour than formerly.

There has been in the past, and still is in some quarters, a tendency on the part of Canadians to look upon people from the Old Country as decidedly inferior in education and more particularly in *nous* to themselves. Doubtless, this has been due in large measure to the class of people who formerly came here, but a change is taking place.

During recent years, owing partly to increased and improved travelling facilities, partly to the steady development of the country, its growing wealth and the consequent greater demand for highly trained technical men, and partly to the bad trade conditions which have obtained in the Mother Country during the past few years, there has been an increasing number of well educated and refined people attracted to the Dominion. Such people are steadily making their influence felt and are causing Canadians to appreciate their good qualities.

The inhabitants of Great Britain are seen to be not quite so slow and so behind the times as was once thought, and it is becoming apparent to "Jack Canuck" that John Bull though he does not "hustle" yet accomplishes a good deal, in fact, as much as most other people, and does it, perhaps, a trifle better into the bargain.

British goods are found to be reliable, delivery is good and generally sure, while prices are in very many cases little, if anything, higher than those asked for Canadian or American articles.

One of the chief difficulties in the path of the Canadian purchaser of British plant or apparatus is that of obtaining spare parts. It therefore behoves all firms trying to do business here to make, if possible, some arrangements whereby such parts can be kept in stock in this country.

ELECTRICAL DEVELOPMENT IN INDUSTRIAL AREAS.

By L. CROUCH.

For a number of years past there have appeared in the technical Press most interesting descriptions of applications of electric motors to particular industrial duties. The value of these descriptions cannot be exaggerated in any case where guidance or a precedent is sought in connection with a proposed application of electric driving. Yet, by their very individuality, it is impossible to form general conclusions from single descriptions of such a nature. Invaluable data can be compiled by systematic classification of particulars of isolated motor applications in a particular field, but few persons have the time required to prepare a suitable record. At a later date the writer hopes to be able to present generalised notes dealing with particular industrial applications of electric motors, but, for the present, attention is confined to the general electrical development attained in various towns and districts mainly devoted to specified manufactures or industries. Most manufacturing centres being engaged in several industries, a certain amount of overlapping is inevitable, but the industries in question are usually more or less closely allied, and, by examining each group of towns in turn, and comparing the characteristics of supply in each with the corresponding average data referring to the whole country, valuable results are derived which are unattainable by any other means, and which must be of special interest to central station engineers and all industrial power users.

The data on which the following notes are based are correct to the end of 1910. The work involved in their utilisation has prevented an earlier publication of results, but developments during the present year have not been of so sweeping a nature as to affect materially the averages concerned.

Before entering upon a consideration of the conditions obtaining in the industrial groups of towns selected for treatment, a review is given of the corresponding conditions and results in 80 of the most important inland towns, and 29 of the chief ports of the kingdom.

*Inland Towns.*—The 80 towns examined have a total population of about 7,116,000, *i.e.*, an average of 89,000 per town. The area of central station supply ranges from 1.5 to 40 sq. miles, and averages 11 sq. miles. A total generator capacity of 270,000 kw. supplies 362,000 kw. of connected load, and 174,000 kw. maximum load (hence, on the average, each kw. of generator capacity supplies 1.34 kw. of connected load and 0.65 kw. of maximum demand. The total sales per annum, excluding traction demand and for traction purposes, respectively total 190 and 126.6 million B.T.U., an average of 32 and 18 units per annum per head of population. The total number of consumers supplied is approximately 108,000, an average of 1,345 per town and about 1.52 per cent. of the total population of the towns considered. The number of consumers per square mile of supply area averages 161.

As a measure of the general electrical development of the group, it may be noted that the average connected load per head of population is 0.051 kw. and per consumer is 3.35 kw. The annual sales, excluding traction demand, average 26.7 B.T.U. per head of population and 1,760 B.T.U. per consumer. The average load factor (17.5 per cent.) is not unsatisfactory for the provincial towns concerned, many of the latter being rather market towns than centres of industry.

It must be noted that the load factors quoted here and later take account of the traction output (where any exists). The load factor of ordinary domestic supply does not vary very greatly from part to part of the country, so that an exceptionally high overall load factor denotes the free use of electric motors in private industrial or in traction service. A reasonable idea as to which class of motor is chiefly responsible for the high load factor may be obtained from the data given concerning the number and horse-power of private and traction motors respectively. In the present group of towns 24,500 private motors total 176,300 H.P., and 3,400 traction motors total 130,000 H.P.; the private motor connections

TABLE I.

Generator capacity between kw.	No. of stations.			Total.	Population 1,000's per station.	Consumers per station.	Sq. miles supply area per station.	Average generating capacity, kw.	Connected kw. per station.
	D.C.	A.C.	D.C. and A.C.						
0—100	37	1	—	38	3.6	110	4.5	50	130
100—250	45	7	3	55	7.4	230	2.5	160	310
250—500	46	6	6	58	14.3	380	7.0	360	620
500—1,000	67	6	6	79	38.7	620	7.4	690	1,150
1,000—2,500	67	27	6	100	54.0	1,070	6.5	1,680	3,490
2,500—5,000	12	8	22	42	107.8	1,920	9.0	3,440	5,580
5,000—7,500	4	8	9	21	156.6	2,260	9.1	6,130	9,140
7,500—10,000	2	1	3	6	144.0	2,340	8.1	8,840	10,600
10—15,000	2	2	3	7	311.8	4,140	11.8	11,600	16,320
15—20,000	1	2	4	7	418.6	9,030	19.0	16,740	23,470
Over 20,000	2	—	4	6	600.0	12,000	—	38,800	51,000

total 36.5 per cent. of the total non-traction connections in the group.

Within the next few years, a great increase in load factor may be expected as a result of the wide adoption of electrical cooking and heating devices, and in consequence of the favourable tariffs which will, incidentally, become available.

From Table III it will be seen that the mean horse-power per private motor, in the inland towns group, is 7.2 H.P., while the average motor load per consumer is 1.6 H.P. Excellent utilisation of electric motors is thus indicated in our average provincial town, but it is, naturally, to groups of manufacturing towns that we must look for the highest total and individual motor loads. (See Table III.)

In these 80 towns, the average tariff for supply for "power" purposes is 1.62d. per B.T.U., *i.e.*, 70.5 per cent. of the average price (2.30d.), obtained by the sale of energy for "all purposes." (The price of power quoted here and hereafter is deduced from the published tariffs of various stations. The greater part of the total power sales being at the lowest tariff scheduled, or even at lower "special" rates, the average price obtained is lower than the average price quoted. As a result, the price obtained by power sales, as a



percentage of the price obtained for all sales, will be lower than the figure given in the last line of Table III, but by an amount incapable of determination from the data available.)

To facilitate later reference to the above figures and inter-comparison of the conditions obtaining in various groups of

treated. For the purpose of the present statistics, all the central London and inner suburban stations have been included in the figures for the Metropolis. Industrial conditions are, however, very different in various parts of London, and owing to the great effect of the London figures

TABLE II.

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Group	Inland towns.	Ports. With London Without London.		Industrial centres.	Textile. Cotton. Wool.		Iron making.	Ship building.	Miscellaneous machinery.	Miscellaneous metal manfrs.	Miscellaneous manufacturers.
Number of towns	80	29	28	7	17	13	15	11	13	8	42
Average population (in 1,000's)	89	313	226.7	974	154	110	93	275	133	188	111
Average consumers...	1,345	6,230	2,600	22,780	1,745	1,715	1,247	3,465	1,270	1,810	1,300
Consumers as per cent. of population	1.52	2.00	1.14	2.30	1.14	1.56	1.25	1.26	0.95	0.96	1.16
Mean area of supply, square miles	11	19	14	50	21	17	7	12	15.5	12	8.25
Mean generator KW.	3,370	17,000	7,860	66,500	6,150	3,840	2,770	10,300	3,680	5,840	2,815
Connections per generator capacity	1.34	1.32	1.35	1.20	1.32	1.52	1.50	1.22	1.50	1.48	1.48
Maximum load per generator capacity	0.65	0.64	0.61	0.64	0.76	0.66	0.70	0.58	0.68	0.65	0.73
Load factor, per cent.	17.5	18.7	20.0	21.2	20.6	17.8	19.0	19.0	19.4	19.1	18.5
Millions B.T.U. sold per annum	316.6	708.0	391.5	637.6	212.6	91.3	59.7	176.0	65.2	81.4	185.9
Connections per consumer KW.	3.35	3.54	3.95	3.50	4.80	3.42	3.15	3.60	4.35	4.80	3.24
Maximum load per consumer KW.	1.61	1.70	1.78	1.87	2.72	1.48	1.50	1.69	2.00	2.57	1.60
Non-traction B.T.U. per head pop. per ann.	26.7	53.2	41.5	62.9	57.6	39.6	29.4	37.0	28.8	33.5	25.5
Traction	17.8	25.0	20.0	30.9	23.8	24.6	13.4	21.6	8.9	20.5	14.5
Non-traction B.T.U. per consumer per ann.	1,760	2,660	3,620	2,690	5,100	2,500	2,350	2,900	2,600	3,500	2,200

TABLE III.

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Group	Inland towns.	Ports. With London. Without London.		Industrial centres.	Textile. Cotton. Wool.		Iron making.	Ship building.	Miscellaneous machinery mfrs.	Miscellaneous metal mfrs.	Miscellaneous manufacturers.
Private motors ; No.	24,500	24,770	18,170	22,190	7,865	6,180	3,710	8,880	2,600	4,600	8,630
" " H.P.	176,250	265,400	171,700	236,000	69,060	34,600	34,380	90,300	27,600	41,800	69,350
Traction motors ; No.	3,400	6,840	4,500	6,220	2,800	864	720	2,215	660	720	2,370
" " H.P.	130,000	266,700	126,300	250,800	89,000	25,300	19,200	63,200	24,500	19,300	65,800
Private motors as per cent. non-traction connections	36.5	31.2	44.5	31.5	37.0	34.0	46.5	48.8	29.1	45.1	29.6
Mean Private Motor horse-power :—											
Per town	2,319	9,152	6,100	33,700	4,600	2,660	2,295	8,210	2,510	5,970	1,780
Per consumer	1.63	1.48	2.35	1.48	2.33	1.56	1.96	2.36	1.68	2.90	1.29
Per machine...	7.2	8.6	7.3	9.3	8.0	5.6	7.7	6.6	10.4	8.8	6.7
Meand. per B.T.U. quoted for power supply*	1.62	1.55	1.55	1.43	1.50	1.83	1.36	1.43	1.52	1.60	1.46
Ditto as per cent. price obtained per B.T.U. for all purposes.*	70.5	77.0	77.5	87.0	93.0	91.0	74.0	77.0	84.0	88.0	72.0

\* See remarks in text concerning these figures.

TABLE IV.

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Group	Inland towns.	Ports. With London. Without London.		Industrial centres.	Textile. Cotton. Wool.		Iron making.	Ship building.	Miscellaneous machinery mfrs.	Miscellaneous metal mfrs.	Miscellaneous manufacturers.
Number of towns	80	20	28	7	17	13	15	11	13	8	42
Mean population (in 1,000's)	89.0	313.0	226.7	974.3	154.0	110.0	93.0	275.0	133.0	187.5	110.8
Supply area, square miles	11	19	14	50	21	17	7	12	15.5	12	8.25
Consumers as per cent. of population	1.52	2.0	1.14	2.3	1.14	1.56	1.25	1.26	0.95	0.96	1.16
Consumers per square mile	161	330	186	455	110	101	160	300	87	158	157
Mean generator capacity, KW.	3,370	17,000	7,860	66,500	6,150	3,840	2,770	10,300	3,680	5,840	2,815
Connections per generator capacity	1.34	1.32	1.35	1.20	1.32	1.52	1.50	1.22	1.50	1.48	1.48
Maximum load per generator capacity	0.65	0.64	0.61	0.64	0.76	0.66	0.70	0.58	0.68	0.65	0.73
Load factor per cent.	17.5	18.7	18.6	21.2	20.6	17.8	19.0	19.0	19.4	19.1	18.5
KW. connection per head population	.501	.071	.045	.083	.053	.054	.030	.045	.041	.046	.035
B.T.U. per head per annum	44.5	98.2	61.5	93.8	81.4	64.2	42.8	58.6	37.7	54.0	40.0
Per cent. ditto for traction use	40.0	32.0	32.6	33.0	29.4	38.5	31.5	37.0	23.8	38.0	36.3
Traction motors as per cent. private H.P.	74.0	100.0	74.0	106.0	129.0	73.0	56.0	70.0	89.0	46.2	95.0
Private motor H.P. as per cent. total connections	36.5	31.2	44.5	31.5	37.0	34.0	46.5	48.8	29.1	45.1	29.6
Private motor H.P. per machine	7.2	8.6	7.3	9.3	8.0	5.6	7.7	6.6	10.4	8.8	6.7
" " per consumer	1.63	1.48	2.35	1.48	2.33	1.56	1.96	2.36	1.68	2.90	1.29
Mean price* power supply (d.)	1.62	1.55	1.55	1.43	1.50	1.83	1.36	1.43	1.52	1.60	1.46
Ditto per cent. of mean price in all stations	81.0	77.5	77.5	71.5	75.0	91.5	68.0	71.5	76.0	80.0	73.0

\* See remarks in text concerning these figures.

towns, the leading data considered are collected in Tables II, III and IV herewith. In Table I are given figures showing the general size, nature and service of English central station equipment and loads as a whole. Ports.—In dealing with the chief British ports, we are at once faced with the problem as to how London should be

on the average data in any group in which they occur, the "Ports" data are shown in two columns ( (2) and (3) respectively in Tables II, III, IV), including and excluding London in turn. For a similar reason London is omitted from col. 8, and Newcastle and Glasgow from col. 7 in Tables II, IV ; all three cities are, of course, included in col. 4.



The 28 ports dealt with in col. 3 have an average population of 226,700, of which 1.14 per cent. (*i.e.*, 2,600 per town), represents electrical consumers. The average number of consumers per square mile is 186, the mean supply area being 14 sq. miles. A total generator capacity of 212,200 kW. (7,860 kW. per town), supplies 287,000 kW. of connected load (excluding traction), *i.e.*, an average of 1.35 kW. per kW. of generator capacity. The maximum load recorded at the stations averages 61 per cent. of the generator capacity and 1.78 kW. per consumer. The connected load per consumer is 3.95 kW., and the average sales per annum for non-traction purposes is 41.5 B.T.U. per head of population and 3,620 B.T.U. per consumer.

The average private motor load per town is 6,100 H.P., equal to roughly 45 per cent. of the total connections, excluding traction, and averages 7.3 H.P. per motor and 2.35 H.P. per consumer. The relative cost of power (determined as explained above and subject to the limitations stated) is 77.5 per cent. of the price obtained for all purposes.

The chief effects of including London in the "Ports" group are:—To increase the average population per town to 313,000, and the mean area of supply district to 19 sq. miles, and to raise the mean generator capacity per town to 17,000 kW., and the average maximum load to 10,700 kW. The relative values of the generator capacity, and the connected and maximum loads, are little affected, and the mean load factor remains practically unaltered at 18.6 per cent. The total number of consumers is increased 2.5 fold, and the total sales are nearly doubled. The percentage of consumers rises to nearly 2 per cent. of the total population, the number per sq. mile of supply area being now about 330. The average sales per consumer falls to 2,600 units per annum, and the percentage of motor connections and the mean private motor horse-power per consumer are also reduced.

(To be concluded.)

## REVIEWS.

*Die Schutzvorrichtungen der Starkstromtechnik gegen Atmosphärische Entladungen und Überspannungen.* By Dr. G. RENISCHKE. Second Edition. Brunswick: Fried. Vieweg & Sohn. Price 3 m. 50 pf.

The subject of the protection of systems and machinery against internal and external voltage-rises dealt with in this book is one which has still largely to be treated empirically, in spite of the great amount of literature available in connection with it. Consequently the new information collected and incorporated in this second edition is of direct practical value.

A knowledge of the ordinary direct and alternating current effects is assumed, and theoretical explanations are relegated to footnotes or to references to text-books, so that, although the book is quite small, it covers a great deal of ground effectively.

There are seven sections, dealing with: The nature of and danger from the various forms of discharge; atmospheric discharges; voltage rises due to internal causes; protective methods; protective devices without spark gaps; protective devices with gaps; and auxiliary apparatus and connections.

The explanations of the occurrences in circuits are cut too short for clarity in some cases, but the diagrams are always good, and the numerous instantaneous oscillograph records of the effects of switching operations, &c., are a valuable addition to the book.

*Electric Cranes and Hoists: Their Design, Construction, and Application.* By H. H. BROUGHTON, A.M.I.E.E., &c. London: The Electrician Printing and Publishing Co., Ltd. Price 25s. net.

This book is called, in the prospectus issued by the publishers, "a great new work." We do not altogether like that somewhat flamboyant style, but we can certainly congratulate the author on his workmanlike production. As we open the book and casually glance over the "about 900 pages" and inspect the "more than 600 illustrations," we

are almost appalled when we return to the flyleaf and read beneath the title (which runs as above) the following words: "Being Vol. I of a complete manual on lifting and hauling machinery." In the prospectus occurs the sentence, "The publishers put forward Mr. Broughton's book as a worthy addition to their series of standard works on advanced electrical engineering subjects." We certainly agree to that; this one, except for a few blemishes to be discussed later, is most excellent.

Now about the author, has he had the experience necessary for such a work? We think that we can reassure the reader on that point. He dedicates his work to Horace Broadbent "as a slight expression of a keen appreciation of the many happy hours spent in his works." Then he goes on, in the preface, to say that more than ten years ago he started to collate the literature on electric cranes, and to compile data and notes for his own use. About five years ago he formed the idea of putting the notes into book form. Further, he holds the position of head of the electrical engineering department and lecturer on machine design and structures at the Municipal Technical College at Brighton. Mr. Broughton holds a curious position, which, however, keeps him in touch with both sections of the work which is described in this volume. In any case, he ought to be up to date on the electrical and structural aspects of cranes.

We notice a tinge of regret among the optimism of the preface; for the author apologises for the delay in publication. Any man who sets himself a task such as this book shows evidence, runs the risk of a great disappointment. Some other author may be first in the field. How badly we wanted a book four or five years ago, and now we read the author's regret for delay. "It has enabled the other writers to be first in the field." But Mr. Broughton adds, "it has afforded the author the opportunity of incorporating particulars of several new types of machines which have only just become available."

It is not proposed to compare this with the other books. The specialist on the subject will probably purchase all of those yet issued. This one appeals to us, especially, as a book for the student, as well as the designer. After all, when a man has had to lecture on a subject he gets into the way of putting things in such a manner that they are less vague and indistinct to the beginner. So many so-called "practical men" think that anyone can write a book or teach engineering students. There never was a greater fallacy. It requires practice to do either of these things, but, curiously enough, lecturing is a capital training for book writing. That is probably because it is essential for a good lecturer to be very careful in the preparation of notes. Anyway, the author of this book ought to be a good lecturer, because he is a good writer on a technical subject.

The first five chapters contain matter common to all cranes. We like the first chapter least of any in the book. It is called "introductory," but it seems scrappy. There are tables and quotations from the technical Press; the contents of this chapter are not grouped together at all well. It does, however, contain matters of interest, although they are poorly arranged, and some might have come, with advantage, later. The second chapter is on electric equipments and is quite good. We are not wearied with elementary work; the reader is referred to other text-books for it. Chapter III is on materials and structures, and some excellent examples are given of solving the force diagrams. One of these is a 50-ton crane girder of 45 ft. span, loaded for a crane of 7-ft. wheel base, the weight of the trolley being 13 tons. All of the details are fully worked out. A crane pillar is also given. Another excellent example is a bent jib for a 10-ton locomotive crane. Then we have constructional details.

The next chapter deals with the power required to drive cranes. This is followed by more than 100 pages on the details of mechanical equipment, such as ropes, chains, reducing gears, shafts, bearings, brakes, &c. On p. 325 we find Rankine's formula for shafts—the author is surely aware that recent researches show that Guest's formula is more accurate. In Chapter VI we are given a useful and general idea of the arrangement of the principal types of cranes, of which we have later more detailed consideration. Indeed, the typical installations discussed in Chapters IX



to XIII contain some of the best material, a good deal of which has probably appeared in technical papers, but which is here grouped consecutively. Comparisons are therefore easy. Some of the illustrations of this part of the book are wonderfully good. We could quote a dozen pages, all of which would be of interest, but we are forbidden by space considerations.

The fourteenth chapter is on specifications, and should be of use to those who have to prepare and watch these important documents. Hints are given how to minimise correspondence. We have here typical specifications of cranes, and also there are included two for storage batteries. The last chapter (which seems entirely superfluous, for every engineer possesses a pocket-book) is on properties of sections and conductors.

A few words must be devoted to the general appearance of the book. It is a very thick volume, and we think that the amount of printed matter on nearly all of the pages might have been with advantage increased. Thus, contrast pages 773 and 777. The latter is the better, undoubtedly. People do not want to store unprinted paper. Take a typical page, as 251; at least six lines more should appear on it, and half an inch less border to the page would be better. Then again, the reviewer hates advertisements in text-books. They are excellent in the technical journals, but entirely out of place in a text-book, although, of course, the publisher may say that they help to reduce the price of the book. Having thus complained, one feels free to praise. That can be done with ease. The author, the draughtsman—Mr. E. L. Billington—and the publisher are to be all heartily congratulated on the way in which the book is turned out. It is an excellent production.—M.Sc.

*The Electric Propulsion of Ships.* By H. M. HOBART, M.Inst.C.E. London: Harper & Bros. Price 5s. net.

During the last two years or so, principally by means of papers read before the various Institutions, the attention of electrical engineers has been turned to the question as to the possibility and desirability of employing electric motors for the propulsion of ocean-going vessels.

After a somewhat prolonged and careful study of the problem, the reviewer is of the opinion that, for some classes of ships, electric driving would be found to be a distinct commercial success, and that for others the installation of electrical propulsive apparatus would be a financial calamity.

There is undoubtedly a considerable difference between the knowledge and experience possessed by electrical engineers and that of marine engineers or naval architects, and the book under consideration has been produced with the hope that it may serve as a bridge over which the two specialists may travel and to a certain extent inspect each others' territory.

Chapter I is introductory, and the book really opens in Chapter II, which deals with the size and power of ships; some useful information is given by means of tables and curves.

The energy required per ton-mile for propelling ships at constant speed is next dealt with. This section is very short, consisting of three pages only. It seems somewhat curious to see friction per ton-mile measured in watt-hours. The author states in a footnote that friction is to be taken as including the energy of wave motion set up by the ship during its passage through the water. This new terminology can scarcely be commended, since friction is certainly not energy at all, but a force.

Chapter IV treats of the frictional resistance of ships, and this time frictional resistance is measured chiefly in kilogrammes per ton—surely a queer combination to apply to English ships.

Chapter V deals with what the author calls the momentum of ships. He measures this "momentum" in kw.-hours, and what he calls momentum everyone else would call kinetic energy. Of course, people possessed already of sufficient knowledge to read this book with advantage will know what the author means, but slovenliness in terminology is a decided fault in a technical or scientific work. Energy required for manœuvring and for accelerating a ship is well treated of in this chapter.

The speed and efficiency of propellers receive attention in the following chapter, which is largely a collection of statements made by various authorities in presidential addresses, and so on.

Mechanical speed reduction gearing for steam turbines is entered into in Chapter VII, and estimates are worked up for the *Mauretania*, showing the great saving of weight and increase in efficiency which would have accrued had it been possible to install turbines of higher speed.

Three pages are then devoted to electrical speed reduction gearing for steam turbines. This chapter, so far as it goes, is very good.

Chapter IX gives a collection of more or less well-known data regarding the use of superheated steam in marine engines. The arguments for and against the use of such steam are well stated.

An instructive article on the use of electric gear as a means for improving the load factor is given in the succeeding chapter. The following statement by the well-known expert, Prof. Rateau, is worth quoting: "There is, therefore, a lower limit of speed below which the use of turbines cannot be recommended. I have already expressed the opinion that this limit is in the neighbourhood of 20 knots." The application of an electric drive to a British third-class cruiser is also considered in this chapter. Owing to the large variation of speed and manœuvring capacity necessary in a warship, the reviewer is of the opinion that it is in connection with this class of vessel that we shall see the first large electric drives instituted.

Internal-combustion engines for marine propulsion are treated of in Chapter XI. Some good information is given by means of a collection of quotations and extracts from Institution papers and articles in technical periodicals. The source of information is always given, and the matter is put forward in an interesting and convincing style.

Chapter XII deals with the use of alternating and continuous current for ship propulsion. The author is very severe on the direct-connected turbo-driven continuous current generator, and advocates gearing between the generator and turbine. The various combinations of machines and their control are described in a thoroughly satisfactory manner.

The remainder of the book is occupied by detailed descriptions and illustrations of the various methods of electric driving for ships that have been proposed during the last few years. The greater part of this is quite good, but some of the illustrations are practically unreadable, owing to the small scale adopted.

Mr. Hobart has in this book abandoned the use of the comma for the decimal point, and the book, which has been compiled rather than written, serves the purpose for which the author has produced it. It is clearly printed, and worth its price.—H. G. S.

## STANDARDS FOR ELECTRICAL MACHINERY.

By E. KILBURN SCOTT

THE recent paper by Dr. Pohl is as important as any that the Institution has had for some time, for it is a bread-and-butter paper, and to gain a livelihood by electrical engineering is, after all, the main business. It is all very well to be able to design and make electrical machines, but if they cannot be sold at a fair margin of profit, there isn't much use in making any. Now to sell machines means that we must be able to compete in price as well as in quality, and in case of overseas business, it also means that the orders must be assiduously sought for.

For many years our electrical manufacturers were so busy competing for municipal work that the overseas business was somewhat overlooked. When, under the fire of criticism, the bottom of municipal electric supply gave way, manufacturers then directed their attention overseas, and found that foreigners had already secured a strong foothold.



The amount of electrical apparatus supplied to Australasia, India and South Africa, &c., by foreign firms has been very large indeed, and they have secured it for two reasons:—*First*, greater energy displayed in seeking the business; and *second*, low prices for standard machines kept ready for delivery. Dr. Pohl has clearly shown that owing to lack of standardisation and through having to make machinery to freak specifications, our manufacturers are severely handicapped, and it should be remembered that he is in a position to give authoritative and first-hand information on the matter, because of intimate knowledge of both Continental and British conditions. The standards for machines as drawn up by the Standards Committee, are not only hopelessly out of date, but they always had an amateurish Victoria Street ring about them. At least half the men on such a Committee should be actual designers and manufacturers.

Regarding the rating of machines, the writer would like to see the actual figures stamped on the metal of the machine itself, because the usual small brass name-plate lends itself so easily to abuse, especially for motors for abroad. For example, there is the practice of stamping the correct rating of the machine on the name-plate affixed to it and then sending out a blank name-plate so that the agent can stamp any output he likes upon it. It is known that certain people in Australia do this kind of thing.

For small machines the time specified for testing is frequently out of all proportion to the importance of the apparatus. For example, motors of 5 and 10 H.P. are turned out by the hundred, and it may happen that 20 or 30 are wanted for one order. There is a choice between running all the machines for the full number of hours or else picking out a given percentage and testing them fully and assuming the rest as all right. When finding efficiencies, it is generally sufficient to find three points and then plot the rest of the curve. This method is generally accepted for efficiency, so why not accept it for heating tests as well? Take the case of a number of direct-current dynamos. Thermometers placed on the field coils, could be read off at intervals, and the temperatures plotted. If the heat curves are similar or below the heat curve obtained on a similar machine which has had the test prolonged to the full number of hours, then the machines may be considered to be satisfactory. At the end of each run the temperature of the armature can be taken, and if it is lower than the field coils then all is well. If higher then that circumstance would require to be taken into consideration.

In this connection it may be remembered that cable specifications frequently have a clause that the cable shall be kept under water for 24 or 48 hours. This not only means great waste of time, but it is not effective because a flaw which is at the bottom of the drum, and, therefore, has the hydraulic head of, say, 6 ft. of water over it may be discovered, whereas, the top of the drum is only a few inches under water and the pressure is much less. The result has been that a great deal of cable is now tested by being placed in a tank which is filled with water, and then subjected to considerable pressure. A flaw can be found in a few minutes that would escape detection the other way.

Although mercury thermometers are usually employed they are dangerous, because if a bulb should break the mercury may run amongst the coils. They are especially objectionable for high-tension windings; spirit thermometers are safer. An instrument for measuring temperature, which has recently been introduced, has a small flexible copper tube about the size of No. 14 s.w.g. The hole is filled with a liquid, and it communicates with a bulb made of nickel containing saturated vapour, beyond which there is a pressure gauge. The copper tube is placed against the part to be measured, and being small and very flexible, it can be placed in positions that are impossible for a thermometer.

Dr. Pohl's suggestion that 35° C. should be assumed to be the normal atmospheric temperature is very much to the point, because about 90 per cent. of the area of the British Empire has an average temperature well over 35° C. It is just an example of how absurdly insular we are that, in all official tests, we have adopted a figure that only suits this island. In hot climates, it frequently happens that the machinery is only protected by a corrugated iron building and the temperature inside may be almost as much as it is outside, that is to say, over 55° C. (100° F.). By the way,

when the work of revision is taken in hand, it would be well to have some members on the committee who have had overseas experience, not "Paget M.Ps.," but those who have lived and made a special study of the conditions in the Colonies.

It is interesting to note that Dr. Pohl refers to the coming of asbestos and enamel-covered wires. The writer ventured to point out about 10 years ago that enamel-covered wire would be a solution of many troubles, yet unmechanical cotton coverings still continue. The right enamel does not appear to have been found as yet, and clearly the thing to do is to draw upon the experience of those who understand enamelling from A to Z. If we, as a nation, had understood enamelling as the Japanese have done for centuries, they would have been over here long ago and picked up all there was to learn about it. It is said that Japanese enamel is kept under sea water for long periods. It is a matter that might well receive attention by some electrical engineer living in Japan.

### DUDELL-MATHER WATTMETERS FOR MEASURING DIELECTRIC LOSSES AT 30,000 VOLTS.

THE increasing use of underground cables for long-distance extra-high-tension transmission brings the question of dielectric losses again into prominence, and makes the measurement of such losses of considerable importance. Makers undertaking the manufacture of extra-high tension cables must be able to determine the losses with fair accuracy, in order to give the guarantees required by purchasers.

During the past summer two wattmeters for testing cables at 30,000 volts have been supplied by Mr. R. W. Paul to a well-known Continental firm, and a short description of them may be of interest. The current capacities of the instruments were 5 amperes and 50 amperes respectively, so that tests on long lengths of cable must have been contemplated, for a current of 50 amperes at 30,000 volts, 50 periods, means a capacity of over 5 microfarads, supposing the wave form sinusoidal.

One of the chief difficulties in measuring dielectric losses in cables arises from the low power factor of good cables, which is of the order 0.02 to 0.03. To measure power by the simple wattmeter method under these conditions, instruments having very large overload capacity and high sensibility are necessary. The

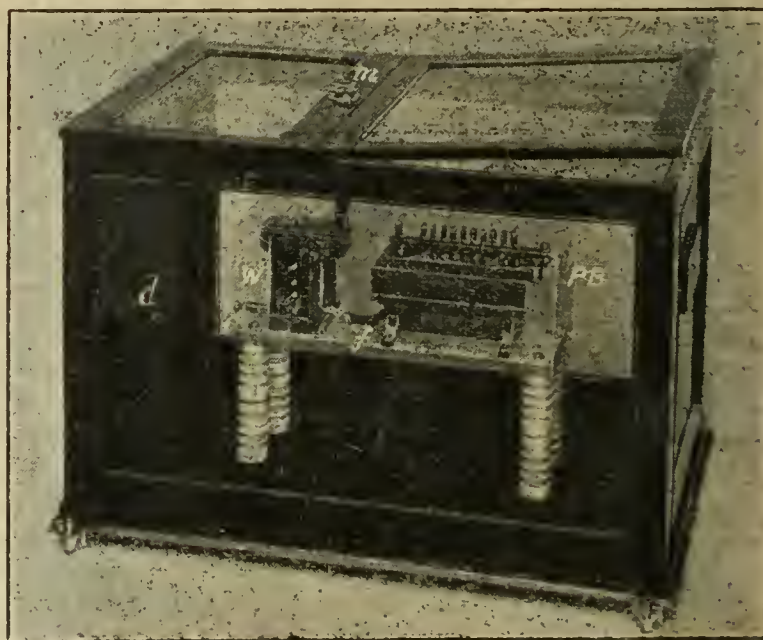


FIG. 1.

Duddell-Mather wattmeter possesses these features in a marked degree, and this, we presume, is one of the reasons why the equipment was purchased in this country.

The instrument is of the "Zero" dynamometer type, and, as used on ordinary circuits, has been previously described in this journal, so it will suffice now to indicate its main features. These are:—

1. An entire absence of unlaminated metal in proximity to the moving coils, in which eddy currents might be induced.
2. Current coils of fine insulated wire stranded together and subdivided into 10 equal sections.
3. Astatic pressure coils of low inductance capable of carrying continuously 12 times the current necessary to give a full deflection (360°) with unity power factor.



A plug board is provided on which the sections of the current coils may be connected in series or parallel or series-parallel, thus giving a wide range of current. For example, with a 50-ampere instrument a full deflection can be obtained by currents from half an ampere to 50 amperes by suitably arranging the sections of the current coils and the resistance of the pressure circuit. The plug board is seen at P, fig. 1, whilst the wattmeter itself is shown at W. Flexible well-stranded wires bunched together at *f* connect the plug board to the instrument.

The added resistance in the pressure circuit consists of Duddell-Mather anti-capacity non-inductive gauze, by means of which the current in the pressure circuit is kept in phase with the voltage

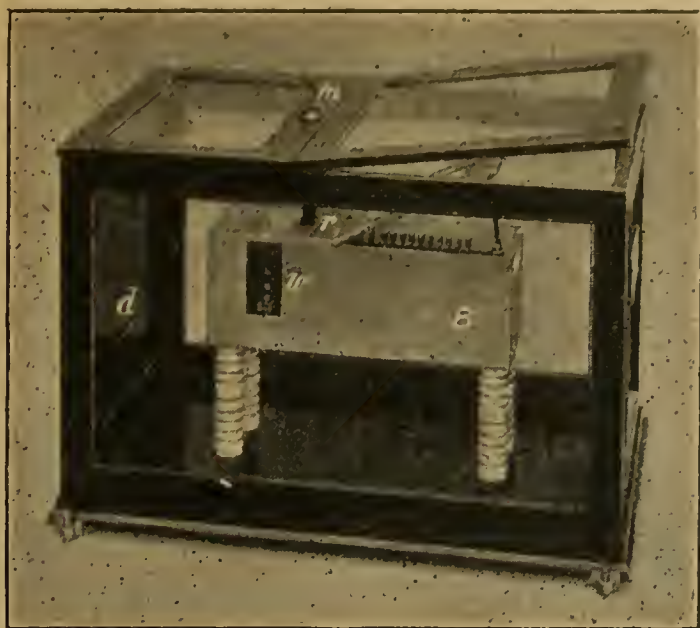
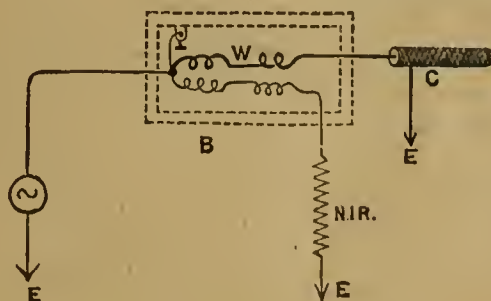


FIG. 2.

on the circuit, a matter of great importance when dynamometer wattmeters are used in circuits of very low power factor. A set of these resistances renders the instrument suitable for a wide range of pressures.

When a wattmeter is used on very high-pressure circuits such as 30,000 volts, electrostatic attractions and repulsions become appreciable, so precautions must be taken to screen the instrument from such disturbing forces and also to ensure the safety of the experimenter from shock. These desiderata are secured by enclosing the wattmeter and plug board in a wooden box B, fig. 2, lined with tin-foil in electrical connection with the supply side of the instrument, thus forming a Faraday cage as indicated in fig. 3, and by supporting this with glass sides and top, as seen in figs. 1 and 2. There is a clear space of 8 in. between the box and the outer case. Windows *w* (fig. 2) in the inner box are provided, through which the pointer and index may be observed.

The torsion head is operated from the outside of the case by a milled head *m* (figs. 1 and 2) on an ebonite rod *r* some 10 in. long. This rod passes through a brass bush in the top of the case, which is earthed when the instrument is in use. The lower end of the rod turns an ebonite pinion which gears into a wheel cut on the



Foil-lined box; *c*, cable; *w*, wattmeter; *N.I.R.*, non-inductive resistance.

FIG. 3.—DIAGRAM OF CONNECTIONS.

ebonite torsion head. From these particulars it will be understood that there is little risk of shock in using the instrument, and that the moving portions are effectively screened from electrostatic forces.

At the right-hand end of the outer case there are bell-mouthed holes in a wooden block through which heavily insulated cables are led to and from the plug board, whilst at the left-hand end a sliding door *d* gives access to the clamping head seen at *c*, fig. 1.

The non-inductive resistances used in series with the pressure coils of each wattmeter have a total resistance of 300,000 ohms, and will carry one-tenth of an ampere. They are contained in two galvanised iron tanks filled with oil, the interior construction being shown in fig. 4.

The anti-capacity gauze,\* *gg*, is carried on porcelain rods, *pp*, supported by a framework from the lid, *ll*, of the tank. Connection

with the gauze is made by metal rods passing through long porcelain insulators, *P P*, projecting well above the cover, whilst the lower ends dip into the oil when placed in the tank. There is a minimum distance of about 6 in. between any live metal and the sides of the tank, in order that the tank may be earthed whilst the gauze is connected with the 30,000-volt supply.

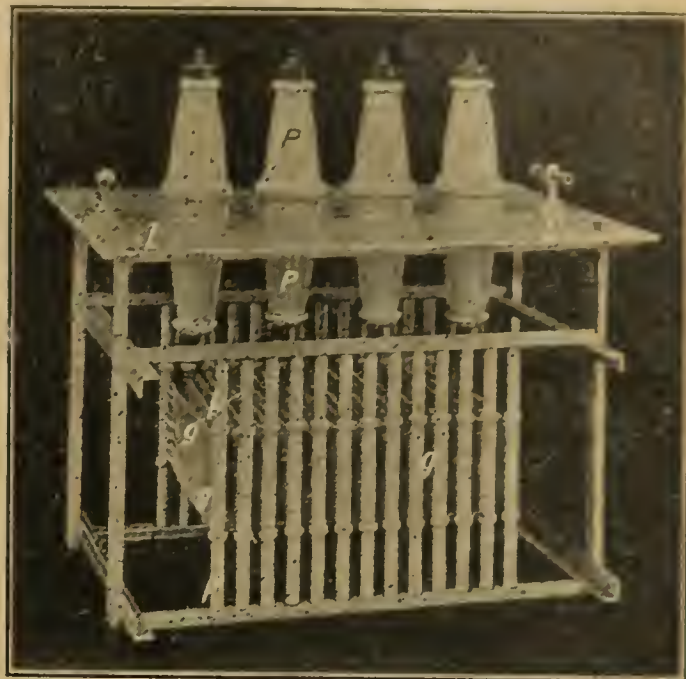


FIG. 4.

Before being dispatched, both the wattmeters and the resistances were tested at the National Physical Laboratory at pressures considerably in excess of the working voltage, with satisfactory results.

## PARLIAMENTARY.

### Tramways and Electricity Estimates.

THE following estimates have been prepared in connection with the various Bills to come before Parliament next session:—

West Ham Corporation (J. G. Morley, engineer) tramways, £25,400; works other than tramways, £13,200: total ... ..	£38,600
Loch Ericht Water and Electric Power (Scotch Provisional Order), J. & H. Leslie & Reid, engineers ... ..	300,000
Birmingham Corporation (H. E. Stilgoe, engineer) tramways, £218,900; (R. A. Chattock, city electrical engineer) purchase of land for generating station, £8,500; erection of generating station, £124,000; machinery and equipment of station, £156,000; development of existing transformers station and provision of new transforming sub-stations, including erection of buildings, plant and equipment, £84,000; provision and laying down of extra-high-tension trunk mains to connect the new generating station to the existing generating station and transforming sub-stations of the Corporation, and of the extra-high-tension mains required to supply large consumers, £67,500; provision and laying down of low-tension feeders, £60,000 ... ..	718,900
Kingston-on-Hull Corporation (A. E. White, engineer) tramways—permanent way, £28,000; electrical equipment, £7,000; 35 tramway cars, £28,000; land and buildings, £12,000; generating plant and machinery and additional cables, &c., £20,000 ... ..	95,000
Hove Corporation (H. H. Scott, engineer), purchase of land for generating station, depôts, car-sheds and other buildings, £4,000; erection of generating station, depôts, car-sheds and other buildings, £20,000; provision of overhead equipment and construction of other works and lighting trolley vehicles, £32,238; provision of trolley vehicles, £24,000; provision of motor-buses, £24,000 ... ..	104,238
Glasgow Corporation (J. Ferguson, engineer) tramways ... ..	19,853
County of Lanark tramways (Blyth & Westland, engineers), purchase of land, £4,570; construction and equipment of tramways, £96,470; electrical equipment of trolley vehicles, £19,000 ... ..	120,040
L.C.C. Tramways (M. Fitzmaurice, engineer), tramways ... ..	312,700
Stockport Corporation (R. Lomax, engineer), overhead electrical equipment for the purposes of running trolley cars along a route 4½ miles in length, including standards, cables, &c., £6,913; five trolley cars, £3,750 ... ..	10,663

\* The gauze is like a ribbon some 7 in. wide, having silk as warp and wire as woof.



Swansea Corporation (C. A. L. Prusmann, borough electrical engineer) tramways, £15,694; posts, standards, &c., £2,300 ... ..	£17,994
Brighton Corporation (W. Marsh, tramways engineer), purchase of land and easements, £1,500; sheds and buildings for trolley vehicles and buses, £17,500; underground cable-ways and cables for trolley vehicles, £21,730; shelter for passengers, £1,500; trolley vehicles, £46,000; motor-omnibuses, £30,000 ... ..	184,400
Brighton and Hove and District Railless Traction ...	8,919
Sheffield Corporation (C. F. Wike, engineer) tramways, £216,114; provision of, and electrical equipment of, trolley vehicles, £40,681; purchase of land for tramroad, £5,127 ... ..	261,922
Metropolitan Electric Tramways (Stephen Sellon and A. H. Pott, engineers), tramways ... ..	12,410
Penwortham Bridge Tramway ... ..	941
North Ormsby, South Bank, Normanby and Grangetown Railless Traction (W. Porritt Ingram, engineer) ...	7,015
Edgware and Hampstead Railway ... ..	131,933
Metropolitan District Railway ... ..	244,565
London Electric Railway ... ..	753,100
Metropolitan Railway ... ..	375,144

## NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 29,065. "Tramcars and like vehicles." BRUSH ELECTRICAL ENGINEERING Co., LTD., and S. LEECH. December 27th.
- 29,074. "Electric lamp." F. W. DAVIES. December 27th.
- 29,098. "Manufacture of metallic-filament incandescent lamps." SIEMENS and HALSKE AKT.-GES. (Addition to 19,077/1910. Convention date, December 30th, 1910, Germany.) December 27th. (Complete.)
- 29,126. "Electric furnace." A. HELFENSTEIN. (Addition to No. 17,650/09. December 27th. (Complete.)
- 29,138. "Controllers for electric motors." P. S. TURNER. December 27th.
- 29,141. "Miners' safety lamps of the electric type." J. L. HUDSON. December 27th.
- 29,145. "Spinning or twisting machines with separately and electrically-driven flyers." H. SCHNEIDER. December 27th. (Complete.)
- 29,146. "Electrical control for direct-current motors." A. MARTIN, H. JACKSON, A. J. CAMPBELL, T. B. CAMPBELL and W. CAMPBELL. December 28th.
- 29,148. "Electro-magnet mover for points of electric tramway lines." E. KELYNACK. December 28th.
- 29,160. "Inner field magnet composed of a number of separate magnets for multipolar electrical machines having an outer armature." E. VOLKERS. (Convention date, December 31st, 1910, Germany.) December 28th. (Complete.)
- 29,161. "Field magnet consisting of a number of permanent magnets for multipolar electrical machines having an outer armature." E. VOLKERS. (Addition to No. 29,160/1911. Convention date, January 21st, 1911, Germany.) December 28th. (Complete.)
- 29,178. "Regulation of dynamo-electric machinery." E. C. R. MARKS. (Akt.-Ges. Brown, Boveri et Cie, Switzerland.) December 28th. (Complete.)
- 29,195. "Telephonic transmitters." W. J. MARCHANT. (Addition to No. 24,390/1910. December 28th. (Complete.)
- 29,201. "Magnetic separators." FRIED. KRUPP AKT.-GES. GRUSONWERK. (Convention date, January 12th, 1911, Germany.) December 28th. (Complete.)
- 29,209. "Safety electric mining lamp." R. C. HALL. December 28th.
- 29,224. "Magnetic separators." FRIED. KRUPP AKT.-GES. GRUSONWERK. (Convention date, January 12th, 1911, Germany.) December 28th. (Complete.)
- 29,234. "Combined electrical switch and resistance or current-grduating device." DIMMING SWITCHES, LTD., and W. L. BARBER. December 28th.
- 29,290. "Electric shade carrier," J. H. ORMROD and W. J. PURDUE. December 29th.
- 29,291. "Electric measuring instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) December 29th.
- 29,316. "Electric hand lamps suitable for use in mines and apparatus for charging the same." CALLENDER'S CABLE AND CONSTRUCTION Co., LTD., and J. C. A. WARD. December 29th.
- 29,322. "Combined electric floor lamp and table lamp and palm stand." W. H. BENNETT. December 29th.
- 29,326. "Electric ignition apparatus for internal combustion engines." G. COWHER. December 30th.
- 29,327. "Appliances for use in connecting electrical accumulators for charging and use." K. R. SMITH. December 30th.
- 29,334. "Electric safety lamps." G. A. DICKIE. December 30th.
- 29,354. "Portable electric hand lamps." E. A. HAILWOOD. (Addition to No. 486, 1911.) December 30th. (Complete.)
- 29,368. "Electrical ignition devices for internal-combustion engines." R. BOSCH (Firm of). (Convention date, February 18th, 1911, Germany.) December 30th. (Complete.)
- 29,392. "X-ray tubes and the like and the manufacture thereof." C. A. FRIEDRICH. December 30th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

- DEVICE FOR MAKING AND BREAKING ELECTRIC CONTACTS IN WIRELESS SIGNALING SYSTEMS. F. H. VAYLEY. 20,585. September 3rd.
- MECHANISM FOR APPLICATION OF MASSAGE BY VIBRATION OR PERCUSSION WITH OR WITHOUT COMBINATION OF ELECTRICITY. A. RAY. 29,225. October 7th. (May 4th, 1911.)

- EXCITATION OF INDUCTION DYNAMO-ELECTRIC MACHINERY. Akt.-Ges. Brown, Boveri et Cie. 25,397. November 1st. (November 1st, 1909.)
- ELECTRIC ARC LAMPS. Ges. für Maschinen und Metall Industrie. 27,942. December 1st. (December 1st, 1909.)
- METHODS FOR REGULATING THE FREQUENCY OF ELECTRIC CURRENTS PRODUCED BY ROTARY FIELD GENERATORS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 28,081. December 2nd.
- ELECTRIC OVENS. C. J. Ogden and M. M. Hay and J. Templeton. 28,129. December 3rd.
- METHOD OF FORMING DIELECTRIC FILMS IN ALUMINIUM AND OTHER ELECTROLYTIC CELLS. R. Mershon. 28,352. December 6th. (January 5th, 1910.)
- ELECTRODES FOR ELECTRIC STORAGE BATTERIES. P. J. Kamperdyk. 28,419. December 6th. (December 6th, 1909.)
- ELECTRIC CURRENT GENERATORS. A. E. R. Bottone. 28,612. December 8th.
- ELECTRIC BATTERIES. R. Russell. 28,986. December 13th.
- MAGNETIC SEPARATORS. H. H. Thompson. 29,052. December 14th.
- MEANS FOR AUTOMATICALLY ACTUATING THE TRACK POINTS OF ELECTRIC RAILWAYS AND THE LIKE. E. Fehr. 29,410. December 19th. (Cognate application, No. 14,092 of 1911.)
- MEANS FOR REGULATING ELECTRICAL HEATING APPARATUS. W. E. Trumpler. 30,201. December 29th. (January 10th, 1910.)
- ELECTRICALLY-OPERATED INDICATING OR RECORDING APPARATUS FOR WEIGHING MACHINES OR THE LIKE. S. Round. 28,555. November 15th.
- ELECTRIC CURRENT REGULATORS. J. S. Goodwin, J. A. J. Haslop and T. H. Brown. 28,613. December 8th.
- HOSE-PIPES FOR ELECTRICALLY-CONTROLLED VACUUM CLEANING APPARATUS AND THE LIKE. T. H. White. 28,720. December 10th.
- ELECTRIC HORNS. H. C. Davy. 28,793. December 10th.
- ELECTRIC CLOCKS. H. Creese. 28,881. December 12th.
- ELECTRIC TRANSMISSION OF POWER BY POLYPHASE CURRENTS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 29,168. December 15th. (Patent of Addition not granted.)
- IRONCLAD, OIL-BREAK ELECTRIC SWITCHES. Spagnoletti, Ltd., and V. F. Joyce. 22,270. December 16th.
- ELECTRIC SIGNALLING SYSTEM. A. Mathys. (Morkrum Co.) 29,296. December 16th.
- PRINTING TELEGRAPHS. A. Mathys. (Morkrum Co.) 29,297. December 16th.
- ELECTRIC ALARM SYSTEMS. P. L. L. Leduc. 29,304. December 16th.
- MEANS FOR AUTOMATICALLY OPERATING ELECTRIC SWITCHES FOR USE IN CONNECTION WITH ELECTRICALLY-DRIVEN OR ELECTRICALLY-CONTROLLED MACHINES. F. Jackson and G. E. Pearson. 29,441. December 19th.
- APPARATUS FOR DUPLEX TELEGRAPHY. Heurtley & Gott. 30,402.

### 1911.

- ELECTRIC HAND-LAMP FOR THE USE OF POLICE, POSTMEN, WATCHMEN AND THE LIKE. R. Westmancott. 3,374. February 9th.
- ELECTRIC LANTERN FOR EXTERIOR ILLUMINATION. F. C. McQuown. 3,892. February 10th.
- INTERCOMMUNICATING TELEPHONE SYSTEMS AND APPARATUS. R. L. Murray. 3,524. February 11th.
- MOUNTING OF DYNAMOS ON RAILWAYS AND THE LIKE VEHICLES. Lake. (United States Light and Heating Co.) 3,722. February 14th.
- ATTACHMENT OR COVER FOR TELEPHONE MOUTHPIECES. A. B. Leete. 4,000. February 16th.
- WATER HEATING BY MEANS OF ELECTRICITY. W. A. Toppin. 5,309. March 3rd.
- ELECTRICALLY-PROPELLED VEHICLES. D. Balachowsky and P. Caire. 7,062. March 21st. (March 22nd, 1910. Addition to No. 28,475 of 1909.)
- ELECTRICAL ALARM SYSTEM. R. Goldstein. 7,671. March 25th. (March 28th, 1910.)
- PRIMARY GALVANIC BATTERIES. A. Sandrini and C. Sanguineti. 9,523. April 19th.
- ELECTROMAGNETIC SWITCHES. H. Lofquist. 10,652. May 2nd.
- INDUCTIVE WIRELESS TELEGRAPHIC INSTALLATIONS. H. von Kramer. 10,857. May 4th.
- TIMING DEVICES FOR REGULATING THE IGNITION IN THE CYLINDERS OF INTERNAL-COMBUSTION ENGINES. W. Moore and Ambrose Shardlow & Co. 13,191. June 1st.
- CONTROLLING APPARATUS FOR ELECTRIC MOTORS CHIEFLY AS USED WITH ELECTRIC LIFTS. A. Turner and C. Wilkinson. 13,469. June 5th.
- SPEED REGULATION OF POLYPHASE SERIES MOTORS. Siemens-Schuckertwerke Ges. 13,877. June 9th. (June 10th, 1910.)
- MERCURY OR OTHER VAPOUR ELECTRIC APPARATUS. J. S. Anderson and G. B. Burnside. 16,157. July 13th.
- AUTOMATIC ELECTRIC SWITCHES. E. A. Fagerlund. 17,284. July 29th. (August 8th, 1910.)
- CARBON ELECTRODES FOR ARC LAMPS. M. P. Schiff. 17,690. August 3rd.
- CONSTRUCTION OF ELECTRICALLY-HEATED OVEN. Veritys, Ltd., and H. Fletcher. 24,021. October 6th.
- MEANS FOR OPERATING ELECTRIC MOTORS DRIVING MOTOR TRAINS. W. A. T. Muller. 1,209. January 17th.
- ELECTRICALLY RESISTANT MATERIAL AND A PROCESS FOR PRODUCING THE SAME. J. Jones. 1,459. January 19th.
- ELECTRIC INCANDESCENT LAMP WITH INTERCHANGEABLE CARRIER FOR THE FILAMENTS. A. Bloch. 1,707.
- SIGNALLING APPARATUS FOR USE WITH MONO OR POLYPHASE CURRENT. G. G. M. Hardingham. (Hartmann & Braun Akt.-Ges.) 2,140. January 27th.
- WIRELESS TELEGRAPHY AND TELEPHONY. J. Shoemaker and N. Wilson. 2,456. January 31st.
- RELAYS FOR AUTOMATIC CONTROLLERS FOR ELECTRIC MOTORS. J. M. L. Slater. 2,530. January 31st.
- MEANS OF PACKING AND TESTING INCANDESCENT ELECTRIC GLOBES. A. A. Brown. 2,667. February 2nd.
- ELECTRICAL CONNECTOR. J. H. Harpin and Walker, Horrocks & Co. 3,794. February 15th.
- TELEPHONE SYSTEMS. W. J. Rickets. 4,282. February 20th.
- ELECTRICAL CONTACT-MAKING DEVICES. G. St. J. Day. 5,422. March 4th.
- ELECTRICITY METERS. Chamberlain & Hookham, Ltd., and S. James. 5,654. March 7th.
- ELECTRIC SWITCHES. A. Page. 6,129. March 11th.
- ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co. 7,104. March 21st.
- ELECTRIC FLAME ARC LAMPS. N. Schuer and R. Haddrell. 8,018. April 6th.
- ELECTRIC REGULATING ARRANGEMENTS. W. E. Lake. (United States Light and Heating Co.) 9,366. April 15th.
- ELECTRICALLY-DRIVEN PUMPS. J. C. Merryweather. 9,717. April 21st.
- THERMO TELEPHONES. B. Gwozdz. 11,234. May 9th.
- MICROPHONES. F. Nussbaum. 11,610. May 18th.
- ARC LAMPS WITH PARALLEL ELECTRODES. R. W. James. (Ges. für Verwertung Technischer Patente.) 15,217. January 29th.
- ELECTRIC SWITCHES. H. Thiel. 16,078. July 11th.
- DEVICE FOR HEATING RUNNING WATER OR OTHER LIQUID BY ELECTRICITY. R. Lofquist. 16,602. July 18th.
- CIRCUIT ARRANGEMENTS FOR AUTOMATIC TELEPHONE EXCHANGES. Siemens and Halske Akt.-Ges. 19,185. August 27th. (August 27th, 1910.)



# THE ELECTRICAL REVIEW.

Vol. LXX.

JANUARY 19, 1912.

No. 1,782.

## ELECTRICAL REVIEW.

Vol. LXX.]

CONTENTS: January 19, 1912.

[No. 1782.]

	Page
Electric Cooking and Heating ... ..	81
Electric Cooking ... ..	82
The Association of Consulting Engineers ... ..	82
Railway Electrification ... ..	82
Printing Proceedings ... ..	83
Brazil: Its Present Conditions, and the Possibilities for Future Commercial Relations with Great Britain ( <i>illus.</i> ) ( <i>concluded</i> )	83
Notes on the Chemistry of the Lead Cell ... ..	85
Notes from Canada ... ..	86
Correspondence:—	
The Association of Consulting Engineers ... ..	86
Capital and Labour ... ..	86
Old Carbon Ends ... ..	86
The Economy of Electric Cooking ... ..	87
Legal ... ..	87
Our Legal Query Column ... ..	87
The Physical Society Exhibition ( <i>illus.</i> ) ( <i>concluded</i> ) ... ..	88
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ... ..	89
Business Notes ... ..	91
A Battery Sub-Station Plant at Hucknall Colliery ( <i>illus.</i> ) ... ..	99
The New "Avenue" Exchange ( <i>illus.</i> ) ... ..	102
Reviews ... ..	104
Notes ... ..	106
City Notes ... ..	108
Stocks and Shares ... ..	110
Market Quotations ... ..	110
Share List of Electrical Companies ... ..	111
Proceedings of Institutions:—	
The Use of Electricity for the Control of Railways ... ..	113
The Electrical Engineering Laboratory at the Heriot- Watt College, Edinburgh ( <i>illus.</i> ) ( <i>concluded</i> ) ... ..	114
Electric Power for the Panama Canal.—I. ( <i>illus.</i> ) ( <i>continued</i> )	116
Electrical Development in Industrial Areas ( <i>concluded</i> ) ... ..	117
Trade Statistics of Peru ... ..	119
Foreign and Colonial Tariffs on Electrical Goods ... ..	120
New Patents Applied For, 1912 ... ..	120
Abstracts of Published Specifications ... ..	120
Contractors' Column... ..	Advertisement pages xxiv and xxvi

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades,  
and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain,  
19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.  
TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris:  
BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter  
den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to  
Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## ELECTRIC COOKING AND HEATING.

Now that the days are lengthening and the slack season (for electricity works) is approaching—even though it be far off as yet—it may be opportune for us to ask ourselves whether we are doing all that can and ought to be done to develop those outlets for electrical energy which help to fill up the valleys in the day-load curve, and to level up to the "peak" which has so long played the part of the old-man-of-the-sea to the electricity supply industry. As regards the use of electricity for motive power, such splendid progress has been made in this direction during the last five years or so that we need not dwell upon its possibilities. The pre-eminent advantages of the electric drive have compelled the popular world to accept it as unquestionably the most satisfactory and economical motive agency available, and it advertises itself. But in many districts there is very little existing demand for motive power, and until the manifold uses of the electric motor in the domestic *ménage* have been brought home to the housekeeper, who is usually a most conservative person, there is little prospect of awakening such a demand.

On the other hand, the demand for cooking and heating is universal, and all that is required is to divert the trade from coal and gas to electricity, not to create a new want as in the case of domestic power. To attain this most desirable object, two main conditions must be satisfied: the apparatus must be brought within the reach of the middle-class purse; and the supply of energy must be given at a low rate—certainly not above 1d. per unit. How far have these requirements been fulfilled?

Taking the latter first, excellent progress has been made: the penny unit (for cooking and heating) has already been widely adopted, and the process of reducing the price to that figure is in full swing all over the country. At least one manager, courageous beyond his fellows, has even reduced it to a halfpenny! We think, therefore, that this condition is in a fair way to be met. But as regards the former, we are by no means satisfied with what is being done. The prices of electrical cooking apparatus, in particular, are still far beyond what they should be—and, we make bold to say, what they *could* be. Until they are brought down to a level comparable with those of gas cooking apparatus, and until, like the latter, the electric cookers are made available to the ordinary consumer on hire terms, there is little prospect of any important addition accruing to the load curve from this source.

Yet, from the number of manufacturers of electric cooking apparatus in the field, and the variety of the devices which they list, it is perfectly clear that there is a large, growing and profitable market for their products. Are we not justified in suggesting that they are skimming the cream, and selling only to the well-to-do, on the principle of small production but large profits? Why do not the supply works managers bring pressure to bear upon the manufacturers, to induce the latter to cater not merely for the

## THE

## UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN  
PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



rich, but also for the middle class? Until the latter is tapped, the station engineer will not make much out of the cooking business, and it is for him to see to it that a remedy is found for what, in our opinion, is a rather short-sighted policy on the part of the makers.

We should like to see a drastic reduction in the price of electric cookers; the output of these would then increase so rapidly that the lessened cost of manufacture would enable the makers to reap a rich reward, while the supply works would be greatly benefited also, and the cost of electricity for all purposes would come down still further.

### Electric Cooking.

IN our "Correspondence" columns, Mr. G. C. Allingham raises the question whether the shrinkage of meat cooked in an oven is detrimental to its nutritive qualities, seeing that nothing but water is lost. No one, we think, has ever suggested that the wastage represents the disappearance of solid meat; such matter is neither soluble nor volatile, and we have always understood that the loss in weight must be due almost wholly to evaporation. We should be very much surprised to find that any other view was held or advocated.

We are not in agreement, however, with our correspondent in his suggestion that, as the meat is obtained in a more concentrated condition when well shrunk, a correspondingly smaller quantity of it should satisfy the appetite. We are digressing into a highly contentious field, we know, as illustrated by numerous proverbial sayings; but we believe it will be admitted that the appetite is satisfied only by volume, and takes no account of the percentage of nutritive matter in the food consumed. Most people eat too much rather than too little, and therefore the lower concentration of the nutriment would not hurt them, even were the conditions of assimilation the same; but they are not. The fact that meat cooked in an electric oven retains more moisture, and is correspondingly juicy and succulent, is not only gratifying to the palate, but also ensures that the food is much more readily digested, and a greater proportion is assimilated than when it is dried up and toughened by faulty methods of cooking. Thus, while (as pointed out in our last issue) the butcher's bill is greatly reduced, the consumer is benefited by the improvement in the quality of his food. It would be an excellent thing if some independent authority would undertake a thorough scientific investigation into the whole question.

### The Association of Consulting Engineers.

THE inaugural meeting of those interested in this *proposed* Association was held at 4 p.m. on Monday, but we are at a loss to know why it was called a public meeting, for the Press was excluded. True, when we were turned away, we were promised an official report of the proceedings, but at the time of going to press with these notes, it is Wednesday night, and nothing has come to hand. Mr. Swinburne was in the chair, and he was supported by Messrs. Hammond, Patchell, Handcock, Dykes, Snell, Taylor, and others of the self-elected committee of senior and junior men who have set themselves up to say what engineers shall or shall not practise their profession free of molestation, for to this, so far, the affair has got, and it promises to go further.

To begin with, though the printed rules no longer contain the obligation of being a member of the "Civils," this unfair obligation has been, or is going to be, put back. It snits the self-appointed. The Association is going back on its amended resolution, and proposes to narrow its boundaries, in response to the agitation of those who evidently want to make the organisation as limited and exclusive as they can. The rules, however, will admit of special condescension being meted out to non-Civil consultants if the Council regard them as "fit."

A courteous letter received from the Institution of Civil Engineers relating to the Association could not be read, as it was found to be marked "confidential." We

believe, however, that, in brief, it gave the promoters very little encouragement, and, from what we can learn from an observation passed by the chairman, it did not admit that such an Association was necessary.

The self-elect ensconced behind the barrier are to sit in judgment on their fellows. No matter that a man may have entered the profession by the old and time-honoured method of pupilage; no matter that he may have been 20, or even 40, years in practice, he is to be subject to this self-elected body, some of whom may never have been engineers at all, or may have entered by flaws in the fence, and some, who have fairly and squarely entered, were in their cradles or at school when years of strenuous work had begun to bleach the heads of those they assume to judge. To our minds the whole thing is ludicrous. The rules of conduct are all very well; but can all the proposers of them lay their hands to their hearts and say, "All these things have we observed from our youth up"? We fancy not, and one of the speakers in the body of the hall seemed to think so, too, for he twitted the Committee with being now easily able to keep these rules, as perhaps the flow of business obviated the need to-day of their breaking them. General dissent seemed to hang round the proposal to shut out all but "Civils." An Association can do as it pleases as regards its membership; but when this Association is stronger it means to try for an Act of Parliament to compel all public bodies to employ only these "Unionists!" We have all been sorry to see Lancashire operatives lately condemning to unemployment non-unionists, fully their equals; but this absurd proposal of the A.C.E. out-Herods Herod in this respect.

Certain speakers spoke of the mean practices employed by certain engineers in touting for work where already consultants had been called in. If the A.C.E. would widen its base and do what it could to preserve honest practices, we would gladly welcome it, but nothing transpired at the meeting which led one to expect any great attempts in this way. The object to be attained is so far, only too obviously, advertisement, but advertisement which will be all to the benefit of the self-elect and their friends. Everyone knows that requests to presidents to name men for certain work have been abused. The new Association, by its methods, is to secure this sort of patronage, and where will the wheat be allotted and where the mere chaff?

A grave injustice is being attempted upon men who are outside the Civils, men who would snap their fingers at any attempt to coerce them, yet who would join the A.C.E. if it were fair dealing. If, as the chairman said, clean practice is a chief aim of the Association, let it stick to this, and avoid all advertisement.

This meeting cannot be said to have given confidence to anybody; and notwithstanding the vote of confidence in the committee that for some reason or other it was thought necessary to pass—though there were some against, some neutrals, and some who had criticised had left the meeting before the vote was taken—we imagine that the moving spirits are hanging their heads. However, we will not anticipate—we will wait and see.

### Railway Electrification.

THE electrification of main-line railways is a topic which every day is bringing more closely to realisation. What it means to the electrical industry of this country can hardly be measured. It would be a misfortune should the early work fall into the hands of foreign firms who would carry out the work on different systems, thus bringing about a worse confusion than the confusion of gauges many years ago. The time appears to be ripe for a preliminary conference of railway men, who might discuss first the general principles which should guide the railways in their choice of a system, much on the same lines as the Continental authorities have dealt with this matter. Uniformity of system throughout the country is essential. Already we find men advocating a double system, one for suburban traffic and another for main-line work. This may be wise; we would not hastily condemn it, though on the face of it, it appears to be fraught with very serious consequences in the future. So far as the main-line work is concerned, it can-



not be regarded otherwise than as essential that an agreement should be come to between all the railways to follow the same system, so that in every main detail absolute interchange of vehicles should be possible. Except in the matter of brakes this is practically the case with the steam roads to-day, but the one item of brakes has led to a difference of practice that has been of very considerable inconvenience, and should afford a lesson to the men of to-day. Our railway men generally have not in the past acted together very harmoniously. In America, where vehicles may break down very far from home, there has been a serious effort to standardise cars, so that repairs can be made by foreign lines, and vehicles kept in service and rendered fit to be run home on their own wheels. A moment's thought will convince anyone of the difficulties into which railway working would be thrown by a break of system from overhead to third-rail or from single-phase to D.C. Already the directorate of one short main-line railway is contemplating an early change-over to electricity.

It ought at least to be agreed that no railway should change over more than a certain limited mileage until a given year. It is quite likely that all the railways which carry out the conversion of 50 or 100 miles of line will find cause to effect many changes and improvements; but neither the faults nor the successes of any change-over ought to be kept secret. Every detail should be tabled and brought to a properly comparative datum, so that all may know what each venture has proved, whether good or bad. With such facts on which to work, a Committee of engineers and managers should be able to arrive at a conclusion to which all should faithfully adhere. Commercial men have been too little disposed to work amicably together, and the interests of all have too often been sacrificed to mere personal pique. Such a spirit ought not to be allowed to jeopardise the future of electric traction on main-line railways.

#### Printing Proceedings.

FOLLOWING in the steps of the American Society of Mechanical Engineers, the American Society of Civil Engineers has made a slight, but very commendable, change in the arrangement of papers in copies of the *Transactions*. Every paper is commenced on an odd-numbered page, that is to say, on the right-hand page of the open book. By this means the first part of a paper can never be printed upon the same leaf as the last part of another paper, and in splitting up a volume for separate filing, or even preservation of papers, every paper can be removed without destroying the completeness of another paper. Possibly the councils of many institutions will stand aghast at the idea that any member could be so lost to a proper sense of the value of their *Proceedings*, and will scout the idea as vandalism. But everyone knows that the accumulation of *Proceedings* is a serious problem in the library of the average house. Few of the volumes are ever opened or read; the majority, if not sent out cut, are never cut. When a man dies, his accumulations of years are sold for a few pence only, and the dealer who purchases the volumes sells them to an unwary junior thirsting for literature, at a huge profit.

Everyone knows the vexation of desiring to preserve adjoining papers on different subjects and the impossibility of making up one's sets of filed cuttings. The Institution of Civil Engineers' *Proceedings* forms about the worst example, because of the range of subjects treated. With the enormous mass of *Proceedings* which are now pouring from the press, it would seem desirable that a way should be found that would lead to the issue of unbound *Proceedings*, every paper being separate. Members might even be able to have sent to them only such papers as they desired.

A very large number of the published papers of any society cease to have any but historic interest in 10 to 50 years according to the nature of the subject. In electricity particularly this applies, because practice has not become crystallised.

## BRAZIL: ITS PRESENT CONDITIONS AND THE POSSIBILITIES FOR FUTURE COMMERCIAL RELATIONS WITH GREAT BRITAIN.

BY C. E. BEST AND H. L. PARROTT.

(Concluded from Vol. 69, page 990.)

*Water-power in the State of S. Paulo.*—We believe that in no country in the world has Nature more bountifully bestowed this latent power than in Sao Paulo State. In the River Tieté—the same as that which supplies the S. Paulo Light and Power Co.—there is another large waterfall, the "Salto de Itu," where, for a length of 150 m., there is a very rapid fall. If its full capacity were controlled, it would be sufficient to generate at least 75,000 H.P. At present it is tapped in Itu in several places, and thus supplies several sugar factories with ample motive power. The town is not of very great importance, the population being some 25,000; however, a system of electric tramways with public lighting might prove an attractive enterprise.

Lower down the same river there are several other falls, the most important being Bana Grande, Escaramuca and Avanhandava.

The Brazilian North-Western Railway has a line which reaches the last-mentioned fall.

Still further down this river, and near its junction with the Rio Grande, there are other rapids, and also the renowned cascade of Itapura, with a fall of over 44 ft.

Then in the Rio Grande is the Urubuhanga fall. The volume of water in these two last-mentioned falls is calculated to be some 7 million litres a second, which nearly equals the great Niagara. Power to the extent of more than 1,000,000 H.P. could be generated in this locality. It is well that English firms should be aware of these latent sources of power, for industry of the future must inevitably utilise them.

*The Sao Paulo Tramway, Light and Power Co., Ltd.*—This company was authorised to transact business in Brazil in 1899. It has acquired all the tramway lines of Sao Paulo with virtually perpetual concessions and exclusive rights to operate the tramways service in the city and suburbs for a term of 40 years from 1901, and has also the concession for the supplying of electrical energy, which is practically perpetual.

The company has now some 100 miles of track in operation, and is still extending its lines, not only in the city, but also out to various suburbs. There are also some 150 nine-bench standard-gauge open cars running, which gives Sao Paulo, with a population of 350,000, a car service that can be favourably compared with any city of its size in the world.

The electric energy is generated near the village of Parnahyba, on the River Tieté, some 35 km. distant from Sao Paulo. Here are installed eight turbines and generators, with a capacity of some 32,000 H.P. The current is received from the generators at a pressure of 2,300 volts, which is transformed to 40,000 volts, then sent over a four-circuit transmission line to the distributing station in Sao Paulo, where it is again transformed to 2,200 volts for distribution throughout the city for general use.

The city of S. Paulo is situated in the valley of the River Tieté, 2,500 ft. above level of the sea, and 35 miles from Santos, the seaport of the State.

Owing to the natural resources of the State, and the advantageous position of the city, Sao Paulo is now the third most important city of South America, being only surpassed in commercial movement and population by Buenos Ayres and Rio de Janeiro.

It is an industrial centre for the manufacture of cotton goods, which of late has developed to a very large extent, and therefore greatly diminished the importation of such goods from Manchester. It tends to become self-supporting in the supply of the home demand, which the Government has conscientiously assisted by the imposition of a very high Customs tariff.

Then, again, there is an enormous industry of the bag and



sack manufacture. There is a big local demand for sacks, especially for the coffee, of which there is an average export of some 12 million sacks. Rice and sugar also use up a big quantity of bags, while flour is another big item. Nearly all the supply is furnished locally.

The big factories have taken advantage of electric power, and now most of them have supplanted the old style of motive power by electricity. This is an example of what is taking and must take place in most of the important towns of Brazil. The national policy is that Brazil should become self-supporting as far as possible in all branches of industry.

*Rio de Janeiro.*—As most of our readers probably know, the Central Railway of Brazil, one of the most important in the country, is under direct control of the Federal Government.

Its main route connects Rio with Sao Paulo, a journey of some 250 miles. Besides this, there is a good local service connecting the various suburbs with the Federal capital of Rio. It is to this service that we would call our readers' attention. Last year the Government decided to electrify this system, which comprises some hundred miles of lines. But we understand that the Congress has not yet passed the credit to pay for this big change, so no contract to do the work can yet have been accepted.

It seems probable that the electric power will be furnished by one of the companies already established there, who are the Rio Tramway, Light and Power and Messrs. Guinle and Co.; the latter are a very important Brazilian firm, who, by their brilliant enterprise and energy, have obtained some excellent concessions during the last few years.

However, it is in the furnishing of all the necessary material for electrifying the lines that we think English firms should interest themselves. In this respect it is at once evident that it will not be sufficient or advisable to rely upon information obtained either from journals or the British Consul. It is absolutely necessary that big firms should have their own representatives resident in the country, as only by this means can they be kept informed of the continual improvements and developments under project.

*Bahia.*—Going further north, the first seaport town of importance we reach is Bahia, a port at which nearly all the mail steamers call. The completion of the port works at present in operation will bring general improvement, not only to the welfare of the State, but also to shipping interests. At present the big trans-Atlantic steamers anchor some considerable distance away from the quays, the cargo having, therefore, to be transported in lighters, while the passengers are conveyed to and from the shore in rowing boats.

The town has a very good service of electric tramcars, this being in the hands of the same company, which controls the trams and lighting of the Capital, Rio de Janeiro.

The lighting of the town still needs much improvement, but this will, no doubt, be effected in the near future.

The railways of the State of Bahia have all been taken over by a French Syndicate, who paid the late owners a large sum as compensation. The railways are in a very bad condition, both as regards permanent way and rolling stock, but they are to be greatly improved and extended, as the prospects for new developments are very encouraging.

The city of Bahia was the first Federal Capital of Brazil, but in the latter part of the eighteenth century the great natural advantages of Rio deprived it of this honour.

The city is built on a big incline, and is divided into two parts, the district of the higher locality being called the "Upper" town, which is the residential part, and is reserved almost exclusively for private dwelling-houses, hotels, and the Governor's Palace, &c. The "Lower" town comprises the commercial centre. Access to the Upper town is by means of electric lifts. Both sections of the city have a good telephone service.

*Products.*—The chief products of the State are :—Tobacco, cocoa, sugar, hides, coffee, cotton, and manganese ore, the first two mentioned being the most important.

Proceeding Northward we come to the seaport town of *Maceio*, Capital of the State of Alagoas, with a population of some 40,000 people. No passenger steamers call at this port, but it is of considerable commercial importance. Electric light is already used here, but acetylene gas is used to a large extent in the dwelling-houses.

The tramways are at present mule-drawn, and are, therefore, in sad need of reform. There seems to be every facility at hand for generating electric power, and encouragement is offered to firms who entertain the project.

The town offers various employment to engineering interests. The telephone service is far from satisfactory, while the drainage of the town needs thoroughly reforming. The harbour also lacks facilities for shipping purposes, but we are given to understand that a Government Commission of engineers has studied the locality, and its report and proposed improvements are under consideration.

*Pernambuco.*—Going further north we come to Pernambuco. This is a town and port of first importance, as it is the first port at which mail and passenger steamers call from Europe. It is protected by a coral reef which runs parallel to the coast for some miles. Port and harbour construction works are proceeding favourably, and their completion will greatly increase the natural progress of the town and State.

It is upon the coral reef that the new quays are being constructed, and when they are finished the inner channel will be dredged. This will permit any steamer to enter the port and discharge alongside the wharfs.

At present big steamers, such as those of the Royal Mail type, are forced to anchor outside the coral reef, and discharge passengers and cargo in similar manner to that at present in vogue in Bahia. The extra expense thus entailed must tend to retard normal development.

The town of Pernambuco is rather compact, though some of its suburbs are situated a considerable distance away, as Olinda, for instance, which was at one time the Capital of the State. It is now the chief residential suburb. There are several important suburbs, which are suffering under a poor service of the "Street Railway" to connect them to the city.

For want of more modern and satisfactory means of transit, the cars of the "Street Railway" are well patronised, in spite of the black smuts and dirty smoke, which are blown into the passengers' faces.

Although one may travel in greater comfort by tramcar, it takes much longer, as the trams are drawn by mules. Probably no other town of importance in Brazil is burdened with such an unsatisfactory service of road-car. However, a new political party has lately been elected to govern the State, so we are confident that many drastic and much-needed reforms will now be carried into effect.

This appears to us to be a most opportune time for British firms to take active interest in the country, if they wish to take a share in the many big engineering works which will undoubtedly be put into operation in the near future.

There are some 35 miles of tramway lines served under the present concession, but if the whole system were to be electrified, it might easily be extended to 80 or even 100 miles of profitable tramway. The present concession holds good for a further period of nine years, but this in no way prohibits firms from procuring a concession to electrify and extend the service later on.

The lighting of the town and private houses is by gas, and very poor at that. The municipality has the street lamps extinguished on moonlight nights, which occur frequently in tropical countries, such as Brazil. It seems probable that a concession might be granted to furnish public lighting as well as run a service of electric trams.

The telephone system and service here are also much in need of reform and improvement. They are at present so poor that, but for absolute necessity, there would be few new subscribers.

The principal and practically only railway in the State is that of an English company—the Great Western of Brazil Railway. It is one of the most important in the whole Republic. It connects the principal towns with the Capital, and has a branch line running north to Rio Grande do Norte and another line running south to Victorio and Maceio. Besides this, there are many miles of new line under construction.

Commercially, Pernambuco is principally noted for the large quantity of sugar and cotton which she exports. Her cotton is highly appreciated both in England and in U.S.A., and is considered by many to be the finest quality that is



grown. Of sugar she produces more than any other State in Brazil, while she is the second most important tobacco producing State.

The most delicious tropical fruits grow here in great abundance, especially pineapples and mangos. As Brazil is the only country in the Southern Tropics where fruit is grown and cultivated with so little trouble, a very profitable business of preserving and exporting fruit might easily be established. Their best fruits ripen during our winter, just at the time when fresh fruit is so expensive in Europe.

We are of opinion that the tide of prosperity has turned in favour of Pernambuco, and as she is adopting a policy of liberal progress and rapid improvement, British firms may with advantage study the present conditions more closely, with a view to obtaining a share in the work of development. This also applies to many other parts of Brazil.

## NOTES ON THE CHEMISTRY OF THE LEAD CELL.

By J. HORSNELL MAY, M.I.E.E.

THE time has passed when any such simple formulæ as those of Gladstone and Tribe, Darrius and FitzGerald, satisfy later experience with the lead storage battery. Wade, in his theory of polymeric lead sulphates, probably touched the fringe of the reactions which may and do occur. Something of the nature of the reactions indicated by him would probably take place in the lead peroxide—sulphuric acid—lead cell *per se*, but this has not yet been produced. Every cell contains materials which to a greater or less extent affect its internal changes from a chemical or electrochemical point of view, and these materials doubtless have their effect on the production or the reduction of the lead sulphates, as well as in other directions. In other words, there are always substances in a cell, the presence of which have a part in the ultimate action and reaction between the lead active material and the elementary electrolyte. These substances play an important part in the behaviour of the cell—substances which, for the want of a better name, may be termed “impurities,” and which may be defined as additions to the cell which, entering into chemical or electro-chemical action, modify those changes in the cell which would take place in their absence. In this article the term “impurity” is used in this sense.

The degree and class of sulphatation (and the ease of desulphatation) are largely governed by these impurities, although it is admitted that in certain cases their presence may to some extent affect the reactions from a physical cause.

At one time it was an article of faith that stringent purity in the lead cell was essential. To-day this article of faith has become an established fact, so long as the impurities are not chosen with care. It would, however, appear also true that impurities are often beneficial.

Some time ago, a systematic agitation was started in order to prove that a minute quantity of ammonium in the electrolyte of a cell was necessarily fatal; yet it is known that far higher percentages have not been without good effect. The presence of chlorine is said to produce good results under certain conditions. Zinc added to negative paste has occasionally given beneficial results. Arsenic (in conjunction with copper) has proved, after the closest investigation, to be the salvation, in at least one case, of a portion of a battery. Iron and antimony are other impurities which have been greatly condemned—yet these have been known in particular circumstances to give beneficial effects.

In connection with all the above instances, the greatest care has been taken to eliminate the influence of disturbing factors. “What then,” asks the engineer with a battery, “am I to do—shall I add ammonia, arsenic and copper to my cells in order to keep them in good condition?” The answer is an emphatic “No,” coupled with sympathy for the engineer who (having heard that iron might conceivably be good under certain conditions) dropped French nails into his cells. (The thought arises that arsenic, in the

form of rat poison, and properly used, might possibly be a surer and quicker end to that engineer’s troubles.)

The promiscuous use of impurities is not advocated. What is wanted is a keen and prolonged examination into the effect of impurities, under all likely conditions of usage to which cells may be subject.

It has often been stated by those who should be best qualified to know, that the use of wood sheet separators increases the capacity of cells. This effect would not seem to be entirely physical, or due to modifications in circulation of the electrolyte. There is surely a chemical effect. Again, the benefit of certain “expanders” in paste (in order to prevent it from shrinkage and to keep it porous) would not seem to depend entirely on physical action. The physical condition of the paste is certainly altered (initially and afterwards), but there is probably beyond this a species of local action due to the electrochemical effects of an impurity. A full recognition of this would be the beginning of the end of the fetish of purity. Edison uses lithium in his alkaline cells, and is not ashamed to own that its action is obscure. The actions of certain impurities which may be beneficial in the lead cell are probably less obscure, although the difficulties in the way of their elucidation are many. One of these difficulties is found in the inaccuracies of chemical analysis, which often lead the patient observer astray.

Chemistry is one of the exact sciences, and it might reasonably be inferred that within fair limits, chemical analysis was an exact art. Experience, however, leads one to suppose that, in matters relating to the storage battery (and the materials used in its manufacture), there is room for very considerable improvement as far as the analyst is concerned.

The following (culled from a fuller note-book) are a few instances which show the vagaries of analysts, care having been taken to choose the results of those having repute:—

(a) It was desired to know the exact percentage of ferric oxide in certain samples, this point being particularly impressed upon those making themselves responsible for the results given. The percentages certified are as below:—

			Sample 1.	Sample 2.	Sample 3.
Analyst 1...	...	...	·0188	·0331	·0034
" 2...	...	...	·0126	·02	·0686
" 3...	...	...	·0108	—	—

The significance of the above can be seen, when taking the writer’s own figures as 100 the following table presents itself:—

			Sample 1.	Sample 2.	Sample 3.
Analyst 1...	...	...	165	155	36
" 2...	...	...	110	93	91
" 3...	...	...	95	—	—

Disconcerting as the above figures may prove, the further examples show greater discrepancies:—

(b) A sample of pig lead was submitted to a firm of analysts, with the result that the figures for iron and for antimony were each about 1,000 per cent. higher than the figures from another source (which had confirmation).

(c) A sample of pig lead was sent to a metallurgist for estimation of impurities. He reported ·22 per cent. of impurity, and on the absurdity of this being pointed out, he reconducted his analysis and gave a further report showing only ·02 per cent.

(d) Two samples of acid were certified as identical. These were sent respectively to two independent analysts. One found the presence of five impurities, which the other did not find, and the latter found three impurities undiscovered by the former. Only two like impurities were found by both, and of these two the quantitative estimations varied by 192 per cent. and by 500 per cent.

(e) Two samples of acid, known to be of the same order, were submitted to an analyst. The comparative results were absurd and contradictory. One impurity was given as ·437 per cent., instead of ·045 per cent., in one sample, while conforming to a figure previously obtained in the other.

(f) In a case before the High Court, which centred round a certain impurity of easy estimation, the sworn evidence as to its quantity varied by 250 per cent.

These facts and figures show one of the difficulties to be overcome before the “impurities” in a lead cell can have their action rightly determined.



## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

SOME forty municipalities and villages in the province of Ontario voted, on January 1st, on the question as to whether they were in favour of obtaining electric power from the Ontario Hydro-Electric Power Commission. Every place voted in favour, and in most cases the majorities were very large. As these townships are distributed over all the older parts of the province, and many of them are quite small communities, it shows the evident desire of the people of Ontario to own and utilise its water-powers for themselves. There is talk of the Commission buying out the Electric Power Co., which supplies current in a large part of Eastern Ontario, and mention of which has already been made in these Notes.

Very wide legal powers are possessed by the Commission, and, besides acting as a distributor of power, it intends to draw up and enforce rules and regulations relating to the generation, transmission, distribution and application of electrical energy throughout the province. At the request of any municipality the Commission also prepares estimates of the cost of supplying hydro-electric power, and takes measurements of stream-flow, &c., in cases where undeveloped water-power is available locally. The Commission also acts as a mediator between municipalities and private companies if desired.

One of the aims of the Commission for the near future is the supply of electrical energy to farmers for agricultural and dairy purposes, and, of course, for lighting.

If it be possible to carry out this scheme successfully, the country districts of Ontario will become much more attractive than they are at present, as the roads and streets of small villages will be comparatively well lighted, and a good deal of the drudgery of farm work will be done by machinery.

The Conservation Commission of Canada has just issued a comprehensive and extremely interesting report on the water-powers of the Dominion. The water-powers of Western Canada, although touched upon in the report, are to be dealt with more fully in a later one. The present report contains a number of very good photographs of some of the more important waterfalls, in addition to which six large maps are issued in conjunction with it. The writer hopes to give some interesting details from this report shortly.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## The Association of Consulting Engineers.

The attention of our client Mr. A. H. Dykes, of 11, Victoria Street, Westminster, S.W., who is the honorary secretary of the Association of Consulting Engineers, has been drawn to the leading article headed "The Association of Consulting Engineers," which appeared in the issue of your paper, the ELECTRICAL REVIEW, for January 12th, 1912. The article contains the following statement:—"The honorary secretary himself . . . if we are not mistaken, is a director of a contracting company which undertakes wiring work in connection with schemes in which he is interested."

This statement is quite untrue and without any foundation whatever.

As it certainly will, if not contradicted, cause our client considerable injury in his profession, we must request you to publish this letter in your next issue, and in as prominent a position as that in which the statement complained of appeared.

Faithfull &amp; Owen.

Westminster, January 16th, 1912.

[Before the above letter reached us we had been informed by Mr. Dykes that we were mistaken in the statement referred to by our correspondents, and that being so, of course, we have no hesitation in withdrawing it.—Eds. E.R.]

## Capital and Labour.

As a working electrician, I was keenly interested in your open letter on Capital and Labour, and write to thank you for inserting the same. It is not to be expected that the Trade Union leaders like it, but it cheers all true workers to find that at least one paper is not afraid to support justice against the unions.

It is not often that we working men express our views in the Press, but this is not because we do not feel the tyranny of the unions quite as much as the masters.

When I use the term workers (so loved by our present-day politicians), I use it in the true sense, *i.e.*, by applying it to the men who do work, and have an interest in that work—not clock-watchers and shirkers.

I often try to find what good the unions have done the real worker. All I can find is that in most cases the same, and in some, better wages are paid to the unskilled than to the skilled worker. In skilled workers I include draughtsmen, engineers, assistants, &c.

How often does one notice vacancies advertised for the above at wages far below that of a dock labourer or a coal miner?

Trade Union leaders are fond of talking about political economy. Is it ideal economy from a political point of view to overpay a class of man whose only interests are beer, baccy and football, at the expense of the men who have first to go through years of training, and whose interests are such as to increase the better trades, for instance, such as tool-making, book-binding, &c., and who is usually keen on improving himself and his trade. I maintain that it is impossible to go on increasing the unskilled wages at the rate which has been done of late without making the skilled man's lot harder.

A real working man's politics consist only in his wanting a fair wage. The politician talks a lot, but only gives him inspectors, causes ill-feeling between his master and himself, puts up the price of production, and therefore the cost of living, and, worst of all, reduces his chance of getting a better job.

If the unions are ever to help the real worker, and draw him to their ranks, they must throw over the political section, and work for what they only pretend to do now, *i.e.*, to improve the workers' conditions, and that must be in a common-sense manner with honest men for leaders, not job grabbers.

It would not be long, under these conditions, before most of our works would be running under a co-operative system, and England's trade regaining what it has lost in the past through strikes and the fear of them.

A Conscientious Worker.

## Old Carbon Ends.

A correspondent from the Straits Settlement asks for a suggestion regarding the utilisation of old arc-lamp carbon ends. Instead of consigning them to the cinder tip or mortar mill, experience has shown that they may be employed with advantage in connection with lightning conductor work. Owing to the higher conductivity of pure carbon compared with coke, the unconsumed pieces of arc-lamp carbons make an excellent bed for conductor earth plates. The resistance is low and the demand rarely exceeds the supply. About six bushels per hole is a reasonable allowance.

A more ingenious, though less practical, suggestion is that of cementing several ends together, so as to form a single long carbon. The procedure is as follows: First cut the ends of the pieces so as to allow them to fit together, then cover the ends with a paste made of water glass and powdered carbon, afterwards lightly pressing the pieces together and allowing time to dry and harden. Such made-up carbons were found to be satisfactory when a number of tests were made several years ago. They burned both with direct and alternating currents just as well as new carbons, even at the



junctions. The resistance was but little greater than that of new carbons, whilst, as regards mechanical strength, the made-up carbons, when subjected to a uniform stress, were found, if anything, more liable to break between joints than at the joints.

The exception to this rule was noticeable in the case of open type D.C. arc lamps, where the excessive rush of current at the moment of striking the arc acted disastrously upon the made-up carbons. The jointed ends became red hot, then incandescent, and immediately afterwards broke into as many parts as there were jointed sections. Experiments with enclosed lamp jointed carbons were invariably successful.

The whole of the foregoing observations have reference to solid carbons; the subject of mineralised carbons is, therefore, not dealt with.

J. H. Runnett.

Bolton, January 15th, 1912.

[An article on the subject by Mr. Runnett appeared in our issue of August 17th, 1906, giving more detailed information.—EDS. E.R.]

### The Economy of Electric Cooking.

It has been frequently stated that meat, when roasted in an electric oven, loses only about 10 per cent. in weight, as compared with a loss of about 30 per cent. when cooked in a gas or coal heated oven. But does that mean that 30 per cent. of the actual meat disappears? Is it not almost entirely water which evaporates? Surely no appreciable amount of the nutritive substances in the meat vanishes into thin air?—a small quantity of the juices may run out of the meat, but that would only represent a very small fraction of 30 per cent. of its weight, and would, moreover, be saved.

If my supposition is correct, I fail to see where the saving of meat due to cooking by electricity comes in, for the only effect of cooking by the older methods is that the meat is obtained in a more concentrated condition, and a correspondingly smaller quantity of it should be needed to satisfy the appetite.

I am open to correction, and I hope I may be wrong, for I am a whole-hearted supporter of electricity. But if I am right, it does seem to me that the new "electric cooking" poster of the Electric Supply Publicity Committee is based on a mis-statement worthy of the *Journal of Gas Lighting*.

G. C. Allingham.

Hendon, January 15th, 1912.

[We refer to this matter in our leading columns.—EDS. E.R.]

## LEGAL.

### AVEBURY v. THE NATIONAL TELEPHONE CO.

IN the Chancery Division on January 11th, this action was again mentioned to Mr. Justice Joyce on an application to fix a date for the trial.

MR. YOUNGER, K.C., reminded his Lordship that the question to be determined was as to the right of the debenture stockholders to a premium on the redemption of their security under the terms of the sale of the company's undertaking to the Post Office. When the motion for an injunction came on, it was recognised that it would not benefit anybody to stop the sale, and it was agreed that £50,000, which was the amount in dispute, should be placed in joint names pending a decision of the dispute. He now asked that a convenient date early these sittings should be fixed for the trial.

HIS LORDSHIP: There is no hurry, except to get the money.

MR. PERCY WHEELER said that the parties were anxious to have the matter disposed of. Next Monday fortnight (January 29th), would be a convenient day.

HIS LORDSHIP said that the case must be mentioned again later. He could not fix a date, and it was quite possible that some other Judge would try it.

### THE DAVIS ELECTRICAL CO., LTD.

MR. JUSTICE NEVILLE, sitting for the disposal of companies' winding-up business, had before him on Tuesday, January 16th, a petition by James McDougall, for an order for the compulsory winding up of the Davis Electrical Co., Ltd.

MR. JENKINS, K.C., in support of the petition, said that the

respondent company was formed in 1908 to take over a business of dealers in and manufacturers of electric lamps. It was in the nature of a private company, and the nominal capital was £3,000, divided into 1,000 preference and 2,000 ordinary shares. For the sale of his business to the company, Mr. Davis received £1,998, which was satisfied as to £998 by the issue of fully-paid ordinary shares, and £1,000 was satisfied by the issue of a debenture which was a first charge on the assets of the company. Further debentures were issued by the company, which were alleged to have been issued in consideration of cash. There were two directors of the company—Mr. Davis (who was entitled to £500 a year, which £500 he received right up to the date of liquidation) and a Mr. Howlett (who was entitled to 7s. a week). The company from the commencement, said counsel, carried on business at a loss, and in fact, it was alleged that Mr. Davis was himself carrying on business at a loss when the company was formed. The petitioners were creditors for goods supplied, and it was alleged that the company went on trading right up to the time that it went into voluntary liquidation, and received goods to a considerable value, which goods were now claimed by the debenture-holders. Those debenture-holders were Mr. Davis and a Mr. Levy, who was said to be his father-in-law. The resolution for voluntary winding-up was passed on October 11th, 1911, and Mr. Corfield, an accountant, was appointed voluntary liquidator. He was also appointed receiver and manager for the debenture-holders, and although no allegation whatever was made against Mr. Corfield, the petitioners felt it was to the interest of the creditors that an independent liquidator should be appointed.

MR. YOUNGER, K.C., for the company, offered that an independent liquidator should be appointed, but objected to a compulsory winding-up on the ground of expense. The resolution for voluntary winding-up, he said, had the support of creditors to the amount of £1,884 odd, out of a total liability of £3,333. Mr. Corfield was a complete stranger to the parties until he was appointed liquidator. The principal reason urged by the petitioners for the interference of the Court, seemed to be that goods to the value of about £1,600 were obtained by the company within a few months of the voluntary liquidation, but such a contention rather savoured of hypocrisy, for the goods the petitioners had supplied during the last few months were but for a very small amount, and they were seeking to get the advantage of the larger quantity of goods supplied by the other creditors.

MR. HARMAN, for Mr. Davis, objected to a compulsory order on the ground that the voluntary liquidation was for the benefit of all the creditors.

HIS LORDSHIP said he thought that in a case such as this he must give effect to the wishes of the majority of the creditors, and there must be a compulsory order.

The usual order for winding up the company compulsorily was made accordingly.

### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"VEXED" writes:—"I bought certain telephones as per advertisement in your paper, 'the lot' going for £5. I had two on appro. at first, conditionally that if I did not buy I paid carriage on return. The seller, instead of sending carriage paid, sent carriage forward, and asked me to send them on to another firm carriage forward if I did not buy. I protested against sending them to any one but himself, as a third person might involve complications. I offered him £4 10s. for telephones delivered. This he refused to accept, and said he would send them if I would send cheque for five guineas, 5s. being for boxes to pack them in. I replied he was legally bound by his advertisement and by sending appro. instruments on the terms as advertisement. I said I accepted his offer, as advertisement, for £5 for telephones delivered to me. By this I meant carriage paid, and not free on rail. I told him I should pay for no boxes or any packing, as that had nothing whatever to do with me, as he could deliver as he liked, either by railway company, motor-car or any means, as I bought the telephones delivered to me, and they were his, and at his responsibility, till I accepted them as being equal to samples. Of course, I sent cheque with order, as he would not send goods without cash, and I deducted the carriage of goods sent on appro.

"He then sent the remaining goods carriage forward. I refused them, and they have lain on railway company's hands for some days, and I maintain they are not mine till I accept them, and free of any liability. He refuses to pay carriage.

"I think that such goods as these, when advertised, are bound to be delivered free to buyer, and they are sender's goods till accepted."

\* \* \* There is no rule of law which provides that goods bought must be sent by the seller to the buyer at the expense of the seller. It is difficult to see how any such undertaking on the part of the seller is to be inferred from the contract; and there is no form of action by which the expense of sending or packing could be recovered from the buyer. When the goods "on appro." arrived carriage forward, the buyer then had the option of refusing to accept on the ground that he wanted to take delivery at the seller's place of business; but if (as is most likely) he asked for two to be



sent "on appro," it seems that the seller was entitled to send them "carriage forward." "Vexed" might now, in asserting his full legal rights, say that the contract was to take delivery at the seller's place of business, and claim delivery there; but then he will only have the expense of paying carriage over again to his own place.

## THE PHYSICAL SOCIETY EXHIBITION.

(Concluded from page 53.)

### Weston Electrical Instrument Co.

A LARGE variety of switchboard and portable instruments of the dynamometer, permanent-magnet, moving-coil, and iron types was exhibited, together with interesting power factor, frequency and wattmeters, and a new synchroscope—all of which were excellent

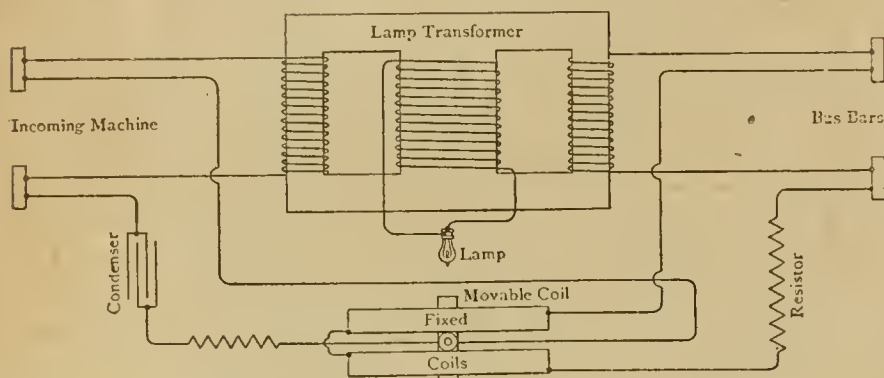


FIG. 14.—DIAGRAM OF CONNECTIONS OF SYNCHROSCOPE.

illustrations of the beautiful workmanship and skilled design which have always characterised the Weston instruments. Delicacy combined with strength is a marked feature of the movements, and it is interesting to see the principles which guide the designer of heavy structures embodied in the construction, for example, of a delicate pointer, which is, in fact, described as "a triangular truss with tubular members." The total weight of the movable system of a Weston single-phase wattmeter is only 1.84 grammes, and the power consumed at full load is less than 4 watts at 110 volts; the accuracy of the readings is practically independent of frequency, power factor and temperature.

The new synchroscope is not of the rotating type; it operates on a novel principle, the mechanism being very similar to that of the single-phase wattmeter, except that both fixed and movable coils are wound with fine wire. The connections are shown in the accompanying diagram, fig. 14, and the appearance of the instrument is represented in fig. 15. A lamp is inserted behind the dial, and throws the shadow of the pointer upon the latter; in this lies the novel and extremely ingenious device upon which the working of the instrument depends.

The two circuits of the wattmeter mechanism, as shown in the diagram, are in series respectively with a condenser and an inductance coil, so adjusted that when the applied pressures are in phase, the currents are in quadrature, and instead of the maximum deflection, the pointer stands at zero. If the pressures are out of phase, the pointer will be deflected to one side or the other, depending on which is the leading pressure, and when the pressures are exactly opposite the pointer again stands at zero. Thus, if one circuit is connected to the bus-bars and the other to the incoming machine, the pointer will oscillate to right and left. But the lamp at the same time is lighted and extinguished in the usual way, and as it is out when the pressures are in opposite phase, the passage of the pointer through zero at this moment cannot be seen. The result is that when the incoming machine is running too fast, the pointer is only seen while it is moving from left to right, giving a perfect illusion of continuous revolution.

Similarly, when the incoming machine is slow, the pointer appears to revolve in the opposite direction. Finally, when the speed is right and both pressures are in phase, the pointer stands at the zero index mark, and the lamp is bright. It is impossible to mistake the indications of this beautiful device, which shows to a very close approximation the relation between the phases, and clearly indicates which machine is the faster.

In the Weston power-factor meter, which is a special form of the electro-dynamometer, the movable system consists of two circular coils mounted on the same staff in planes at right angles to one another; one is not slipped inside the other, as this would render magnetic equality impossible—the coils are actually interlaced, layer by layer, where they cross and are thus practically identical.

The frequency meter is illustrated herewith, without the cover; it has a soft-iron needle, with two fixed coils at right angles, and the movable system is uncontrolled. A resistance and inductance are connected in series across the mains; one coil in series with an

inductance is then joined across the resistance, and the other coil in series with resistance is joined across the inductance. The arrangement then forms a kind of Wheatstone bridge, which is balanced at normal frequency, but any change in the frequency will upset the balance and cause a corresponding deflection of the pointer. It will be seen that a very open and uniform scale is obtained, with a high degree of accuracy. The higher harmonics are damped out with an extra inductance.

HARRY W. COX & CO., LTD.

An interesting item of this exhibit was Mr. B. H. Morphy's flux-meter, consisting of a small coil carried on a frame suitable for insertion into the air-gap of a dynamo, and provided with an arrangement of lamp, mirrors and scale to indicate the deflection when a small current was passed through the coil. The latter being mounted on a radial arm could be moved to various positions, and the field in the air-gap could thus be plotted, under all conditions of loading.

A new glass, made with lithium and twice as permeable to X-rays as soda glass, was shown in use, fitted into an X-ray tube.

GAMBRELL BROS.

This firm exhibited Dr. Lowndes's thermo-electric potentiometer, having a range of 0.5,000 microvolts and designed for the measurement of the small E.M.F.'s obtained from thermo-elements; a new pattern of discharge key for insulation resistance testing, &c, and a variety of other apparatus.

R. & J. BECK, LTD.

A new model of photometer—the "Holophane Lumeter"—was shown by this firm; it is a portable instrument consisting of a small box, fig. 17, in which an illuminated disk C can be seen, with an aperture D in the centre through which the surface to be tested is viewed. By turning a pointer H on the top of the box the brightness of the disk can be adjusted to equality with that of the object, and is read on a scale of candle-feet K. The range of the instrument is from  $\frac{1}{100}$  to 2,000 candle-feet. The screen is illuminated by an incandescent electric lamp B and storage battery. For testing the illumination of a horizontal surface, a screen can be supplied which automatically takes up a horizontal position without levelling, and a daylight attachment is also made.

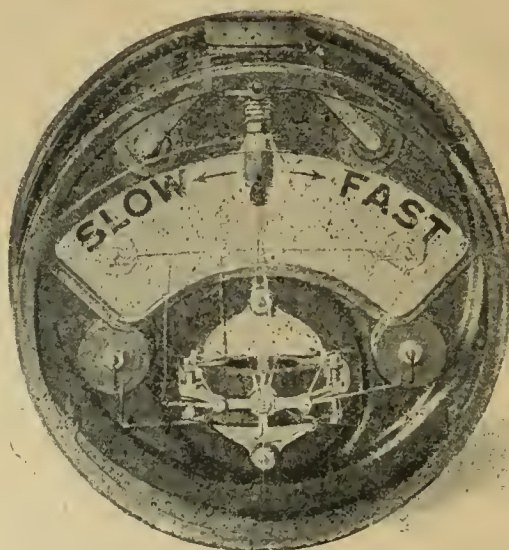


FIG. 15.—PHANTOM VIEW OF SYNCHROSCOPE.

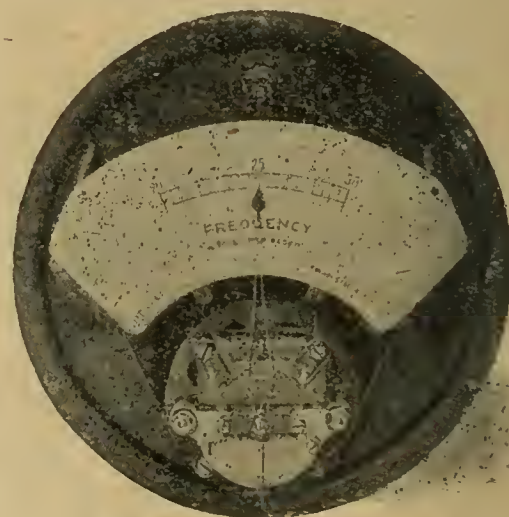


FIG. 16.—FREQUENCY METER, WITHOUT THE COVER.

Another exhibit was Dow's new candle-power standard, an extremely ingenious device in which two lamps are used—one a carbon, the other a metallic-filament lamp. The brightness of these lamps varies with the current according to different laws, and by varying the current a point can be found at which the two

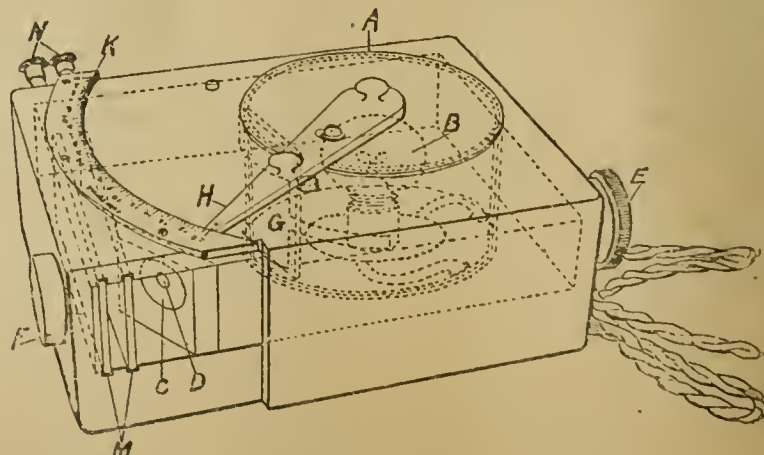


FIG. 17.—THE HOLOPHANE LUMETER.

lamps are of exactly equal power, as judged by a photometer; this is then a standard C.P., which can always be set independently of the supply voltage or any other external condition.



## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Adams "Igranic" Semi-Automatic Machine Starters.

The ADAMS MANUFACTURING CO., LTD., of Bedford, have introduced a series of semi-automatic starters for motors of small size, which ensure full protection for the machine and the starting-resistance at all times, one of which is illustrated in the accompanying figures. After closing the main switch shown below the starter, the handle of the latter is raised, and by this movement the circuit is closed through all the starting resistance. The weighted resistance arm then falls by gravity against the action of a dashpot, gradually cutting out the resistance. The main circuit is opened on the failure of supply, or on pressure of a releasing button

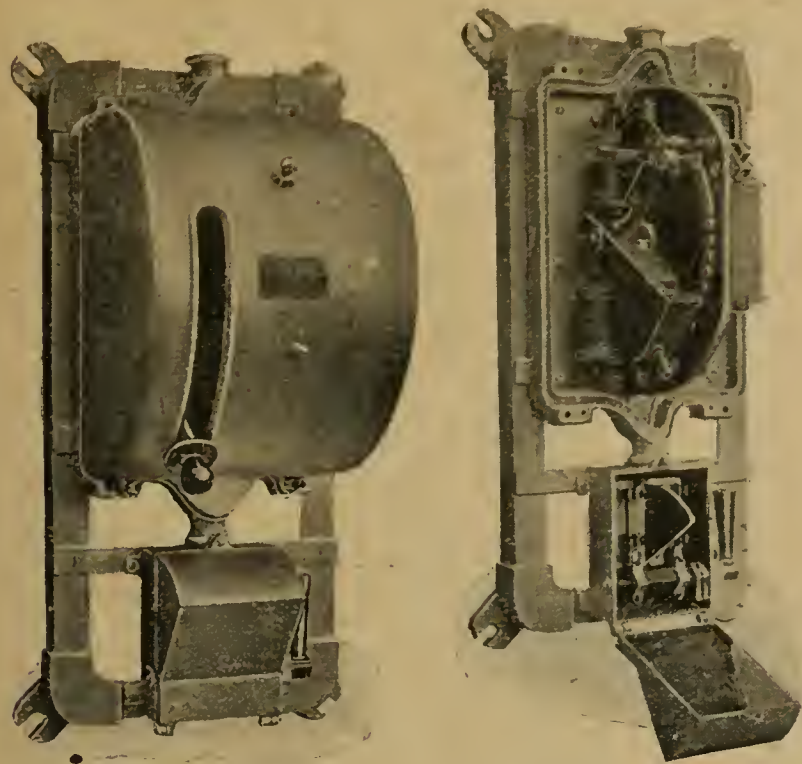


FIG. 1.—COMPLETE SEMI-AUTOMATIC STARTER.

FIG. 2.—STARTER WITH COVERS REMOVED.

there are two hot plates taking 1,100 and 700 watts respectively with lower heats controlled by switches. A smaller range is also made.

The oven will cook a three-course dinner for 12 people, consuming about 6 units; an ordinary breakfast for 12 people, consisting of



FIG. 3.—DOWSING ELECTRIC COOKING RANGE.

attached to the case of the starter, or of distant stop push-buttons. A separate regulator can be mounted on the same frame for shunt speed regulation if desired. The rate of starting can be varied by adjusting the dashpot. It will be seen that, after closing the main switch, only one operation is required to start the motor.

### Dowsing Cooking Range.

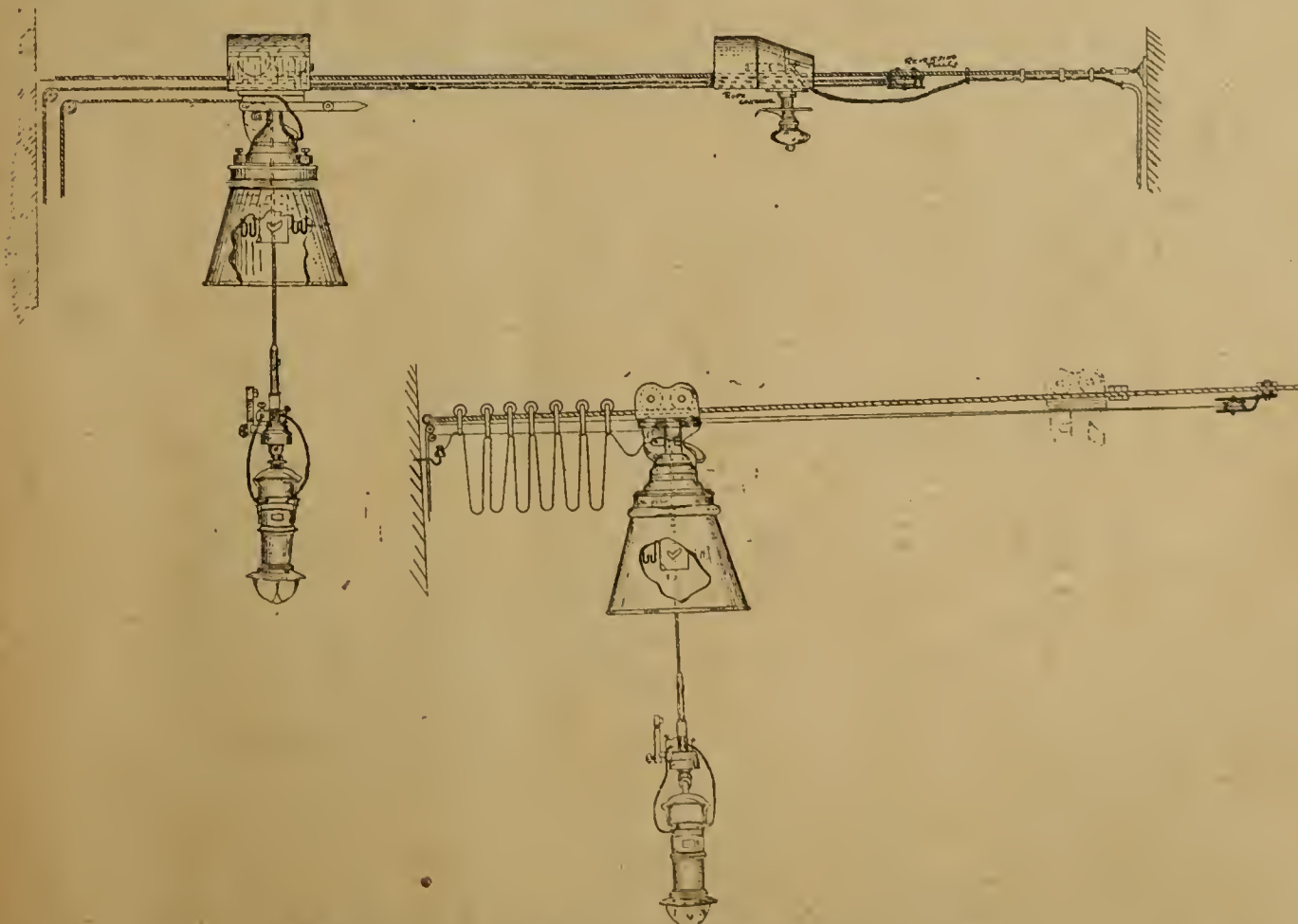
THE DOWSING RADIANT HEAT CO., LTD., of 105, Great Portland Street, W., have introduced an electric cooking range, of which we give an illustration, fig. 3. The oven is heated from the outside, and takes a maximum of 3,000 watts; a grill is provided on the top of the oven for grilling and toasting, taking 1,200 watts, and

bacon, eggs, toast, and boiling water ( $\frac{3}{4}$  of a pint per person) would require from  $1\frac{1}{2}$  to 2 units, and a lunch for 12 persons,  $3\frac{1}{2}$  units. These figures are taken from practical tests.

### Arc Lamp Lowering Gear.

THE NORTH-WESTERN ELECTRICAL APPLIANCE CO., of Darlington (formerly Cathcart, Glasgow), who make a special line of the above, have sent us some illustrations showing recent developments in connection with their equipments of arc lamp lowering gear.

Fig. 6 shows a new type of central carrier lowering head, which is operated by a single rope. The gear is the company's standard



FIGS. 4 AND 5.—TYPES OF SPAN-WIRE LAMP SUSPENSIONS

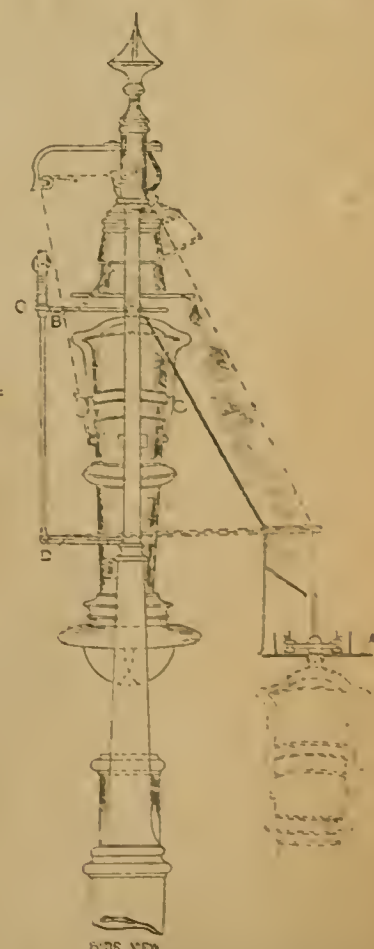


FIG. 6.—CENTRAL CARRIER LOWERING HEAD.



pattern No. 3 clip design, and has a disk of metal A attached to the lowering flange; this disk lowers on to a special-shaped fork B attached at right angles to an upright lever-arm C. When the lamp is lowered on to this, its weight carries the lever outwards. The lever-arm has a broad grooved pulley which engages with the rope, and when it is in position the lamp is lowered. The fork is so designed as to catch the plate when the lamp is being raised and lever the lamp into position and guide it up into the suspension and contacts. The attachments are very simple, and we are informed that the device is reliable and efficient. Old frames can be readily adapted to suit this lowering equipment. No unsightly span rods, or costly inner frame, are required. The gear is operated by a single rope from the side, there being no skill required in operating, as the self-sustaining direct-wind winch prevents any sudden jarring or rough usage by unskilled or careless operators.

Figs. 4, 5 and 7 show their span-wire side lowering equipments with lamp, and span-rope automatic contacts and suspension gears. Fig. 5 shows a simple and cheap arrangement; the cable is suspended on pulleys and cleats on the span-wire, and folds into the side. The lamp does not lower until it is brought to the side, and thus avoids fouling overhead wires and street traffic.

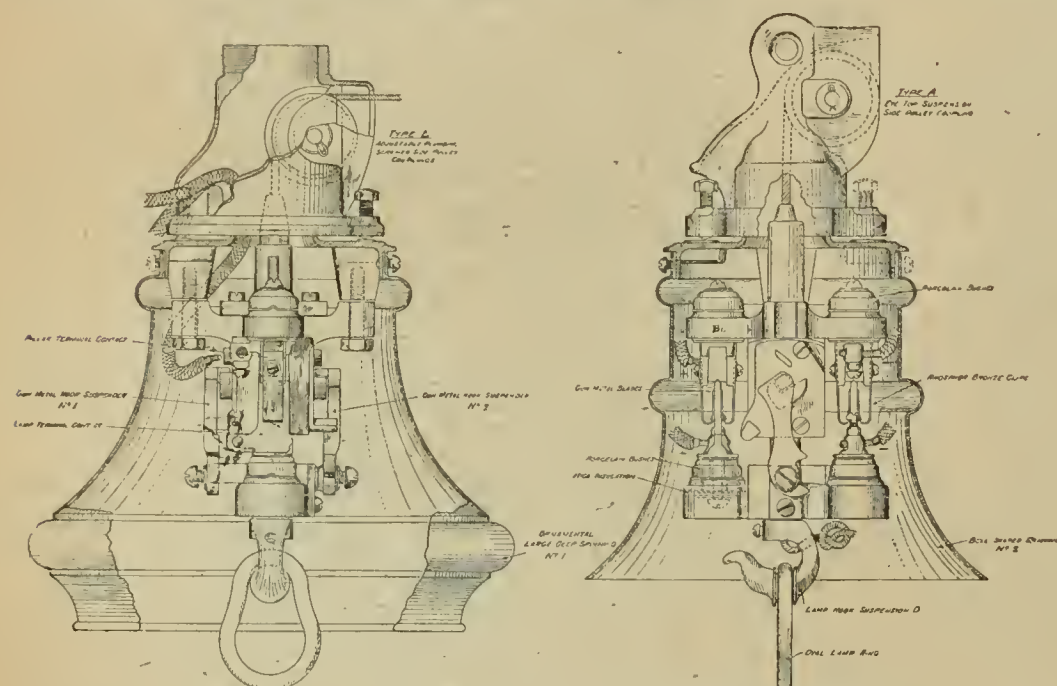


FIG. 7.—AUTOMATIC CONTACT SUSPENSION GEAR.

The company have a simple automatic suspension (only) side lowering equipment in which the cable swings down with the lamp. They also supply span-rope clamp-pulley couplings for attaching their ordinary gears to span wires, for lowering the lamps in the centre of the street instead of at the side. This arrangement, although cheaper and the simplest possible arrangement, is not suitable for busy thoroughfares.

Their Nos. 2 and 3 gears have undergone many important minor improvements and developments since they were last reviewed in our pages. We understand that they have been largely adopted by Glasgow, Belfast, Dublin, Bristol, Newcastle and other Corporations, &c., and by the British Admiralty.

The firm have recently introduced new patent gears for automatically short-circuiting the contacts when the lamp is lowered, so as to preserve the continuity of the circuit when the lamp is removed for trimming or repairs, either throwing the extra voltage into the circuit, or absorbing it through a substitutional resistance to preserve the correct voltage to the other lamps in the circuit. This enables a considerable saving in the first cost to be effected, namely, the cost of an isolating switch and automatic cut-out at the pillar base, besides other apparent advantages, such as giving a ready means of detecting faulty lamps.

Their are lamp winch is exceedingly simple in construction, and is an ingenious adaptation of the coil-clutch principle; it gives a direct wind or unwind of about 14 in. per revolution, and is self-sustaining in all positions.

## New Patent Earthing Clip.

A neat clip for earthing electrical circuits or earth wires to pipes has been put on the market by MR. A. E. INGLE, of 13, Albert Place, Bridge Street, Manchester. As illustrated, it consists of two

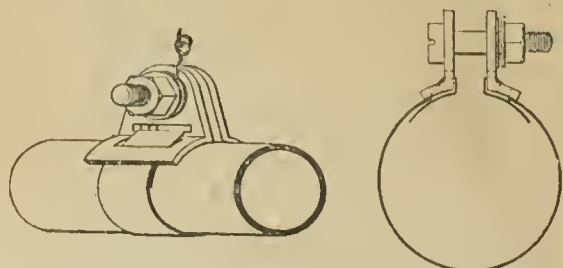


FIG. 8.—INGLEE EARTHING CLIP.

iron stampings, which, with the bolts and nuts, are Sherardised to prevent them from rusting, and a strip of tinned copper; the latter is passed round the cleaned pipe and threaded through slots in the

stampings, which are then drawn together with the bolts. As the copper tape is cut off a bobbin to suit the circumference of the pipe, and the same stampings are always used, only one size of clip need be kept in stock ; if necessary, two or three thicknesses of tape may be used, where the earth current is likely to be heavy. The stampings and tape are supplied in two standard sizes. It will be noticed that the clip is also suitable for earthing or bonding the sheathing of electric cables, and conduits.

**“Korfund” Foundation Plates.**

THE KORFUND CO., of 47, Victoria Street, S.W., are introducing into this country their patent foundation-plates, which are made of strips of selected cork, treated so as to preserve their elasticity and resiliency, and bound together in iron frames, stiffened by tie-bars. The plates are made in various sizes, and are laid under the foundation block, covering the whole area. The cork, in the substance of which air is imprisoned, acts like a pneumatic cushion, and thus forms an admirable anti-vibration layer; it is claimed that, unlike rubber and felt, the cork retains its elasticity permanently. Fig. 9 shows in section the application of "Korfund" to the

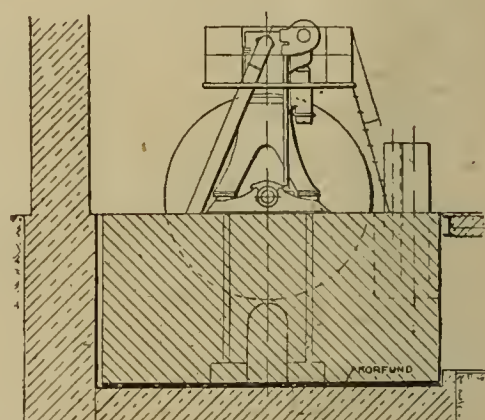


FIG. 9.—“KORFUND” FOUNDATION  
PLATE FOR DIESEL ENGINE.

foundation of a Diesel engine, for which purpose it has been very widely used on the Continent; it has also been adopted for elevator apparatus, gas engines, electric motors, &c. It is made in two thicknesses— $1\frac{1}{2}$  in. and  $2\frac{3}{8}$  in.

## Sloan Insulators.

Amongst the many insulator specialities which appear in the recent list issued by the SLOAN ELECTRICAL CO., LTD., of Conrady,

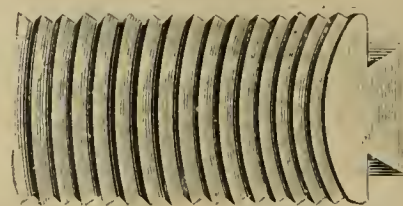


FIG. 10.

House, Golden Lane, may be mentioned a series of resistance plates, fig. 10, which can be built up to form a resistance of desired

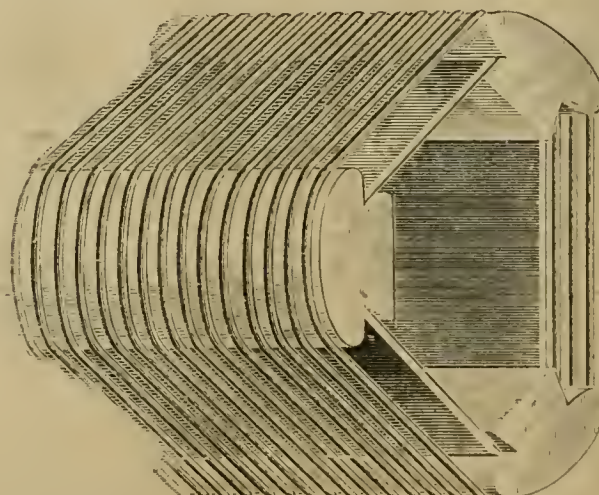


FIG. 11.

length or size, three plates being shown with distance pieces, as well as the method of winding them, in fig. 11. The plates are threaded different sizes to suit various gauges of wire, viz., 26 s.w.g. to





FIG. 12.—BUTTON INSULATOR.

14 S.W.G. An ingenious two-part button insulator for fixing flexible cord is shown in fig. 12; this insulator does not injure the flexible, and is made  $\frac{1}{2}$  in. in diameter, with a  $\frac{1}{16}$ -in. hole.

#### "Reyrolle" 10-Ampere Mining Circuit-Breaker.

MESSRS. A. REYROLLE & Co., LTD., of Hebburn-on-Tyne, have designed a 10-ampere circuit-breaker to meet the rapidly increasing demand for some means of controlling small circuits in collieries, and to supersede fuses, which are entirely out of place in a pit. As will be seen from the illustration, the circuit-breaker is of the double-pole type, enclosed in a flame-proof and explosion-proof case

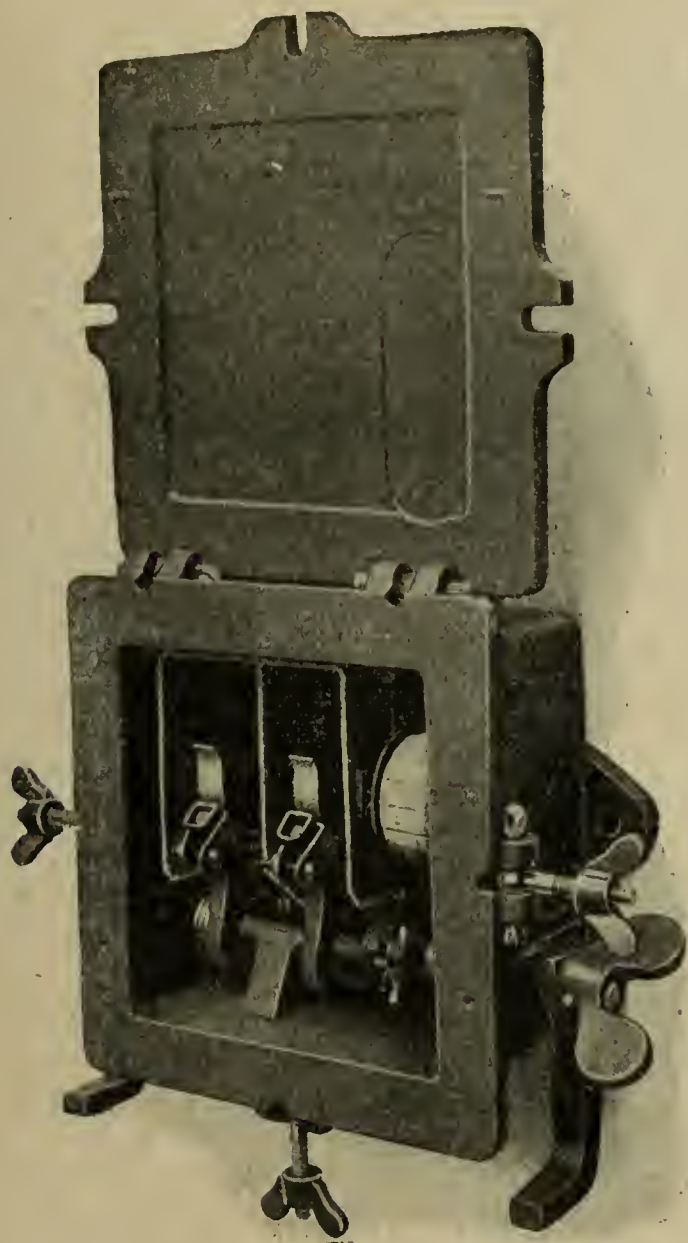


FIG. 13.—REYROLLE 10-AMPERE CIRCUIT-BREAKER.

and fitted with a cover having a broad machined face joint. The cover can be removed only when the switch is in the "off" position, and the switch cannot be put "on" until the cover is in place, so that carelessness on the part of the attendant is guarded against to a considerable extent. The circuit-breaker is of the free-handle type, and has overload protection on both poles.

**Graphite Lubricants.**—As we have received many inquiries for the address of agents for the Acheson "Aquadag," "Oildag," &c., and are unable to ascertain that these lubricants are at present on sale in this country, we may save inquirers trouble by stating that the address of the makers is the "International Acheson Graphite Co., N.Y., U.S.A."

**Shops Act, 1911.**—MESSRS. OETZMANN & Co., LTD., write as follows:—"In view of the coming into operation of the above Act on May 1st next, it appears to us that, if it be then desirable to curtail the hours of business, it is equally desirable that they should be shortened now. We have decided, therefore, to close our establishment on Saturdays at 1 o'clock instead of at 2 o'clock, commencing Saturday, 20th inst., and, in order to avoid any inconvenience to the shopping public, may we beg the courtesy of your columns."

## BUSINESS NOTES.

**New Zealand.**—The New Zealand Customs authorities have recently given a decision to the effect that "Electrical appliances, viz., electric cables in sets, with terminals affixed, enclosed in flexible tube," are to be classified under No. 176 of the Tariff, the duty being at the rate of 30 per cent. *ad valorem* on foreign productions, and 20 per cent. on British goods.

**Japan.**—According to a recent official return the number of electrical companies registered in Japan at the end of September last was 1,016, the aggregate capital of the same being £35,517,973. For the supply of electricity, there are in the country 186 concerns, while 15 are operating electric tramways, 25 working tramways and supplying current for lighting purposes, 697 are private concerns and 93 are controlled by the Government. At the date named 168 other concerns had secured charters, but had not yet commenced operations.

In cases of signing contracts for sole representation in Japan, the *Elektrotechnische Nachrichten* points out that it is needful to particularise the territories intended, as the old term Japan may be interpreted to apply to Japan proper only, and not to the land acquisitions recently made, including Korea.

**Tramcar Meters.**—We learn that Chamberlain and Hookham ampere-hour car meters are being installed on the Delhi tramcars. MESSRS. VENN & Co. have also received an order for 21 meters to equip the Ilford cars. The Nottingham Corporation is going to install the firm's type of meter on its cars, and has placed with it an order for the first 100.

**Geipel Traps.**—MESSRS. WILLIAM GEIPEL & Co. report a satisfactory increase in sales of the Geipel steam traps during 1911. For high-pressure work and large discharge their "Rapid" trap has now replaced the ordinary Geipel trap. They have also during the year introduced, for low-pressure purposes, a new type of trap called Geipel's Spirit Trap, which operates by the expansion of spirit, the spirit being contained in a cylinder, the two ends of which are formed of flexible diaphragms. A special form of this trap is supplied for the purpose of draining railway carriage heating apparatus.

Messrs. Geipel report that the results of their trading for the year 1911 have shown a considerable increase on 1910, and, in fact, upon any year since they took over the business of Messrs. Paterson & Cooper. They inform us that they have been particularly busy in their cable and carbon departments, as well as in the works which they have equipped for turning out motor-controlling apparatus. Considerable success has also attended the sale of their new Time Switch, of which the Manchester Corporation alone has over 100 in use. Further improvements have been made in Henrich carbons, particularly in their flame carbons, with the result that the business in the latter has shown a substantial increase. Yearly contracts have been obtained from some of the leading local authorities using flame arc lamps, as well as from various of the most important industrial concerns.

**Consular Notes.—Brazil.**—The British Consul at Sao Paulo reports that the abundance of hydraulic power which exists throughout the State of Sao Paulo constitutes one of the most valuable natural assets of the State. The principal waterfalls are as follows:—In the course of the Rio Grande, 600,000 H.P.; Rio Parana, 447,000; Rio Tiete, 159,300; Rio Juquary, 50,000; Rio Branco, 15,000 = 1,271,300. In addition to the above principal falls there exist a vast number of lesser falls distributed through the State, and such wide distribution is undoubtedly an advantage. There exist in the course of the Riberia de Ignapa 10 considerable falls; of the Rio Juguia and its tributaries 10 or more falls; of the Rio Paranapanema nine falls, besides many others along the slopes of the Sierra do Mar. The amount of hydraulic force actually utilised in the State at the present time represents some 80,000 H.P. Rights pertaining to the unexploited falls above mentioned are mostly vested in the State Government. The Sao Paulo Tramway Light and Power Co., Ltd., occupies a position of much importance in the city of Sao Paulo. The company was incorporated in April, 1899, under the constitution of the laws of the State of Maine, U.S.A., for the purpose of exploiting certain concessions (practically perpetual) for running street railways and for the supply of electric light and power for industrial and other purposes in the city of Sao Paulo. The company generates its electrical energy from a waterfall of the Rio Tiete, which it possesses, situated 23 miles from the city, capable of developing up to 60,000 H.P. Power is conveyed by a transmission line built upon the company's private right of way. The company works 105 miles of tramway in the city and surrounding districts. It supplies light to over 5,000 customers using some 72,000 lamps, and power to over 500 customers using nearly 15,000 H.P. The working of the Sao Paulo Tramway, Light and Power Co. has proved very successful from its inception, and year by year it has earned increased dividends for its shareholders, viz.:—During 1904, 7 per cent.; 1905-6, 8 per cent.; 1907, 9 per cent.; 1908-9, 10 per cent.; 1910, 13 per cent. At the close of 1910 the company was in a position highly gratifying to the shareholders. The directors decided, after paying a dividend of 13 per cent., to place £200,000 to the reserve fund and to carry forward £273,000 to the next account.

**Bavaria.**—The British Consul in Bavaria reports that the Bavarian Ministry of Communications have reserved to themselves for the purpose of electrification of the State Railways, the exclusive use of seven distinct sources of water-power, viz.:—Those obtainable from Lake Walchensee and from the Rivers Isar, Alz, Lech, Iller, Saalach and Lin. The rest of the water-power belonging to the Bavarian Government, amounting to about 500,000 H.P., which includes the Rivers Danube and Loisach, will be at the disposal of private enterprise. It is considered that, even



if this power is fully utilised, Bavaria will not be able to produce a quantity of electrical energy equal to the average of the rest of the German Empire, which is stated to be 15 kw. per head (Bavaria, 10 kw.). The differences between the Bavarian and the Austro-Hungarian Governments respecting the use—for generating electricity—of the River Ache and the Achensee on the frontier, which together would yield 44,000 H.P., have not yet been settled. These watercourses, rising on Austro-Hungarian territory, flow into Bavaria, and the Government of the latter country contend that Austria-Hungary has no right to claim the sole use of this power, whilst the Government of the Dual Monarchy argue that every country may unreservedly dispose of such watercourses as are within its limits. Austria-Hungary claims as compensation, if she is to give up her intention of using this water-power, the right to construct a railway connecting the Tyrol with Salzburg, which would lead through Bavarian territory near Reichenhall. This scheme is rejected, however, as the Bavarian State Railways would lose a considerable amount of traffic in Bavaria proper by the projected Austro-Hungarian line. The whole question will probably be brought before an arbitration court. The water-power of the River Isar is now being used in Munich to the amount of 3,500 H.P. in over 100 works, of which the municipality own eight and the Government four. The Bavarian Home Office granted in 1911 to a private firm the concession to utilise the water-power of the River Ammer between Unterammergau and Ammersee, a lake in the neighbourhood of Munich. The water-power obtainable is estimated to be about 28,000 H.P. Another important undertaking of the same kind will be the Leitzach Works in Upper Bavaria, utilising the waters of the River Leitzach and of the Seehamer Lake. The works, of about 10,000 H.P., will provide four large districts with electric light and power. The Bavarian Government—in order to prevent parishes wishing for the introduction of electric power being charged too high rates by private firms—offer the free advice of their official experts, who also invite tenders and examine those submitted.

Great efforts are being made to introduce ploughing by electricity in Bavaria. A society has been formed whose object is to undertake trials with the electric plough, and, for that purpose, to arrange for the necessary supply of power, which is to be provided by the Amper Works, near Munich. The trials made near the latter town, proved most successful, and will probably lead to the general introduction of electric ploughing wherever the requisite power is available.

**Poland.**—The British Consul at Warsaw calls attention to the fact that electric light is practically always installed in new buildings there, either alone or in conjunction with gas. Birmingham electroliers and electric light accessories are both cheaper and better than those procured in Germany, but British manufacturers in these lines are very little represented in Warsaw. The increasing demand for electricity in Warsaw may be seen from the following table:—

	Dec. 31, 1909.	Dec. 31, 1910.
Users for lighting purposes...	2,405	4,700
„ power purposes ...	737	
Consumption for lighting ...	2,904·261 kw.	3,435·000 kw.
„ „ power ...	2,260·888 kw.	3,365·000 kw.

Prices remained the same. The number of town subscribers to the Warsaw system of telephones reached 22,445, as against 17,744 in the previous year. Suburban and long-distance subscribers also increased. The project of the Warsaw-Lublin line was not carried into effect, nor were any other provincial towns supplied. In Lodz, as may readily be supposed, owing to the general development, the system is annually being extended.

**Private Meeting.**—BOHM LENS LAMP CO., LTD., 15, Great St. Helens, E.C., electric lamp manufacturers.—A meeting of the creditors herein was held at the offices of the company on the 9th inst., having been convened by the liquidator, Mr. Edward S. Neave. A statement of affairs presented showed liabilities to unsecured creditors, £1,553. The assets consisted only of £34, being the balance resulting from the sale of patents. It appears that the company has not been trading for some months past. No proposition was before the meeting, and the appointment of Mr. Neave as voluntary liquidator was confirmed. The following are creditors:—

B. N. C., Ltd. ..	£476
Edison & Swan United Electric Light Co. ..	32
Neave, R. & T. ..	115
Albion Electric Works ..	32
B. N. C., Ltd. ..	861
Secured creditor—	
Neave ..	600

**Supper.**—The staffs of Blackpool Tramways and Electricity Departments joined round the festive board at the Wellington and Pier Hotel, on January 10th, and a pleasant evening was spent by over 100 men. The men on duty in both departments that evening had their gathering on January 11th, when there was another happy company at the hotel. Mr. Chas. Furness, head of the tramways and electricity departments, presided. Mr. Furness proposed the “Mayor and Corporation.” Alderman Brodie responded. Councillor Bean proposed “The Blackpool Corporation Tramway and Electricity Departments.”

**The Machine Tool Association.**—On January 11th the first annual meeting of the Machine Tool and Engineering Association was held at the Midland Hotel, Manchester. The report stated that the membership was now 80, 43 firms having joined since the statutory meeting in March last. They had been in communication with the Home Office during the year respecting the adequate guarding of gear wheels of machines. It appeared

that foreign manufacturers supplied their machines adequately guarded, but British firms had lost orders, because they had failed to do so. The Association strongly advises its members to act upon the suggestions of the Home Office in this matter. Of the available space (£13,500) at the Machine Tool Exhibition of October next, £8,000 has already been definitely let. There will be a supply of electric power, steam, and compressed air for the purpose of operating the exhibits. During the year several members applied to the Association for permission to show at various exhibitions, “and permission has been given or refused according to the circumstances of the case.” The number of founders’ shares subscribed is 1,499 at 5s. each = £374 15s.

**The Trade Prospects of Indo-China.**—In the course of a very interesting report on the trade of French Indo-China, U.S. Consul General George E. Anderson, Hong Kong, says that Indo-China has come to be a trade factor of importance in the Far East and in countries trading with the Far East. Its advancement along all lines has been rapid but at the same time safe. Its trade recently has been interfered with somewhat by a lack of proper trade facilities, since its advancement has outstripped its development in such things as port improvements and commercial machinery. But the development of the country along modern lines in agriculture and in some branches of industry, and the opening up of some of its natural resources, have brought notable results and promise still greater achievements in the immediate future.

New industries are being established on an increasing scale. Three large cotton factories have been started and are reported a great success on the whole—one at Haiphong with 25,000 spindles, one at Nam Dinh with 24,000 spindles, and one at Hanoi with 10,000 spindles. The three factories produced somewhat over 351 metric tons of cotton yarn from native cotton during last year.

In Hanoi there is a large ice factory, also a match factory, a large paper-making establishment about to be put in operation, several distilleries, a brewery, furniture factories, and similar establishments. The great cement establishment at Haiphong is already one of the notable factors in export trade. During the past 10 years the cities have been laid out upon a modern plan, great waterworks establishments have been installed, the cities are lighted by electricity, the larger ones are equipped with tramways, telephone and similar conveniences, and even a subsidised opera season in theatres of more than ordinary quality is a feature of the life of the people.

Mines are being opened up, as is evidenced by increased output of zinc and other metals.

The most notable advance, however, has been in matters of communication—an advance which may be taken as largely the basis of all other improvement. During the past year the railway into Yunnan has been completed, and several lines in Indo-China itself extended; besides these improvements there were the inauguration of boat services upon several rivers, the extension of telegraph and telephone services between districts, the construction of automobile roads in various directions, and the establishment of a fairly complete wireless telegraph system all over the country.

The most notable of these accomplishments is the completion of the line into China. While the matter of further extension of these lines in keeping with French plans is held in abeyance, it is nevertheless a fact that the most practicable route from the sea-board into Szechwan Province and the great inland Empire of west China, is over this new railway through Indo-China and Yunnan Province.

The only serious drawback to the development of this interior trade along new lines is the fact that the French colony charges 20 per cent. of its full import duty on goods entering Indo-China as a transit duty across Indo-China into Yunnan and Kwangsi Provinces. This transit duty is large enough to overcome the advantage of rail haul on foreign goods going into west China, and, in spite of the railway facilities, the trade returns from Customs stations like Tang Yueh in west China show substantially the same trade in goods imported by mule back from India that has been had heretofore and before the railway’s service to Yunnan and Szechwan was possible. Such goods have actually been delivered in Yunnan Province itself after 32 days’ transportation on mule back in direct competition with railway-borne goods.

**Book Notices.**—*The Commerce of Cape Town.*—The commercial, agricultural, and manufacturing opportunities of the City of Cape Town are set forth in an official handbook, “The Industrial and Commercial Inducements of Cape Town,” compiled under the joint auspices of the Corporation of the City of Cape Town and the South African Railway Administration. The book briefly reviews facts with which the manufacturer who is considering the possibilities of Cape Town as a centre for the establishment of a local factory, will desire to be acquainted. For the establishment of factories in Cape Town and district, the handbook contains much useful statistical information and a number of illustrations. Copies of the handbook may be obtained free on application to the office of the High Commissioner for the Union of South Africa, 32, Victoria Street, London, S.W.

*The Rubber Industry.* Edited by Dr. J. Torrey and A. Staines Manders. 1912. London: International Rubber and Allied Trades Exhibition, Ltd. Price 15s. 6d. net.—This volume is the official report of the proceedings at the International Rubber Congress, held at the International Exhibition of 1911. It contains numerous papers on the question of rubber planting by experts, and on various other features of the rubber industry, from the treatment of the rubber trees to the manufacturing processes and tests, as well as a full report of the Exhibition. At a meeting of planters, chemists and manufacturers, the problem of the maintenance of a uniform standard of quality was discussed, and the extreme



difficulty of devising reliable tests for rubber was clearly evidenced. The chairman suggested that, as the real test came at the vulcanising stage, the planter should carry out vulcanising tests on the plantation, so as to master the lack of uniformity, which was "the growing evil of the whole planting industry." An important paper on "Mechanical Tests for Rubber" was read by Mr. K. Memmler, who described the methods experimented with at the Royal Prussian Testing Office of Gross-Lichterfelde. The subject of testing was also discussed by the India-Rubber Testing Committee. As a record of the work done at these and other meetings, the volume will be of permanent value to those engaged in the rubber industry.

*British Standard Definitions of Yield Point and Elastic Limit.*—This is a leaflet (Report No. 56) issued gratis by the Engineering Standards Committee (post free 1d.), in response to a request that standard definitions of these terms should be formulated.

"Quarterly Trade Journal of the British Chamber of Commerce of Turkey." December, 1911. Constantinople: The Chamber. Price 2s. 6d.

"Atti della Associazione Elettrotecnica Italiana." November, 1911. Milan: Stucchi, Ceretti e C.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXI, No. 1. January, 1912. New York: The Institute. Price \$1.

"Alternating-Current Design." By Julius Frith. 1911. London: Harper & Bros. Price 5s. net.

"Journal of the United States Artillery." Vol. XXXVI, No. 3. November-December, 1911. With Index to Vol. XXXVI. Fort Monroe, Va.: Coast Artillery School Press.

"The Post Office Electrical Engineers' Journal." Vol. IV, Part 4. January, 1912. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Machine Tools." By James Weir French. 2 Vols. 1911. London: The Gresham Publishing Co. Price 42s. net.

"Laboratory Exercises in Physical Chemistry." By J. N. Pring. 1911. London: Sherratt & Hughes. Price 4s. net.

**Canada.**—H.M. Trade Commissioner for Canada reports that the stock of catalogues of the city engineer of a town in Western Canada has been destroyed, and suggests that firms interested in water-works, tram lines, telephone lines, &c., should forward copies of their catalogues. The name of the town referred to may be obtained by British contractors and manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Calendars and Catalogues.**—THE WESTINGHOUSE BRAKE CO., LTD., 82, York Road, King's Cross, London, N.—We have received a large hanging wall calendar with monthly tear-off slips, the general design including views of Westinghouse (Morse) rocker-joint silent chain drives.

THE DOMINION BELTING CO., 91, Minories, London, E.C.—52-page catalogue containing illustrations and particulars relating to the firm's leather and textile beltings. Prices are fully tabulated for Balata, hair, cotton, duck, leather, "Pyramid" cotton, vulcanised india-rubber and other beltings, also ropes, laces and sundries. The company have recently fitted up their works with modern and improved machinery.

MESSRS. DICK, KERR & CO., LTD., Abchurch Yard, Cannon Street, London, E.C.—New catalogue of 20 pages (art paper) containing description and excellent illustrations of various forms of their automatic metallic shield blow-out circuit breakers for continuous currents for power and traction work, for which numerous repeat orders have been received from Governments, municipalities, mines, and other power-users. Line diagrams, tabulated prices, catalogue numbers and dimensions are given.

THE VALOR CO., LTD., Rocky Lane, Aston Cross, Birmingham.—Leaflet relating to their "Perfection" oil heating stoves.

MESSRS. ALFRED HERBERT, LTD., Coventry.—Finely got-up brochure, describing and illustrating their automatic stud machine with sliding turret.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, London, E.C.—A booklet has just been issued containing extracts from British technical and other papers regarding the Mazda drawn-wire filament lamps. They have also prepared a very attractive postcard illustrating their show-card design of the "Mazda" lamp—in which against a circular red background a clenched fist is shown striking a lamp, emphasising the strength quality of the Mazda lamp. Both these publications are intended for the use of contractors and others in their business, and contractors who have not yet received a supply with their name printed on them should apply to the above address.

THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., are once again supplying their friends with refills for their perpetual desk calendar issued several years ago. During 1912 on these daily slips reminders of future engagements may be indicated, the whole being preserved as a complete record of one's movements for reference.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—New edition of their booklet (42 pages) containing a description, and many interesting illustrations showing the application, of the "Magic" British-made suction cleaner.

MESSRS. KELVIN & JAMES WHITE, LTD., 18, Cambridge Street, Glasgow.—Pamphlet No. 5 revised, containing a full and illustrated description of Lord Kelvin's multicellular electrostatic voltmeters (1911 pattern) with multipliers.

MESSRS. FREDK. THOMAS & CO., 189, Drummond Street, Hampstead Road, London.—12-page art pamphlet showing illustrations and stating prices of a choice selection of cast-brass candlesticks

adaptable for electric lighting, and other metal work. Also a leaflet showing illustrations of a number of designs of luminous radiators, with iron and polished-brass frames. The firm makes a special feature of artistic electric light fittings in metal.

MESSRS. W. GEIPEL & CO., Vulcan Works, St. Thomas Street, London, S.E.—Pamphlet relating to aluminium for electrical conductors, giving extracts from reports, &c., by users in U.S.A., notes on erecting and jointing, and a table of diameters, areas, resistances, weights, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 325, containing a description, with diagrams of connections for A.C. and for D.C., of their "Winkey" leakage detector for mining work, and of the B.T.-H. selective leakage protective device; also list No. 326 briefly describing, with illustrations and prices, the B.T.-H. non-luminous radiators of several types.

THE SAFETEE CONTROLLING APPLIANCES CO., Langley Street, Luton, Beds.—Eight-page pamphlet containing brief particulars, with illustrations and diagrams and notes of prices of the "Safetee" switch fuse. The firm are also makers of controlling motor-panels and main switchboards.

MESSRS. JAMES KEITH & BLACKMAN CO., LTD., of 27, Farringdon Avenue, London, E.C.—Two circulars have been received descriptive of the "K. B." portable air blower with electric motor combined for foundry moulds, and for expelling foul air from varnish tanks, brewers' vats, &c., also for use in other industries.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Catalogue of wires, cables and accessories (Section W., fourteenth edition, 64 pages). The opening pages contain a number of tables, including one of comparison of various wire gauges, particulars of copper conductors, wiring tables, and a price calculator table prepared with the idea of facilitating estimating and costing. The general contents of the catalogue comprise particulars, with illustrations, and plainly tabulated prices, of a variety of wires and cables, lighting flexible, lift and motor-car cables, bell and telephone wires, aerial line wires, insulating materials, insulators and tools. The firm holds a very large stock of goods covered in this department.

THE TURNBULL MOTOR WHEEL CO., Bishopbriggs, Glasgow.—Pamphlet relating to the "Bullturn" patent emergency motor wheel, which replaces a damaged tire.

MESSRS. PREMIER ELECTRIC HEATERS, LTD., 258-260, Bradford Street, Birmingham.—Leaflet illustrating, and giving prices of, the "Smoothwell" electric iron, and electric water and food heaters.

MESSRS. SYKES & SUGDEN, Spring Place Works, Huddersfield.—Eight-page pamphlet containing illustrated descriptions and prices of single and double-pole "Elixum" bridge fuse-boxes, ironclad switches, the "Elixum" combined supply set, service, junction and other boxes, knife switches, tubular fuses, and feeder pillars. Copies of this catalogue will be sent on application.

**Dissolutions and Liquidations.**—JOHNSON-LUNDELL ELECTRIC TRACTION CO., LTD.—At a meeting held at Cannon Street, Hotel, E.C., on December 21st, it was resolved to wind up voluntarily with Mr. A. E. Messer, 14, Old Jewry Chambers, E.C., as liquidator.

W. ROBSON & SONS, electrical and gas engineers, 226, Westminster Road, Kirkdale, Liverpool.—Messrs. W., T. W., and R. W. Robson have dissolved partnership. Messrs. W. & T. W. Robson will attend to debts, &c., and continue the business at the same address.

ELECTRIC AND GENERAL ASSURANCE, LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. Lionel Maltby, 5, London Wall Buildings, Finsbury Circus, E.C., by February 5th.

ELECTRIC INSTALLATION CO., LTD.—A meeting is to be held at 5, Clarence Street, Albert Square, Manchester, to hear an account of the winding up from the liquidator, Mr. J. Bell.

**Trade Announcements.**—MR. LANCE FEATHER has commenced business as an electrician at 50, Nelson Street, Bridlington.

The M. & C. MANUFACTURING Co. will in future be known as the Curtis Manufacturing Co., electrical manufacturing engineers. Their address is Conduit Place, Paddington, London, W. The firm are doing a good business in cinematograph resistances for the trade and for export.

**Social and Dance.**—MESSRS. GENT & CO., LTD., of the Faraday Works, Leicester, held their annual social and dance on Tuesday evening, the 9th inst., at the Queen's Hall in that town. The first part of the evening was devoted to a concert in which the following artistes gave their services:—Miss Hubbard, Mr. W. Atkinson, pianist; Mr. J. Monaghan, Mr. W. R. Chapman, Mr. J. O'Shea, Mr. R. Hart, Mr. Riley, and Mr. C. Newton. Mr. H. Parsons presided. After refreshments, the remainder of the evening was given up to dancing. A hornpipe and sword dance by the Misses Mabel Wilson and C. Skinner were also greatly enjoyed.

**Annual Dinner.**—The drawing office of the REES ROTURBO MANUFACTURING Co. held their second annual dinner and smoking concert at the Talbot Hotel, Wolverhampton, on Monday evening, under the chairmanship of Mr. G. J. Wheeler, chief draughtsman. A humorously-worded menu had been drawn up for the dinner, and the concert consisted of songs, recitations, and 'cello solos by members of the staff and others. Mr. Finnimore's services as accompanist at the piano were much appreciated. The toasts included "The King," "The Rees Roturbo Manufacturing Co.,"



"The Artists" and "The Chairman," and were heartily responded to. Mr. P. Alebon proposed the toast of "The Company," which was drunk with great enthusiasm. Cordial appreciation of the chairman and his services in the chair were voiced by several speakers, and his health was drunk with musical honours. In responding, the chairman held out very hopeful prospects for the future of the company, which, he said, since its reconstruction, had taken up an additional line of business—viz., hydraulic work. It was specialising in the various branches of work to which the Roturbo pumps could be applied, and he had no doubt that at no distant date the name of the Rees Roturbo Manufacturing Co. would be known not only from one end of the United Kingdom to the other, but throughout the world.

**Bankruptcy Proceedings.**—THOMAS TOPPING, electrical and mechanical engineer, 361, Lord Street, Southport, Lancaster. — Mr. Registrar Howarth held a sitting at the Court House, Government Buildings, Victoria Street, Liverpool, last Monday, for the public examination of the above-named debtor. The liabilities were put at £363, and the assets were estimated to produce £148. Mr. Hadfield appeared for the debtor. It transpired that the debtor started business on his own account in August, 1910, with a capital of £30, which he had saved while in employment. He attributed his present position to losses on contracts and bad trade. The furniture at his house was purchased by his father-in-law and given to his (debtor's) wife before their marriage. The debtor executed a deed of assignment for the benefit of his creditors on December 4th last, but the deed was not registered. He only became aware of his position about a month before filing his petition, probably about the beginning of last November. An adjournment was ordered.

## LIGHTING and POWER NOTES.

**Barnsley.**—The B. of G. has decided to consider at its next meeting the following resolution which has been passed by the House Committee, viz.:—"That the time has now arrived when the question of supplying the workhouse with electric lighting should be considered, and that the Guardians be requested to appoint a Committee for the purpose."

The L.G.B. has sanctioned the borrowing of £4,620, making £17,100 in all, for electricity extensions. The time for repayment is 15 years.

**Bath.**—At a meeting of the Surveying Committee, a report was read from the Lighting Committee recommending that Queen Square, Wood Street, Charlotte Street, Queen's Parade Place, Chapel Row, Palace Mews, Princes Street, Harington Place, York Street, Old King Street, Queen Street and Queen's Parade, be lighted in future by 100-C.P. electric lamps, costing the sum of £253. In regard to this, a letter was read from the secretary of the Gas Co., which had offered to light that area, or part of the area, at £2 10s. instead of £3 10s. a year per lamp, but arc lamps would then have to be removed by the Committee for which it would have to pay. After some discussion, the recommendation of the Committee was carried. The Committee also recommended that 23 electric lamps be placed on the line of new cable to be laid through Brougham Hayes to the new Co-operative Bakery, the first instalment in the added area.

**Bedwas and Machen.**—The joint Parish Councils have assented to an E.L. scheme for the district submitted by the South Wales E.L. Co.

**Belfast.**—At the last meeting of the Tramways and Electrical Committee, Mr. Bloxam, electrical engineer, reported that his negotiations with Messrs. Willans & Robinson, contractors for the duplicate turbo-dynamo and condensing plant, had been satisfactorily arranged, and he recommended that he should be authorised to place the order, which was done. Permission was also given for extensions of the mains on the Lisburn Road.

**Bexhill.**—Under ordinary circumstances a six weeks' supply of coal is kept at the Corporation electricity works; to guard against a strike, a special supply has been ordered which will secure the running of the works for ten weeks.

**Birstall.**—The U.D.C. has resolved that application be made to the B. of T. for a prov. order under the Electric Lighting Acts for the purpose of transferring the powers granted by the Birstall Electric Lighting Order, 1901, to the Electrical Distribution of Yorkshire, Ltd.

**Bray.**—The Urban Council has resolved to raise the sum of £3,500 for the purpose of extending the electric lighting works.

**Burnham (Somerset).**—The U.D.C. has decided to insert in the draft prov. order for E.L., a clause to enable the Council to dispose of the undertaking, if necessary, to the company. A L.G.B. inquiry into the subject is to be held.

**Burnley.**—The Corporation having consented to supply electricity in the residential district of Reedley Hallows, and having applied for a provisional order, the local authority has been informed that electricity would be supplied for lighting purposes at 4d. per unit; for heating and domestic appliances at 2d.; and for power the same as in Burnley plus an additional 83½ per cent. The

supply will be given within three months of the order being received.

**Cheltenham.**—The T.C. has received the sanction of the L.G.B. to a loan of £1,250 for a motor-generator, &c.

With reference to the extension order being applied for by the T.C., the Gloucestershire C.C. has decided to oppose it if, in the opinion of the Law and Parliamentary Committee, the order would be prejudicial to the county, unless satisfactory arrangements are made by the promoters. The order seeks to include in the area of supply ten rural parishes.

**Chesterfield.**—The T.C. has arranged to supply energy on a five years' agreement to Messrs. Eyre & Sons, Ltd., house furnishers, at 3d. per unit for an annual consumption of 60,000 units.

**Chile.**—Don Pablo Fritz has obtained a concession for the establishment of an electric light service in the town of Pitrufrquen. Twelve months are allowed for the completion of the work.—*Board of Trade Journal.*

**Continental Notes.**—NORWAY.—An interesting review of the water resources of Norway is given in a recent issue of the *Christiania Tidens Tegen*. Works supplying 490,000 H.P. have been completed and are in use, while others to a total of 430,000 H.P. are under construction. On the completion of the latter, the available water-power will be nearly doubled. Several of the large schemes, for which within the last 10 years concessions have been granted, are now approaching a finish. The Mjosen is almost completed; at Samnanger, whence the city of Bergen will draw its electric supply, the most important part of the work has just been completed; that on the Tyin has only recently been taken in hand. On the Maarsvand and the Totak, which will complete the development scheme in the province of Telemarken, the distribution is deferred till the near future in consequence of the large sums which have had to be paid for expropriation. The great works contemplated near Matre and at Kinsaa, in the Hardangar district, have not yet been begun.

Besides the undertakings completed or under construction, there are the tenders for concessions which the Works Department has received for developing another 200,000 H.P.; on the Selbusjø, which the city of Drontheim will carry out, to provide 35,000 H.P.; then there are the three other large schemes—the Randsfjord, the Nidelv, near Arendal, and the Otteraa, near Christianssand. When these great works will be taken in hand cannot be said for certainty. From their importance they will probably come up for consideration in the next session of the Storting.

The development on the Nidelv or River Nid, a matter of the first moment to the city and district of Arendal, will increase the present available 28,000 H.P. to 97,000 H.P.

The development of the Otteraa includes the damming of the Biglandsfjord and the use of a series of mountain streams in the east and north of the Sättersdal. By these works 80,000 H.P. will be made available, principally to the advantage of the flourishing industries in the neighbourhood of Christianssand. The matter came under the consideration of the Storting in 1909, but on that occasion the damming of the Biglandsfjord failed to obtain approval.

The town of Hammerfest, which is the most northern town in the world, has been rebuilding its electrical works, which was one of the very first in Norway. Previously the works were driven by steam, but water-power has now been adopted. Two generators of 360 H.P. each have been installed. The generated pressure is 3,000 volts, while energy is distributed at 220 volts for motors and 130 volts for lighting.

The new electrical works at Vardö have now been completed. A Diesel engine plant of 240 H.P. and dynamos of 30 kw. each, also an accumulator battery for 216 ampere-hours, are provided. Distribution is at 2 × 110 volts, and 2,500 lamps have been installed.

The Lilleström electrical works (in a suburb of Christiania) have also been completed. Energy is derived from Kykkelerud, and alternating current is transmitted at 5,000 volts to four transformer stations, and there reduced in pressure to 220 volts for motors and 130 volts for lighting.

The town of Tromsø was one of the pioneer Norwegian towns in introducing electric lighting, for which purpose the energy was produced by means of steam power. The municipality has now decided on the harnessing of a waterfall at Simavik, situated about 20 miles from the town, which is capable of supplying 1,800 H.P. when fully developed. In the first instance only a part will be taken into use, and a sum of £27,777 was voted for the purpose of defraying the expenses in connection therewith. Owing to the town being situated on an island, the energy will have to be transmitted by a submarine cable for a distance of about ½ mile.

**HOLLAND.**—The district authorities of Wageningen, Holland, are contemplating the installation of an electric lighting plant.

**GREECE.**—It is proposed to install electric lighting in the town of Volo in Greece, and to effect this, a company with the title of "Société Electrique de Volo" has been founded. Manufacturers wishful to supply materials, machinery or apparatus necessary for the new installation, should apply to M. Glavani, the Mayor of Volo, who is director of the new company.

**FRANCE.**—The Compagnie Parisienne de Distribution d'Energie Electrique, which has carried on the supply of electricity to the whole city of Paris since 1908, intends to lower its prices on January 1st, 1913, and, in anticipation of a considerable increase in demand, has been reorganising its distribution system, erecting new substations, &c., without interruption to the existing service. The old generating stations are also to be superseded by two new works, one of 75,000 kw. at Saint-Ouen, the other of 25,000 kw. at Issy-les-Moulineaux, which are being equipped with generators of 10,000 kw. each. The company holds a monopoly of the lighting



supply, but not of power, and there is some talk of a new company with a capital of two millions sterling to supply energy to works at very low prices. The supply of electricity in the suburbs is also under consideration, and it is said that two new power stations may be erected at Creil and Laon for this purpose, while the transmission of energy from the coal mines of the Straits of Dover and the northern district is also suggested. — *L'Industrie Electrique*.

La Compagnie Electrique du Nord is erecting a large generating station at Beautor for the supply of energy for lighting and power purposes throughout the Department of Aisne.

GERMANY.—The Thuringische Electricitäts Gesellschaft is a new company which has just been formed with a capital of £300,000 to acquire and carry on the central stations in Thuringia of the Elektrizität Lieferungs Gesellschaft, a concession secured by the A.E.G. for an electric tramway in the town of Gotha and also the generating station in Gotha belonging to the Lahmeyer Gesellschaft.

HUNGARY.—The Neusatzter Electricitäts Gesellschaft is the name of a new company which has just been in Budapest with a capital of £180,000 to acquire and carry on the electricity supply undertakings in the towns of Neusatz, Peterwardein and Karlowitz.

RUSSIA.—A few months ago attention was directed to the extraordinary conditions which were imposed by the Moscow municipal council in connection with the granting of a concession to a Belgian group for the establishment of electric supply works in the city, in competition with the existing works of the St. Petersburg (1886) Electric Lighting Co. The conditions were so onerous that it was thought likely to be impossible for capital to be raised to carry out the scheme. This has apparently proved to be the case, as the holders of the concession wish to abandon it on the one hand, whilst on the other the City of Moscow is said to desire to be relieved of its obligations by retaining a portion of the deposit money paid by the concessionaires.

SPAIN.—According to an official announcement, the Compania Barcelonesa de Electricidad, in consequence of being threatened with serious competition, has decided to sell out its assets to the Canadian company, which has lately acquired large waterfalls in the Pyrenees, with the object of supplying Barcelona and its neighbourhood with light and power. The new company, whose style is the Barcelona Traction, Light and Power Co., was lately launched in Toronto with a capital of \$4,000,000. The Spanish company was formed in 1895 by the group of the A.E.G., and its shareholders are offered a price of 140 per cent., plus interest, Berlin usance, with accrued dividends up to December 31st. A limited compensation in shares of the Canadian company is also offered. The dividend of the Spanish company in 1911 will probably be the same as that earned in 1910—8 per cent. The ratification by the shareholders of the sale has yet to be made. According to *Electron* negotiations are under weigh not only for the purchase of the Barcelona-Sarria railway, but of other lines in Cataluna, as also of other waterfalls in Tremp and Pallaresa. The capacity of the waterfalls acquired in the Pyrenees is stated to be 120,000 H.P.

Madrid is served by three groups of electric companies, whose mutual relations, according to *Electron*, instead of becoming easier are tending to further complications. These groups are severally, the Hidraulica Santillana, which supplies current to Chamberi and Mediodia; the Salto de Bolarque, which has just entered into a contract to supply current to the Madrilenia; and the Hidroelectrica Española which supplies current to the tramways of Madrid, and to its allied company, La Co-operativa Electra de Madrid. The causes of dispute are the prices charged, the last-named company having reduced its charge per K.W.-hour to 0.40 peseta and abolished the charge for meters. These charges are considered to be unjustifiable and disastrous to other companies, and to the shareholders of the company itself as well as to those of the Hidroelectrica Española. A breach of compact on the part of the last-named company is alleged by the Salto de Bolarque, and legal opinion has been taken by both parties. In the view of *Electron*, the lamentable deadlock is owing less to the difficulties of the case than the incapacity of those who have directly intervened in the matter.

BELGIUM.—La Société d'Electricité du Nord de la Belgique has completed negotiations for the supply of electrical energy for lighting and power purposes to a dozen small towns and villages in the Malines district, and is in treaty for a number of other municipal contracts. The generating station at Malines, which will be put into operation during the course of the present month, comprises two sets of 3,000 H.P. steam turbines and dynamos.

Dartmouth.—The T.C. has sealed a contract with the Urban Electric Supply Co., Ltd., for the public lighting of the borough for a period of 10 years. The arc lamps are to be superseded by high candle-power metal lamps, and the candle-power of the small incandescent lamps is to be doubled.

Dundee.—At a meeting of the Electricity Committee of the T.C. last week, the electrical engineer—Mr. Harry Richardson—advised that a new sub-station be erected in Dock Street at an estimated cost of £7,200. The engineer explained that the proposal was really a necessity, as the load at present was so heavy that they had both turbines working, and the machinery in the old station was also running hard. He was of opinion that the proposed sub-station would feed the most congested area of the city, and would more than pay for itself in preventing the loss in distribution. In reply to a question, the engineer stated that when the new station at the Stannergate was opened he did not anticipate that a sub-station such as that proposed would be required for two years yet, but the demand for current had far exceeded his expectations. He also hinted that, at the present rate of progress, an extension of the new station would also be necessary soon. The matter was remitted to a Committee for consideration and report.

Dunoon.—The B. of T. has been in communication with the T.C. regarding the fulfilling of its obligations in connection with the electric lighting provisional order of 1906. The T.C. has already received three extensions of time.

Ealing.—At the last meeting of the Council, the district auditor reported that the net profit on the undertaking for the past year amounted to £1,665, as against £2,005 for the preceding year; this showed a decrease of £340. Owing to the large number of new consumers, the sales of current continue to increase in the aggregate. The total of loans raised amounts to £144,594.

Edinburgh.—A meeting with a view to promoting an electrical exhibition was held on January 12th. Mr. G. W. Crawford pointed out the desirability of holding the exhibition in view of a probable gas exhibition in the city. It was finally agreed that it was desirable to hold such an exhibition, and a Committee was appointed to inquire into the financial support which may be forthcoming.

The Corporation Electric Lighting Committee has purchased sufficient coal to meet the requirements of the undertaking until May 15th. The supply has been augmented owing to the possibility of a miners' strike, and partly owing to the fact that the condensing plant has not been completed.

Gellygaer.—The U.D.C. has declined to allow the Rhymney Valley Electric Supply Co. to use overhead wires for the purpose of supplying current to Gilfach, Church Place and Heolddu, where there are many applications for current. The Council demands the use of underground cables.

Goole.—In regard to the proposed electric lighting schemes for Goole, which have been suggested at the instance of the Electrical Distribution of Yorkshire, Ltd., and Mr. James W. Speight, the members of the U.D.C. were hurriedly called together on Monday—the last day for lodging objections—and decided to lodge objections with the B. of T.

Gravesend.—The T.C. has now decided to support the Bill of the I.M.E.A., and to contribute up to £10 towards the cost.

As the result of arbitration, current is to be supplied by the T.C. to the Tramway Co. for seven years from August 7th, 1910, at 2d. per unit up to 180,000 units a year; 1.3d. per unit between 180,000 and 280,000 units; and .8d. per unit beyond. These rates are subject to agreed coal clauses.

Harrogate.—Further extensions are to be made in lighting the streets with electricity.

Hazelgrove and Bramall.—The U.D.C. has decided not to assent to the application of the Stockport T.C. for permission to supply current to the owner of the Woodlands Estate, Offerton. A committee has been appointed to consider the advisability of the Council obtaining its own provisional order.

Heckmondwike.—The L.G.B. is to be asked for an answer to the application of the U.D.C. for sanction to borrow over £20,000 on the electricity account, in regard to which an inquiry was held in May last. Most of the money has been spent, but the Council has decided that other pressing work must remain in abeyance pending the Board's decision.

Knaresborough.—The R.D.C. has assented to the Harrogate T.C. laying electric cables in the district on the payment of 1s. per annum in respect of each highway utilised for the purpose.

Launceston.—At a meeting of the T.C. recently, Mr. J. H. B. Prouse asked what steps had been taken to carry into effect the resolution passed at the last meeting to procure an estimate of the cost of electric light installations at the Guildhall, Town Hall, and Public Library. Dr. Thompson, chairman of the Launceston Gas Co., thought they should also ask for an estimate for lighting these buildings by incandescent gas in place of the antiquated gas burners now used. The Corporation settled the matter by inviting suggestions for the better lighting of the public buildings of the borough.

Leeds.—The Micklefield Coal Co. is opening new pits at Kippax, near Leeds, which have certain points of interest, in that the terms of the lease stipulate that no chimney shaft will be permitted after the sinkings are completed, and also provide for an ornamental winding house, and the planting of the dump with trees and shrubs, &c. In order to comply with these requirements, electrical power is being largely used, the supply being obtained from the Yorkshire Power Co. through a local sub-station, and fed at 2,000 volts to a Lahmeyer rotary-converter set with a 10-ton fly-wheel, which in turn supplies two 400-H.P. 200-volt motors direct-coupled to an 11-ft. winding drum. The whole of the haulages are to be driven by compressed air, the compressor, and presumably pit pumping, being electrically operated. A second pit and winder are also to be erected near the first one, but the whole of the output will be taken about 2½ miles to screens at another of the company's pits, in order to safeguard the beauty of the neighbourhood, which is residential in character.

Liverpool.—In view of the recent controversy on the Corporation electricity supply, it is interesting to note that the report of the electrical engineer upon the supply for 11 months to the date of the report, shows a considerable increase in the use of current for power. The units supplied from January 1st, 1911, to November 30th, for lighting were 8,279,473, an increase of 1.35 per cent. on the corresponding months in 1910; for traction,



20,575,097, an increase of 1'442 per cent. ; and for power, 4,821,019, against 3,701,821, an increase of 30'234 per cent. The total number of units supplied during the period was 33,675,589, compared with 32,150,416 for the eleven months of 1910.

**London.**—**HAMPSTEAD.**—At the meeting of the B.C. on January 11th a letter was received from Mr. G. H. Cottam resigning his position as chief electrical engineer. The Lighting Committee recommended that the resignation be accepted, and the engagement terminate on July 12th. An amendment that the engagement terminate in three months was defeated by 22 votes to 10, and the Committee's recommendation was then agreed to. The Lighting Committee further recommended that the question of granting a superannuation allowance to Mr. Cottam be referred to the Finance Committee. After discussion it was resolved that the further consideration of the matter be postponed for three months, or until the L.G.B. inquiry into the lighting expenditure. The Lighting Committee further reported that it had considered a letter from Mr. E. Sayer, expressing surprise at being summarily dismissed from his position as chief assistant electrical engineer without having any opportunity of defending himself before the Council, and asking to be paid three months' salary in lieu of notice. It was decided to repudiate liability for the payment of the salary.

**MARYLEBONE.**—£2,650 is to be borrowed from the L.C.C. for the period of 12 years for storage batteries for the electricity undertaking.

**BERMONDSEY.**—Sanctions have been received from the L.C.C. to the erection of (1) an addition to the boiler house at the electricity works, and (2) for an extension of the existing condenser plant. Such consents, however, do not include any sanction to the Borough Council's proposed loan, sanction for which was refused by the County Council in November last.

**Lowestoft.**—At the last meeting of the Council the auditor's report on the electricity undertaking was adopted, which showed a net surplus for the year of £99. £854 has been debited to the revenue account for the purpose of redeeming loans, and £3,723 has been spent on capital account, and for part of this amount no sanction has been received from the L.G.B., but application had been made for sanction to cover this capital expenditure.

**Lytham.**—In reply to the representatives on the matter, the U.D.C. has been informed by the B. of T. that in view of the efforts being made by the Lytham Electric Light and Power Co., Ltd., to proceed with the scheme for electric lighting, the department had for the present decided to defer the revoking of the provisional order.

**Marazion (Cornwall).**—An electricity scheme for the parish is under contemplation between the P.C. and the Cornwall Electric Power Co.

**New Zealand.**—A New Zealand municipality has under consideration a scheme for the installation of electrical power plant for tramway working, house and street lighting, drainage and water works pumping, and general industrial uses. It is proposed to equip the station with Diesel oil engines. The proposal involves the flotation of a loan of about £11,000; particulars may be obtained by British manufacturers on application to the Commercial Intelligence Branch of the B. of T.

**Newport (Fife).**—At a meeting of the Town Council last week a motion was put forward by one of the members that electricity for lighting and power purposes be supplied throughout the burgh, and that a committee be appointed to ascertain the terms upon which a supply could be obtained from Dundee, and alternatively, the cost of the erection and maintenance of a generating station in the burgh. It was also suggested that information might be obtained as to the terms upon which the Tayside Electric and Gaslight Co.'s undertaking could be acquired. The motion, on being put to the meeting, was defeated by six votes to three.

**North Cray.**—The Bromley (Kent) R.D.C. has consented to the order being applied for by Bexley U.D.C. to enable the latter to supply current to the parish of North Cray.

**Nuneaton.**—The T.C. has applied to the L.G.B. for a loan of £1,850, for a feeder and feeder booster needed in connection with a supply of current to the Griff Granite Quarry.

**Oldham.**—The General Committee of the Equitable Co-operative Society has decided that the Society should cease to generate its electricity and that in future the supply should be obtained from the Corporation. It is found that the plant is not capable of supplying energy as economically as it can be purchased from the Corporation.

**Paisley.**—The manner in which the recent arrangement came to between the Corporation and the tramway company is working—whereby a flat rate was fixed for current—may be judged by the electrical engineer's monthly report. From November 17th to December 16th the electric current supplied to the Paisley District Tramways was 112,788 units at '975d., which raises the current consumed from May 17th to December 16th to 834,788 units at £2,958. Over the corresponding period of the previous year the current consumed was greater by 44,541 units, but the income had fallen off by £865.

**Rhyl.**—The Council has decided to apply for a loan of £500 for additional electric service required at the Marine Lake in connection with various enterprises to be introduced by the Rhyl Amusement Co., Ltd. Special terms for lighting and power have been arranged between the Council and the company.

**Sherborne.**—The U.D.C. has passed a resolution consenting to the application for a prov. order for E.L. by Messrs. J. & W. Purves, of Exeter, who undertake to supply current for public lighting at not more than 3d. per unit.

**Sidmouth.**—A meeting of ratepayers was held on Friday last to discuss the question of the proposed purchase of the Sidmouth Gas and Electricity Co. by the Urban District Council. Mr. T. Kennet-Were presided, and explained to a large assembly the steps which had been taken in the matter. A resolution approving steps to enable the Council to acquire the undertaking of the company was carried by a large majority.

**Skegness.**—The U.D.C. is in communication with several experts who have offered their services as consulting engineers in connection with the proposed electric lighting scheme.

**Southampton.**—The electrical engineer has reported that the receipts of the electricity undertaking show an increase for the half-year ended September 30th last of nearly £2,700 over the corresponding period of last year, while the estimated increase up to March 31st, 1912, was put at £2,837. Thus there was every reason to anticipate that at the end of the present year the income would be some £5,000 or £6,000 more than what it was in the previous 12 months; 25 per cent. more units were sold than for the same period 12 months ago, and the returns for the current half-year indicated a still greater increase. On the suggestion of the engineer, it has been decided to apply to the L.G.B. for sanction to borrow £9,600, the estimated cost of providing additional plant for next winter's load. Such plant is to be the exact duplicate of that last installed. Application is also to be made to borrow £2,000 for motors, £1,000 for radiators, £3,500 for services, and £1,500 for meters.

**Swindon.**—The T.C. has received the sanction of the L.G.B. to loans of £1,600, £1,500 and £410 for electricity purposes.

**Teignmouth.**—The U.D.C. has referred to a committee of the whole Council the question of applying for a prov. order for E.L.

**West Hartlepool.**—At a meeting of the T.C. on the 9th inst., the Electricity Committee reported the receipt of a letter from the I.M.E.A. asking for a contribution towards the expense of promoting a Bill to amend the Act relating to electric lighting. Ald. MacFarlane (chairman of the Committee) said the Committee had decided to take no action. Ald. Robson, who said he was speaking for the majority of the Committee, said the object of the Association was to obtain powers to enter into a retail trade in competition with tradesmen in the sale of various fittings for houses. For that reason alone the Committee decided not to support the Bill. Ald. MacFarlane said all the Bill proposed to do was to put municipalities in the same position as gas companies. After further discussion the minute was sent back to the Committee.

**Whitehaven.**—The T.C. has again deferred consideration of a scheme for assisted wiring, submitted by the electrical engineer.

Mr. Thos. Richardson, M.P., has informed the T.C. that he will support in Parliament the Bill of the I.M.E.A. seeking wiring powers for local authorities.

**Widnes.**—The T.C. on January 9th signed an agreement with the Mersey Power Co. for a supply of electricity. The necessary connections with the power station are being made, and the supply will shortly be available.

**Winchester.**—The T.C. has adopted a schedule of wiring prices on the deferred payment system.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The T.C. has, by 29 votes to 4, adopted the recommendation of the Tramways Committee for a system of rail-less traction for the Footdee district, the route to be from Market Street, along the quays to the east end of York Street. It was agreed that a communication be addressed to the Harbour Commissioners for consent to application being made for the requisite powers to carry out the scheme.

**Argentina.**—The Paraná Municipality has granted a concession for an electric tramway to a company represented by Dr. Juan V. Garcia. The concession is for 90 years, after which it will pass over to Corporation.

**Ashton.**—Further trouble is threatened by the employés of the three tramway authorities running into Ashton-under-Lyne. Some time ago Mr. Ernest Moon, K.C., representing the B. of T., sat as arbitrator, and his award appeared to give satisfaction. After a few weeks' trial the men are dissatisfied. They complain that each of the three authorities is carrying out the terms of the award differently; that the conditions generally are not in the spirit of the award; and that they do not get the full period allowed for meal times. They are desirous of another visit by Mr. Moon, and are threatening to strike.



**Belfast.**—The revenue account of the tramways department for the nine months ended December 31st last, shows a balance at credit of net revenue of £30,157. The general manager's recommendation that in view of the satisfactory state of the finances, £13,000 be appropriated and placed to the credit of the depreciation account and invested, has been adopted by the Committee. One hundred motormen have won the annual bonus for careful driving and freedom from avoidable accidents during the past year, and of that number 14 had gained special commendation. One hundred and twenty-six conductors received the bonus for accuracy in their cash and daily accounts during the same period, 43 of these being commended for special accuracy. It is advised by Mr. Nance—and the Committee has under consideration the proposal—that a system of profit-sharing be adopted under which the tramway staff will benefit each year to the extent of 10 per cent. of the amount of the excess of revenue over expenditure.

**Bradford.**—The first accident to happen in connection with the new railless trolley system of the Corporation occurred last week on the route between Dudley Hill and Laisterdyke, when, as the result of the trolley leaving the overhead wires, the car, which was going down-hill, swerved heavily and smashed through a wall into a field. The steering gear was severely damaged, and the conductor was injured and removed to the infirmary.

**Brighton.**—At the public meeting convened to consider the proposed Parliamentary Bill for railless traction powers, the voting resulted in a majority of 6 in favour, and a written demand for a poll of the town has been put in by opposers of the scheme.

**Continental Notes.**—**FRANCE.**—It is recognised that an improvement in the traffic at the Saint Lazare Station, Paris, can only be effected by electrifying the suburban railways, a matter which has been under consideration for a long time; but, according to *l'Industrie Electrique*, the Minister of Public Works has suddenly given orders to suspend the preparation of a scheme of this nature. The Orleans Co. is contemplating the electrification of the line to Sceaux, on which the steam trains give rise to foul fumes in the Luxembourg tunnel, and has sent an engineer to the United States to study the work that has been carried out there. Our contemporary fears that the result will be the placing of large orders abroad, although French engineers are perfectly competent to do the work.

**AUSTRIA.**—The Istrianer Electricitäts und Kleinbahn Gesellschaft has secured a preliminary concession for the construction and working of an electric tramway in the town of Pola.

**ITALY.**—The Consiglio Superiore dei Lavori Pubblici have acceded to the applications for the following concessions:—For the construction of an electric tramway between Lucca, Camaiore and Pietrasanta, with Government subsidy; for an electric tramway line connecting Milan, Balsamo and Cinisello, with a branch to Sesto San Giovanni; an electric tramway line from Velletri to Genzano, for which the Società delle Tramvie e Ferrovie di Roma are applicants; and the establishment of an electric tramway service in Modena.—*Giornale dei Lavori Pubblici*.

**GERMANY.**—The electric express railway projected between Cologne and Düsseldorf appears to be approaching realisation. The track has been decided upon. The railway is purely a municipal line, to serve the passenger traffic between the two cities named. It is designed solely to serve the purpose of speedy transit. At first a 20-minute service will be established, which is intended to be increased later to a 10-minute service. With regard to the Cologne section, it will be carried out by Rhine firms. The course chosen is the left Rhine bank, the river near Düsseldorf being crossed by substantial bridges. The track is to be 35.4 km. long, exclusive of 4.7 km. within the purlieus of Cologne and Düsseldorf.—*Elektrotechnik und Maschinenbau*.

**SWITZERLAND.**—The energy required for the electric working of the Gotthard Railway will, according to the scheme of Engineer Kummer, with a 30 per cent. increase of traffic over 1907, be supplied by three generating stations, namely, the Amsteg (20,000 kw.); the Göschenen (13,000 kw.); and that on Lake Rittom (30,000 kw.). The total cost of the undertaking in this case will amount to £2,480,000. Working costs should come out at 30 per cent. lower than steam.—*Zeitschrift für das gesamte Turbinenwesen*.

**Crewe.**—The question of introducing the railless traction system is engaging the attention of the Corporation. It is suggested that there should be four miles of route with a quarter hourly service; the first cost would work out at about £1,500 to £1,600 per mile.

**Doncaster.**—By 6 votes to 4 the Tramways Committee has decided that the extended tramway to Brodsworth shall be on sleeper track in preference to adopting the railless trolley system.

The Committee has resolved that application be made for an order to extend the tramway from Balby to Warmsworth, so as to link up the town with the Edlington colliery village.

**Dundee.**—The working of the tramway parcel traffic between the city and Broughty Ferry has been considered by the Corporation Tramways Committee, Mr. Fisher, the manager, giving it as his opinion that it would be to the interest of the Department to extend its business as parcel carriers. A sub-Committee was appointed.

**East London Railway.**—The half-yearly report of this company refers to the preliminary work and financial arrangements in connection with the electrification of this railway; specifications, plans, &c., have been completed for both electric traction and automatic signalling.

**Edinburgh.**—The burgh engineer is to confer with the engineer of the Tramways Co. with a view to fitting up a car with a new type of life-guard. A Sub-Committee of the Council Tramways Committee is to meet representatives of Leith T.C. regarding the adoption of railless traction instead of tramway extensions. The Tramways Committee has considered the possibility of running double-decked cars to the terminus at Gorgie; a railway bridge, it appeared, presented a difficulty, and the town clerk is to communicate with the Railway Co. and the Tramways Co. on the matter.

**Fife.**—The Fife Electric Power Co. having taken over the Wemyss Tramway Co., Ltd., numerous changes are to take place in the staff of the company at Methil. The manager is to be retained, but the others have received notice terminating their engagements.

**Jarrow-on-Tyne.**—At a meeting of the T.C. on the 11th inst. a letter was read from the B. of T. in reference to a communication from the Council as to the proposed transfer of the Jarrow and South Shields Light Railway Order, 1901, to the Jarrow and District Electric Traction Co., Ltd. The letter stated that the Board was not aware that there was anything in the position of the purchasing company which would justify the Board in refusing to consent to the transfer, and, in the absence of any specific objection from the Corporation, the Board proposed to sanction the transfer of the undertaking.

**Leeds.**—The trials of weather screens on the tramcars have proved satisfactory. During the recent period of bad weather comparisons were made on screened and unscreened cars travelling over the severest route on the Leeds system. When the proposal was first mooted a great majority of the drivers were opposed to it, holding the view that a screen would impede clear vision. On the dozen or so cars on trial, however, the screen is fitted with an adjustable shutter in the front panel which overcomes this objection. The screens have been manufactured at the tramway workshops, and the Tramways Committee is shortly to discuss the advisability of fitting screens to all cars in use on exposed routes.

**Lowestoft.**—At the last meeting of the Council the Tramways Committee reported an increase of £1,040 in receipts to date, as compared with the corresponding period of last year.

**Nuneaton.**—The T.C. has under consideration the question of a tramway installation for the borough, and an inspection has been made of the railless traction system at Leeds. The matter is to be fully gone into at the February meeting of the Council.

**Paisley.**—The Sub-Committee on By-Laws of the Town Council has been in negotiation with Mr. Coutts, the general manager of the Paisley District Tramways, with reference to the question of overcrowding and lack of ventilation on the company's cars. Mr. Coutts explained that the main congestion was on the Paisley and Renfrew section, and that it was impracticable to provide an additional service during the hours when the pressure of workmen's cars was on, as not only was there a difficulty regarding plant, but the lines, as laid, would not carry more cars without additional feeders. He also objected to the provision of larger cars on the ground that these would necessitate the laying of heavier rails, and the use of trailers he considered dangerous. As to improved ventilation, Mr. Coutts stated that the cars were being fitted with ventilators of a different type.

**Ramsbottom.**—The proposal of the Council to promote a Bill in Parliament for the provision of a system of railless traction in Ramsbottom, was explained and considered at a public meeting of townspeople, on January 10th. Councillor Stockdale said it was proposed to run railless cars by overhead equipment from Holcombe Brook to Edenfield, along 3½ miles of road, and powers of extension would be secured. There would be a half-hourly service, and the estimated cost of the scheme was £9,250. The half-hourly service and the proposed route were criticised, but eventually a resolution was carried approving the scheme.

**Stalybridge.**—With reference with work being carried out in Stalybridge by the Joint Board, the Highways Committee of the T.C. recommended that the Board should be informed that the provisions of the Tramways Acts and the Electric Lighting Acts, with reference to the giving of notices prior to the commencement of any further works, must be complied with. Councillor Bottomley, at the meeting of the Stalybridge Council, said the Board, he believed, had always advertised in the local papers when it had been its intention to do work of that kind, and he thought that it had thereby done all that was necessary to comply with the Act of Parliament.

**Swinton and Pendlebury.**—On the minutes of the Tramways and Electricity Committee coming up for adoption at the meeting of the Council, several members expressed dissatisfaction with the single-deck electric cars which the Salford Corporation is now running over the local route. It was decided that the clerk write to the Corporation requesting the withdrawal of the cars from the local service on the ground of their being dangerous.

**Twickenham.**—The Highways Committee has decided to prepare a petition against the Southall, Hounslow and Twickenham Railless Traction Bill, on the ground that there were several portions of Whitton Road unsuitable for railless traction unless widenings were effected; also that the protection clauses of the Bill required strengthening materially. When satisfactory clauses are obtained the petition will be withdrawn.



**Venezuela.**—A concession has been granted for the construction of a railway from either the Orinoco or the Caroni to El Callao. Four years are allowed for carrying out the work. Under the terms of the agreement the concessionaire may utilise the waters of the Rivers Caroni and Cano del Toro with the object of generating electric power for railways, tramways and other industrial purposes.—*Board of Trade Journal*.

**York.**—The Tramways Committee has under consideration the possibility of utilising railless cars in connection with an extension to Heworth. The laying of tramways down Bootham, and by means of a bridge over the Ouse near Clifton, extending the system to the Leeman Road area, is also to be discussed.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—It is reported in the *Australian Mining Standard* that in view of the litigation between the Marconi Co. and Messrs. Siemens Bros. & Co., regarding wireless telegraph patents, and the great delay which has already been incurred in the establishment of wireless stations round the coast of Australia, the Commonwealth Government has decided to proceed with the work, using a system recommended by Mr. Balsillie, the Government wireless expert. If infringement of existing patents is proved, the Government will pay for it. Under the present circumstances the Government cannot take the responsibility of adopting either of the contending companies' systems. Four stations will be erected at once.

**Communication with Australia.**—A return showing the progress of Press cable communication between London and Australia during recent years, by way of the Pacific and the Eastern Extension Company's lines, states that the number of Press words received *via* Pacific for the year ended December 31st, 1909, was 21,635, and for the year ended September 30th, 1911, 463,726. (It was in 1909 that the Press rates were reduced.) The number received *via* Eastern for the first period was 218,467, and for the second 220,214.—*Australian Mining Standard*.

**Telegraph Mechanics.**—At a meeting of the Nottingham Branch of the P.O. Telegraph Mechanics' Association a resolution was carried protesting against the Postmaster-General's reclassification scheme, whereby it was alleged the work of highly-skilled mechanics had been depreciated and put upon a scale of pay far below its commercial value.

**United States.**—Recently it was announced that the Postmaster-General would recommend the Government to purchase the telegraph systems of the United States and work them as part of the postal service; the cost of the purchase was estimated at 100 millions sterling. It appears, however, that little importance can be attached to the statement. A proposal to purchase the Canadian telegraph and telephone systems will shortly be made in the Dominion Parliament; at present the rates charged by the companies are very uneven.

**Uruguay.**—The Government has issued a decree making it obligatory that all passenger vessels trading with Uruguayan ports shall be provided with wireless installations before May 1st.

The Government is reported to be taking active measures for placing the telephone wires underground, and at the same time adopting the automatic system for exchanges.—*Review of the River Plate*.

**Wireless in Warfare.**—A writer in the *Times* of January 6th gives some particulars of the wireless telegraph equipments used by the Italian army of occupation in Tripoli. At the commencement of the war Italy possessed about a dozen wireless field stations, mostly Marconi 1½-kw. sets, which can work over 100 miles and can be erected in 20 minutes. The equipment, including carts and *personnel*, weighs in all under 60 cwt. Changes in wave length are effected by the movement of one handle; the transmitter is not sharply tuned, but the receiver is capable of very sharp tuning. Secrecy is secured by frequent changes of wave length and the use of different codes.

**Wireless Telegraph Conference.**—It is stated that the next International Conference for wireless telegraphy will take place in London on June 4th, when representatives of all Governments which are parties to the Berlin Convention will be present. The total number of wireless stations throughout the world is computed at 1,100, of which 869 are on merchant vessels. Of the latter, Great Britain is credited with 305, the United States with 205, Germany with 143, Italy with 51, Holland with 35, and France with 31.

**Wireless Telegraphy.**—On January 11th, says the *Times*, the Cross Sands Lighthouse, near Yarmouth, reported by wireless telegraphy that the German brigantine *Fulke* had stranded on the sands during a fog. In reply to the message the Caister lifeboat was sent out and rescued the crew.

According to an American Consular report, the Mexican Government announces the early establishment of a series of wireless telegraph stations along the coast of Lower California.

**Wireless Telephony.**—The outcome of the complaint made by Mr. Grindell-Matthews, at the end of September, that during a demonstration of his wireless telephone system at the War Office, experts attached to the War Office took notes and made sketches of the apparatus without permission, and contrary to agreement, is that on January 10th the inventor addressed a letter of apology to the War Office, and completely withdrew the charges which had been made and published in the Press.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—January 24th. Three Lancashire boilers and two 1,500-kw. turbo-alternators, for the Corporation. See "Official Notices" January 5th.

**Australia.**—N.S.W. GOVERNMENT RAILWAYS.—January 22nd.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

February 7th.—The Prahran and Malvern Tramways Trust, Melbourne, are inviting tenders for 1,272 tons of tramway rails. Specifications and forms of tender, £2 2s. (returnable), from J. Coates & Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C.

February 19th.—Wire-testing machine, for the Postmaster-General's Department in Tasmania. See "Official Notices" January 5th.

MELBOURNE.—March 5th. Telephone material (Sch. 612). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

**Austria.**—KIRCHBICHL.—January 27th. Tenders are invited for the supply of an electrically-driven winding engine and other mining machinery. Particulars, K. K. Bergverwaltung in Kirchbichl.

**Belgium.**—January 29th. The municipal authorities of Vaux-sous-Chevremont (Liège) are inviting tenders for the establishment of a central electric lighting station in the town.

March 1st.—The Belgian Direction Générale des Ponts et Chaussées in Brussels (38, Rue de Louvain) are inviting tenders for the supply and erection of a 40-ton electric crane at the port of Ostend.

**Belgrade.**—January 17th and 22nd. The Servian State Railway Department requires tenders for the supply of 1,400 oak railway sleepers and oak telegraph poles.

**Bulgaria.**—January 29th. The municipal authorities of Phillipopolis are inviting tenders for the concession for the electric lighting of the town.

**Burnley.**—Lighting battery for the Workhouse, for the Guardians. See "Official Notices" January 5th.

**Burton-on-Trent.**—January 27th. One 1,250-kw. turbo-alternator, and other electrical and steam plant for the Corporation. See "Official Notices" January 12th.

**Cheltenham.**—January 23rd. Electric light fittings, for a year, for the T.C. J. S. Pickering, borough engineer.

**Croydon.**—January 29th. Mixed-pressure turbine plant, for the Corporation. See "Official Notices" January 5th.

**Dartford.**—January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" December 15th.

**Dublin.**—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

**Exeter.**—February 2nd. Vulcanised rubber cables, distribution fuseboards, distribution switch and fuseboard, steel conduits and fittings, for the Visiting Committee of the Asylum. See "Official Notices" January 12th.

**Halifax.**—February 5th. Stores and materials for a year, for the Corporation Electricity Department. See "Official Notices" January 12th.

February 12th.—Stores and materials required by Tramways Department during year ending March 31st, 1913. Forms of tender, &c., obtainable from Tramways Engineer, Tramway Offices, Skircoat Road.

(Continued on page 105.)



# A BATTERY SUB-STATION PLANT AT HUCKNALL COLLIERY.

By G. C. ALLINGHAM.

THE employment of three-phase current in mining, and especially in colliery work, has become so well-nigh universal of late years, that many people have come to look upon it as the only system worthy of consideration for such purposes. It may therefore be useful to point out that there is still a field in mining work for the older direct-current system, which presents important advantages in certain cases.

As an example of direct-current power distribution in a

At the other pit, known as No. 1 Pit, the only electrical plant installed until recently consisted of a small Robey

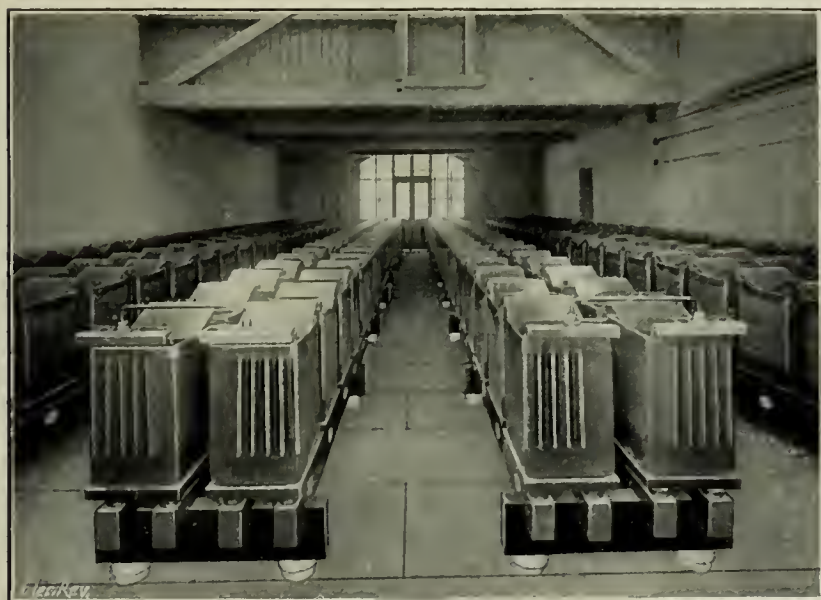


FIG. 1.—BATTERY ROOM, NO. 1 PIT.

colliery, combined with three-phase transmission, the following description of the electrical plant at the Hucknall Colliery may be of interest.

The Hucknall Colliery possesses two pits, which are situated about  $1\frac{1}{2}$  miles apart, at opposite sides of the town of Hucknall Torkard, which lies between Nottingham and Mansfield.

At one of these pits, known as No. 2 Pit, an exhaust steam turbo-alternator set was put down some years ago for the purpose of supplying power to some underground haulage gears in that pit. This set is run by the exhaust steam from the winding engine, of which there is an ample supply, and consists of a turbine of the Rateau type direct coupled to a three-phase two-pole alternator having a rated output of 110 KW. with a power-factor of 0.85 at 500 volts between phases; the periodicity is 50 and the speed 3,000 revs. per min. This set is illustrated in fig. 3.

This plant, although a comparatively small one, is of interest as being the earliest instance of the employment of an exhaust steam turbine in a colliery in this country.

A full description of the plant was given in a paper read by Mr. W. Maurice before the Institution of Mining Engineers in 1906.

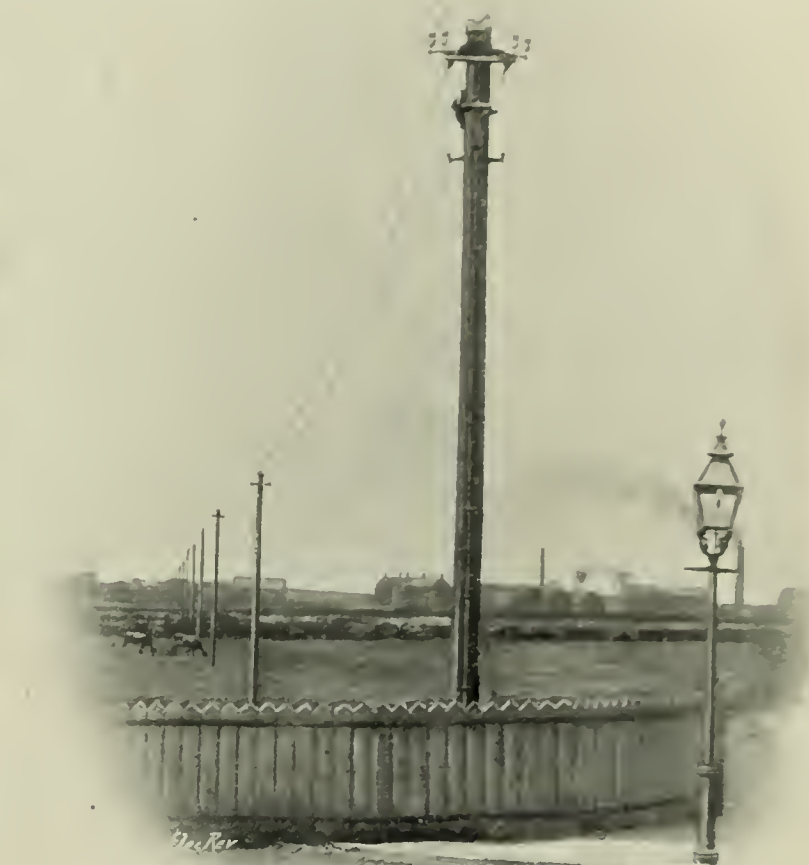


FIG. 2.—OVERHEAD TRANSMISSION LINE, HUCKNALL COLLIERY.

single-cylinder vertical engine belted to a D.C. dynamo having an output of 80 amperes at 400 volts, which supplied

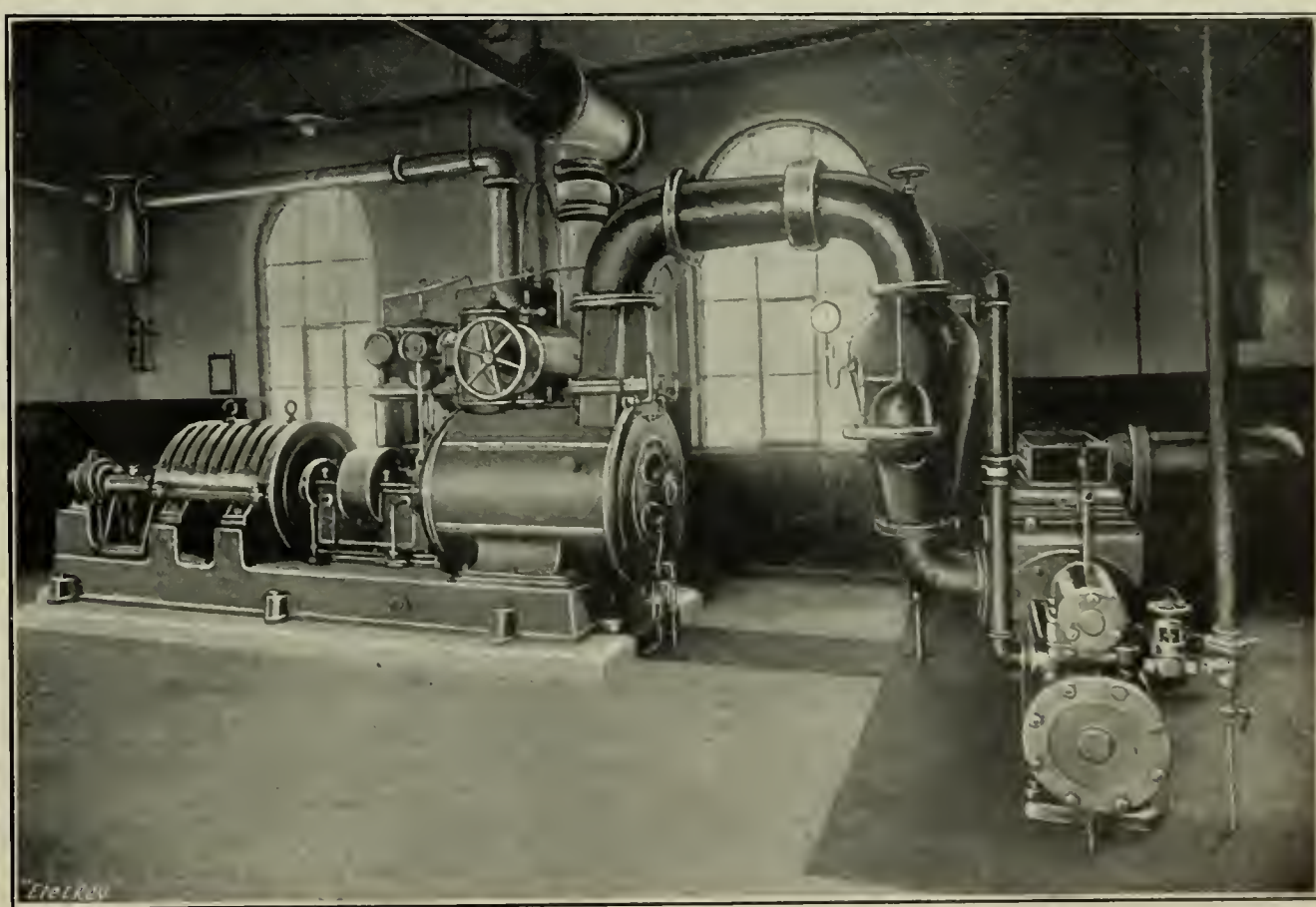


FIG. 3.—EXHAUST TURBO-GENERATOR SET, POWER STATION, NO. 2 PIT.

one coal-cutter underground, besides lighting the offices, workshops and other buildings on the pit-bank. Within



the last few years, however, the workings at No. 1 Pit have been considerably developed, with the result that a greatly increased supply of power was required for driving additional coal-cutters, a small underground haulage, a new screening plant, workshops, a sawmill, &c.

Instead of putting down a new generating plant at No. 1 Pit, it was decided to utilise the spare power available at

received at No. 1 Pit to direct current, and working in conjunction with a storage battery.

An additional argument for the employment of direct current at No. 1 Pit, was that the management of the colliery greatly preferred direct-current coal-cutters to three-phase ones, which have an inferior starting torque and take much heavier starting currents.

In order to transmit the power to No. 1 Pit, a 90-kw. transformer has been put down at No. 2 Pit, which steps up the voltage from 500 to 3,000 volts, at which latter pressure energy is transmitted by a bare overhead line (fig. 2) to No. 1 Pit, where a converting set has been installed, consisting of an 80-k.v.a. 3,000-volt synchronous motor, direct coupled to a 500-volt 100-ampere compound-wound D.C. generator, an automatic reversible booster for regulating the working of the battery being also coupled on the same shaft. This motor-generator-booster set was built by the Lancashire Dynamo & Motor Co., Ltd., and is shown in fig. 5.

The battery, which is illustrated in fig. 1, consists of 240 Tudor cells, type H. Q. 9, capable of giving discharges of 110 amperes for 3 hours, 236 amperes for 1 hour, or 400 amperes momentarily. The cells contain nine plates each, but are mounted in glass boxes of sufficient size to contain 13 plates, thus rendering it possible for the capacity of the battery to be increased by 50 per cent. in the future, if required, by filling up the boxes with additional plates.

The general arrangement of the plant is shown diagrammatically in fig. 4, where A is the three-phase turbo-generator at No. 2 pit, B the step-up transformer, C the overhead line, and D, E, F the converting set in the sub-station at No. 1 Pit.

The 3,000-volt synchronous motor D normally takes power direct from the overhead line, and drives the D.C. generator E and the booster F; E supplies the power load at No. 1 Pit

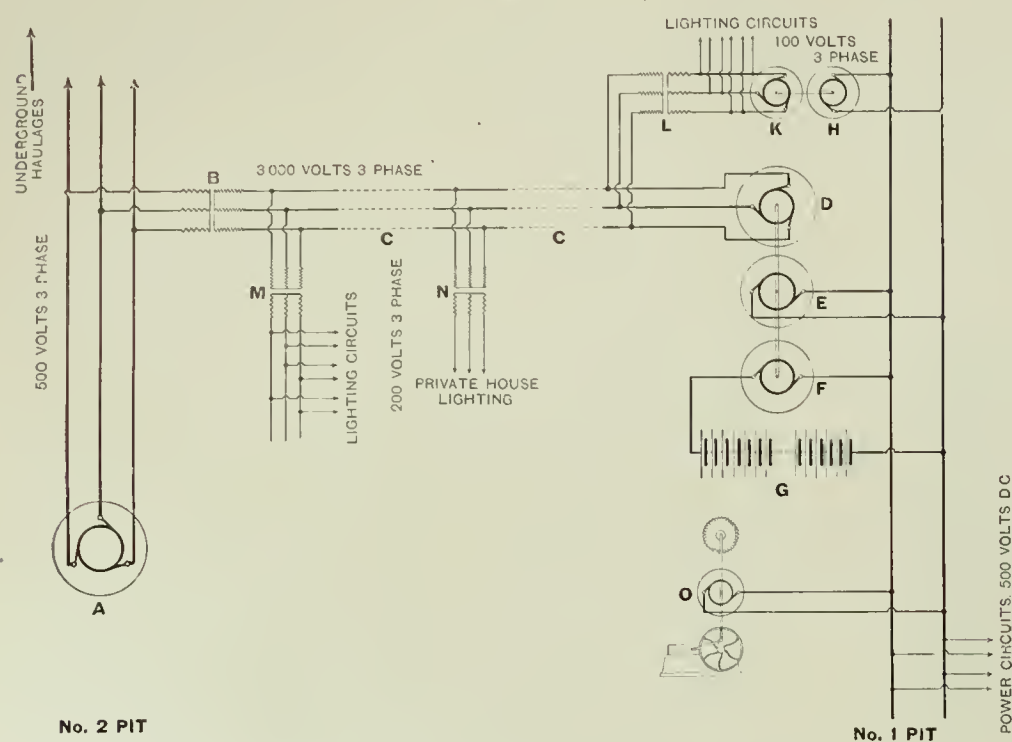


FIG. 4.—GENERAL CONNECTIONS OF BATTERY AND TURBINE PLANT.

No. 2 Pit (where the exhaust turbo set was running on a very poor load-factor) for supplying the requirements of No. 1 Pit also.

At first sight, the obvious method of doing this would have been to distribute the three-phase supply from the generator at No. 2 Pit direct to three-phase motors at No. 1 Pit. There were, however, two objections to this course. Firstly, the power demand, both of the haulages at No. 2 Pit and of the coal-cutters, sawmill, &c., at No. 1 Pit, fluctuates heavily and rapidly, and it would have been absolutely impossible for the exhaust turbo set to have taken the overloads unaided, especially as the power factor would have been very low on the peak loads. Secondly, the winding engine at No. 2 Pit only works 16 hours a day and five days a week, and sometimes even less when the pit is not working full time, whereas power is being consumed at No. 1 Pit throughout the 24 hours, and also during the week-ends: so that, unless some means of storage had been provided, the exhaust turbine would have had to run more than twice the number of hours per week, and during the additional hours it would have been running very uneconomically on live steam reduced to atmospheric pressure, for the set was put in before the days of mixed-pressure turbines.

The only possible method of overcoming these difficulties was to provide means for storing and equalising the power supply, and this was effected by converting the power

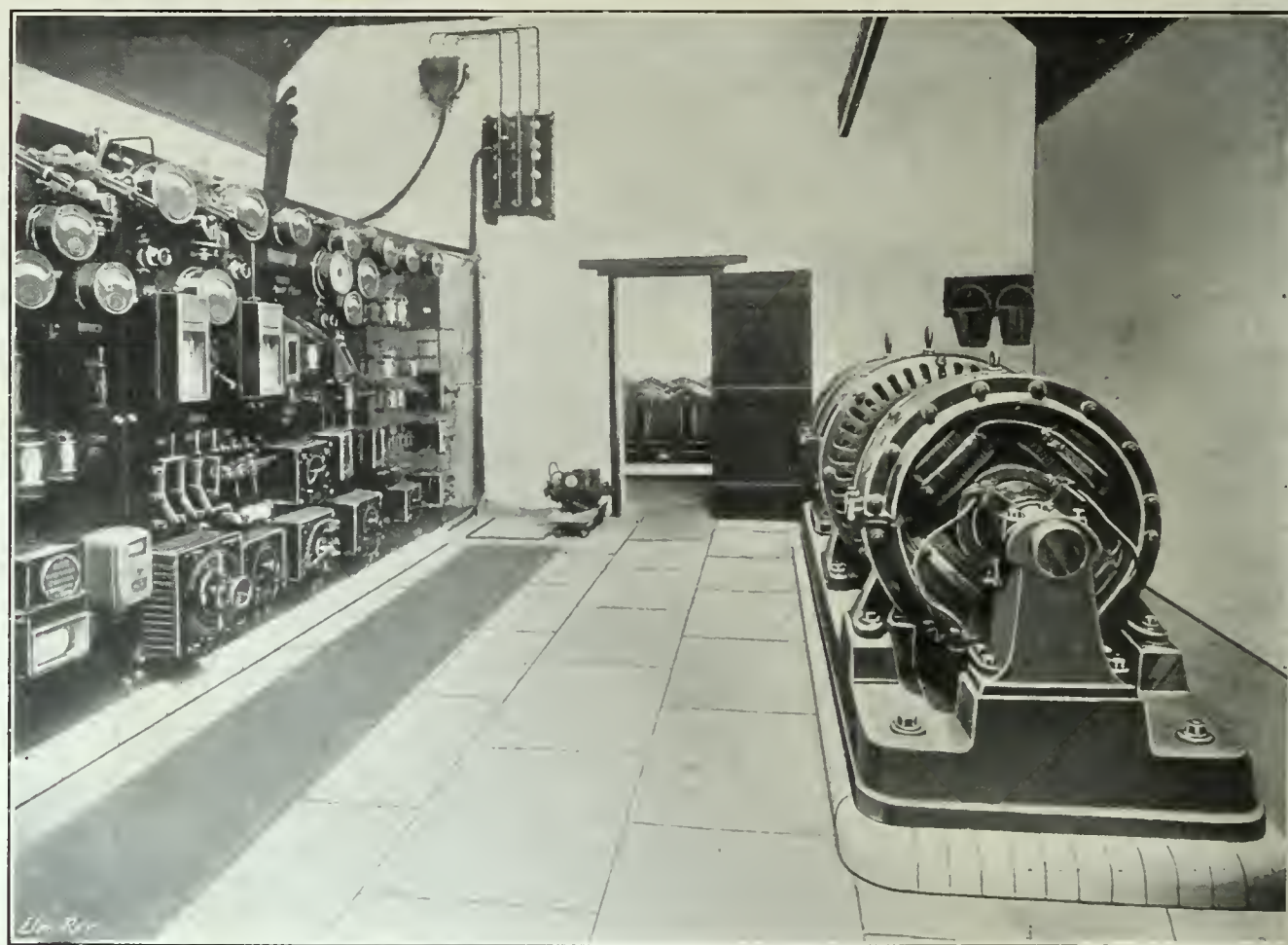


FIG. 5.—SWITCHBOARD AND MOTOR-GENERATOR-BOOSTER SET, NO. 1 PIT, HUCKNALL COLLIERY.

and at the same time charges the battery G through the booster F.

The three-phase haulage load at No. 2 Pit, which is supplied direct from the alternator A, fluctuates very heavily, and whenever this haulage load increases, the motor-generator D, E, F tends to drop its load, and the charging current supplied to the battery falls off. Thus the motor-generator



set acts as a buffer, and steadies the load on the alternator to a considerable extent; at the same time, it also tends to compensate automatically for the drop in power factor on heavy haulage peak-loads, with the result that the voltage regulation of the alternator is greatly improved while the motor-generator is running. On very heavy haulage peak-loads, the motor-generator actually reverses, taking current from the battery and supplying power back to the generating station to assist the alternator A.

All fluctuations in the D.C. power load at No. 1 Pit are in the meantime taken care of by the automatic reversible booster F and battery G, so that they do not affect the output of the D.C. generator E, nor disturb the three-phase supply in any way.

The way in which the plant works may be summarised briefly as follows. The generating set A supplies power direct to the three-phase motors at No. 2 Pit, and any surplus there may be is delivered to the motor-generator set at No. 1 Pit; this in its turn supplies power direct to the D.C. motors at No. 1 Pit, and any surplus is stored in the battery; when momentary peak-loads occur, the battery discharges, and assists both the D.C. converter and the A.C. generator. When the generating plant is shut down, the battery takes the power load at No. 1 Pit, and also supplies

The lights at No. 2 Pit are supplied at 200 volts through the 3,000 200-volt transformer M. The overhead line is tapped at about its centre to light two private houses through the step-down transformer N. The lights at No. 1 Pit-bank and in the adjoining offices and private houses are supplied at 100 volts three-phase, as shown in the diagram. When generator A is running, these lights are supplied through the transformer L, which steps down; and when A is shut down, they are supplied direct by the small motor-generator H K, which also supplies the lights at M and N through the transformer L, which then steps up.

One of the D.C. motors at No. 1 Pit, which is usually employed for driving the sawmill, is arranged so that it can, if required, be belted to a steam engine, which is kept in reserve for the purpose, and run as a generator, when it is capable

of giving an output of 50 amperes at 500 volts. This machine, which is shown at O on the diagram, is available as a stand-by for maintaining the D.C. supply at No. 1 Pit, in conjunction with the battery, in case of any interruption or stoppage of the three-phase supply from No. 2 Pit.

The whole plant is remarkably flexible in working, and forms an interesting example of the utilisation of waste power and of the equalisation of a mixed three-phase and direct-current load by the employment of a storage battery.

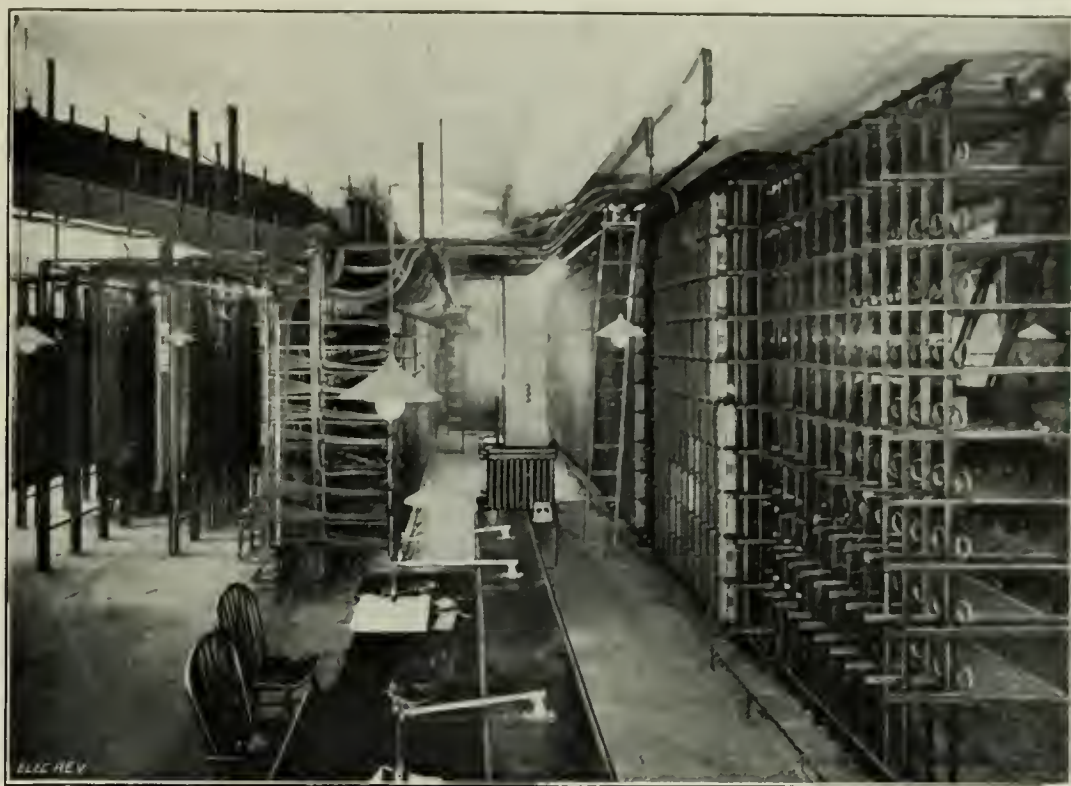


FIG. 1.—TEST ROOM AT THE NEW "AVENUE" TELEPHONE EXCHANGE (page 102).

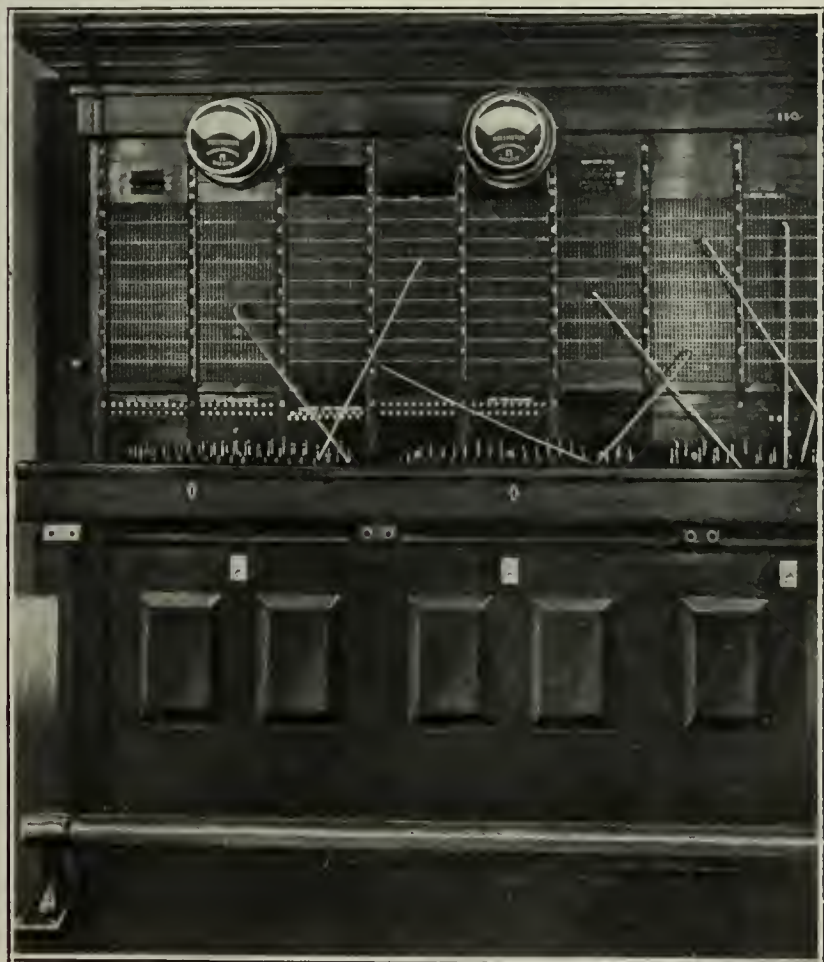


FIG. 2.—TESTING POSITIONS AT END OF JUNCTION SWITCHBOARD.

THE NEW "AVENUE" TELEPHONE EXCHANGE (page 102).

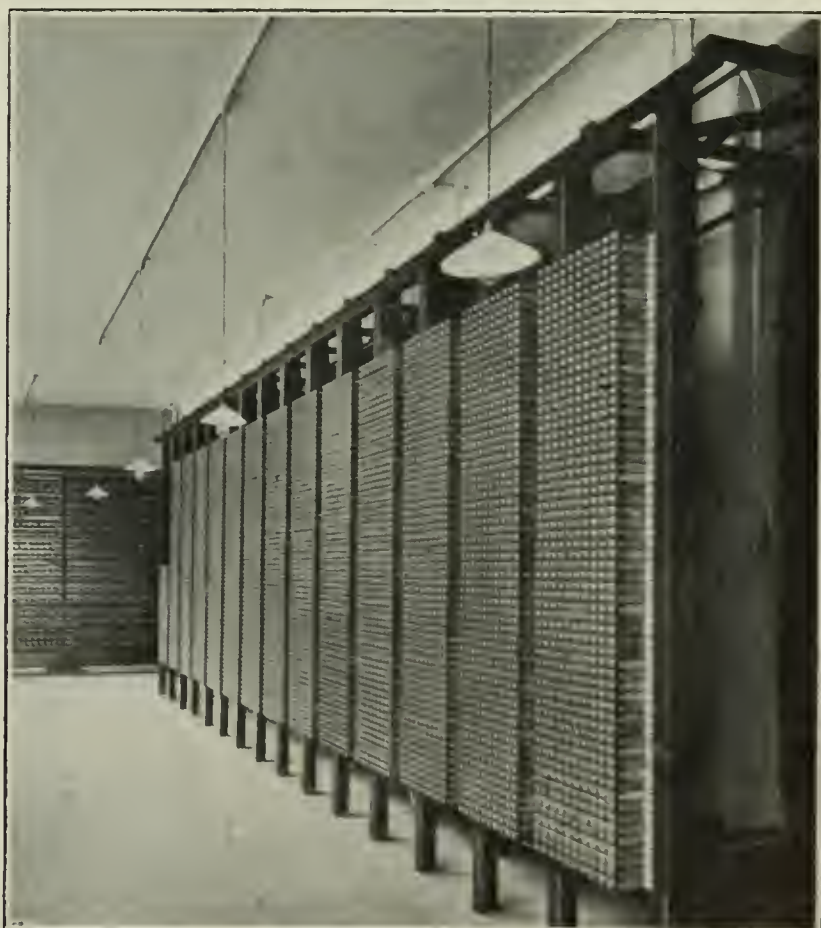


FIG. 3.—SUBSCRIBERS' METER RACK.

the lighting load through a small motor-alternator H K, consisting of a 500-volt motor H direct-coupled to a 100-volt three-phase generator K, which has an output of 5 kW., and is coupled to the A.C. line through the 100 3,000-volt transformer L.

The complete equipment of the sub-station, including motor-generator-booster set, battery and switchgear, was designed and carried out by the Tudor Accumulator Co., Ltd.

It is often maintained that storage batteries are unsuited for the rough conditions of colliery work. It may, therefore,



be of interest to mention, in conclusion, that the battery at Hucknall has now been in use for three years without giving

most 434 eight years ago, has now been increased to no fewer than 1,600, thus greatly augmenting the carrying capacity of the conduits; nine of these large cables at present enter the cable chamber, as well as nine of 1,200 wires each, and four of 500 wires each.

A general view of the test room is given in one of the accompanying illustrations (p. 101). The main distribution frame is 11 ft. high and 41 ft. long; on the line side it carries 760 glass tube fuse mountings each fitted for 40 fuses, and on the vertical side each strip is fitted with arrester bars, with heat coils and lightning arresters for 200 circuits, the total capacity being 9,000 subscribers' lines, and 4,400 junctions and miscellaneous circuits.

The intermediate distribution frame, of the standard P.O. pattern, runs parallel with the main frame, the connecting cables being carried on wrought-iron runs; the relay rack comes next, fitted for 9,000 exchange lines and 1,200 miscellaneous relays and resistance spools, and lastly, the meter rack, which we illustrate, is designed for the ultimate equipment of 9,000 meters—one for each subscriber, suggesting, no doubt, that the ultimate intention is to make the measured rate universal.

At one end of the test room is the junction repeating coil and condenser rack with a capacity of 1,728 coils and 3,456 condensers; repeating coils are not required for subscribers' connecting cord circuits on the Peel-Conner system. The fuse cabinet, fitted with alarm and indicating fuses, the fault and test clerks' desks, and the power plant are also on this floor. We give below a view of the machines, which are of an improved type; hitherto the Post Office exchanges have been equipped with one storage battery and one or two motor-generators, which were used to charge the battery and supply the exchange in parallel with it, the voltage on the exchange therefore being subject to considerable variation. The motor-generators installed in the new exchange are provided with boosters, so that the battery can be charged while the generator continues to supply the exchange at constant voltage. Improved provision has also been made

any trouble; there has been no difficulty in keeping it in good order with the ordinary attendance available at the colliery, and at the present time it is in excellent condition.

The author wishes to express his thanks to Mr. W. Maurice and to the Tudor Accumulator Co., Ltd., for permission to use the information given in this article.

### THE NEW "AVENUE" EXCHANGE.

THE new central-battery telephone exchange in Creechurch Lane, E.C., which has been equipped for the Post Office by the Peel-Conner Telephone Works, Ltd., is now ready for use. The switchboard, like that installed by the same company at Glasgow, is of their 40-volt type, and accommodates 9,000 subscribers; it also embodies some features of interest which are new to this country, and make it one of the most up-to-date equipments in Europe. The exchange is housed in a new building purchased by the Post Office, which, though not erected for the purpose, has proved to be readily adaptable to the needs of the case.

The main cable rack and battery room are in the basement: the test room is on the ground floor, and contains the main and intermediate distribution frames, relay racks, subscribers' meter racks, power plant, and test desks. The first floor is devoted entirely to the operating staff, being divided into kitchen, dining room and rest room, and the second and third floors respectively are the junction and subscribers' switch-rooms.

The street cables enter the basement from a manhole in the street, which receives 30 conduits from the north and 30 from the south; they are carried on a convenient type of cable rack and jointed to indoor 200-pair silk and cotton core lead-sheathed cables, which are led through cast-iron pipes to the main frame immediately above. Provision is made for forcing dry air through the street cables by means of nozzles and flexible tubes connected to the main air supply. The number of wires in a street cable, which was at

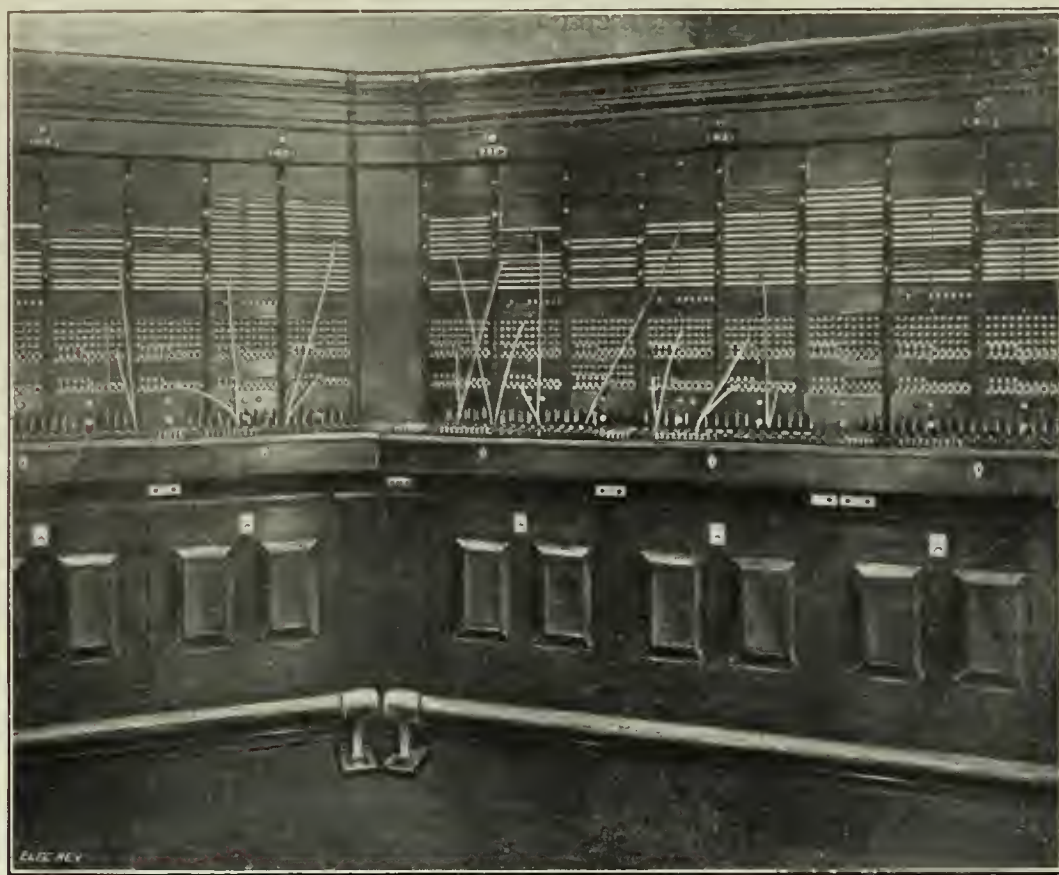


FIG. 4.—SUBSCRIBERS' SWITCHBOARD; SECTION SHOWING ANCILLARIES.

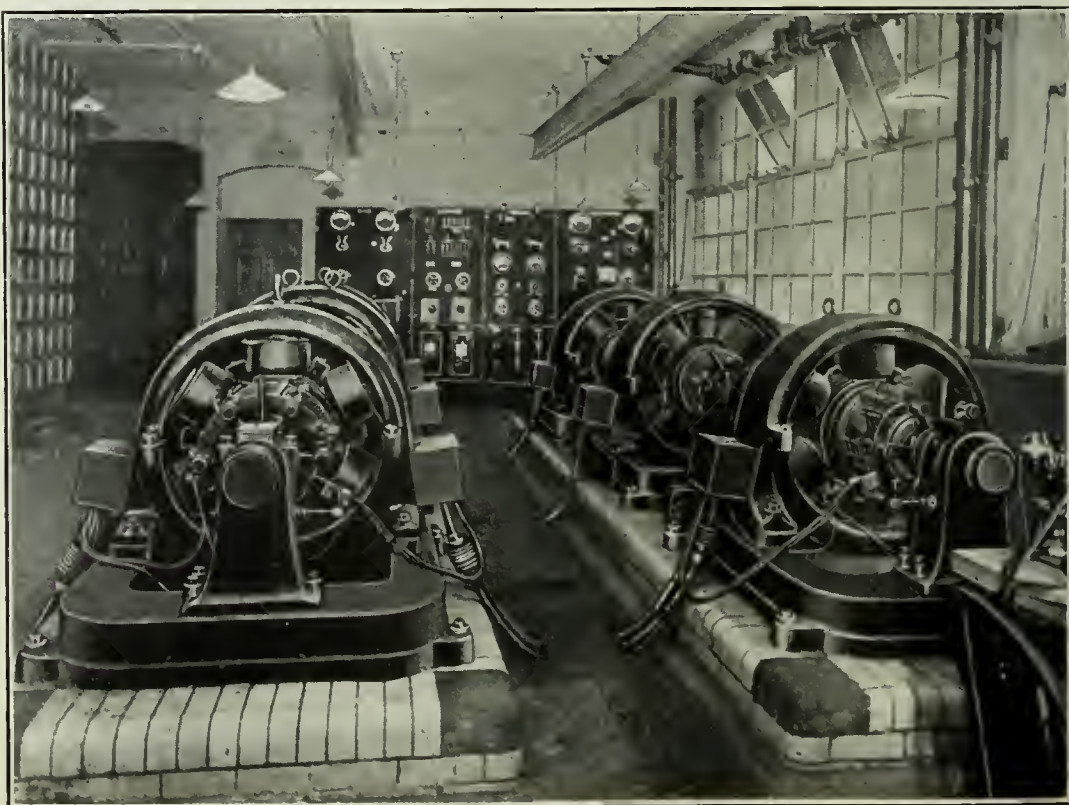


FIG. 5.—CHARGING MACHINES.

for recording the energy supplied from the street mains and that consumed by the telephone apparatus, as well as the current going to the latter and to or from the battery.

The junction switchboard is at present equipped for 57



positions; of these three are wired for trunk purposes, one for electrophone distribution, two for testing and plugging up faulty lines, eight for local transfer working, and the remainder for incoming calls from other London exchanges. With the exception of the trunks and a few ringing junctions, the whole of the circuits are arranged for keyless ringing. The present equipment per position is 30 circuits, with an ultimate capacity of 36 circuits. A 12-position information desk is provided, taking the place of the inquiry desks formerly used, and fulfilling other purposes also. The apparatus connected with the junction positions is conveniently arranged on vertical racks behind and at right

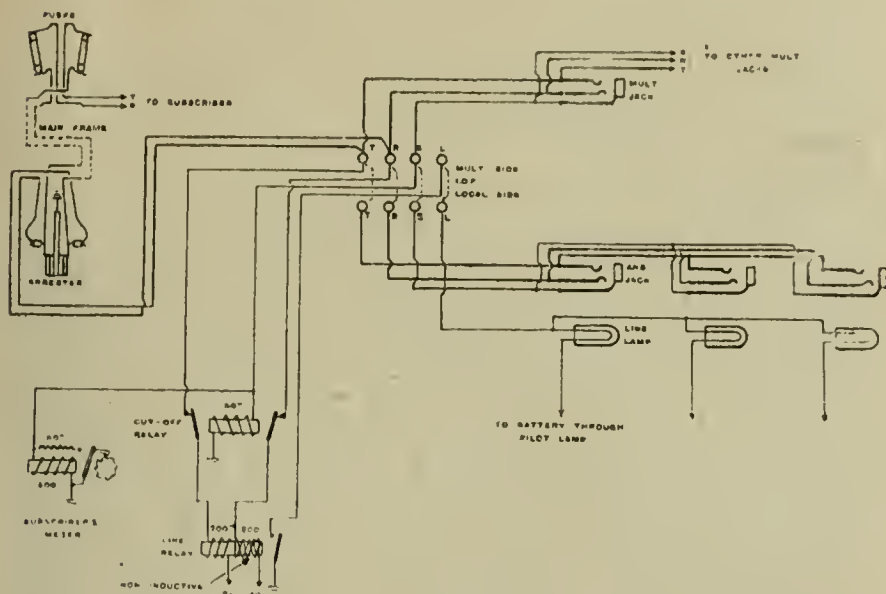


FIG. 6.—SUBSCRIBER'S LINE CIRCUIT WITH ANCILLARY JACKS.

angles to the switchboard, where the relays, &c., are readily accessible. Fig. 2, p. 101, shows the end section of the board.

On the top floor are switchboards equipped for 123 subscribers' answering positions, dealing with all calls originating with subscribers connected to the exchange. There is no subscribers' multiple on this board, as most of the calls are for subscribers connected with other exchanges; the junction sections, however, are fitted with a full multiple of subscribers' lines every nine panels, and local calls are completed at the junction switchboard by means of keyless transfer circuits. These transfer circuits are multiplied on the answering positions on outgoing junction jacks, and are plug-ended at the transfer position at the junction switchboard; the

answering positions may be considered as made up of three groups of 41 positions per group, each subscriber having a lamp and jack in each of the three groups.

The primary answering jacks are arranged on the switchboard at the bottom of the various panels, in the space usually occupied by answering jacks, the auxiliary answering jacks being immediately above them. The circuits with primary answering jacks in the first group of positions have ancillary answering jacks in the second and third groups. Similarly those with primary jacks in the second group have ancillary jacks in the third and first groups; and those with primary jacks in the third group have ancillaries in the first and second groups.

The above arrangement has been adopted for the following reasons, amongst others:—

1. The subscribers' calls are answered more promptly, as the signal appears in more than one position, and the calls are taken up more quickly.

2. The distribution of the traffic is rendered more even, and the work of each operator is made more uniform.

3. The method is useful for purposes of concentration at night and during periods of light load, as all the subscribers have answering jacks and lamps on one-third of the total answering positions, and it is only necessary for operators to be at these positions.

A subscribers' line circuit wired on this system is clearly shown in fig. 6, the three answering jacks and lamps being connected in parallel. The circuit is equipped with the usual line and cut-off relays, and it will be noted that the insertion of the answering plug in any one of the three jacks extinguishes all three lamps.

As in other London exchanges, the calls between subscribers in different exchanges constitute the major portion of the traffic, and the rapid and accurate working of junction lines becomes a most important factor. A considerable saving in the time of operating the junction circuits is effected by the use of keyless-ringing circuits. Each junction or "B" position has provision for 36 keyless incoming junctions and a present equipment of 30 junctions. It is estimated that this method of working junction circuits admits of 25 per cent. more junctions being worked from one position than is possible on existing switchboards without keyless circuits.

The circuits of a keyless junction will be clearly seen from fig. 7, and the operation of the circuit very briefly is as follows:—

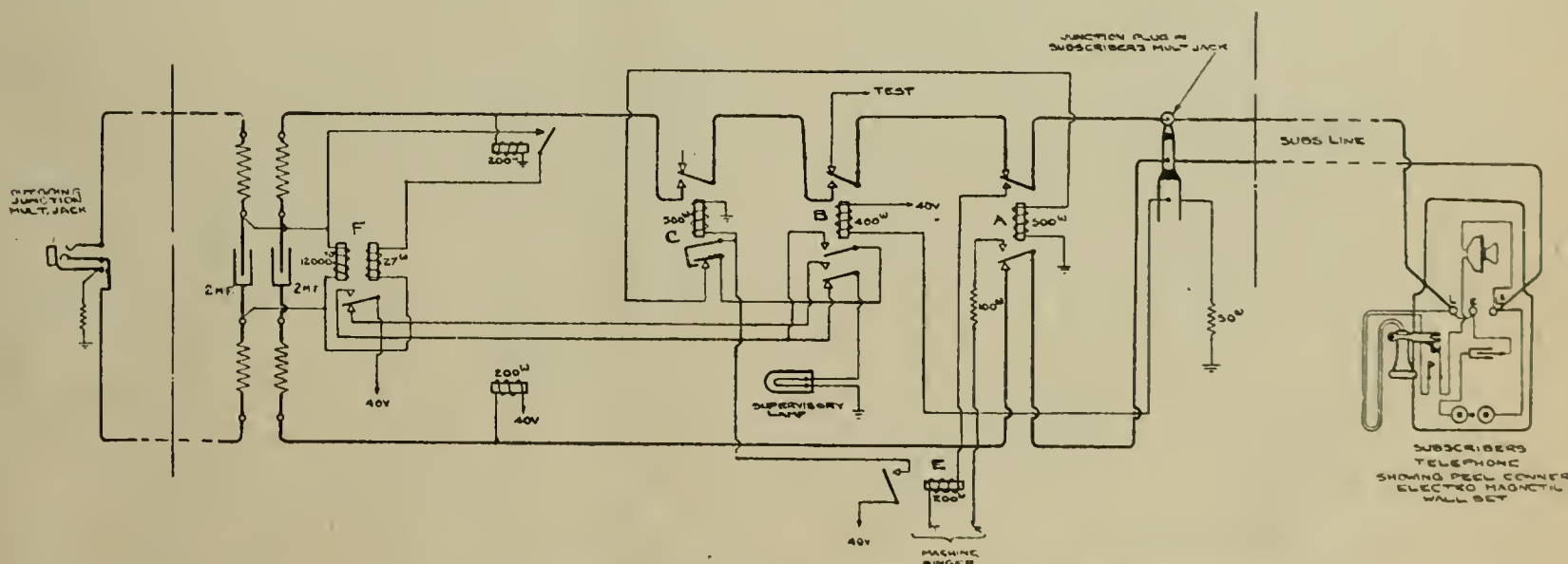


FIG. 7.—INCOMING C.B. JUNCTION FROM C.B. EXCHANGE; KEYLESS RINGING.

signalling is automatic, and complete supervision is given at each position.

The special feature of the subscribers' calling circuits is the use of the "ancillary jack" system.

Each subscriber's circuit is equipped with three answering jacks and lamps, situated at different points on the switchboard. One of the three jacks may be described as the primary answering jack and the others as auxiliary answering jacks, the circumstance differentiating the one class from the other being that a disengaged operator, in front of whom two lamps (one a primary and the other an auxiliary) light up simultaneously, will answer the call of the primary lamp in preference to the other. The total of 123 subscribers'

The request from a distant exchange for a connection is given over an order wire. The "B" operator at Avenue Exchange allots a disengaged junction circuit, and the distant operator inserts the calling plug of the pair in use into the corresponding junction jack of the same circuit. The "Avenue" operator at the same time inserts the incoming junction plug into the multiple jack of the required subscriber's line if it is disengaged. Through the insertion of the two plugs, relays "B" and "F" are operated, which close the circuit through the winding of relay "A," and so allow ringing current to pass out to the subscriber's line.

It will be noted that the ringing control relay "A" cannot operate until relay "F" is actuated. This is arranged



to prevent false calls, should the distant operator take up a wrong junction.

Upon the subscriber removing his receiver from the hook the 1,000  $\omega$  bell and condenser in his instrument are shunted by the talking circuit, which allows battery current to flow through the relay "E," which now pulls up and in its turn operates relay "C," which locks up until either plug is removed. The actuating of this relay opens the circuit through the relay "A" and the ringing current is removed from the subscriber's line.

The supervision of the conversation is maintained from the originating end, and should it be necessary to ring the called subscriber again owing to his having left his telephone (with receiver restored), the distant operator has only to remove the plug from the jack and re-insert it, when the ringing will be recommenced. The clearing signal to the "Avenue" operator is given by the taking down of the connection by the operator at the outgoing junction end.

The circuit described and shown in the diagram, fig. 7, is arranged for order-wire working from a C.B. Exchange, and illustrates a typical junction. The same principle of keyless working is applied to junctions from magneto and C.B.S. Exchanges, whether arranged for order-wire working or for calling direct on the junction line, in which cases, of course, the circuits are equipped to suit their own particular requirements.

The quantity of apparatus used in the construction of the exchange includes 250,000 jacks, 30,000 lamps, 35,000 relays, 6,000 miles of wire, and 3,000,000 soldered connections.

The installation has been completed well within the contract time of six months, in spite of the delays due to the recent strikes in Manchester, which practically stopped the work for several weeks, owing to the impossibility of getting any material on to the site. This time, it is claimed, constitutes a record for an installation of this magnitude. The whole of the apparatus is of British manufacture, and was installed by British labour with British capital.

---

## REVIEWS.

---

*Steam Turbine Design*, with special reference to the reaction type, including chapters on condensers and propeller design. By JOHN MORROW, M.Sc. London: Edward Arnold. Price 16s. net.

We have had a perfect plethora of books about the steam turbine during the last four or five years. There are the well-known treatises of Stodola, Jude, Hobart and Stevens, Richardson (on the Parsons turbine) and others. Therefore, our first question on looking at a new volume on this subject must inevitably be—"In what way does it differ from those which have already appeared?" Anyone who knows a little thermodynamics can write a book about steam turbines; it requires a man with some considerable ability to write one such that the details of design can be readily understood by the reader. In this respect (we are glad to be able to say) the author of the new treatise justifies its publication. We are not at all sure that the publishers will justify the somewhat exorbitant price. It is, we suppose, quite true that the man who has to design steam turbines can as easily afford to pay 16s. as 6s., and if the book had been written entirely for the drawing offices of the firms manufacturing steam turbines we should have had nothing to say. But the matter is not quite so simple, for the author says most distinctly that it is written "for designers, draughtsmen and students." The latter class are certainly more moneyed nowadays than they were in the days when the reviewer was at college, if they can afford to pay that amount for a book on one section (steam turbine design) of one subject (heat engines) of a curriculum which usually includes, in addition to the subject mentioned, structures, machines, electrical technology, surveying, hydraulics, &c.—all of which have to be learnt (more or less) in some three years.

While there is a good deal which merits praise in other parts of the book, we quite readily give the author fullest credit for

the chapters on thermodynamics. That on heat diagrams is excellent. We are rather at a loss to explain why the author thought fit to use up two pages of his preface in dealing with the matter of irreversible operations. A short chapter on thermodynamics might have been considered necessary, but it was apparently the author's intention to omit any such work at first; more or less as an afterthought he included it in the preface. However, we can readily forgive him that, for he does give a very useful chapter on heat diagrams. Not the least interesting fact about the steam turbine is the extraordinary manner in which it illustrates how valuable was the work done in the 'eighties by those who wrestled with entropy and the only heat diagram then known.

Since that day we have had Moliere's diagram, and others (not quite so useful) have been suggested. Now, we have Morrow's diagram, the only objection to which is the use of a logarithmic scale. However, the diagram itself is quite good. Volumes and heat contents are measured along rectangular co-ordinates; and as these quantities are those mostly used in steam turbine design, the diagram should be most useful. The steam tables of Marks and Davis have been used, and although these are probably the best published at this present time, yet, of course, the most consistent tables are those based upon the work of Callendar, and used by Moliere in the compilation of his tables. (We understand that Prof. C. A. M. Smith and Mr. Warren are about to publish steam tables in British units based on Callendar's work.) The use of heat diagrams certainly provides the engineer with a new tool.

We notice that the Fahrenheit scale of temperature is used, despite the efforts of Ewing, Perry, and others, who are trying to introduce the Centigrade system of temperature, and retain the foot-pound. Of course, there is nothing to justify the Fahrenheit scale, but we think it will be some time before it is abandoned by British engineers. On page 36 we come across the term "rank of energy," and on going further we find it is used by the author in a way slightly different to, but resembling, "availability of heat energy," as other writers put it. The author means almost its temperature height. We think the word "rank" is most unfortunate, when we remember Perry's strenuous efforts to get it accepted as a unit of entropy—in compliment to Rankine. We are sorry to say that fig. 20 (page 55) is somewhat misleading. Long before the water curve gets down near the part shown on the diagram it disappears, and the ice (change of state) appears on the diagram.

The book is extremely good when the design of turbines is discussed, and we must assume that the author had some privileged method of obtaining many points culled from practice. The chapter on condensers is good, although the marine type only is dealt with (indeed, the book smacks of marine practice rather than central station work, throughout). The illustrations might have been a good deal worse, and could possibly have been a little better. The impression that one obtains is that the author has not kept quite rigidly enough to his subject, as stated in the title of the book. But we are quite confident in stating that any man who wishes to design steam turbines must have this volume by him. It is a valuable addition to the rapidly-growing literature on steam turbines.

---

**A French Aluminium Process.**—L'Aluminium Française, of Paris, is the title of a new undertaking which has been formed with the participation of important French aluminium manufacturing companies, for the purpose of producing nitrogen products for the manufacture of aluminium according to the process of the Société Générale des Nitrures. The new company has secured the exclusive right to use the process, and will also deal in aluminium and work it into manufactures. The share capital has been provisionally fixed at £200,000, and it can be increased to £600,000, apart from a gradual issue of bonds of from £600,000 to £800,000. It is proposed to erect branch works in the United States.

**Russia.**—A fact of interest to exporters of electrical goods to Russia is that the Government have now decided to give the haven of Libau the equipment needed for the import trade. Libau is the only Russian port which is ice-free throughout the winter, but its arrangements for dealing with cargo have hitherto prevented its use by all but the smallest ships. Large works are now to be undertaken, which will place the port on a level with the most up-to-date.—*Elektrotechnische Nachrichten.*



## CONTRACTS OPEN.

(Continued from page 98.)

**Hopfgarten (Tyrol).**—February 13th. Construction of a generating station. Particulars from the Marktgemeindevorsteher, Hopfgarten.

**Hornsey.**—January 25th. Extension of Temperley transporter, for the T.C. See "Official Notices" January 12th.

February 7th.—Electricity meters, cables and cable stores, for the T.C. See "Official Notices" to-day.

**Italy.**—Tenders will be received, within 60 days from December 20th, at the office of the "Presidente del Consiglio Generale dell' Ente Autonomo Volturmo, Piazza Municipio 37," Naples, for the supply and erection of machinery and apparatus, as well as hydraulic, electric and general accessories, required in connection with the central electric generating station in Naples. For further particulars see this column last week.

**Leeds.**—February 14th and 21st. (a) 1,000 A.C. meters and (b) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" to-day.

**London.**—L.C.C.—January 23rd. 3,500 tons of steel girder tramway track rails and fastenings, and 1,500 tons of slot rails and conductor tees. Specifications, forms of tender, and drawings, £2 (returnable), from the Chief Engineer's Department, County Hall, London, S.W.

January 30th.—Electrical installation at the School of Photo-Engraving and Lithography. See "Official Notices" to-day.

**STEPNEY.**—January 29th. The B.C. is inviting tenders for one E.H.T. converting plant, suitable for 6,000-volt three-phase A.C. to L.T. D.C., together with E.H.T. and L.T. switchgear, &c., for the Limehouse and Whitechapel stations. See "Official Notices" January 12th.

**Morocco.**—February 5th. The Moroccan Adjudications Commission intends to make a contract, by private arrangement after competition, for the supply and delivery of machinery and tools, and the supply and installation of two steam engines and of electric lighting plant, for an engineering workshop to be established at Tangier for the repair of lighters, &c. Applications from firms desirous of tendering to "M. le Président de la Commission Générale des Adjudications et des Marchés, Dar En Niaba," Tangier. The general regulations (in French) may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal*.

**Nuneaton.**—January 24th. One 500-KW. mixed-pressure turbo-generator, with condensing plant, pipework, &c., for the Corporation. See "Official Notices" January 5th.

**Plymouth.**—January 20th. Stores for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 5th.

**Portugal.**—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes, in accordance with the specifications which may be seen at the offices. Deposit 1,500 milreis (about £309) required to qualify any tender, which amount must be increased by the successful tenderer to 7 per cent. of the accepted price. Each of the 10 cranes must have a lifting capacity of 1,500 kg., but four of them must also be capable of lifting material up to 3,000 kg. in weight.—*Board of Trade Journal*.

**Prague.**—January 31st. Supply of two turbo-generators, of a normal capacity of 3,600 kw., with accessories. Particulars, plans, &c., from Städtischen Kanzlei der Elektrizitätszentrale, Prague VII, and tenders to Haupteinreichungsprotokolle der Electricischen Unternehmungen, Altstädter Markthalle, Prague, Austria.

**Rhyl.**—January 31st. 1,700 yards of .1 overhead feeder cable, for the U.D.C. See "Official Notices" to-day.

**Siam.**—BANGKOK. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

**Spain.**—The municipal authorities of Dolores (province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

**Tunbridge Wells.**—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

**Turkey.**—February 20th. Tenders will be received at the "Ministère des Travaux Publics," Constantinople, for a concession for the supply of electric light and power to the town of Adalia, which has a population of some 30,000. For particulars see this column December 22nd.

**York.**—Electric shunting locomotive for the Corporation. See "Official Notices" January 12th.

## CLOSED.

**Australia.**—SYDNEY.—According to the *Australian Mining Standard*, the City Council has approved of the acceptance of the following tenders for sundry services:—

Conduits at generating station, construction of additional.—J. Stewart and Co., £9,845.  
House transformers.—Australian General Electric Co., £508.  
Flame arc lamps.—Union Electric Co., £1,873.

It was agreed to purchase 50,000 yards of fibre conduit, required for high-tension cable extensions in various municipalities, from Messrs. Haes & Eggers, representing the Key Manufacturing Co., Manchester, England, at an estimated cost of £4,690.

Approval was given for the payment to Messrs. Dick, Kerr & Co. of £1,500 for extras on contract for two 4,000-KW. turbo-generators, in addition to the sum of £575 authorised by the Council on August 1st, 1911.

Our contemporary also records the following tenders accepted for the Postmaster-General's Department, Victoria:—

Repeating coils, test-jacks, common-battery switchboards, &c.—J. Bartram and Son Pty., Ltd., Melbourne, £2,676.  
Cords, gravity-restoring bull's-eye indicators, jacks.—British Insulated and Helsby Cables, Ltd., £442.

12 sections of a common-battery switchboard, at the Post Office, Ballarat.—Western Electric Co. (Australia), £1,265.

Jacks, electrical registers, line and cut-off relays, switchboard cable.—Western Electric Co. (Australia), Ltd., £519.

5 miles of telephone cable, at £185 per mile; 10 miles ditto, at £120 per mile; 10 miles ditto, at £72 per mile; total £2,845.—Western Electric Co. (Australia), Ltd.

**Bradford.**—Mr. H. Moss, of Bradford, has secured an order for the supply and erection of a 49-KW. generator, switchboard, cables, &c., for the Beacon Dyeing Co., Ltd. He is also supplying motors to Messrs. Hirst & Sons, which will be worked from the above plant.

**Chesterfield.**—The T.C. has accepted the tender of Messrs. Belliss & Morcom, Ltd., for a 750-KW. triple-expansion three-crank engine at 300 R.P.M., including steam separator and trap, at £2,250.

**London.**—The Metropolitan Asylums Board has accepted the tenders of Messrs. W. J. Fryer & Co. and Rhodes Motors, Ltd., at £36 for extensions to the electric lighting at Queen Mary's Hospital, and at £28 for the installation of larger motors to drive the mechanical stokers at Queen Mary's Hospital, respectively.

**MARYLEBONE.**—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, at £480, for two internal superheaters for boilers at the electricity station.

**SOUTHWARK.**—The B.C. has provisionally accepted the following tenders:—

British Insulated and Helsby Cables, Ltd.—50 yards of 1.0 cable, £62.  
Western Electric Co., Ltd.—220 yards of .023 cable, £16; 440 yards of .05 cable, £66.

**Lowestoft.**—The T.C. has accepted the following tenders for supplies to the Electricity Department:—

Motors.—British Thomson-Houston Co.  
Meters.—Siemens, Ltd.  
Carbon lamps.—Edison & Swan Co.  
Metallic-filament lamps.—Electrical Co.

**Newport (Mon.).**—The B. of G. on Saturday accepted the tender of the Neville Engineering Co., Ltd., of Worcester, for an automatic push-button electric lift for the Workhouse Infirmary at £230.

**Norwich.**—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for overhead coal-bunkers, conveyor, induced-draught fan, crane, grab, and provision for dampers and sundries, for the electricity works, at £3,495; and for two boilers, with superheaters and mechanical stokers, at £3,450.

**Wednesbury.**—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for the maintenance of the battery for a period of 10 years.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued:—

Monday, January 22nd.—"A" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Tuesday, January 23rd.—"B" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Thursday, January 25th.—"C" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Friday, January 26th.—"D" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Saturday, January 27th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. R. S. CAMPBELL, Capt. R.E. and Adj.,  
For Officer commanding L.E.E.



## FORTHCOMING EVENTS.

**Institution of Mechanical Engineers.**—Friday, January 19th. At 8 p.m. Paper on "The Evolution and Present Development of the Turbine Pump," by Messrs. E. Hopkinson and A. E. L. Chorlton.

**Institution of Civil Engineers.**—Friday, January 19th. At 8 p.m. Students' meeting. Paper on "The Turbo-Blower and Turbo-Compressor," by Mr. G. Ingram.

Tuesday, January 23rd.—At 8 p.m. Paper on "The Central Heating and Power Plant of the McGill University, Montreal," by Mr. R. J. Durley (time permitting).

**Faraday House Old Students' Association.**—Friday, January 19th. At 8.30 p.m. At the Holborn Restaurant. Annual smoking concert.

**Royal Institution.**—Friday, January 19th. At 9 p.m. Discourse on "Heat Problems," by Prof. Sir J. Dewar.

Friday, January 26th.—At 9 p.m. Discourse on "The Pressure of a Blow," by Prof. B. Hopkinson.

**Junior Institution of Engineers.**—Saturday, January 20th. At 9.30 a.m. Visit to the works of the Western Electric Co., Ltd., Woolwich.

**Association of Engineers-in-Charge.**—Saturday, January 20th. At 7.30 p.m. At St. Bride's Institute, E.C. Discussion on "The Various Systems of Warming Buildings."

**Institution of Electrical Engineers (London).**—Thursday, January 25th. At 8 p.m. Paper on "The Heat Paths in Electrical Machinery," by Messrs. M. Walker and H. D. Symons.

**Physical Society.**—Friday, January 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Exhibition of a Direct-Reading Instrument for Submarine Cable and other Calculations, by Mr. K. Appleyard; paper on "The Vibration Galvanometer and its Application to Inductance Bridges," by Mr. S. Butterworth; and "Note on a Negative Result connected with Radio-Activity," by Messrs. J. H. Vincent, M.A., and A. Bursill.

**Institution of Electrical Engineers (Newcastle Local Section).**—Saturday, January 27th. Smoking concert.

**Institution of Electrical Engineers (Manchester Local Section).**—Saturday, January 27th. At 7.30 p.m. At the University, Manchester. Meeting of the Manchester Association of Engineers. Paper on "Electrical Furnaces," by Mr. C. Myers.

## NOTES.

**Old Students' Dinner to Prof. Unwin.**—Prof. Unwin being one of the very few teachers who have been honoured by being made President of the Institution of Civil Engineers, the Old Students' Association of the Central Technical College is organising a dinner to celebrate the occasion. The dinner is intended to be a gathering of all the old students of the Central Technical College and all Prof. Unwin's students at Cooper's Hill. It bids fair to be a very representative gathering of those who have had the advantage of Prof. Unwin's kindly teaching and advice. The Old Students' Association has asked us to draw attention to the dinner, as many of our readers have probably been students under Prof. Unwin and will wish to be present on the occasion. The dinner will be held at the Criterion Restaurant, Piccadilly, on Saturday, February 10th, at 7 for 7.30 p.m. The chair will be taken by the President of the "Central" Old Students' Association, Mr. W. Duddell, F.R.S. Those who wish to take part in the dinner should communicate with the Dinner Secretary, Mr. G. W. Tripp, 4, Fairfield Road, Charlton, Kent. The price of the tickets is 7s. 6d.

**B.E. & A.M.A.**—The annual general meeting of this Association will be held on Thursday, February 1st, at 2.30 p.m., at the offices, 36, Kingsway, London, W.C. The business to be transacted will include the presentation of the annual report and balance-sheet, and the election of a new Council. The following firms have recently been elected members of the Association, and we are asked to say that any member, unaware of the fact, who desires to nominate them for the new Council, will be economising time at the annual meeting by advising the secretary in advance of his intention:—W. H. Allen, Son & Co., Ltd.; Belliss & Morcom, Ltd.; Electric Construction Co., Ltd.; the Morgan Crucible Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.; Switchgear and Cowans (1911), Ltd.; Willans & Robinson, Ltd.

**Mining Exhibitions.**—We are informed that the quarterly meeting of the Sub-Committee of the Northern Mining Industries Exhibitors' Committee was held at the Midland Hotel, Manchester, on January 9th, Mr. A. E. L. Chorlton (Messrs. Mather and Platt, Ltd.) in the chair. Amongst those present were Messrs. A. E. Mathewson (Tilghman Sand Blast Co., Ltd.), Walter Yates (Messrs. Matthews & Yates, Ltd.), J. Butterworth (Lancaster and Tonge, Ltd.). The Committee discussed a letter which the chairman had received from the secretary of the Colliery Exhibitors' Association, in which it was suggested that the two bodies should co-operate in connection with exhibitions. The secretary was instructed to write and express the desire of the Committee to co-operate in any way possible, while pointing out that the main object of the Northern Mining Industries Exhibitors' Committee was to promote exhibitions in the North of England, at such times as suited the trade, and that it had been decided to recommend the trade to hold one in Manchester in May or June, 1914.

**Electricity in Agriculture.**—Particulars were recently published in the *Standard* of an experimental application of electrical treatment to potato crops in Scotland, by Miss Dudgeon, of Lincluden, near Dumfries. The Lodge high-tension system was used on a plot of 8 acres, and the discharge was applied daily over a period of four months for 413 hours in all. A similar plot of land adjoining was untreated. The result was that the electrified area produced over 6 tons more than the control area. The trials will be continued this year.

**Legal.**—**ALLEGED NUISANCE BY ELECTRIC MOTOR.**—Mr. Justice Neville, in the Chancery Division, on Wednesday, concluded the hearing of the action of Jenkins and Others v. The Empire, Aberdare, Ltd., by which the plaintiffs, as trustees of a chapel, schools, and other buildings at Aberdare, sought to restrain an alleged nuisance arising from the electric lighting arrangements of the Aberdare Empire.

Evidence was given by experts for the defence to the effect that neither the noise nor vibration apparent in the defendants' buildings was sufficient to cause appreciable inconvenience. Mr. Peterson K.C., submitted that from the plaintiffs' own evidence it was clear that whatever might have been the result of working the old gas engine, since the installation of the dynamo there had been no appreciable vibration.

His Lordship said he need not trouble him as to the vibration.

Mr. Peterson said, with regard to noise, he contended that the plaintiffs had failed to prove that such noise could penetrate their buildings so as to amount to a legal nuisance, and his Lordship had had the evidence of the defendants' manager that no expense had been, or would be, spared in preventing any nuisance.

His Lordship, in giving judgment, said that, in his opinion, there was not sufficient evidence to support the claim as to vibration. He came to the conclusion, however, that there was sufficient noise from the electric motor to penetrate to the lecture hall and the minister's room, and to cause a legal nuisance. He must, therefore, grant an injunction to restrain the defendants permitting a nuisance to the plaintiffs' premises, but inasmuch as he thought that such nuisance as there was could be remedied and the plaintiffs had shown no alacrity in bringing their action, he would suspend the operation of the injunction for three months.

**Inventors' Institute.**—A meeting was held at the Inns of Court Hotel on Monday, Major W. A. Denny presiding, at which a large number of inventors, patent agents, and manufacturers' representatives attended to consider the founding of an Inventors' Institute. According to a daily paper the objects of the Institute are as follows:—

1. The protection of the rights and liberties of inventors and patentees.
2. The furtherance of their interests by procuring the passing of suitable Acts of Parliament removing existing hardships and anomalies.
3. The provision of lectures and discussions on matters or controversies of interest.
4. The assistance of members who are in difficulties.
5. The provision of funds for prosecuting or defending actions by or against members.
6. The granting of legal aid or advice and such other objects as shall benefit the work of its members.

Lord Minto is to be the first president.

**Walking Club.**—Arising out of the successful Electrical Trades London to Brighton Walking Race which was held last year, and in which H. E. Purnell, of the General Electric Co., won the Osram Cup, it has now been decided to form two walking clubs, one in the North of London (Hackney Walking Club) and the other in the South of London (Clapham Walking Club), and all particulars of same can be obtained from the respective secretaries, viz., Mr. S. C. Haynes, 20, Penda Road, Clapton Park, London, and Mr. A. R. Edwards, 47, Courtenay Road, Merton, London. Training quarters are being arranged for in both districts, and a programme of suitable strolls and races will be fixed up shortly.

**Socials.**—The Annual Fancy Dress Ball of the Robertson and Osram Social and Athletic Club was held on Saturday evening last at the Brook Green Works, Hammersmith. There were 320 present, including Mr. and Mrs. C. Wilson, Mr. and Mrs. E. G. Sheppard, and Mr. J. Brandon, L.C.C. Messrs. F. Pluck and J. Minson officiated as M.C.'s, and Messrs. G. H. Freeman and B. Philpot as honorary secretaries. The prizes presented to the successful employés and visitors were as under:—

**Ladies: Employés.**—1st prize, Miss M. Panymore (Sea Queen); 2nd prize, Miss M. Freeman (Japanese Girl); 3rd prize, Mrs. Bennett (Picture Palace); 4th prize, Miss E. Pearce (Folly); 5th prize, Miss H. Clarke (Road to Ruin).

**Ladies: Visitors.**—1st prize, Miss R. Vaux (Indian Girl); 2nd prize, Miss M. Loraine (Ice Queen).

**Gentlemen: Employés.**—1st prize, F. Snewin (Clown).

**Gentlemen: Visitors.**—1st prize, E. Alty (Red Indian); 2nd prize, G. E. Truss (Black Cat).

A gathering of the staff of the National Telephone Company in the Northampton centre was held at the Divan Café, Northampton, on 6th inst., to commemorate the transfer to the Post Office. About 40 were present, under the chairmanship of Mr. C. B. Robinson (chief inspector). The chairman presented the local manager, Mr. W. Dickinson, with a smoking cabinet, as a token of esteem, on the occasion of the transfer to the Post Office, by the members of the staff of the Northampton centre.

**St. James' Electric Athletic Club.**—The eleventh annual smoking concert of this club is to be held to-morrow (Saturday), January 20th, at 7.30 o'clock p.m., at the Pillar Hall, Victoria Station (S.E. & C.R.). The following artistes are announced to appear:—Miss Elsie Steadman, Messrs. Philip Ritte, Harrison Latimer, A. L. Taylor, Walter Churcher, Walter Montagu, Frank Powell, Will Edwards, Herbert J. Collings, Jock McPherson, and Geo. Swaine (accompanist).



**Decision Under the Workmen's Compensation Act.**

—According to a report in the *Times* of January 11th, an interesting case under the Workmen's Compensation Act was brought forward at the Woolwich County Court, when his Honour Judge Granger announced his decision. The applicant was the widow of Richard George Schwartz, and the respondents were the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. The applicant's husband, acting on the instructions of the respondents, his employers, embarked in December, 1910, in the ss. *Asim* to proceed to Teneriffe, where he was to carry out some work for the company. About December 14th the *Asim* foundered with all hands in the Bay of Biscay. For the applicant it was argued that the case came within the Act, because the *Asim* was a British ship, and because the accident arose out of, and in the course of, the man's employment. The respondents denied that these circumstances entailed liability within the Act.

"His Honour now gave judgment for the respondents, expressing the opinion that although the accident arose out of, and in the course of, the man's employment, it was taken out of the Act because it could not be held that it occurred within the territorial limits of the United Kingdom. The section of the Act which included seamen, did not apply in this case, as the man was merely a passenger. Stay of execution was granted pending an appeal."

**Electrical Banks in Germany.**—A period of slightly over three years has elapsed since the formation of the Elektro Treuhand Gesellschaft as the financial organisation of the A.E.G. and the Siemens-Schuckert Works, for the purpose of financing large transactions and facilitating the establishment of supply works and tramways. The beginning of activity was, however, postponed to a later period, partly because the time was not favourable for large operations and partly because the founders themselves had ample funds at their own disposal. The share capital of the bank was to be £1,500,000, and bonds of three times this amount were also to be issued. It is now announced that the first transaction to be proceeded with will be in connection with the Hamburg Elevated Railway. It is understood that the bank will take over shares of £750,000 in the railway, and issue bonds of its own of a similar amount, the bonds having an additional guarantee based upon the working lease to be taken over by the manufacturing companies. Shortly after the constitution of this particular bank the Felten & Guillaume Co. followed the example by forming a similar organisation. The latter, however, has not hitherto done any business, and the slight distribution of profits so far made has been derived from interest receipts. On the other hand, the financing company of the Bergmann Electricity Works—the Bergmann Electricity Enterprises Co.—was brought into existence at a later date, and has recently issued its first annual report. This shows a loss of £15,000 for 1910-11 on a paid up capital of £150,000 out of nominal capital of £600,000. It will, however, be necessary to call up further capital this year in connection with the construction of authorised electric railways in Upper Bavaria.

**Electrical Copper Extraction Works.**—The Electro-Chemical Co. is contemplating building an extraction works for copper in the south of Norway to utilise the method of Engineer Hybinette. The residue from pyrites works will be used as raw material, and apart from the chief product, copper, there will be produced purple ore, which represents an excellent raw material for the production of iron and steel.

**Aluminium.**—The world's production of aluminium in 1910 was, according to *Glückauf*, 34,000 tons, of which the United States and Canada produced 11,000 tons; Germany, Austria and Switzerland, 7,000 tons; France, 9,500 tons; England, 5,000; and Italy and Norway, 1,500 tons. The price fluctuated between 1'8 and 1'9 krone, which was higher than in 1909.

**Fatality.**—An inquiry was held at Crook (Co. Durham), on the 10th inst., into the circumstances of the death of John Brett, a wireman, living at Pease's West Colliery. The evidence showed that the deceased had been employed as a wireman at Bowden Close Colliery, owned by Messrs. Pease & Partners, for the past seven weeks, and had served previously under the same firm at Thorne, near Doncaster. On the 8th inst. he was engaged at Bowden Close fixing a temporary hand lamp. While doing so he ought to have switched off the current, but according to the evidence he had been making the connections while the wires were alive. He took hold of one of the wires, then cried out, and collapsed. He would receive a shock at 250 volts.—John Farrar said he heard Brett call out, and went to his assistance, and snatched the wires out of Brett's hands. The switch was then on, and the wires were alive.—The medical evidence was to the effect that death was due to shock due to contact with a live wire.—The Coroner said he thought it was a case of forgetfulness.—A verdict was returned to the effect that the deceased died from an electric shock, accidentally received.

**Tramcar Accident Claim.**—In the High Courts on Tuesday, January 16th, Mr. Justice Lush and a common jury awarded Annie Childs, a certificated nurse, £73 damages for injuries sustained whilst alighting from one of the London United Tramways Co.'s cars in the London Road, Twickenham, on August 13th last. The defendant company denied the negligence.

**Midlands Electrical Engineers' Ball.**—The first Midlands Electrical Engineers' Ball was held in the Grand Hotel, Birmingham, on Friday, 12th inst., when about 200 guests were present. The suite of rooms set apart for the hosts and their guests had been charmingly decorated, the entrance hall being quite transformed in appearance by an arrangement of bay trees, palms, and

white and pink chrysanthemums, with a miniature fountain cunningly devised out of a block of natural ice, in the base of which gold fish were disporting themselves. Trailed with smilax, with carnations interspersed, and illuminated with electric lamps, the creation called forth many admiring comments. In the Grosvenor Room, where the dancing took place, the electroliers were entwined with smilax and Britannia carnations. Dancing commenced at 8.15, and continued until 2 o'clock, interrupted only by supper, at which the healths of Mr. R. A. Chattock, the City Electrical Engineer and Chairman of the Executive Committee of the ball, and Mrs. Chattock, were drunk with enthusiasm. We are informed that the extraordinary success of this, the first Midlands Electrical Engineers' Ball, will encourage the Executive Committee to make it an annual affair.

**Finsbury Technical College O.S.A.**—The fifth annual dance of this Association will be held at the Caxton Hall, Westminster, on Saturday, February 3rd, at 6.30 p.m. Pritchard's Band has been engaged. The price of tickets, including light refreshments, is 5s. Application should be made to Mr. John F. Shipley, Hon. Sec. for dance, 63, Shorrolds Road, Walham Green, S.W., as soon as possible.

**Inquiries.**—A correspondent who has been experimenting with tantalum wire finds that the smallest die he can get is 1/16", which leaves the wire far too thick for metal-filament lamps. He asks whether some reader will tell him how other firms are able to draw this kind of wire. If we are not mistaken, no one but Messrs. Siemens & Halske has been able to accomplish this feat.

A contracting firm which has had unsatisfactory experience with electric flashers wants a reliable one which will work for six months without attention. Information from readers who have had experience with mercury flashers is invited.

A correspondent who is troubled by the large starting currents of single-phase induction motors supplied from a 100-H.P. water turbine, asks what is the smallest starting current required by such motors of sizes up to 10 H.P. at 100 volts, 100 cycles.

**Institution and Lecture Notes.**—**TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.**—The *Journal* for January contains the annual list of members. The annual dinner and smoking concert of the Association will be held on Friday, March 1st.

**INSTITUTE OF METALS.**—Prof. W. Gowland, the new President, on Tuesday was to have delivered his inaugural address on the subject of the early history of copper and its alloys. In his absence through illness, the paper was read by the Secretary.

**Appointments Vacant.**—Mains superintendent, for the Stoke-on-Trent Electrical Engineer's Department (£130); sub-station shift engineer, for the Bristol Electricity Department (30s.); assistant telegraph engineer for the Posts and Telegraphs Department of the Federated Malay States (£300); engineer for combined refuse destructor and electric light station for the Elland D.C. (£150); assistant engineer for the Tramways Department, Birmingham (£175); shift engineer for the Neath Electricity Works (25s.). See our advertisement pages in this issue.

**For Sale.**—The Eccles Corporation has for disposal one 120-Kw. Browett, Lindley-Johnson & Phillips single-phase A.C. generating set, and one 25-Kw. J. & P. motor-alternator set. See our advertisement pages in this issue.

---

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. W. J. GOURLAY, shift engineer, has been presented with a travelling clock by the staff of the Stuart Street station, Manchester Corporation, on his leaving to take up the appointment of station superintendent at Madras.

The Dundee Corporation Electricity Committee on Monday night unanimously recommended that the salary of MR. HARRY RICHARDSON, the engineer, be increased by £100, making it £700 per annum. Mr. Richardson was appointed in 1902 at a salary of £400 per annum, and has had much to do with recent important developments of the enterprise. In connection with the last big extension of the department, it was stated by the convener, Mr. Richardson saved to the Corporation about £4,000 in fees.

The Annual Ball of the Kilmarnock Tramways Department took place on January 15th in the Art Galleries. After supper the presentation of a Kodak was made to the engineer and manager, MR. A. H. BURBIDGE (who has been appointed tramways manager in Mandalay), by Mr. W. C. Bexon on behalf of the staff, and Councillor T. McKerrill also presented Mr. Burbidge with a chronometer on behalf of the Council. The remainder of a very enjoyable evening was taken up by singing and dancing.

On Saturday last MR. EGERTON SAYER was entertained at a farewell dinner given by his late assistants and employés at Hampstead, when he was presented with a handsome silver watch and a parchment signed by those who had subscribed to the present. A silver rose bowl was at the same time handed to him for Mrs. Sayer. The



dinner was followed by an excellent concert arranged by Mr. Harry Widden, a late assistant of Mr. Sayer, and a very successful evening resulted, marred only by the thought that it would be in all probability the last one in company with the guest, a man who has ever been popular. The evening closed with the singing of Auld Lang Syne and vigorous handshakes with Mr. Sayer.

**General.**—The Wirral Joint Hospital Board has appointed Mr. A. P. PORTWAY, of Hoylake, as electrician at the hospital.

MR. NORMAN MITCHELL has resigned his position with the Kensington and Knightsbridge Electric Lighting Co., Ltd., in order to take up a position with Messrs. Duncan Watson and Co., as manager of a new branch opened by them in the South of England.

The Stretford U.D.C. has decided to reappoint Mr. T. L. MILLER consulting engineer for one year at a fee of 25 guineas, to cover the following services:—(1) Conference as may be necessary from time to time with the Electricity Committee, or its chairman, or its engineer; (2) quarterly preparation and submission of reports on the working of the station and condition of the plant.

The Committee of the City and Guilds Technical College, Finsbury, have appointed Mr. J. K. CATTERSON-SMITH to be chief assistant to the Professor of Electrical Engineering.

MESSRS. HOOGHWINKEL & THURSFIELD, consulting engineers, of Leeds and London, are dissolving their partnership. After February 1st all communications should be addressed to Mr. Hooghwinkel, at his London office, 24, Martin's Lane, Cannon Street, E.C.

MR. F. DOUGLAS WATSON, late provincial superintendent for the National Telephone Co. in Scotland, who has been appointed general manager and secretary of the Société Anonyme Ottomane des Téléphones de Constantinople (Constantinople Telephone Co.), left Paris by Oriental Express on Saturday, the 13th inst., to take up his duties in Constantinople.

**Obituary.**—The death is reported from Darlington as having occurred on the 15th inst., of Mr. C. J. O'Dowd, traffic manager of the Corporation electric tramways. Years ago Mr. O'Dowd drove the first horse car in Dublin, and was also engaged on the Leicester tramways. He was for a number of years associated with the late Sir Clifton Robinson, and went from Stockton to Darlington when the Imperial Tramways Co. took over the old horse cars prior to installing the electric system, with a view to connecting Tees-side and Skerneside. When Darlington Corporation decided to construct and manage the new system, Mr. O'Dowd was appointed traffic manager.

The *Times* contains an announcement to the effect that the death occurred on January 11th at Hong Kong, of pneumonia, of MR. CHARLES THOMAS HOSE, of the Eastern Extension Telegraph Co., son of Bishop Hose, at the age of 31 years.

We regret to learn of the death, at the age of 80 years, of MR. S. W. JOHNSON, a past president of the Institution of Mechanical Engineers, who, in the course of his career, has been chief mechanical engineer of the Midland, North British, and Great Eastern Railways.

## NEW COMPANIES REGISTERED.

**Pintsch's Electric Manufacturing Co., Ltd.** (119,600).—This company was registered on January 9th, with a capital of £30,000 in £5 shares, to acquire patents and rights relating to processes for lighting or heating railway carriages, tramcars and other vehicles, ships, boats, buildings or structures, and to adopt an agreement between Julius Pintsch Aktien-gesellschaft of the first part, H. Grob of the second part, Pintsch's Patent Lighting Co. of the third part, and this company of the fourth part. The subscribers (with one share each) are:—C. P. Whitcombe, Durward House, Kensington Court, W., civil engineer; F. R. C. Worsley, Friars House, New Broad Street, E.C., company secretary. Private company. The number of directors is to be four; the first are A. Pintsch and Dr. A. Golinelli (appointed by Julius Pintsch Aktiengesellschaft) and C. P. Whitcombe and F. R. C. Worsley appointed by Pintsch Patent Lighting Co., Ltd. Registered office, Friars House, Old Broad Street, E.C.

**Barker Patents Syndicate, Ltd.** (119,548).—This company was registered on January 6th, with a capital of £1,000 in £1 shares, to carry on the business of heating, electrical and general engineers, chemists, contractors, scientific instrument manufacturers, &c. The subscribers (with one share each) are:—A. H. Barker, 32, Bromley Road, Beckenham, consulting engineer; G. P. Stickney, 50, Elmwood Road, Chiswick, W., secretary. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration not more than 10 per cent. of the distributed profits. Registered office, 199, Strand, W.C.

**Mirfield Garage and Electric Works, Ltd.** (119,654).—This company was registered on January 12th, with a capital of £1,000 in £5 shares, to take over the business of an electrician, motor dealer and automobile and cycle engineer, carried on by Frances Alice Morton, at Nettleton Road, Mirfield, Yorks., as "A. Morton & Co." The subscribers (with one share each) are:—T. W. Sproule, Easthorpe Grove, Mirfield, surgeon and physician; E. B. Wilson, Quarry Gap, Mirfield, solicitor. Private company. The number of directors is not to be less than three or more than five; the first are T. W. Sproule, E. B. Wilson, E. W. Lee, T. Nevin and R. F. Walker; qualification, £25. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

**Edwin Noel, Ltd.** (119,614).—This company was registered on January 10th, with a capital of £5,000 in £1 shares, to acquire an invention in relation to wireless telegraphy and all the patents granted to R. C. Galletto, in respect thereof, and to carry on the business of electrical engineers, contractors for the supply of electricity, dealers in all kinds of electric, magnetic and galvanic appliances, instruments and apparatus, &c. The subscribers (with one share each) are:—A. W. Boon, 18, Fleet Street, E.C., secretary; H. J. Gulliver, 18, Fleet Street, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £50; remuneration as fixed by the company. Registered by Amery Parkes & Co., 18, Fleet Street, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Pacific and European Telegraph Co., Ltd.** (36,683).—Capital £100,000 in £10 shares. Return dated November 29th (filed November 29th), 1911. All shares taken up. £4 per share called up. £40,000 paid. Mortgages and charges: £78,900.

**Anglo-Norwegian Aluminium Co., Ltd.** (92,830).—Mortgage on raw materials supplied to and remaining in possession of Nigeland's Brug, whether in raw state or course of manufacture, and the aluminium or other products made thereon; and net proceeds of sale of all aluminium sold to date but unpaid for, and certain moneys owing to company, dated December 5th, and as further security for prior charge dated January 31st, 1911, securing £15,000. Holders: German Bank of London, Ltd., 34, Old Broad Street, E.C.

**Electromobile Co., Ltd.** (75,139).—Issue on December 14th, of £164 5s. debentures, part of a series of which particulars have already been filed.

**English Electrical Co., Ltd.** (112,639).—Issue on December 9th, 1911, of £1,000 debentures, part of a series of which particulars have already been filed.

**General Electric Co., Ltd.** ((67,307).—Mortgage dated December 21st, 1911, supplemental to trust deed dated November 80th, 1900, securing £200,000 first mortgage debenture stock, charged on land at Witton, near Birmingham. Trustees: F. B. Ross, Cromford Court, Manchester; and W. Warburton, 15, Norfolk Street, Manchester.

**Sunbeam Lamp Co., Ltd.** (25,498).—Issue on January 5th, 1912, of £5,000 debentures, part of a series of which particulars have already been filed.

**Sheerness and District Electric Power and Traction Co., Ltd.** (65,749c).—Issue on December 30th, 1911, of £600 debentures, part of a series of which particulars have already been filed.

**"Electrical Engineer," Ltd.** (104,347).—Mortgage debenture dated December 21st, 1911, to secure £2,336 2s. 5d., charged on copyright of the *Electrical Engineer*, and the company's undertaking and property, present and future, including uncalled capital. Holders: Smith's Printing Co. (London and St. Albans), Ltd., 23-32, Hutton Street, Whitefriars, E.C.

**"Hart" Accumulator Co., Ltd.** (60,059).—A memorandum of satisfaction in full on January 1st, 1912, of mortgage dated July 15th, 1909, securing £4,500, has been filed.

**Musselburgh and District Electric Light and Traction Co., Ltd.** (85,169).—A memorandum of satisfaction to the extent of £500 on January 2nd, 1912, of mortgages dated November 13th, 1905 and May 11th, 1909, securing £90,000, has been filed.

**Max Follert & Co., Ltd.**—Particulars of £600 debentures, created December 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of present issue being £300. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Issue on December 20th, 1911, of £100 debentures, part of a series of which particulars have already been filed.

**Yarmouth (I.W.) Electricity Supply Co., Ltd.** (56,884).—Return dated November 8th, filed November 13th, 1911. Capital £5,000 in £5 shares. 347 shares taken up. £1,735 paid. Mortgages and charges: Nil.

**National Conduit and Cable Co., Ltd.** (59,251).—Return dated November 28th, filed December 8th, 1911. Capital £1,000 in £1 shares. All shares taken up. £7 paid. £993 considered as paid. Mortgages and charges: Nil.

**Anchor Cable Co., Ltd.** (69,073).—A memorandum of satisfaction on December 14th, 1911, of charge dated March 17th, 1904, securing unspecified amount (stamped to cover £10,000), has been filed.

**Nairobi Electric Power and Lighting Co., Ltd.** (87,728).—Issue on December 13th, 1911, of £200 debenture bonds, part of a series of which particulars have already been filed.

## CITY NOTES.

### Llandudno and Colwyn Bay Electric Railway, Ltd.

THE accounts for the year to November 30th, 1911, show a profit, after providing for operating and administrative expenses, interest on loan and debenture stock, amounting to £5,784. The amount brought forward from last account was £2,328, of which there has been expended in special track repair and renewal work, £1,413, leaving £915, making a total available balance of £6,699. There has been placed to depreciation reserve account (making a total to date of £3,000), £1,000, and to writing off balance of expenses of loans, per last account, £2,500, leaving £3,199. Out of this the directors recommend a dividend at the rate of 2½ per cent. per annum (payable, less income-tax, on January 31st, 1912), £2,485, leaving to be carried forward, £714. The traffic receipts show an increase of £634 over those of the previous year.

In accordance with the recommendation in the last report, a considerable portion of the track in Llandudno and Colwyn Bay has been overhauled, and special expenditure in this direction, amounting to £1,413, has been charged against the balance brought forward from last year's accounts. During the year the line between Rhôs-on-Sea and the top of Penrbyn Hill, a distance of about two miles, has been double-tracked, and in certain places improvements have been effected in the grades and curves. These alterations have proved of great advantage in handling heavy traffic during the summer season, and have contributed to the increase in takings. No settlement has yet been effected with regard to widenings in connection with the extension to Old Colwyn; but, if a reasonable arrangement can be made with the local authority, the work can be commenced next year.

The sixth ordinary general meeting was held on Friday at Basildon House, Moorgate Street, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN, in moving the adoption of the report, said that the profit for the year had amounted to £5,784, as compared with £3,612 for the previous year, being an increase of £2,172. That increase might be regarded as fairly satisfactory, and was due to



an increase in the traffic and miscellaneous receipts, and to a reduction in expenses. The traffic receipts amounted to £15,359, as compared with £14,725, showing an increase of £634. That increase was encouraging, when it was remembered that the traffic during part of the year was somewhat interfered with by the construction of the double track on part of the road. The Coronation also kept away a number of visitors in the district during the early summer, and the takings in August were somewhat affected by the railway strike. It was only reasonable to expect that given fair weather during the coming summer they would be able to show a further increase during the current year. The miscellaneous receipts showed an increase of £325. The power expenses showed a decrease of £474, and it would interest them to know that they had used during the year 70,174 less units, although they had run 6,269 more car-miles. The traffic expenses showed an increase of £11, repairs and maintenance a decrease of £197, and the general expenses had decreased by £454, due to the absence of special expenditure and the reduction of directors' fees. Interest on loans showed a decrease of £132. During the year a considerable part of the track in Llandudno and Colwyn Bay had been overhauled, and special expenditure in this connection, amounting to £1,413, had been charged against the balance brought forward from last year's account. In the early part of the year they were able to make satisfactory arrangements with certain parties which enabled them to proceed with a doubling of a portion of the line. The double track had been completed for a distance of about two miles between Rhôs-on-Sea and the top of Penrhyn Hill, and in the process of construction they were enabled to effect improvements in the grades and curves at certain places. That had tended to a more efficient service, and they had been enabled to reduce the time of the through journey, which was of considerable importance in dealing with the "rush" traffic in the summer. The capital expenditure during the year had increased from £123,514 to £133,085. They had recently concluded arrangements for the acquisition of a quarry at Penrhyn Hill, whereby they would be able to effect a saving in the cost of material for road maintenance and other purposes. The directors were now in negotiation with a view of obtaining the right to double track a further portion of the line, as they thought it was of the greatest importance to have as much of the line as possible double tracked in order to cope with the summer traffic. No settlement had yet been arrived at with regard to widenings in connection with the extension to Old Colwyn. They had made an offer as to the amount which they considered the company should be called upon to contribute for road widenings, but so far they had been unable to arrive at a settlement. Whilst they believed that the construction of the extension would be a considerable public convenience, they could not advise the construction to be proceeded with unless the Colwyn Bay Council were reasonable in their demands. They had, however, intimated to them that immediately a settlement of the question could be effected they were prepared to proceed with the work. No further progress had been made with regard to obtaining the right to Sunday running, although he observed that recently there had been considerable expression of opinion by residents in the public Press as to the benefits which Sunday running would give to the public at large. It was unfortunate that North Wales should be behind the North of Scotland in recognising that Sunday running would not only be of benefit to the public at large, but would also be of considerable assistance to parties who wished to attend public worship. He felt sure the shareholders would appreciate the considerable improvement which had been made in the company's affairs during the year, not only by the further construction work which had been carried out, and which had enabled them to run the service more expeditiously, but also by the fact that they had consolidated their indebtedness by means of the issue of debenture stock. If reasonable arrangements could be made for the extension to Old Colwyn, their prospects for the current year ought to be further improved.

MR. GEORGE BALFOUR, in seconding the motion, said it was a source of great pleasure to the directors to know that they had been able to decrease the expenses and at the same time improve the service, because he was satisfied that the improvement was permanent so long as they had the traffic. He was pleased to say that even during the winter the improvement in the receipts had amounted to about 12 per cent., while their working expenses were lower. If they could do that in the winter they had every reason to believe that the company would be a highly successful undertaking, and that in future years they would be able to go on paying improved dividends regularly.

The CHAIRMAN, in reply to a shareholder, said that with regard to Sunday running, an arrangement was made some time ago by which they had the right to take a poll of the inhabitants once in three years. That poll was taken 1½ years ago, so that the right would not arise again for another 18 months. There was, however, no reason why the residents themselves should not ask the Council to approach the company in order that a Sunday service might be given. There was a growing tendency on the part of the public to show their dissatisfaction at the absence of Sunday running, and he need hardly say that if the residents decided that they wanted Sunday trams, the company would be only too willing to supply them. With regard to the expense ratio, that had been decreased during the year by 10 per cent.—last year it was 62 per cent., while this year it was 52 per cent.

The report was adopted.

**Dublin United Tramways, Ltd.**—The directors have announced a dividend of 6 per cent. per annum and a bonus of 1s. per share for the half-year, carrying forward £10,374.

**The French Compagnie Générale d'Electricité.**—The report for 1910-11 of the Compagnie Générale d'Electricité, of Paris, which has an ordinary share capital of £720,000, records profits of £320,000, of which £220,000 represents extraordinary profits derived from large transactions carried out during the year. Among these are mentioned the transfer of the company's station at Nantes to the Empain group and the sale of the Rouen station for £500,000 to the Centrale d'Energie Electrique, belonging to the Thomson-Houston group. The dividend amounts to 8 per cent., £205,000 has been placed to the reserve fund, and £53,900 has been carried forward. During the year the company participated in the formation of the Compagnie Générale Radiotélégraphique and in the new Compagnia Generale Italiana di Elettricità, of Milan, and a considerable portion of the capital in the Energia Elettrica de Catalana, of Barcelona, has also been acquired.

**The Madrid Amalgamation.**—The Union Electrica Madrileña is the title selected for the amalgamation of electric supply undertakings in Madrid, to which reference was made a week ago. It is composed of the General Madrid Electricity Co., whose bonds are largely in French ownership, the Sociedad de Gasificación and the Bolarque Waterfall Co. (Salto de Bolarque), and it forms a syndicate with the Electricity Co. of Chamberé. The share capital amounts to 33,000,000 pesetas and the bond capital to 14,000,000 pesetas. The hope is expressed in Madrid that the constitution of the union represents the beginning of a general amalgamation of electricity producers in Madrid.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each (issued at £1 premium), 10s. paid (of which 2s. 6d. is capital and 7s. 6d. premium) (Nos. 750,001 to 1,000,000).

Puebla Tramway, Light and Power Co.—Scrip, fully and partly paid, for \$3,600,000 prior lien 5 per cent. 50-year gold bonds.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Commercial Cable Co.—£35,101 additional sterling 500-year 4 per cent. debenture stock.

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 8,498 to 8,697.

**East London Railway Co.**—In their report just issued the directors state that the question of electrification has advanced considerably since the last report, and the arrangement foreshadowed in the chairman's speech at the half-yearly meeting, under which the money for the electrification would be advanced by the Great Eastern Railway Co., had been embodied in the Bill which that company was promoting for the forthcoming Session of Parliament. The main provisions are as under:—The Great Eastern Railway Co. to provide the capital, and the lessee companies, including the Great Eastern, to guarantee interest of £4 per cent. in the proportion of the liability of each of them under the lease. The East London Railway Co. to apply any receipts exceeding the minimum of £30,000 per annum secured to them under the lease, to the payment of this interest. A survey has already been made by the engineers of the Metropolitan, Metropolitan District, and South Eastern Companies, and specifications and drawings have been completed for the sub-station machinery and equipment, electrical equipment of the track, and automatic signalling. It is proposed to obtain the supply of electrical energy from the Metropolitan District Railway Co.'s generating station at Lot's Road, and to feed it to the rails through their existing sub-station at Whitechapel, and through a new sub-station which it is proposed to build at Deptford. In connection with and as a part of the electrification a new passenger station will be provided between Surrey Docks (formerly Deptford Road) and New Cross Stations the plans for which are in hand.

**Montreal Light, Heat and Power Co.**—The directors announce a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the quarter ending January 31st.

**British Columbia Electric Railway Co.**—The directors announce a dividend at the rate of 5 per cent. per annum on the 5 per cent. non-accumulative preferred ordinary stock for the half-year ended December 31st, 1911, together with an additional dividend at the rate of 1 per cent. per annum for the same period.

**City and South London Railway Co.**—The accounts for the half-year ended December 31st show a balance, after providing for debenture interest and preference dividends and the transfer of £1,500 to the renewal fund, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of 1½ per cent. per annum, carrying forward £2,814. The dividend for the corresponding half-year was at the rate of 1½ per cent. per annum.

**Kaministiquia Water and Power Co.**—The directors have declared a dividend of 1 per cent. for the quarter ending January 31st, being at the rate of 4 per cent. per annum, payable on February 15th.

**British Electric Traction Co., Ltd.**—It is announced that the directors have, after conference with representative shareholders, appointed Mr. G. T. Symons and Mr. C. G. Tegetmeier to fill the vacancies on the board until the next annual general meeting.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 17th.

CHEMICALS, &c.			Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. ..	per cwt.	5/-	..
a	" Nitric .. ..	..	22/-	..
a	" Oxalic .. ..	per lb.	23d.	..
a	" Sulphuric .. ..	per cwt.	5/6	..
a	Ammoniac Sal .. ..	..	42/-	..
a	Ammonia, Murate (large crystal) ..	per ton	£29 10	..
a	Bleaching powder .. ..	..	£5 10	..
a	Bisulphide of Carbon .. ..	..	£18	..
a	Borax .. ..	..	£16	..
a	Ferro-Silicon (45 %) .. ..	..	£12 12 6	..
a	Copper Sulphate .. ..	..	£23 10	£3 10 inc.
a	Lead, Nitrate .. ..	..	£25 10	..
a	" White Sugar .. ..	..	£22 15	..
a	" Peroxide .. ..	..	£32	..
e	Methylated Spirit .. ..	per gal.	2/6	..
a	Potassium, Bichromate, in casks ..	per lb.	3½d.	..
a	Potash, Caustic (80/82 %) .. ..	per ton	£20 5	..
a	" Chlorate .. ..	per lb.	3½d.	..
a	" Perchlorate .. ..	..	4½d.	..
a	Potassium, Cyanide (98/100 %) ..	..	7½d.	..
a	Shellac .. ..	per cwt.	68/-	..
a	Sulphate of Magnesia .. ..	per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. ..	..	£6 10	..
a	" Recovered .. ..	..	£5 10	..
a	" Lump .. ..	..	£5 6	..
a	Soda, Caustic (white 70/72 %) ..	..	£10 5	15/- dec.
a	" Chlorate .. ..	per lb.	3½d.	..
a	" Crystals .. ..	per ton	£3 5	..
a	Sodium Bichromate, casks .. ..	per lb.	3d.	..
a	" Cyanide (basis 100 %) .. ..	..	7d.	..
d	" " ( " 128/130 %) .. ..	..	..	..
METALS, &c.				
b	Aluminium Ingots, in ton lots ..	per ton	£65	£2 inc.
b	" Wire, in ton lots .. ..	..	£102	..
b	" Sheet, in ton lots .. ..	..	£120	..
p	Babbitt's metal ingots .. ..	..	£38 0 £145	..
c	Brass (rolled metal 2" to 12" basis) ..	per lb.	8d.	..
c	" Tube (brazed) .. ..	..	10½d.	..
c	" (solid drawn) .. ..	..	8½d.	..
c	" Wire, basis .. ..	..	7½d.	..
c	Copper Tubes (brazed) .. ..	..	10½d.	..
c	" (solid drawn) .. ..	..	10d.	..
g	" Bars (best selected) .. ..	per ton	£80	£1 inc.
g	" Sheet .. ..	..	£80	£1 inc.
g	" Rod .. ..	..	£8½	£1 inc.
d	" (Electrolytic) Bars .. ..	..	£68 10	10/- dec.
d	" " Sheets .. ..	..	£83 10	10/- dec.
d	" " Rods .. ..	..	£71 10	10/- dec.
d	" " H.C. Wire .. ..	per lb.	8½d.	..
f	Ebonite Rod .. ..	..	5/3	..
f	" Sheet .. ..	..	4/9	..
n	German Silver Wire .. ..	..	1/11	..
h	Gutta-percha, fine .. ..	..	5/- to 7/-	..
h	India-rubber, Para fine .. ..	..	4/7	9d. inc.
i	Iron Pig (Cleveland warrants) ..	per ton	49/10½	8d. dec.
l	" Wire, galv. No. 8, P.O. qual. ..	..	£14	..
g	Lead, English Pig .. ..	..	£15 5 to £15 7 6	12½ inc.
m	Manganin Wire No. 28 .. ..	per lb.	6/6	..
g	Mercury .. ..	per bot.	£8	..
e	Mica (in original cases) small ..	per lb.	6d. to 2s.	..
e	" " " medium .. ..	..	2/6 to 4/-	..
e	" " " large .. ..	..	4/6 to 8/6	..
p	Phosphor Bronze, plain castings ..	..	11d.	..
p	" " rolled bars & rods .. ..	..	1/0½	..
p	" " rolled strip & sheet .. ..	..	1/1	..
o	Platinum .. ..	per oz.	185/-	..
d	Silicium Bronze Wire .. ..	per lb.	9½d.	½d. dec.
r	Steel Magnet, in bars .. ..	per ton	£55	..
g	Tin, Block (English) .. ..	..	£193 to £195 nom.	£2 inc.
a	" Wire, Nos. 1 to 16 .. ..	per lb.	2/4	..
p	White Anti-friction Metals .. ..	per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.) ..	..	£31 2 6	..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p W. F. Dennis & Co.
h Edward Till & Co.	

## STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange is, like the traditional curate's egg, good in parts. Some markets are but a sorry waste of desolate inactivity; in others there is the bustle of eager business, and amongst the latter the miniature boomlet in Rubber shares is an outstanding feature.

Home Railway stocks are moving in lively fashion, and, after being steeped in gloom, prices recovered upon the appearance of one or two rifts in the labour sky. Whether there be a coal strike or not, opinion is very general that the recent fall in quotations has largely discounted its earlier effects. Manifestly, too, a fair amount of bear selling has been in progress, and the partial closing of this position was of material aid to the rally.

Districts are still a wild market, and since we last wrote have been down 2½, to pick up the loss later on, so that on balance the change is only ¼ lower. Underground Electric Railway shares have hardened again after their substantial rise of last week. The Income Bonds, however, are unchanged. Metropolitan Consolidated retains its big improvement. Central London Ordinary, with City and South London, went back a little.

The only Underground shares which, so far as we are aware have not moved up during the revival created by the boom in London General Omnibus stock, are the £10 fully-paid Preferred issue of the Great Northern and City, the present price of which is 22s. 6d. middle.

With 'Bus stock still soaring, advantage was taken of the excitement to give London United Tramways Preference a hoist, and from 3½ the price jumped to 4½ during the course of a few days. The pace was too hot to last, and, on the rise, shares came in which put the price back to 3½, at which a gain of ¾ remains on the week. Demand for the Debenture stock has also slackened, a point coming off the previous quotation. British Electric Traction First Debenture stock shows a rise of 1. Yorkshire 6 per cent. Preference shares are a little harder.

Changes in the Electricity Supply section are neither numerous nor important. Attention is being turned to Brompton Ordinary, on the good yield afforded by the shares, and the fact that they had not moved much of late. The price put on ½, and Westminster Preference are ¼ higher, although Westminster Ordinary are dull, yet the return on the last-named is more than 6 per cent. on the money, and the Company occupies a fine position. City "Lights" parted with ½ of their ¾ advance. The various Debenture stocks are inclined to improve.

The feature in the Telegraph and Telephone section is violence of the fluctuations in Marconi shares. They touched 79s. 6d. slumped right away to 62s. 6d. within an hour, then climbed above to 70s., only to decline again. The Preference fell ¼ in sympathy. As the immediate cause of the drop, the unwieldy nature of the bull position was the main factor. Dublin especially had been ardent in buying shares for which the purchasers could not pay, and when it was found that the shares could not all be carried over, the wild rush to sell forced the price down to 3½, at which support was again forthcoming. Quoted *ex* the dividend of 1s., the Ordinary at 3½, are 9s. down on balance.

West India and Panama are to the fore again, after their little rest, and business has been done as high as 4½. The rest of the telegraph market is somewhat supine. American Telephone and Telegraph capital stock rose 4, which is the more noticeable in view of the pronounced depression affecting American Railroad shares. Chili Telephones are about ¼ higher, allowing for the dividend deducted, and United River Plates benefited to the extent of ½. National Telephone Preference shares are lower, and speculation in the Deferred stock is dwindling. The price shows a shrinkage of another point, following upon the drop of 3½ last week. The proposal to take over the telegraph service in the United States by the American Government has occasioned considerable surprise.

Telegraph Constructions are 10s. better, and Babcock Ordinary have put on the half-crown which of recent weeks seem to have become a habit with them. Dick, Kerrs are a shade higher, and Crompton Debenture is 1 up. The Manufacturing division on the whole is very quiet.

Amongst Colonial and Foreign Electrical issues, Rangoon Preference stand out with a big rise of 7s. 6d., and the company's Debenture stock put on 2 points. Calcutta Trams also are harder at 5½, and Calcutta Supply Ordinary have risen ½, so that it may be said that the fall consequent upon the change of capital in India has been recovered as regards the electric issues. Amongst the Latin-Canadians, Montreal Light, Heat and Power Common went back 4, which is not astonishing in view of the enormous rise that has lately taken place. Mexico Trams are a little easier, and so are Rios, but the general tendency of the group is steady. A few further *ex*-dividend markings have the effect of making prices look cheaper again. River Plate Ordinary strengthened to 255, showing a rise of 15 points, and the Preference continue to creep up. Canadian General Electric are also better as regards the Common shares, a rise of 2 taking the price to 114½. The steady investment buying of Anglo-Argentine Tramways Preference shares has further advanced the prices of those issues, the Seconds being ½ up. Some of the more recent buying has come from Ireland. Para Electric Ordinary put on ½, but the Preference declined to the same extent. Brisbanes are a little harder again, and in British Columbias there is very little doing.

**The Siemens & Schuckert Companies.**—It appears from the reports of recent annual meetings that as a consequence of the necessity for additional capital on the part of the Siemens-Schuckert Works, the two proprietary companies—the Siemens and Halske Co. and the Schuckert Electricity Co.—have decided to make a further non-terminable loan of £1,000,000 to the former, thus increasing this 6½ per cent. loan to £2,500,000. The half to be furnished by the Siemens & Halske Co. will apparently be provided out of current funds, whilst the Schuckert Co.'s half will be raised by the latter issuing new shares of £500,000. If still further money is needed it is stated that provision has been made for this purpose. The orders now on the books of the Siemens & Halske Co. and the Siemens-Schuckert Works show a large advance over the same period in 1911, and all the works are declared to be fully employed.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 16th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 16th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½ 5½	7½—8½	..	6 5 9	Kensington & Knightsbridge, Ord.	5	9 8½	6½—7½	..	6 4 2
Do. 4½ % Pref.	10	4½ 4½	8½—9½	..	4 12 4	Do. 4 % Deb.	Stock	4 4	94—96	..	4 3 4
Do. Second 6 % Pref.	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb.	Stock	4½ 4½	73—82 xd	..	5 9 9
Do. 4½ % Deb. Stock	Stock	4½ 4½	10½—102	..	4 8 8	London Electric, Ord.	8	2 ..	1½—2	..	3 0 2
Brompton & Kensington, Ord.	5	10 9½	8—8½	+ ½	5 17 8	Do. 6 % Pref.	5	6 6	4½—4½	..	6 3 1
Do. 7 % Cum. Pref.	5	7 7	7½—8	..	4 7 6	Do. 4 % First Mort. Deb.	Stock	4 4	85—91	..	4 8 0
Central Electric Supply, 4 %	100	4 4	98—101	..	3 19 3	Metropolitan	5	5 4½	3½—4	..	6 5 0
Guar. Deb.						Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5 5½	3½—4	..	6 5 0	Do. 4½ % First Mort. Deb.	Stock	4½ 4½	99—104	..	4 6 7
Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½	..	4 14 9	Do. 3½ % Mort. Deb.	Stock	3½ 3½	84—87	..	4 0 6
Do. "City Undertaking"	5	4½ 4½	8½—4½	..	5 9 1	Midland Electric Corporation	100	4½ 4½	94½—96½	..	4 13 3
4½ % Cum. Pref.						4½ % First Mort. Deb.					
Do. Do. 4 % Deb.	100	4 4	93—96	..	4 3 4	Newcastle-on-Tyne	5	4 4½	3½—4	..	5 0 0
Chelsea, Ord.	5	5 4½	4—4½	..	5 11 1	Do. 5 % Pref., Non-Cum.	5	5 5	4—4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½ 4½	98—101	+1	4 9 1	North Metropolitan Power Sup-	100	5 5	99—102	..	4 13 0
City of London, Ord.	10	7 6½	12½—13½	— ½	5 4 8	ply, 5 % Mortgages (Red.)					
Do. 6 % Cum. Pref.	10	6 6	12—13	..	4 12 4	Notting Hill, 6 % Non-Cum.	10	.. ..	9½—10½	..	..
Do. 5 % Deb.	Stock	5 5	117—121	..	4 2 8	Pref.					
Do. 4½ % Second Deb.	100	4½ 4½	100—103	..	4 7 5	Oxford	5	7½ 6½	6½—6½	..	5 9 5
County of Durham, 5 % First	Stock	5 5	87—89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10 10½	8—8½	..	5 17 8
Mort. Deb.						Do. 7 % Pref.	5	7 7	6½—7½	..	4 19 1
County of London, Ord.	10	5 4½	9—9½	..	5 5 3	Do. 3½ % Deb.	100	3½ 3½	85—87	..	4 0 6
Do. 6 % Pref.	10	6 6	11—11½	..	5 4 4	Smithfield Markets, Ord.	5	Nil ..	1½—1½	..	Nil
Do. 4½ % Deb.	Stock	4½ 4½	106—108	..	4 3 4	South London, Ord.	4	5 ..	2½—3½	..	6 3 1
Do. 4½ % Second Deb.	Stock	4½ 4½	100—103	..	4 7 5	Do. 5 % First Mort. Deb.	100	5 5	98—101	..	4 19 0
Edmundson's, Ord.	5	Nil Nil	3—3½	..	Nil	South Metropolitan, 7 % Pref.	1	7 7	1—1½	..	5 4 5
Do. 6 % Cum. Pref.	5	Nil Nil	2—2½	..	Nil	Do. 4½ % First Deb. Stock	100	4½ 4½	96—99	+1	4 10 11
Do. 4½ % First Mort. Deb.	100	4½ 4½	82—85 xd	..	5 5 11	Urban, Ord.	5	5 ..	1—1½	..	..
Folkestone	5	6 6½	4½—5	..	6 0 0	Do. 5 % Cum. Pref.	5	5 ..	2—2½	..	..
Do. 5 % Cum. Pref.	5	5 5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb.	100	4½ 4½	86—88	— ½	5 2 3
Do. 4½ % First Deb.	100	4½ 4½	95—98	..	4 11 10	Westminster, Ord.	5	10 10½	7½—8½	+ ½	6 1 2
Hove	5	9 8½	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref.	5	4½ 4½	4½—5½	+ ½	4 6 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	5 6	5½—5½	..	5 4 4	Monterey Rly. Light & Power,	100	5 5	89—91 xd	..	5 10 0
Calcutta, Ord.	5	8½ 7½	6½—6½	+ ½	6 6 0	5 % 1st Mort. Deb.					
Do. 5 % Pref.	5	5 5	5—5½	..	4 15 3	Montreal, Lt., H. and Power	\$100	7 8	194—198	—4	3 10 8
Calgary Power, 1st Mort. Bds.	100	5 5	93½—95½	— ½	5 4 9	Northern, Lt., Power and Coal,	\$500	5 ..	39—41	..	12 3 10
Canadian Gen. El. Com.	\$100	7 7½	112—117	+2	5 19 8	5 % 1st Mort. Bonds					
Do. 7 % Pref.	\$100	7 7	118—122	..	5 14 9	River Plate, Ord.	Stock	10 ..	250—260	+15	3 16 11
Cordoba Lt., Power and T., Ord.	1	3 3½	7—1	..	3 0 0	Do. 6 % Non-Cum. Pref.	Do.	6 6	107—113	+1	5 7 2
Do. 5 % Deb.	100	5 ..	94—97	..	5 3 1	Do. 5 % Deb. Stock	Do.	5 5	100½—102½	+ ½	4 17 7
Elec. Lt. and P. of Cochabamba,	100	6 6	91—93	..	6 9 0	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	99—101	..	4 9 1
6 % Bonds						1st Mort. Deb.					
Elec. Supply Victoria, 5 % 1st	100	5 5	83—86	..	5 16 3	Shawinigan Water, Capital	\$100	4 5½	125—127	— ½	3 3 0
Mort. Deb.						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	105—107	..	4 13 6
Elec. Dev. Ontario, 5 % 1st	\$500	5 5	92—94	+ ½	5 6 5	Do. 4½ % Per. Deb.	Stock	4½ 4½	102½—104½	..	4 6 2
Mort. Bonds						Toronto Power, 4½ % Deb.	Do.	4½ 4½	99—101	..	4 9 1
Kalgoorlie Elec. P. and L., Ord.	10½	Nil ..	5½—3½	+ 3½	Nil	Vera Cruz Lt., P. and T., 5 %	100	5 5	91—93	..	5 7 6
Do. 6 % Pref.	1	6 6	102—104	+ 3½	7 7 8	1st Mort. Deb.					
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	102—104	+ 3½	4 16 2	Victoria Falls Power, Pref.	1	Nil 11½d.	1½—1½	..	..
Madras, Ord.	5	.. ..	25—3½	..	..	West Kootenay Power and Lt.,	100	6 6	106½—108½	..	5 10 7
Melbourne, 5 % 1st Mort. Deb.	100	5 5	100—102	+1½	4 18 0	1st Mort. 6 % Gold					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	87—89	+1	5 12 4						
Mexican Lt. & Power, Common	\$100	4 4½	86—88 xd	..	4 10 11						
Do. 7 % Cum. Pref.	\$100	7 7	107½—109½	..	6 7 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	97½—99½	+1	5 0 6						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4 7—7½	..	..	Monte Video Telephone, Ord.	1	6 6	15—1½	..	5 12 11
Do. 5 % Deb. Red.	Stock	5 5	98—100	..	5 0 0	Do. 5 % Pref.	1	5 5	1½—1½	..	5 6 8
American Telep. & Teleg., Cap.	\$100	8 8½	144—146	+4	5 9 7	National Telephone, Pref.	Stock	6 6½	101½—104½ xd	..	5 14 10
Do. Collat. Trust	\$1000	4 4	93—95	..	4 4 3	Do. Def.	Do.	6 6½	122½—124½ xd	—1	4 16 5
Anglo-American Telegraph	Stock	3½ 3½	67—69	..	5 8 8	Do. 6 % Cum. 1st Pref.	10	6 6	9½—10 xd	— ½	6 0 0
Do. 6 % Pref.	Do.	6 6	111—112	..	5 7 2	Do. 6 % Cum. 2nd Pref.	10	6 6	9½—10 xd	— ½	6 0 0
Do. Def.	Do.	80½ ..	26½—27½	..	5 8 1	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½—5½	— ½	4 9 11
Anglo-Portuguese Tel., 5 %	100	5 5	101—103	..	4 17 1	Do. 3½ % Deb.	Stock	3½ 3½	98—100	..	3 10 0
Mort. Deb.						Do. 4 % Deb.	Do.	4 4	98—100	..	4 0 0
Chili Telephone	5	7 ..	7½—7½	+ ½	4 15 9	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	101½—102½	+ ½	4 7 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	86—88	..	4 10 11	Oriental Telep. and Elec.	1	8 ..	1—1½	..	4 18 6
Cuba Telegraph	10	6 6½	10½—11	+ ½	5 9 1	Do. 6 % Cum. Pref.	1	6 6	1½—1½	..	4 13 8
Do. 10 % Pref.	10	10 10	17—18	..	5 11 1	Do. 4 % Red. Deb.	Stock	4 4	87—89	..	4 9 11
Direct Spanish Telegraph, Ord.	5	4 4½	3½—3½	..	5 6 8	Pacific and European Tel., 4 %	Do.	4 4	98½—100½	..	3 19 7
Do. 10 % Cum. Pref.	5	10 10	8½—8½	..	5 14 3	Guar. Debs.					
Do. 4½ % Debs.	50	4½ 4½	98½—100½	..	4 9 7	Reuter's	8	5 5½	8½—9½	..	4 6 6
Direct United States Cable	10	4½ ..	7½—8½	+ ½	5 7 5	Submarine Cables Trust	Cert.	6 6	130—133	..	4 10 3
Direct W. India Cable, 4½ %	100	4½ 4½	98½—100½	..	4 9 7	Telephone Co. of Egypt, 4½ %	Stock	4½ 4½	98—100	..	4 10 0
Reg. Deb.						Deb. Red.					
Eastern Telegraph, Ord. Stock	Stock	7 5½	137—140 xd	..	5 0 0	United River Plate Telephone	5	8 8	7½—7½	+ ½	5 4 11
Do. 3½ % Pref. Stock	Do.	3½ 3½	83—85 xd	..	4 2 4	Do. 5 % Cum. Pref.	5	5 5	5½—5½	..	4 8 11
Do. 4 % Mort. Deb.	Do.	4 4	101—103	..	3 17 8	West Coast of America	2½	2½ 2½	1½—1½	..	4 15 3
Eastern Extension	10	7 5½	13½—13½ xd	..	5 1 10	Do. 4 % Debs., 1 to 1,500	100	4 4	98½—100½	..	3 19 7
Do. 4 % Deb.	Stock	4 4	100½—102½	..	3 18 1	guar. by Braz. Sub. Tel.					
East and S. Africa Tel. 4 %	25	4 4	99—101	..	3 19 3	West India and Panama Teleg.	10	1½ 1½	3½—4½	+ ½	2 19 8
Mt. Db. Mauritius Sub.						Do. 6 % Cum. 1st Pref.	10	6 6	10½—10½	+ ½	5 10 4
Globe Telegraph and Trust	10	5½ 6½	10½—11½	..	5 6 8	Do. 6 % Cum. 2nd Pref.	10	6 6	9½—10½	..	5 17 1
Do. 6 % Pref.	10	6 6	12½—13½	..	4 10 9	Do. 5 % Debs.	100	5 5	102—104	+1	4 16 2
Great Northern Telegraph	10	18 5½	32—33	..	5 9 1	Western Telegraph, Ltd.	10	7 6½	13½—14	..	5 0 0
Indo-European Telegraph	25	13 5½	56½—58½	..	5 10 2	Do. 4 % Deb.	Stock	4 4	99—101	..	3 19 3
Mackay Companies Common	\$100	5 5½	80—83	..	6 0 6	Western Union Tel., 4 % Bnds. A	\$1000	4 4	106—109	..	3 13 5
Do. 4 % Cum. Pref.	\$100	4 4	69—72	..	5 11 1	Do. 4½ % Fdg. Bonds	\$1000	4½ 4½	100—103	..	4 7 5
Marconi's Wireless Telegraph	1	5 ..	3½—3½	+9/-	..						
Do. 7 % Cum. Partic. Pref.	1	16 ..	2½—2½	— 1½	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan 16th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan 16th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. . . . .	1	Nil Nil	80 — 85	..	Nil	Metropolitan Railway Consol. . .	100	1 1/2 2 1/2	46 1/2 — 46 3/4	..	2 18 10
Do. 5 % Pref. . . . .	1	5 5	7 1/2 — 8 1/2	..	7 5 6	Do. Surplus Lands . . . . .	100	2 3/4 3 1/4	66 — 68	..	4 0 11
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	80 — 85	..	5 5 11	Do. 3 1/2 % Deb. . . . .	100	3 1/2 3 1/2	90 — 92 xd	..	3 16 1
Brit. Elec. Trac., Ord. . . . .	10	Nil Nil	..	..	..	Do. 3 1/2 % Pref. . . . .	100	3 1/2 3 1/2	85 — 88	..	3 19 7
Do. 6 % Pref. . . . .	10	1 1/2 1 1/2	..	..	..	Do. 3 1/2 % Con. Pref. . . . .	100	3 1/2 3 1/2	85 — 87	..	4 0 6
Do. 5 % Deb. . . . .	100	5 5	94 — 97	+1	5 3 1	Metropolitan District Ord. . .	100	Nil ..	32 3/4 — 33 1/4	— 1/4	Nil
Do. 4 1/2 % 2nd Deb. . . . .	100	4 1/2 4 1/2	79 — 83	..	5 8 5	Do. 6 % Deb. . . . .	100	6 6	141 — 146	..	4 2 2
Central London Railway, Ord.	100	3 3 1/2	63 — 71	—1	4 5 9	Do. 4 % Deb. . . . .	100	4 4	95 — 97	..	4 2 6
Do. Pref. . . . .	100	4 4	84 — 86	—3	4 13 0	Do. 4 % Prior Lien . . . . .	100	4 4	100 — 102	..	3 18 5
Do. Def. . . . .	100	2 2	56 — 58	—1	3 9 0	Do. 4 1/2 % First Pref. . . . .	100	3 1/2 4 1/2	91 — 93	..	3 10 0
Do. 4 % Deb. . . . .	100	4 4	100 — 102 xd	..	3 18 5	Do. 3 1/2 % Gtd. . . . .	100	3 1/2 3 1/2	76 — 78	..	4 9 9
City & South London, Ord.	100	1 1/2 1 1/2	29 — 30	—1	5 0 0	Metropolitan Elec. Trams, Ord.	1	5 1/2 5 1/2	22 — 1 3/4	..	5 6 6
Do. 5 % Pref., 1891 . . . . .	100	5 5	108 — 110	..	4 11 0	Do. Def. . . . .	1	Nil ..	..	..	Nil
Do. Do. 1896 . . . . .	100	5 5	104 — 106	..	4 14 4	Do. 5 % Pref. . . . .	1	5 5	..	..	5 3 1
Do. Do. 1901 . . . . .	100	5 5	103 — 105	..	4 15 3	Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	100 — 102	..	4 8 3
Do. Do. 1903 . . . . .	100	5 5	101 — 103	..	4 15 3	Do. 5 % Deb. . . . .	100	5 5	101 — 103	..	4 17 1
Do. 4 % Deb. . . . .	100	4 4	101 — 103	..	3 17 8	Potteries, Ord. . . . .	1	2 ..	..	..	..
Dublin United Trams, 6 % Pref.	10	6 6	11 — 12	..	5 0 0	Do. 5 % Pref. . . . .	1	5 5	..	..	6 19 3
Great Northern & City, Pr'f. Ord	10	Nil ..	1 — 1 1/2	..	Nil	Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	90 — 93	—1	4 16 9
Hastings Trams, 6 % Pref. . . .	5	Nil 3 1/2	7 — 7 1/2	..	..	South Metro. Trams, 6 % Pref.	1	6 6	..	..	6 17 2
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	73 — 78	..	5 14 8	Do. 4 % Deb. . . . .	100	4 4	70 — 75	..	5 6 8
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	28 — 28	..	4 6 11	Underground Elec. Railways	10	.. ..	3 — 3 1/2	+ 1/8	..
Do. 4 1/2 % Deb. . . . .	100	4 4	75 — 80	..	5 0 0	Do. 4 1/2 % Bonds . . . . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Lancashire United, 5 % Deb. . .	100	5 5	76 1/2 — 79 1/2	..	6 5 9	Do. 6 % Income . . . . .	100	1 1 1/2	79 — 81	..	..
London Elec. Railw'ys, 4 % Deb.	100	4 4	97 — 99	..	4 0 10	Do. Power House Debs. . . . .	100	4 4	100 — 102	..	8 18 5
London United Trams, 5 % Pref.	10	Nil ..	3 1/2 — 4	+ 1/8	..	Yorkshire (West Riding), Ord.	5	Nil ..	1 — 1 1/2	..	Nil
Do. 4 % Deb. . . . .	100	4 4	75 — 78	—1	5 2 7	Do. 6 % Pref. . . . .	5	Nil ..	2 1/2 — 3	+ 1/8	Nil
						Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	80 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . .	5	6	5 1/2 — 5 1/2	+ 1/8	5 4 9	La Plata Elec. Trms, Prf, . . .	1	6 6	22 — 1	..	6 0 0
Do. 2nd Pref. . . . .	5	5	4 1/2 — 5 1/2	+ 1/8	5 3 6	Lisbon Elec. Trams, Ord. . . .	1	5 1/2 6 1/2	1 — 1 1/2	..	4 8 0
Do. 4 % Deb. . . . .	100	4 4	93 1/2 — 95 1/2	..	4 3 9	Do. 6 % Pref. . . . .	1	6 6	1 — 1 1/2	..	4 16 0
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	100 — 102	+1	4 8 3	Do. 5 % Deb. . . . .	100	5 5	93 1/2 — 97 1/2	..	5 2 7
Do. 5 % Deb. . . . .	100	5 5	101 — 103	..	4 17 1	Madras Elec. Tr. (1904), Deb. .	100	5 5	93 1/2 — 96 1/2	..	5 3 8
Auckland Trams, 5 % Deb. . . .	100	5 5	102 — 105	..	4 15 3	Manaos Trams & Lt., 1st Deb. .	100	5 5	90 1/2 — 92 1/2	..	5 8 1
Bombay Elec. S. & Trams, Pref.	10	6 6	107 1/2 — 113 1/2	..	5 5 6	Manila Elec. R. and Lt., Bonds	\$1000	5 5	100 1/2 — 102 1/2	..	4 17 7
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	96 — 98	..	4 11 10	Mexico Trams Com. . . . .	\$100	7 7 1/2	123 — 125 xd	..	5 12 0
Do. 5 % 2nd Deb. . . . .	100	5 5	96 1/2 — 98 1/2	..	5 1 6	Do. Gen. Con. 5 % Bonds . . .	..	5 5	99 — 101	+ 1/8	4 19 0
Brisbane Trams Invt., Ord. . . .	5	8 8 1/2	8 — 8 1/2	+ 1/8	4 7 8	Do. 6 % Bonds . . . . .	100	6 6	101 — 103	..	5 16 6
Do. 5 % Pref. . . . .	5	5 5	4 1/2 — 5 1/2	..	4 15 3	Para Elec. Rlys. & Lt., Ord. . .	5	10 10 1/2	7 — 7 1/2	+ 1/8	6 15 7
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	101 — 104	..	4 1 7	Do. 6 % Pref. . . . .	5	6 6	5 1/2 — 5 1/2	— 1/8	5 6 8
B. Columbia Elec. Rly., Def. . .	100	8 8 1/2	137 — 142	..	5 12 8	Do. 5 % 1st Deb. . . . .	100	5 5	97 1/2 — 99 1/2	..	5 0 6
Do. Pref. Ord. . . . .	100	6 6	120 — 124	..	4 16 9	Perth (W.A.) Elec. Tr., Ord. . .	1	2 1/2 2 1/2	1 — 1	..	2 10 0
Do. 5 % Pref. . . . .	100	5 5	108 1/2 — 111 1/2 xd	+2	4 9 8	Do. 5 % 1st Deb. . . . .	100	5 5	99 — 101	..	4 19 0
Do. 4 1/2 % 1st Mort. Deb. . . .	40	4 1/2 4 1/2	100 — 103	..	4 7 5	Rangoon El. Tr. & Sup., Pref. .	5	6 6	5 1/2 — 5 1/2	+ 1/8	5 2 2
Do. 4 1/2 % Vancouver Deb. . .	100	4 1/2 4 1/2	104 — 106	..	4 4 11	Do. 4 1/2 % 1st Deb. . . . .	100	4 1/2 4 1/2	98 — 101	..	4 9 1
Do. 4 1/2 % Con. Deb. . . . .	100	4 1/2 4 1/2	102 — 104	..	4 6 7	Rio de Janeiro Trams . . . .	\$100	4 1/2 5 1/2	115 — 116	—2	3 17 7
Calcutta Trams, Ord. . . . .	5	6 6	5 1/2 — 6	+ 1/4	5 0 0	Do. 1st Mort. 5 % Bonds . . .	..	5 5	101 — 102	..	4 18 0
Do. 5 % Pref. . . . .	5	5 5	4 1/2 — 5 1/2	..	4 17 7	Do. 5 % Mort. Bonds . . . . .	100	5 5	97 — 98	+ 1/8	5 2 0
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	100 — 103	..	4 7 5	Sao Paulo Tram, Lt. and P. . .	\$100	10 10 1/2	190 — 194	—4	5 3 1
Cape Electric Trams . . . . .	1	Nil 2 1/2	7 — 7 1/2	..	4 0 0	Do. 5 % 1st Deb. . . . .	\$500	5 5	102 — 104	+ 1/8	4 16 2
City Buenos Aires Trams (1904)	5	5 5	5 1/2 — 5 1/2	..	4 5 1	Singapore Trams, 5 % Deb. . .	100	5 5	81 — 84	..	5 19 1
Do. 4 % Deb. . . . .	100	5 5	95 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5 5	95 1/2 — 97 1/2	..	5 2 7
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5 5	93 — 98	..	5 2 0	Un. Elec. Trams Monte Video .	5	6 7	5 1/2 — 5 1/2	..	5 2 2
Havana Elec. Rly., 5 % Bonds	\$1000	5 5	100 — 10 1/2 xd	..	4 17 1	Do. 6 % Pref. . . . .	5	6 6	5 1/2 — 5 1/2	..	5 10 4
Kalgoorlie Elec. Trams . . . . .	1	Nil ..	..	..	Nil	Do. 5 % 1st Deb. . . . .	100	5 5	98 1/2 — 101 1/2	..	4 18 6
Do. 5 % A Deb. . . . .	100	5 5	91 — 94	..	5 6 5	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2 4 1/2	101 — 106	..	4 4 11
Do. 6 % B Deb. . . . .	100	5 5	58 — 62	..	8 1 4						

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	Nil 6	5 — 5 1/2	..	..	Dick, Kerr . . . . .	1	5 ..	22 — 3 1/2	+ 3/8	5 9 1
Do. 6 % Pref. . . . .	1	9 6	6 1/2 — 6 1/2	..	7 2 2	Do. Pref. . . . .	1	6 6	1 — 1 1/2	..	5 12 11
Babcock & Wilcox . . . . .	1	26 24 1/2	6 1/2 — 6 1/2	+ 1/8	4 0 0	Do. Deb. . . . .	100	4 1/2 4 1/2	92 1/2 — 95 1/2	..	4 14 3
Do. Pref. . . . .	1	6 6	1 — 1 1/2	..	4 0 0	Edison & Swan, A, £3 paid	5	Nil ..	1 — 1	..	Nil
B.I. & Helsby Cables . . . . .	5	10 8 1/2	6 1/2 — 7 1/2	..	7 0 4	Do. fully paid . . . . .	5	Nil ..	1 — 2 1/2	..	Nil
Do. Pref. . . . .	5	6 6	5 1/2 — 6 1/2	..	4 16 0	Do. 4 % Deb. . . . .	100	4 4	70 — 74	..	5 8 1
Do. Deb. . . . .	100	4 1/2 4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb. . . . .	100	5 6	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2 4 1/2	94 — 97	..	4 12 9	Electric Construction . . . .	2	Nil 2 1/2	..	..	..
British Westinghouse, Pref. . .	3	Nil ..	4 — 4 1/2	..	Nil	Do. Pref. . . . .	2	7 7	1 — 1 1/2	..	7 9 4
Do. Deb. . . . .	100	4 4	54 — 57	..	7 0 4	Greenwood & Batley, Pref. . .	10	7 7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien . . . . .	100	6 6	100 — 102	..	5 17 8	Do. Deb. . . . .	100	5 5	94 — 96	..	5 4 2
Browett, Lindley, Ord. . . . .	1	Nil ..	1/6 — 2/6	..	Nil	General Electric, Pref. . . . .	10	5 5	8 1/2 — 9 1/2	..	5 8 1
Do. Pref. . . . .	1	Nil ..	5/6 — 6/6	..	Nil	Do. Deb. . . . .	100	4 4	85 — 90	..	4 8 11
Brush, Ord. . . . .	2	Nil ..	0 — 1 1/2	..	Nil	Henley's, Ord. . . . .	5	15 10 1/2	11 1/2 — 12 1/2	..	5 18 10
Do. 7 % Pref. . . . .	2	Nil ..	0 — 1 1/2	..	Nil	Do. Pref. . . . .	5	4 1/2 4 1/2	4 1/2 — 5 1/2	..	4 5 11
Do. 4 1/2 % Deb. . . . .	100	4 1/2 4 1/2	56 — 61	..	7 7 7	Do. Deb. . . . .	100	4 1/2 4 1/2	104 — 106	..	4 4 11
Do. 4 1/2 % Second Deb. . . . .	100	4 1/2 4 1/2	37 — 42	..	10 14 4	India-Rubber, G. & T. . . . .	10	10 ..	10 — 12	..	..
Callender's Cable . . . . .	5	15 10 1/2	9 — 9 1/2	..	7 13 10	Do. Pref. . . . .	10	5 5	94 — 10 1/2	..	4 17 7
Do. Pref. . . . .	5	5 5	5 — 5 1/2	..	4 15 3	Telegraph Construction . . .	12	20 10 1/2	34 1/2 — 36 1/2	+ 1/8	6 17 0
Do. Deb. . . . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1	Do. Deb. . . . .	100	4 4	99 1/2 — 101 1/2	..	3 18 10
Castner-Kellner . . . . .	1	17 1/2 20	9 1/2 — 9 1/2	..	4 10 6	Willans & Robinson . . . . .	1	Nil ..	1 — 1 1/2	..	Nil
Do. Deb. . . . .	100	4 1/2 4 1/2	106 — 110	+1	4 1 10	Do. Pref. . . . .	5	Nil ..	1 — 1 1/2	..	Nil
Crompton & Co. . . . .	3	Nil Nil	4 — 4 1/2	..	Nil	Do. Deb. . . . .	100	4 4	53 — 63	..	7 2 10
Do. Deb. . . . .	100	5 5	58 — 68	..	7 7 1						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.



## PROCEEDINGS OF INSTITUTIONS.

## The Use of Electricity for the Control of Railways.

ON Monday last week an interesting paper was read before the Derby Society of Engineers and Telegraph Superintendents of the Midland Railway, by Mr. J. Sayers, M.I.E.E., chairman of the society. The following is an abstract of the paper:—

The centre of gravity of the Midland system is at Derby, whence radiate the chief railway and telegraph lines, the latter including three lines worked quadruplex, two duplex, and two needle and bell circuits. The important circuits are kept out of signal boxes, where telephones are being largely substituted for telegraphs. All messages to stations not on the same circuit as the station of origin are sent to Skipton, whence they are forwarded to destination; the messages are prefixed by certain letters which indicate the comparative importance and urgency of each message, from D M, the danger signal, which demands instant attention, to D B, which stands next in urgency to a train letter. The average time occupied in the transmission of a telegram with the least important prefix ranges from 14 to 21 minutes; about 17 million telegrams are sent annually, averaging 19 words each, and the company has the right, in addition, to send 320,000 postal telegrams, aggregating 5,120,000 words, free of charge per annum.

The control of goods and mineral traffic on the sections of line roughly from Leeds to London, from Derby to Birmingham, and from Birmingham to Bristol, is carried out mainly by telephones. Three trunk telephone systems from the North, South, and West respectively centre at Derby, each having about six stations upon it, which stations are the main traffic centres; from these centres radiate other telephone circuits, some being extensions of the already existing telephone box circuits, and others telephone circuits superimposed upon an existing telegraph wire. By this combination the smallest local centre can communicate with, or be instructed by, either his immediate governing centre, or if necessary, by the head officers at Derby.

In the busiest sections of the line an accurate record is kept of the exact position of goods and mineral trains, by the control operator keeping continuously a day-book entry of all trains passing him; the state of his book is hourly sent telephonically to the local centre, and, this information being collated within a minute or two from all the stations in this neighbourhood, an accurate record is in front of the controller, showing him the exact positions of such trains at that particular moment.

This is transmitted instantly on one of five separate telegraph circuits to Derby, and the aggregation of the information from the five circuits enables the operator at Derby to move on a large scale model of the line (which includes all sidings and connections), and shows him at a glance how the trains are running. Their loading is also known, as well as the amount of traffic standing in sidings, and its nature and destination.

The net effect of this arrangement, which was designed by the general superintendent (Mr. C. W. Paget), has been to exercise such a control upon the loading, running, and speed of the goods and mineral trains on the chief lines of the Midland as to ensure that they are running at their maximum efficiency as regards weight behind the engine; at their maximum efficiency as regards the absence of unnecessary stopping and shunting, waiting at signals, &c., and with the maximum punctuality. I believe it is quite the usual thing for 90 per cent. of the controlled goods trains arriving at a place like Leeds to be punctual, fully loaded, and, in addition, very frequently to have run, say, from Masboro' to Hunslet, without a stop. This system of communication has been carried out with great economy, considering its size, largely on account of the invention of a telephone system for working on an existing telegraph wire without interfering with the telegraph service. At this moment the Midland employ 328 superimposed telephones, and they are rapidly increasing in number.

In the latest type of these telephones a high-class ordinary high-resistance receiver is used, and the telephonic currents are received from the line through what is called a phonoporic coil, which is really a transformer with discontinuous windings. There is, of course, some interference and noise from the telegraphic currents which traverse the transformer, chiefly owing to its electrostatic capacity, but an operator very soon gets used to this, and the speech is usually very good indeed.

As the operation of intermediate telegraph instruments would necessarily be continually breaking the line, and so cutting the conversation up, it is necessary to shunt each instrument with a two-microfarad condenser. The electrostatic capacity added to the line from this cause, and from the capacity of the telephones themselves, has no prejudicial effect upon ordinary telegraph circuits, and upon quadruplex circuits it is overcome by introducing balancing capacity in the usual manner.

The call on these circuits is given by an electrical vibrator, which operates an electric horn at each instrument, each station having, of course, its own code call. About eight superimposed telephones can be satisfactorily worked on one circuit.

Turning to the electrical control of running trains, personally, I think whether main-line trains are driven by steam or by electricity, they should be controlled as regards their movements by an actual man on the moving train, and his control should be regulated by communications from fixed visual signals, or, as may possibly be to some extent the case in the future, by electro-mechanical signals received by his train by contact, induction or radio-telegraphic means from the track.

The first is really the ideal arrangement, although the oldest and simplest, but for one thing—the obstruction due to fog or heavily falling snow. The ordinary method of replacing the proper sight

of signals in fog is the use of men on the line at the distant signal, who, when the signal is "on," place a detonator on the line, and when the signal is "off" remove it. This system works remarkable well, although it appears to be crude, and its success is due to the use of distant signals.

It is extraordinary how many inventions have been taken out by people who probably do not understand what a distant signal is. Such inventions are always absolutely useless.

The difficulty with all these inventions is that they involve something moving at a speed varying from nothing to 90 miles per hour coming into mechanical contact with a stationary portion of the track, and it is extremely difficult to devise apparatus which shall make sufficient mechanical and electrical connection with the track when a train is stationary, and yet survive continuously the impact which the apparatus would sustain when moving at a high velocity.

So far as I know there is only one system of the kind which is reasonably successful at the present day, and that is "The Great Western system," which is in considerable use on certain lines of the Great Western railway, and which the Midland Co. have been trying for some years past on the Wirksworth branch with a very great measure of success.

The danger signal requires only the mechanical movement of the shoe on the engine due to its riding up and on the ramp, this movement opening a switch on the engine which, by the failure of the local current, operates a whistle that shows danger in the cab. If the signal is off, the ramp and rail have an E.M.F. of about 24 volts connected between them, and the breaking of the switch by the movement of the shoe mentioned above is counteracted on the engine by the received current from the ramp and rail, which cancels the danger signal on the whistle and substitutes a safety signal on a bell.

So far as I remember this system has never given a false signal to the driver in the direction of danger; what few failures there have been out of many thousands of indications, have been on the side of safety, indicating that the signal was "on" when it was really "off."

The difficulty of extending a system of this kind, apart from first cost (which becomes very great on an extensive line), is that engines from one centre run over very large portions of the line, especially if a period such as 12 months is considered, and it is therefore necessary, before converting even one section of the line, that the apparatus should be fixed on all engines which would possibly reach it. If the present method of fog-signalling were abolished, say between Leeds and Derby, it must be absolutely impossible for a single engine at any time to run over that section of the line unless it is fitted with the apparatus.

Apart from this difficulty, there is no doubt that this method of fog-signalling would be considerably dearer than the present, and the only advantage that really remains with it is due to the fact that it would always be ready for operation when a fog came on, whereas fog signalmen have to be called out, and there is a time at the beginning of a fog when the men are not at their posts. This has to be met at present by careful running, with the necessary delay.

After describing the lock and block system in use on the Midland railway, with safety checks to indicate whether signals have acted and whether lamps are burning, the author proceeds:—

The most important addition of recent years to the means for detecting the presence of trains on portions of the line which, for various reasons, are sections upon which a train should not be left or kept waiting without special attention, is that called the track circuit. The bonds used to make each line of rails metallically continuous consist of soft copper studs into which is brazed a No. 8 galvanised iron wire; the copper studs are driven into corresponding holes drilled into the web of the rail and are then compressed with a screw. This ensures an absolutely watertight and perfect contact with the rail, which is further secured by heavily coating it with red oxide paint.

A Midland insulated joint for insulating the section of track circuit from the continuing part of the line is made with vulcanised fibre sheets and tubes. The fibre for side plates is obtained in sheets  $\frac{1}{4}$  in. thick, which is cut into suitable sizes by a circular saw. Holes are then drilled to fit the bolts, after which the pieces are soaked in water until the fibre becomes sufficiently flexible to bend. They are then placed on a piece of 100-lb. rail with ordinary fish-plates on either side, bolted up and left on the rail and allowed to dry slowly—they must not be baked. They are then taken off and the holes enlarged to fit the ferrules, after which the edges are trimmed and the whole coated with red oxide paint. The end pieces are cut out of  $\frac{1}{4}$ -in. fibre sheet shaped to the section of the rail and painted. The ferrules are made from fibre tube so as to get the strength of the wrapping of the fibre. The tube is obtained as nearly as possible to the correct bore to fit the bolts, and the bolt holes in the rails are enlarged to driving fit.

The great advantage of this type of joint is that it gives the minimum amount of interference with the engineer's sections and the permanent way generally. After it is put in, the only precaution that the platelayer has to observe is that he must not slacken this joint at any time for variations of temperature. If it were allowed to become loose, the fish plate edges, rocking against the top and bottom of the rail, would very soon cut through the fibre.

At the entering end of the track circuit is connected a 9-ohm relay, and at the other end of the track circuit is connected a low-voltage large capacity battery (generally one lead accumulator) through a resistance which can be varied at will. On the contacts of the relay is connected a battery, working through a circuit to the signal box, which circuit usually traverses the coils of an electric lock, unlocking one or more signal levers, and also



traversing one or more indicators which show two indications—"Clear" and "Occupied."

A train entering from the entering end short circuits the rails, so reducing the potential on the relay coils to practically *nil*. The relay drops, and so breaks the contacts, maintaining the locking and indicating circuit. Immediately, therefore, the train touches the track, the lock drops into the signal protecting the train and prevents it being pulled off again, and the indicator shows "Line occupied."

If the train becomes at rest on the track circuit for any reason, proper or improper, it will hold the signal at danger behind it, and continue to show "Line occupied," so reminding the signalman of its presence.

On passing through, the train at last runs over a portion of the track where it short-circuits a resistance between the rails and on the train finally leaving the track, the voltage on the relay is raised to a considerable figure above the normal. The object of this is to give the relay an extra amount of lifting power momentarily, so as to ensure the armature of the relay going to its normal position in all weathers if the track is clear.

It should be noted that a track circuit is what is called a positive safety device; that is, the failure of any of its parts locks the apparatus, and shows the "occupied" signal. This happens, for instance, if a rail breaks, breaking the track circuit, or if any of the wires break; and by putting the locking and indicating battery at the relay end (a suggestion by one of my staff) any contact between the wires from this point to the signal box gives a failure indication, and locks the signal. In one case on the Midland where a track circuit was reported to have failed (showing "line occupied" when it was clear), the night was dark, and the lineman, repairing to the spot, found the track under about 2 ft. of water. This was near Swansea, and had been caused by a mountain torrent suddenly becoming very active.

The use of track circuits on the Midland Railway is now so extensive that the directors have had the whole of the passenger rolling stock electrically bonded from the tires of the Mansell wheels to the axles.

It is obvious that track circuits can be used through their relay contacts for doing all sorts of locking, indicating and signal control, and, in fact, all automatic signalling in use in this country is controlled by track circuits and their relays.

The South-Western Co., for instance, have a great many miles of four-line tracks which are automatically signalled by the electro-pneumatic system, in which the power to move the signals is supplied by low-pressure air, and the control valves which admit it and discharge it (so lowering or raising the signal) are operated by electric valves of the diaphragm type, the coils of these valves passing through the track circuit relay contacts.

The Midland Co. have put in a system of controlled automatic signalling between Steeton and Keighley and between Gargrave Hellifield, the whole being about 18 miles of track.

In this case the lines are continuously track-circuited, and the automatic signals are operated by electric motors; the motors in one section pull off the signals through an electromagnetic clutch, the power being supplied from a pair of mains run from a fairly large lead battery at one end of the section. Arrangements are made by which, when the motor has pulled off the signal, it cuts off its own current, but the current to the electromagnetic clutch continues until the train, entering the section beyond, 400 yards away, drops the track relay, when the clutch is de-energised and the signal returns to danger.

In addition to the operation or control of the signals, the signalman at each end of the section (who has no block instructions) has a large diagram which shows him automatically the state of each section between himself and the next box; that is, whether there is a train in the section or whether the line is clear.

In the section between Gargrave and Hellifield, the whole of the electrical power, whether for tracks or for operating the signal motors, is provided by a Gordon primary battery.

Very long and extensive experiments were made in our laboratory with various forms of primary batteries in order to obtain one which would give a constant E.M.F. under a steady discharge and a large capacity, which would stand a temperature of 0° F., and whose condition would be easily observed by the attendant passing through the section. No cell fulfilled these requirements so well as the Gordon cell.

In parallel with the battery of Gordon cells at any one signal post a small set of lead accumulators is placed with a capacity of, say, 20 ampere-hours, the connection from the Gordon battery to the accumulators being through small adjustable resistances so arranged that the discharge from the Gordon battery to the accumulators is just sufficient when integrated to supply energy for all the work of pulling off the signals.

When the motor is operated, therefore, the current for this comes almost entirely from the accumulators, and when the motor has finished its work, and the current is cut off, the Gordon batteries begin to supply slowly and continuously the energy which has been used.

For such a position as the Gargrave-Hellifield section (which is 7 miles long, double track) I hardly think this arrangement can be improved upon for cost of energy and cheapness of labour maintenance. Experience has shown also that it is extremely reliable.

The only efficient substitute, so far as I can see, for the ordinary "light" signal during fog (when it is invisible) is radio-telegraphy.

Some very interesting experiments have been carried out on the Midland and Stratford-on-Avon Junction railway by the Railo-telephone Syndicate, working under Mr. Von Kramer's patents, with a view to telephoning and telegraphing from the track to a moving train.

The cost of such work is very great.

It is quite possible, however, that the cost will be considerably reduced, and in that case there should in certain circumstances be a field for such an arrangement.

In the course of a brief discussion which followed the paper, Mr. ACFIELD (Signal Superintendent of the M.R.) said he thought the track circuit had come to stay. One was put down at Birmingham (not by the Midland) and failed miserably, although it was put down by experts. The track circuit on the Midland Railway had met with unbounded success, and the failures had been very few, and that, he thought, could only be attributed to the very careful design and excellent maintenance of the track circuit by Mr. Sayers. One of the largest railways in England had almost decided to adopt Mr. Sayers's design of insulated joint.

Mr. CONRADIS (secretary) asked whether there would be any trouble in operating the cab-signalling apparatus with the track circuit. The Great Western system was probably the best of that type of apparatus. A commission in America which examined 400 systems, came to the conclusion that only 12 of them were worthy of notice, and the Great Western system was placed first.

In reply, the CHAIRMAN said they did not put track circuits down indiscriminately. They would not install one, say, in a goods yard where there was sand about. The rails would be kept fairly clean by the running service. As to rail film resistance, from thousands of observations from time to time he could say that it was infinitesimal, and the short-circuit was practically "dead."

### The Electrical Engineering Laboratory at the Heriot-Watt College, Edinburgh.

By PROF. F. G. BAILY, M.A., F.R.S.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Edinburgh.)

(Concluded from page 52.)

The oscillograph, a Duddell high-speed pattern for tracing desk and falling plate, is mounted on a table with rubber-tired trolley wheels, which carries all the accessories, and is wheeled alongside the machine to be examined.

For testing the accelerating torque of motors, a heavy fly-wheel is used, 3 ft. in diameter and 6 in. thick, made of mild steel boiler plates riveted through. It weighs 15½ cwt., and at a speed of 1,000 R.P.M. contains 4,700 ft.-tons of energy, or as much as a 10-ton car running at 15 miles per hour. It takes several minutes for a motor of 5 or 6 H.P. to take this up to speed.

Transformers are—three of 10-kw. core type by Ferranti, Ltd., made similar for three-phase combination, with the coils brought out to a connecting board for various combinations, a 10-kw. Berry transformer, 300 to 30 volts or 15 volts at 30 periods, for large currents, and some small ones. These transformers are carried on wheels for easy transport.

A high-pressure transformer is being built to give 50,000 volts, 20 K.V.A., oil immersed, but the makers have not yet succeeded in building a satisfactory machine.

For the most part wire spirals supported on small insulators set on large teak-wood frames are found to be the most convenient load resistances. All the resistances are in parallel, and each is controlled by a switch on a board below. Another convenient form is made up of thin narrow strips of fine wires woven across threads of asbestos to form broad bands, made by Schniewindt. These stand a high temperature, and cool well if fixed side by side in a frame about 1 in. apart. A large water resistance is being constructed for testing machines down to very low excitation.

The tanks are long and narrow, with electrodes of copper plate at each end. One is fixed to the end and the other is hung from a wheel which runs on a bar fixed above the tank from end to end.

The terminals being all on the fixed plates, no long flexible connections are required or any device for bringing current to the moving plates. The resistances are always intended to be used in star connection for three-phase, or in series for single-phase working, one being idle.

The salt to be used is a matter of some importance. The question of choice of liquid is now being examined.

These two forms of resistance are both necessary. Spirals or lamps connected in parallel will operate from a finite value to an infinitely large value, but not the other way. On the other hand, the water resistance operates best from a finite value to an infinitely small value.

Inductive loads are provided by three large choking coils.

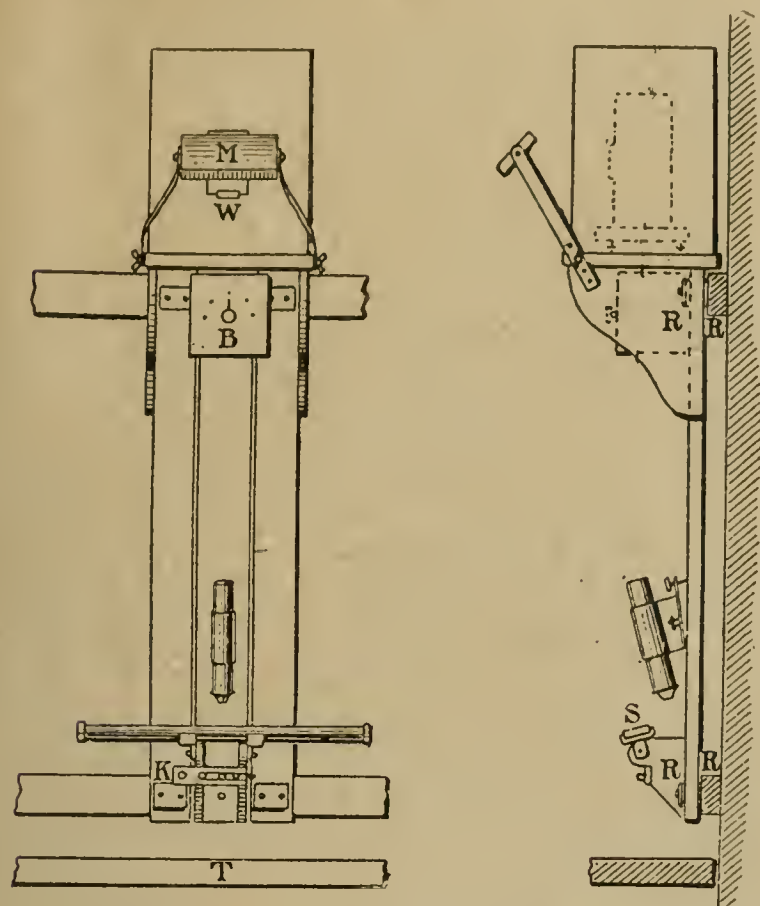
A portable traveller has been designed, which has proved very convenient and cheap to make, and for some purposes is invaluable.

In the test-room an equipment of standards has been laid down, including a large range of standard resistances, an excellent bridge by Nalder Bros., one of Clark Fisher's compensating potentiometers, an Oertling balance, &c.

The galvanometers are mounted overhead with scale just above the bench height, and as the mounting (fig. 3) is very cheap and satisfactory, a short description may be given. A slab of slate is supported by wooden brackets on two wooden straps, which are screwed to the wood straps round the walls with rubber washers between. Over the galvanometer is a light wooden box with a shutter which opens for use. The galvanometer in consequence does not need dusting and is very rarely moved or touched. The reflector is a strip of thin-looking glass fixed to a strip of wood



which is held out by aluminium strips fastened by screws to the reflector strip and by butterfly nuts to studs in the slate slab. To vary the distance of the mirror, the aluminium strips have several holes, which were considered better than slots, as there is no risk of the glass not been parallel to the wall. The lamp and scale are supported on a central strip of wood screwed to the straps. The scale is a paper one laid on a strip of wood, with a strip of glass over it held by metal caps at the ends. The scale can be turned round from the horizontal to suit the observer. The lamp is a 4-volt metal-filament lamp with a crinkled wire. It is set at one end of the brass tube, and at the other is a compound lens of  $6\frac{1}{2}$  in. focal length in a short sliding tube. The lamp-filament is



, shunt box; K, key and terminals; M, mirror; R, rubber pads; S, scale; T, table; W, window.

FIG. 9.—GALVANOMETER STAND.

focused on the galvanometer mirror, and the lens face is focused on the scale. I use, instead of the hair line or scratch, a half-circle screen with a smooth chisel edge along the diameter, which fits as a cap over the lens tube, and can be removed for cleaning the lens. This gives a half-circle of light with a very sharp straight edge, so that it is possible to enlarge with a magnifying glass and to read to fifths of a millimetre with comfort. The lenses are those used in cheap cameras, and while costing only 3s. 6d., are immensely superior to the single convex lens. The light is so good that for all ordinary work plenty of illumination can be used on the apparatus.

A standard direct-current voltmeter and ammeter are being set up, both for checking the numerous instruments in the laboratory and for the convenience of engineers in the neighbourhood. The instruments are Campbell's galvanometers—d'Arsonval galvanometers with powerful magnet, wide bifilar suspension, and moderate sensibility. Owing to the strong gravity control they are very reliable, and the only possible change is a weakening of the magnet, which can easily be checked as years go by.

The voltmeter range is obtained by a series resistance of 50,000 ohms and a universal shunt. With this single combination a range of 600 volts down to millivolts with multipliers of 3, 10, 30, 100, &c., can be obtained, with no error due to the changing resistance of the shunt of more than  $\frac{1}{1000}$  part, while temperature errors are eliminated.

The ammeter is even more convenient, for owing to the sensibility the current shunts can be of low resistance. A combination of five shunts with series resistances in the galvanometer circuit gives a range from 800 amperes down to milliamperes, and the series resistance serves to swamp the temperature change of the copper coil.

The scales and steps are calibrated in the potentiometer in the first instance, and can be quickly checked at any time. A scale of 600 millimetres allows of easy reading to one part in 1,000, a sufficient accuracy for all instrument testing. The controlling resistance for the ammeter is of strip woven with asbestos, and is put on in parallel steps, from 400 amperes downwards. Each one will stand 6 volts. Fine adjustment is made on a slide resistance with a stop to prevent its short-circuiting.

The voltmeter adjustments are very simple, being merely a high-resistance and low-resistance slide in series, forming a potential slide of large range and fine adjustment.

While on the subject of instruments, I desire to make some remarks on the apparatus recently purchased. The resistances and resistance boxes have proved of exceptional merit. Not only is the agreement between the standards and the expensive bridge exact almost to the limit of identification, but several cheaper boxes and

single resistances have considerably exceeded the guaranteed accuracy. This is highly satisfactory, and I mention it because the other kind of apparatus of which several examples have been obtained—galvanometers—have been most disappointing. As examples were obtained from five makers, in all cases their best quality, I am entitled to make a general complaint without mentioning names. The design in one respect or another is characterised by error or inconveniences which argue a lack of knowledge of the habitual use of the instrument. For example, one galvanometer is accessible only at the back, and as these instruments are usually placed against a wall, it is necessary to shift the instrument to find out if the adjustment is out of order. In another it was quite impossible to examine the coil when in position, as the cover carried the whole coil support. I should add that since the purchase of this one, the makers have altered the design, so that the cover can be completely removed. One maker was using copper with a magnetic constituent, which gave a shift of zero of 7 per cent. according as the deflection was to the right or the left. Two of them used methods of insulation in which barely  $\frac{1}{32}$  in. surface of rough ebonite was considered satisfactory, and a third did not insulate from the case at all, and trusted to ebonite feet, which means that one dare not touch the galvanometer unless the battery is cut off at both poles, and the dust and sunlight have free access to the insulating material. In another case the windows of the case all dropped out as soon as they were touched for dusting. They had been stuck on with seccotine.

In one a quartz fibre was supposed to be used of a size which had a breaking strain slightly less than the weight of the parts suspended. Needless to say, the actual fibre was three times as thick and consequently exerted 80 times the controlling force. The actual fibre spoilt the galvanometer for its ostensible sensitiveness.

The most absurd blunder was that of an instrument to read over a definite range and angle. The correct range had been most carefully adjusted, but the window was so restricted that the beam of light was cut off through the first and last quarters.

There seems to be a mania for making galvanometers of the highest sensibility small and elegant, regardless of accessibility, as if they were portable instruments or drawing room ornaments; or else some small economy of manufacture is introduced with no regard to its evil effects on the galvanometer as a scientific instrument.

Absolutely none of these instruments were of special design to unusual requirements. They were all taken straight out of catalogues. Hence I really think that some dissatisfaction is permissible after all these years of experience. I believe that Mr. Sullivan's well-known galvanometers are almost the only ones I have bought in recent years that are thoroughly convenient and pleasant to use. They are roomy, visible, and accessible, and though they are, or were, expensive, many of their good points could be obtained at a trifling cost.

While discussing galvanometers, I should like to raise the question why galvanometers which are used as direct-reading voltmeters, should not be wound with some alloy with low-temperature coefficient and moderate specific resistance. No galvanometer coil ever gets hot from its normal current, so that there is not that reason for putting the swamping resistance outside, while a greater freedom from temperature errors might be obtained by avoiding the use of copper.

The photometer-room has no great novelties. The inexpensive character of the benches is perhaps its chief point.

A museum has been fitted with cases for the display of parts of machines, accumulator plates, &c. On account of limited space the show cases also serve as drawing benches. This is a convenient combination, as examples of parts and drawings are just the equipment required for a drawing office.

The lighting is effected with glow lamps using inverted conical opal shades below and clear glass conical shades above, making a double cone with the lamp along the axis. A subdued light comes down direct, but most goes to the ceiling, and the result is a practically shadowless illumination, although it is certainly more extravagant than direct lighting.

I have put down a complete workshop, containing a small shaper and miller, a 5-in. lathe and a  $3\frac{1}{2}$ -in. lathe, both fully equipped, a pillar drilling machine, emery grinder and buff, grindstone, all being power driven, with fitter's bench, carpenter's bench, instrument maker's bench, plate shears, and spare table for erecting, together with stores of every size and kind of screws, bolts, nuts, washers, terminals, "wireman's sundries," rod, tube, sheet strip, and wire in all required material and sizes. A large equipment of this kind is of incalculable convenience. The shop is not intended for teaching students.

Each machine is driven from a small magnetic clutch in the main shaft actuated by a pear switch hanging by its machine, while the driller is operated by the foot with a bell-push on the floor. I am about to fit a pear switch and a floor-push in parallel on several machines, to give continuous running with one and intermittent running with the other without using a hand.

Each clutch takes from 5 to 7 watts, according to size of  $\frac{1}{2}$  or 1 H.P. They start and stop instantly, having, by kind permission of Electric Clutches, Ltd., their contrivance of a loose disk of thin hard steel between the magnet and the keeper. This is completely effective, eliminating any jerk at starting, and introducing sufficient demagnetising surfaces to produce instant release.

As far as possible the fittings, apparatus and machinery of ordinary commerce have been utilised. Not only is this the cheapest course, but the equipment forms a large demonstration of many kinds of useful objects. Even at some slight sacrifice to convenience, I have used the patterns of as many different makers as possible.



## ELECTRIC POWER FOR THE PANAMA CANAL.—I.

By JOHN GEO. LEIGH.

(Continued from page 46.)

As stated in an earlier article, the hydro-electric station at Gatun briefly referred to above is intended to furnish power to operate the gates, valves and other machinery of the locks, the regulating works of the spillways of Gatun and Miraflores dams, and generally to provide power and light throughout the canal line. With its completion and that of the constructional work on the Atlantic side of the Isthmus, for which it now furnishes power, the existing steam-operated station at Gatun will be no longer required. The Miraflores power house, with its present equipment, will, however, be retained as a reserve generating station, connected with the station at Gatun spillway by a transmission line, with the result that current from either, or both, can be used for any of the operations of the canal.

In the advertisement inviting tenders for the equipment of the new power station, bids were requested on two proposals, one for a plant to be installed a short distance below the spillway dam, and a second for an installation in a position further north, the advantage of the latter situation being, of course, the greater head obtainable. For proposal No. 1, the average difference between the water levels in the lake and in the tailrace was estimated at 75 ft.; and the turbines, necessarily of the vertical type, were rated on this basis. In the event, however, of the adoption of the second proposal, turbines of either horizontal or vertical type would have been admissible, and were rated on the basis of an average difference of 83 ft. in elevations.

The three turbines called for in the circular inviting tenders will be of the unsubmerged vertical shaft type, with runners uncased and in tandem, not more than two per turbine. Each will have a speed of 300, 250, or 214.3 R.P.M., as may be best adapted to the design, must be capable of delivering 2,250 kw. at the shaft, and be subject, in operation, to instantaneous fluctuations of load equal to 50 per cent. of the full rating. The runners are to be of cast-iron or steel plate, or a combination of both, designed to give the blades maximum strength and rigidity, and to be so arranged as to be easily removable from the case, and to withstand all shock occasioned by water-hammer and an increase in speed of 100 per cent. above normal. The outer casing will be of either cast-iron or steel plate, and the inner casing of cast-iron, every facility being provided for the inspection, repair and removal of the runners. The shaft will be of hollow cross-section, and of forged nickel or carbon steel, preferably the former. A vertical thrust bearing of the hanging, ball or roller type is specified for the main bearing, and the speed regulating gates are to be of the balanced wicket type. Each turbine will be provided with quick-acting relay type governors, actuated electrically or hydraulically, and of capacity to operate the gates in such time as will give the minimum variation in turbine speed. Each governor also, in view of possible failure to operate, will be equipped with an auxiliary device for smoothly closing the gate.

The generators will be of the three-phase alternating type, capacity 2,500 k.v.a. (2,000 kw.) at 80 per cent. power factor; poles, 10, 12 or 14; voltage (delta), 2,200; current per phase, 656 amperes; frequency, 25 cycles per second; and speed 300, 250 or 214.3 R.P.M. They will be of the vertical, water-turbine type, with separately excited revolving field; armatures star-connected, and the neutral lead to be brought to the same terminal block as the phase leads. Provision must be made for the operation of the generators in parallel, either with one another or with the installation of three 1,500-k.v.a., 2,200-volt, 1,500 R.P.M., 25-cycle, star-connected, steam turbine-driven alternators, at Miraflores, 40 miles distant, by transmission from Gatun spillway. Owing, moreover, to the fact that they will be subjected to instantaneous fluctuations of an extreme nature—consequent upon the starting and stopping of the many induction motors

required in the operation of the several locks—the generators must be designed to meet the conditions of an instantaneous variation of load equal to 50 per cent. of the full load rating. Mounted directly on the shaft of each will be an exciter generator of the direct-current, shunt-wound type, 50 kw., 125 volts and 400 amperes.

The inside diameter of the penstocks, which will be of the combination metal plate and concrete type, will be not less than 10 ft. 6 in. The plates, of wrought-iron or soft steel, are to be not less than  $\frac{3}{8}$  in. thick, and will be united in a continuous tube from gates to turbines, either by riveting or lockbar joints. To close the entrance to each penstock a headgate will be required. This will be constructed entirely of iron and steel, run in cast-iron or steel guides, and be raised or lowered by means of a vertical stem. To the stem motion will be transmitted by a vertical, non-rising worm, driven by a 220-volt three-phase induction motor. Each gate will be provided with an auxiliary valve for the purpose of passing water slowly into the penstock, and filling it in approximately five minutes, after periods of shut-down or disuse of the turbines. In front of the gates there will be, of course, the usual trash-rack of bar iron to protect the gates, penstock and turbine from damage by timber or other *débris* carried in the water.

The project also provided that in a basement floor of the power house under the generator room there would be placed compressed-air regulators, or surge tanks, of the differential type. Under this scheme there would have been one regulator attached to each penstock, a common header connected to a compressed-air tank, two air compressors, and the necessary auxiliaries. The regulator, in addition to acting as a buffer for shocks, due to rejected loads, was intended to assist the governor in adjusting the turbine speed. It would have been constructed of steel plates, been air-tight, and riveted to the penstock through a tapering nozzle of proportions calculated to give the best results in speed regulation.

Consideration of the tenders received in response to their circular has induced the Canal Commission to sanction several modifications of the installation to which reference has been made. Three tenders, I am advised, came to hand in respect of turbines, and the same number were submitted for the supply of generators, and these permitted of eight different combinations. Of the latter, that including the plans of the Pelton Water Wheel Co., of San Francisco, and of the General Electric Co., of Schenectady, N.Y., was considered most advantageous and, accordingly, contracts with these firms for, respectively, turbines and generators, have been authorised. At the same time, it was resolved definitely that the site proposed for the power house quite adjacent to the spillway dam should be adopted, in preference to that further north, where an additional head of 10 per cent. might be obtained. Two reasons are given for this decision—first, the consideration that even in exceptionally dry seasons there will be more water available in the lake, or summit level, than will be required for all the lockages that time will permit; and secondly, an economy of between £20,000 and £40,000.

In the tender accepted, the Pelton Water Wheel Co. undertakes to furnish for \$85,000 the three water turbines, three governors, three headgates, three penstocks, three compressed-air regulators and the lubricating system specified in the Commission's circular. It further guarantees satisfactory regulation without surge tanks, and, if these machines are installed, recommends the omission of the proposed regulating system. The General Electric Co., it is equally interesting to note, has undertaken to supply three generators, 250 R.P.M., weight 116,200 lb.; three exciters of 50 kw. capacity, and two motor-driven exciter sets of 100 kw. capacity, for \$54,534. Due to the fact that in this type of generator the bearing for the rotating parts is placed on the top of the generator case, it will be possible to dispense with the mezzanine floor in the power house.

Work on the project for lighting and buoying the canal dates from April last, and is advancing rapidly in accordance with a time schedule. The scheme is based upon a study of the subject by an officer of the Lighthouse Board at Washington, who has since been detailed to superintend the arrangements, and has also, at the request of the Government of Panama, submitted a report regarding the placing of lights



and other aids to navigation in Panama Bay, to assist vessels seeking the port of Panama and the Pacific entrance to the canal. In the canal proper, there will be side lights, placed about a mile apart, to mark each side of the channel; range lights—elsewhere than in the Culebra Cut, where their use is hardly practicable—to establish direction in the longer tangents; a light and fog signal on the west breakwater in Limon Bay; a light on the east breakwater, should it be built; and gas and sun buoys marking the channel to the Mount Hope dry dock. For the lighted buoys in all sections of the canal and the beacons in Gatun Lake, acetylene gas will be used; but for the beacons in the Atlantic, Pacific, Miraflores and Culebra sections, electricity will be the illuminant.

At each tangent two ranges of two lights each are needed to prolong the sailing line, in order that the pilot may hold his course up to the point of turning. The range lights are placed upon land, and it has been necessary to cut trocha, or paths, through jungle and forest, frequently very dense, until suitable positions are found, providing an unrestricted view of the range and reference targets. These trocha are the width of the canal at their beginning, and narrow to about 400 ft. at the end. Surveying parties, of 10 men each, run the lines, and then the clearing gangs, numbering from 50 to 100 men, are set to work. The result of these operations up to November 1st is indicated in the following table:—

	Acres cleared.	Trocha cut. Feet.	Profile taken. Feet.	Line run. Feet.
April	... 51'0	—	—	—
May	... 145'5	64,825	10,200	—
June	... 177'0	57,350	6,000	—
July	... 146'2	50,720	28,869	—
August	... 133'0	45,040	4,478	73,000
September...	80'5	42,200	17,226	17,300
October	... 104'0	60,450	—	—
	837'2	320,685	66,773	90,300

There remain to be cleared about 200 acres, the largest area claiming attention being that at the Frijoles tangent on the range line for north-bound ships. The range towers

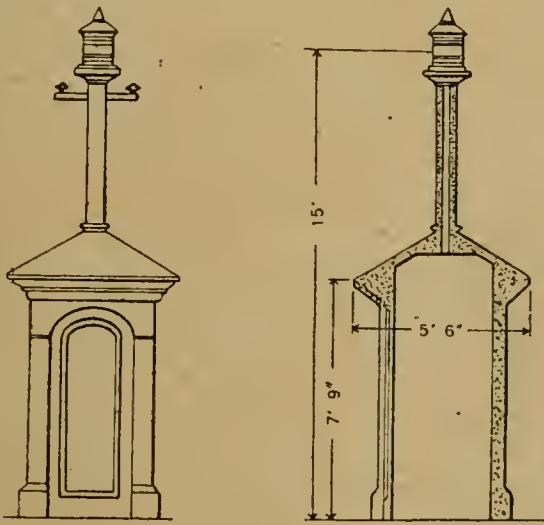


FIG. 3.—BEACON FOR CULEBRA CUT AND GATUN LAKE.

are of two types, one plain, and the other; to be used in positions near the channel, comparatively ornate, and vary in height from base to focal plane from 29 ft. to 74½ ft. The tower illustrated in fig. 4 is one of the highest of the ornate type, and is 16½ ft. in diameter at base and 7½ ft. diameter at focal plane. The beacons, of which an illustration is given above, are 15 ft. high from base to focal plane, 5½ ft. square at cornice of roof, and 4 ft. square below roof. Like the towers, they are constructed of reinforced concrete, and are surmounted by a column of the same material—outside diameter 8 in., inside 3 in.—which will support the lens.

Gas buoys, consisting of a cylindrical floating body, or tank, surmounted by a steel frame, supporting a lens about 15 ft. above the water level, will be moored in positions along the edge of the dredged channels. These, it is estimated, will remain lighted from six to twelve months without being recharged. The candle-power of the range lights will vary according to the length of the range, from 2,500 to 15,000, the most powerful lights being those marking the sea channels in the Atlantic and Pacific entrances. These will be visible from about 12½ to 18 nautical miles. The beacons and gas buoy lights will be of about 950 c.p. To assist identification, all the lights, range, beacon, and buoys,

will have individual characteristics, formed by flashes and combinations of flashes of light and dark intervals. According to present arrangements, there will be constructed and placed in position 34 range towers, 57 beacons, 57 gas buoys, 76 spar buoys and 7 sun buoys.

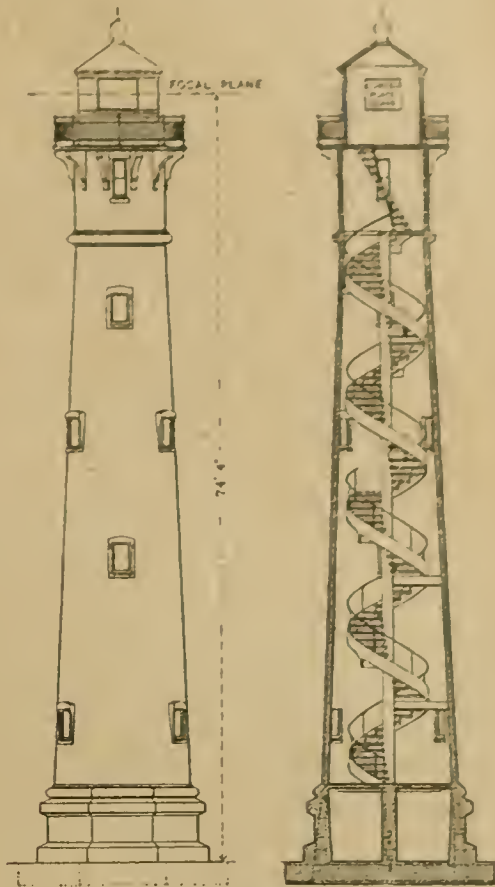


FIG. 4.—RANGE TOWER.

About £136,000 is the estimated cost of all the structures and aids to navigation—other than the floating plant to be derived from the existing construction equipment of the canal—involved in the foregoing scheme; and the annual maintenance charge of the system, when in full operation, is not expected to exceed £12,500.

## ELECTRICAL DEVELOPMENT IN INDUSTRIAL AREAS.

By L. CROUCH.

(Concluded from page 76.)

*Great Industrial Centres.*—Considering a group of seven great industrial centres, the average population per town rises to 974,300, of which as many as 2·3 per cent. are electrical consumers. The mean area of electricity supply per town is about 50 sq. miles, the consumer density being 455 per sq. mile. A total of 470,000 kw. generator capacity supplies 1·20 times as great a connected load (excluding traction), and 0·64 times as great a maximum load. The total sales per annum approximate 211 million units for traction and 427 million units for other purposes. The consumer density reaches the highest value attained in any of the present groups, but though the connections and annual consumption per head of population are high, the corresponding figures on a consumer basis are not exceptional. The sales per annum per head of population, for traction and for other purposes, are nearly double the corresponding sales realised in the group of inland towns or in the group of ports.

The load factor averages 21·2 per cent.—the highest mean value here obtained. The highest individual load factor in the “Industrial Centres” group is 24·2 per cent. for Manchester. Yet higher figures in other towns are:—34·4 per cent. for West Ham; 32·8 per cent. for Stalybridge; and 27·1 per cent. for Prescott.

Private motors show extraordinary development as regards total horse-power in use (this averaging 33,700 H.P. per town), but its percentage relation to the total connections is normal (31 per cent.). The average horse-power per private



motor is 9.3 H.P. or 1.48 H.P. per consumer (the latter figure should be capable of considerable improvement). The traction motor horse-power is practically equal, in total amount, to that of the private motors.

*Textile Towns.*—Thirty towns in all are considered, 17 being mainly engaged in cotton and 13 chiefly in woollen manufactures (Cols. 5 and 6, Tables II, III, IV). The average population per town is 154,000 in the cotton and 110,000 in the woollen centres. The corresponding average areas of supply are 21 and 17 sq. miles. The total generator capacity of 105,000 kW. in the cotton towns (6,150 kW. per town) supplies 139,300 kW. of connected load (excluding traction) and 80,300 kW. of maximum demand. In the woollen centres 50,000 kW. generator capacity (3,840 kW. per town) supplies 76,500 kW. of connected load and 33,100 kW. maximum load. For the cotton and woollen groups respectively: connected load per generator capacity = 1.32 and 1.52, and maximum load per generator capacity = 0.76 and 0.66. The maximum load per consumer in the cotton towns (2.72 kW.) is nearly double the corresponding figure for the woollen group, though the percentage of consumers is 1.56 per cent. of the total population in the latter, as against 1.14 per cent. in the former case. The consumer density is 10 per cent. higher in the cotton group, and the annual sales per consumer averages 5,100 B.T.U., as against 2,500 B.T.U. in the woollen centres. The former figure is the highest attained in any of the present groups, and the load factor of 20.6 per cent. in the cotton manufacturing towns is only slightly lower than the average figure for the great industrial centres.

Private motor connections average 4,600 H.P. per town in the cotton group as compared with 2,660 H.P. in the woollen centres, but, as a percentage of the total non-traction connections, the motor development is nearly equal in the two groups (37.0 per cent. and 34.0 per cent.). The horse-power of traction motors and the annual traction sales are nearly twice as great in the cotton as in the woollen towns. The average horse-power of private motors is also greater in the former, being 8 H.P. as against 5.6 H.P.; the corresponding horse-powers per consumer are 2.3 and 1.6 H.P. respectively.

Cheaper power is obtainable in the cotton than in the woollen centres, but the relative cost, as compared with the price obtained for "all purposes," is practically the same in each case.

*Iron-making Towns.*—Under this heading are included 15 towns, averaging 93,000 population and about 7 sq. miles supply area. The connected load and the maximum load average respectively 1.50 and 0.70 times the generator capacity, which totals 41,500 kW., i.e., 2,770 kW. per town. An average of 1.25 per cent. of the population are electrical consumers (160 per square mile of supply area), and the connections and maximum demand per consumer are, respectively, 3.15 and 1.50 kW. The average sales per consumer per annum (excluding traction sales, which amount to, roughly, one-third of the total) equals 2,350 kW. About 3,700 private motors are in use, averaging 7.7 H.P. per machine, 2 H.P. per consumer and 2,300 H.P. per town; the total horse-power of traction motors is over half as great. The mean load factor of undertakings in this group is 19 per cent.

*Shipbuilding Centres.*—The average population in the eight towns considered, omitting London for the reasons already stated, is 275,000, of which number about 1.3 per cent. represent electrical consumers. The average supply area being 12 sq. miles, the consumer density is approximately 300 per sq. mile. The connected and maximum loads are low as compared with the generator capacity (113,200 kW. per 10,300 kW. per town), being respectively 1.22 and 0.58 times the latter. The connected and maximum loads per consumer average 3.6 and 1.7 kW., and the average annual consumption per consumer is 2,900 units, excluding traction sales. Private motors, to a total number of close on 9,000, average 8,200 H.P. per town, 6.6 H.P. per machine, and 2.4 H.P. per consumer. The latter figure is exceptionally high, and in this group the private motor connections average 48.8 per cent. of the total connections. An average load factor of 19 per cent. is realised.

*Miscellaneous Manufactures.*—In columns 9, 10 and 11 of Tables II, III and IV are included data concerning groups of towns respectively engaged in:—

(a) The manufacture of miscellaneous machinery.

(b) The manufacture of metal goods, other than machinery.

(c) General manufactures, including pottery, porcelain, glass, linen, silk, lace, carpets, straw, gloves, leather, salt, chemicals and brewing. This group may be regarded as a typical selection of miscellaneous manufacturing towns of small and medium size. Though the average population per town is greater than in Column 1, the fact that many of the largest provincial cities do not come under any of the manufacturing heads here considered, prevents the elimination of the "country" towns having as great an effect on such items as the "per cent. consumers," "H.P. per consumer," &c., as might be anticipated.

Treating each group in turn along the general lines already adopted:—

(a) *Machinery Manufactures.*—Thirteen towns average 133,000 population, the percentage of electrical consumers being nearly 1 per cent., distributed over the supply area, which averages 15.5 sq. miles, in the proportion of about 87 consumers per sq. mile. The mean connections and maximum demand per consumer are high (4.4 and 2.0 kW.), but the ratios of total connections and maximum demand to the generator capacity are normal (1.5 and 0.68). The annual sales per consumer for non-traction purposes average 2,600 B.T.U., and the traction sales are roughly one-quarter of the total for all purposes. A low private motor development may be noted (29.1 per cent. of the connected load); the average horse-power per town is 2,510, per machine is 10.4, and per consumer is 1.68 H.P. From these figures it will be seen that towns of this class still offer a wide field for comparatively large motors.

(b) *Metal Manufactures.*—Here again nearly 1 per cent. (of an average population of 187,500 in eight towns), are electrical consumers, and a consumer density of about 160 per sq. mile is reached. A generator capacity of some 47,000 kW. supplies 69,200 kW. of connected load and 30,000 kW. maximum demand. The connected load consumer averages 4.8 kW., and the corresponding maximum demand is 2.6 kW. (average load factor = 19.1 per cent.). The annual sales per consumer averages 3,500 B.T.U., and of the total sales, 38 per cent. is for traction purposes. Nevertheless, an exceptionally high private motor H.P. per consumer (2.9 H.P.), is averaged, and the private motor connections = 45.1 per cent. of the total (this high figure is largely due to the Birmingham data). The average H.P. per private motor in this group is 8.8 H.P.

(c) *Miscellaneous Manufactures.*—In the 42 towns considered in this group, the mean population is 110,800 and the average supply area 8.25 sq. miles. The total generator capacity (118,150 kW. or 2,815 kW. per town), supplies 1.48 times as great a connected load and 0.73 times as great a maximum demand; the average load factor is 18.5 per cent. The number of electrical consumers averages 1.16 per cent. of the population, and the connected and maximum loads per consumer average 3.24 kW. and 1.60 kW. respectively. The annual consumption per consumer (for non-traction purposes) is 2,200 B.T.U. Among 8,630 private motors, the mean horse-power per machine is 6.7 H.P. and per consumer is 1.29 H.P. The private and traction motor loads are nearly equal (at about 1,800 H.P. per town or 30 per cent. of the total connections), and the annual traction sales are roughly one-third of the total for all purposes.

*Conclusions.*—No such treatment as the present can be complete, since so large a portion of the fundamental data required is inaccessible if, indeed, existent. Yet greater are the difficulties to be faced when seeking a comparison of the electrical development attained in various groups of towns. In such a case, the very bases of comparison are largely indeterminate, and there is obviously no definable connection between the conditions and results existing in various towns. Table IV, however, collects sundry data from Tables II and III, whence we may make the following observations. The weight to be attached to these, and other conclusions drawn from the same source, depends essentially upon the particular object in view and its relation to various factors which cannot directly be taken into account.

The number of towns considered in each group is obviously connected with the validity of the various averages deduced, though here again the averages deduced for the



seven "Industrial Centres" (Column 4) are undoubtedly more significant than the corresponding figures for the 42 miscellaneous manufacturing towns treated in Column 11. Accuracy of classification for the object in view, and similarity of conditions from the standpoint assumed, are of the utmost importance in determining the value of the results.

Population, supply area and number of consumers are, of course, inter-connected, though according to no simple law. The nature of the industries carried on in the various areas, the geographical circumstances of the latter, and the wealth or poverty of the inhabitants, are only a few of the factors determining the result. We wish to observe the effect of variations in as many as possible of these factors, but only too many, even of those closely dependent on industrial conditions, are greatly distorted by irrelevant local circumstances, or inter-connected with more or less pertinent matters, in so complex a manner as to render hopeless any attempt at a really detailed analysis.

The number of consumers as a percentage of the total population naturally reaches a maximum in the "industrial centres" group (2·3 per cent.), where also the maximum consumer density (455 per sq. mile of supply area) is to be found. The corresponding figures for the 80 "inland towns," dealt with in Column 1, are approximately 1·5 per cent. and 220 per sq. mile.

The mean generator capacity per town is far greater in the industrial centres and ports than in any other cases treated. The total connections, excluding traction, range from 1·2 to 1·5 kW. per kW. of generator capacity (to allow for the total H.P. of traction motors in service, these limits must be increased by 20-50 per cent.—see Table III). From 0·58 to 0·76 kW. of maximum demand is supplied per 1·00 kW. generator capacity, the highest values of this ratio (*i.e.*, the most complete utilisation of generator capacity) being found in the group of cotton manufacturing towns. Closely allied to these factors is the load factor, the average value of which ranges from 17·5 per cent. to 21 per cent., being a maximum in the industrial centres and a minimum in the inland towns.

The connected load per head of population reaches its maximum value (0·083 kW.) in the industrial centres group, but the mean connections per consumer are considerably higher (4·8 kW.) in the cotton than in the industrial centres group (3·5 kW.), where, however, the percentage of consumers is higher.

Per head of population, the total annual sales for all purposes is 44·5 B.T.U. in the average inland town, and reaches its maximum value of about 94 B.T.U. in the industrial centres group. Of this total, from 24 per cent. in the miscellaneous manufacturing towns up to 40 per cent. in the inland towns is required for traction purposes. In the great industrial centres about one-third of the total sales goes to the tramway load. The traction motor horse-power installed, as a percentage of the private motor connections, ranges from 46 per cent. in the miscellaneous metal manufacturing towns (total sales per head of population, 54 B.T.U. per annum), to 129 per cent. in the cotton group; the corresponding figure for the woollen towns is 73 per cent.

As a percentage of the total non-traction connections, private motors range from 29 per cent. in the miscellaneous machinery group to 46·5 per cent. in the iron-making centres, and 48·8 per cent. in the shipbuilding towns. In the "inland towns" group this percentage is 36·5 per cent., falling to 31·5 per cent. in the "industrial centres."

The industrial centres have by far the greatest total H.P. of private motors per town, but the highest average H.P. per individual motor is attained in the miscellaneous machinery group (10·4 H.P., as against 7·2 H.P. in the inland towns, 8·6 H.P. in the ports and 9·3 H.P. in the industrial centres). The motor H.P. per consumer varies from 1·5 H.P. in the ports and industrial centres, to 2·3 H.P. in the cotton and shipbuilding groups, and 2·9 H.P. in the miscellaneous metal manufacturing towns.

The average price quoted for electricity supply for power purposes in the various groups of towns ranges from 1·36d. per B.T.U. in the iron-making centres to 1·83d. per B.T.U. in the woollen group. The corresponding mean of the power tariffs in 390 supply districts being 2·0d. per B.T.U., it will be seen that the above limiting figures are respectively

68 per cent. and 92 per cent. of the average for the whole country.

To attempt the determination of an order of development from the criteria given in Table IV could only arouse controversy. The reader will at once see which groups show maximum development as judged by various standards (different standards yielding a different order of merit), and which groups show possibilities of further development in these or other directions.

In a mass of figures gleaned from many sources, discrepancies almost inevitably appear, but the writer trusts that any found herein are attributable to no more serious cause than differences in the number of towns on which various averages are based (in cases where incomplete data are available).

## TRADE STATISTICS OF PERU.

THE following figures, showing the imports of electrical and similar goods into Peru during the year 1909, are taken from the recently issued official trade statistics. The figures for 1908 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1908.	1909.	Increase or decrease.
	£	£	£
<i>Scientific instruments and apparatus.—</i>			
From Germany ...	3,000	4,000	+ 1,000
" France ...	3,000	1,000	— 2,000
" Great Britain ...	2,000	2,000	—
" Belgium ...	1,000	2,000	+ 1,000
" Other countries ...	1,000	1,000	—
Total ...	10,000	10,000	—
<i>Telegraph and telephone instruments and apparatus.—</i>			
From Germany ...	800	800	—
" United States ...	2,000	1,300	— 700
" Great Britain ...	100	100	—
" Other countries ...	100	100	—
Total ...	3,000	2,300	— 700
<i>Machinery, other than printing machines, motors, pumps, &amp;c.—</i>			
From Germany ...	20,000	14,000	— 6,000
" Belgium ...	2,000	2,000	—
" United States ...	98,000	22,000	— 76,000
" Great Britain ...	10,000	15,000	+ 5,000
" Other countries ...	6,000	3,000	— 3,000
Total ...	136,000	56,000	— 80,000
<i>Iron wire.—</i>			
From Germany ...	2,100	1,300	— 800
" United States ...	2,100	2,400	+ 300
" Great Britain ...	2,600	2,400	— 200
" Other countries ...	2,700	700	— 2,000
Total ...	9,500	6,800	— 2,700
<i>Rails.—</i>			
From Belgium ...	7,000	17,000	+ 10,000
" United States ...	191,000	35,000	— 156,000
" Great Britain ...	8,000	4,000	— 4,000
" Other countries ...	1,000	—	— 1,000
Total ...	207,000	56,000	— 151,000
<i>Railway material.—</i>			
From Germany ...	7,000	—	— 7,000
" Belgium ...	23,000	35,000	+ 12,000
" United States ...	51,000	16,000	— 35,000
" Great Britain ...	6,000	4,000	— 2,000
" Other countries ...	2,000	—	— 2,000
Total ...	89,000	55,000	— 34,000
<i>Coal.—</i>			
From Germany ...	18,000	6,000	— 12,000
" Australia ...	99,000	23,000	— 76,000
" United States ...	9,000	9,000	—
" Great Britain ...	239,000	152,000	— 87,000
" Other countries ...	22,000	4,000	— 18,000
Total ...	387,000	194,000	— 193,000



	1908.		Increase or decrease.
	£	£	£
<i>Pumps, motors, &amp;c. (includes electric motors).—</i>			
From Germany ...	13,000	6,000	— 7,000
" Belgium ...	3,000	2,000	— 1,000
" United States ...	92,000	38,000	— 54,000
" Great Britain ...	41,000	61,000	+ 20,000
" Other countries ...	2,000	3,000	+ 1,000
Total ...	151,000	110,000	— 41,000

The following details are available for goods further sub-divided, but full details as to the countries from which they are imported can be given. Reference to the above figures will, however, give some indication :—

Morse telegraph apparatus	58	121	+	63
Ditto, without clockwork...	110	111	+	1
Electric bells ...	126	88	—	38
Galvanometers ...	26	34	+	8
Telephones ...	1,083	285	—	798
Motors of all kinds—steam, electric, hydraulic, &c. ...	128,000	87,000	—	41,000
Meters and regulators for electric light ...	393	166	—	227
Parts of motors, &c. ...	9,000	13,000	+	4,000
Armoured cables of copper	16	10	—	6
Flexible cords covered with cotton, wool, &c. ...	1,053	1,318	+	265
Ditto, covered with silk ...	56	26	—	30
Arc lamps ...	399	384	—	15
Incandescent lamps ...	3,592	4,062	+	470

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**FRANCE.**—The French Customs Authorities have decided that drums for steam turbines of iron or steel shall be dutiable as "detached parts of machines," if in the rough state or trimmed, at rates varying from 8 fr. per 100 kg. for heavy goods to 20 fr. per 100 kg. for light goods. If in the worked state, these drums are to be dutiable as "parts of turbines driven by steam, gas, petrol, or any other gaseous or explosive mixture" at the rate of 30 fr. per 100 kg. if weighing 200 kg. or more and 40 fr. per 100 kg. if weighing less than 200 kg.

**AUSTRALIA.**—With reference to the previous notice in the *ELECTRICAL REVIEW* regarding Australian revision of duties on electrical goods, it is to be noted that further important amendments have now been made. The chief of these is that in future preferential treatment will be given to certain British electrical machines. Formerly, British machines were dutiable at the same rates as foreign, but for the future the following discrimination will be made :—

	Rate for British goods.	Rate for foreign goods.
Dynamo-electric machines up to the capacity of 200 H.P. ; static transformers and induction coils for all purposes ; electric fans ...	20 per cent.	25 per cent.
Dynamo-electric machines over the capacity of 200 H.P. ...	12½ "	17½ "

The following decisions as to the duties to be applied to certain electrical and similar goods have also been published :—

Contact breakers, Telewriter ...	10 per cent.
Gas machine, Simpitol, System C ...	20 "
Centrifuge, electrical, including motor which is an integral part thereof (used in cream testing) ...	Free
Motor-car lamps, electric (head, side or rear, similar to ordinary gas or oil lamps but illumined by an electric filament lamp) ...	15 per cent.

**NOTE.**—The rates quoted are in all cases those leviable under the British Preferential Tariff.

**NEW ZEALAND.**—The Customs authorities have decided that electric cables in sets, with terminals affixed, enclosed in flexible tube are to be dutiable at the rate of 20 per cent. *ad val.* if of British origin, and at the rate of 30 per cent. *ad val.* if of foreign origin.

**BOLIVIA.**—The Board of Trade have been informed by telegraph from Bolivia that from January 1st, 1912, the duties formerly leviable on all goods imported into that country have been increased by 15 per cent.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20. "Battery lamp for miners and the like." J. MASON. January 1st.
28. "Primary batteries." H. E. FRX. January 1st.
30. "Electrical switches and fuses combined." R. W. BILL. January 1st.
32. "Means for and methods of charging and discharging electric accumulators or secondary batteries." A. M. TAYLOR. (Addition to 20,906/1910.) January 1st.
37. "Starting means for vapour electric devices." F. CONRAD. (Convention date, January 7th, 1911, United States.) January 1st. (Complete.)
38. "Electrical terminal devices." Y. SAKAI. (Convention date, January 7th, 1911, United States.) January 1st. (Complete.)
44. "Dynamo-electric machines of the homopolar type." F. H. LORING. January 1st.
71. "Storage battery lamps." C. B. BARTLEY. January 1st.
81. "Joint for the metallic coverings of insulated electric wires." F. J. WHITING. January 1st.
86. "Wireless telegraph receivers." G. MARCONI and C. S. FRANKLIN. January 1st. (Complete.)
88. "Electric switches and circuits." G. H. BATLEY and J. M. BEIN. January 1st. (Complete.)
120. "Memorandum and like appliances for use in connection with telephones and other purposes." E. F. M. BRANSON and F. H. BOWDEN (trading as Branson & Bowden). January 2nd.
129. "Electric safety lamps." H. J. DEAN. January 2nd.
140. "Apparatus for heating water by electricity." J. SHANKS and J. A. G. SHANKS. January 2nd.
141. "Heating elements for electric radiators and for other purposes." J. SHANKS and J. A. G. SHANKS. January 2nd.
143. "Automatic signalling on electric tramways." L. C. PARTINGTON. January 2nd.
160. "Controlling device for electric circuits." R. H. HUTCHINSON and F. WILKINS & Bro., LTD. January 2nd.
163. "Mechanical connectors for electric cables." F. NEAVE and CALLENDER'S CABLE AND CONSTRUCTION Co., LTD. January 2nd.
181. "Electric batteries." P. L. LINEY. January 2nd.
183. "Vapour electric apparatus." P. C. HEWITT. (Convention date, January 3rd, 1911, United States.) January 2nd. (Complete.)
190. "Electrically-operated telfers and tracks therefor." R. P. STRACHAN and STRACHAN & HENSHAW, LTD. January 2nd.
192. "System of alternating magnetic flux applicable to magneto electric machines and to alternate current machines." Soc. D'ELECTRICITE "NIMELIOR." (Addition to 22,053, 1911. Convention date, June 8th, 1911, France.) January 2nd. (Complete.)
193. "Electric indicating instruments." THE BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 2nd.
229. "Illuminated signs for use with arc lamps." W. J. BEVILLE. January 3rd.
249. "Registering and recording mechanism for electric meters or the like." C. I. HALL. (Convention date, January 3rd, 1911, United States.) January 3rd. (Complete.)
285. "Electric connecting plugs." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 3rd.
290. "Automatic instantaneous switches for alternating and direct-current circuits." A. M. TAYLOR. January 4th. (Addition to No. 7,041/1910.) January 4th.
315. "Fusible cut-outs." C. M. DORMAN and A. R. SMITH and H. G. BAGGS. January 4th. (Complete.)
330. "Oil immersed electrical switches and circuit breakers." H. R. SCHULTZ. January 4th.
334. "Telephone appliances." V. D. EVANS. January 4th.
335. "Telephone hearing appliances." V. D. EVANS. January 4th.
341. "Construction of secondary batteries." H. LEITNER. January 4th.
346. "Adjustable inductance coils." R. A. FESSENDEN. (Divided application on No. 2,617 of 1911, February 1st. Convention date, February 2nd, 1910, United States.) January 4th. (Complete.)
374. "Methods of obtaining continuous currents from alternating current circuits." A. M. TAYLOR. (Addition to No. 20,867 of 1909.) January 4th.
375. "Ignition spark detector for internal combustion engines." R. G. MOSELEY. January 4th.
378. "Adapter for converting ordinary socket electric conduit fittings into grip continuity electric conduit fittings." H. A. WILKES. January 5th.
387. "Electric heating elements." E. TOWNSEND. January 5th.
392. "Electric lighting switch lock." V. E. WHALLEY. January 5th.
416. "Telephone receiver holder." H. BROWN. January 5th.
491. "Anti-vibration suspension device, applicable for electric lamps." A. W. SPARKES. January 6th.
523. "Electric controller regulators." H. SEFTON-JONES. (American Automotoneer Co., U.S.) January 6th.
528. "Circuit arrangements for connecting a trunk line telephone exchange with the subscribers of a local automatic exchange." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) January 6th. (Complete.)
535. "Terminals such as contacts and electrodes in electrical apparatus." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 6th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

### 1911.

- SYSTEMS OF ELECTRICALLY TRANSMITTING POWER TO THE SCREW SHAFT OF VESSELS. Allmanna Svenska Elektriska Aktiebolaget. 19,903. September 7th. (December 9th, 1910.)
- REGULATOR FOR DYNAMO-ELECTRIC MACHINES. T. Ferguson. 20,586. September 18th. (September 17th, 1910.)
- TROLLEY COLLECTORS FOR ELECTRIC TRACTION SYSTEMS. N. Peffer. 22,295. October 10th. (October 24th, 1910.)
- ELECTRIC REGULATORS. H. Leitner. 81. January 2nd.
- ARMATURES FOR MAGNETO-ELECTRIC GENERATORS. Albion Motor-Car Co. and R. B. Murray. 188. January 4th.
- CONTROL OF ELECTRICALLY-DRIVEN PRINTING PRESSES AND THE LIKE. British Thomson-Houston Co. (Allgemeine Electricitäts Ges.) 5,166. March 1st.
- ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 5,993. March 9th.



THE  
ELECTRICAL REVIEW.

Vol. LXX. JANUARY 26, 1912. No. 1,783.

ELECTRICAL REVIEW.

THE ELECTRIC VEHICLE.

Vol. LXX.]	CONTENTS: January 26, 1912.	[No. 1783.
		Page
The Electric Vehicle	...	121
A Dead Letter	...	122
Electric Railway Working in Germany	...	122
The Rating of Machinery...	...	123
London's Congested Streets	...	123
Director and General Manager	...	123
Electric Power for the Panama Canal.—II. (illus.)	...	124
Correspondence:—		
Transformer Design	...	126
Earthed Concentric System (illus.)	...	126
Capital and Labour	...	126
Arc Lamp Lowering Gear	...	127
Preservation of Poles...	...	127
Official Returns	...	127
The Association of Consulting Engineers and the I.E.E.	...	127
Cheap Disconnecting Boxes	...	128
The Prevention of "Steamy" Shop Windows	...	128
Electric Cooking and Heating	...	128
Proceedings of Institutions:—		
Auxiliary Machinery for Internal Combustion Engined Vessels	...	129
Residence Tariffs	...	129
New Electrical Devices, Fittings and Plant (illus.)	...	132
Legal	...	134
Business Notes	...	135
Association of Consulting Engineers	...	141
Notes	...	142
City Notes	...	145
Stocks and Shares	...	147
Electric Tramway and Railway Traffic Returns	...	148
Share List of Electrical Companies	...	149
Exports and Imports of Electrical Goods during Dec., 1911	...	151
Electrical Exports and Imports during 1911 and Previous Years	...	152
Trade Statistics of Australia	...	154
Machinery for India	...	155
A Vector Calculator (illus.)	...	156
Electricity and Plant Growth (illus.)	...	157
The Earth Fault	...	159
Our Legal Query Column	...	160
New Patents Applied For, 1912	...	160
Abstracts of Published Specifications	...	160
Contractors' Column...	Advertisement pages xxii, xxiv and xxvi	

WE have often pointed out the immense field for development offered by the electric automobile, and deplored the absence of any organised attempt to exploit it in this country, while referring with envy to the success achieved by our friends in the United States. This feeling is revived by a review of the past year's progress which appeared in the *Electrical World* of January 6th. Not only is the private electric vehicle widely adopted in the States, but also the commercial vehicle in even larger measure—a sure proof that it is not merely to the acknowledged convenience, reliability and ease of control of the electromobile that the popular appreciation of it is due, but to its economy compared with other types of automobile. We are told that the pleasure vehicle is now so common a feature in most of the larger cities that it no longer attracts attention: in Denver, for example, one person in every 200 owns an electric pleasure car, and electromobiles are met with in profusion in both the shopping and the residential quarters of the town. The commercial electric vehicles in use in the States, for every kind of service, number about 7,000, and represent an income to the electricity supply companies of about £600 a week. They are said to constitute probably one-third of the "motor trucks" in service in the United States, and if they increase in number at the present rate of expansion, in two years more they will contribute over £60,000 a year to the central stations for battery charging. Each of these commercial electromobiles consumes from 4,000 to 12,000 kw.-hours per annum, and the economical working of the vehicles is leading to their rapid multiplication. So highly is the electric "truck" appreciated by the railway and steamship companies, the police authorities and the insurance interests, owing to the improvement in the traffic conditions in narrow streets and on wharves and docks where it is used, that it is becoming a "privileged character" in the eyes of these people. The electromobile is also making its way into fire service, where its reliability, speed, and flexibility of control, are strong points in its favour. It is estimated that the tonnage of street haulage is no less than 16 times that of train haulage, and that if none but electric "trucks" were used in Greater New York, the present central-station load would be increased 12 times.

In view of these vast possibilities and the successes already achieved, a determined propaganda has been organised to develop electric-vehicle transportation in the Eastern States, various Associations and companies co-operating for the purpose. Over £200,000 worth of electric vehicles are now in course of construction, and a great advance is confidently anticipated during the current year.

In the meantime, what are we doing? Nothing! The history of public electric vehicle enterprise in this country has been one continuous record of disappointment and failure; the field has been infested with company promoters and financial jugglers, who care nought for

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEERAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 24, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN THE PRESS.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



the industry and seek only to enrich themselves at the cost of a too-confiding public, which pays no heed to the warnings of the technical Press, and therefore pays the penalty of its rashness. Not all, it is true, have been enterprises of this class; honest ventures there have been, and are, but they have lacked support, as is too often the fate of genuine industrial enterprise in this country, where capital is always ready to finance a wild-cat scheme. But almost all have shared the same sad fate. Yet there is no fundamental reason why electric road vehicles should fail here, while they are successful in America. It certainly is not the cost of energy—nowhere in the world, on the whole, is electrical energy so cheaply available as in this country. Our lead storage batteries are as good as any made elsewhere, our cars are unexcelled. In one important respect the American procedure has differed from ours; there, it appears, private concerns have been induced to adopt the electric vehicle, while here public transport service and the hiring system have mainly absorbed the attention of those interested in this business.

Is there not here a magnificent opportunity for some person or society to develop what would be a practically new field for the electrical trades? Suppose, for example, one or more of the great carriers were induced to adopt electric parcel delivery vans, under a guarantee, for a stated period—the vehicles being returned daily to a garage for inspection and charging. Excellent terms for energy should be readily obtainable from almost any of the Metropolitan supply authorities for a load which would never come on the peak, and which, for example, would be a godsend to companies supplying a West-End residential district where a power load does not exist.

There are strong grounds for believing that if such a trial were made on an adequate scale, under expert supervision, it would prove a success, and would be an object lesson which other carrying companies could not fail to take to heart. What is wanted is proper business organisation and co-operation for the purpose. The supply authorities themselves should be the first to back up such a scheme—but somehow there is a pitiful lack of energy and enterprise among our central-station managers, with rare but honourable exceptions. Why don't they wake up and *create* a demand for their commodity?

of steam and electrical engineering—in a word, it is a bare-faced advertisement inviting the appointment of the *company* as consulting engineers.

Has either Institution lifted a finger to put a stop to this practice, or to expel the engineers named on the circular from membership, as laid down by the code? If so, we have yet to hear of it. Other insurance companies advertise their staffs as consulting engineers in similar fashion. A more flagrant breach of the letter and spirit of the code it would be difficult to find—but nothing is done.

Not only is this advertising by circular freely carried on without interference from above, but the companies' agents act as touts and canvass for consulting work; we have been informed that they even have the hardihood to depreciate the work of consulting engineers whose clients' plant they insure, with a view to securing the work of advising on extensions. Moreover, the companies are not above accepting fees on a scale that can only be regarded (by consulting engineers) as blacklegs' pay—of the order of 2 per cent.

It cannot be contended that the Institutions have not been aware of these doings; not only have they been notorious, but the facts have actually been brought to their notice. But nothing is done. Can it be that the members of the Councils are debating which shall cast the first stone at the offenders? Or are they afraid?

#### Electric Railway Working in Germany.

It is now just over a year since experimental working with the single-phase system was introduced on the main line between Bitterfeld and Dessau, and the results are declared to have been extremely satisfactory. So much so that the Prussian State Railway authorities, as already reported, have decided to proceed with the electrical equipment of the section between Halle, Leipzig, and Magdeburg, which has a total length of 97 miles, and the extension of the power station at Muldenstein is now being carried out. According to Prof. J. Kollmann, of Dresden, the working conductor on the Bitterfeld-Dessau section, which was provided in equal halves by the Siemens-Schuckert Works and the A.E.G. respectively, has fully answered the purpose during the year, and has not even found sufficient employment for the workmen specially appointed to attend to its maintenance. The working conductor is supplied with single-phase current at 10,000 volts and 15 periods. Single-phase current is produced in the power station at 3,000 volts, and is transformed up to 60,000 volts, and transmitted to the sub-station near Bitterfeld, where it is stepped down to 10,000 volts for feeding into the line. It has been ascertained that about 80 per cent. of the total return current goes back through the rails. As soon as the Halle-Leipzig-Magdeburg section has been completed, it is intended to increase the pressure on the working conductor to 15,000 volts. During the past year eight different types of locomotives have been employed on the Bitterfeld-Dessau section, these including not only locomotives specially ordered for the line, but also some which have been built by the Siemens-Schuckert Works and the A.E.G. for non-Prussian railways; and locomotives intended for the Berlin City and Circle Railways are also to be tested on the section in the near future. Eighteen locomotives have been constructed, or are in course of building, for the railway, and 40 others are to be shortly thrown open to competition, and are intended for the extension to the hilly line of Lauban-Dittersbach-Königszell. Shortly before the close of 1911 a new type of locomotive was delivered by the Bergmann Electricity Works Co., having driving wheels of 1.6 m. and running wheels of 1 m. diameter, and a maximum speed of 86 miles an hour. The weight is 66 tons, of which 26 tons are due to the electrical equipment, whilst the other high-speed locomotives have a weight of about 70 tons. A goods locomotive has been furnished by the Schwartzkopff-Maffei Works, of Berlin, and a locomotive has also been supplied by Brown-Boveri, of Mannheim. Prof. Kollmann adds that the single-phase system has achieved an undoubted success for main-line working, and he expects it to result in economy in operating expenses

#### A Dead Letter.

IN view of the proposed activities of the prospective Association of Consulting Engineers, it may not be without interest to consider for a moment the procedure of the parent Institutions with regard to professional etiquette. The Civil Engineers, for example, not very long ago codified the laws of professional good form, and the Electrical Engineers propose to adopt the same code practically *verbatim*. But the rules have been recognised in principle for many years, and the mere casting of them into the shape of a formal code did not create them. Will it lead to their enforcement?

Is there any case on record where either Institution has ever taken drastic steps to deal with the notorious infractions of the rules which have been committed in the broad light of day? We know of none. We have before us as we write a blatant example of breach of professional etiquette; it is a leaflet issued by an insurance company, which bears the name of the chief engineer of the company in bold type, followed by a string of letters which include those indicating his connection with the Institution of Civil Engineers, together with the name of a colleague claiming membership of both the Institutions above named. The leaflet offers plans and specifications, and advice as to the improvement of existing plant and the laying out of new plant; reference is made to the "consulting work" of the company, which appears to embrace practically all branches



and more punctual service than is the case with steam railways. It is believed that the Halle-Leipzig-Magdeburg section, which is practically a level track, will be opened for traffic by the end of this year.

### The Rating of Machinery.

It is fashionable among men of business to say that the law is uncertain; that rather than submit to legal decision, it is better to pay up and have done with it. Among the legal questions which thus puzzle the commercial world, there is none more prominent than those which arise out of the phrase "rating of machinery." Is machinery rateable? If so, upon what basis? These questions were recently considered in a case heard by the Recorder of Leeds. The owner of a generating station, factory, or mill, knows, to his cost, that there are two ways in which his rates may be increased. Either the district rate may be raised—a matter over which he has no control—or his rateable value may be increased, a matter in respect of which he may appeal from the Assessment Committee to the Court of Quarter Sessions. It is upon such appeals that legal questions are generally discussed, although, of course, they may be taken to a higher Court. In recent years certain manufacturers have made a gallant attempt to persuade the Courts that loose machinery is not rateable, that is to say, that the machinery should not be taken into account in order to enhance the value of the premises. The House of Lords, however, has finally decided that, in accordance with the practice of the last 50 years, machinery may be taken into account, but upon no fixed principle. The rating authority, apparently, must make an estimate of the amount by which the value of premises would be enhanced to a prospective tenant.

In the case in question, Messrs. Greenwood & Batley, of Leeds, appealed against a rateable value of £6,050, which had been imposed upon their works by the Guardians of the Bramley Union. It was alleged that the valuer, in order to bring the machinery on the premises into rating, had put 5 per cent. on machinery valued at £49,000. It was contended that this was a wrong principle on which to fix a rate, and that due regard had not been had to the nature of the premises themselves. The mere value of the machinery could not be relied on, inasmuch as a machine which was valuable in one building might be unworkable in another. It was pointed out, in this connection, that the works in question were extremely inconvenient. There were a large number of processes carried on, and owing to the fact that the works had grown up piecemeal, they were badly arranged. It was also shown that in consequence of high rates on machinery, many firms had left Leeds during the last few years. The Recorder of Leeds was apparently impressed by these arguments, for he reduced the rateable value to £4,872, and allowed the appeal with costs. No general principle was enunciated by him—indeed, none could be; but owners of electrical and other machinery should bear in mind that when they see cause to quarrel with a rate it is quite legitimate and proper to draw attention to the inconvenience of their premises for the purpose for which they are used.

### London's Congested Streets.

DISCUSSION is again becoming prominent on the congested state of the streets of London. It would almost seem that, to many, this state of congestion has only just made itself visible. It is not long since a Commission sat upon the subject, and brought forth a very strenuous proposition, so strenuous, indeed, that it was promptly shelved as being too costly. This proposition was for a great thoroughfare to be driven boldly through huge areas of property at a cost, if we rightly remember, of about 30 million pounds sterling. Some critics considered not only that the scheme was extravagant, but that it would not deal with the difficulty. It was pointed out that the congestion arose almost entirely from the vehicular interference at right-angled crossings, and it was urged that all the congested crossings should be enlarged

to form circuses of considerable diameter, round which traffic would circulate clockwise. Simple as is this proposition, no attempt has ever been made even to test its feasibility. The circus system is equally applicable to tramways and to ordinary vehicles. Yet, though the suggestion was public at the time of the construction of the L.C.C. tramways, that complicated system of tramway "special work" at the Elephant and Castle was put in hand without an attempt to simplify it, even by a partial adoption of the circus system. From time to time proposals have been put forward for the construction of shallow subways to relieve the surface traffic, but the cost of the work, as exemplified by the subways at the Bank, Blackfriars, and the Elephant and Castle, would be enormous. Nobody will ordinarily use a tube for a short journey, for too much time is consumed in the lifts and in waiting for trains down below, and in those breezy walks up hill and down dale, which appear to be so necessary a part of the design of the tubes. The New York subway certainly stands first in the solution of rapid transit. Yet even shallow subways are inferior to surface automobiles in many respects, and the resources of the surface are not exhausted, for the surface has never yet been placed in a position adequately to deal with traffic; nor can it so be placed to deal with it, unless the traffic intersections are taken in hand and dealt with on the lines of the rotatory whirlpool, into and out of which any vehicle can so easily turn. Meantime, the streets are made the roadway for tramcars, 'buses, taxis, and every manner of vehicle, and little is being done to relieve the congestion of traffic.

### Director and General Manager.

THE large majority of the great firms who share the best of the business in electrical matters, are limited companies. Fundamentally, the executive of every such concern comprises a board of directors with a general manager responsible to it. Given a weak body of directors and a sufficiently strong general manager, it is obvious that he can steer the ship very much as he chooses. But given a strong director, or a director who is of an inquiring turn of mind, what power can he exercise over the general manager? What can he say to him without running the risk of an action for libel or slander? That some power and some control should be exercised is manifest, having regard to the fact that responsibility rests with the directors if anything goes wrong. In a recent case in the King's Bench, the exact position and rights of a director in this regard were clearly explained. The facts were very brief. The general manager of an insurance company made a statement to his board which one member of that board characterised as a deliberate falsehood. The manager brought an action against him for slander, to which the plea of privilege was raised. The defendant alleged, in effect, that the words were uttered by him without malice and in the honest discharge of his duty as a director. A City of London jury found as a fact that, although the accusation was false, there was no malice on the part of the defendant. He, accordingly, obtained the verdict. Mr. Justice Scrutton had said, in the course of his summing up: "Directors of a company have a duty to discuss the affairs of their company, and may discuss the conduct of the company's officials, so long as they do so honestly. If so, they are privileged. If, however, a director does not use, but abuses the occasion by showing malice or spite, the privilege is gone. . . . The position of a director cannot be said to be a happy one. If there is a general manager, and the directors leave everything to him, it is said when things go wrong: 'You left everything to the manager; you did not do your duty as directors.' If, on the other hand, the directors hold their own views, it is sometimes said they are interfering with the general manager." This case arose because the general manager thought himself slandered: although it does not appear that if he had not divulged the matter, anyone outside the board-room need ever have known that the words were spoken. The lesson of the case for the general manager is that it is no use being too thin-skinned.



## ELECTRIC POWER FOR THE PANAMA CANAL.—II.

By JOHN GEO. LEIGH.

As already suggested, one of the most conspicuous functions of the new power station in Gatun spillway will be to furnish current to the many hundred electric motors which are to be installed at the various locks. Of these a large majority will be employed in connection with the gate-moving and other operating machinery of the Canal, and with the elaborate system of culverts and valves by which the lock chambers will be filled and unwatered.

Consequent upon the unprecedented dimensions of the locks, all the adjuncts of the latter are necessarily of unusual size, strength and capacity; and this, of course, entails corresponding features in the design of the electrical equipment. To appreciate the importance of the work imposed upon the latter—the aggregate weight of which will exceed 7,000 tons—some indication of the various machines with which it will be associated is obviously desirable, and even essential. This it will be my endeavour to furnish in as few words as possible, and with little reference to details appertaining more closely to the interests of the mechanical than the electrical engineer.

For the design, construction, inspection during manufacture, and erection of this machinery, prime responsibility falls upon what is called the first division of the office of the chief engineer. This is in charge of Col. H. F. Hodges, Corps of Engineers, U.S.A., who, prior to his appointment to membership of the Canal Commission and the positions of deputy-chairman and assistant chief engineer, acted for several years as chief purchasing officer and head of the Canal organisation in the United States—an experience which has proved of great value to the Commission (but possibly not altogether to the liking of many American manufacturers) in connection with the distribution of important contracts. In the purely technical departments of his division, Col. Hodges has enjoyed the advantage of the assistance of an exceptionally capable staff, prominent among whom must be mentioned Mr. Edward Schildhauer, mechanical and electrical engineer, to whom has been committed direct charge of all matters, including inspection and erection, connected with the operating machinery and electrical installations.

To open and close the 46 mitring mates of two leaves each with which the locks are being provided, special machinery has been invented by Mr. Schildhauer, and a patent has been issued upon it. Each leaf, it may be well to recall to mind, is 65 ft. in length; 48 are 77 ft. high, and the height of the remainder varies—according to the distance from the top of the coping on the lock wall to the top of the sill on the concrete floor of the lock chamber—from 47 ft. 4 in. to 82 ft. The weight of each leaf depends upon its height—for all the gates are practically identical in design and construction—and, so far as revolving parts only are concerned, varies from 275 to 450 tons. One gate-moving machine, with individual electrical equipment, will be required for each leaf.

Fig. 5 is a photograph of Gatun locks, looking south, showing the west chamber of the middle lock, with the upper lock and upper guard gates in the distance; while fig. 6, also a photograph from Gatun, illustrates the method of construction of an upper guard gate, and, indeed, of all the lock gates. On the left of the picture is shown the spacing of the internal girders, while the leaf on the right is partially completed, so far as its steel sheathing is concerned.

The essential features of the Schildhauer machine are, first, a "bull wheel," 19 ft. 2 in. in diameter, a combination gear and crank, constructed of cast-steel, and weighing approximately 35,000 lb., which is mounted in a horizontal position on the lock wall, turns on a large centre pin, has gear teeth on its rim, and is driven by a single pinion on a vertical shaft; and, secondly, a steel rod, or strut, connecting the wheel with the top of a gate leaf. When moved through an arc of 197°, the wheel, operating through its strut, opens or shuts in about two minutes—according to the

direction in which it is turned—the gate leaf to which it is attached. The vertical shaft associated with it is driven by a bevel gear and pinion, the latter being fast on a horizontal shaft which passes through a bulkhead separating the motor and wheel chambers, and carries a gear with spring centre, driven by a pinion on the back shaft of the motor.

A second machine required in the operation of the gates is designed to force the latter to perfect mitre and lock them in that position when they are closed. It consists essentially of two box-shaped castings, one bolted to the outer case of the top girder of each gate leaf. Of these castings, one carries a pair of movable jaws and their operating mechanism, and the other a large pin which is enclosed by the jaws when the gate leaves are brought together. A prominent feature of the mechanism is a screw, turned by a bevel gear in mesh with a bevel pinion on the motor-driving shaft, which passes through a plug bearing and is connected to the motor shaft by means of a friction cut-off coupling. The motor is provided with a solenoid brake, by which the machine can be brought to rest instantaneously when the current is shut off by the limit switch. It is estimated that the time required for the completion of the operations for which this mechanism has been devised is but 15 seconds. In this case, of course, only one machine and installation of auxiliary electrical equipment are required for each gate, or pair of leaves.

Ten tenders, ranging from \$652,000 to \$862,000, were submitted for the supply of gate-moving machines, and 12, varying from \$41,200 to \$71,500, for that of mitre-forcing machines, each without electrical equipment; and in each case an award was made to the lowest bidder for a sample trial machine. For trial motors, orders have been placed, after long delay, with the Allis-Chalmers and General Electric Companies. To the tests to which these and other motors supplied to the Canal Commission have been and are yet to be subjected, I propose to refer at some length in a later portion of these articles.

For the purpose of checking the flow of water through the locks in the event of damage to the gates, or of repair or other work in the lock chambers necessitating the shutting off of water from Gatun Lake level, six so-called emergency dams are being built. These will be placed in the approaches to the upper twin locks of each flight, about 200 ft. above the upper lock gates. The total amount of metal required in their construction is estimated at 12,000 tons, and the value of the contract which has been placed for their supply and that of the machinery to operate them is about £461,100. Each dam is constructed on a steel bridge of the cantilever type, of which the long arm, intended to extend over the lock chamber and hold the dam, is 163 ft. long, and the short arm about 98 ft., the extreme width being 93 ft. The bridge will be pivoted on the side wall of the lock approach, and when not in use will rest parallel to the channel, but, when required, will be swung across the latter, with the long arm resting on the middle wall. A series of six girders, hinged to the bridge, will first be lowered into the channel, their ends resting in iron pockets embedded in the masonry floor, and then six panels, or gates, moving in the girders on roller bearings, will be dropped by gravity until they form a horizontal tier spanning the lock approach, and damming the water to a height of 10 ft. Successive rows of six panels will subsequently be lowered until a complete closure of the channel is effected from the bottom upwards. At the Gatun and Pedro Miguel locks, the dams will be provided with five series of panels, but at Miraflores, consequent upon the lesser depth of water, only four rows are required.

Three classes of machinery, all to be controlled from an operator's house erected at the end of the short arm of the cantilever bridge, are needed for the working of these dams—(1) for turning the bridge; (2) for lowering and raising the wicket girders; and (3) for hoisting the panels, or gates. The first will consist of two motors for turning each bridge, a limit switch preventing operation beyond an arc of 90°, and a motor for driving the steel wedges which will hold the bridge firmly in place across the channel or when at rest on the lock wall. The machinery for operating each of the wicket girders includes two hoisting units and a motor unit, all gearing driven from the latter being contained in oil-tight cases affording complete protection from the weather. The motor is started by turning the handle of the controller



to the lowering position, and a solenoid at the same time draws a jaw clutch on the motor shaft into mesh with the high-speed gearing, the girder being dropped to the lock-approach floor in about four minutes at a quite uniform rate of speed. When there exists necessity to raise a girder against the current, to allow an obstruction to be washed out of the floor seat, or for other reason, the controller handle is brought back to the hoisting position, whereupon the clutch is engaged



FIG. 5.—GATUN LOCKS, LOOKING SOUTH.

with the slow-speed raising gear, permitting a return of the girder to its original position in about 18 minutes. Movement in either direction is stopped at the proper time by means of a limit switch. The machine to be employed in hoisting the several gates required to close the openings between the wicket girders consists of a system of hoisting drums, loose on a common drum shaft, which is motor driven through spur gears and a worm and worm gear, the last-mentioned being self-locking and capable of holding a gate in any position when the motor is stopped.

From the foregoing it will be seen that for the operation of the six emergency dams there will be required 12 motors for driving the machines employed to turn the bridges, with six limit switches and six motors for driving the wedges; 36 wicket girder machines, provided with 36 motors and an equivalent number of limit switches; and 36 gate-hoisting machines, each driven by its individual motor.

The next appliances connected with the locks to which attention must be directed are the chain fenders, 28 in number, which are to be placed at various points in the three lock flights. Properly speaking, these should not be included among the lock-operating machinery, but rather under the head of protective devices, for their purpose is to prevent from being rammed the gates above or below which they are placed, by forming a barrier to the further progress of any ship approaching a lock under its own power, or which may have escaped from the control of its escort of electric towing locomotives. A fender chain, therefore, will always be in service, that is, stretched across a lock chamber or approach from the tops of the opposing walls, except when it is desired that a ship shall pass: it will then be lowered into a groove provided for the purpose in the lock floor, the operation of lowering or raising being performed from both sides by mechanism installed in the lock walls.

During the past three years or more, extended studies have been made by the Canal Commission with a view to arriving at a more satisfactory design than prevails at English docks in respect of the method of producing resistance to the paying-out of such chains. Attention has been directed mainly to three forms of resistance—the raising of heavy weights, the friction of metallic surfaces, and the flow of a fluid through small orifices; and in all the designs studied, except where a fluid resistance was used (the chain in such cases being raised and lowered by hydraulic machinery), winding machines driven by electric motors were adopted. The result of the studies thus far must be regarded as provisional, it having been decided to test in place a sample hydraulic machine, and, pending the issue of this trial, to hold in abeyance the definite adoption of any particular system. As at present arranged, therefore, the fender chain mechanism

will consist in the main of a system of hydraulic cylinders, operated by a centrifugal pump connected to a motor, and of the necessary sheaves, bearings and connections for attaching and supporting the chains. Should this apparatus prove unsatisfactory, there is little doubt that frictional resistances, with increased electrical equipment, will be substituted.

The incident, or conflict, if such it can be called, is certainly of more than local and passing interest, for—throughout the 50-miles-long Panama Canal—in connection only with these fender chains has hydraulic power been able to withstand the superior and ever-encroaching claims of electrical power. This triumph of electricity is especially noteworthy, first, because canals and docks have been regarded heretofore as the most appropriate and peculiar fields for the application of hydraulic power, and secondly, because the abnormal humidity of the Central American isthmus constitutes a strongly inimical factor against the installation of comparatively delicate and susceptible apparatus.

An interesting and, from some points of view, instructive story has to be told in connection with the supply of the machines and electrical equipment required for the operation of the 240 rising stem and cylindrical valves forming part of the culvert system for filling and unwatering the various lock chambers. The first circular inviting proposals for furnishing and erecting certain portions of this machinery was issued in July, 1910, and resulted in the receipt of seven tenders, all of which were regarded as excessive, and, for that reason, eventually rejected. The work was then re-advertised, with modified specifications, embodying one change in design and some minor variations as regards material; and special efforts were made to attract to the contract the attention of foreign manufacturers. Whatever its causes, there can be no question of the reality of the transformation effected by this action of the Canal Commission, duly authorised by the President. February 25th, 1911, was announced as the date on which tenders would be opened, and it was then found that there had been received 11 offers for the supply of rising-stem valve machines, 15 for the cylindrical valve machines, four for the motors required for each class of machine, and seven for the limit switches. Even more suggestive proved a comparison of the prices quoted in response to the two circulars. The total consideration of the contracts placed last year, and of those which remain to be awarded after satisfactory trials of the sample machines ordered, will amount to about £186,600. Had, however, the same quantity of material been purchased



FIG. 6.—BUILDING UP AN UPPER GUARD GATE, GATUN LOCKS.

in 1910 on the basis of the tenders then received, the Government and people of the United States would have been mulcted in an additional sum of over £100,000.

For both types of valve-operating machines the Wheeling Mold and Foundry Co. submitted the lowest tenders, and, accordingly, with this firm were placed orders for four sample sets of mechanism, exclusive of electrical equipment. It appears that one reason why these West Virginian manufacturers were enabled to underbid their competitors was that they offered for the valve stems Mannesmann steel tubing.



made in Germany, at a price clearly proving that such tubes, free of duty, cost less than one-half the sum demanded for similar American-made material. The first two completed machines were tested in September and October at Wheeling, under the direction of a representative of the Canal Commission, and subsequently in place at Gatun locks. They were operated with

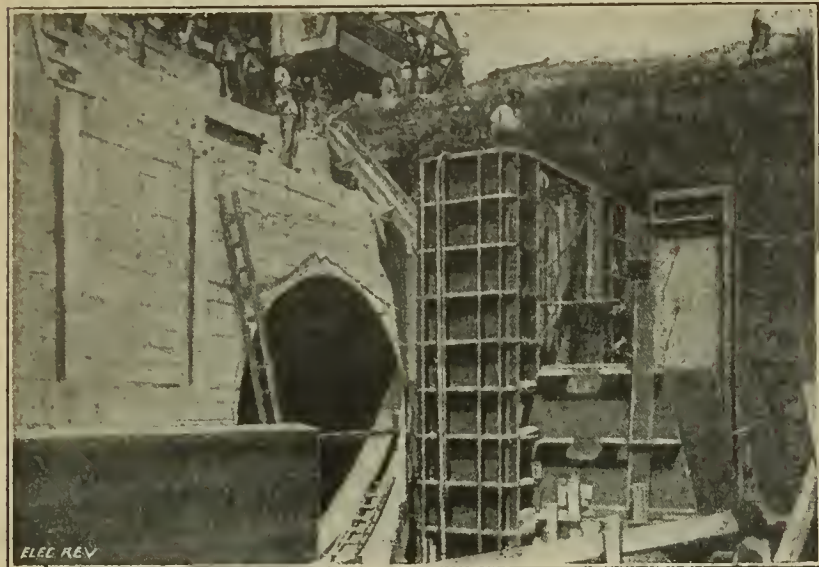


FIG. 7.—STONE GATE VALVE-FRAMES IN POSITION, EAST SIDE WALL, UPPER LOCKS, MIRAFLORES.

four different motors and limit switches, in each instance satisfactorily and in accordance with the specifications; and, as a result, the conditional contracts with the makers have been extended to cover all plant of similar type required. As regards the electrical equipment, definite awards are yet in abeyance, pending the completion of the exhaustive trials to which the sample motors supplied are being subjected. The lowest tenders received in February, 1911, for motors for each class of valve-operating machinery, and also for limit switches, were submitted by the General Electric Co. of Sweden. They compared favourably, even with duty added, with any offer made by an American concern, but, after consideration, were ruled *hors concours*, owing to certain informalities and to the fact that they were not received until some weeks after the time fixed for the opening of tenders. That there existed a strong feeling on the part of the Canal authorities in favour of the offers from Vesteras is evidenced by the fact that, in the first instance, and despite the informalities referred to, conditional awards were made to the Swedish company. They were, however, withdrawn later, in deference to a semi-legal ruling to the effect that, under the circumstances, the tenders could not properly be accepted. Orders for sample motors were consequently placed with the Allis-Chalmers, Westinghouse Electric and Manufacturing, and General Electric Companies, at prices, per motor, ranging between \$710 and \$567, in the case of the rising-stem valve machines, and \$350 and \$277, in that of the cylindrical valve machines. Awards were also made to the two last-mentioned firms and the Cutler-Hammer Manufacturing Co. for two limit switches for each class of machine, at an average price of about \$55.

In my next article will be included descriptions of the two classes of culvert valves, their duties, and the manner in which they will be electrically operated; of the special requirements of the Commission in respect of the electric motors to be installed in the locks, and the severe tests to which this plant is being subjected; and of the electric towing locomotives to be used in the navigation of the locks. In the meantime, attention may be directed to fig. 7, as indicating in some degree the massive proportions of the lock culvert system and its equipment.

**Canada.**—H.M. Trade Commissioner reports that a company has been formed, with a capital stock of \$500,000 (about £103,000), to manufacture bare and insulated and underground, aerial and submarine cables. The names of the companies may be obtained by British manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Transformer Design.

May I, for the benefit of other unwary ones like myself, refer to what I conceive to be an error in that, in many ways, estimable book by Dr. Hay on "Alternating Currents." In describing the Scott method of phase transformation, Dr. Hay states on page 134, 1911 edition, that the primary of the one transformer "has  $\sqrt{3}$  times the number of turns in the primary of the other transformer."

I recently had occasion to wind a pair of transformers for the above purpose, and, in an unguarded moment, took my figures direct from the book without checking them, with the result that I now have the privilege of working all night to set matters right. The ratio, of course, should be

$$\frac{2}{\sqrt{3}} \text{ times.}$$

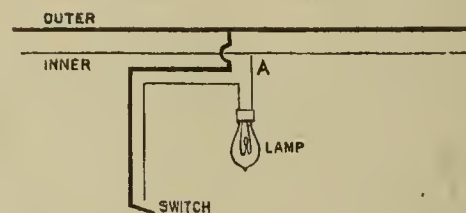
If I have misread Dr. Hay I shall be glad to have it pointed out.

C. Franklin Tubbs.

Leeds, January 19th, 1912.

### Earthed Concentric System.

Can you inform me why it is considered by some engineers bad practice on earthed concentric systems of house wiring



to feed the light with the inner conductor, with the switch across inner and outer, as sketch attached?

### Earthed Outer.

[The point is covered by Rule 65 of the I.E.E. Wiring Rules, 1911:—"All consuming devices must be controlled . . . only on the internal conductor." "No switches . . . may be placed in the external conductor." The spirit of the Rules, however, is not broken by the arrangement illustrated, for the continuity of the outer conductor is never interrupted, and all live conductors are continuously surrounded by the earthed outer.

To be in strict accordance with the letter of the Rules, the switch wire must be taken off at A, and must be run double to the switch, the outer conductors in this case being idle. We see no real objection to the connection shown, except that it does not conform with the Rules.—Eds. E.R.]

### Capital and Labour.

In reply to "A Working Electrician," I may say I am not a Trade Union leader, and perchance have to work as a wireman equally as hard as any other conscientious worker. 'Tis the first time that I have seen it stated that men outside a Trade Union have a monopoly in that respect.

Really I don't quite know how to answer my friend. The mere fact of dock labourers and miners getting better wages in a great number of cases than draughtsmen, engineers, &c., get, is because the so-called unskilled men belong to strong Trade Unions, and the others do not. He wants to know how Trade Unions do good. Take our own trade, for instance. For the sake of argument, let us say that a working electrician, boiled down, is a wireman. Let us also suppose that he lives in London, and gets the standard rate of 9½d. per hour. For that rate he has to thank the Electrical Trades Union, and I think that any fair man will admit the truth of this statement. If there had been no branches of our Union in London the rate would be what it is in other towns where no branch of the Union exists, viz., anything up



to 7d. an hour. This rate of 9½d. was not got by a strike, but by agreement.

Possibly our friend gets more than the standard rate, as heaps of men who are above the average do, but the amount over the rate always has, as its base, the standard rate of the district. Heaps of men have conscientious objections to joining a Trade Union, but never yet have I met a man conscientious enough to refuse any increase that has been gained through the action of Trade Unions. I may say the Electrical Trades Union has no politics. We don't ask any man whether he is a Tory, Radical, Socialist, or what not: we are out to try and get fair treatment from our employers, and the first object, quoting our organising leaflet, is: "To provide employers with competent men in the various branches of the trade." That, I take it, is why our membership is increasing so rapidly all over the country, but more especially in London. We are up against scamped work and underpaid labour, and if the employers could only see it, we are their best friends.

A firm that is fair has no chance to compete in the open market with firms that pay low wages to their workmen. The latter, we, as a Union, are out to fight, and I think even our "C. W." friend would admit (if he could know what work in that direction we are doing) that we are doing some good for the trade, at which we both have to earn a living.

W. J. Webb,

*Electrical Trades Union.*

London, W., *January 20th, 1912.*

I shall be glad if you will allow me to express my concurrence in the remarks on this subject made in your last issue by "A Conscientious Worker."

There is no doubt that England's trade—as he infers—has suffered badly through the growth of Trade Unionism, and it must be cheering to all struggling employers to find that at least one worker is not afraid to support our case against the Unions.

The most vital factor in our prime costs is labour; and, in order to keep ahead of our competitors, we must have cheap labour, which (as "A Conscientious Worker" shows) the Unions are doing their best to kill.

It is scandalous that the Unions should be allowed to fix such a high standard of wages for the comparatively unskilled worker, while really efficient men can be obtained for such branches of the electrical profession as draughtsmen, engineers, station attendants, &c.—where the workers are too highly educated to suffer any interference from Trade Unions—at wages from 10s. to 30s. a week.

As your correspondent truly remarks, "It is impossible to go on increasing the unskilled wages . . . without making the skilled man's lot harder."

Until Trade Unions are abolished we can never hope to keep down our labour costs to their proper level, and I hope that all aristocrats of labour will follow the example of "A Conscientious Worker," and concentrate their attention on the abolition of Trade Unionism, so that we can compete more successfully in the world's markets.

Capitalist.

#### Arc Lamp Lowering Gear.

I have read with interest your description of the arc lamp lowering and traversing gear, as illustrated in the *ELECTRICAL REVIEW*, January 19th. There are disadvantages, however, in following the method described, of drawing the lamp and contact gear to the side of the road before lowering. The disadvantage is generally experienced when the second contact is introduced. This contact is a horizontal one, and by no means rigid, so that in a high wind there is a probability of arcing. Several manufacturers are supplying contact gear which dispenses with the side contact, thus reducing the first cost and cutting out an unnecessary complication.

Another disadvantage is the fact that the vertical contact traverses the span wire; this means that the cable is not permanently in position, and when the lamp is drawn to the side of the road, the cable hangs in a loop or loops. When this cable has been in use for some time, particularly in an atmosphere like that of London, it will be found that the

braiding will crack, and if the rubber is not of the very best, a breakdown of insulation will soon occur. The better method is to fix the contact gear permanently to the span wire, and have an independent traversing carriage to draw the lamp to the side for lowering. Of course the lamp must be released from the fixed contact and lowered about a foot before this can be done.

N. D. W.

#### Preservation of Poles.

We have read with interest your interesting article on "The Preservation of Telegraph Poles" in your issue of December 22nd. We notice that you refer to the greasy condition of creosoted poles and recommend that they should be stored six months after creosoting, so that the oil adhering to the surface may get removed. This would add materially to the cost and, in many instances, would be impossible. You also refer to the draining out of oil after the erection, with the consequent fouling of streams and wells.

Both these disadvantages can be obviated by having telegraph poles and other timber such as fencing creosoted by the new Rüping process, by which a better penetration of the timber is secured and the wood is dry and clean and consequently fit for immediate erection. There is no subsequent draining out of the oil and consequently nothing to foul streams and wells.

This process is gradually superseding the older methods, and on the Continent and in America it has completely done so.

For Richard Wade, Sons & Co., Ltd.,

W. L. SHOOTER.

Hull, *January 16th, 1912.*

#### Official Returns.

In your issue of the 19th inst. we notice the following paragraph under heading of "Official Returns of Electrical Companies":—"General Electric Co., Ltd. (67,307).—Mortgage dated December 21st, 1911, supplemental to trust deed dated November 30th, 1900, securing £200,000 first mortgage debenture stock, charged on land at Witton, near Birmingham. Trustees: F. B. Ross, Cromford Court, Manchester; and W. Warburton, 15, Norfolk Street, Manchester."

In our opinion, this announcement is distinctly calculated to convey to the public at large that there has been a new issue by our company of £200,000 mortgage debentures. Such, however, is not the case. All that has been done is to release one security from the operation of the original debentures for £200,000, which were created by a trust deed dated December 30th, 1900, and substitute another security with the consent of the debenture-holders.

We shall be glad if you will in your next issue correct the erroneous impression conveyed by the above paragraph.

The General Electric Co., Ltd.,

M. RAILING, *Director.*

London, E.C., *January 22nd, 1912.*

#### The Association of Consulting Engineers and the I.E.E.

Referring to the rules drawn up in connection with the above, No. 4c requires that no consulting engineer can be a member of the Association unless he is a member of the Institution representing his profession. This appears to be unreasonable.

I have been in practice for nine years as a consulting electrical and mechanical engineer, and I belong to no Institution. Why should it be necessary for me to join the Institution of Electrical Engineers if I want to belong to the Association of Consulting Engineers?

Is it sentiment? Is it that the Consulting Association want the backing of the Institution and the advantage of using their building, or have the Rules of the Institution been so strict in the past that a Member is sure to possess special qualifications? It seems to me a very unnecessary rule—a man's qualifications can be gauged without it; in fact, it is rather like the cotton Trade Unionist swearing he won't work with a non-Unionist. However, it may save me



a guinea—perhaps a great many, as I am free to work without restriction.

I applaud the efforts of Mr. Ferranti to improve the status and value of the Institution of Electrical Engineers. I believe he stated publicly that it is of little value to its members as it stands, and many of its members are fairly blunt in their statements as to its lack of status and value—yet the new Association binds its members to be members of an Institution which has some lack of status and value.

It would be an advantage to be a member of the Institution if every Electrical Association were a branch of the Institution, and partly under its control—while retaining self-control in each branch.

The Institution would increase its funds by each branch paying in subscriptions, also its power, and, further, each branch would have a status and more power than at present. I believe the only objection held in the highest quarters is that some of the present members of outside Associations are not qualified electricians, but surely that could be got over.

The member of a branch need not be admitted a member of the Institution, although branches will act as feeders to the Institution and also provide a means by which men will be educated up until they possess the qualifications for membership of the Institution.

F. G. C.

#### Cheap Disconnecting Boxes.

There are many undertakings which find the cost of a sufficient number of mains disconnecting boxes of good design to be more than the job will stand, and they therefore put in very few, and thus find themselves in an awkward predicament in the event of a main breaking down.

After many years' experience with mains work in seven distinct districts, I have come to the conclusion that the best arrangement is an underground chamber with two or three bus-bars each mounted on insulators on a separate wall of the chamber. Where single cables are in use, the ends are sealed and thimbles sweated on which are fixed to the bus-bars with set screws.

Where the cables are concentric or triple-concentric, the cable ends should be sealed with compound, and the conductors sweated to suitable concentric fittings, from which rubber insulated tails are led to the bus-bars.

Of course, if the chambers are liable to flooding, a switch pillar above ground is the alternative, but these are liable to damage from vehicular traffic. However, both the above arrangements are costly, and for my own work I find that a shallow brick box with frame and cover varying from 12 in.  $\times$  12 in. to 24  $\times$  24 in., according to the size and number of the cables answers every purpose. The cables are terminated in ordinary sealing troughs filled with compound, and rubber insulated tails are sweated to the cable conductors by means of the usual fittings. The tails are each fitted with a copper sweating thimble, and those belonging to each pole are fixed to a short piece of bus-bar fitted with a set screw for each. The whole is then taped up.

To the lead sheath of each cable there is soldered a heavy strip of lead with a hole in the end, and a brass bolt then bonds the whole of the leads together. The cables are each independent, and can be removed, or additional ones can be added with small expense, whereas the ordinary disconnecting box has to be entirely dismantled for each alteration.

I find that the total cost of a seven-way box complete with labour, re-instatement materials, &c., in a brick pit with 24 in.  $\times$  24 in. frame and cover does not exceed £5.

I should like to have criticisms on the above arrangement from practical mains engineers.

Arch. J. Howard.

Taunton Electricity Works,  
January 19th, 1912.

#### The Prevention of "Steamy" Shop Windows.

At the present season of the year both the shopkeeper and the lighting engineer are faced with the difficulty of "steamy" windows, which have a disastrous result for both. The shopkeeper is unable to display his goods to the best advantage; and the engineer casts a sore eye on the light he is supplying, hidden, as it were, under a bushel.

To combat this, various systems have been tried—gas has

been used; and how often has gas made its way into shops for this reason? Comment is needless. We notice that on a cold day that "steamy" windows are all prevalent in shops where the entrance door is kept closed, whereas in butchers' shops, this is not the case; they are provided with good ventilation, hence a very slight difference of temperature between the outside and inside of the shop. All tradesmen cannot provide such ventilation, for on damp days their goods would be affected, so some other method must be adopted.

The writer has found that the cold air outside has a tendency to freeze the air inside the window. Hence condensation sets in, and eventually we have water running down the glass inside, which, if left there, freezes.

To burn gas jets is of very little use, as the heat given off rises, and we find the top clear, but the bottom, which is the most important part of the show case, is "steamy."

To prevent the air nearest the glass in a confined window from depositing moisture it must be kept in circulation. To introduce fresh air into the case, either hot or cold, is disastrous to a jeweller, consequently a small fan must be used, say, with blades of 4 in. diameter; such a fan, however, is not on the market to work direct on 250 volts, and should a larger fan be used, the tickets are blown about, and it has a tendency to draw in fresh air.

An experiment was tried in a jeweller's window, which consisted of six air-tight compartments; six fans were required, and to obtain the small fans to work on 250 volts direct being impossible, six 4-volt fans were procured; these were found to take 2 amperes from a 4-volt cell, when running at a good speed. The lighting of the shop being by electricity, the six fans were run in series with one another and the lamps in the window, a single-pole switch short-circuiting the fans when not required. By this method the speed of the fans could be regulated by switching on or off the lights without causing a noticeable drop in the voltage, so that it did not interfere with the lighting. Five minutes has been found ample to run the fans as soon as any signs of "steam" are noticed, and the effect will hold good for perhaps half-an-hour or more, according to the state of the weather.

I must say I do not advocate the method of running the fans through the lights, but being unable to procure such small fans to run on 250 volts, I had no alternative. It is only left for the fan makers to design such fans, which I am sure will be to their advantage and that of the supply authorities.

A. Preston, *Electrical Engineer,*  
*Ammanford Electric Supply.*

January 22nd, 1912.

#### Electric Cooking and Heating.

I did not reply last week to the letter sent you by Mr. Meares, as I felt sure others would only be too ready to disabuse him of the idea that there is anything difficult in replacing the kitchener with electrical apparatus.

At present it is true that the modern household is not run entirely by electricity, but it will be very soon. How long was it between the introduction of gas and its almost universal use? I don't know, but I expect we shall beat it easily.

Electricity can cook perfectly, it can provide at a reasonable cost all the hot water necessary. Even if the radiator or electric fire is felt to be a little too good for the servants to sit round, give them a small open fireplace.

You cannot economically produce a large quantity of hot water electrically at the moment it is wanted. Neither can you by any other method. The coal fire does it slowly. The gas geyser is horrible, and takes, say, 15 minutes for 30 gallons.

Electricity, as I have shown before, can produce it very well without any patent or expensive apparatus, without anything likely to break down. It may cost a little more, but it is cleaner and better.

For example, in a house holding a family of six persons and four servants, it would cost to cook and heat water by electricity, say, £80-£100 per annum. Using a kitchener, the coal for it would be, say, £30-£40. One servant less could do the work. This seems to me to be a business pro-



position. I expect I have much overstated the electricity consumption, but it is near enough.

The cost of installation of the water heater would be, say, £5.

The complaint that makers of cooking apparatus do not supply means for heating persons and water can easily be answered. They do. A few specialise, but most do it all.

Smaller establishments can easily be dealt with, perhaps at present not so cheaply as with coal or gas, but so much better that it is worth the extra.

Finally, if Mr. Meares's friend will not go the whole hog, let him cook by electricity and fit a small closed stove for the hot water. He would save its cost very quickly. People seem to think because a kitchenier does everything it is cheap. Generally it is a jack of all trades and master of none. It is not comfortable to sit round in the evening. It is wasteful of coal for hot water and a bad cooking appliance.

Percy Good.

London, S.E., January 22nd, 1912.

## PROCEEDINGS OF INSTITUTIONS.

### Auxiliary Machinery for Internal Combustion Engined Vessels.

BEFORE the members of the Institute of Marine Engineers, London, on January 15th, MR. W. R. CUMMINS read a paper on the above question.

MR. CUMMINS pointed out that it was desirable, if not necessary, that the same type of motive power should be used throughout the ship. In the case of internal combustion engined ships some difficulty arose. He went into details of mechanical, hydraulic, compressed air, and electrical methods of driving the auxiliaries, including various types of electrical steering gear that had been proposed, and in some cases applied to actual ships. He explained one of the difficulties met with when applying an electric motor to the steering gear; if a steam steering gear were to get out of control and put the rudder up against the stops, or if a heavy sea struck the rudder, the engine would pull up, and no damage would be done, and the engine would start up again when the excessive load was removed, but in the case of the electric motor, if it were pulled up dead it would burn out if no overload cut-out were provided. On the whole, he thought that the compressed-air system would be best for the auxiliaries.

The CHAIRMAN (Mr. F. M. Timpson) in opening the discussion, stated that compressed air had been used for auxiliaries, on the oil-engined vessel *Vulcanus*, but the owners had reverted to the use of steam with oil-fired furnaces in later boats.

MR. W. P. DURTNALL said that many attempts had been made to utilise compressed air for the various purposes, but the compression and other losses were such as to make the over-all efficiency very unfavourable. Hydraulic gear was more efficient, but neither could compete with electrical driving for the purposes concerned. Recently, he had tested a 7,000-ton cargo vessel at Venice, whilst she was unloading her cargo, and had weighed the water consumed. The evaporative efficiency of the boilers was found to be approximately 9 lb. of water evaporated per lb. of coal burnt, but on weighing the coal used during three days' working, it was evident that as much as 29.2 lb. of coal was burnt per ton of cargo discharged, which was an enormous consumption for the work done; most of the consumption represented losses through radiation, &c.

The owners had since decided to install the "Paragon" variable-voltage system of electrical transmission on this ship, and Mr. Durtnall described in some detail this method of driving, demonstrating that a great advantage in the matter of fuel economy will result from its use. A high load-factor could be kept on the prime-mover in the engine room, and the kinetic energy of the falling weight, and of the mass of the motor and the winch would be recuperated in the form of electrical energy, which would be sent back to the mains. No resistances were used in connection with this system for starting and speed regulation, and as the steering-gear motor could stand if desired with the full current on at low voltage, the conditions of the steam engine would be met, and a great reduction in the fuel consumption per ton of cargo discharged would take place. He further stated that anything that could be done by means of steam could by proper design be satisfactorily carried out by electric motors, and with greater fuel economy, because of the higher thermal efficiency that could be obtained by quick-running engines as prime-movers compared with slow-working direct-coupled pumps, fans, &c., driven by steam or compressed air.

MR. W. McLAREN considered that the deck machinery, such as winches, windlasses, and capstan, should be driven by electrical gear, especially as with hydraulic gear it cost just as much to lift 1 cwt. as to lift, say, 3 tons, on a 3-ton winch or crane. He

thought, however, that either hydraulic power or compressed air could be used with advantage on the steering gear.

The meeting was adjourned for a further discussion on the subject at a later date.

### Residence Tariffs.

By A. H. SEABROOK, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, December 14th, 1911.)

THE cost of supplying a residence consumer with electricity is composed of two parts:—

(a) "Standing cost," or the cost of being "ready to supply" him, made up of capital charges, the greater part of management costs, a small proportion of repairs, wages, coal, &c., and all charges which depend upon the maximum power he requires at any one time.

(b) "Running costs," made up of a small proportion of management expenses, and the greater portion of repairs, coal, wages, oil, stores, &c., and all costs which vary in proportion to the number of hours per annum he uses power.

No tariff is theoretically sound which does not differentiate between these two sets of variable costs, and which does not charge the consumer separately as to his standing costs and as to his running costs.

Another factor also has to be taken into account in tariff making, and that is "expediency." It may be quite justifiable on commercial grounds (and by "commercial grounds" is meant from the point of view of the balance-sheet of the undertaking) to take a line of action which, viewed by itself, appears to be unsound. A tariff which does not allow for expediency will be a failure.

The characteristics to be desired in a residence tariff are:—

1. It should ensure a proper return from each consumer upon the total cost of supplying him, this cost being made up of standing and running charges, and the ideal tariff must take into account variables of each, and not assume them constant for all consumers.

2. It should be as simple as possible and capable of easy explanation to the consumer.

3. It should render unnecessary the use of more than one meter and one system of wiring, however varied the application of electricity, and it should hold out special inducements and facilities to consumers to make the freest use possible of the electric service for all the purposes that it can be adapted to; it should facilitate the installation of the greatest number of points and encourage the long-hour use of electricity for lighting.

4. It should be cheap in application as regards accountancy, book-keeping, and labour generally, and should eliminate as far as possible complaints from consumers, which, of course, means a saving in labour.

5. It should possess great flexibility as regards the number of lamps installed, so that a consumer may install and pay for exactly the amount of light he requires, and he should not be charged on any arbitrary assessment based on the amount of light which is considered necessary for his purpose.

Residence tariffs at present in use may be put under three heads:—

(a) *The Flat Rate per Unit.*—This is the most common system of charge; it does not take into account the consumers' demand, but merely his consumption of units.

(b) *Flat Rate Charge per Kilowatt of Maximum Demand and no Charge per Unit.*

(c) *Hopkinson Differential Rates.*—These consist of a primary and secondary rate of charge for standing and running costs, thus charging for maximum demand required as well as for units used. There are various methods of applying the principles laid down by the late Dr. John Hopkinson.

The following are some of the best known varieties:—(1) Wright maximum demand system; (2) Norwich or rateable value system; (3) Detroit system; (4) Contract demand system (Handcock and Dykes); (5) Glasgow system; (6) "Metropolitan" system; (7) "Telephone" system.

#### (a) THE FLAT RATE PER UNIT.

By this tariff the consumer is charged by meter so much per unit, with or without discounts, and regardless of his maximum demand. It therefore ignores an important item of cost, viz., standing charges, and it assumes that all consumers require the same proportion of units to their maximum demand, which is unsound and theoretically indefensible.

Another more serious objection, is that separate wiring has to be installed before electricity can be employed for "other uses" than lighting, because consumers will not pay 1d. or 6d. per unit to run kettles, irons, toasters, and such apparatus. There is a growing tendency on the part of residence consumers to make use of such auxiliary apparatus, and unsuitable tariffs should not be allowed to stifle the demand which is being so carefully and assiduously cultivated by manufacturers and some electric supply managers.

There is no doubt that auxiliary apparatus merely requires to be brought efficiently and tactfully to the notice of consumers and they will adopt it. This business may be encouraged to such an extent that these "other uses" units will yield as valuable and important a proportion of the total revenue as the power load in industrial areas. In fact, it would not be unduly optimistic to say that they will eventually become more important, as there is a bigger public to use electric heating and cooking than there is to use power, and the prices charged for electricity and electrical



apparatus are now sufficiently attractive to encourage a great and immediate expansion of business.

The flat rate per unit has another serious drawback. It does not encourage the long-hour use of electricity for lighting, such as basement lighting, a most desirable class of load which cannot be obtained in any quantity even at as low a flat rate as 3d., but which a differential tariff will nearly always secure.

In spite of the foregoing statements, there is little doubt that "expediency" demands a flat rate for lighting as an alternative to the differential tariff, but it must be a high flat rate, say not less than 6d. per unit.

Some of the London electric supply companies were severely criticised recently for raising their flat rates from 5½d. to 6d., but it was the proper and correct course for them to adopt, as they were introducing a differential tariff, and were, therefore, compelled to keep the flat rate high.

#### (b) FLAT RATE PER KILOWATT OF MAXIMUM DEMAND.

This is analogous to the unlimited "telephone" service rate. It consists of a weekly or monthly sum per lamp or per kilowatt or part of a kilowatt installed, and has generally been applied to lighting supplies only. Probably the best known application in this country is that by the Fixed Price Light Co., who have successfully introduced it into small residences in South London.

It has been applied on a small scale in St. Marylebone for artisans' dwellings, consisting of one, two and three-room tenements. The price per tenement is calculated, in the case of kitchens and sitting-rooms, in such a way that if the consumer uses his lamps day and night, the price per unit obtained would be a little under 1d., and lower in the case of bedrooms. In practice there is not much difficulty experienced from consumers wasting light, as in these blocks of tenements the caretaker is a person of considerable importance, and exercises a good deal of control over the tenants.

The price per lamp per week includes lamp renewals, and also a sum calculated to write off within a reasonable period the capital expended in wiring. For a single-room tenement the charge is 7d. per week (one 25-C.P. Osram), made up of current, 4d.; lamp renewals, 2d.; installation repayment, 1d.; and for a bedroom 5d. per week (25-C.P. Osram).

About half the tenements adopted the system immediately it was available, and as new tenants come in all the tenements will be fitted up. If in the future the tariff is generally applied in the district, it appears from inquiries made, that by arrangement with the landlords the charge for electric light can be included in the rent, and the flats can be let inclusive of light. As it is, there is a tendency for flat owners to insist upon the exclusive use of electric light in their flats on account of the saving in decorations, &c., and there is little difficulty in inducing landlords to make this compulsory where contracts for a period of years have been entered into for electric lighting arrangements.

Messrs. Handcock & Dykes have put into operation a similar system, but a limiter is used in conjunction with it, the charge being based on the watts of maximum demand at which the limiter is set to flicker. It is as expensive, however, to put in a limiter as a meter.

The flat rate per kilowatt of maximum-demand system has very wide possibilities among small residence consumers where meters are impracticable on account of cost, and it seems to be the only solution at present of the small-consumer problem; at the same time, it is a very satisfactory solution, both to suppliers and consumers.

#### (c) HOPKINSON DIFFERENTIAL RATES.

It would be difficult to find an electric supply manager who would deny that the Hopkinson principle is the only scientifically correct basis of charge, whether he adopts it or not himself.

The question then arises, Why are there so many flat rates per unit in force? The answer is, Because of the difficulty of applying the Hopkinson principle in a simple and easily explained and understood system of charge, which complies with the requirements of expediency as well as with the laws governing supply costs.

The *Electrical World* says:—"It is indeed difficult for those who have studied this matter for years to realise the ignorance of the first fundamental principles of rate-making among some of the smaller companies." In this country the last sentence will apply to the large as well as the small supply authorities, because most of the large ones, which should lead the way, are peacefully sleeping upon inconsistent flat rates per unit.

It would appear that the correctness of Hopkinson's principles is quite as fully agreed in the States as here. In both countries the reason why tariffs on these principles make such little headway is the same, viz., the difficulty in applying those principles in the form of a simple tariff.

The best known of the Hopkinson systems are:—

1. *The Wright System*.—This system is well known, and needs no description. Its main disadvantages are: (a) It is impossible for the consumer to understand it, and that is a most serious bar to obtaining new business. (b) It is practically impossible for the consumer to use electricity for other purposes than lighting. (c) It is expensive in capital cost, meter and accounts department, and the cost of settling consumers' complaints is excessive. (d) Consumers do not, as a body, appreciate the value of the low secondary charge, consequently the system tends (with a few exceptions) to restrict the use of electricity.

2. *Norwich, or Rateable Value System*.—This is a differential system, in which the primary rate is a fixed percentage of the rateable value of the house, all units being charged at a low price of 1d. or thereabouts.

It has several advantages, being extremely easy for the consumer to understand, and therefore a good "business getter"; it is cheap in application, it encourages the use of electricity for other purposes than lighting, only one meter and system of wiring is required, and it encourages a liberal use of electricity for lighting.

It has, however, several serious drawbacks. It is an "inflexible" rate, because it assumes that each consumer in each similarly rated house requires the same number of watts for lighting, whereas in practice it is found that the requirements of different persons in similar houses differ enormously. It relies upon houses assessed at the same amount for rating purposes requiring similar installations of electric light. This must be a serious difficulty in nearly all districts.

Again, the rateable value of two houses of the same size and only one street apart from each other, may be very different.

3. *Detroit System*.—In this system the primary charge is based on the number of rooms in a house, &c., in the form of a predetermined number of units per room at a high price per unit, all additional units being supplied at a low secondary rate.

The author is not aware of any application of it in this country, but it is in use in Detroit and other cities in the States.

This system has some of the disadvantages of the Norwich system.

4. *Contract Demand System*.—On this system the primary charge is based on the connected load, and the consumer states his maximum demand required in kilowatts, at which figure a limiter flickers the lights when that maximum demand is exceeded. The system has many advantages as regards simplicity, and would be almost ideal if lighting were the only use to which electricity could be put. The disadvantage which puts the contract demand system right out of court is the impossibility of using electricity for other purposes than lighting; irons, kettles, &c., are all barred because they cannot be used at the high lighting rate of charge. In practice it is found that the diversity of this class of load taken in bulk entitles it to be charged at a much lower rate than lighting, which has practically no diversity.

5. *Glasgow System*.—The system recently put into force in Glasgow is as follows:—

Up to 800 hours' use of the maximum demand the primary charge is 3d. per unit (the present flat rate of charge) and all additional units 1d.—the secondary rate. The trouble is, however, that the consumer would be sadly alarmed at his first bill if he put in a kettle and an iron. This system will work out very differently from what is expected by the consumer, and instead of his units of increased use being at 1d. per unit they will be 3d. The only way to get over this difficulty is to assess the lighting maximum demand.

6. *"Metropolitan" System*.—The "Metropolitan" system, which is used by the Metropolitan and the Brompton (London) Electric Supply Companies, is based on the connected load and consists of three charges:—

(a) Primary kilowatt charge.

(b) First energy charge 2d. per unit, the amount in £ s. d. at 2d. per unit to be equal to the amount of the annual primary charge, then all units in addition are charged at:—

(c) The second energy charge at 1d. per unit.

The only difference between the "telephone" system (as the contract system is called in St. Marylebone) and the "Metropolitan" system, is the intermediate energy rate of 2d., and one would imagine that very few consumers get the 1d. rate.

There are so many good points in the system not possessed by systems of charging other than the "telephone" system, that this intermediate charge of 2d., even if it does complicate the straight annual charge and 1d. per unit system, cannot be considered to be any serious disadvantage provided it is found that consumers actually do get on to the 1d. rate.

7. *The "Telephone" System*.—This is a differential tariff based on the connected lighting load. The idea was first suggested to the author by Mr. Arthur Wright when discussing rates of charge for small consumers.

The system, as described in the paper, was the outcome of that conversation and of the various improvements made by the staff at St. Marylebone as experience was gained. The author fears that a good deal more credit has been awarded to him than he really is entitled to, as the only thing about it which he fixed was the name "telephone," and that was adopted for the following reasons:—

Practically all consumers, if not actually telephone subscribers, are acquainted with the system of charge for the telephone, which is roughly an annual sum, payable in advance, and 1d. per call. Calling the system the "telephone" system immediately causes people to think of the telephone charges and accustoms them to think of payments in advance. It has frequently been most useful to be able to show a consumer what the Telephone Co.'s annual charge covers in standing and capital charges, to explain how in like manner electric supply standing charges are almost identical, and that it costs the Telephone Co. and the Electric Supply Undertaking a certain definite sum to be "ready to supply" him apart altogether from the number of calls he makes or units he uses, and then to show him from which costs the 1d. per call and 1d. per unit are made up. It would be most difficult to explain all this to the consumer if the Telephone Co. did not exist. Thus the name is purely a "selling point."

Briefly, the "telephone" system is:—

(a) A differential system with its primary charge based on 70 per cent. of the connected lighting load at £14 per kw. per annum, not counting convenience and decorative lights, and not counting any watts installed for other uses than lighting. The secondary charge is an energy rate of 1d. per unit.

(b) The exclusive use of electricity for artificial lighting is insisted upon.



(c) The primary charge is payable annually in advance, or quarterly at an increase of 10 per cent. in the price.

(d) The primary charge is not increased in subsequent years provided the consumer does not increase the wattage of his lighting installation.

(e) Maximum-demand indicators are used in all but small installations and are put in circuit with the whole installation—lighting and “other uses”—not for charging purposes, but as a guide in noting the load factor of the entire residence installation. When sufficient information has been obtained these will be discontinued.

(f) It will be seen that the standing charges of the entire residence service are based on the lighting installation.

The advantages of the system are:—

1. Each consumer pays his share of standing and running charges and separately. If he chooses to use his service only for lighting, that is his loss; the fact remains that it is open to him to use it for other purposes than lighting at no increase in the annual charge.

2. The system encourages longer hours' use per annum of lighting and does not encourage economy in units.

3. A large amount of “other apparatus” than lighting can be connected to the lighting circuits without the expense of separate circuits and meters.

4. The system has not the disadvantage which many differential systems based on the connected load have, namely, discouraging the free installation of lighting points, because convenience and decorative lamps are not counted.

5. The system has not the objection which many differential tariffs have, viz., assuming that all consumers of equal size require the same amount of light. On the “telephone” system the consumer has to wire his house throughout, but he can have and pay for the number of lighting watts that he wants.

6. The system is extremely simple in application, merely consisting of a quotation of so much per annum and 1d. per unit, and it is easily understood by the consumer.

7. It practically eliminates the possibility of complaints, as these can only refer to the number of 1d. units, and consequently strict meter accuracy is not so essential as when units are being charged at 4d. and 6d.

Seventy per cent. of the lighting watts installed may be considered high (several electric supply managers have adopted 60 per cent.), but convenience and occasional lights, such as those used in cellars, pantries, bath-rooms, lavatories, larders, and occasional rooms are not counted, nor are lamps counted which are used for purely decorative purposes, provided there is already 1 watt per sq. ft. of floor space (based on tungsten lamps) installed in the room. This proviso is obviously necessary to prevent a consumer claiming nearly all the lamps installed in a room as decorative, which in some large houses it would be possible to do.

It is found in St. Marylebone that a very small house or flat uses on the maximum demand system 80 per cent. of the lamps installed at any one time; as the size of the house increases the percentage decreases to 33½ in the largest houses. The larger the house, however, the greater the number of convenience and decorative lamps, which brings out the 70 per cent. about right.

One penny per unit was taken for the secondary rate because it is a rate at which consumers can afford to use electric heating and cooking, as at that rate electricity can compete with gas.

One penny per unit is also quite a safe figure from the point of view of cost per unit in St. Marylebone, but this is a matter which each supply manager must consider for himself, because conditions differ in nearly every district. In some cases the rate could profitably be ½d., but it is a pity to charge as low a price as ½d. per unit for cooking and heating, unless for the six summer months only (½d. per unit is now being seriously considered in St. Marylebone as a summer rate and 1d. in the winter), as there is such a large amount of business to be done at 1d. before there is any necessity to go any lower in price.

The exclusive use of electricity as an artificial illuminant is one of the essential points of the system. It would be inadvisable at the moment to offer, with no restriction, 1d. per unit for all “other uses” than lighting in St. Marylebone, but if the exclusive use of electricity for lighting can be obtained and thus the full standing charge on the premises, then 1d. per unit for “other uses” is remunerative. It would surprise many people to know what the results are. A typical case may be cited, one of many. A consumer came to the showroom and purchased a radiator. The showroom attendant immediately enlarged on the advantages of the “telephone” system; the result was that 19 gas light points were changed to electricity, “telephone” system and maintenance contracts were obtained, and an order for several more radiators.

In St. Marylebone, during the first two years of the “telephone” system, nearly £25,000 was received in annual payments in advance. Here, again, the Telephone Co.'s charge helped considerably. An increasing sum is carried forward each year in the form of unexpired annual payments; this materially assists to increase the working capital of the undertaking. In a short time, in spite of the very large half-yearly payments on account of capital charges, there will be a credit bank balance on revenue account all through the year.

A large business is done in hire and hire-purchase, the capital expended on which it is considered preferable to write off at the end of each year instead of raising loans, and a large working capital is particularly useful in this case, which is only one example.

Altogether there is no reason why annual payments for electric supply should not be obtained in advance just as telephone subscriptions are. Although quarterly payments in advance are

accepted at 10 per cent. increase, the number of consumers paying quarterly is negligible.

The following is printed in large red type on all agreement forms:—“The annual charge in future years will not be increased provided you do not increase the number, candle-power and watts of the installation as per schedule attached.”

No claim is made for the “telephone” system being perfection, but the author believes that for the time being it is preferable to base the primary charge of differential residence tariffs on the connected lighting load.

It must be borne in mind, however, that when the complete electric service—lighting, heating and cooking—is installed in residences, the proportion of lighting revenue to the total revenue per residence will be about one-third to one-half, and the whole aspect of residence supply will be changed. The lighting load factor will not then be the dominating factor; lighting and heating will be still essentially winter requirements, cooking, taken in the aggregate, will be largely non-peak. Many other accessory uses, such as fans, bath-water heating, polishing, ironing, &c., will also be found to be largely non-peak.

One point as to the diversity of the cooking load might be worth mentioning. From recording ammeter charts it is found in St. Marylebone that even where late dinners are the custom in an ordinary family, the midday cooking load is generally greater than the evening, perhaps due to the fact that the children, maids, governesses, &c., have a middle-day dinner, and also that a good deal of food is cooked in the middle of the day and early afternoon for the evening meal, as naturally the average cook prefers to leave as little as possible to be done in the evening. A large number of these recording ammeters are kept going in order to ascertain the diversity of load in various residences and blocks of flats, and the information accumulating is most valuable.

Probably the optimist will say that in a few years' time, when electricity is universal, it will be possible to offer a flat rate per unit of 1d. or less, and it will not be necessary to bother about differential tariffs. It is difficult to see how that can come about, because there will always be the long and short-hour users, and they cannot be fairly charged at the same rate per unit. A universal flat rate must be as unfair in the future as at present unless some genius abolishes load and diversity factors.

#### DISCUSSION.

The paper was discussed on December 14th, 1911, and January 18th, 1912.

MR. E. T. RUTHVEN MURRAY, in opening the discussion, remarked on the importance of tariffs in view of future developments due to “other uses.” He wondered whether one of the principal benefits of the telephone system was not that it did not differentiate between standing and running costs; perhaps expediency was a valid reason for its adoption. The system adopted by the author only assessed lighting charges, and left “other uses” to chance, but electric cooking was growing, and ought to be assessed as well, if of any amount. How did the author satisfy himself that it was remunerative to charge 1d. per unit for other uses? If he charged £14 per kW. for lighting—a high fixed charge—other uses should be charged something. No tariff ought to necessitate entering a consumer's premises, and he thought the author's forms (in an appendix) were somewhat appalling. He discounted any advantage in name, but agreed with the author's premises as to what a tariff should be.

MR. GEORGE WILKINSON said that while the name “telephone” was new, the system was old, and had been used by himself for some years. In referring to current limiters, the author lost sight of the fact that there was no shunt loss in the limiter, and this turned the scale as against a meter. The contract demand system (with limiters) was essentially for workmen's dwellings where only lighting was in use. The author obtained £14 per kW. standing charges in advance, but he (the speaker) only obtained £9 per kW. of maximum demand. The author had no check on his assessed demand, as it was easy to change lamps, and he ought to be glad to obtain 1d. per unit as well as the £14 per kW. The “other uses” referred to were limited by the service's capacity. A large house which might take 1 kW. for lighting, would, perhaps, take 6 kW. for cooking and 3 kW. for radiators, and thus other uses would soon load up the mains and necessitate additional capital charges for cable. He thought it would soon be necessary to make a kW. charge to cover such items.

MR. ARTHUR WRIGHT said the author had given practical proof of the business-getting capabilities of his system, but it appeared that rather too much was left to the discrimination of those who assessed an installation. The author did not appear to allow a commercial discount for quantity, and reduction in costs was more due to quantity than to improved load factor. In an average house the cost of electricity consumed was small compared with standing charges on mains, cost of collecting accounts, &c., so that small installations ought to be charged on the lamps installed. It was necessary to meet this class of consumer, who represented the great bulk left to be dealt with.

MR. C. A. BAKER (L.C.C.) said that body consumed 2½ million units per annum for lighting its offices, schools, &c., of which more than half was purchased from 27 different supply undertakings. In Marylebone he had never been tempted to adopt the telephone system, as the standing charges were too heavy, and it would cost more than on the maximum-demand system with a rebate for large consumption. Only one London undertaking (Stepney) relied on the maximum-demand system, and there electricity was cheap. The author relied too much on expediency; he got his standing charges paid but if the consumer left or was away, the department



did not return the money, although it was not really entitled to more than the statutory charge per unit. In Lombardy, with water-power, it was usual to charge 15s. per lamp per annum, and this was justifiable with water-power, however long the lamps were used. He suggested that it should be possible to frame flat rates based on averages, much on the lines of insurance business; and that it would be a good thing for the business if unnecessary rules and regulations were abolished.

MR. W. R. COOPER said he favoured the Hopkinson system, and was glad to see that it was going ahead, even under another name; he had no belief in a flat rate. If he were a consumer on the telephone system, he would expect a 10 per cent. discount for paying quarterly in advance, instead of paying 10 per cent. extra. It was, however, much more important to get business than to worry about a tariff, and if business resulted from the telephone system it was satisfactory.

MR. A. H. DYKES said tariffs largely depended on the people who were supplied, but also on the system of supply and plant. A flat rate was absurd unless one could store cheaply. The original Hopkinson system tended to reduce the number of lamps installed, and the Wright modification was supposed to get over this difficulty. The author's system was the contract demand system with the indicator omitted, but the limit indicator was inserted in order to fix standing charges for other uses according to the demand. It seemed, from the figures given in the paper, that the author was obtaining a very high price for lighting units, and so it was easy to supply at 1d. per unit for heating, &c. The system required inspection and differentiation between lights, which was a drawback, and he thought that a good deal more would be heard of two-rate systems in future. In conclusion, he drew attention to the operations of the Fixed Price Light Co. among small property in South London, where 300 consumers had been obtained in face of the competition of an energetic gas company. The average cost of services was 10s. each, and the company paid 10s. per point for wiring, exclusive of the lamps, which were hired at 1s. each for the life of the lamp, thus, to some extent, relieving the consumer of their cost.

MR. A. K. SCOTT-MONCRIEFF, referring to the consumer who was away for a period, suggested that he ought to be charged less if away in the winter. It was not a "selling point" to ask a consumer to pay five-sixths of his bill beforehand; the £14 per KW. reminded him of overweight butter. The telephone system was, however, a good one; a system of this sort was required or else double wiring was necessary, but he thought that the flat rate would come eventually, as some industrial towns were getting very near it, the peaks in those cases being of small importance and relatively of small cost.

MR. F. M. LONG, referring to the Norwich system, said it would probably not be suitable in a place like Marylebone or at seaside towns. A system of primary and secondary charges was the right one for a private house, and the former should be fixed and independent of what the consumer did in his house. The Marylebone figures for primary charges were high compared with Norwich, where £4 per KW. connected was an average. There were, however, 2,500 consumers connected on the Norwich system, two-thirds of whom were private consumers.

MR. A. B. HORSLEY said that at Harrow, where there were numerous small consumers, in 1907, there were 1,047 consumers, of whom 14 per cent. were supplied through slot meters at 8d. per unit. The average consumer's revenue was £8 per annum, but the slot meters only averaged 26s. each. They now offered a rebate after the first 5s. per quarter was paid, on condition that the consumer gave notice before leaving, and this, with nearly double the number of slot meters, had increased the revenue to 32s. 6d. per meter. The average price obtained represented 1s. 8d. standing charges per quarter, and 5½d. per unit supplied.

In opening the adjourned discussion (January 18th). MR. J. S. HIGHFIELD said a tariff should be framed to extract such a price as would return a reasonable profit. Owing to such a large share of the supply business being municipally controlled, the question of profit was to some extent obscured, although it was a vital matter if new capital was to be introduced into the supply business. He pleaded for more uniformity of rates in adjoining areas. With flat rates one could not use the same service for both lighting and cooking supply, and a fixed charge and low rate per unit enabled this to be done. He did not hold with the idea that one could alter the habits of a consumer by the tariff, and complained that neighbouring authorities often reduced their prices when there was no necessity for doing so, as he did not believe that price was such an important factor in obtaining new business. It was a strange thing that the slot meter system, although successful in the case of gas, was, on the whole, a failure with electricity; systems embracing fixed charges were not really successful, but he had found a contract system including a fixed payment of 1s. or so per week, and 1d. or 2d. per unit consumed, to be successful where the slot meter failed. It was, he thought, a great mistake to reduce the price of energy for cooking to very low figures, as the actual cost of supply was not really known.

MR. L. BUCKELL considered that the form of the tariff was of more importance than the actual price, and most important was what the consumer thought he was going to pay. A tariff should depend both on the state of the undertaking, and on the area to be supplied. He had been disappointed to find in the case of a 12-room house that the lighting, heating, and cooking load peaks coincided with the normal peak load, and more complete information on the point was desirable. By introducing a flat rate in his district in place of the maximum-demand system, the average price had been raised 7½d. per unit owing to increased turnover due

to a simple rate, and he thought the importance of load factor might be over-rated in supply work. Load factor only affected the generating plant, and the question of increased turnover required more attention. It might be disadvantageous to have a tariff which discouraged additional lighting, and reduced the turnover, though improving the load factor. He had adopted a modified Norwich system, charging 2s. 6d. in the £ on the rating of the house, and 1d. per unit consumed, and this system was understood by the ordinary ratepayer.

MR. E. COWAN, going back to first principles, pointed out that price was a compromise between the factor of demand and the cost of production. The telephone system had some particularly good points; it embodied the principle of classification. The author said it was expedient to take a line which was apparently unsound, and he (the speaker) believed he was on the right road.

MR. A. J. CRIDGE did not agree that meters should be discarded, recalling a case where the substitution for one meter of separate meters on individual services had resulted in a reduction of the amount of energy supplied but an increase in revenue. The Norwich system was based on the ability of the consumer to pay, and it was quite justifiable to charge in that way. He questioned the legality of restricting a consumer to one class of illuminant, and suggested that the author's method of determining maximum demand was rather lax.

MR. W. E. BURNAND thought that "other uses" would probably swamp the lighting supply, with the probable introduction of further improvements in the latter, and suggested the possibility of differential rating corresponding to the class of supply. He thought that an attractive case had been made out for the telephone system.

MR. A. H. SEABROOK, in replying, said that price was not the primary factor in electric supply; business-getting methods were more important. The gas people were following electrical methods closely, and he understood they were now getting out an oven with an enclosed cooking chamber as a result of the criticism of gas cooking methods. As regarded the modified Norwich system based on rateable value, it would be difficult to make a man pay more for electricity because his assessment was raised. He quite agreed that all units supplied should be metered; at the John Street dwellings they had found the price per unit to work out almost the same as the maximum-demand price. The Norwich system had advantages in the case of more economical lamps being introduced. The question of expediency had attracted a great deal of attention—he failed to see why it should not be allowed; he could not see why a low-priced short-hour motor unit should be preferred to a low-priced cooking or heating unit. The telephone system might not be technically correct, but it was not arbitrary like the Norwich or Detroit systems. The high initial charges at Marylebone were, of course, due to the heavy capital charges there. In reply to Mr. Wright, he pointed out that discount for quantity in the case of the telephone system was met by a reduction in the fixed charge per KW.; he quite agreed as to charging a lump sum per lamp per week for small consumers. The L.C.C. school lighting in Marylebone was an unremunerative load, supplied under an old tariff agreed with the Metropolitan Co., which had not been altered. With the Norwich system the consumer paid for an arbitrary standard of illumination, but with the telephone system the consumer paid for exactly the installation he wished for. He understood that the Norwich system was intended to be a reduction in price, which might explain why it was largely adopted; the Marylebone tariff was intended to encourage "other uses," but not to give a reduced price.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Tesla Steam Turbine.

A turbine recently devised by MR. NIKOLA TESLA presents an interesting departure from orthodox views on this subject. Mr. Tesla dispenses with blades altogether, and relies wholly upon

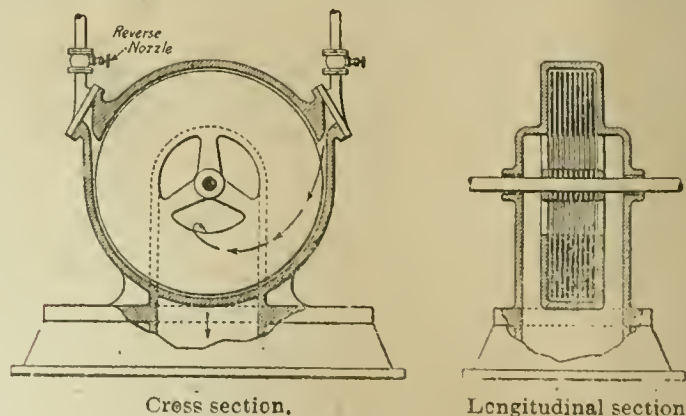


FIG. 1.—TESLA TURBINE.

friction for the propulsion of his rotor. The accompanying illustrations, published in the *Engineering News*, show how he applies the idea. The steam enters through an expanding nozzle, and strikes tangentially a series of closely set steel disks, between which it follows a spiral path to the central outlet. The velocity of the steam being very great, and the friction between the steam



and the disks being assumed to be proportional to the square of the difference in velocity, the turbine exerts a large torque when starting or running slowly; at higher speeds the difference in velocity decreases, but the path of the steam is lengthened by the action of centrifugal force, so that the torque is maintained. With such a turbine reversing is effected simply by applying a second nozzle acting in the reverse direction, as shown.

A turbine of this type with 25 disks, 18 in. in diameter, was tested by the New York Edison Co. with steam at 125 lb. pressure, exhausting to atmosphere; the speed was 9,000 R.P.M., and the output 200 H.P., the steam consumed being about 38 lb. per H.P.-hour. The set weighed 400 lb., and occupied a surface of  $20 \times 35$  in. Mr. Tesla claims that the consumption can be reduced to 10 or 12 lb. per H.P.-hour.

#### Bell-Push Fire Alarm.

An ingenious device has been patented by MR. F. R. C. JOYCE, of Oak Road, Farnborough, Hants., for utilising the ordinary bell circuits for fire-alarm purposes. It consists, as shown, of a bell-push mounted on a perforated metal base, within which is an automatic contact connected in parallel with the push, on the base of which it is fixed. The contact maker is a compound metal strip with a gold-

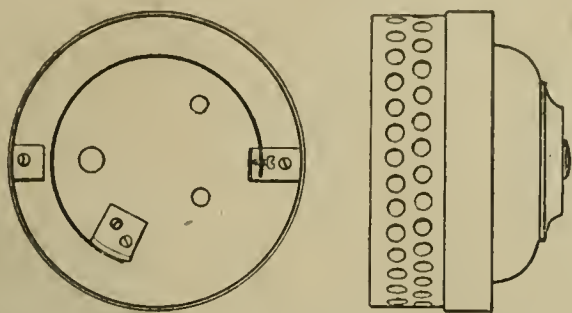


FIG. 2.—JOYCE PATENT BELL-PUSH FIRE ALARM.

tipped adjusting screw, which makes contact when the temperature rises above a given value, and rings the bell to which the push is connected. By this simple means, every room in a house in which a bell-push is fitted can be protected, and the system is self-testing, as the failure of the battery or circuit is at once detected in the ordinary use of the push. The position of the fire is also shown by the indicator.

#### New Wiring System.

We were recently favoured with an opportunity of inspecting a new system of wiring buildings, such as factories, offices, &c., by the courtesy of the inventors, MESSRS. FOOTE & MILNE, LTD., of 66, Victoria Street, S.W. The system is as bold in conception as it is simple in execution; it consists essentially in the use of bare

shown in figs. 4 and 5; this, it will be seen, is provided with projections undercut sufficiently to retain a wire, and staggered so that the wire, when bent into place, cannot be pulled through without great force. In erecting the wires, they are bent into these insulating holders, and drawn tight from one insulator to the next; the operation of stringing them up is obviously very easy and takes up very little time. To provide against any possible slackness and expansion due to temperature rise, it is thought necessary to place

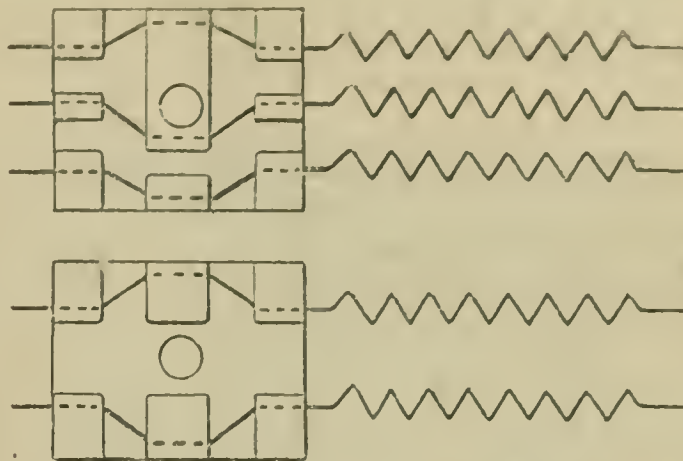


FIG. 4.—UPPER AND LOWER SIDES OF INSULATOR.

the wire under a slight additional tension, and this is effected by means of a special tool which crimps a few inches of the wires, as shown in fig. 4. It is found that the resulting spring tension is sufficient to keep the wires clear of one another and of the casing in a horizontal length of much more than 4 ft., the maximum allowed. The crimping is done close to an insulator, where the wires are rigidly supported, to prevent any possibility of their touching one another. This done, the cover is placed in position with a steel saddle piece over the joint, and secured by a nut on the bolt. Special accessories, as stated above, are few, and very simple; they consist of elbow and tee-joint covers, angle-pieces, &c., all of steel, as shown in fig. 3. Joints in the conductors are made with porcelain-covered couplings of the well-known type.

A special feature of the system is the continuity of the earthing shield. The sole-plate and steel cover are always arranged to break joint, and are in contact throughout their length; the saddle pieces are also in contact with the covers and the bolts, and it is believed that lack of continuity can hardly be possible. No attempt, of course, is made to render the system watertight; on the contrary, ventilation is provided for. It is claimed that the



FIG. 5.—SIDE AND END VIEWS OF INSULATOR.

system is absolutely safe and self-testing; for either the insulation resistance between the conductors and to earth is extremely high, or there is a dead earth or short-circuit which would blow the fuses. But it is highly improbable that contact would occur, once the conductors were in place and the cover secured in position.

The insulators are made in two standard patterns, for four and five wires respectively; the five-wire pattern is shown in figs. 4 and 5, which also illustrates the mode of crimping the wires. Any less number of conductors may, of course, be used. An installation fitted up by Messrs. Foote & Milne on this system has been in use for six months without any trouble arising, and their offices have recently been wired with it for demonstration purposes; a circuit has also been run out of doors to ascertain whether there is any risk of corrosion or incrustation of the insulators in a damp situation, and so far no effect of this kind has been observed. Accessibility is obviously a prominent advantage of the system.

The device is not considered suitable for domestic purposes, on æsthetic grounds, but it is well adapted for use in offices, shops, and factories; ordinary switches and roses, switch-boxes, &c., are employed in conjunction with it, and lamp brackets are wired with covered conductors in the usual way. The system appears to possess marked advantages, and is well worth examination.

#### "Leuconium" Lamps of Low Candle-power.

THE STEARN ELECTRIC LAMP CO., LTD., of 47, Victoria Street, S.W., have succeeded in producing high-voltage lamps of small candle-power, with metallic filaments; these are made of 15 watts for 200 volts, giving 9 C.P., and 20 watts for 200-250 volts, giving 12.5 C.P. For 100-125 volts similar lamps are made, taking 8 to 10 watts, and giving 4.5 to 6 C.P. We understand that these lamps are ready for delivery from stock. The company have sent us a sample, which closely resembles their ordinary "Leuconium" lamps, and burns, of course, quite well on our 200 volt circuit. While the supply station engineer may not be altogether delighted with this further development of the metallic-filament lamp, there is no doubt that it will prove most useful to consumers for places where not much light is required.



### E.M.B. Grid Resistances.

These resistances, for which MESSRS. SCHOLEY & CO., LTD., of 151, Queen Victoria Street, E.C., are the sole selling agents, represent a material advance upon the cast-iron grids hitherto used for tramway and railway equipments, cranes, haulage gears, &c. They are made of unbreakable and jointless material, the successive grids being bent to shape out of a continuous length—apparently without limit—of wire or strip; thus the danger of open circuit in the resistance frame is reduced to the minimum. The loops formed by the conductor between successive grids form convenient points of attachment for intermediate resistance steps, and the grids are

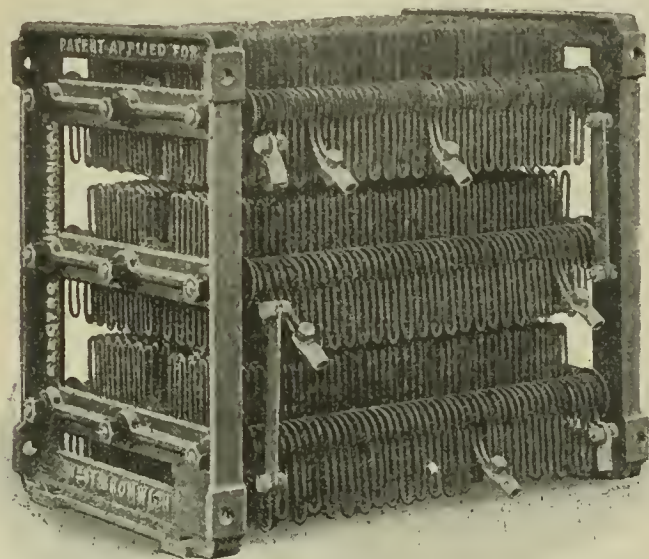


FIG. 6.—STANDARD E.M.B. GRID RESISTANCE FOR TRACTION.

clamped between mica washers, so that the resistance can be run red hot without fear of injury or distortion. The E.M.B. wire has a temperature coefficient similar to that of cast-iron, an advantage in many cases; but other alloys, of constant resistance, can be substituted if desired. The material is also rustless, and does not scale. The grids have been widely adopted for electric traction, and are very suitable for all such applications, being capable of withstanding the roughest usage; for export purposes they are admirably adapted, as breakage is avoided. Fig. 6 shows a standard type for electric traction.

### The M.E. Printing Motor System.

We recently illustrated the new "Marryat-Elliston" equipment, which has been introduced by MESSRS. MARRYATT & PLACE, of 28, Hatton Garden, E.C., for driving machines and other apparatus in which a very large variation of speed is necessary, especially where reversing is required, as the apparatus will work equally well in either direction. It has the advantage of having a good efficiency characteristic through the whole of its working range. We have since obtained further particulars from the makers, which enable us to explain the mode of operation of the device. The equipment consists of a simple shunt or compound-wound direct-current electric motor, coupled to an electric clutch. The latter consists of two parts, both capable of rotation, and for the sake of clearness of explanation, we will consider this clutch as an electric motor, calling one rotating part the "armature" and the other rotating part the "field." The armatures of the driving motor and the clutch are rigidly coupled together.

The set is started up by running the armatures up to speed by means of an ordinary starter operating on the driving motor. The clutch field is then excited until the clutch armature generates a voltage equal to that of the supply, when the clutch armature is switched on to the mains. The motor has a large speed range by shunt field regulation, and if this field is weakened, the armatures will revolve faster. This will cause the clutch armature to generate current, and a torque is produced, which will cause the clutch field to revolve. The rate of revolution will depend upon the amount by which the armature speed has been increased. It is thus possible to obtain on the clutch field speeds from the very lowest to the maximum, which is limited by mechanical considerations, and a working range of at least 60 to 1 is possible by field regulation only.

This makes the equipment very efficient as compared with the use of diverting or series armature resistances for obtaining the lower speeds.

The machine to be driven is coupled to the set by means of a pinion or pulley mounted on the field portion of the clutch.

For control, it is only necessary to have a main double-pole switch, a push button or other motor starter and a shunt regulating switch.

### Alu-Sol Flux and Solder for Aluminium.

WE have received from the ALU-SOL MANUFACTURING CO., Worcester Street, Wolverhampton, samples of their new flux and solder for aluminium, which, it is claimed, make absolutely permanent joints (joints made 14 months ago, and exposed to all weathers, are still unaltered), are easy to use and economical. The process is quite simple; we have made some joints between aluminium wires according to the inventor's directions, and find

them as strong as could be wished, while, on dissecting them, we find that the solder has run well into the joints. The solder, in fact, appears to be much harder and stronger than plumbers' solder, and can only be torn asunder by the exercise of great force. Besides wires, all thicknesses of aluminium sheet, rods, tubes and stranded cables can be joined, without loss of conductivity, and alloys containing aluminium such as magnalium and duralumin can also be soldered with these materials. They are the invention of Mr. C. M. Bowes, and can be obtained from the company above-named. We understand that the Admiralty has had them under test for some months, and has placed a large order for them with the company.

## LEGAL.

### ELECTRICITY IN MINES.

ON January 16th charges against the manager and under-manager of the Pinxton Colliery, were down for hearing at the Alfreton Police Court, but a conference between the prosecutor and defendants, with their solicitors, resulted in the charges being withdrawn.

The matter is reported as follows in the *Sheffield Daily Independent* :—

At the instance of Mr. W. H. Pickering, Inspector of Mines, of York, Henry Stevenson, general manager of the Pinxton Colliery Co., and James Strachan, under-manager of the Brookhill Colliery, were charged with contravening special Rule 21 by installing and using electricity, and placing unenclosed fuses more than 2 ft. from the floor, and not suitably protecting them in the Brookhill shaft pump-room, on October 12th. Two further charges were preferred as follows :—Contravening special Rule 25 by using electricity with the exposed ends of the cables unprotected and unfinished, and contravening special Rule 34 by the use of electricity without providing an ammeter to indicate the load put on the machine. Mr. W. H. Pickering prosecuted on behalf of the Home Office, and Mr. Maddox (London), instructed by Mr. H. R. Cleaver, defended.

Before proceeding with the case, MR. PICKERING asked for a private conference with the defendants and their solicitors, and then informed the Bench how the charges should be proceeded with. The charges were offences under the Electricity Rules, which should be strictly observed in all mines. He had been assured that everything had now been put right by the colliery company, and that being so, and the defendants at the same time admitting that the rules had been violated, he now proposed to withdraw the charges on payment of costs. In doing this, however, he did not wish to minimise the importance of the special rules which had been violated. The rules in question were now under revision, and would probably be made more stringent. He hoped further that the apparatus complained of would now be made in accordance with the rules, and that the electrical appliances at the colliery would be put in first-class order.

MR. MADDOX said he agreed with what Mr. Pickering had said. It was true that certain complaints were made by the Inspector, and certain things pointed out. An undertaking was given by the colliery company to have the things put right, but considerable delay was caused through not getting goods supplied. When the Inspector came again on October 12th the work was not completed, owing entirely to the firm who had the order for the appliances not delivering. On behalf of the colliery company he now gave an undertaking that all the Inspector's instructions should be carried out.

The MAGISTRATES agreed with the course taken, and granted Mr. Pickering's application to withdraw the charges.

### JACOBS v. NEWBALD.

IN the City of London Court, on Friday, before Mr. Registrar Wild, a claim was made by Messrs. W. & R. Jacobs, electrical apparatus manufacturers, 39C, King William Street, E.C., against Messrs. E. Newbald & Co., electrical engineers, Court Road, High Street, Sutton, for 17s. 6d. for electrical goods supplied.

MR. STROUTS, solicitor for the plaintiffs, said that the defendants had sent the plaintiffs a cheque for the sum of 15s. 2d., making a deduction of the amount of 2s. 4d. for damaged goods broken in transit. As a matter of fact, he (Mr. Strouts) considered the defendant should have counter-claimed for that amount. There was a notice contained upon the plaintiffs' invoices to the effect that all goods being properly packed, they took no responsibility for breakages in transit. All claims were to be made to the carriers.

In answer to the REGISTRAR, plaintiffs' representative said this was their first transaction.

The defendant, MR. NEWBALD, said they had had lots of previous transactions, but this was the first dispute.

The REGISTRAR: Well, what have you to say to the notice on the invoice?

The DEFENDANT said that upon the arrival of the goods the case was found to be in perfect order. The glass goods inside had



evidently been broken before they were packed. He telephoned to the plaintiffs about the matter at the time. The plaintiffs' traveller, when taking the order, had guaranteed sound delivery. The case arrived in excellent order, and the goods inside were broken without damage to the case. Their point was that they were damaged before they were packed.

MR. STROUTS said that as the case contained glass goods, the contents might very well have become broken by dropping.

The REGISTRAR thought that the onus was upon the plaintiffs to show that the goods were all right before they were packed.

The plaintiffs' WITNESS said that the packer in question could not be called, as he was out of the country.

Eventually judgment was entered for the defendants, an allowance being made for the witness's attendance.

## BUSINESS NOTES.

**Consular Notes.—Sweden.**—H.M. Consul at Stockholm states that Swedish reports continue justifiably to offer congratulations on the success of home efforts in the industries comprised under the title "Machines, instruments and tools." The importation is decreasing, and the exportation increasing, but it will be noted from the returns that Sweden imports annually about £1,000,000 of articles of this denomination, and has continued steadily to do so for some years, except that in 1907, the record year in many ways, a still greater quantity was imported. About one-third of the Swedish exportation of machinery is accounted for by separators, the next leading article being petroleum and benzine motors. Electrical machines find their best market in Norway; other articles of export under this head are oil-cooking stoves, oil lamps, electric lamps, telephone apparatus, surgical instruments, sewing machines, weapons and cycles. This list will indicate that there must be need for a good deal of machinery to be imported, as the Swedish manufacturers seem to cover special patents rather than ordinary machines used in the principal industries. This industry has received considerable attention in the revision of the tariff.

The Vice-Consul at Lulea reports that the scheme for the electrification of the Gellivare-Norwegian Frontier Railway was sanctioned in 1910. It was decided that the Porjus Waterfall, situated at the outlet of the Lake Lulevattnet, should be harnessed for electrical energy to be used for the railway and also for the supply of electrical energy to the mining industries in the neighbourhood. The cost of this construction is calculated at about 9,400,000 kr. (£522,222), and the electrical outfit of the power station at about 2,300,000 kr. (£127,777), or in all a total cost of about 12,000,000 kr. (£666,666.) The work for the erection of this power station is now under progress and is expected to be completed and in working order during 1914. This development must lead to new openings for trade and industries in this part of the country, where industries are likely to be able to obtain abundant convenient working power at a reasonable cost.

The Vice-Consul at Gefle reports that an extensive scheme has been in preparation for some time by the Waterfalls Department of the Swedish State, with a view to the utilisation of the Elfkärleby Waterfalls, about 15 English miles south of Gefle, for the generation of electrical energy. The works were to be begun during the summer of 1911, and it was estimated that power equal to 45,000 H.P. would be made available at a cost of 9,210,000 kronor (£510,000), when the scheme in its entirety had been carried through. It is calculated that the bulk of this energy will be taken up by the various communities and industrial works situated within about 70 miles of the power station, to which distance the power can be economically distributed.

**Brazil.**—The British Consul at Santa Catharina reports that the State Government has contracted (subject to approval by the State Congress) with a firm of bankers in Paris for the construction of an electric railway, gauge not to be less than 1 metre, starting from the Estreito on the mainland in front of the capital to the city of Lages upon the highlands, about 280 km. from the Estreito, the State paying 40 contos (about £2,666) per km., payable on the delivery of every 40 or 50 km. constructed. Of the above £2,666 about £1,666 is to be paid in State bonds at 84 per cent. net, 5 per cent. interest, and  $\frac{1}{2}$  per cent. amortisation, and £1,000 to be paid by the Federal subvention of 15 contos per km., for which the State Government will apply to the Federal Government. On the above basis the company will exploit the line until the bonds issued have been all redeemed. The State concedes also to the company gratuitously three waterfalls which are indicated in the contract, and others that may exist in public lands in the privileged zone, as well as public lands at the minimum price. The plans of the route are to be presented within four months from the date of definite signature of contract, and the construction is to be commenced within the following three months, and to be completed in two years. The engineers have already studied the route.

**Russia.**—A U.S. Consul at Batum reports to the effect that the Caucasus offers practically a virgin field for the introduction of modern improvements of all kinds. More than three-fourths of the population is engaged in agriculture, but little advantage is taken of modern machinery and implements. The development of public-service properties offers a promising future. There are 15

cities with populations of 20,000 to 50,000, 1 of 80,000, and 3 of over 150,000. These cities will require electric lighting, sewerage, and water systems. Batum has lighting and water plants but lacks proper sewerage, while the city of Baku was authorised in 1910 to contract a loan of \$13,505,000 for municipal improvements, including a waterworks and a sewerage system. The work of constructing a stone conduit and collecting station for the waterworks was given to a British firm, at a contract price of about \$5,000,000.

The development of mining of all kinds offers a wide range for the sale of appropriate machinery. So far, in the development of mining, preference has been given to no single country in the buying of equipment. The best has been purchased irrespective of its country of origin. The equipment of one big mining property, for instance, includes machinery from the United States, Germany, England, France, and Russia.

"Correspondence with business firms in the Caucasus may be carried on in either French or German. Nearly every firm of importance has in its employ some one understanding one or both of these languages. Catalogues and correspondence in English would have an indifferent reception. Whereas it is probable some attempt would be made to secure a translation of a letter in English, the the ordinary circular or catalogue in the language would be promptly consigned to the waste-basket."

**Diesel Engines.**—MESSRS. MIRRLEES, BICKERTON AND DAY, LTD., Hazel Grove, Stockport, have recently received, in addition to a large number of orders for these engines for Great Britain, the following for electricity supply stations abroad:—

Australian Commonwealth, for Naval Depot, Williamstown.—One 40-B.H.P.  
Dunedin Corporation, New Zealand.—One 750 and one 500-B.H.P.  
Hastings Corporation, New Zealand.—Two 150-B.H.P.  
Marine Board of Burnie and Table Cape, Tasmania.—One 50 and one 100-B.H.P.  
Queenstown Corporation, South Africa.—Two 85-B.H.P.  
Uitenhage Electric Supply Co., South Africa.—One 135-B.H.P.  
Wilkie Electricity Works, Canada.—One 100-B.H.P.  
Scott Electricity Works, Canada.—One 100-B.H.P.  
Secteur Electrique des Ilets de la Seine, Paris.—Three 150-B.H.P.  
Jindrichuv-Hrades Corporation, Austria.—One 200 and one 100-B.H.P.  
Crown Agents for the Colonies, for Lagos, S. Nigeria.—Two 200 B.H.P.  
India Office, for Bombay Dockyard.—One 170-B.H.P.]

**Calendars and Catalogues.**—MR. C. FRANKLIN TUBBS, of 2, Craven Terrace, Leeds, has prepared for circulation among his friends a small wall thermometer on a hanging celluloid card, which will serve to keep in mind the "Nonpareil" auto-starters and transformers.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—In our reference to list No. 325, *Winkey* leakage indicator was, of course, a mistake for *Winkey*.

We have received from MR. M. H. SMITH, of 4, Racquet Court, Fleet Street, E.C., an electrical advertisers' reference chart which consists of a hanging card whereon appear the names of electrical papers with their day of publication, size of type space, screen for half-tone blocks, and other information. Spaces are left in the table for similar particulars to be entered relating to other papers in which firms may be interested.

MESSRS. RASHLEIGH PHIPPS & CO., 147, Oxford Street, London, W.—Leaflet giving some particulars and prices of cab tire sheathed cables and flexible.

THE EARTH-DRIVEN CLOCK CO., Rowton Buildings, Bowling Green Street, Leicester.—Illustrated pamphlet describing the earth-driven clock, and giving prices of same, and containing a report thereon by Prof. S. P. Thompson.

UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Advance copy of 12-page pamphlet containing an illustrated description of their D.C. machines with interpoles.

MESSRS. BARKER, SPINK & LEASE, Park Works, Rosse Street, Shipley, Yorks.—Large postal card illustrating a number of their lathes

MR. WM. CROWTHER, 629A, West Derby Road, Tuebrook, Liverpool.—Twelve-page pamphlet entitled "Notes on Drilling," dealing with certain difficulties that arise in electrical workshops, and giving an illustrated description of Crowther's patent reliance drill-grinding jig with instructions for its use.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester.—New switchgear supply catalogue. The first half of it comprises, in addition to index and discount sheets, a number of sections relating to switchboard assemblies covering the following ground:—D.C. motor panels up to 800 amperes, 650 volts; A.C. motor panels, ditto; D.C. generator and A.C. generator panels, ditto; D.C. and A.C. feeder panels, ditto; bus-bars and miscellaneous fittings. The remainder of the sections are devoted to the following:—Ironclad air-break switches and fuses and motor control panels; knife switches; cartridge fuses and fuse blocks; porcelain handle fuses; automatic circuit breakers; ammeters and voltmeters; open dial ditto; moving coil ammeters and voltmeters; long scale induction instruments; long scale induction wattmeters; long scale power factor meters, and rotary synchroscopes. The great feature of this catalogue is the care that has been devoted to arranging the contents in a special way to facilitate the preparation of estimates for switchboards of all sizes and for all purposes. The system must be seen to be fully appreciated. Numerous illustrations and line dimension drawings are included. The lists are all brought together in an expanding binder case.

THE HOYT METAL CO., 26, Billiter Street, London, E.C.—24-page booklet relating to Hoyt's standard Babbitt or anti-friction metals, with a few particulars of tests, and directions for using the metals.



THE BRITISH ALUMINIUM CO. LTD., 109, Queen Victoria Street, London, E.C.—Eight-page illustrated pamphlet relating to aluminium as a material for jigs, the matter being reprinted from an American contemporary.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Mailing card No. 172 illustrates, and states prices of, a small combination electric cooking outfit, specially suitable for small flats, &c. It consists of a 6½-in. boiling plate, with two terminals with a loading of 650 watts, a copper kettle and aluminium frying-pan and saucepan.

THE KNOWLES OXYGEN CO., LTD., Shrubbery Works, Walsall Street, Wolverhampton.—Expanding binder case containing a collection of pamphlets regarding their oxygen, hydrogen and acetylene plants, oxy-acetylene and oxy-hydrogen welding plants, and oxy-hydrogen cutting plants. One of the lists shows the application of the oxy-hydrogen cutters in cutting tram-rails; others describe the Draeger-Wiss oxy-acetylene blow-pipe, the "Lane" acetylene generator, and the "Ideal" acetylene generating plant. A paper by Mr. A. E. Tucker, F.I.C., on "The Influence of Impurities in Oxygen when used for Cutting Iron and Steel," is reprinted, as are also some *Proceedings* of the Municipal Tramways Association bearing on the use of the oxy-hydrogen and oxy-acetylene welding systems for tramway track work.

MESSRS. JAMES NEIL & SONS, LTD., Grange Iron Works, Shetleston, Glasgow.—Several pamphlets have been received relating to Neil's patent rocking bar furnaces for water-tube boilers. One is entitled: "The Twin Nuisance, black smoke and dust from the chimney," and contains coloured drawings showing the application of induced draught with double-rocking fire-bars; another is entitled: "Furnace Efficiency," and is illustrated effectively in colour; and yet another contains "Logical Arguments on Forced Draught." This self-cleaning furnace has, we understand, been extensively adopted, and is in use at many electric light and power stations.

THE PHOENIX MANUFACTURING CO., LTD., Thornbury Works, Bradford.—Leaflet showing small illustrations indicating the character of the contents covered in the firm's different pamphlets.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—New catalogue of 16 pages giving illustrated particulars of various insulators and insulating material, including some 350 insulators and parts. Prices are stated of a variety of insulators which they carry in stock, to hold one, two, and three wires, and to hold wire from ⅛ in. diameter up to 3 in. diameter, besides a wide range of leading-in tubes. Messrs. Donovan stock insulators for carrying out installations on the Continental system of wiring with flexible on insulators. Round insulators are listed ranging in diameter from buttons ⅝ in. diameter to reels 4½ in. diameter. Insulating and jointing material, and other goods required by linesmen, are included. Copies of the catalogue can be obtained on application.

MESSRS. E. BENNIS & CO., LTD., 28, Victoria Street, London, S.W.—Leaflet relating to the economy of small elevators in industrial boiler-houses. A number of half-tone views and line drawings show the applications of Bennis elevators and mechanical stokers in service in connection with boiler-houses. Copies of the leaflet will be sent to any engineer on application.

**Callender's Hospital Fund.**—The ninth annual report and accounts of Callender's Hospital and Distress Fund were approved at the meeting held at the works on January 20th. Mr. T. O. Callender presided. The report showed that during the year 1911 the Fund subscribed to the hospitals its highest amount since 1905. It referred to the letters issued for out and in-patients at hospitals, for nursing homes, convalescent homes, surgical aid, and so forth. Cases of distress were not so prevalent as hitherto. The 1d. weekly subscription amounted to £219 (the highest since 1905), against £199 in 1910. In addition to a donation of £50 by Callender's Co., and one of £5 5s. from Mr. T. O. Callender, there were seven subscriptions of £2 2s. each from directors and others. The total amount disbursed among hospitals and other institutions was £218, as compared with £194 in 1910. The Committee express a hope that all the members will continue to support the Fund, as most of the benefits it confers cannot be obtained through the new Insurance Act.

**Electrical Trades Union.**—The Western branch includes among its arrangements evenings devoted to social science subjects and the practical applications of electricity. Such events are held once a month during the winter, beginning in October and ending in April, with a concert here and there as a relief. We are informed that the results are exceedingly pleasing. So far social science has formed the principal subject of the lectures, as members who deliver some of them give electrical subjects second place, arguing that social science is the principal feature of Trade Union education. It is therefore necessary to seek assistance outside, and in this respect the branch has greatly appreciated the help of Messrs A. P. Lundberg & Sons, whose works manager, Mr. G. Pegg, on Tuesday, 16th inst., gave a demonstration of their switches from 28 boards, prefacing it by an historical survey.

**Australia.**—According to a recent report the Australian Customs authorities have increased the import duty on "Dynamo electrical machines (a) up to the capacity of 200 H.P., static transformers and induction coils for all purposes, electric fans," from 20 per cent. to 25 per cent. *ad valorem* under the General Tariff, the preferential rate remaining at 20 per cent. Similarly the duty, under the General Tariff, on "(b) Dynamo-electric machines over the capacity of 200 H.P.," has been raised from 12½ per cent. to 17½ per cent. *ad valorem*, the preferential duty remaining at 12½ per cent.

## Cable and Wire Manufacturing in Japan.—Our

American exchange, the *India-Rubber World*, in the course of a recent article, from a special correspondent, on the "Rubber Industry of Japan," refers to the manufacture of electric wires and cables in the following terms:—

"The Japanese insulated wire and cable companies now number five—the Yokohama Insulated Wire Works, a joint stock company, with a capital of \$600,000; the Nippon Electric Wire and Cable Co., a joint stock company, with a capital of \$500,000; the Fujikura Cable Works, a joint stock company, with a capital of \$500,000; the Sumitomo Electric Wire Department, in Osaka; the Tsuda Co., a limited partnership, with a capital of \$10,000, in Kyoto—these factories yearly manufacture insulated wires and cables (except submarine and underground) valued at \$5,000,000. The value of imported submarine and underground cables and all other wires and cables is about \$1,700,000. The Nippon Electric Wire and Cable Co. manufactures one-fourth of the estimated Japanese production. This company was established at Terashima, Minami-Kazushika-gun, Tokyo, March, 1907, purchasing Mr. T. Komori's electric wire works at the same place. In June, 1910, after passing through financial and technical difficulties, the Furukawa Mining Co. came to its assistance, and Mr. J. Oga took the post of managing director; Mr. T. Komori became manager, and Mr. S. Soki, from Yokohama Insulated Wire Co., became sales agent, Mr. S. Kurozawa becoming engineer-in-charge. It is said now that Mr. S. Kurozawa has improved all of the processes, so that the plant is very complete. He studied under the direction of Mr. M. Wachter, an engineer of the Yokohama Insulated Wire Works, and, being possessed of much mechanical ability, is accounted one of the best equipped works managers in Japan. The product of the factory to-day embraces lighting and power cables, insulated wire, rubber and weatherproof, lead-covered and armoured cables, &c.

"The factory is exceedingly well situated on the Sumida River, the grounds being about 3 acres in extent. It is on the railroad and an electric line also runs close to the factory. The motive power is steam. The boilers are Dutch, of the Alban water-tube type, the engine (compound) running at 150 R.P.M. The washers, mixers and calenders were built by Krupp & Co., Germany. The tubing machines came from Germany and the United States. The 500 braiders are from the New England Butt Co. The testing apparatus came from Elliot Bros., England, the saturating tanks from America, the measuring machines from Austria. About 500 hands are employed—300 men and 200 women. The copper wire used is drawn for the company by the Furukawa Mining Co. The customers of the company are the War, Navy and Railroad Departments of Japan, and electric companies in both Japan and China."

**Carbons for Spain.**—The import of carbons for arc lamps to Spain is continually increasing, and the figures for the first seven months of the year 1911 show a marked increase compared with those during the same period of the previous year. Germany is a long way ahead of the other supplying countries, and France comes second; the total of the latter country for the year 1910 was 20,000 pesetas.

**Increased Prices.**—MR. W. J. STOKVIS, of Arnhem, Holland, notifies an advance of 5 per cent. in net prices of electric lighting fittings, consequent on the increase in price of metals, &c.

**Bankruptcy Proceedings.**—CHARLES AUBREY SMITH, electrical engineer, 23, King Street, Regent Street, W., and 6, Granard Road, Wandsworth, Common, S.W.—An application for an order of discharge was made on Tuesday to Mr. Registrar Linklater at the London Bankruptcy Court.—Mr. Egerton A. Grey, Official Receiver, reported that the applicant failed in April, 1904, Mr. R. J. Ward, chartered accountant, being appointed trustee of the estate. The provable debts amounted to £1,085 and the assets, valued by the bankrupt at £777, had realised only £657, out of which dividends aggregating 7s. 10d. in the £ were paid on proofs for £1,085. Upon the death of his father in June, 1901, the bankrupt's mother succeeded to an old established family business of general engineers at 23, King Street, Regent Street, W. It was carried on for three months under the bankrupt's management, and was then handed over to him, with the stock and effects worth about £200. The mother undertook to pay, and did pay, the then existing debts of the business, and as consideration for the transfer of the business, the bankrupt agreed to pay to her £900 out of the proceeds of collection of the book debts then owing, and estimated to produce that figure. He collected from the book debtors, and paid over to his mother £400, and the latter was now a creditor for the balance of £500. The bankrupt continued the business under the old style of "C. J. Smith" until March 29th, 1904, when a judgment creditor issued execution, and sold everything upon the premises, and being unable to collect the balance of the debts of the business to discharge his liabilities, the bankrupt filed his petition. He had since been in employment as an electrical engineer at a salary of about £2 a week; finding his bankruptcy a bar to his advancement, he had induced his mother to provide the costs of his application for discharge, which he otherwise could not afford to pay, and he had acquired no property, and had incurred no debts since the receiving order. His Honour granted a discharge, subject to a judgment for £10. Order entered accordingly.

**Social.**—On Tuesday, 16th inst., the office staff of the FOSTER ENGINEERING CO., LTD., assisted by members of the engineering works and other departments, gave a concert to which members of the Metal-Filament lamp works were invited. The office had been prettily decorated with bunting and evergreens. The staff and guests present numbered upwards of 150. The



directors, Mr. M. V. Ely (who occupied the chair), Mr. Grote, Mr. E. Dobson and Mr. Lazenby were present; also Mrs. M. V. Ely, Mrs. Grote, and friends, Mr. S. H. Cowen (secretary), Mr. Hill (export and publicity departments), Mr. Delfosse (works superintendent), Mr. Gwyn (superintendent of the lamp works), and other heads of the departments, including Mr. Scott (head of the laboratory). At the conclusion, Mr. M. V. Ely made a short speech, in which he referred to the rapid growth of the company's business and the extension of the works which had already been found necessary, although the company had only built their present works a few months since.

**Trade Announcements.**—MESSRS. BENJAMIN ELECTRIC, LTD., announce that the word "Luxogen" has been registered as their telegraphic address for their offices and show-rooms at 117, Victoria Street, Westminster, S.W.

Owing to the success of the "Venner" patent signs, and the great increase in business in them, the patentee, Mr. R. F. Venner, has decided to take over the entire manufacture himself. While the Credenda Works at Birmingham will continue in full swing, new and separate works will be immediately equipped in London. We are asked to state that in future all communications should be addressed to MESSRS. VENNER & CO., 6, Old Queen Street, Westminster.

The addresses of MESSRS. WARD & GOLDSTONE'S Glasgow and Cardiff branches are as follows:—Baltic Chambers, 50, Wellington Street, Glasgow (Phone: No. 2355 Central); 4, Church Street, Cardiff.

THE ADAMS MANUFACTURING CO., LTD., ask us to state that they have not appointed sole agents in London for their electrical business, as might be gathered from the note appearing under this heading in our issue of January 12th. Their removal from New Bond Street to Balfour House, Finsbury Pavement, E.C., was largely in order to get into closer touch with their London electrical customers. They have only disposed of the sole selling agency of their motor-car business in London.

**Dissolutions and Liquidations.**—J. G. CHILDS & CO., LTD., Willesden Green, N.W.—In announcing his intention to apply to the Board of Trade for his release, Mr. H. Brougham, the Official Receiver and Liquidator, says that the Receiver for the debenture-holders, who took possession of all the company's assets in March, 1911, states that there is no prospect of any surplus being ultimately available for the unsecured creditors and shareholders.

THE JOHNSON-LUNDELL ELECTRIC TRACTION CO., LTD.—A meeting of creditors is called for January 29th, at 14, Old Jewry Chambers, London, E.C. Mr. A. E. Messer, liquidator.

ELECTRO-THERAPEUTIC INSTITUTE, 16, Park Place Villas, Maida Hill, London.—H. L. Hart and Bertha Blackith have dissolved partnership. Mr. Hart attends to debts, &c.

REORGANISATION AND CONTROL SYNDICATE, LTD.—A petition presented by a creditor for the winding up of this company is to be heard on January 30th.

JANDUS ARC LAMP (CONTINENTAL PATENTS) AND ELECTRIC CO., LTD.—This company is winding up voluntarily, with Mr. A. A. Gillies, 46, Brown Street, Manchester, as liquidator. A meeting of creditors is called for January 31st, at Manchester. It should be stated that the Continental Co. was formed to acquire the Continental rights only of the original Jandus patents, but there is no connection between this company and the Jandus Co., of Holloway. The latter is in no way affected by the liquidation.

**Annual Dinner.**—Over 200 ladies and gentlemen, including members of the Marylebone Council, and the entire staff of MESSRS. DUNCAN WATSON & CO., sat down to the annual staff dinner given by Mr. Duncan Watson at Pagani's Restaurant on January 6th. Mr. Cunliffe Owen, secretary of the Metropolitan Electric Supply Co., Ltd., was one of the principal speakers, and he was in reminiscent mood, remembering the days when people were "tumbling over each other to get electric light into their houses." Mr. Rawlinson, one of the oldest members of the staff, proposed the health of the chairman, Mr. Duncan Watson, and presented him, on behalf of the employés, with a pair of silver candlesticks. The chairman, in the course of his reply, referred to his work as a member of the Marylebone Council. Other speakers included Mrs. Courthope Adams and Councillors Helsdon and Fettes.

**Electric Laundry on Board Ship.**—The laundry on board the ss. *Medina*, in which the King and Queen travelled to and are returning from India, was equipped with ironing machinery by MESSRS. THOS. BRADFORD & CO., the plant consisting of a 90-in. x 24-in. "Decondun" machine for table linen and flat work, and a smaller machine of the "Mirror" type for shirts, collars and cuffs. Both machines were driven by a Witton shunt-wound interpolator motor of 6 B.H.P. at 105 volts, 850 R.P.M., which was fixed inverted to the ceiling, and was controlled by a G.E.C. motor panel fitted with a double automatic starting switch. A similar motor drove the machinery in another room.

**Book Notices.**—*Ship Wiring and Fitting.* By T. M. Johnson. London: Constable & Co., Ltd. Price 1s. net.—This is a very practical book and contains a large amount of information in a very small compass. It is assumed that the reader has some preliminary knowledge of electricity and some practical acquaintance with the subject. Sea-going engineers will find the book very useful, as it gives just the kind of information which they require in connection with wiring for electric light, bells, telephones and small motors. The book is a handy size for the pocket.

*Report on British Standard Heads for Small Screws.* London: Crosby Lockwood & Son. Price 2s. 6d. net.—This is Report No. 57 of the Engineering Standards Committee, and contains the recommendations of the Committee for the dimensions of countersunk, instrument, round, cheese and fillister heads for B.A. screws sizes 6 to 14, and for the saw-cuts in the same.

"Boletín de la Sociedad de Fomento Fabril." December 1st, 1911. Santiago de Chile: The Society.

## LIGHTING and POWER NOTES.

**Argentina.**—The Government of the Province of Buenos Ayres has forwarded to the Legislature an *ad referendum* contract, signed with Mr. P. C. Ferreyra, for an electric power house in La Plata for public and private lighting. The contract provides that the Government contract for 100 arc lamps in La Plata, paying \$7.85 gold and \$7.85 paper per month, the concessionaire to install 500 more at the same price when the Government so decides. The tariff for private lighting and power is to be the same as that charged by the R.P. Electricity Co. In the centre of the city all mains are to be laid underground.

The Buenos Ayres Municipality has signed a new contract with the Compania Alemana Transatlantica de Electricidad, for public lighting. The company is to install during the next three years all the arc lamps that may be required, up to the number of 4,000—or more if required—and at its own expense, and supply the current during 15 years at the cost of 4½ cents gold per kw.-hour. The changing of carbons, cleaning of lamps, &c., is to be paid for by the municipality.—*Review of the River Plate.*

**Australia.**—In connection with the improvement of the lighting of railway carriages, the expenditure of £2,000 has been approved by the Queensland Minister for Railways for fitting electrical equipment into carriages which were, in the first instance, fitted with gas, and which now require renewal. This is in continuation of the policy of carriage lighting laid down some three or four years ago. It has also been decided to install an Edison battery in one of the carriages, in the place of one of the Stone type, which is generally used in Queensland.—*Mining and Engineering Review.*

**Aylesbury.**—The U.D.C. has decided to apply to the B. of T. for a prov. order for E.L.

**Barnsley.**—The T.C. has received the sanction of the L.G.B. for a loan of £4,620 for electric light extensions and service mains.

**Brighton.**—The T.C. has, by 20 votes to 12, declined to adopt an assisted wiring scheme recommended by the Lighting Committee. The objection was on the ground that the scheme would not pay.

**Bromley (Kent).**—The T.C. has decided to take no steps to resume possession of the electricity undertaking. The period of seven years at which the Council has the power to take over the undertaking expires next March.

**Continental Notes.**—FRANCE.—The utilisation of water-power for the generation of electricity on the Continent is closely associated with river navigation and similar improvement schemes. The Upper Rhone especially has attracted particular attention, and notably from electricians, as is shown by the projects for the transmission of current mooted in recent times. A new departure of first importance is the formation of a Franco-Swiss Committee, with the object of creating a new river traffic highway between Lyons, Geneva, Constance and Ulm, and thus facilitating communication between Marseilles and Wurtemberg, Bavaria and the Danube countries. If carried out, the scheme will exert an influence favourable to the realisation of many projected electrical schemes.—*La Revue Electrique.*

DENMARK.—The municipal authorities of Struer, Jutland, have decided on the establishment of a central electric lighting station in the town.

BELGIUM.—La Société Centrale Electrique de l'Entre-Sambre et Meuse is the name of a new company which has just been formed at Auvellais, with a capital of £100,000, to acquire and carry on the central electricity generating station at Velaine-sur-Sambre owned by a colliery company, and also the agreements completed with the authorities of 22 small towns and villages in the district with regard to the supply of electricity for lighting and power purposes.

A new company has just been formed in Antwerp, with a capital of £30,000 and the title La Compagnie Electrique d'Anvers et du Limbourg.

**Douglas (Isle of Man).**—No decision has yet been arrived at by the T.C. with reference to the proposed electricity undertaking. The Manx Electric Railway Co. has approached the Council with reference to a supply of current in bulk, but the Council has deferred action pending further information being obtained.

**Dover.**—The T.C. has fixed the price of energy for the tramways, after the end of January, at 2½d. per unit.



**Erith.**—The U.D.C. has agreed to supply current to Messrs. Callenders on the terms that the minimum annual payment for three years shall be not less than the sum represented by £3 16s. per annum per kW. or two-thirds of the total capacity of the Council's transformer plant installed for the purpose of the supply. There is a proviso that the company shall be entitled to a rebate in the event of stoppage of work through strikes, lock-outs, flood, fire, or other similar unpreventable causes.

**Falkirk.**—The T.C. last week discussed the steps to be taken in opposing the Falkirk and District Electric Lighting order, which is being promoted by Mr. George Balfour. The Council contends that the proposed order will injuriously affect its gas undertaking in Larbert, Stenhousemuir, Carron and Carronshore, and at a private meeting held recently the members decided to adopt every method of opposition to the order, including burgh extension. It was also agreed to take a plebiscite of the ratepayers. At last week's meeting it was decided that a circular be drawn up laying the whole question before the ratepayers.

**Fleetwood.**—The U.D.C. has decided to submit a petition against the Bill now being promoted in Parliament by the National Electric Construction Co.

**Hayle.**—On Saturday an accident occurred at the newly-erected electrical power station at Hayle. Sea-borne coal, discharged in the harbour, is transferred in up-to-date mechanical appliances to the station adjoining and there deposited in a store with compartments formed by wooden barriers; with the weight of about 30 tons of coal against it, the partition dividing off the empty section of the store gave way, imprisoning three workmen. Efforts were at once made to remove the coal, and when the men were rescued they were found to have luckily escaped without any serious injuries.

**Hornsey.**—It has been decided to charge a special rate of 3d. per unit to hospitals in the borough supported by voluntary contributions, on condition that the buildings are entirely lighted by electricity. Instructions have been given to the Parliamentary Committee to take any necessary steps, should it be found desirable, as to lodging a petition against the Bill of the National Electric Construction Co., Ltd.

**Irthlingborough.**—The U.D.C. has passed a resolution consenting to the prov. order for E.L. being applied for by the Higham Ferrers and Rushden E.L. Co.

**Kirkheaton (near Huddersfield).**—The U.D.C. has successfully brought to a conclusion the lighting by electricity of the whole of the central district of the village. The current is conveyed from the central station of the Kirkheaton and Lepton Electric Light and Power Supply Co. by overhead wires.

**London.**—**POPLAR.**—A loan of £3,965 is to be taken up from the L.C.C. as follows:—Mains, £3,148; plant, £817.

The Charing Cross Co. has intimated that in future in the City area the standard rate for lighting is:—Upper floors, 5d., ground floor, 4½d., basement and external lighting, 3d. per unit; power, heating and cooking, 1½d. per unit. An alternative sliding scale for lighting of 5d. per unit for the first six units per 30 watts of connected demand (each quarter) plus 2d. per unit for further supply, and for power a fixed charge each quarter of 10s. per kW. of connected demand plus 1d. per unit consumed, is provided. For heating and cooking purposes the fixed charge of 10s. per kW. is remitted during the two summer quarters.

**North Berwick.**—Steps are now being taken for the installation of electric light. Messrs. Crompton & Co. hope shortly to announce the formation of a local company to carry out the work.

**Radcliffe.**—Among the improvements proposed to be carried out by the Lancashire and Yorkshire Railway Co. at Radcliffe, is a large warehouse provided with modern equipment for the handling of goods, including electrical haulage plant.

**Reeth.**—The B. of G. has decided to have the Workhouse premises lighted with electricity by Messrs. Burton, of Askrigg, who have carried out the installation for the village.

**Stirling.**—The Lighting Committee of the T.C. recommends that no action be taken regarding the provisional order applied for by the Scottish Central Electric Power Co. for the generation and sale of electricity in certain portions of the counties of Stirling, Linlithgow and Dumbarton. The area affected does not come nearer to Stirling than the parishes of Denny, Dunipace and Larbert.

The T.C. is to appeal against the poor and school assessment on the electricity undertaking, and to ask for a deduction of 35 per cent. instead of the present deduction of 10 per cent.

**Swansea.**—The electrical engineer has been instructed to prepare specifications, plans, &c., for carrying out the work of extending the machinery plant, &c., at the generating station and sub-stations, and for new feeder and distributing cables, &c. The cost is put at £45,257, and tenders are to be invited for the carrying out of the work. The borough treasurer reports that in accordance with instructions he has settled the income-tax for 1909-10, with the result that the tax paid on the electric light undertaking had been reduced by £240—this being effected by successfully claiming allowances in respect of depreciation of plant and machinery and

rebate on account of current supplied to the Corporation's own departments. The electrical engineer has been instructed to obtain two superheaters for water-tube boilers at a cost not to exceed £250 each.

**Tasmania.**—The receiving of applications for shares in the Hydro-Electric Power and Metallurgical Co. of Tasmania has closed. As to the work of construction, it is proceeding satisfactorily. Large quantities of machinery and tools have been sent up to the Great Lake and the Ouse, including a complete sawmill, which is to be erected near the power station site.—*Standard*.

**U.S.A.**—Some time ago the *Electrical World* stated that the newly installed 15,000-kw. turbo-alternator in the Boston Edison station was the largest in New England. That paper pointed out recently that since the Boston unit was installed, the Rhode Island Street Railway Co. has put in operation in its power station, in Providence, a 20,000-kw. unit, which has been in regular service about two months up to the present time.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—At a meeting of the Law Committee of the Corporation, held last week, instructions were given to the town solicitor to take action to have set aside the second award of the arbitrator, Mr. Macassey, in the matter of the purchase of the Cavehill and Whitewell tramways.

At a special meeting of the same Committee last week, Mr. Nance, general manager, made certain recommendations, including the adoption of a universal 1d. fare, and that 10 per cent. of the excess of revenue over the expenditure be paid to the tramway staff as a bonus. The Committee discussed these and other proposals for some time, and finally adjourned the matter for further consideration at an early date.

**Continental Notes.**—**DENMARK.**—The scheme for an electric railway from Aarhus to Randers, previously announced, has met with a series of vicissitudes. The undertaking, when carried out, will unite two of the most prosperous towns of Jutland, besides being the first rural railway constructed in Denmark. It was at first understood that an English company would construct the line, but a visit of inspection made in November last has had for result the withdrawal of its offer. A Swedish company has now come forward—the Allmänna Svenska Elektriska Aktiebolaget—and offers to build a large electricity station for the city of Aarhus and its neighbourhood, and afterwards to mortgage it. The station and entire network are estimated to cost 1,000,000 Danish kroner, which will be provided if the communes interested will give their guarantee. An essential stipulation is that the current for the railway should be drawn from the power station, Aarhus already possessing a municipal station of its own.

Another Danish electric railway is that to connect the port of Køge in the south-eastern portion of Seeland with Taastrup, where a large beet sugar factory, started with German capital, exists, which will provide traffic for the line.

A third Danish electric scheme associated only in the second place with the supply of current for railway working, is that for the building of a power station at Struer, on the island of Jutland. The authorities have decided to build the station at a cost of 150,000 Danish crowns, and to supply current to the State Railways. The station is expected to be completed by October, 1912.—*Elektrotechnik und Maschinenbau*.

**ITALY.**—La Società Elettrica Bresciana has secured a concession for the construction and working of an electric tramway between Brescia and Cellatica.

**GERMANY.**—Plans are being prepared in respect of a proposed electric tramway between Rothenberg and Connern, Saxony.

**HOLLAND.**—The Rotterdam Tramways Co., of Rotterdam, is in negotiation with the local authorities of Middelbourg, with reference to the supply from its power station of electrical energy for lighting and power purposes in the town.

**BELGIUM.**—La Société des Tramways Bruxellois has applied for authority to adopt electric traction on its line between Ixelles and the Bourse, Brussels.

**AUSTRIA.**—The Austrian Government has granted a concession to the A.E.G.-Union Electricity Co. for the electrical equipment of the Austrian section of the Vienna-Pressburg electric railway. The Hungarian section is to be carried out by the Ganz Electricity Co., and the whole of the work is to be completed by the end of this year.

**Cowes (I. of W.).**—At a meeting of the Council last week, a communication was read from Mr. Adam Scott, of Westminster, inquiring if local support would be forthcoming for any good and cheap project for direct communication between Cowes and Ryde, either by electric tramway or by the railless electric trolley system. The matter was referred to the County Council.

**Cowling (Yorks.).**—At a meeting of the Parish Council last week a resolution was passed that the Skipton Rural District Council and the West Riding County Council be urged to oppose the Bill which the Keighley Corporation is promoting in Parliament, with regard to the running of railless cars over a portion of the main road in the Cowling district, which would thereby give Keighley a monopoly over the road, and thus prevent the local authority at any future time adopting a similar system over that particular road.



**Croydon.**—At the last meeting of the County Council it was stated that the takings on the tramways during the last financial year had been £5,119 more than in the previous year.

**Dover.**—The T.C. has applied to the B. of T. for a loan of £800, for tramway track doubling, &c.

**Huddersfield.**—The Borough Treasurer's statement respecting the Corporation Tramways for the nine months ended December 30th, 1911, shows that the capital outlay to date is £412,660. The miles run were 1,687,596, compared with 1,540,571 for the corresponding period of the previous year. The income amounts to £80,253, or 11'41d. per car-mile, against £72,993, or 11'37d. for the corresponding nine months of 1910. The total working expenditure is £44,311, or 6'30d., compared with £41,087, or 6'40d. The gross surplus is £35,942, or 5'11d., against £31,906, or 4'97d. Interest on capital absorbs £9,912; redemption of debt, £7,554; and after allowing for depreciation at 3 per cent. (£9,285), there is a net surplus of £9,191, or 1'30d. per car-mile, compared with £4,772, or '74d. The reserve or renewals accounts amounts to £4,700, compared with £9,959 at the beginning of the nine months.

The application of the tramway men for improved working conditions has been left to a Sub-Committee to deal with.

At a meeting of the T.C. last week, a proposal in favour of railless trolley cars was moved, but was withdrawn after the chairman of the Tramways Committee had stated that the Committee would approve of an application to Parliament for the running of railless cars to outlying districts not served by the present system.

**Japan.**—Two new lines of electric tramways in Yokohama—known as the Honmoku and Hagaromo lines—have just been opened for traffic by the Yokohama Electric Tramway Co.

**London.**—A scheme is stated to be on foot to enable the L.C.C. tramway termini to be linked up by omnibuses, in connection with which through fares could be issued, and thus get over the discontinuity of the Council's tramways in North and South London. The L.C.C. already has powers to establish through bookings with the underground electric railways of London, but at present has no powers to enter into any arrangement with the omnibus companies.

**Manchester.**—Further tramway extensions in the Withington district are contemplated.

**Mansfield.**—On the electric tramway near Mansfield on Monday, a car crowded with miners on their way to work was nearing the top of Skerry Hill, which has a gradient of 1 in 10, when it stopped and began to run backwards. There was a panic among the passengers, who scrambled off the car at both ends. Two men were injured in a fall. The car ran down the declivity at a great pace, but just before the bottom was reached the brakes began to hold, and the car was pulled up. The manager of the tramways stated that the accident was caused owing to a fuse blowing. The passengers in their excitement rushed to the driver's end, interfering with him, otherwise he could have checked the car much quicker. The brakes were in perfect order.

**Port Glasgow.**—Messrs. D. & A. Horn Morton have been deputed to report on the cost of putting down electrical plant for the requirements of the town.

**Ramsbottom.**—A petition has been lodged at the offices of the Ramsbottom D.C. requesting a poll of the electors in respect of a resolution put to a meeting of electors on January 11th, re the promotion of a bill in Parliament to enable the U.D.C. of Ramsbottom to install overhead equipment and run trolley cars by railless traction. The requisition is signed by a sufficient number of persons to demand a poll, and arrangements will be made to put the poll into effect. A poll will necessitate considerable expenditure, but the Council has no alternative but to comply therewith. It is to be hoped the result of the poll will be such as to enable the Council to proceed with its project, and thus help to develop the district.

**Rawtenstall.**—At the T.C., on the 18th inst., it was reported that the B. of T. had written enclosing sanction to the borrowing by the Corporation of the sum of £4,668 to meet excess expenditure in the electrical equipment of the tramway undertaking and the purchase of cars. A Committee was appointed to meet a deputation from the fire brigade with reference to the best method of erecting fire alarm and electric lighting, &c., wires on tramway standards and overhead equipment. It was decided that the engine room at the electricity works be extended, and that a duplicate of the last engine and generator be installed; also that the necessary borrowing powers be obtained.

**Stalybridge.**—On Tuesday afternoon the employes of the Gas, Sanitary and Highway Departments at Stalybridge came out on strike because six tramwaymen, who had been discharged, were not to be reinstated by the Corporation Tramways Department. About 160 men abstained from work, and as there was not much gas in the gasholder, the outlook was considered serious.

**U.S.A.**—It has been announced officially that the New York, Newhaven and Hartford Railroad will extend its electric zone from Stamford to Newhaven, a distance of 41 miles. Use will be made of the 25-cycle, single-phase overhead catenary contact system operated at 11,000 volts, similar to that now under construction on the Harlem River branch of the road and on the New York, Westchester and Boston line. Work of construction on the overhead system will be begun within the next six months and completed in about one year. For the present and until the line is extended beyond Newhaven all energy for train operation will be supplied from the generating station at Co. Cob. With the extension completed the electric locomotives will cover a total distance of 75 miles between New York and Newhaven, and will completely supersede the steam locomotives for both freight and passenger service throughout this zone.—*Electrical World*.

**Worthing.**—The T.C., at a special meeting convened for the purpose, has unanimously decided to oppose the Bill being promoted by the Brighton, Hove and Preston Omnibus Co., for powers to run a system of electrically-propelled trolley cars between Brighton and Worthing. Every one of the 23 members in attendance held up their hands for the resolution.

## TELEGRAPH and TELEPHONE NOTES.

**American Trust Law.**—The *Daily Telegraph* financial correspondent states that steps are being taken to secure a Government suit to dissolve the \$700,000,000 American Telephone and Telegraph Co., on the ground that it is a combination in restraint of competition, and therefore a violation of the Sherman law.

**Cables Interrupted.**—On Friday last a steam trawler was wrecked off the Isle of Man, and broke the only cable connecting the island with the mainland.

The Turkish submarine cable between Suakin and Hodeidah has been interrupted, presumably by Italian warships.

**Congo State.**—The Budget for 1912 includes 40,000 fr. for the erection of telephone lines, and 1,700,000 fr. for the establishment of wireless telegraph stations.—*Board of Trade Journal*.

**Effects of the Storm.**—The violent wind and snow-storm last week caused much damage to the telegraph and telephone systems throughout the country, with consequent delay in communication. The telephone service especially suffered severely. The telegraph service in the South-Eastern district was seriously disturbed, the wires in that part being more numerous than elsewhere on account of the Continental traffic, and much delay in communication with France and Belgium resulted. The underground lines from London to the chief provincial centres were, of course, immune from damage, and proved their value in maintaining communication without interruption.

**Marconi Telegraph Shares.**—The *Sunday Times* of January 21st, states that the advance in Marconi shares will be largely based on the success of their subsidiaries, and quotes the Marconi Wireless Telegraph Co., of Canada, with its capital of \$5,000,000, in shares of \$5, quoted at 18s., as owning stations at Glace Bay with direct communication with Clifden, Ireland, and in Canada 29 coast stations. It states that in Canada it is expensive, and, in places, almost impossible to lay telegraph wires over the prairies of the West, hence wireless has an enormous field, and that is why the Canadian Government is actively assisting the company and granted it an annual subsidy of \$60,000 for 20 years. The *Express* for January 23rd, in "Market Gossip," opens out again as to a provisional agreement between the Marconi Wireless Telegraph Co. and the Post Office having been signed, and states that the subsidy to be received will give the shares a value of about £5, as against the present price of 3½. The *Express* thinks they will reach £7 to £10. It is admitted, however, that there is nothing to go upon at present beyond the market rumours. The chief of these is to the effect that it is in contemplation to provide more adequate telegraphic communication with the British Colonies. This matter was dealt with in our issue of November 3rd.

**Turkey.**—Reuter states that a convention for the renewal of the Constantinople-Odessa cable concession has been finally signed by the Turkish Minister of Posts and Telegraphs and a representative of the Eastern Telegraph Co. An innovation is introduced permitting of the transmission of telegrams in Russian and Arabic characters between certain centres.

**Wireless Telegraphy.**—According to the *Ges für drahtlose Telegraphie*, wireless stations will be erected at Swakopmund, Lüderitz Bay, and Duala in German South-West Africa, the last-named being able to communicate with the station at Togo. This station can also communicate with the station on the Spanish island of Fernando Po. As a central point for East Africa, a station has been set up at Muansa on the Victoria Nyanza.—*Elektr. und Maschinenbau*



## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—February 13th. 50,000 incandescent lamps and 1,350 opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" to-day.

March 12th.—Testing instruments, for the P.M.G.'s Department. See "Official Notices" to-day.

MELBOURNE.—March 5th. Telephone material (Sch. 612); also 120 miles rubber-insulated cotton-covered tinned copper wire (Sch. 594). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

TASMANIA.—February 19th. Wire-testing machine, for the Postmaster-General's Department. See "Official Notices" January 5th.

February 26th. Five miles of cable, for the P.M.G.'s Department. See "Official Notices" to-day.

**Austria.**—January 29th. The Austrian Post and Telegraph authorities in Vienna are inviting tenders for the supply of 45 tons of copper wire and 70 tons of telegraph cables.

**Belfast.**—February 12th. One automatic coal weighing machine, and overhead electrical equipment material, for the Corporation. See "Official Notices" to-day.

**Belgium.**—January 31st. The municipal authorities of the town of Jumet are inviting tenders for the supply of a switchboard for the central electric lighting station.

March 1st.—The Belgian Direction Générale des Ponts et Chaussées in Brussels (38, Rue de Louvain) are inviting tenders for the supply and erection of a 40-ton electric crane at the port of Ostend.

BRUSSELS.—April 10th. Erection and equipment of four new telephone stations, and the supply of switchboards and accessories. Particulars, Bureau des Adjudications, Rue des Augustins, 15, Brussels.

**Birkenhead.**—January 29th. Stores for a year, for the Corporation electricity and tramway departments. Mr. W. Wyld, borough electrical engineer, Laird Street.

**Blackburn.**—February 12th. Stores for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" to-day.

**Bristol.**—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" to-day.

**Bulgaria.**—PLEVNA.—Installation of the electric light. £60,000. Guarantee £1,000. Particulars from, and tenders to, the Municipality.

**Burton-on-Trent.**—January 27th. One 1,250-KW. turbo-alternator, and other electrical and steam plant for the Corporation. See "Official Notices" January 12th.

**Croydon.**—January 29th. Mixed-pressure turbine plant, for the Corporation. See "Official Notices" January 5th.

**Dublin.**—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

**Epsom.**—February 13th. 200-KW. Diesel generator, for the U.D.C. See "Official Notices" to-day.

**Exeter.**—February 2nd. Vulcanised rubber cables, distribution fuseboards, distribution switch and fuseboard, steel conduits and fittings, for the Visiting Committee of the Asylum. See "Official Notices" January 12th.

**Halifax.**—February 5th. Stores and materials for a year, for the Corporation Electricity Department. See "Official Notices" January 12th.

February 12th.—Stores and materials required by Tramways Department during year ending March 31st, 1913. Forms of tender, &c., obtainable from the Tramways Engineer, Tramway Offices, Skircoat Road.

**Hornsey.**—February 7th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" January 19th.

**Leeds.**—February 14th and 21st. (a) 1,000 A.C. meters and (b) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 19th.

**London.**—L.C.C.—January 30th. Electrical installation at the School of Photo-Engraving and Lithography. See "Official Notices" January 19th.

STEPNEY.—January 29th. The B.C. is inviting tenders for one E.H.T. converting plant, suitable for 6,000-volt three-phase A.C. to L.T. D.C., together with E.H.T. and L.T. switchgear, &c., for the Limehouse and Whitechapel stations. See "Official Notices" January 12th.

SHOREDITCH.—January 30th. The B.C. is inviting tenders for the conversion into electric motor drive, of a steam-driven deep well pump at Hoxton Public Baths. Specifications and forms of tender from the Superintendent and Engineer, Hoxton Baths, Pitfield Street N. Deposit, £5 (returnable) to be sent with tender.

BERMONDSEY.—February 19th. Stores for a year for the B.C. Electricity Department. See "Official Notices" to-day.

**Manchester.**—February 20th. The Corporation Tramways Department is inviting tenders for tramcar-type ampere-hour meters. J. M. McElroy, general manager, 55, Piccadilly, Manchester

**New Zealand.**—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwt. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

**Portugal.**—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes, in accordance with the specifications which may be seen at the offices. For further particulars see this column last week.

**Rhyl.**—January 31st. 1,700 yards of .1 overhead feeder cable, for the U.D.C. See "Official Notices" January 19th.

**Roumania.**—The municipal authorities of Constantza have lately invited tenders for the construction of a central electric lighting station in the town.

**Siam.**—BANGKOK. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kW. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

**Southend-on-Sea.**—February 7th. The Corporation is inviting tenders for four pier tram trailer cars. Particulars from the Town Clerk.

**Tunbridge Wells.**—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

**Wallasey.**—February 12th. One 500-KW. alternator and Diesel engine combined, for the Corporation. See "Official Notices" to-day.

**York.**—Electric shunting locomotive for the Corporation. See "Official Notices" January 12th.

### CLOSED.

**Australia.**—In last week's list of Sydney contracts, for "The Key Manufacturing Co., Manchester," read "The Key Engineering Co., Ltd., London and Manchester."

**Barnsley.**—The T.C. has accepted the tender of Messrs. D. Snowden & Sons, Barnsley, for electrical repairs for a year at the hospitals.

**Barrow-in-Furness.**—The T.C. has accepted the tender of Mr. C. Armstrong-Lamb for the electric light installation at the new fire station, at £124.

**Binsley Colliery.**—The British Electric Plant Co.'s tender of £305 has been accepted for turbine pump equipment.

**Faversham.**—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for the repair of a dynamo, at £43.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government departments named:—

#### WAR OFFICE.

Travelling electric cranes.—Craven Bros., Ltd.  
Electric wire.—Hooper's Telegraph and India-Rubber Works, Ltd.  
Internal wiring, Louisberg Barracks, Bordon, and Married Quarters, Bordon.—G. E. Taylor & Co.

#### INDIA OFFICE: STORES DEPARTMENT.

Cable.—Liverpool Electric Cable Co.  
Fans.—Veritys, Ltd.  
Wireless telegraphy apparatus.—Marconi's Wireless Telegraph Co.

#### CROWN AGENTS FOR THE COLONIES.

Diesel engines.—Mirrlees, Bickerton & Day, Ltd.  
Dynamos.—Mather & Platt, Ltd.

#### OFFICE OF WORKS.

Electric lighting of National Gallery of Scotland.—Wm. Finlay & Co.  
Generating sets at Royal Courts of Justice.—J. Howden & Co., Ltd.  
Four electric push-button lifts for die and seal department of Royal Mint.—R. Waygood & Co., Ltd.

#### GENERAL POST OFFICE.

Telephonic apparatus, flexible cords.—London Electric Wire Co. and Smiths, Ltd.  
I.R. and C.C. cable.—Henley's Telegraph Works Co., Ltd.  
Paper-core cable.—Callender's Cable and Construction Co., Ltd.; Johnson and Phillips, Ltd.  
Stoneware conduits.—Albion Clay Co., Ltd.  
Projectors.—British L.M. Erics-on Manufacturing Co., Ltd.  
Electrical equipment, sub-station, Birmingham Head P.O.—British Thomson-Houston Co., Ltd.  
Electric lifts, G.P.O. (North) and G.P.O. (West), London, E.C.—A. W. Penrose & Co., Ltd.  
Telephone equipment, Finchley Exchange.—Western Electric Co., Ltd.

**London.**—L.C.C.—The Highways Committee has received the following tenders for electric wiring material required at certain tramway buildings:—

Armorduct Manufacturing Co., Ltd.,	..	(recommended)	£249
Edison & Swan United E. L. Co., Ltd.	..	..	252
Pinching & Walton	..	..	254
General Electric Co., Ltd.	..	..	260



Messrs. Doulton & Co., Ltd., are to supply 400 cream coloured glazed earthenware plough bases at 8s. 6d. each.

Messrs. Newton Chambers & Co., Ltd., are to supply the necessary pipe work in connection with a new coal shoot from the upper coal bunkers above the boilers at Greenwich generating station in substitution for the shoot erected on the outer coal store, at £58.

The Stores and Contracts Committee has placed contracts with the following firms:—

*Electric Carbons.* Plutte, Scheele & Co., Ltd., and Sloan Electrical Co., Ltd.

*Electric Fittings.*—Brotherton Tubes and Conduits, Ltd., Dorman and Smith, Elliott Bros., General Electric Co., Ltd., W. McGroch and Co., Plutte, Scheele & Co., Ltd., A. Round, Simplex Conduits, Ltd.

**POPULAR.**—The B.C. is to place an order with Messrs. Willans and Robinson for an additional 3,000-KW. turbine alternator and condenser, at £7,581, less scheduled prices of spare parts.

**Swansea.**—The tender of the Stirling Boiler Co., Ltd., at £3,508, has been accepted by the T.C. for the supply of two water-tube boilers, mechanical stokers and accessories (except super-heaters) for the generating station.

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, January 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Exhibition of a Direct-Reading Instrument for Submarine Cable and other Calculations, by Mr. R. Appleyard; paper on "The Vibration Galvanometer and its Application to Inductance Bridges," by Mr. S. Butterworth; and "Note on a Negative Result connected with Radio-Activity," by Messrs. J. H. Vincent, M.A., and A. Bursill.

**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, January 26th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Paper on "Motion and Change," by Dr. F. B. Jevons.

**Institution of Electrical Engineers (Newcastle Local Section) and Association of Mining Electrical Engineers (North Branch).**—Saturday, January 27th. At 7 p.m. At Tilley's Rooms, Newcastle. Smoking concert.

**Institution of Electrical Engineers (Manchester Local Section).**—Saturday, January 27th. At 7.30 p.m. At the University, Manchester. Meeting with the Manchester Association of Engineers. Paper on "Electrical Furnaces," by Mr. C. Myers.

**Institution of Civil Engineers.**—Tuesday, January 30th. At 8 p.m. Paper on "The Central Heating and Power Plant of McGill University, Montreal," by Mr. R. J. Durley.

Friday, February 2nd.—At 8 p.m. Students' meeting. Paper on "Steam Turbines: Some Practical Applications of Theory," by Capt. H. Riall Sankey.

**Institution of Electrical Engineers (London Students).**—Wednesday, January 31st. At 7.45 p.m. Paper on "Choice of Material for Overhead Transmission Lines," by Mr. E. V. Pannell.

**Royal Society of Arts.**—Wednesday, January 31st. At 8 p.m. Paper on "Recent Progress in Radio-Telegraphy," by Mr. G. W. O. Howe.

**Northampton Institute Engineering Society.**—Thursday, February 1st. Visit to the G.P.O. sub-station, &c.

Friday, February 2nd.—Paper on "Steam Turbines," by Messrs. T. R. Houston and F. G. Parnell.

**Royal Institution.**—Friday, February 2nd. At 9 p.m. Discourse on "Vital Effects of Radium and other Rays," by Sir J. M. Davidson.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued:—

Monday, January 29th.—"A" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Tuesday, January 30th.—"B" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Thursday, February 1st.—"C" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Friday, February 2nd.—"D" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Saturday, February 3rd.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

**Loans for Electric Lighting.**—The Local Government Board in its fortieth annual report states that during the last 20 years the following amounts have been sanctioned for the purposes of the Electric Lighting Acts, 1882:—

1891, £115; 1892, £315,545; 1893, £773,722; 1894, £357,886; 1895, £515,543; 1896, £796,588; 1897, £964,837; 1898, £1,058,164; 1899, £2,390,235; 1900, £3,023,692; 1901, £3,995,459; 1902, £2,736,673; 1903, £1,938,775; 1904, £2,134,623; 1905, £1,058,462; 1906, £802,678; 1907, £1,247,781; 1908, £1,377,268; 1909, £835,068; 1910, £814,746; total, £27,137,680.

The whole of this amount was required by Town Councils and Urban District Councils, with the exception of loans amounting to £20,000, £7,000 and £13,484 sanctioned to be raised by Rural District Councils in 1905, 1908 and 1909 respectively.

## ASSOCIATION OF CONSULTING ENGINEERS.

THE official report of the recent meeting of this Association states that it was convened for the purpose of formally receiving the rules which had been drawn up by the committee appointed for this purpose at the opening meeting some 13 months ago. Between 60 and 70 engineers were present, and the chair was taken by Mr. James Swinburne.

The chairman, in opening the proceedings, said that they all knew what the objects of the Association were. The Association should have been launched 50 years ago; in the present state of things, however, it was very difficult to form an Association in such a way as to be satisfactory to everybody. At the same time he was of opinion that if consulting engineers did not take this opportunity of uniting themselves together there was no chance of their ever doing so. It behoved them, therefore, to proceed very carefully and to build on sure foundations.

One of the qualifications for membership in the rules was that the applicant should be a full member of the Institution controlling the branch of engineering in which he practised. It was true that the rules provided that, in addition, members should be of such standing as, in the opinion of the Committee of the Association, entitled them to admission to the Association; but in the initial stage in which they were at the moment (namely, of having formed the Association and appointed the Committee, drawn up rules and received applications for membership, but not having yet actually any members), the Committee were of opinion that it would be wise to adopt some recognised standard of qualifications and to limit the first members to those possessing the qualification of corporate membership of the Institution of Civil Engineers.

This restriction might be criticised by some people, who might say that they were mechanical or electrical engineers and of eminence in their profession, and did not see why the fact that they had not joined the Institution of Civil Engineers should prevent them from joining the Association. On the other hand, it must not be overlooked that the Institution of Civil Engineers was not only the oldest but also the parent engineering institution, and that the majority of consulting engineers already belonged to it in addition to the institutions representing the particular branches in which they practised.

If any competent consulting engineer, who was not a member of the Civils, felt aggrieved that he could not belong to the Association, surely it was not asking a very great deal of him to ask him to join the Civils. If the Association, starting as a young society, could use a body like the Institution of Civil Engineers, which had always been fairly strict in the selection of its candidates and was getting stricter every year, and thus throw the responsibility of deciding as to a candidate's qualifications upon an established institution, leaving the Association merely to decide as to his qualifications in other respects, they were solving one of the greatest difficulties.

Later on, they might find it advisable to make some change, but that was a matter for the future. With regard to the admission of engineers who were receiving a salary and were giving practically the whole of their time to some corporation or some public body, the Committee wished to be logical in carrying out their idea of starting on the narrowest lines, and felt that they should confine the Association initially to those regularly in practice as consulting engineers and having their own separate office and staff.

The Association did not aim at stopping competent consulting engineers who might not join them from doing consulting work, nor did they wish to claim a monopoly. The Committee felt, however, that engineers falling within the class he had outlined were entitled to form an Association which would gradually, through its own standing and character, become recognised as the body of consulting engineers.

After the proposed rules had been introduced by Mr. Midgley Taylor and Mr. S. R. Lowcock, a general discussion took place, the speakers being Messrs. B. M. Jenkin, W. Fairley, A. Williams, A. G. Hansard, Cawley, Robert Hammond, E. J. Silcock, H. P. Boulnois, A. S. E. Ackermann, H. P. Raikes, F. W. Hodson, Moss Flower, Drutt Halpin and P. Griffiths. The main points to which speakers referred were the scope of the Association, the desirability or otherwise of the membership being restricted to corporate members of the Institution of Civil Engineers, registration of consulting engineers, solicitation of work and the desirability of consulting engineers being free from trading or manufacturing interests.

In conclusion, at the suggestion of Mr. Lomax and Mr. W. Duddell, the chairman put a motion to the meeting to the effect that corporate membership of the Institution of Civil Engineers be a condition of membership of the Association\* (with discretionary power to the Committee), and that the Committee have power to elect members from among those who have applied. This motion having been duly carried, the proceedings terminated with a vote of thanks to the chairman. All consulting engineers possessing the necessary qualifications who wish to join the Association should communicate at once with Mr. A. H. Dykes, the honorary secretary, at 11, Victoria Street, Westminster, S.W. This will enable a list of first members to be made without delay. A meeting of members will then be called to ratify the rules and to appoint the Executive Committee.

\* Rule 4 (c) now reads as follows:—"He shall be a full member of the Institution representing the particular branch of the profession in which he practises and a corporate member of the Institution of Civil Engineers."



## NOTES.

**Resuscitation from Electric Shock.**—The *Electrical World* announces that a Committee has been appointed to carry out a thorough study of methods of resuscitation from electric shock, and to prepare a set of rules for their application. The Committee includes members of the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers. It is suggested that the scope of the inquiry will be made international in character. The rules will be issued by the National Electric Light Association.

**Electrical Irrigation.**—The *Electrical World* gives a description of an exceptionally large installation of hydro-electric power for irrigation at Minidoka, U.S.A. It was laid down by the U.S. Reclamation Service, and raises water to a height of 66 ft. to irrigate an area of 48,000 acres. The plant is driven by water-power, and has a total capacity of 10,000 H.P. in five generating sets, which work at 2,200 volts three-phase; the pressure is transformed to 33,000 volts before reaching the bus-bars, all the switching being done on the E.H.T. side. The cost of the power station (7,000 kW.) was about £12½ per kW. Power is transmitted over 38¼ miles of line to the pumping stations, of which there are three, equipped with turbine pumps driven by 600-H.P. synchronous motors. The latter are provided with squirrel-cage windings to increase the starting torque, and are started up with the fields short-circuited. The output for pumping amounts to 14 million kW.-hours, costing 0.13d. per unit, including depreciation allowance; but if interest and taxes had to be paid, amounting to, say, 10 per cent., the cost would be 0.3d. per unit. The total investment per acre was £3.8, and the total cost of irrigation per acre £0.28. There is also an increasing output for lighting and heating to towns in the district. The efficiency from the water behind the dam to the water pumped is 46.3 per cent.

**The National Telephone Arbitration.**—The Railway and Canal Commission, consisting of Mr. Justice A. T. Lawrence, the Hon. A. C. Gathorne Hardy and Sir James Woodhouse, sitting in the King's Bench Division on Wednesday, January 24th, heard an application made on behalf of the National Telephone Co. that a date should be fixed for the hearing of the arbitration between the company and the Post Office with respect to subjects transferred from the company to the Post Office, on the value of which the parties could not agree.

Sir Alfred Cripps, K.C., and Mr. H. H. Gaine, appeared for the National Telephone Co.; the Attorney-General (Sir Rufus Isaacs), the Solicitor-General (Sir John Simon), and Mr. Branson for the Post Office.

Sir Alfred Cripps first raised the question of the date of the hearing of the arbitration on the subjects on which the parties disagreed. The undertaking of the company, he said, passed over to the Post Office from the beginning of this year, and he was anxious that the valuation and arbitration should take place as soon as possible. He now suggested that the Court should appoint the first Monday after Easter as a convenient time.

The Attorney-General said his difficulty with the suggestion was that it was premature to fix that date at present. By the agreement, the Post Office had come under certain terms of payment which made it essential that a settlement should be come to as soon as possible, so that they might know what they had to pay. At the same time they were dealing with very huge sums, and it was essential that they should know the particulars before coming into Court, so that they might narrow the issues as far as possible and save a great deal of time. Much of the work could be done out of Court as soon as they had arrived at the real issues between them. It would be better for the present not to fix a date. He did not think it would be possible to deal with the case immediately after Easter. But everything depended on the way in which the case was presented to the Post Office. The inventory had been just about completed, and his friends would know what it was that they were claiming from the Post Office as payment for the plant and undertaking handed over. That was a matter which, no doubt, they could tell him when they came to put their application into writing, and they could also give him some particulars which would be of very great use in respect of the different groups and varieties of plant. If they were to tell him, for example, the number of ducts, there might, or might not, be a question of price arising. What he did want to know, in particular, was the age of the plant, because under the terms on which the Post Office had to make payment, depreciation was an important element, and the plant taken over would have to be assessed at a value dependent on the age and life of the plant. The duration of the life was, of course, a question of opinion, but the age was a question of fact which the applicants would know, and particulars of that kind would be important.

The inventory would be taken by agreement between them. Fortunately, in regard to that there would be very little difficulty between them, but that, of course, was only the material upon which they had to work. The only point was the plant on which they could not come to an agreement. There might be questions which would be left open to the Court, particularly questions of opinion such as the amount to be allowed for depreciation, but he hoped that on many of these they would be able to agree. It was, however, too early to say. The difficulty at present was that they had not the material before them that would enable them to say that there would be only one or two or a certain number of issues for the Court. If they would give him particulars of the nature he had suggested, he could then ask for any further information that he

might require, but he did not intend to go through the form of coming before the Court again for that purpose.

Sir Alfred Cripps said that what were known as grouping of class, and variety of class, were already known between them, and he would supply any other information they wanted upon those points. It was not, he said, a question of valuation, but of the agreed inventory which had been arranged between them. With regard to the question of the age of the plant, he thought all the information was already in the possession of the Post Office. But, of course, at any later stage if he could exchange information with the Post Office, he would always be willing to do that, the Post Office giving his clients information on the same heads given to it. He agreed that they should eliminate any issues they could in order to narrow the issue. It appeared to him that all these matters could be perfectly well done so as to enable the case to be heard at the date he had mentioned. As regarded groups, age, &c., if there was any information the Post Office wanted they could have it to-morrow if they wished. A further question that would arise later would be that of the company's tables and the Post Office tables as regarded valuation, but he was willing to exchange the information at any time.

Mr. Justice A. T. Lawrence: Does that mean exchange of inventories, with the prices attached?

Sir Alfred Cripps: Certainly; I am quite willing to put my cards on the table. Let the two parties exchange the whole of the information, then they can see, looking at one another's valuation, what the points are on which they agree. I don't think there will be any friction. The other matter has gone perfectly smoothly, and so, here, we both desire to arrive at a just conclusion, giving the Court as little trouble as possible, and saving the parties as much cost as possible.

Mr. Justice A. T. Lawrence said the Attorney-General seemed to think the date named would not give him sufficient time.

The Attorney-General said his friend had the advantage of knowing his case.

Sir Alfred Cripps said that, outside formal documents, he was willing to give his friend every assistance in real substantial matters.

The Attorney-General: I do want to point out that my friend is coming at this moment to fix a date for hearing, before he has even launched his proceedings.

Mr. Justice Lawrence said that technically that was a difficulty, and out of order. He added, however, that the date was three months hence. If that date were fixed, he said it would leave him two months for dealing with the hearing before going on circuit in June.

Sir James Woodhouse asked how long the hearing was likely to last.

The Attorney-General said it would be impossible to say until they knew how they stood.

Mr. Justice A. T. Lawrence asked Sir Alfred Cripps when he could deliver the particulars desired by the Attorney-General, in respect of groups, varieties, &c.

Sir Alfred Cripps: He can have them at once. When it comes to the question of valuation, another issue arises. We have made a valuation and the Post Office has made a valuation, and we are willing to exchange information on that point.

Mr. Justice A. T. Lawrence: What does the Attorney-General say to that? By this exchange you would be able to investigate the particulars.

The Attorney-General said that depended on the particulars they gave him. If his friend would give him the particulars he was entitled to ask for, so that he might learn what value was attached to one class or another, he might be able to say when he would be ready for the hearing. He said he thought he knew how his friend was going to put his claim, but it was very difficult for him to agree. The matter was one that must have very careful consideration which might possibly lead to a very considerable saving of time. The matter was very easy for his friend, who had his valuation.

Sir Alfred Cripps: And you have yours.

The Attorney-General: That is exactly what I have not. At present I don't know what value I am going to put upon these various classes of plant. Until my friend says what the value of the various classes of plant is, we cannot arrive at a total, which he can do quite easily.

Mr. Justice A. T. Lawrence said if Sir Alfred Cripps said his total claim was so much and his claim for each variety so much, the Attorney-General could agree to so many and disagree with so many others. Sir Alfred's suggestion then was that they should exchange figures on the varieties on which they disagreed, and the Attorney-General's position was that he would not be in a position to do so unless those who instructed him had made some estimate. (Addressing the Attorney-General) "If they give you their particulars within a fortnight, could you say when you would be ready? What I want is to keep these two months available for you to deal with this matter."

The Attorney-General said he would have no objection to the suggested date being provisionally reserved, but he objected to having it fixed, because that would put upon him the burden of coming again to the Court if he could not be ready on that date. That was a position in which he did not want to be placed. He thought he was entitled to look for some little proof of the friendliness professed before consenting to fix a date.

Sir Alfred Cripps said he believed if the appointment were made it would make both parties anxious to have their case ready by that time, and if, for any good reason, that could not be done, the Court would always assent to an application to postpone the hearing. He stated that his clients knew, broadly, some of the valuations made by the Post Office, which were so far apart from their



own that there was no chance of an agreement being reached, and the decision of the Court would have to be taken.

After some further discussion, the President suggested that, as the Court would be sitting again on March 25th, the case might be adjourned to that date, when the parties might be prepared to say whether they would be ready by April. That, he said, would give an opportunity for the Attorney-General to consider whether he could fall in with Sir Alfred Cripps's suggestion to exchange figures in cases where they differed. It was quite certain that in adopting that course the Attorney-General would be giving up certain of his technical rights, but, on the other hand, in a huge matter of this sort, the saving would be probably quite as much as by following the more technical way of dealing with the matter.

The Attorney-General: I quite agree. It may save a good deal of trouble.

Sir Alfred Cripps said the information he proposed to give by way of exchange was such as could not be obtained under any procedure.

The application was, therefore, adjourned until March 25th.

**Why the Meter would not Mete.**—Electricity meters have been subjected to an amount of suspicion which is not altogether warranted by the number of times that they have actually failed to give the exact registration of energy consumed. Possibly this is due to the fact that they are associated in the mind of the public, which has a tendency to generalise, with their distant relation, the gas meter. Whatever may be the reason, however, the consumer who is called upon to pay his lighting or power account has an irritating tendency in the direction of ringing up the supply station and demanding in pungent language the instant examination of the meter on his premises. Sometimes, however, the boot is on the other foot. The consumer pays his bill with a serenely happy smile, and the electricity supply authority is casting about for an adequate reason why such and such an account should be a diminishing quantity. The meter again is the object of suspicion, and sometimes these suspicions are well founded.

The reason is, however, not always a technical one. Without referring to ingenious methods of influencing the incorruptibility of the meter or of by-passing the current by means of unostentatious pins stuck through the insulation of the leads, there sometimes arise cases which look like a special interposition of Providence on behalf of the consumer. In one instance, an electricity supply was taken for lighting purposes by an establishment devoted to the process of converting cattle hides into leather, and the electricity staff used to say that if anything was worse than the local perfume, it was the swarm of blue bottles and other flies which infested the place during the larger part of the year. This, however, did not interfere with the electricity supply until on one occasion the meter reader found that the demand for light during the quarter had come down very considerably. This was noted again in the succeeding quarter, and the supply authority thought that the time had then arrived to make investigation as to the reliability of the meter. It was, therefore, replaced by another one and the old one was taken to the works for overhaul. It was found that the series and shunt connections were all right, but that the disk of the meter seemed to move with a certain amount of friction, and this led the inspector to examine the interior of the meter by the aid of a strong local light. After poking about around the disk with a small piece of stick, he found out the cause of sluggishness on the part of the meter, inasmuch as he dug out from between the disk and the pole piece adjacent to it a beautifully preserved specimen of the blue bottle. This had evidently pitched on the disk, and having been carried round by the rotation got itself jammed between the pole piece and the disk, and it had then given up the ghost. The question, however, that has agitated the minds of the meter staff ever since is this: Seeing that the case of the meter was hermetically sealed, how did that fly get into the meter?

**Hardanger Electrical Iron and Steel Works.**—At a general meeting of the company on the 11th inst. the manager of the works, Engineer A. Hartmann, gave the following information as to the working of the electrical process:—Operations were started early in November, the charges employed have been comparatively poor as regards their content of iron. This is due to the fact that the roasting oven of the works has not been completed as yet, and will not be ready for use before February, for which reason the available ore has not been subjected to the proper pre-treatment. The results obtained have, however, been just as successful as those which were achieved at the Trollhättan experimental works in Sweden with charges of a corresponding quality, and the process being the same, this proves that the anticipated results have not been too optimistic. As soon as the roasting oven is completed, the work will be carried on with full speed, and richer charges will be used. This will increase the output considerably, and there is no reason to doubt that the same results as at Trollhättan will be obtained, and even improved upon. The prices which have been obtained for the products up to the present are very favourable, and the anticipated reduction in the cost of production, or rather the improved quality of the products, will, of course, exercise a beneficial effect in favour of the new enterprise.

**New Electrical Ironworks in Norway.**—A new company, which owns iron deposits in Nordland, just within the Arctic Circle, has submitted an application to the Meløy parish with the view of acquiring the Sykan waterfall in the Glomsfjord. The river in question comes from the large glacier "Svartisen." The

company intends to harness the Sykenfas, and by means of the energy derived from it, to start the electrical smelting of iron ore on a large scale. The water will pass through two tunnels, and will have a head of nearly 440 yards. It is reported that a sum of nearly £400,000 will be spent on the plant and the necessary works in connection with the enterprise.

**Institution and Lecture Notes.**—By the courtesy of the Liverpool University Authorities and Prof. Marchant, members of the Engineering Society attached to the Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, were present on Friday evening at a very interesting invitation lecture on "The Generation and Transmission of Electrical Energy." In spite of the bad weather the meeting was well attended. Prof. Marchant showed a most interesting series of slides depicting hydro-electric installations in America and elsewhere, and further illustrated his lecture with some experiments demonstrating fundamental electrical principles.

**INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION)**—The annual smoking concert of this Section is to take place at the Grosvenor, Glasgow, on Saturday, February 10th.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—Our Bath correspondent states that the time has been thought opportune to inaugurate a new Local Section of the Institution extending over the counties of Somerset, Gloucestershire, Wilts, Dorset, Devon and Cornwall, and on the other side of the Channel, taking in that part of South Wales extending down to the neighbourhood of Swansea. A canvass of members of the profession has been made, and it has been ascertained that there is a practically unanimous desire to see the scheme adopted. Arrangements are being considered for the inaugural meeting, and this, it is expected, will take place towards the end of February, in Bristol, under the chairmanship of Mr. S. Z. de Ferranti, the president. A dinner will follow the meeting. The fact that there are upwards of 200 members of the Institution within the area covered by the Western Section should ensure a strong organisation from the outset.

**INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.**—On Tuesday a paper by Mr. H. A. Mavor on the screw propeller was to be discussed by the Institute. There appears to be no limit to the departments of engineering into which the electrical engineer is compelled to pursue his investigations, while developing new applications for his own science.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (NEWCASTLE BRANCH).**—A lecture by Dr. W. M. Thornton, on the "Use of Electricity in Coal Mines," was delivered at the Eldon Colliery Institute, on Wednesday, January 24th.

**BIRMINGHAM AND MIDLAND INSTITUTE.**—A successful conversation was held on January 9th-12th, and was attended by no fewer than 5,120 persons. A variety of exhibitions was arranged, and music, dancing and lectures were included in the programme.

**NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.**—On January 19th Mr. W. A. Hislop read a paper on "Reinforced Concrete Construction" before the above Society.

**THE CONCRETE INSTITUTE.**—An interim report has been issued on the consistency of concrete, with a number of replies received from correspondents on the subject.

**A Chinese Cotton Mill.**—U.S. Consul-General Wilder, of Shanghai, in a recent report, says that a new mill has been completed in Shanghai by the Japanese Naigai Wata Kaisha for spinning cotton yarn. The mill is distinctive as the only one in China whose machinery is operated by electricity generated on the premises and supplied direct from the dynamos in the engine house to the plant in its various departments. The site includes about 9 acres of ground on Soochow Creek. The plant has been three years in course of construction. A feature is the water tower, surmounted by a reinforced concrete tank 60 ft. above the level of the ground and with a capacity of 12,000 gallons. Residential quarters are near by for the heads of departments. The mill hands are housed in a series of one-storey buildings. There are three main B. & W. water-tube boilers, fitted with automatic chain stokers, feeding Japanese fine coal. The main power is generated in the house adjoining by two Belliss & Morcom triple-expansion engines, driving two Siemens direct-current dynamos, each capable of developing 600 kw. The engines rest on a solid foundation of reinforced concrete 40 ft. thick, 25 ft. of which is below the surface of the ground. In the factory proper there is space for 40,000 spindles, 20,000 of which are now running, 16s yarn being a speciality. The spinning machinery is all by Platt Bros., of Oldham. The entire establishment is provided with a complete equipment of patent sprinklers. At present there are 300 women operatives and 150 men employed, with Japanese foremen, fitters, and overseers at the heads of the departments; 90 per cent. of the cotton handled is of local native growth and 10 per cent. is Indian. The company also owns two mills in Japan, one at Osaka and the other at Nishinomiya.

**State Monopoly of Electrical Enterprises in Uruguay.**—The Government of Uruguay has recently submitted to the Second Chamber a Bill authorising the Government to acquire all the electrical works of the towns and villages in the country, with the view of creating a State monopoly for this industry. The Bill further authorises the Government to issue bonds for 4½ millions Uruguay gold dollars, which are to be at the Government's disposal for the erection of new electrical works for power and lighting purposes in places where there are no such works as yet.

As a compensation to the town of Monte Video for the acquisition of the municipal electrical works, the Government will take over the responsibility in connection with the so-called Baring Loan



of Monte Video, the amortisation and interest of which represents an annual expenditure of \$360,000. This amount, which is thus liberated, will be spent on various improvements in the town.—*Buenos Ayres Trade Journal.*

**The Association of Consulting Engineers.**—From among the various criticisms that have appeared in the technical Press regarding the intentions of those interested in this movement, we select for reproduction the following editorial view expressed in the *Times Engineering Supplement* on Wednesday, January 24th:—

"The official account of the proceedings at the inaugural meeting of the Association of Consulting Engineers contains what may be assumed to be a fairly full report of the opening remarks of the chairman, Mr. James Swinburne, but it is singularly lacking in detail and information as to the discussion that took place afterwards. Mr. Swinburne admitted that the inauguration was half a century later than it should have been, and the general impression conveyed by the report is that its birth and baptism might have been delayed for another 50 years without serious detriment to the welfare of the profession or the happiness of nations. It was recognised by the chairman that all applicants for admission into the Association should be full members of the Institution controlling the branch of engineering in which they practise, and it was further insisted that in addition they should, at least to begin with, belong to the Institution of Civil Engineers. This device, of course, saves the Association all expense, and most of the responsibility involved in the examination and selection of candidates, and leaves it merely the pleasant task of placing the crowning glory upon the heads of those whom it deems worthy to pass into the full blaze of notoriety as consulting engineers. It does not seem to occur to the chairman that the greater includes the less. An engineer who has been duly elected by the Council of his specialist institution into the full fellowship of his specialist branch, and who has moreover had bestowed upon him the diploma of the Institution of Civil Engineers by its honoured Council, has all he wants. To submit himself to further analysis by the Council of a lesser body is of no advantage either to himself or to that Council. In other words the Association seeks to paint the lily. The situation is not devoid of humour, and, as usual, it has arisen from a misconception of the scope and definition of the word 'consulting' as applied to engineers. There is no added virtue or qualification necessary for a qualified engineer to take up consulting work. In a certain sense, all qualified engineers are consultants, whether their functions are fulfilled in India, Egypt, Crewe, Chatham, or Victoria Street."

**Appointments Vacant.**—Assistant installation inspector, for the Shanghai Municipal Council (£25 per month); charge engineer, for the Newport Corporation Electricity Works (£2); assistant electrical engineer for the Bispham-with-Norbreck U.D.C. (25s.—30s.); shift engineer for the Rawtenstall Corporation Electricity Department (30s.). See our advertisement pages to-day.

**Room for Improvement.**—A correspondent sends the following cutting from the *Manchester Evening Chronicle*:—

Vacancy for Improver in Electricity Supply Station, near Manchester; salary 5s. per week to commence; good prospects for suitable man.

Granted that an "Improver" can hardly expect a "living wage," as his labour is largely given in payment for the opportunity of acquiring knowledge and experience in his calling, still he is entitled to expect a good deal more than the pay of a young apprentice. Is the 5s. a misprint for 15s.? Anything less would be justly called a sweating rate.

**An Electric Light Rescue.**—The master of a hopper barge having fallen overboard in the Thames, an apprentice named Pusey jumped in to the rescue, with an electric torch; supporting the master with the aid of a lifebuoy, Pusey flashed his torch to guide others to the spot. Last week he received the award of the Royal Humane Society for his pluck and resource.

**The Electrical Industry in the U.S.A.**—Some interesting figures are given in a review of last year's results in the *Electrical World* of January 6th, and are reproduced below:—

	1910.	1911.
Electrical apparatus made ...	\$300,000,000	\$325,000,000
Electric railway earnings ...	520,000,000	575,000,000
Central station sale of energy, &c. ...	300,000,000	375,000,000
Telephone earnings ...	275,000,000	310,000,000
Telegraph earnings ...	65,000,000	75,000,000
Isolated plant service ...	100,000,000	125,000,000
Miscellaneous electric service ...	75,000,000	100,000,000
	\$1,635,000,000	\$1,885,000,000

Yet, in spite of these remarkable returns, our contemporary speaks of 1911 as undoubtedly "a rather dull, off year, when little business, not less than 'big,' has been checked in a season of depression."

A financial authority is quoted in respect of six properties in the electric railway field, which in four years up to December 31st, 1910, show gains of 70 per cent. in gross earnings, 166 per cent. in dividends, and 140 per cent. in reserves and surplus. Another publication charts the gross and net earnings of electric railway, electric light and gas properties, as compared with other industrials, and shows not only a general absence of disturbing effect on elec-

tricals from the panic and depressed periods of the last five years, but an upward trend of the curves that is almost startling in its persistent ascension. Our contemporary concludes that there is every reason to believe that in 1912 the electrical arts will be giving a service far in excess of \$2,000,000,000, a fair profit on which will mean greater prosperity than the industry has ever enjoyed before. We can well believe it: would that similar figures could be shown for the industry in this country.

It is interesting to note, too, that in North America there are 6,300 central stations, of which 85 per cent. serve communities of less than 5,000 residents.

**Concerts.**—The second annual Siemens Supplies smoking concert is to be held in the Pillar Hall, Cannon Street Hotel, E.C., on February 2nd.

On Friday evening last, the Faraday House Old Students' Association held their smoking concert. Mr. H. H. Perry, M.I.E.E., President of the Association, was in the chair. The programme was under the direction of Mr. H. H. Heap.

### International Congress of Applied Chemistry, 1912.

—For the interest of prospective authors of contributions to this Congress there have been issued printed rules on papers, their presentation, discussion and publication. The Congress takes place at Washington and New York in September next. Mr. B. C. Hesse, 25, Broad Street, New York City, is the Secretary.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—At a smoking concert held at the Rawson Hotel, Bradford, on Friday last, a presentation was made on behalf of the staff and employes of the Bradford Corporation electricity department, to Mr. H. S. ELLIS, on the occasion of his vacating the post of deputy city electrical engineer and manager in Bradford, to take up the position of borough electrical engineer at South Shields. In making the presentation, which consisted of a solid silver cigarette-box, cigarette-case, and a match-box, Mr. T. Roles, city electrical engineer, paid a tribute to the able manner in which Mr. Ellis had carried out his duties in Bradford, and wished him every success in his new sphere of labour. Alderman G. H. Robinson, chairman of the Electricity Committee, expressed on behalf of the Committee their appreciation of Mr. Ellis's services. The following members of the staff representing the various departments also testified to the good feeling which had always existed between them and Mr. Ellis, and to his never-failing courtesy towards them on all occasions:—Mr. J. H. Schnauber, deputy engineer; Mr. J. Fairbairn, deputy works superintendent; Mr. C. R. Brown, generating engineer; Mr. J. E. Albrow and Mr. C. A. Gillin, mains department; and Mr. C. B. Holdsworth, secretary. Mr. Roles made apologies for the absence of Councillor Jas. Hustler, deputy-chairman of the Committee, who had a prior engagement, also for Mr. Wm. Jones, works superintendent, who is away recuperating after a long illness, and for Mr. C. E. Allsopp, consumers' superintendent. The opportunity was also taken by Mr. Dudge, electrical engineer to the Bradford Dyers' Association, Ltd., to hand to Mr. Ellis, on behalf of the staff of his department, a pair of silver vases, as a mark of the esteem in which Mr. Ellis was held by them. Mr. Ellis, in acknowledging the presents, expressed his appreciation of the kindness and assistance he had received at the hands of all he had come into contact with during his five years' association with the electricity department of the Bradford Corporation. A capital programme of humorous and musical items was sustained by members of the Corporation staff and the B.D.A. staff.

MR. F. H. EDWARDS, late deputy electrical engineer to the Erith Council was on 16th inst. the recipient of a gold albert, together with a slide rule, presented by the members of the Council's staff, on the occasion of his leaving Erith to take up his new duties as chief electrical engineer to the Cornwall Electric Supply Co. at their Hayle power station. The presentation was made by Mr. Arthur Coveney, the electrical engineer and tramways manager. Mr. Edwards returned thanks in a few appropriate remarks. Tributes to his quality and the esteem in which he was held by his old colleagues were also paid by Mr. W. E. Deighton, of the electricity and tramways department; Mr. W. Barton Young, librarian; and Mr. J. Custance, of the surveyor's department. The subscribers, who attended to the number of 50, were accommodated in the Lecture Room of the Public Library.

The Poplar B.C. has decided to grant increases of salary to the following officials in the electricity department:—MR. W. INNES, assistant engineer, £265 increased to £277 10s. per annum; MR. E. R. INGRAM, mains superintendent, £185 increased to £197 10s. per annum.

The Aberdare U.D.C. has appointed MR. W. T. HILDER, shift engineer, as mains superintendent.

The Burton-on-Trent T.C. has increased the salary of the electrical engineer, MR. T. HALL from £200 to £225 per annum.



**General.**—The Leicester Education Committee have increased the salary of MR. A. E. CLAYTON, instructor in electrical engineering at the Technical Schools, from £160 to £170 per annum.

The *Review of the River Plate*, of December 29th, says:—"Engineer MAURO HERLITZKA has left for Europe on a business trip in connection with the various electrical companies in which he is interested."

MR. HUGH ROSE, foreman electrician, Locomotive Works, Inverurie, has been appointed engineer at Dunecht House, to Lord and Lady Cowdray. Mr. Rose, who has been in the service of the railway company for a long period, has had charge of the power and lighting at the Inverurie Works for the past six months. He has also had charge of the installation at the Palace and Cruden Bay Hotels.

General regret is felt in Huddersfield at the resignation from the Town Council of ALDERMAN ANDREW CHATTERTON, chairman of the Electricity Committee, and at a meeting of the Corporation last week, high appreciation was expressed of Mr. Chatterton's services during the 11 years he has been a member of the Council.

With reference to the dissolution of partnership of MESSRS. HOOGHWINKEL & THURSFIELD, consulting engineers, of Leeds and London, Mr. F. Thursfield is joining the staff of Messrs. Balfour, Beattie & Co., and his address, after February 1st, will be 22A, College Hill, Cannon Street, London, E.C.

We regret to learn that a note appearing under this heading in our issue of December 1st, 1911, is in some respects inaccurate. We now understand that MR. JENSEN was not assistant electrical inspector, but was a temporary assistant engineer engaged specially for the Durbar work. The resignation of MR. J. S. PITKEATHLY, the electrical inspector to the United Provinces, was in no way connected with the salaries of the Royal Engineer officers. These officers were appointed by the Government of India at Mr. Pitkeathly's own request to assist him in the Durbar electric lighting work, and his relations with them were pleasurable throughout. As long ago as last July, Mr. Pitkeathly asked the Government of the United Provinces to accept his resignation from the end of the Durbar.

**Obituary.**—MR. W. HAYNES, J.P.—The death occurred on Sunday of MR. WM. HAYNES, J.P., head of the firm of Haynes Bros., Ltd., electricians, Gabriel's Hill, Maidstone. Deceased, who was found dead in bed, was a former Mayor of Maidstone, a Justice of the Peace for the borough, and last June received the Honorary Freedom of the borough.

## NEW COMPANIES REGISTERED.

**Tramways (M.E.T.) Omnibus Co., Ltd.** (119,684).—This company was registered on January 13th, with a capital of £200,000 in £1 shares, to carry on the business of omnibus, van, motor-car and cab proprietors, carriers of passengers, parcels, goods and mails, motor and electrical engineers, contractors, &c., and to enter into contracts with the Metropolitan Electric Tramways, Ltd., and others. The subscribers (with one share each) are:—J. J. Gibbons, 5A, Lyric Road, Barnes, S.W., clerk; H. Munro, 6, Connaught Avenue, Chingford, clerk; J. McLeod, Canonbie Road, Honor Oak, S.E., accountant; A. O. Ingram, The Beeches, Carshalton, clerk; P. A. Godfrey, 34, Nairford Road, Upper Clapton, registrar; E. Boys, 74, Cromford Road, East Putney, S.W., secretary; T. Bower, 1, Kingsway, W.C., secretary. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £250; remuneration, £100 (chairman, £100 extra). Registered office, Electrical Federation Offices, 1, Kingsway, W.C.

**Telephone Duplicating Recorder Co., Ltd.** (119,644).—This company was registered on January 11th, with a capital of £200 in 195 pref. shares of £1 each and 100 ordinary shares of 1s. each, to acquire any existing agency, business or undertaking now engaged in the purchase and resale of an instrument or apparatus commonly known as "Gamble's Duplicating Telephone Recorder," and the purchase and resale of paper refills used in connection therewith. The subscribers (with one preference share each) are:—T. K. Irwin, 5, London Wall Buildings, E.C., engineer; G. F. Fergusson, 5, London Wall Buildings, E.C., merchant. Private company. The number of directors is not to be less than two; the subscribers are to appoint the first. G. F. Fergusson is the first secretary. Registered offices, 5, London Wall Buildings, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**"Z" Electric Lamp Manufacturing Co., Ltd.** (96,594).—Issue on December 15th, 1911, of £200 debentures, part of a series of which particulars have already been filed.

**Willans & Robinson, Ltd.** (40,660).—Debenture dated December 20th, 1911, to secure £40,000, charged on the company's undertaking and property, present and future, including uncalled capital, subject to indenture of mortgage and trust as regards certain freeholds and leaseholds. Holders: G. H. D. Coates, Rugby; and W. C. Buckley, Eden Place, Edmund Street, Birmingham.

**Bankfoot Power Co., Ltd.** (98,134).—Issue on December 23rd, of £22,200 debentures, part of a series of which particulars have already been filed.

**C. F. Casella & Co., Ltd.** (106,869).—Issue on December 15th, 1911, of £50 debentures, part of a series of which particulars have already been filed.

**Evershed & Vignoles, Ltd.** (43,266).—Particulars of £15,000 debentures, created December 6th, 1911, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £12,500. Property charged: The company's undertaking and property, present and future, including uncalled capital, and land and buildings at Acton Green. Trustees: London County and Westminster Bank, Ltd.

**Middleton Electric Traction Co., Ltd.** (68,935).—Particulars of £9,000 debentures, created December 19th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

**Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.** (107,917).—Trust deed dated December 13th, 1911, supplemental to trust deed dated June 14th, 1910, to secure £25,000 debenture stock, ranking *pari passu* with £80,000 debenture stock secured by principal deed, charged on various premises. Trustees: Right Hon. Lord Waleran, P.C., 44, Hans Mansions, S.W.; and Right Hon. Lord Rotherham, 61, Queen's Gate, W.

**Egham and Staines Electricity Co., Ltd.** (99,625).—Particulars of £5,000 debentures, created February 22nd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**South American Light and Power Co., Ltd.** (74,416).—Particulars of £150,000 debentures, created October 5th, and secured by trust deed dated December 7th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Premier Investment Co., Ltd., 9, New Broad Street, E.C.

**Midget Electric Lamp Manufacturing Co., Ltd.** (114,092).—Debenture dated December 30th, 1911, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Turner, jun., Shepherd's Bush, W.

**Thomas Kesnor & Co., Ltd.** (100,419).—Mortgage on certain land and buildings in Watford, dated December 28th, 1911, to secure all moneys due or to become due from the company to the London and South-Western Bank, Ltd., 170, Fenchurch Street, E.C. Also mortgage dated December 29th, 1911, to secure £260, charged on same property. Holders: W. Judge and G. A. Judge, Watford.

**Reason Manufacturing Co., Ltd.** (64,701).—Mortgage dated December 29th, 1911, to secure £1,000 and any other present or future indebtedness, charged on present and future indebtedness of Corporation of Stepney. Holders: Barclay & Co., Ltd., 54, Lombard Street, E.C.

**Hong Kong Tramway Co., Ltd.** (75,486).—Mortgage dated November 30th, 1911, executed in Ceylon and supplemental to trust deed dated July 1st, 1908, securing £195,000 debentures, charged on certain land and premises in Hong Kong. Trustees: Consolidated Trust, Ltd., Dashwood House, New Broad Street, E.C.

**Oswestry Electric Lighting and Power Co., Ltd.** (38,303).—Particulars of £1,500 debentures, created July 1st, 1910, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1903, the amount of the present issue being £1,000. Property charged: The company's property, present and future, including uncalled capital, but excluding book debts due to company for current supplied, subject to any legal priority attaching to the security already given to Parr's Bank, Ltd., to secure advance made by them. No trustees.

**Engineering Instruments, Ltd.** (66,427).—A memorandum of satisfaction in full on January 13th, 1912, of debentures dated from December 20th, 1906, to April 27th, 1909, securing £3,480, has been filed.

**Globe Electric Co., Ltd.** (102,289).—Particulars of £1,000 debentures, and £1,000 second debentures, created December 30th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amounts being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Electromobile Co., Ltd.** (75,139).—Issue on January 15th, 1912, of £163 10s. debentures, part of a series of which particulars have already been filed.

**Corona Lamp Works, Ltd.** (116,527).—Particulars of £20,000 debentures, created January 9th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,800. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A memorandum of satisfaction in full in January, 1912, of debentures dated July 10th, August 22nd, September 13th, October 10th, and November 9th and 21st, 1911, securing £2,000, has been filed.

**Woking Electric Supply Co., Ltd.** (46,175).—Issue on December 5th, 1911, of £1,400 debentures, part of a series of which particulars have already been filed.

**Frinton-on-Sea and District Electric Light and Power Co., Ltd.** (70,689).—Particulars of £3,000 debentures, created October 26th, 1905, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first debentures. No trustees.

**Electrical Power Storage Co., Ltd.** (30,313C).—Particulars of £30,000 debentures, created February 14th, 1907, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Ackroyd & Best, Ltd.** (54,600).—Issue on December 8th, 1911, of £6,700 debentures, part of a series of which particulars have already been filed.

**General Electric Co., Ltd.**—A statement of the total amount outstanding on July 1st, 1908, in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First mortgage, dated 1900, securing £200,000 first mortgage debenture stock.

**Consolidated Signal Co., Ltd.** (71,141). (Formerly known as Pneumatic Electric and General Engineering Co., Ltd.).—Return dated November 23rd, 1911. Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. 214 195 preference and 150,348 ordinary shares taken up. £1 per share called up on 24,998 preference and 27,840 ordinary. £52,839 paid. £311,904 considered as paid on 199,196 preference and 122,703 ordinary. Mortgages and charges: Nil.



**G. C. Milnes Voss & Co., Ltd.** (89,352).—A memorandum of satisfaction to the extent of £1,700 on November 30th, 1911, of debenture dated December 14th and Equitable charge dated December 15th, 1910, securing £1,950, has been filed. (The Equitable charge has been discharged.)

**W. R. Sykes Interlocking Signal Co., Ltd.** (93,078).—Return dated October 10th, filed October 19th, 1911. Capital, £50,000 in 10s. shares (87,500 "A" and 12,500 "B"). 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share called up on 42,297 "A"; 5s. per share credited as paid on the same. 10s. per share credited as paid on 12,500 "B." Mortgages and charges: £15,000.

## CITY NOTES.

### Yorkshire (West Riding) Electric Tramways Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the operations of the past 12 months, after providing for all expenses, including repairs, maintenance, and debenture interest, resulted in a net income of £19,037. Adding the amount of £2,000 brought forward, the available balance is £21,037, which has been appropriated as follows:—Depreciation, renewals and general reserve fund accounts, £7,465; written off preliminary expenses account, £13,572. The number of passengers carried during the past year amounted to 9,640,027, and the miles run to 1,785,696, as against 9,220,853 and 1,770,028 respectively, for the previous year.

The seventh ordinary general meeting was held on Friday last at 31, Throgmorton Street, E.C., Sir H. S. Leon, Bart., presiding.

The CHAIRMAN, in moving the adoption of the above report, said that the passenger fares had amounted to £64,463, and with £1,191 from parcels, advertisements, &c., they had a total revenue of £65,655. The passengers carried numbered 9,640,027, as against 9,220,853 last year, an increase of 419,174. The miles run were 1,785,696, as against 1,770,028 in 1910, an increase of 15,668, while the increase from passengers had amounted to £2,278. The passenger receipts had averaged 8'6d. per car-mile, against 8'4d. last year, an increase of 0'2d., and the total receipts from all sources had averaged 8'824d., compared with 8'572d., an increase of 0'252d. per car-mile. The increase in traffic was only normal, and was not to be attributed to the fine weather, as the district served by the company was not a good one for pleasure traffic. The working expenses had amounted to £31,477, which left a balance of £34,177 to be carried to the net revenue. As compared with 1910, the working expenses showed a decrease of £312, despite the fact that they had run 15,668 car-miles more. Theirs was a record for economy in working, the results attained not having been equalled by any other tramway or light railway in the kingdom. It was just as well that that was the case, because their revenue per car-mile was so low, and it would have been almost impossible for them to have existed if their expenses had been as high as other systems, which amounted, on the average, to 6'55d. per car-mile, while theirs were but 4'23d., and their percentage of expenses to receipts was only 47'94 per cent. This percentage was an improvement on last year, when it was 50'28 per cent. They considered that a remarkably good figure, but it had been bettered by no less than 2'34 per cent. Considering that they only took 8'824d. per car-mile in receipts, such a result was remarkable. All they wanted was more traffic to make the undertaking successful. The service they were giving in the district was capable of accommodating more than double the number of passengers now being carried without adding one penny to the expenses. From the net revenue they had deducted £15,343 for debenture interest, income-tax, directors' fees and general expenses, leaving a balance of £19,037; and adding the amount carried forward from the previous year they had a total of £21,037. The depreciation and renewals fund account and the general reserve fund account showed the amounts that should be in cash to provide for any renewals or for any exceptional call upon the yearly revenue. As a matter of fact, they never had been so—they never had had any ready money, and he had explained to them on previous occasions the difficulty they had had in financing the business without it. They had had to pay capital expenditure out of their reserves and their revenue, and had lived from hand to mouth. Their reserves had existed only on paper, and all their money, after paying the debenture interest, had had to be used to redeem the 6 per cent. bonds, and to pay capital charges that were necessarily incurred for the proper equipment of the undertaking. He thought they ought to have a cash reserve of £50,000 ready money on which they could put their hands in the event of anything happening out of the ordinary. Fortunately, they had been exceptionally free from serious accidents, but one never knew when they might be called upon to disburse a large sum to persons who might be injured in an accident of a grave character. Again, they must be prepared for extensive renewals in a few years' time. They were keeping the property in the best possible order by constant repairing, but there must come a time when renewals would be necessary, and they must be prepared and have cash ready to meet any call of this kind. Instead of having £43,540, the total amount of the renewals fund, reserve fund and special reserve for plant insurance, in hand in cash, they had really only £6,428. The remainder had been absorbed in the business, and was not available for its proper purpose. No other course was open to them. He had often explained this; but it was now, when there was a silver streak in their financial horizon, that he thought they must appreciate the wisdom of the past actions of the directors and must be satisfied that what was done was the only practicable

solution of the difficult situation in which they found themselves. During the year they had repaid the last of the 6 per cent. bonds, amounting to £12,000, so they were now entirely free of this incubus; and although they need only have paid £6,000 in the year, they paid off the whole sum of £12,000, and so saved a year's interest. He was happy to be able to say that they continued to live in peace and harmony with the numerous local authorities in their area. It was quite true that their attempt to abandon their powers to build light railways in the districts of Alverthorpe, Ardsley and Oulton, were strongly opposed before the Board of Trade last November by the various local authorities concerned, but, after all, such opposition was good-natured, and showed how the service they had rendered and were rendering to the districts, was appreciated and required. It was admitted that the tramways were a splendid success, so far as public utility and convenience were concerned, and their services were prized to such an extent that the authorities wished them to extend them, but it was forgotten and overlooked that the financial result was not equally enjoyable to those who had found the money. He could well understand the attitude of the local authorities. They did not care whether the tramways were a financial success or otherwise. They did not care whether the shareholders reaped any benefit from their enterprise or not; but they did want tramways, and they requested that they should make the lines for which they had powers quite regardless of the financial results. He would like to point out to the authorities concerned that if theoretically it was for the good of the public that town or county councils worried, and extorted money from, a company, in practice it was to the prejudice of the public. A company which had been subject to exactions which resulted in the useless expenditure of money not only could not do justice to shareholders, but could not provide the service for the people it would like to do. Everyone suffered; the public and the company, and local authorities should recognise that it was neither a wise nor a fair policy to seek to cripple the company which provided public utilities. If such a policy were carried out, it was quite certain that the service rendered by the company to the public would be inefficient and generally unsatisfactory all round. He did not think the local authorities really wished to oppress them, but they had had to spend a lot of time on this question. They had prepared estimates and considered the prospects from all standpoints, and were convinced the suggested routes could not pay if constructed, and therefore they did not intend to spend any money on them. The Board of Trade had decided to extend the time allowed for construction to November, 1912. Meanwhile they had made an offer to the local authorities, provided they would find the money for construction, to work the lines on their behalf at an agreed sum per car-mile. If this were refused, they would press their claim upon the Board of Trade for permission to abandon the unconstructed lines. Having referred to the fact that the board had last October voluntarily put in operation a new scale by which the staff would receive slightly increased wages, the chairman said that referring again to the appropriation account, as he had shown them all the money that should be in hand as a reserve had gone into the business, and they had a cash balance of £6,428 only. That money must be kept in hand. Therefore, it was quite impossible for them to pay a dividend on account of 1911, and the course they had taken, to write down the preliminary expenses, was the only possible one. He was certain no shareholder would wish them to commence paying dividends and then find that owing to quite temporary causes they were unable to continue. He did not want to be in such a position, and when they paid their first dividend on the preference shares, he wanted to feel that they were in a position to go on doing so, and that an indifferent half-year would not cause them to default. This was their policy. The prospects of the company had been brightening for some time past, and he thought he might be permitted to take some credit to himself for this; because if he had listened to some of his friends, and distributed dividends, the company would now have been in such a hopeless muddle as to preclude any chance of future ones, whereas now he thought he was in a position to say that provided everything went along smoothly, or that they did not run up against any exceptional expenditure, they would be able to declare a dividend for the six months ending June next, and he had every hope, after fully investigating the financial position, that they would be able to properly maintain such a dividend.

MR. B. NEWGASS seconded the motion.

Replying to a shareholder, the CHAIRMAN said he did not think there was any fear of motor-bus competition. As to how it was that their expenses were so extremely low, he was not in a position to enter into all the details, but the result was the outcome of efficiency and economy in every direction.

The report was adopted.

**Liverpool Overhead Railway Co.**—The accounts of this company for the half-year ended December 31st last, show an available balance of £13,439, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, which, with the 1 per cent. paid for the half-year ended June 30th last, makes 1½ per cent. for the year, against ¾ per cent. for last year. The balance of £4,763 will be carried forward to next half-year.

**Electric Construction Co., Ltd.**—The directors announce the interim dividend of 7 per cent. per annum on the preference shares for the half-year ended November 30th, payable on January 31st.



**City and South London Railway Co.**

THE report of the directors for the half-year ending December 31st, 1911, states that the receipts from all sources amounted to £91,040, and the cost of working was £43,291, leaving a profit of £47,748. Inclusive of the balance brought forward from June 30th last, the net revenue account shows an aggregate total of £50,589. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £35,165. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1½ per cent. per annum be paid upon the consolidated ordinary stock for the half year, leaving a balance of £2,815 to be carried forward.

Half-year (inclusive of estimated number of season ticket journeys.	No of passengers.	Receipts (including season tickets).	Div. per cent. per ann. on ord. stock.
June 30th, 1910 ...	12,357,324	£83,412 11 2	1½
December 31st, 1910	12,800,719	86,102 15 8	1½
June 30th, 1911 ...	13,318,622	87,590 11 8	1½
December 31st, 1911	12,840,839	85,316 14 5	1½

The amount carried forward, £2,815, compares with £1,788 in the corresponding period in 1910. The largely-increased amount proposed to be carried forward is not more than such as the directors think should be kept in hand, in view of further increases in wages to which they are committed under the agreement mentioned below, and in view also of increases in the cost of materials necessary to the working of the system. The peculiar form of competition to which the enterprise is exposed precludes the recouping of these increased costs by any corresponding increase in fares, such as is open to many other railway companies to adopt. The strike in August last caused a loss of receipts and occasioned outgoings amounting together to about £700. Omnibus and tramway competition has further developed; increased sums for local rates have become payable since 1910, and the exceptionally fine summer of 1911 was not favourable to underground travelling. Apart from the increase in expenses due to the greater mileage run, there is an increase of about £400 in wages, consequent on the concessions made under the terms of the agreement for rates of pay and hours of duty, announced in July, 1910, as having been made with certain classes of the staff. The construction of the subway referred to in the report for the half-year ended December 31st, 1910, providing easier access between the stations of the Metropolitan, Great Northern and City and this railway at Moorgate Street is well in hand.

**Prospectus.—Tramways (M.E.T.) Omnibus Co., Ltd.—**

The list is to close to-day in an issue of £100,000 4½ per cent. guaranteed debenture stock of this company which is offered by the Electric and General Investment Co. at 96½. The stock is guaranteed unconditionally both as to principal and service fund by the Metropolitan Electric Tramways, Ltd. The company has an authorised share capital of £200,000, divided into shares of £1 each, of which 100,000 have been subscribed by the Metropolitan Electric Tramways, and a similar number by the B.E.T. Co.; 1s. per share has been paid up. The company intends to operate services of motor-omnibuses primarily as feeders in connection with the system of electric tramways and light railways worked by the Metropolitan Electric Tramways, Ltd. The proceeds of the issue will enable the omnibus company to purchase 100 new motor-omnibuses and to provide the necessary garages and equipment, and leave a margin for contingent requirements.

**Metropolitan Railway Co.**—For the past half-year the directors recommend a dividend at the rate of 1½ per cent. per annum on the consolidated stock, carrying forward £9,200. A year ago 1½ per cent. per annum was paid, and £9,498 was then carried over. The dividend on the surplus lands stock is also announced for the past half-year at the rate of 2½ per cent. per annum, the same as a year ago.

**Allis-Chalmers Co.**—We read in the *Electrical World* that an announcement was issued on December 30th to the effect that interest on the first mortgage 5 per cent. bonds due January 1st would not be paid. Our contemporary, however, says that a receivership is not a necessary consequence of this announcement. The bondholders' and stockholders' committees are working in harmony with the company on measures that will accomplish the conservation of the property, and plans are under consideration which may place the company in a better condition than ever.

**Metropolitan District Railway Co.**—Subject to final audit of the accounts, the directors have decided to recommend the payment of a dividend on the 4 per cent. guaranteed stock for the six months ended December 31st, 1911, at the rate of £4 per cent. per annum, the same as in the corresponding period of last year. The directors have also decided to recommend the payment of a dividend on the first preference stock of the company for the six months ended December 31st, 1911, at the rate of £4 10s. per cent. per annum, as against £3 10s. per cent. per annum in the corresponding period of last year, and the payment of a first dividend on the 5 per cent. second preference stock of the company for the half-year ended December 31st, 1911, at the rate of £2 per cent. per annum, £10,000 has been reserved for renewals, and the carry forward is £2,000.

**Dundee and Broughty Ferry and District Tramway Co., Ltd.**—The directors have declared an interim dividend at the rate of 6 per cent. on the preference stock

**London United Tramways, Ltd.**

THE report of the directors to be submitted at the meeting to be held at Winchester House, E.C., on Tuesday, January 30th, states that the operation of the company's undertaking during the year ending December 31st, 1911, resulted in the gross receipts amounting to £343,987, and the working and general expenses, maintenance and repairs to £219,033, leaving, with the balance brought forward from last account, a net revenue of £125,768. After payment of interest on debenture stock and loans for the year, and providing for income-tax, there remains a balance of £56,432, an increase of £25,618 as compared with the preceding year. The available revenue would have sufficed for a dividend distribution on the preference shares, but the directors consider that in the company's best interests it is advisable for this year to continue to strengthen the reserves by appropriating the sum of £30,000 to a general reserve. Of the remaining balance the directors propose to place £25,000 to reserve for renewals and contingencies, and to carry £1,432 forward to next year's accounts. With the amount now added, the reserve for renewals and contingencies will total £76,033. The gross receipts show an increase of £10,328, and the working expenses a decrease of £15,178, resulting in an increase in net revenue of £25,506 as compared with the previous year. The number of passengers carried during the year was 62,547,128, an increase of 2,414,677 over the number carried during the preceding year. The undertaking has been well maintained and extensive improvements made to the permanent way during the year; 7,500 rail joints have been repaired by the cast welding process, making a total of 11,250 joints similarly dealt with to date. This method of levelling up the rail joints and thus improving the surface of the rails has proved very efficient, and has resulted in smoother running of the cars. The total cost of improvements made during the year, including the balance of expenditure on improvements to the power house, commenced in the previous year, amounted to £18,365, of which £16,265 has been charged to the reserve for renewals and contingencies. Forty cars have been equipped with covered tops, completing the number of 100 cars which it was intended to so equip. The Bill promoted by the company in the last session of Parliament extending the time for one year for the electrification of the tramway along Kew Road, Richmond, received the approval of Parliament. The company is promoting a Bill in the ensuing session of Parliament seeking powers for a further extension of time for the construction of the Kew Road line. Provision is also made in the Bill for the abandonment of the line unless the Richmond Corporation shall have exercised their powers to purchase the tramway, or, in the alternative, given their consent to the use of the overhead trolley system. The directors are still unable to place before the shareholders any definite information with regard to the sale to the London County Council of the company's tramways within the Borough of Hammersmith.

**London Electric Railway Co.**—The directors recommend a dividend at the rate of 1 per cent. per annum on the ordinary stock for the past half-year, with the transfer of £7,500 to renewal account, carrying forward £2,400. This time last year ¾ per cent. per annum was paid, a similar amount was placed to renewal account, and £3,474 was carried forward.

**Stock Exchange Notices.**—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Central London Railway Co.—£385,000 4½ per cent. preference stock, in lieu of the scrip, together with £95,000 additional 4½ per cent. preference stock.  
Para Electric Railways and Lighting Co., Ltd.—45,000 additional 6 per cent. cumulative preference shares of £5 each fully paid, Nos. 70,001 to 115,000.

**St. James' and Pall Mall Electric Light Co., Ltd.**—The directors recommend a balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1911, of 3s. 6d. per share, and 5s. per share on the ordinary shares, making with the interim dividend paid thereon a total distribution of 10 per cent. The dividend for 1910 was at the same rate.

**Direct United States Cable Co., Ltd.**—The board have resolved upon the payment of an interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum for the quarter ending December 31st, 1911, payable on and after the 31st inst.

**Blackpool and Fleetwood Tramroad Co.**—The directors have declared a dividend for the half-year at the rate of 9 per cent. per annum and a bonus at the rate of 1 per cent. on the ordinary shares, both free of tax.

**STOCKS AND SHARES**

Tuesday Evening.

ACTIVITY in the Stock Exchange remains centred round the comparatively few spots of interest. Amongst these, the various issues connected with London traffic absorb the greater amount. Since we were last writing, there has been a recurrence of the gambling in Districts, Underground Electric income bonds, and London United Tramways, as well as in the Ordinary stock of the London General



ELECTRIC TRAMWAY AND RAILWAY  
TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen ..	Jan. 17	2,765	+ 251	33	50,276	+ 2,891	..	..
Ayr ..	" 20	362	+ 10	36	11,625	+ 189	8	..
Bath ..	" 20	1,372	+ 65	3	2,127	+ 150	..	..
Birkenhead ..	" 21	2,088	+ 119	42	48,560	+ 1,775	13.68	..
Birmingham Corp.	" 13	21,243	+ 7,067	41	360,541	+ 75,449	56.8	..
Blackburn ..	" 17	2,026	+ 222	42½	49,576	+ 4,185	14.6	..
Blackpool Corp.	" 18	841	+ 140	..	59,900	+ 7,829	..	..
Blackpool-Fleetw'd	" 20	439	+ 61	2	730	+ 19	..	..
† Bolton ..	Dec. 2	2,412	+ 172	36	90,575	+ 6,040	26	..
Bournemouth ..	Jan. 17	3,010	+ 345	42	76,178	+ 165	21.9	..
Bradford ..	" 14	9,953	+ 225	41	226,405	+ 14,204	56	1.2
Brighton ..	" 21	1,579	+ 188	42½	44,472	+ 2,515	9.5	..
Bristol ..	" 19	12,232	+ 3,566	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie ..	Jan. 12	614	+ 149	2	535	+ 129	3.65	..
Barnsley ..	" 12	365	+ 23	..	292	+ 23	..	..
Barrow ..	" 12	194	+ 159	..	495	+ 131	5.87	..
Devonport ..	" 12	1,048	+ 166	..	912	+ 151	8.85	..
Gateshead ..	" 12	2,175	+ 99	..	1,775	+ 68	11.25	..
Gravesend ..	" 12	423	+ 53	..	347	+ 40	6.5	..
Greenock ..	" 12	1,259	+ 185	..	1,137	+ 111	7.25	..
Hartlepool ..	" 12	501	+ 72	..	416	+ 62	6.72	..
Kidderminster ..	" 12	188	+ 17	..	148	+ 8	..	..
† Leamington ..	" 12	244	+ 31	..	242	—	2	..
Merthyr ..	" 12	399	+ 43	..	329	+ 33	2.9	..
Metropolitan ..	" 12	17,046	+ 1,978	..	14,213	+ 1,511	22	..
Middleton ..	" 12	185	—	8	473	+ 1	8.5	..
Mid. Joint Com'tee	" 12	5,983	+ 164	..	4,978	+ 263	..	..
Oldham—Ashton	" 12	1,130	+ 73	..	933	+ 64	9.13	..
Peterborough ..	" 12	236	+ 10	..	189	+ 25	5.31	..
Potteries ..	" 12	4,020	+ 250	..	3,394	+ 226	29	..
Rothsay ..	" 12	153	+ 30	..	134	+ 29	2.75	..
Southport ..	" 12	487	+ 25	..	429	+ 23	8.17	..
S. Metropolitan ..	" 12	1,515	+ 114	..	1,235	+ 78	..	..
Swansea ..	" 12	2,251	+ 198	..	1,909	+ 160	12.5	..
Tynemouth ..	" 12	301	—	19	252	—	13	3.75
Weston-s-Mare ..	" 12	56	+ 19	..	51	+ 20	8	..
† Worcester ..	" 12	515	+ 10	..	434	—	5.75	..
Wrexham ..	" 12	201	+ 22	..	162	+ 18	..	..
Yorks. Wool. Dist.	" 12	2,226	+ 217	..	1,849	+ 98	17	..
Miscellaneous ..	" 12	415	+ 16	..	312	+ 10	..	..
Burnley ..	Jan. 20	2,616	+ 231	..	..	..	11.7	..
Burton-on-Trent ..	" 21	528	+ 54	42	12,257	+ 640	6.6	..
† Bury ..	" 14	1,163	+ 114	40½	53,294	+ 4,369	22.5	..
Cardiff ..	" 10	4,647	+ 532	43	103,937	+ 7,743	..	..
Chatham and Dist.	" 19	1,572	+ 17	3	2,049	—	40	15
Cork ..	" 18	913	+ 58	3	1,176	+ 30	9.89	..
Croydon ..	" 12	3,373	+ 283	41	74,446	+ 5,104	11.4	..
Darlington ..	" 20	438	+ 53	43	9,543	+ 897	..	..
Darwen ..	" 19	471	+ 27	42	11,361	+ 806	4.36	..
Dover ..	" 13	410	+ 46	41	10,696	+ 1,439	4.75	..
Dublin ..	" 19	10,914	+ 619	..	15,019	+ 1,129	54.2	..
Dundee ..	Dec. 22	2,212	+ 57	27	12,513	—	760	15
East Ham ..	Jan. 10	2,114	+ 327	42	46,616	+ 2,666	15	7.13
Exeter ..	" 19	546	+ 46	42	14,564	+ 964	5.5	..
Glasgow ..	" 20	24,564	—	143	637,573	+ 23,023	98	25
Hastings ..	" 18	1,441	+ 57	..	..	+ 203	..	..
Huddersfield ..	" 20	3,121	+ 104	42	81,188	+ 7,559	29.5	1
Hull ..	" 23	6,025	+ 512	42	124,206	+ 6,886	14.5	..
Ilkeston ..	" 18	250	+ 26	42	5,661	+ 123	..	..
Ipswich ..	" 20	648	+ 41	42	18,906	+ 1,011	10.5	..
Kilmarnock ..	" 13	372	+ 37	55	6,837	+ 412	4.25	..
Lancashire United	" 17	2,335	+ 45	3	3,078	+ 31	39	..
Leeds ..	" 13	14,475	+ 926	41	312,065	+ 21,175	50.75	2
† Leicester ..	" 20	5,062	+ 595	..	..	..	..	..
Leith ..	" 20	1,166	+ 95	35	23,524	+ 1,859	8.7	..
Liverpool ..	" 13	24,377	+ 2,095	..	23,361	+ 2,042	116	..
† L.C.C. ..	" 10	87,612	+ 4,820	..	1,602,470	+ 91,111	138.4	6
London United ..	" 20	10,862	+ 479	..	15,749	+ 649	..	..
Lowestoft ..	" 20	291	+ 7	16	2,760	+ 48	8.5	..
Manchester ..	" 20	31,148	+ 1,440	42	637,315	+ 86,589	113	..
Newcastle ..	" 20	8,135	+ 434	..	181,883	+ 14,254	14.5	..
Newport ..	" 13	1,882	+ 94	41	29,344	+ 1,035	14.5	..
Oldham ..	" 21	3,596	+ 175	43	83,636	+ 3,870	23.75	5
Pontypidd ..	" 20	774	+ 39	42	17,610	+ 56	5.5	..
Portsmouth ..	" 13	3,735	+ 262	41	92,450	+ 6,770	15.25	..
Preston ..	" 17	1,409	+ 65	42	33,236	+ 2,465	..	..
Rotherham ..	" 18	1,909	+ 98	41½	29,170	+ 2,314	12	..
Salford ..	" 15	9,445	+ 513	41½	203,444	+ 9,019	..	..
Sheffield ..	" 23	12,811	+ 682	..	280,649	+ 17,989	40	..
Southampton ..	" 17	2,350	+ 334	42	52,427	+ 6,014	22	..
Southend-on-Sea ..	" 17	923	+ 100	42	29,351	+ 4,491	..	..
South Shields ..	" 20	1,114	+ 68	42	26,615	+ 2,885	..	..
† Swindon ..	" 10	152	+ 26	..	6,673	+ 732	..	..
Tyneside ..	" 17	810	+ 90	3	1,021	+ 81	..	..
Wallasey ..	" 13	2,129	+ 271	40½	45,960	+ 6,084	..	..
Walthamstow ..	" 20	1,318	+ 158	42	31,812	+ 1,965	9	..
West Ham ..	" 11	5,840	+ 475	41	112,368	+ 9,758	15.25	..
Wolverhampton ..	" 17	1,836	—	17	41,812	+ 2,087	25	..
Cen. London Rly.	" 20	10,431	—	671	15,475	—	1,332	6.32
† City & S. Lon. Rly.	" 21	8,615	—	10	10,349	—	513	7.26
Dublin-Lucan Rly.	" 19	216	+ 14	3	298	+ 3	7	..
G.N. and City Rly.	" 20	8,448	+ 224	3	5,161	+ 312	8.5	..
L'pool Overh'd Rly.	" 21	2,890	+ 143	..	4,318	+ 220	6.8	4.3
Llandudno-Col. Bay	" 19	254	+ 86	7.5	1,003	+ 125	..	..
Lon. Elec. Ry. Co.	" 20	30,640	+ 1,555	8	45,585	+ 1,650	21.25	..
Mersey Railway ..	" 20	4,221	+ 80	8	6,392	+ 121	4.5	..
Metropolitan Rly.	" 21	25,092	+ 855	3	62,745	+ 633	25.75	..
Met. District Rly.	" 20	25,518	+ 1,328	3	38,058	+ 1,758	25	..
Anglo-Argentine ..	" 21	99,119	+ 2,467	..	150,544	+ 2,579	..	..
† Auckland ..	Dec. 15	18,078	+ 1,867	6	99,479	+ 8,038	23.31	..
Bombay (B.E.T.) ..	" 8	8,789	+ 8,242	49	146,254	+ 11,943	..	..
† Brisbane ..	Dec.	24,130	+ 3,105	52	252,100	+ 80,555	..	..
Brit. Columbia Rly.								
Calcutta ..	Jan. 22	8,605	+ 1,321	..	..	+ 3,414	..	..
Cape Electric T.Ld.								
† Kalgoorlie, W.A. ..	Dec.	8,389	..	..	41,333	..	20.5	..
† Lisbon ..								..
Madras ..	Jan. 15	1,570	—	102	..	..	..	..
† Montevideo ..	Dec.	29,043	+ 2,419	2	55,707	+ 4,947	..	..
Perth (W.A.) ..	Jan. 19	3,915	+ 521	..	5,523	+ 871	29	..

\* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts.

§ One month.

Omnibus Company, the huge increase in the price of the latter being accountable in no small degree for the rise in hopes and prices in respect of other stocks and shares. Marconis, too, are a very lively market, and West India and Panama shares fluctuated wildly.

The struggle for control of the London General Omnibus Company has brought about a check to the long ascent in the price. It was on Monday that the decline started, and with it came a sharp setback in the price of Underground Electric income bonds, which had been up to 85 a few days previously, but which slipped back again to 80. The shares are lower at 2½, but the market as a whole shows a good deal of strength, and the satisfactory dividend announcement by the London Electric Railways Company has helped to keep prices up. The District dividend, too, makes a good showing, and Districts, after rising to nearly 36, still show a gain on the week at 33½. Metropolitan Consolidated sagged off slightly, despite a fairly good dividend announcement. It was only in the last issue of this journal that we were drawing attention to Great Northern and City Preferred Ordinary shares as the only ones amongst Tube Railways that had not moved during the recent excitement over Underground Railways. Someone apparently has taken the hint or noticed the same thing, the price at 35s. now showing a rise of 12s. 6d. per share. There are comparatively few about, the market is a limited one, and to the gambler £10 shares at such a price present attractive possibilities when there is anything doing in similar securities.

City and South London again suffered by reason of what is considered a disappointing dividend, and this reacted upon Central London Ordinary, which fell 1, while the Preferred and Deferred remain weak. London United Tramways Preference went back to 3½, the advent of another motor-omnibus company rather chilling the recent bullishness.

Marconis, which have been in the front rank of active shares, jumped from 3½ to 3¾, reacting a little from the top, and the Preference shares have come up from 2½ to a full 7s. 6d. higher. Apparently the weak account which the last Stock Exchange settlement revealed has been thinned out; at all events, support is being given to the shares. West India and Panama Telegraphs, which have been running Marconis's very close in the amount of speculative interest, soared to 5½, at which price heavy selling took place on the part of those who had good profits to secure, and back came the quotation to 4½ with a run. The rise on balance this week is 1½. The buying of these shares is based on what may be expected by the company when the Panama Canal is opened for traffic; and although this latter event is still some way ahead, the excellent progress which the Telegraph Company has been making of late years is considered sufficient to justify a stride in the quotation for the shares. Both Preference issues are higher.

Apart from Marconis's and Panama Telegraphs, there is not much doing in this section. Little practical attention has been given to the idea of the United States taking over for the State, the telegraph and telephone business of the country. Anglo-American Deferred is ½ down, on anticipations of a reduction in the dividend, and a similar fraction came off the price of Direct United States Cable shares. West Coast of America are ¾ harder. National Telephone stocks continue to dwindle, falls being marked in the Preferred and Deferred. Globe Telegraph Preference gained ¼ upon a slight investment demand. New York Telephone Bonds have again improved, but Mackay Common slipped back \$2 in sympathy with the uncertainty in the American Railway market.

English Electricity Supply shares are remarkably quiet, the only quotable change being ¼ rise in City of London Ordinary. There is some demand for Debenture stocks, in which County First Debenture, Midland Electric Debenture, Edmundson's and Urban Debenture, have participated to the extent of ½ to 2 per cent.

There has been a big recovery in Sao Paulo Light and Power, lifting the price once more to almost 200. Montreal Light, Heat and Power is very nearly the same price. This department, as a whole, is good, with the exception of British Columbia issues, which have given way generally. The fall in the latter has extended to the Debentures, the offer of new Vancouver Debentures causing sales of the other securities. Bonds in this section are distinctly firm. Rio Trams have gone ahead after their fall, and at one time got up to 118½, reacting later to 117. Mexico Trams are better as regards the Common shares and the 5 per cent. Bonds. Shawinigan issues have hardened, the Capital stock gaining 3. Canadian General Common went up 3½ points, although the Preferred fell 1. The business being done in these descriptions is on a large scale, and the dealers in this department have as much as they can do to cope with the work brought to them.

The recent big rise in River Plate Ordinary stock, taking it to 255, has drawn attention to some of the other Argentine issues, amongst which are La Plata Trams Ordinary shares—the price of these is about 14s. middle. The company is making good progress. Manaos Trams, which were introduced into the market not long since, are about a shilling higher in price. This, of course, is not the place for giving tips, but, as a speculative investment, the La Plata Trams, at all events, seem well worth looking up. The recent little spurt in Kalgoorlie Electric Power Ordinary shares, which took the price up to 7s. 6d. middle, has subsided somewhat, and the quotation is a shade easier at 7s. middle, the 6 per cent. Preference being 15s. United Electric Trams of Monte Video are slightly lower, but Para Electric Ordinary have risen ½, Calcutta Preference gaining an equal amount.

Amongst manufacturing shares, Babcock & Wilcox are ½ down this week, after their steady rises for so long. Henleys eased off to 12½, and other manufacturing issues are firm. The rubber market has quieted down, business falling away, to some extent, and causing a mild reaction in the prices of the leading shares, but a rally in the raw stuff occurred on Tuesday afternoon, and the share market again improved.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 23rd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 23rd.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. . .	10	5½	5½	7½—8½	..	6 5 9	Kensington & Knightsbridge, Ord	5	9	8½	6½—7½	..	5 4 2
Do. 4½ % Pref. . . . .	10	4½	4½	8½—9½	..	4 12 4	Do. 4 % Deb. . . . .	Stock	4	4	94—96	..	4 3 4
Do. Second 6 % Pref. . . . .	10	6	6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. . .	Stock	4½	4½	78—82 xd	..	5 9 9
Do. 4½ % Deb. Stock . . . .	Stock	4½	4½	10½—102	..	4 8 8	London Electric, Ord. . . . .	8	2	1½—2	..	3 0 2	
Brompton & Kensington, Ord. . .	5	10	9½	8—8½	..	5 17 8	Do. 6 % Pref. . . . .	5	5	6	4½—4½	..	6 3
Do. 7 % Cum. Pref. . . . .	5	7	7	7½—8	..	4 7 6	Do. 4 % First Mort. Deb. . . .	Stock	4	4	85—91	..	4 8 0
Central Electric Supply, 4 %	100	4	4	98—101	..	8 19 3	Metropolitan . . . . .	5	5	4½	8½—4	..	6 5 0
Guar. Deb. . . . .							Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5	5½	8½—4	..	6 5 0	Do. 4½ % First Mort. Deb. . .	Stock	4½	4½	99—104	..	4 6 7
Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—4½	..	4 14 9	Do. 8½ % Mort. Deb. . . . .	Stock	8½	8½	84—87	..	4 0 6
Do. "City Undertaking" }	5	4½	4½	8½—4½	..	5 9 1	Midland Electric Corporation }	100	4½	4½	95—97	+ ½	4 12 9
4½ % Cum. Pref. }							4½ % First Mort. Deb. }						
Do. Do. 4 % Deb. . . . .	100	4	4	93—96	..	4 8 4	Newcastle-on-Tyne . . . . .	5	4	4½	8½—4	..	5 0 0
helsea, Ord. . . . .	5	5	4½	4—4½	..	5 11 1	Do. 5 % Pref., Non-Cum. . . .	5	5	5	4—4½	..	5 11 1
Do. 4½ % Deb. . . . .	Stock	4½	4½	98—101	..	4 9 1	North Metropolitan Power Sup-	100	5	5	99—102	..	4 18 0
City of London, Ord. . . . .	10	7	6½	13½—13½	+ ½	5 2 9	ply, 5 % Mortgages (Red.) }						
Do. 6 % Cum. Pref. . . . .	10	6	6	12—13	..	4 12 4	Notting Hill, 6 % Non-Cum.	10	..	..	9½—10½	..	..
Do. 5 % Deb. . . . .	Stock	5	5	117—121	..	4 2 8	Pref. }						
Do. 4½ % Second Deb. . . .	100	4½	4½	100—103	..	4 7 5	Oxford . . . . .	5	7½	6½	6½—6½	..	5 9 5
County of Durham, 5 % First	Stock	5	5	87—89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10	10½	8—8½	..	5 17 8
Mort. Deb. }							Do. 7 % Pref. . . . .	5	7	7	6½—7½	..	4 19 1
County of London, Ord. . . .	10	5	4½	9—9½	..	5 5 3	Do. 8½ % Deb. . . . .	100	8½	8½	85—87	..	4 0 6
Do. 6 % Pref. . . . .	10	6	6	11—11½	..	5 4 4	Smithfield Markets, Ord. . . .	5	Nil	..	1½—1½	..	Nil
Do. 4½ % Deb. . . . .	Stock	4½	4½	107—109	+ 1	4 2 7	South London, Ord. . . . .	4	5	..	2½—8½	..	6 3 1
Do. 4½ % Second Deb. . . .	Stock	4½	4½	100—103	..	4 7 5	Do. 5 % First Mort. Deb. . . .	100	5	5	98—101	..	4 19 0
Edmundson's, Ord. . . . .	5	Nil	Nil	2—2	..	Nil	South Metropolitan, 7 % Pref. .	1	7	7	1—1½	..	6 4 5
Do. 6 % Cum. Pref. . . . .	5	Nil	Nil	2—2½	..	Nil	Do. 4½ % First Deb. Stock . .	100	4½	4½	96—99	..	4 10 11
Do. 4½ % First Mort. Deb. .	100	4½	4½	83—86	+ 1	5 4 8	Urban, Ord. . . . .	5	5	..	1—1½	..	..
Folkestone . . . . .	5	6	6½	4½—5	..	6 0 0	Do. 5 % Cum. Pref. . . . .	5	5	..	2—2½	..	..
Do. 5 % Cum. Pref. . . . .	5	5	5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb. . .	100	4½	4½	88—90	+ 2	5 0 0
Do. 4½ % First Deb. . . . .	100	4½	4½	95—98	..	4 11 10	Westminster, Ord. . . . .	5	10	10½	7½—8½	..	5 1 2
Hove . . . . .	5	9	8½	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—5½	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. . . . .	5	6	6	5½—5½	..	5 4 4	Monterey Rly. Light & Power, }	100	5	5	89—91 xd	..	5 10 0
Calcutta, Ord. . . . .	5	8½	7½	6½—6½	..	6 6 0	5 % 1st Mort. Deb. }						
Do. 5 % Pref. . . . .	5	5	5	5—5½	..	4 15 3	Montreal, Lt., H. and Power . .	\$100	7	8	195—200	+ 1½	3 10 0
Calgary Power, 1st Mort. Bds.	100	5	5	93½—95½	..	5 4 9	Northern, Lt., Power and Coal, }	\$500	5	..	39—41	..	12 3 10
Canadian Gen. El. Com. . . .	\$100	7	7½	118—120	+ 3½	5 16 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. . . . .	\$100	7	7	117—121	— 1	5 15 8	River Plate, Ord. . . . .	Stock	10	..	250—260	..	3 16 11
Cordoba Lt., Power and T., Ord.	1	3	3½	7—1	..	3 0 0	Do. 6 % Non-Cum. Pref. . . .	Do.	6	6	107—113	..	5 7 2
Do. 5 % Deb. . . . .	100	5	..	94—97	..	5 3 1	Do. 5 % Deb. Stock . . . . .	Do.	5	5	100½—102½	..	4 17 7
Eleo, Lt. and P. of Cochabamba, }	100	6	6	91—98	..	6 9 0	Roy. Elec. Co., Montreal, 4½ % }	100	4½	4½	99—101	..	4 9 1
6 % Bonds }							1st Mort. Deb. }						
Eleo. Supply Victoria, 5 % 1st	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital . .	\$100	4	5½	128—130	+ 3	8 1 7
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	105½—107½	+ ½	4 13 0
Eleo. Dev. Ontario, 5 % 1st	\$500	5	5	92—94	..	5 6 5	Do. 4½ % Per. Deb. . . . .	Stock	4½	4½	103—105	+ ½	4 5 9
Mort. Bonds }							Toronto Power, 4½ % Deb. . .	Do.	4½	4½	99—101	..	4 9 1
Kalgoorlie Eleo. P. and L., Ord.	10½	Nil	..	5½—3½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	91—93	..	5 7 6
Do. 6 % Pref. . . . .	1	6	6	102—104	..	7 7 8	1st Mort. Deb. }						
Kamintiquia Power, 5 % G. Bs.	\$500	5	5	102—104	..	4 16 2	Victoria Falls Power, Pref. . .	1	Nil	11½d.	1½—1½	..	..
Madras, Ord. . . . .	5	..	..	28—3½	..	..	West Kootenay Power and Lt., }	100	8	6	106½—108½	..	5 10 7
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101—103	+ 1	4 17 1	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87—89	..	5 12 4							
Mexican Lt. & Power, Common	\$100	4	4½	87½—89½ xd	+ 1½	4 5 5							
Do. 7 % Cum. Pref. . . . .	\$100	7	7	107½—109½	..	6 7 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	98—100	+ ½	5 0 0							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph . . . . .	10	Nil	4½	7—7½	..	..	Monte Video Telephone, Ord. . .	1	6	6	1½—1½	..	5 12 11
Do. 5 % Deb. Red. . . . .	Stock	5	5	97—99	— 1	5 1 0	Do. 5 % Pref. . . . .	1	5	5	1½—1½	..	5 6 6
American Telep. & Teleg., Cap.	\$100	8	8½	144—146	..	5 9 7	National Telephone, Pref. . .	Stock	6	6½	100—103 xd	— 1½	5 16 6
Do. Collat. Trust . . . . .	\$1000	4	4	93—95	..	4 4 3	Do. Def. . . . .	Do.	6	6½	121½—123½ xd	..	4 17 2
Anglo-American Telegraph . .	Stock	8½	3½	67—69	..	5 8 8	Do. 6 % Cum. 1st Pref. . . .	10	6	6	9½—10 xd	..	6 0 0
Do. 6 % Pref. . . . .	Do.	6	6	111—112	..	5 7 2	Do. 6 % Cum. 2nd Pref. . . .	10	6	6	9½—10 xd	..	6 0 0
Do. Def. . . . .	Do.	30½	..	26½—27	— ½	5 11 1	Do. 5 % Non-cum. 3rd Pref. .	5	5	5	5½—5½	..	4 9 11
Anglo-Portuguese Tel., 5 % }	100	5	5	101½—103½	+ ½	4 16 7	Do. 8½ % Deb. . . . .	Stock	8½	8½	98—100	..	3 10 0
Mort. Deb. }							Do. 4 % Deb. . . . .	Do.	4	4	98—100	..	4 0 0
Chill Telephone . . . . .	5	7	..	7½—7½ xd	+ ½	4 14 1	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	+ ½	4 7 0
Commercial Cable, Stlg. 4½ Deb.	Stock	4	4	86—88	..	4 10 11	Oriental Telep. and Eleo. . .	1	8	..	1½—1½	..	4 13 6
Cuba Telegraph . . . . .	10	6	6½	10½—11	..	5 9 1	Do. 6 % Cum. Pref. . . . .	1	6	6	1½—1½	..	4 13 8
Do. 10 % Pref. . . . .	10	10	10	17—18	..	5 11 1	Do. 4 % Red. Deb. . . . .	Stock	4	4	87—89	..	4 9 11
Direct Spanish Telegraph, Ord.	5	4	4½	8½—8½	..	5 6 8	Pacific and European Tel., 4 % }	Do.	4	4	98½—100½	..	3 19 7
Do. 10 % Cum. Pref. . . . .	5	10	10	8½—8½	..	5 14 8	Guar. Debs. }						
Do. 4½ % Debs. . . . .	50	4½	4½	98½—100½	..	4 9 7	Reuter's . . . . .	8	5	5½	8½—9½	..	4 6 6
Direct United States Cable . .	10	4½	..	7½—9½	— ½	5 9 1	Submarine Cables Trust . . .	Cert.	6	6	130—133	..	4 10 3
Direct W. India Cable, 4½ % }	100	4½	4½	18½—100½	..	4 9 7	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	98—100	..	4 10 0
Reg. Deb. }							Deb. Red. }						
Eastern Telegraph, Ord. Stock	Stock	7	5½	136—13½	— 1	5 0 9	United River Plate Telephone .	5	8	8	7½—7½	..	5 4 11
Do. 8½ % Pref. Stock . . .	Do.	3½	3½	83—85 xd	..	4 2 4	Do. 5 % Cum. Pref. . . . .	5	5	5	5½—5½	..	4 8 11
Do. 4 % Mort. Deb. . . . .	Do.	4	4	100—102	— 1	3 18 5	West Coast of America . . .	2½	2½	2½	1½—1½	+ ½	4 3 4
Eastern Extension . . . . .	10	7	5½	13½—13½ xd	..	5 1 10	Do. 4 % Debs., 1 to 1,500 }	100	4	4	98½—100½	..	3 19 7
Do. 4 % Deb. . . . .	Stock	4	4	100½—102½	..	3 18 1	guar. by Braz. Sub. Tel. }						
East and S. Africa Tel. 4 % }	25	4	4	99—101	..	3 19 3	West India and Panama Teleg.	10	1½	1½	4½—4½	+ ½	..
Mt. Db. Mauritius Sub. }							Do. 6 % Cum. 1st Pref. . . .	10	6	6	10½—11	+ ½	5 9 1
Globe Telegraph and Trust . .	10	5½	6½	10½—11½	..	5 6 8	Do. 6 % Cum. 2nd Pref. . . .	10	6	6	10—10½	+ ½	5 14 4
Do. 6 % Pref. . . . .	10	6	6	13—13½	+ ½	4 9 0	Do. 5 % Debs. . . . .	100	5	5	102—104	..	4 16 2
Great Northern Telegraph . .	10	18	5½	82—83	..	5 9 1	Western Telegraph, Ltd. . . .	10	7	6½	13½—14	..	5 0 0
Indo-European Telegraph . .	25	13	5½	56½—58½	..	5 10 2	Do. 4 % Deb. . . . .	Stock	4	4	99—101	..	3 19 3
Mackay Companies Common . .	\$100	5	5½	78—81	— 2	6 3 5	Western Union Tel., 4½ Bnds. A	\$1000	4	4	106—109	..	3 18 5
Do. 4 % Cum. Pref. . . . .	\$100	4	4	69—72	..	5 11 1	Do. 4½ % Fdg. Bonds . . . .	\$1000	4½	4½	101—104	+ 1	4 6 7
Marconi's Wireless Telegraph	1	5	..	3½—3½	+ ½	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	3—3½	+ ½	..							

\* Unless otherwise stated, all shares are fully paid. } Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 23rd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 23rd.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil	1/2 — 1/2	..	Nil	Metropolitan Railway Consol. ..	100	13	24	46 — 46 1/2	— 1/2	2 19 2
Do. 5 % Pref. ..	1	5	5	78 — 78	..	7 5 6	Do. Surplus Lands ..	100	2 1/2	3 1/2	67 — 69	+ 1	3 19 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	80 — 85	..	5 5 11	Do. 8 1/2 % Deb. ..	100	8 1/2	8 1/2	90 — 92 xd	..	3 16 1
Brit. Elec. Trac., Ord. ..	10	Nil	Nil	..	..	..	Do. 3 1/2 % Pref. ..	100	3 1/2	3 1/2	86 — 88	..	3 19 7
Do. 6 % Pref. ..	10	1 1/2	1 1/2	..	..	..	Do. 3 1/2 % Con. Pref. ..	100	3 1/2	3 1/2	85 — 87	..	4 0 6
Do. 5 % Deb. ..	100	5	5	95 — 98	+ 1	5 2 0	Metropolitan District Ord. ..	100	Nil	..	33 1/2 — 34	+ 1/2	Nil
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2	79 — 83	..	5 8 5	Do. 6 % Deb. ..	100	6	6	144 — 146	..	4 2 2
Central London Railway, Ord.	100	8	8 1/2	57 — 69	— 1	4 6 11	Do. 4 % Deb. ..	100	4	4	95 — 97	..	4 2 6
Do. Pref. ..	100	4	4	84 — 86	..	4 13 0	Do. 4 % Prior Lien ..	100	4	4	100 — 102	..	8 18 5
Do. Def. ..	100	2	..	56 — 58	..	3 9 0	Do. 4 1/2 % First Pref. ..	100	3 1/2	4 1/2	91 — 93	..	8 10 0
Do. 4 % Deb. ..	100	4	4	100 — 102 xd	..	3 18 5	Do. 3 1/2 % Gtd. ..	100	3 1/2	3 1/2	76 — 78	..	4 9 9
City & South London, Ord. ..	100	1 1/2	1 3/4	28 1/2 — 29 1/2	— 1/2	5 1 8	Metropolitan Elec. Trams, Ord.	1	5 1/2	5 1/2	83 — 101	..	5 6 6
Do. 5 % Pref., 1891 ..	100	5	5	108 — 110	..	4 11 0	Do. Def. ..	1	Nil	..	..	..	Nil
Do. Do. 1896 ..	100	5	5	104 — 106	..	4 14 4	Do. 5 % Pref. ..	1	5	5	..	..	5 3 1
Do. Do. 1901 ..	100	5	5	103 — 105	..	4 15 3	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99 — 101	— 1	4 9 1
Do. Do. 1903 ..	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	5	101 — 103	..	4 17 1
Do. 4 % Deb. ..	100	4	4	101 — 103	..	3 17 8	Potteries, Ord. ..	1	2	..	..	..	..
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0	Do. 5 % Pref. ..	1	5	5	..	..	6 19 3
Great Northern & City, Prf. Ord	10	Nil	..	13 — 17	+ 1/2	Nil	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	90 — 93	..	4 16 9
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2	7 — 13	..	..	South Metro. Trams, 6 % Pref.	1	6	..	..	..	6 17 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	75 — 80	+ 2	5 12 6	Do. 4 % Deb. ..	100	4	4	70 — 75	..	5 6 8
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2	23 — 27	..	4 6 11	Underground Elec. Railways	10	..	..	23 — 27	— 1/2	..
Do. 4 % Deb. ..	100	4	4	75 — 80	..	5 0 0	Do. 4 1/2 % Bonds ..	100	4 1/2	4 1/2	99 — 101	..	4 9 1
Lancashire United, 5 % Deb. ..	100	5	5	76 1/2 — 79 1/2	..	6 5 9	Do. 6 % Income ..	100	1	1 1/2	79 — 81	..	..
London Elec. Railwys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10	Yorkshire (West Riding), Ord.	5	Nil	..	..	..	Nil
London United Trams, 5 % Pref.	10	Nil	..	8 1/2 — 9 1/2	— 1/2	..	Do. 6 % Pref. ..	5	Nil	..	23 — 31	+ 1/2	Nil
Do. 4 % Deb. ..	100	4	4	75 — 78	..	5 2 7	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	80 — 85	..	5 6 0

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5½ — 5½	+ ½	5 3 6	La Plata Elec. Trms, Ord. ..	1	6	6	23 — 1	..	6 0 0
Do. 2nd Pref. ..	5	5	5½	4½ — 5½	..	5 3 6	Do. Pref. ..	1	..	..	1 — 1½	..	..
Do. 4 % Deb. ..	100	4	4	94 — 95½	..	4 3 9	Lisbon Elec. Trams, Ord. ..	1	5½	6½	1 — 1½	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	100 — 102	..	4 8 3	Do. 6 % Pref. ..	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb. ..	100	5	5	101½ — 103½	+ ½	4 16 7	Do. 5 % Deb. ..	100	5	5	93½ — 97½	..	5 2 7
Auckland Trams, 5 % Deb. ..	100	5	5	102 — 105	..	4 15 8	Madras Elec. Tr. (1904), Deb. ..	100	5	5	93½ — 96½	..	5 3 8
Bombay Elec. S. & Trams, Pref.	10	6	6	104 — 113	..	5 5 6	Manaos Trams & Lt., 1st Deb. ..	100	5	5	90½ — 92½	..	5 8 1
Do. 4½ % Deb. ..	100	4½	4½	96 — 98	..	4 11 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	101 — 103	+ ½	4 17 1
Do. 5 % 2nd Deb. ..	100	5	5	97 — 99	+ ½	5 1 0	Mexico Trams Com. ..	\$100	7	7½	123½ — 125½	+ ½	5 11 7
Brisbane Trams Invt., Ord. ..	5	8	8½	83 — 91	+ ½	4 6 6	Do. Gen. Con. 5 % Bonds ..	..	5	5	99½ — 101½	+ ½	4 18 6
Do. 5 % Pref. ..	5	5	5	47 — 54	..	4 15 3	Do. 6 % Bonds ..	100	6	6	101 — 103	..	5 16 6
Do. 4½ % Deb. ..	100	4½	4½	101 — 104	..	4 1 7	Para Elec. Rlys. & Lt., Ord. ..	5	10	10½	71 — 73	+ ½	6 13 4
B. Columbia Elec. Rly., Def. ..	100	8	8½	137 — 140	— 1	5 14 4	Do. 6 % Pref. ..	5	6	6	5 — 5½	..	5 6 8
Do. Pref. Ord. ..	100	6	6	118 — 122	— 2	4 18 4	Do. 5 % 1st Deb. ..	100	5	5	97½ — 99½	..	5 0 6
Do. 5 % Pref. ..	100	5	5	107½ — 110½	— 1	4 10 6	Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 — 1	..	2 10 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 — 103	..	4 7 5	Do. 5 % 1st Deb. ..	100	5	5	99 — 101	..	4 19 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	102 — 104½	..	4 6 7	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 2 2
Do. 4½ % Con. Deb. ..	100	4½	4½	101 — 103	— 1	4 7 5	Do. 4½ % 1st Deb. ..	100	4½	4½	98 — 101	..	4 9 1
Calcutta Trams, Ord. ..	5	6	..	52 — 6	..	5 0 0	Rio de Janeiro Trams ..	\$100	4½	5½	116½ — 117½	+ 1½	3 16 7
Do. 5 % Pref. ..	5	5	5	5 — 5½	+ ½	4 15 3	Do. 1st Mort. 5 % Bonds ..	..	5	5	101 — 102	..	4 18 0
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	+ ½	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	97 — 98	..	5 2 0
Cape Electric Trams ..	1	Nil	2½	..	+ ½	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10½	197 — 199	+ 6	5 0 6
City Buenos Aires Trams (1904)	5	5	5	58 — 67	..	4 5 1	Do. 5 % 1st Deb. ..	\$500	5	5	102 — 104	..	4 16 2
Do. 4 % Deb. ..	100	5	5	95 — 98	..	5 2 0	Singapore Trams, 5 % Deb. ..	100	5	5	81 — 84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 105½	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 — 5½	— ½	5 4 4
Kalgoorlie Elec. Trams ..	1	Nil	..	32 — 32	..	Nil	Do. 6 % Pref. ..	5	6	6	51 — 51½	— ½	5 11 7
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	98½ — 101½	..	4 18 6
Do. 6 % B Deb. ..	100	5	6½	58 — 62	..	8 1 4	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 — 106	..	4 4 11

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	..	..	..	Dick, Kerr ..	1	5	..	27 — 31	+ ½	5 3 1
Do. 5 % Pref. ..	1	9	6	..	7 2 2	..	Do. Pref. ..	1	6	6	27 — 31	..	5 12 11
Babcock & Wilcox ..	1	26	24½	6 — 6½	— ½	4 0 9	Do. Deb. ..	100	4½	4½	92½ — 95½	..	4 14 3
Do. Pref. ..	1	6	6	1 — 1½	+ ½	3 16 10	Edison & Swan, A, £3 paid	5	Nil	..	..	..	Nil
B.I. & Helsby Cables ..	5	10	8½	6 — 7	..	7 0 4	Do. fully paid ..	5	Nil	..	1 — 2½	..	Nil
Do. Pref. ..	5	6	6	5 — 6½	..	4 16 0	Do. 4 % Deb. ..	100	4	4	70 — 74	..	5 8 1
Do. Deb. ..	100	4½	4½	101 — 103	..	4 7 5	Do. 5 % Second Deb. ..	100	5	5	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9	Electric Construction ..	2	Nil	2½	..	..	..
British Westinghouse, Pref. ..	3	Nil	..	1 — 1½	..	Nil	Do. Pref. ..	2	7	7	1 — 1½	..	7 9 4
Do. Deb. ..	100	4	4	54 — 57	..	7 0 4	Greenwood & Batley, Pref.	10	7	7	7 — 8½	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	100 — 102	..	5 17 8	Do. Deb. ..	100	5	5	94 — 96	..	5 4 2
Browett, Lindley, Ord. ..	1	Nil	..	1/6 — 2/	..	Nil	General Electric, Pref. ..	10	5	5	82 — 91	..	5 8 1
Do. Pref. ..	1	Nil	..	5/ — 6/	..	Nil	Do. Deb. ..	100	4	4	85 — 90	..	4 8 11
Brush, Ord. ..	2	Nil	..	0 — 1	..	Nil	Henley's, Ord. ..	5	15	10½	11½ — 12½	— ½	6 2 5
Do. 7 % Pref. ..	2	Nil	..	0 — 1	..	Nil	Do. Pref. ..	5	4½	4½	4½ — 5½	..	4 5 11
Do. 4½ % Deb. ..	100	4½	4½	56 — 61	..	7 7 7	Do. Deb. ..	100	4½	4½	104 — 106	..	4 4 11
Do. 4½ % Second Deb. ..	100	4½	4½	37 — 42	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	10 — 12	..	..
Callender's Cable ..	5	15	10½	9 — 9½	..	7 13 10	Do. Pref. ..	10	5	5	9½ — 10½	..	4 17 7
Do. Pref. ..	5	5	5	5 — 5½	..	4 15 3	Telegraph Construction ..	12	20	10½	84 — 86½	+ ½	6 17 0
Do. Deb. ..	100	4½	4½	98 — 100	— 1	4 10 0	Do. Deb. ..	100	4	4	99½ — 101½	..	3 18 10
Castner-Kellner ..	1	17½	20	31½ — 31½	— ½	4 11 10	Willans & Robinson ..	1	Nil	..	..	..	Nil
Do. Deb. ..	100	4½	4½	106 — 110	+ 1	4 1 10	Do. Pref. ..	5	Nil	..	..	..	Nil
Crompton & Co. ..	3	Nil	Nil	8 — 8½	..	Nil	Do. Deb. ..	100	4	4	53 — 63	..	7 2 10
Do. Deb. ..	100	5	5	58 — 68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.



## EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1911.

By contrast with the excellent returns for electrical business in all sections during November last, the figures for the closing month of the year are a little disappointing.

The export total of £375,000 included only some £25,000 worth of telegraphic material, as against over £100,000 worth in November, and, of course, compares unfavourably with the £527,000 worth of export business during that month. It may be of interest to note that the December total compares with a monthly average during 1911 of £385,000, and during 1910 of £473,000—the last-mentioned year containing some unusually large telegraphic exports.

Neglecting the telegraphic business, the December export figures are, however, considerably above the averages obtaining in 1911 and

1910, due, no doubt, to the respectable total of electrical machinery exported during the month—roughly, £160,000.

As regards the imports, the total of £207,000 compares with £230,000 in the previous month, and is probably quite up to the average of the year; the re-export total £24,391 compares with £25,049 in November, remaining at a fairly high level.

The month's returns include some £17,000 worth of glow lamps and £3,000 worth of arc lamps and parts exported, and it is of interest to contrast these figures with the £48,000 worth of similar goods which entered this country from abroad—the latter figure, of course, showing a great reduction as compared with the £78,000 worth of such imports recorded for December, 1910. The various purchasing countries remain much as usual, but attention may be drawn to the improving Australian figures.

## Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	743	528	167	25	166	960	6,904	804	176	...	81	28	10,582
Germany ...	800	1,878	172	5	555	9	1,305	4	...	16	316	347	5,407
Netherlands, Java and Dutch Indies ...	625	1,380	35	59	35	79	758	24	8	...	90	331	3,424
Belgium ...	355	200	255	6	271	5	1,742	113	...	12	988	13	3,960
France ...	2,496	16	1,029	67	59	25	4,372	875	3	...	687	310	9,939
Portugal ...	34	47	...	127	11	...	178	515	25	9	...	192	1,138
Spain and Canary Isles ...	240	36	166	42	10	50	1,038	734	4	...	...	124	2,444
Switzerland, Italy and Austria-Hungary ...	714	126	803	6	79	11	2,772	100	58	3	14	2,006	6,692
Greece, Roumania, Bulgaria, Servia & Turkey	44	48	39	54	14	...	497	...	25	6	...	74	801
Channel Isles, Gibraltar, Malta and Cyprus...	164	59	62	52	38	51	108	...	...	5	7	571	1,117
U.S.A., Philippines and Cuba ...	502	53	36	356	37	54	584	...	...	...	4	7,182	8,808
Canada and Newfoundland ...	755	1,836	371	2,697	27	2,243	6,411	4,601	94	151	189	679	20,054
British West Indies and British Guiana ...	155	53	397	229	37	...	95	31	7	12	93	16	1,125
Mexico and Central America ...	44	7	49	55	9	...	1,224	1,187	...	6	60	12	2,653
Peru, Uruguay and Paraguay ...	325	922	152	88	16	125	668	...	56	3	9	7	2,371
Chile ...	245	381	299	92	8	...	5,002	489	43	8	105	183	6,855
Brazil ...	135	864	669	883	46	444	5,812	1,598	911	50	1,325	1,380	14,117
Argentina ...	2,384	10,532	831	1,135	443	418	11,113	2,019	6,700	277	2,648	3,431	41,931
Colombia, Venezuela, Ecuador and Bolivia	40	134	...	118	5	4	254	...	...	4	8	...	567
Tripoli, Tunis, Morocco and Liberia ...	...	4	13	7	...	...	28	...	...	...	...	97	149
Egypt and Persia ...	766	489	347	88	326	49	2,493	9	1,585	3	288	276	6,719
British West Africa and St. Helena ...	86	45	15	41	...	26	93	...	108	...	13	67	494
Rhodesia, O.R.C. and Transvaal ...	2,567	1,170	350	1,899	79	208	7,384	...	287	118	183	5	14,250
Cape of Good Hope ...	2,047	3,655	795	984	53	426	3,478	663	485	38	170	287	13,081
Natal ...	1,343	7,124	166	768	208	111	1,577	2,772	175	6	157	1,617	16,024
Zanzibar, Brit. E. Africa, Mauritius & Aden	86	97	74	104	12	8	200	2	2	...	37	87	709
Azores, Madeira and Portuguese Africa ...	199	857	126	50	13	...	254	7	4	22	10	123	1,665
French African Colonies and Madagascar...	15	5	16	...	...	...	7	...	...	...	...	...	43
China and Siam ...	499	515	311	124	34	139	1,630	...	512	...	1,618	5	5,387
Japan and Korea ...	339	2,358	65	22	...	1,055	17,602	2,615	21	...	5,020	975	30,072
India ...	3,799	9,055	2,305	2,428	172	1,189	12,159	4,104	1,752	50	1,154	624	38,791
Ceylon ...	250	801	156	97	5	25	5	...	8	5	63	65	1,480
Straits Settlements, Fed. Malay States and Sarawak ...	591	789	241	91	7	75	594	1,276	68	121	158	307	4,318
Hong Kong ...	196	2,894	208	28	...	262	261	...	...	3	190	109	4,151
West Australia ...	364	126	118	940	24	220	412	97	78	10	1,247	70	3,706
South Australia ...	1,053	896	375	206	5	52	1,870	283	5	10	87	30	4,872
Victoria ...	3,183	10,042	553	646	...	641	2,721	15	436	...	1,340	1,131	20,708
New South Wales ...	3,028	7,436	863	952	75	1,639	13,946	1,353	1,771	23	1,021	36	35,143
Queensland ...	271	1,274	71	189	...	131	3,546	2,519	185	9	1,782	1,896	11,873
Tasmania ...	18	488	...	112	...	...	12	480	...	...	...	34	1,144
New Zealand and Fiji Islands ...	2,425	1,309	736	835	43	391	8,954	32	312	5	946	456	16,444
Total, £	33,925	70,529	13,436	16,707	2,922	11,125	130,063	29,521	15,704	985	25,108	25,183	375,208

## Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark ...	174	...	...	103	...	...	6,420	...	356	29	9,663	16,745
Germany ...	2,460	4,936	1,251	31,448	7,229	2,703	41,806	...	2,026	7,073	36,293	137,225
Holland ...	...	...	...	1,346	382	...	17	...	...	15	...	1,760
Belgium ...	964	457	205	5	60	238	1,675	15	662	802	6,330	11,413
France ...	296	440	1,169	333	977	771	856	130	831	4,553	868	11,224
Switzerland ...	24	496	129	36	...	16	3,185	...	...	...	30	3,916
Italy ...	14	102	...	...	18	...	24	...	...	...	2,270	2,428
Austria-Hungary ...	21	990	...	1,090	144	...	20	...	64	399	45	2,773
United States ...	1,673	97	521	3,021	1,726	15	6,931	4,781	721	91	135	19,712
Total, £	5,626	7,518	3,275	37,382	10,536	3,743	60,234	4,926	4,660	12,962	55,634	207,196

Additional imports: Spain, carbons, £85; Canada, goods, £117; Japan, machinery, £3.

## Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,728	435	...	2,892	623	...	7,988	...	89	383	253
----------------------------------------	--------	-----	-----	-------	-----	-----	-------	-----	----	-----	-----

TOTAL EXPORTS: £375,208.

TOTAL RE-EXPORTS: £24,391.

TOTAL IMPORTS: £207,401.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.



## ELECTRICAL EXPORTS AND IMPORTS DURING 1911 AND PREVIOUS YEARS.

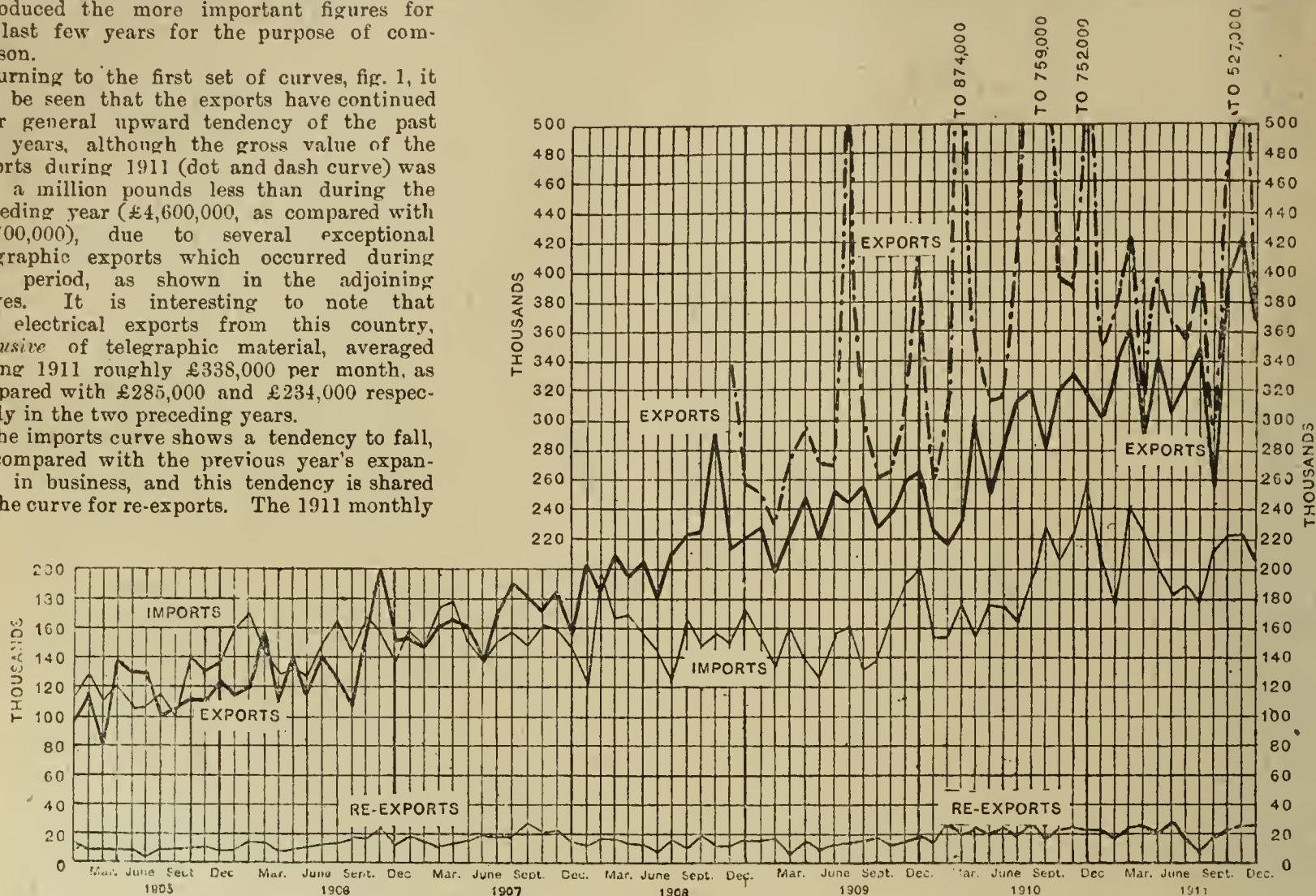
THE figures for electrical export and import business during the closing month of 1911, which we publish on the previous page, complete the returns for last year. As in previous years, we have, for the convenience of our readers, graphically reproduced the more important figures for the last few years for the purpose of comparison.

Turning to the first set of curves, fig. 1, it will be seen that the exports have continued their general upward tendency of the past few years, although the gross value of the exports during 1911 (dot and dash curve) was over a million pounds less than during the preceding year (£4,600,000, as compared with £5,700,000), due to several exceptional telegraphic exports which occurred during that period, as shown in the adjoining curves. It is interesting to note that the electrical exports from this country, *exclusive* of telegraphic material, averaged during 1911 roughly £338,000 per month, as compared with £285,000 and £234,000 respectively in the two preceding years.

The imports curve shows a tendency to fall, as compared with the previous year's expansion in business, and this tendency is shared by the curve for re-exports. The 1911 monthly

trade, and the improvement is reflected in the average export figures given above.

The chart showing the three principal imports, fig. 3, is particularly interesting, indicating, as it does, a great decline in value in



The upper export curve is inclusive of telegraphic exports from November, 1903.

FIG. 1.—CHART SHOWING MONTHLY ELECTRICAL EXPORTS AND IMPORTS DURING THE PAST SEVEN YEARS.

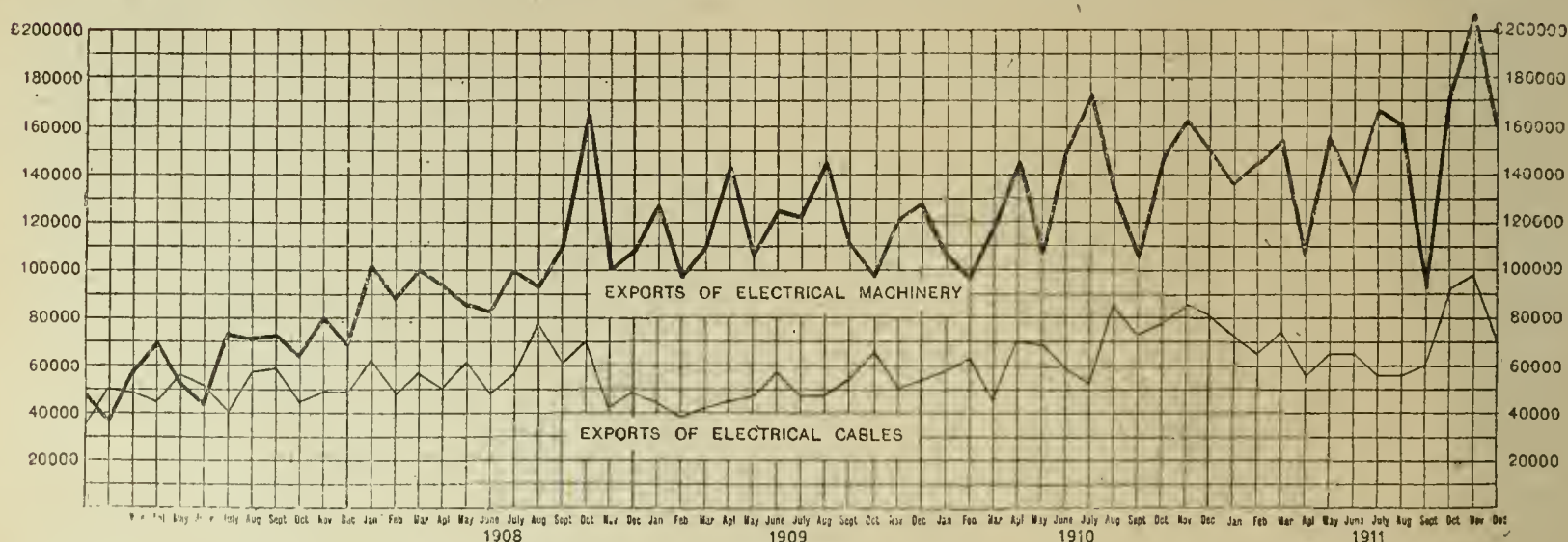


FIG. 2.—MONTHLY EXPORTS OF ELECTRICAL MACHINERY AND ELECTRICAL CABLE, OTHER THAN TELEGRAPHIC OR TELEPHONIC CABLE, DURING 1907-11 INCLUSIVE.

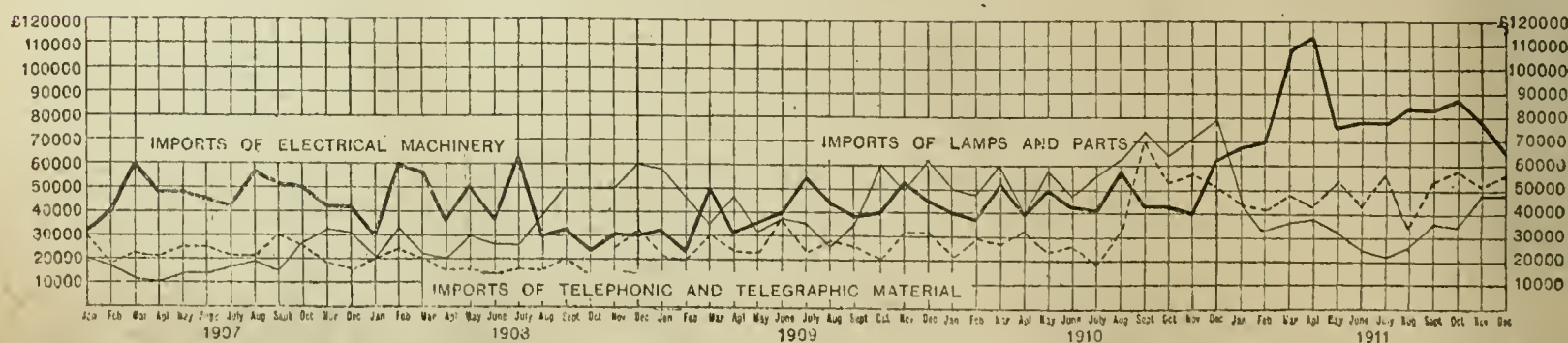


FIG. 3.—MONTHLY IMPORTS OF ELECTRICAL MACHINERY, TELEGRAPHIC AND TELEPHONIC MATERIAL (INCLUSIVE OF TELEGRAPHIC AND TELEPHONIC CABLE AFTER NOVEMBER, 1908) AND ELECTRIC LAMPS AND PARTS, DURING 1907-11 INCLUSIVE.

average of the imports, however, was over £200,000, as against £189,000 during 1910.

Incidentally, it will be seen that the telegraphic export business during 1911 was rather featureless.

Steady progress was, however, made by our export business in electrical machinery and cables, as shown in fig. 2; these two items constitute the major portion of our electrical export

the importation of foreign lamps, due presumably to the numerous lamp factories which have been opened in this country during the past 12 months or so. In passing we may note that the exportation of lamps from this country has not appreciated to any extent during the year.

The importation of telegraphic and telephonic material remained steadily at a higher level than during 1910, while machinery imports probably doubled in value as compared with that year.



**PURCHASING COUNTRIES AND IMPORTERS INTO THE UNITED KINGDOM.**—Under this heading we publish in up-to-date form the series of curves which appeared last January, grouping some of the leading purchasers of British electrical goods, also the most prominent importers of similar goods into this country.

Thus the curves shown in fig. 4, cover three years' business with our leading American customers, and on the whole indicate a steady rather than an expanding business with the three countries represented, viz., Canada, Argentina and Brazil. During the years

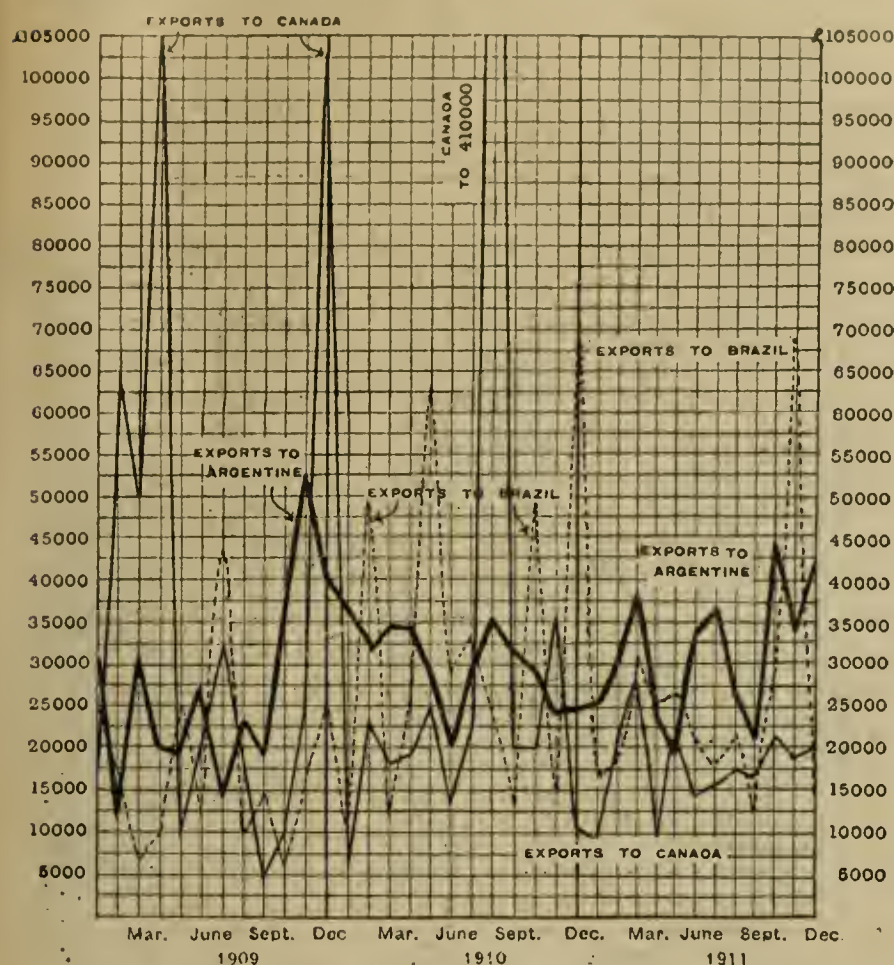


FIG. 4.—EXPORTS TO CANADA, ARGENTINA, AND BRAZIL, 1909-11.

1909 and 1910, several abnormal telegraphic purchases—indicated by the peaks in the curve—were responsible for very high totals in the case of Canada; this year's curve shows a normal general trade.

The fifth set of curves deals with our South African and Australasian markets, comprising in the former case, Cape Colony, Natal, Transvaal, Orange River Colony and Rhodesia, and in the latter case, Australia and New Zealand.

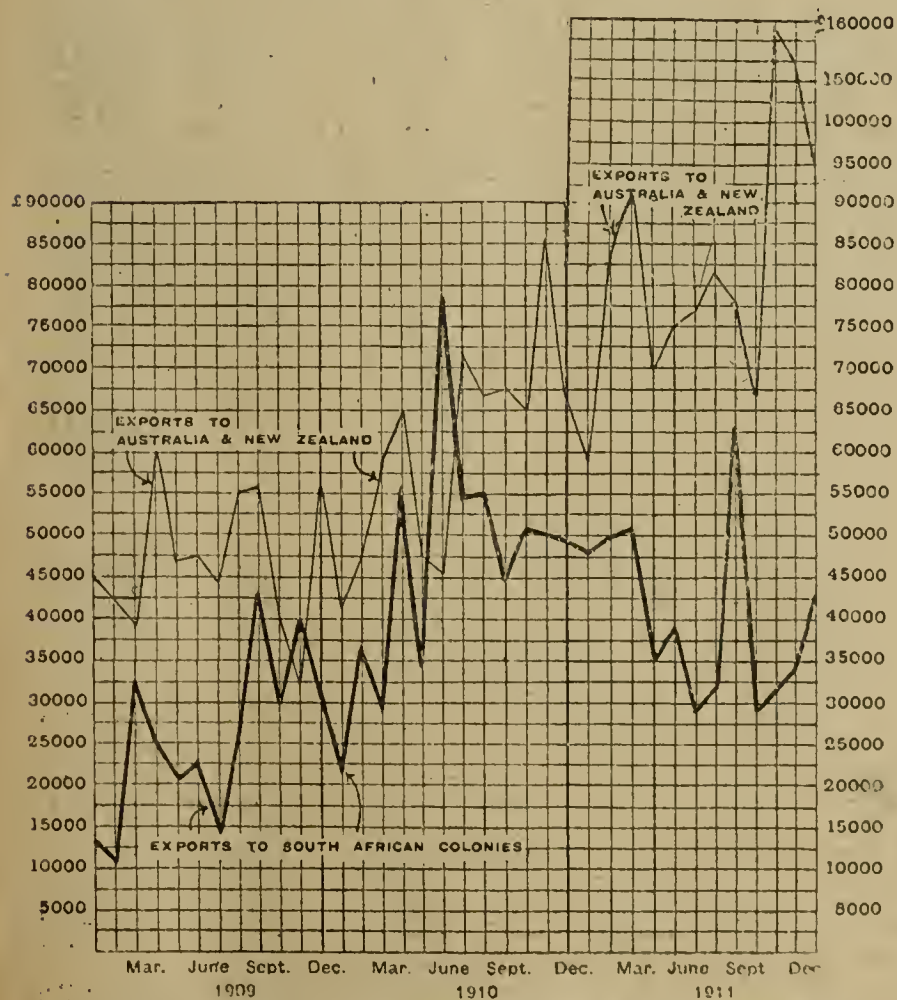


FIG. 5.—EXPORTS TO AUSTRALASIA AND SOUTH AFRICA, 1909-11.

The trend of the curve showing South African business is somewhat disappointing after the steady upward tendency of the years 1909 and 1910. On the other hand, Australasian business appears

to be rapidly expanding, the improvement shown being quite equal to that during 1910.

The sixth set of curves deals with our Indian and Far Eastern business, and it would appear that on the whole, Indian, Japanese and Chinese business did not vary greatly during the three years

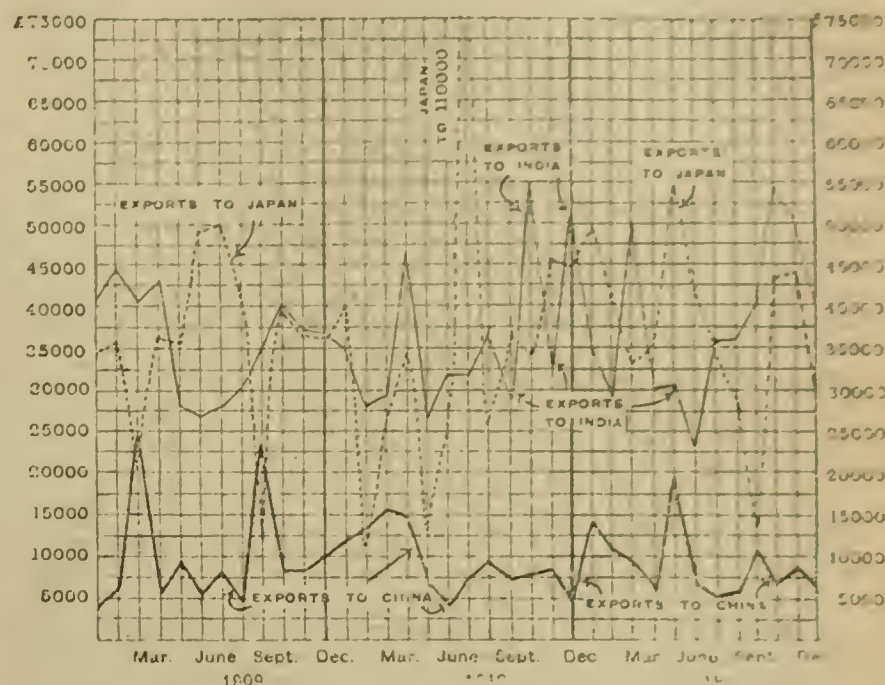


FIG. 6.—EXPORTS TO JAPAN, INDIA AND CHINA, 1909-11.

shown—although Chinese business shows a tendency to fall off, a fact which we noted last year.

The last set of curves, fig. 7, deals with the most important countries importing into the United Kingdom, and it is of interest

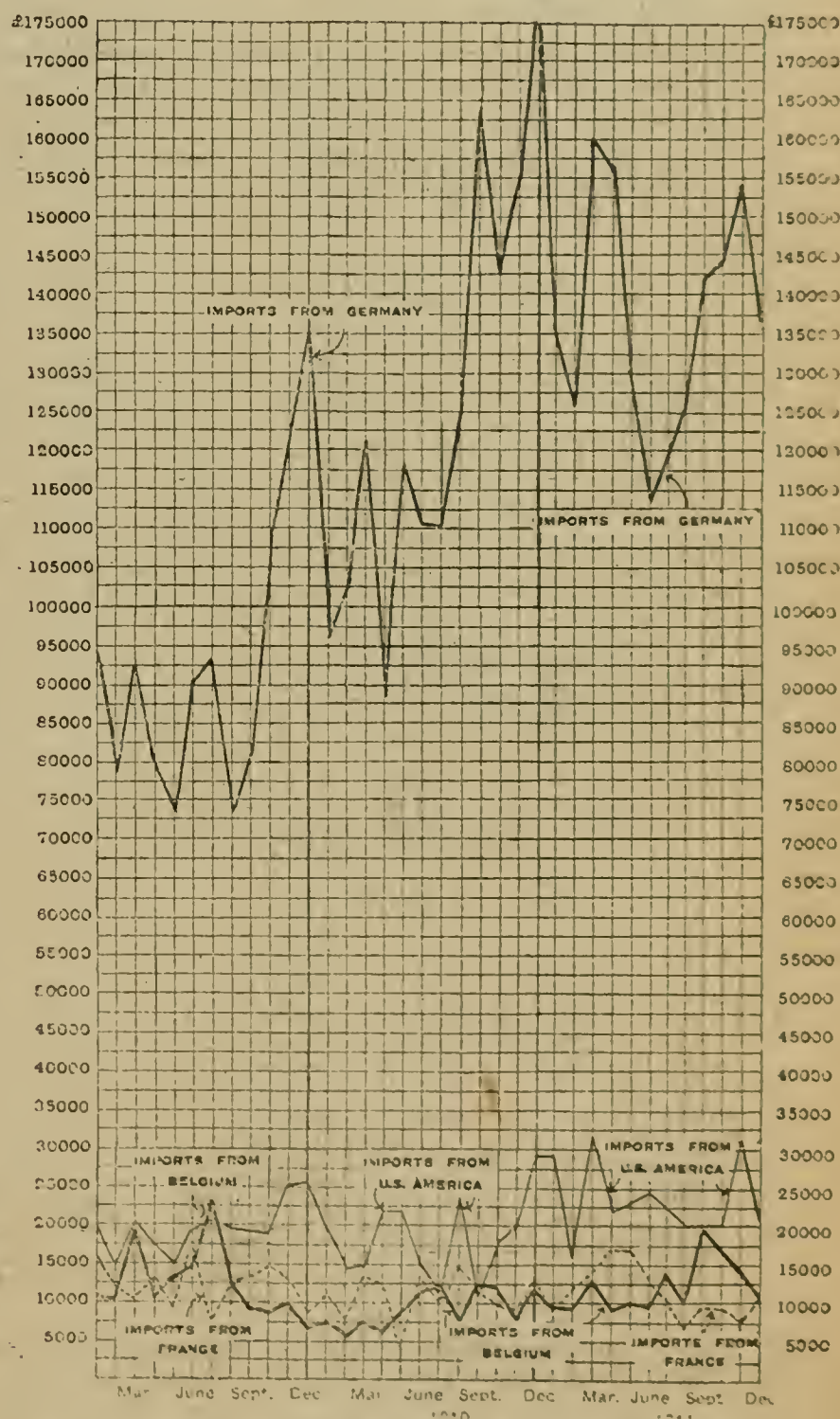


FIG. 7.—IMPORTS FROM GERMANY, U.S.A., BELGIUM AND FRANCE, 1909-11.

to note that the giant strides made by Germany during 1909 and 1910, have, to some extent, been arrested, although Germany's total electrical business with us was probably greater in 1911 than in



1910. From the other curves shown, it will be seen that American imports reached an appreciably higher level last year, as compared with 1910, and that Belgian imports have also moved upwards, while French importations show no particular movement.

GENERAL.—The conclusions which one may draw from the export curves, as a whole, are satisfactory as regards the most important branches of our business—viz., machinery and cables: the telegraphic export business, the fluctuating character of which has been remarked upon from time to time, was the duldest feature of the year's returns.

The only really satisfactory instance of expanding business in 1911, shown in the curves, is in the case of our Australasian Colonies—of the other examples chosen, the best that can be said is that business, generally, compared favourably with the previous year.

Turning to the import curves, the marked increase in value of foreign machinery entering this country in 1911 seems to require some explanation, this being really the only section of the import business which is making any great headway in the home market.

**New Zealand New Patents Act.**—MR. J. OWDEN O'BRIEN, chartered patent agent, of 6, Bank Street, Manchester, writes as follows:—

"We have received information that an Act relating to patents, designs and trade marks, has recently passed the Legislature in New Zealand, and is to come into force on July 1st next.

"The Act has been based principally upon the British Patents Act, 1907, and contains most of the provisions of such Act with the exception of that relating to the liability to revocation of a patent, should the invention of which it is the subject be manufactured mainly abroad. Instead of this provision, the provision of the Australian Act, 1909, has been embodied in the new law. The position of patents, therefore, will be that at any time not less than four years from the date of the patent, and not less than two years after the commencement of the Act, any person may petition for an order declaring that the patented article or process is not manufactured or carried on in New Zealand to an adequate extent. An order may then be issued, to take effect at once, or at a future date, and during the currency of the order the patent will not be infringed by the manufacture or carrying out of the process in New Zealand by others. Provision is made for the revocation of the order should its benefits not be availed of.

"Thus, in any event, the patentee will retain full patent rights, so far as the right to import the patented article into New Zealand is concerned. Consequently, therefore, the patentees of inventions that cannot be manufactured in New Zealand, or manufactured at a price to compete with the imported article, need not take any steps to manufacture within the Dominion in the period referred to.

"The Act provides for the investigation of the novelty of an invention before the grant of the patent, and for the refusal of the application, or for its grant, on condition that a reference to the anticipations be inserted in the specification. An appeal from the Registrar's decision may be made to the Supreme Court.

"Hitherto it has been possible to oppose the grant of a patent on any grounds, but the new Act limits the grounds of opposition to certain specified objections corresponding with those allowed under the present British Act of 1907.

"The Act also follows the British provisions, so far as it relates to patents, in respect to a single patent for cognate inventions covered by separate provisional specifications; patent of addition; restoration of lapsed patents; compulsory licences; revocation of patents on grounds of invalidity; exemption of innocent infringer from damages; the individual rights of co-patentees; restriction on conditions of sale of patented articles; the granting of costs and giving of security for costs in opposition and other proceedings; the exemption of a patent from the effect of unauthorised or unknown prior publication of the invention; and the exemption of a patent from invalidity because of disconformity between the complete and provisional specifications.

"For design registrations the only important departures made by the new Act are those by which the term of registration (five years) may be extended for two further periods of five years each, and for the same working provisions that apply to patents being applied to designs, with the exception that manufacture must commence within one year of the date of registration.

"The Trade Mark provisions of the new Act follow closely those of the British Act of 1905 with respect to registrable Trade Marks, and we consider that the practice under this Act will follow that built up under the British Act. They provide as well for the lodging of security of costs by an opponent in opposition proceedings, or an appellant from a decision of the Registrar, where such opponent or appellant is outside New Zealand. They also provide for the registration of associated marks."

**Solid Metal Solution.**—A remarkable example of diffusion of solid metals has been observed by Messrs. G. Bruni and D. Meneghini, and is quoted in the *Electrical World*. A nickel wire was coated with copper by electrolysis, to a thickness such that the two metals were in the same proportions as in the alloy Constantan (40 per cent. nickel, 60 per cent. copper). The compound wire thus formed was then maintained at a temperature of about 1,000° C. for 157 hours. Its resistance was 0.0260 ohm at the start, and was measured at intervals; it gradually rose to 0.2105 ohm, at which it became practically constant. This indicated that the wire had become converted to Constantan, and the fact was proved by chemical analysis.

## TRADE STATISTICS OF AUSTRALIA.

THE following statement, showing the imports of electrical and similar goods into Australia during the year 1910, is taken from the recently issued official trade statistics. The figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1909.	1910.	Increase or decrease.
	£	£	£
<i>Plumbago or graphite.</i> —			
From Great Britain ...	6,000	6,000	—
" Ceylon ...	1,000	1,000	—
" United States ...	1,000	1,000	—
" Other countries ...	1,000	2,000	+ 1,000
Total ...	9,000	10,000	+ 1,000
<i>Gas and oil engines.</i> —			
From Great Britain ...	104,000	125,000	+ 21,000
" France ...	1,000	1,000	—
" United States ...	31,000	40,000	+ 9,000
" Other countries ...	3,000	—	— 3,000
Total ...	139,000	166,000	+ 27,000
<i>High-speed reciprocating steam engines.</i> —			
From Great Britain ...	564,000	124,000	— 440,000
" Germany ...	13,000	11,000	— 2,000
" United States ...	30,000	40,000	+ 10,000
" Other countries ...	1,000	4,000	+ 3,000
Total ...	608,000	179,000	— 429,000
<i>Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof.</i> —			
From Great Britain ...	119,000	129,000	+ 10,000
" Germany ...	32,000	23,000	— 9,000
" United States ...	71,000	73,000	+ 2,000
" Sweden ...	3,000	5,000	+ 2,000
" France ...	4,000	3,000	— 1,000
" Italy ...	3,000	4,000	+ 1,000
" Switzerland ...	3,000	2,000	— 1,000
" Other countries ...	1,000	4,000	+ 3,000
Total ...	236,000	243,000	+ 7,000
<i>Dynamo-electric machines over 200 H.P. and parts.</i> —			
From Great Britain ...	13,000	22,000	+ 9,000
" Germany ...	9,000	1,000	— 8,000
" United States ...	10,000	3,000	— 7,000
" Other countries ...	1,000	—	— 1,000
Total ...	33,000	26,000	— 7,000
<i>Generators for direct coupling to steam engines.</i> —			
From Great Britain ...	25,000	5,000	— 20,000
" Germany ...	3,000	7,000	+ 4,000
Total ...	28,000	12,000	— 16,000
<i>Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards.</i> —			
From Great Britain ...	11,000	19,000	+ 8,000
" Germany ...	3,000	3,000	—
" United States ...	11,000	17,000	+ 6,000
" Other countries ...	2,000	2,000	—
Total ...	27,000	41,000	+ 14,000
<i>Flue-heated economisers, mechanical stokers, steam traps, steam turbines, superheaters, water purifiers.</i> —			
From Great Britain ...	35,000	56,000	+ 21,000
<i>High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps.</i> —			
From Great Britain ...	21,000	30,000	+ 9,000
<i>Motive-power machinery not elsewhere specified.</i> —			
From Great Britain ...	134,000	192,000	+ 58,000
" France ...	4,000	5,000	+ 1,000
" Germany ...	6,000	6,000	—
" Switzerland ...	3,000	1,000	— 2,000
" United States ...	50,000	72,000	+ 22,000
" Other countries ...	4,000	3,000	— 1,000
Total ...	201,000	279,000	+ 78,000
<i>Electroliers, gasoliers, pendants, brackets, &amp;c.</i> —			
From Great Britain ...	28,000	26,000	— 2,000
" Germany ...	4,000	2,000	— 2,000
" Other countries ...	1,000	1,000	—
Total ...	33,000	29,000	— 4,000



	1909.	1910.	Increase or decrease.	
	£	£	£	
<i>Electric fittings and appliances: switches, fuses and lightning arresters.—</i>				
From Great Britain ...	17,000	20,000	+	3,000
" Germany ...	7,000	6,000	—	1,000
" United States ...	4,000	6,000	+	2,000
" Other countries ...	1,000	3,000	+	2,000
Total ...	29,000	35,000	+	6,000
<i>Electric heating and cooking appliances.—</i>				
From Great Britain ...	1,000	2,000	+	1,000
" Other countries ...	1,000	—	—	1,000
Total ...	2,000	2,000	—	—
<i>Other electric light and gas appliances (except gas meters).—</i>				
From Great Britain ...	62,000	79,000	+	17,000
" Germany ...	39,000	43,000	+	4,000
" United States ...	12,000	19,000	+	7,000
" Other countries ...	13,000	13,000	—	—
Total ...	126,000	154,000	+	28,000
<i>Rails, fishplates, &amp;c., for railways and tramways.—</i>				
From Great Britain ...	437,000	400,000	—	37,000
" Canada ...	133,000	—	—	133,000
" Belgium ...	22,000	15,000	—	7,000
" Germany ...	70,000	34,000	—	36,000
" United States ...	140,000	372,000	+	232,000
" Other countries ...	1,000	—	—	1,000
Total ...	803,000	821,000	+	18,000
<i>Telephones, telephone switchboards and appliances.—</i>				
From Great Britain ...	74,000	46,000	—	28,000
" Germany ...	8,000	5,000	—	3,000
" Sweden ...	20,000	40,000	+	20,000
" United States ...	5,000	3,000	—	2,000
" Other countries ...	9,000	11,000	+	2,000
Total ...	116,000	105,000	—	11,000
<i>Electrical articles: Accumulators, arc lamps, arc lamp carbons, cable and wire covered, carbon in blocks of 12 sq. in. and over, electrical vacuum tubes, measuring and recording instruments, prepared insulating tape.—</i>				
From Great Britain ...	164,000	277,000	+	113,000
" France ...	2,000	3,000	+	1,000
" Germany ...	42,000	61,000	+	19,000
" United States ...	11,000	10,000	—	1,000
" Other countries ...	3,000	7,000	+	4,000
Total ...	222,000	358,000	+	136,000
<i>Iron and steel wire.—</i>				
From Great Britain ...	75,000	116,000	+	41,000
" Belgium ...	11,000	14,000	+	3,000
" Germany ...	306,000	381,000	+	75,000
" United States ...	158,000	180,000	+	22,000
" Other countries ...	3,000	9,000	+	6,000
Total ...	553,000	700,000	+	147,000

## MACHINERY FOR INDIA.

THE following notes recently appeared in the *Indian Trade Journal* from the pen of Mr. Frederick Noël-Paton, who is the Director-General of Commercial Intelligence, India:—

The movement towards manufactures and the use of machinery in India has become unmistakable; and India is now the largest single purchaser of machinery from England. But in India it is often, if not usually, found that the circumstances of a particular industry differ from those present in countries where the manufacturing processes have been evolved and long practised. For this reason an element of uncertainty and risk attaches to the first ventures in India; and if to these deterrents to investment others be added, it becomes inevitable that capitalists with any business sense should hold back. One such additional and unavoidable deterrent is due to the remoteness of India from the Western centres where experts and specialised appliances abound. As a consequence of India's isolation, difficulties are encountered even by wealthy and intelligent native gentlemen who want information about the approximate capacity and cost of the complete installation requisite for a given industry for which raw material and demand are present.

The central Government and certain of the provincial Governments in India have in recent years appointed officers one of whose functions it is to procure and supply information of this kind. On

one side their duties are analogous to those of a Consul or Commercial Attaché. These officers travel from time to time about the territories assigned to them: and they report that they receive many *bonâ fide* inquiries from persons qualified financially and by intelligence to establish useful works. But they have to reckon with the absence of co-operation between British makers of machinery.

Many engineers in England make only part of the appliances required in a given industry. In Europe this matters little; for it is possible for any respectable man of business in the West to find makers of the complementary plant, and to consult them with a view to completing the requisite estimate. The several firms who produce appliances for carrying out the distinct but connected processes in a given industry know each other, and are prepared to work together when a definite order is in sight.

But they are indifferent to or definitely suspicious of inquiries not related to a specific project and a known individual or group. They have found by experience that inquiries of this kind are often made by people who have no serious intention of placing an order, or who, if they have such intention, are quite likely to place the order elsewhere after having used the estimate obtained from one source to "spring" the rates quoted in another quarter. Indeed, this is not the limit of the misuse sometimes made of estimates indiscriminately given; and it must be recognised that the attitude of manufacturers in this matter is not only deliberately assumed, but is justified.

But it is believed by many experienced commercial intelligence officers that it would pay manufacturers to carry discrimination a little further, and that while ignoring specious and merely plausible inquiries from persons who profess to contemplate business, it would be worth their while to assist officials who seek to create in backward countries an active public interest in those industries which the said manufacturers want to equip.

A manufacturer will often spend large sums in advertisement and in sending travellers in quest of really improbable orders. Agents are appointed in India by such firms; or travelling representatives visit the country for the purpose of selling one part only of the plant required for a particular industry; and they are often disappointed by results. One of the causes of such failure is that their quotations for one part of the plant have no practical interest for capitalists in the absence of quotations for the rest of the plant, and the agent has not been put in a position to give information about the whole. Another is that the ground has not been prepared, the capitalist's interest in the matter has not been awakened or instructed, and he has not gone into the questions of material and demand. Consequently, the traveller often finds no one to whom he may address himself.

Now, one of the duties of a commercial intelligence officer in a backward country is to direct the attention of the community to such openings as seem to exist for the exploitation or development of the country's resources. Until interest has been so awakened there can be no effective demand for the machinery required. But before a mere interest can be converted into effective demand for machinery, the capitalist must be given some sort of idea of what it would cost him to start work on a given scale. The commercial intelligence officer is anxious to give him the information in order that development may take place; and it is obviously to the interest of manufacturers as a class that it should so take place, since an incident in the progress must be the placing of orders for appliances. But manufacturers commonly do not realise the wide difference that exists between the specious call for estimates made by an unknown or too well known individual and the request for a *pro forma* but comprehensive quotation to be used by an official in preparing the ground for business.

It is not necessary or even desirable that the estimates furnished should go forth as that of a particular maker. On the one hand, the firm would object to their names being connected with it; because it might be used against them by a customer or by a rival when the elaboration of a specific scheme called for modifications in detail. On the other hand, the commercial intelligence official would object to the firm's name being associated with a figure which he quoted; because he might be thought to be favouring a particular maker. So here again the wishes of the maker and the official are identical.

All that is necessary is that manufacturers or their agents should exercise the forethought they expect of the official when they have recourse to his services, and should interest themselves in seeing that through one channel or another he will receive a full complement of information about all the appliances necessary for a given industry. In most cases the manufacturer knows what other appliances are required, and what their power or capacity should be. He knows where a suitable engine could be obtained, and where—say suitable crushers or centrifugals could be bought to complete the equipment. In such cases it would be sufficient if he dropped a line to the makers of the complementary plant saying that a certain official wanted information about a plant for such-and-such an industry, stating that the writer was sending drawings and approximate quotation for such-and-such appliances of stated capacity, and asking that his correspondent should forward similar information about such-and-such complementary appliances of corresponding capacity. In certain foreign countries organisation and co-operation among manufacturers has been carried further than in England; and co-ordination between officials and manufacturers is more highly developed. Even in England most of the great firms go out of their way to help the official, knowing very well that he really does create a set of conditions favourable to the prospects of their business. But there are many others whose operations have never brought them in contact with a commercial intelligence office. They have not the least idea as to what it sets out to do, and they consequently regard it as merely troublesome



and inquisitive. There can be little doubt that so long as this view exists a good deal of business will fail to take shape, or will continue to go to those countries whose manufacturers and officials play thoroughly into each others' hands. For neither the capitalist nor the official can wait indefinitely.

## A VECTOR CALCULATOR.

By F. ADDEY, B.Sc.

In the calculations involved in dealing with questions of telephone transmission and similar problems, we are concerned largely with vector quantities. We can, of course, plot our vectors to scale, and perform the necessary mathematical operations by graphical methods. It is much more convenient, however, to express the vector quantities in an algebraical form, and to perform the calculations by algebraical processes.

A vector may be expressed algebraically in two ways. Let  $OP$  (fig. 1) be a vector  $\hat{R}$  of magnitude  $R$ , making an angle  $\theta$  with the axis  $OX$ . Let  $a$  and  $b$  be the rectangular

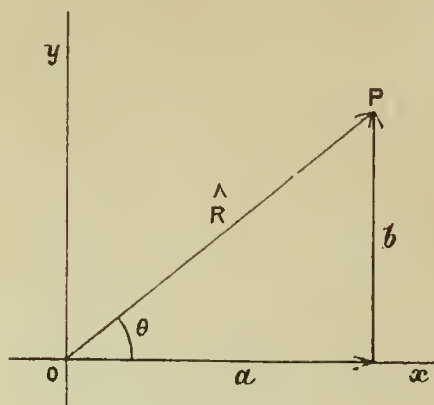


FIG. 1.

components of the extremity  $P$  of the vector. We may then either express the vector  $OP$  in terms of its magnitude  $R$ , and its angle  $\theta$ , or else in terms of its rectangular components  $a$  and  $b$ .

By the first method the vector is written—

$$\hat{R} = R / \theta,$$

while by the second method, considering  $a$  and  $b$  as vectors, we may write—

$$\hat{R} = \hat{a} + \hat{b}.$$

Now  $a$  is along the  $OX$  axis, which is the axis from which the angle  $\theta$  is reckoned, while  $b$  is at right angles to this axis. Therefore we may write  $b$  as  $\sqrt{-1} b$  or  $i b$ , and our vector becomes—

$$\hat{R} = a + i b.$$

It can easily be shown that to add or subtract vectors we must add or subtract the real parts to obtain the real part of the resultant, and add or subtract the imaginary parts to obtain the imaginary part of the resultant. Thus, if

$$\hat{R} = a + i b \text{ and } \hat{S} = c + i d,$$

$$\text{we have } \hat{R} + \hat{S} = (a + c) + i(b + d).$$

On the other hand, to multiply or divide vectors, we multiply or divide the magnitudes to obtain the magnitude of the product or quotient, while we add or subtract the angles to obtain the angle of the product or quotient. Thus, if

$$\hat{R} = R / \theta \text{ and } \hat{S} = S / \phi,$$

$$\text{we have } \hat{R} \times \hat{S} = RS / \theta + \phi.$$

Thus, for addition and subtraction, we must have our vectors expressed in the form  $\hat{R} = a + i b$ , while for multiplication and division they are best expressed in the form

$$\hat{R} = R / \theta.$$

In telephone calculations it is continually necessary to transform a vector from one of these forms to the other. From fig. 1 we see that if the vector be expressed in the  $a + i b$  form, we have—

$$R = \sqrt{a^2 + b^2} \text{ and } \theta = \tan^{-1} b/a,$$

while, if the vector be expressed in the form  $R / \theta$ , we have  $a = R \cos \theta$  and  $b = R \sin \theta$ . In a problem involving much calculation, these transformations occupy a considerable length of time, and in order to avoid this inconvenience the writer has devised a simple calculator based on a method given by Dr. Franke (*Elektrotechnische Zeitschrift*, 1891, page 451) which enables the transformation from one form to the other to be immediately performed.

The arrangement of this calculator is shown in fig. 2.

A 10-in. square is drawn on a sheet of xylonite. The sides of this square are divided into inches and tenths, and the whole is ruled up as squared paper. A strip of transparent

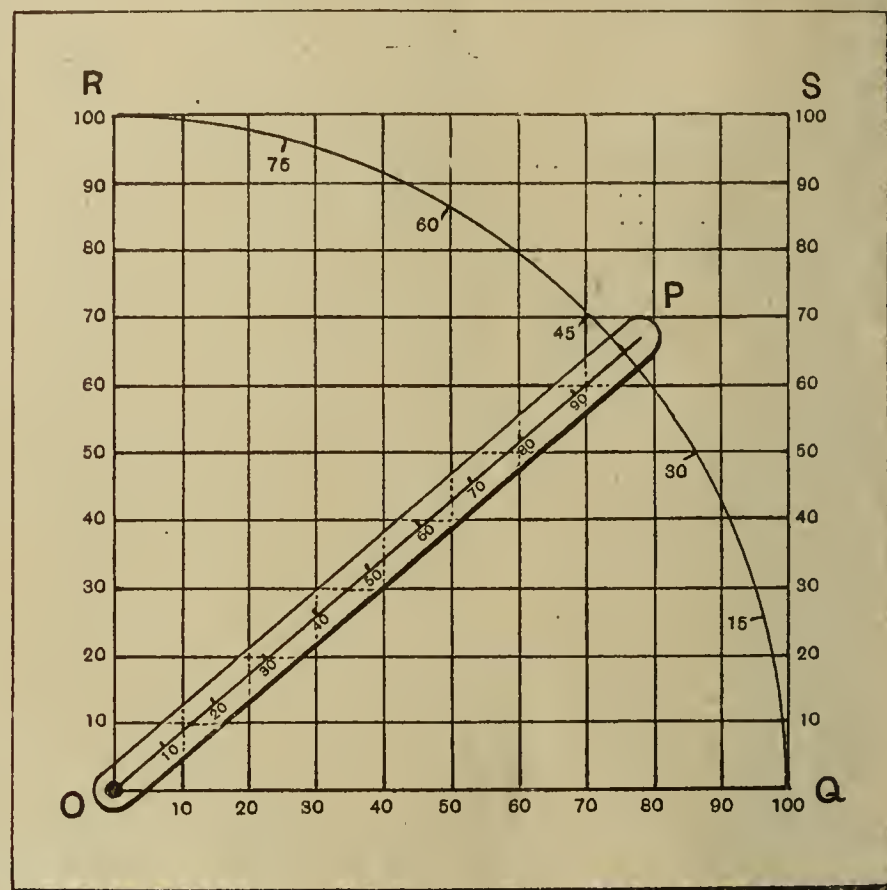


FIG. 2.

celluloid  $OP$  is pivoted at the point  $O$ . A line is ruled along the under surface of this strip passing through the point  $O$ . This line is also divided into inches and tenths.

A quadrant  $QPR$  is described about the centre  $O$  with a radius of 10 in., and this quadrant is divided into degrees.

If a vector be given in the  $R / \theta$  form, and it be required to transform it into the  $a + i b$  form, the arm  $OP$  is set to the value of  $\theta$  on the quadrant, the extremity of the radius  $R$  noted by means of the graduations on the arm  $OP$ , and then the value of  $a$  is read off at once from the side  $OQ$ , and the value of  $b$  from the side  $QS$ .

If, on the other hand, the vector be given in the form of  $a + i b$ , the line on the arm  $OP$  is set on the point of which the co-ordinates are  $a$  and  $b$ , and then the value of  $R$  can at once be read from the graduations on  $OP$ , and the value of  $\theta$  from the arc  $QR$ .

For rough work, good tenth-squared paper could be employed, but xylonite is a far better material, especially when the instrument has to be frequently used.

**Exhibition in Spain.**—The Union de Productores de Espana para el Fomento de la Exportacion has decided to hold an international exhibition in December next, in the Universidad Industrial at Barcelona. Besides a display of the products of Spain, there will be a section set apart for machinery in operation, chiefly agricultural, where English electrical engineering firms may exhibit the advantages of their particular specialities. Cargo-handling appliances, in connection with a cinematograph review of the principal ports of the world, will also be among the features. —*Industria e Invenções.*



## ELECTRICITY AND PLANT GROWTH.

THE value of experimental research has been over and over again demonstrated in the way that laboratory and small scale experiments have led the way to practical applications on a commercial basis of electricity to many spheres of utility

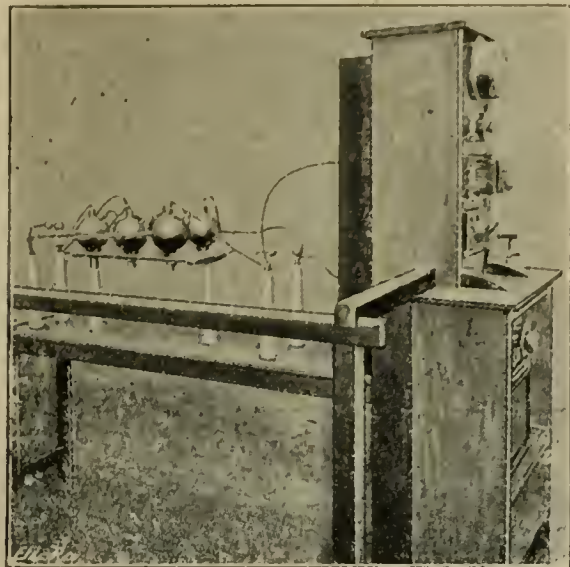


FIG. 1.

which, at first sight, appeared to be beyond the range of this form of energy. It is, perhaps, not beside the mark to refer to the fixation of atmospheric nitrogen as an example of the unexpected developments which may occur from the prac-

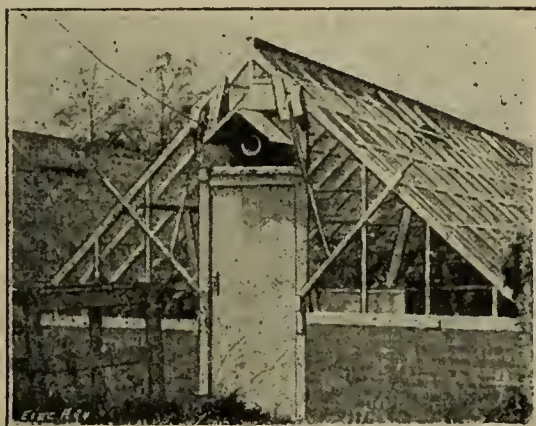


FIG. 2.



FIG. 3.

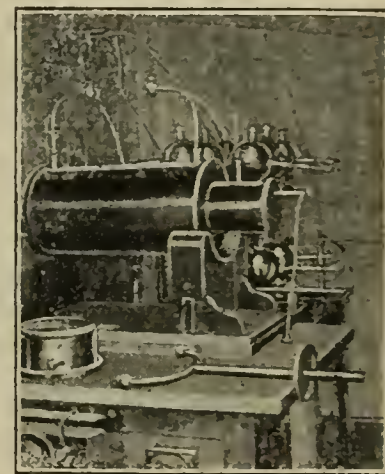


FIG. 4.

tical application of facts which were well known in the laboratory, to a process which may do very much to revolutionise the economics of agriculture, and the success with which this is now, especially in Norway, demonstrated to be workable on a commercial and paying scale, makes one bold enough to hope that in the future we shall see the successful commercial application of researches which are at the present time proceeding with regard to the application of electricity to another department of agriculture. This work, which is at present only in its initial stages, is the use of electrical static discharges from overhead conductors, in order to stimulate the growth of cereals and root crops planted beneath the electrical conductors. Even at the present time it is demonstrated, without fear of contradiction, that at any rate with some forms of plant growth, the stimulating action of high-tension and high-frequency discharges is most marked; and although up to now the experiments have not proceeded long enough and on a large enough scale to enable accurate and uniform results as to the increase of the value of crops compared with the cost of the electric discharge to be obtained, the results have been sufficiently encouraging to warrant us in making somewhat extensive reference to the means and methods adopted. By the courtesy of Prof. J. H. Priestley, of the Department of Economic Biology of the University of Bristol, we are able to reproduce interesting photographs of some portions of the apparatus used, and some of the results achieved thereby, but before referring particularly to this, it may be interesting to abstract briefly from Mr. Priestley's

paper on "Overhead Electrical Discharges and Plant Growth," in the *Journal* of the Board of Agriculture, and from his recent paper on "Electricity in Relation to Horticulture," before the Royal Agricultural Society, some account of the present position of this new development.

For the purpose of obtaining the high-tension and high-frequency discharges in the experiments carried out by Lemström, the electric influence machine was used in order to charge the conductors above the crop, but it was found to be difficult to keep machines of this type running continuously for long periods with a satisfactory discharge, and also, owing to the small quantity of electricity obtained by this means, the wires had to be kept comparatively close to the ground in order to secure an adequate discharge upon the crops. This meant that the men employed on the field were hampered in their movements by the network of wires. It was only when Sir Oliver Lodge developed his high-tension valve for use in connection with an induction coil similar to those used in X-ray work, that high voltages and high-frequency currents of a continuous and ample nature could be obtained. By the courtesy of Mr. Lionel Lodge, of the Research Laboratory of the University of Birmingham, we are able to show an illustration in fig. 1 of a high-tension discharge set suitable for use in this connection. The Lodge valve is simply a vacuum tube which allows the current to pass in one direction and prevents its return, thus acting in a similar manner to the valves in an ordinary water pump. Its action depends entirely upon its shape, which was arrived at chiefly by experiment. The discharge set shown in the illustration gives the valve in position and other details of the apparatus as used by the Agricultural Electric Discharge Co., of Gloucester, which has done a great amount of experimental work at Evesham in connection with

electric discharges for stimulation of plant growth. Owing to the high voltages which can be obtained in connection with the use of this valve, and its steady running properties, it is possible to raise the network of overhead conductors to a considerable distance above the ground, enabling men to work below them, and a minimum amount of attention is required to secure continuous running. Mr. J. E. Newman, of the Gloucester company above mentioned, has carried out some very interesting experiments upon the land of Mr. R. Bomford, near Evesham, while other trials have been made at nurseries at Bitton, near Bristol. The application of electric discharge has been divided into two groups of experiments, the first being conducted in the open, and the second upon plants under glass. At Evesham an area of some 20 acres has been subjected to electric action. The network of charged conductors is carried by about 20 poles, a series of thin wires being stretched between a pair of parallel thick wires: each of these pairs is borne by insulators raised about 16 ft. above the ground by means of larch poles. These wherever possible are placed near the hedge, although some are in the open field. Unfortunately, it is impracticable to show the network satisfactorily by photographs, as the wires are too fine to be seen. Owing to the high tension employed and the danger of excessive leakage in wet weather, special attention is paid to the insulation. The insulators used are of a special high-tension type, and prevent leakage down the pole, and interposed between the actual charged conducting wires and the insulator on the pole is a short length of wire terminating in another



insulator, which in its turn carries the charged conductor. These conductors are made of comparatively large cross section so as to diminish leakage in the air, while the network over the area to be operated upon is composed of smaller wires. Mr. Priestley has found that in some cases it is advisable to place at intervals on these wires, twists or barbs pointing downwards, the points of the barb acting as a sort of jet for the electric "spray" to be directed towards the growth beneath. This does not appear to be so advisable when very high voltages are used. Fig. 4 shows a view of the induction coil or transformer of the Lodge valve used at Evesham, while fig. 3 illustrates the exterior of the transformer shed, showing the high-tension insulator leading the wire from the inside of the shed to the



FIG. 5.



FIG. 6.

fields. It will be noticed that the insulator is protected as far as possible by a pent-house cover from the weather. As an example of the stimulating effect which the electric discharge has on the plant growth, figs. 5 and 6 may be compared to the boy shown. The first shows a growth in an electrified portion of the area, while the second shows a similar growth which is not under the treatment of electric discharges. If current is not available from a power house in the neighbourhood, a most convenient method of obtaining power is to use a small oil engine and dynamo set giving from 100 to 500 watts, with a voltage of from 10 to 250. The low-tension current should then be led to a transformer shed of water-tight construction placed as nearly as possible in the centre of the area to be treated, in order to diminish the chances of leakage from the high-tension conductors as far as possible. The strength of the discharge is tested at the induction coil by measuring the distance over which the spark will leap by means of the sparking arrangement shown lying on the table in fig. 4. In the field it is possible to test the discharge which is occurring by means of an insulated exploring wire held near to the ground which, on being touched with the finger, will give a slight shock when the high-tension wires, 10 ft. to 16 ft. overhead, are charged with high potential. At night the same effect can be tested by means of a vacuum tube placed in connection with the insulated wire.

In the experiments on plants under glass, the generating plant used at Bitton was of the influence machine type, while at Evesham the high-tension system used in the fields was extended to the green-houses. In this case the wires are attached to the door, which opens outwards, in such a way that it is impossible to open a door until the wire inside the green-house has been slackened and lowered to the ground, so as to earth it and prevent the person entering from receiving an electrical shock. If the door is closed again by the person entering, the wire is lifted again from the ground, and put under pressure, and he has to be careful of this fact. Fig. 2 shows the method of leading high-tension conductors into the green-houses. Under a pent-house roof is a porous cylinder, within which is a silica tube. Through this tube passes a wire which is insulated with india-rubber. Inside the house this wire is hooked on to another wire of small diameter running the length of the house, and supported by ebonite insulators fixed on either door by lengths of paraffined string running through holes in an ebonite rod. As the houses are arranged in groups of five, without partition walls between them, the charged wire is conducted from house to house under the wooden roof frames through a long cylinder of porous earthenware slung

from the roof by paraffined string. At Bitton the risk of shock to the men working in the glass houses is avoided by running the discharge only at night, as a general rule, while if the discharge has to be run in the day, earthing arrangements, as described above, may be adopted.

It is impossible in a short article of this description to enter fully into the actual extent to which the results justify the treatment. As regards green-house work, Mr. Priestley is of the opinion that electrical treatment is more useful in the cases of crops grown in pots all over the floor of a large house, than for vines, cucumbers, &c., which climb up the sides of the house. The discharge does not appear to be very effective behind hot-water pipes and wire put up to support plants in green-houses. In the fields it appears that it is not desirable to apply electric discharge in very dry weather, as the crops yielded are decreased, while during rain the overhead wires leak too much, and therefore the treatment yields its best results when the weather is fine, and the soil contains enough moisture. Under these conditions the crop is accelerated, which acceleration may produce an increased crop by allowing the plants to mature and produce under the best conditions as to season. Moreover, acceleration means an early arrival of the produce on the market, which, of course, is of money value. For actual data regarding the results obtained on the various crops, it would be advisable to refer the reader to the two papers by Mr. Priestley, mentioned above, but sufficient has been said in this article to show that a comparatively new and very interesting field of experiment has been opened up for electricians who have sufficient knowledge of agriculture to operate under favourable conditions, and with a clear knowledge of the natural causes tending to produce good results. There appears to be no reason to doubt that within the next few years very remarkable developments will be seen in the application of electric discharges to agriculture. Possibly such developments will be more noticeable in regions such as the Canadian wheat areas, where large-scale farming is well understood, and where also supplies of current from centralised sources are freely available. There is, however, every reason to hope that even in Great Britain some attempt will be made on a larger scale even than at Evesham towards the development of this application, which, if successful, should prove of the greatest benefit to the agricultural community. The time has hardly yet arrived, however, when one may freely enter into the field with certainty that financial prosperity will, as a matter of course, follow from the application of electric discharges. Much more experiment and research must be effected before the conditions are fully known, but sufficient has already been done to make it evident that careful and painstaking work will not go without its due reward.

---

**London County Council Coal Supply.**—The Highways Committee reported at Tuesday's L.C.C. meeting that in view of the possibility of a difficulty arising with regard to the supply of coal for use at the Greenwich generating station, it had asked the Stores and Contracts Committee to make arrangements for the supply at an early date of a quantity of coal over and above the quantity which would be supplied during the next few weeks under the current coal contracts for the generating station, and in accordance with this request, a purchase of 4,500 tons had been made.

**Fatal Accident.**—An inquiry relative to the death of Alexander Macdonald, plumber, St. Mary's Terrace, East Wemyss, which took place at the Fife electric power station on December 14th last, was held at Cupar Sheriff Court last week before Sheriff Armour and a jury. It was stated in evidence that while Macdonald was on his way to procure some tallow for the purposes of his occupation at the power station, he had gone near a cable which was being tested and had touched it with the palm of his hand, death from electric shock resulting. Mr. Newlands, H.M. Inspector of Factories, said that, although there had been no violation of the regulations, he thought it was a case where the jury might add a rider to their verdict that there should be a screen or guard erected while such work was in progress. In accordance with this expression the jury added to their formal verdict the following rider: "The jury would suggest that in all cases of testing or general work where permanent fencing or safeguarding is impracticable, the danger zone should be screened off and a warning placard erected."



## THE EARTH FAULT.

By A. T. BULLEN.

EARTH faults frequently develop on electric circuits, as many of us know only too well, and some faults are hard to locate, and difficult to clear, as a large number of us also know. Other faults, although not really difficult to locate and clear, are tricky in their action, and often misleading.

Some earth faults again are very serious, while others which appear very similar on the face, have a practically negligible effect. As an illustration of this, two faults on the wound rotors of two induction motors on the same supply circuit may be cited. In the first case it necessitated the rewinding of the rotor, while in the second case the motor appeared none the worse for the defect.

Perhaps the most serious earth fault is the one that is registered by the consumer's meter. These faults are exceedingly unpopular. On one occasion a certain consumer had a very faulty installation, in fact, the current was leaking to earth in three separate places, and the result at the end of one quarter was astounding. Naturally the meter was disputed, but it was tested and found to be correct. The "dead earths" on the installation were, however, revealed, and the consumer had to pay. To say that he was indignant is putting it very mildly.

The most curious effect of an earth fault which it has been my privilege to witness, was on a certain D.C. circuit which supplied a butcher's shop. At the back of the shop was kept a brine tub which was slightly leaky, or else the brine had been carelessly handled, with the result that after a time some of it trickled through the floor, and came in contact with the electric wires. Electrolysis must have taken place, and metallic sodium was deposited, which, coming in contact with some water, caused an explosion and almost a fire. I feel satisfied that the explosion was not a short-circuit on the wires, since the fuses, which were of proper gauge, were afterwards all found to be intact.

The mains department of a certain supply company were misled recently by an earth fault which occurred on one of their own services. The supply taken was for two poly-phase induction motors, and an earth was traced from the sub-station to the yard in which these motors were working. One of the jointers called in at the yard to inspect the installation armed with a lamp and lead, which seems to be the jointer's usual method of testing. On tapping across from the main switch on one phase of the motor to the lead cover of the cable with his lamp, he obtained a full glow, and immediately jumped to the conclusion that the "earth" was on the motor. Instructions were given for the dismantling and cleaning of the motor, which certainly was in a very dirty condition. This done, an insulation test was taken on the motor and wiring, and being found to be of sufficient insulation resistance, the circuit was reconnected.

A day or so later the jointer, still tapping with his lamp in the sub-station, again obtained a full glow, which apparently meant a dead earth on the inner, and this he traced to the motor as before. The mains superintendent now visited the yard armed with a megger, and found that the motor and installation were in an excellent condition. He then tapped with his lamp from the company's cut-out (the fuses having been drawn) to the lead cover, and a dull glow showed—decidedly a partial earth on the service cable. Next the motor was reconnected and started, and the tapping again taken when the dull glow became a full glow.

The fuses on the other phase were next withdrawn, leaving the one phase only in circuit, and the glow once more dropped to half, thus showing that the additional voltage had been supplied from the opposite phase by a transformer action in the motor, and that the earth fault which existed was on the service only, and not half so serious as it appeared.

Had it been possible to open the switches on each circuit separately instead of them being coupled together, it is more than likely that much of the trouble caused by this partial earth would have been avoided. It was also curious, and perhaps misleading, that the earth voltage, together with the assistance it received from the motor, should just bring the lamp up to a full glow.

Before leaving the lamp and lead, it is worth while noting the older practice of permanently connecting a lamp between outer and earth. On one occasion where this had been done, a transformer failed and a large excess of voltage occurred across the lamp, smashing it and the holder completely. After that the other lamps were removed, and have not since been replaced.

An earth fault that occurs on an installation fitted with an auto-transformer is sometimes a very serious matter, and often ends very disastrously for the installation, since under certain conditions it is possible to get the full supply voltage across the lamps, which are often for use on circuits of about one-quarter the voltage. Such a case occurred some time ago at one of our public libraries, although, fortunately, only about 30 lamps suffered.

Earth faults sometimes assist electricians, as in the case of a motor which, although wrongly connected, was enabled to run simply because the installation was earthed in two places; but, generally speaking, they are things to be avoided.

They are often productive of very unpleasant shocks. The writer was once in a test room, the floor of which was of some patent material which reminded him of compressed red lead. Moreover, the installation was earthed on one pole. In making an adjustment to a meter he did not take the precaution of pulling out the switch, with the result that he was knocked backwards on to the floor. On that floor even the telephone could produce an unpleasant shock.

Speaking of meters calls to mind the inquisitive gentleman who was determined to know all about his electric meter, and therefore descended into the cellar with a candle, but, unfortunately, that meter was "earthed to case," and the gentleman found out more about the meter than he wanted to know.

The testing of meters for insulation is often carried out by flashing them with a considerable voltage from the coils to the frame, but this has been attended on more than one occasion with disaster. In one of our largest test rooms one of the assistants had his face blackened through flashing an earthed meter with about 600 volts and trying to see the effect too closely.

In a public convenience where lead-covered wires were used, an earth fault once developed, and the walls—which were quite damp—produced livid blue sparks at every point where contact was made with the lead. Needless to say, the attendant in charge became exceedingly alarmed.

Nearly all of the instances cited above serve to show how necessary it is to avoid earth faults on wiring, and contractors should do their utmost to assist in preventing accidents, which are often due to carelessness on their part.

Many contractors have great faith in the maxim, "Out of sight, out of mind," as is evidenced by the unprotected wires which we so often find under floors, and the flexible cords which have been run through disused gas pipes, simply because they go in easily.

Accidents, of course, are not always preventable, as is shown by the following case. Here the wires had been run in steel tubing under the floor, but some person other than an electrician had got to work with nail and hammer, pierced the tubing and found the wire. Great was his surprise to see the lamp above him suddenly burst into a most dazzling light, although the switch had not been touched, and then as suddenly break and go out. This was, of course, a circuit with an auto-transformer. It is worth noting that even stout steel tubing, if laid in contact with the floor boards, can readily be pierced in this way with a nail.

Although no blame can be put on electricians for such happenings as these, they are to blame for many similar accidents, and we cannot but hope that at least those who happen to read these lines will be more careful with hidden wires, and remember that the exposure of bad workmanship—and such exposures are bound to come—will not assist them in earning their daily bread.

---

**Patent Restoration.**—The *London Gazette* announces that an order was made on January 16th restoring No. 13,746, of 1903 (Samuel Marsh Young), for an invention entitled, "Improved method for operating signals on electric railways."



## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"V. L. P." writes:—"I remember a case some time ago in which action was brought by a municipality against a private concern supplying electrical energy, and the case was successfully fought, I believe, under Sec. 23 of the Electric Light Act, 1909. I have looked up all my back numbers of the REVIEW in which I thought the case was reported, but I have not been able to find the information, and I shall be much obliged if you can enlighten me on the matter."

\* \* There is an excellent reason why "V. L. P." did not find the case referred to, namely, that there is no such case. Sec. 23 of the Electric Lighting Act, 1909, provides that where a supply is given in any area by authorised undertakers, no other local authority, company or person, may "commence to supply or to distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts, provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electric energy to consumers. Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking, other than the conveyance of public traffic." The Act which contains the above provision only came into operation in April, 1910, and there has been no case which involved the point raised.

No case could well have been decided favourably to a local authority prior to that date, in view of the fact that before the Act in question no restriction was placed on the supply of electricity by private persons in any part of the country.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

546. "Electrical ignition plugs for use in internal-combustion engines." G. CLARK. January 8th.
582. "Incandescent electric lampholders." J. FARLEY. January 8th. (Complete.)
588. "Telephone relay." P. DRESLA. January 8th. (Complete.)
627. "Systems of electric distribution." BRITISH THOMSON-HOUSTON Co., LTD., and A. P. YOUNG. January 8th.
628. "Electric indicating instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 8th.
643. "Method of regulating the current in direct-current arc lighting, search-lights, electric welding and the like." A. MARTIN, H. JACKSON, A. J. CAMPBELL, T. B. CAMPBELL and W. CAMPBELL. January 9th.
687. "Telephone systems." W. H. DERRIMAN. (Automatic Electric Co., United States.) January 9th. (Complete.)
719. "Starting switches for use with electric motors and like purposes." C. W. ATKINSON. January 9th.
720. "Electrical train equipment." P. H. DAWE. January 9th.
722. "Electric clocks." BRITISH THOMSON-HOUSTON Co., LTD., and F. HOLDEN. January 9th.
723. "Electrically-heated stoves." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 9th.
725. "Apparatus for the electro-osmose method." GES. FÜR ELEKTRO-OSMOSE m.b.H. (Convention date, October 2nd, 1911, Germany.) January 9th. (Complete.)
728. "Manufacture of electric accumulator electrodes." R. PAPE. (Divided application on 12,019/11, May 18th.) January 9th.
741. "Means for increasing the power factor and overload capacity of alternating-current asynchronous machines." G. KAPP. January 10th.
743. "Magnetic brakes of tramcars and like vehicles." G. J. CONATY and C. B. KETLEY. January 10th.
750. "Electric lampholders or the like." G. St. J. DAY. January 10th.
757. "Speed regulation of electrically-driven turning machines, such as lathes, boring machines and the like." F. GREENHALGH. January 10th.
771. "Electrolysis of metals." N. V. HYBINETTE. (Convention date, January 12th, 1911, Germany.) January 10th. (Complete.)
777. "Electrical apparatus for transmitting and receiving signals." SIR A. T. DAWSON and G. T. BUCKHAM. January 10th.
778. "Radio-disinfectant." A. E. GOODGER and P. O. GRIFFITHS. January 10th.
801. "Stabilising voltaic arcs." C. E. GUYE. (Convention date, January 10th, 1911, Switzerland.) January 10th. (Complete.)
816. "Wheel for rail-borne vehicles, especially applicable to electric tram-cars." A. H. MAYES. January 10th.
819. "Construction of electric storage batteries of the solid type." J. T. NIBLETT. January 10th.
828. "Electrical accumulators." W. BANNISTER. January 11th.
873. "Mounting filaments for incandescent electric lamps." DEUTSCHE GASGLÜHLICHT ART.-GES. (Auerger.) (Convention date, August 12th, 1911, Germany.) January 11th. (Complete.)
874. "Manufacture of electric incandescent lamps." DEUTSCHE GASGLÜHLICHT ART.-GES. (Auerger.) (Convention date, May 11th, 1911, Germany.) January 11th. (Complete.)
881. "Telephone receivers." SOC. WOLFF MANOURY ET CIE. (Convention date, February 9th, 1911, France.) January 11th. (Complete.)
900. "Means for retaining in position the shades of incandescent electric lamps." J. FARLEY. January 11th. (Complete.)
906. "Electric switches." M. GREENWALD. January 11th.

910. "Alternating-current electric motors." A. C. BELL. January 11th. (Complete.)
925. "Miners' electric safety lamp." G. LEACH. January 12th.
939. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. January 12th.
955. "Electric arc lamps." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) January 12th. (Complete.)
956. "Apparatus for controlling motion from a distance, applicable more particularly to the control of searchlights or projectors, steering-gear and the like." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, September 28th, 1911, Germany.) January 12th. (Complete.)
957. "Alkaline electric accumulators." W. K.-L. DICKSON. January 12th. (Complete.)
976. "Holders and shades of incandescent electric lamps." J. FARLEY. January 12th. (Complete.)
986. "Holophane or other reflector shade carriers for electric lamps or the like." D. L. J. BROADBENT. January 12th.
991. "Incandescent electric lamps." F. BOUSSIN and J. AUGER. January 12th. (Complete.)
998. "Electric current regulators." J. KNIGHT. January 12th.
- 1,001. "Electrolytic manufacture of alloys of light metals with heavier metals and the continuous treatment of such alloys for obtaining final products and apparatus therefor." E. A. ASHCROFT. January 12th.
- 1,003. "Electrolytic manufacture of light metals and reaction products thereof, and apparatus therefor." E. A. ASHCROFT. January 12th.
- 1,004. "Electrolytic manufacture of caustic alkalies in pure anhydrous condition, and apparatus therefor." E. A. ASHCROFT. January 12th.
- 1,010. "System of metering electrical energy with special tariffs." LANDIS and GYR. (Convention date, August 19th, 1911, Switzerland.) January 12th. (Complete.)
- 1,013. "Miners' electric safety lamps." H. HUNTE and A. HUNTE. January 13th.
- 1,039. "Automatic electric winding mechanism for clockwork." SOC. ANON. DES HORLOGES ELECTRIC SILENTIA. (Convention date, March 10th, 1911, France.) January 13th. (Complete.)
- 1,079. "Electric measuring instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 13th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1910.

- ELECTRIC HEATING APPARATUS. H. F. BERRY. 21,665. September 17th.
- ELECTRIC CURRENT REGULATING AND CONTROLLING APPARATUS, SUCH AS ELECTRIC MOTOR STARTING AND CONTROLLING APPARATUS AND THE LIKE. J. A. HIRST and P. S. BROOK. 29,339. December 17th.
- EDDY-CURRENT ABSORPTION BRAKES. J. G. P. THOMAS. 29,734. December 22nd.
- ELECTRIC SUPERVISORY SYSTEMS FOR SPRINKLER FIRE-PROTECTION SYSTEMS. F. J. BROUGHAM. (Dominion Guarantee Co.) 30,024. December 24th.

## 1911.

- ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 6,095. March 10th.
- PORTABLE TELEPHONES. W. Fairweather. (S. Stein.) 6,345. March 14th.
- APPARATUS FOR TREATING LIQUIDS WITH ULTRA-VIOLET RAYS. V. Henri, A. Helbronner and M. von Recklinghausen. 8,157 and 8,158. March 3rd. (Divided application on No. 12,948 of 1910, December 23rd.)
- TELEPHONE TRANSMITTERS. K. M. TURNER. 8,932. April 11th.
- TROLLEY WHEELS FOR ELECTRICALLY-DRIVEN VEHICLES. L. PINTNER. 10,038. April 25th. (August 4th, 1910.)
- ELECTRIC FURNACES. ROCHLING'SCHE EISEN UND STAHLWERKE GES. and W. RODENHAUSER. 10,231. April 27th. (December 13th, 1910.)
- SPARK-GAP DEVICES FOR WIRELESS TELEGRAPHIC AND TELEPHONIC APPARATUS. E. BELLINI and A. TOSI. 10,266. April 27th.
- INSULATORS FOR HIGH-TENSION ELECTRICITY CONDUCTORS. F. CLOUTH, Rheinische Gummi-warenfabrik. 13,676. June 5th. (Addition to No. 1,009 of 1910.)
- METHOD OF AND APPARATUS FOR REGENERATING BURNT-OUT CARBON AND METAL-FILAMENT ELECTRIC LAMPS. S. BLOCH. 16,230. July 13th.
- METHOD OF APPLYING A METALLISING LIQUID TO ELECTROTYPING MOULDS AND APPARATUS THEREFOR. H. S. LEVY. 16,689. July 20th. (February 11th, 1911.)
- DRUM-TYPE CONTROLLERS FOR THE SHUNT CONTROL OF ELECTRIC MOTORS. Allen, West & Co. and R. Moggridge. 16,870. July 21st.
- ELECTRIC PUSH-BUTTON SWITCH. W. BRUNNER. 18,778. August 20th.
- FURNACES FOR THE PRODUCTION OF METALLIC SODIUM BY ELECTROLYSIS. Scheitlin. 18,804. August 20th.
- ELECTRIC HORNS. N. LUCAS and S. EDWARDS. 19,034. August 24th.
- MEANS FOR AUTOMATICALLY CONTROLLING HEAT IN ELECTRIC HEATING APPARATUS. J. NIGHTINGALL. 19,942. September 7th.
- ELECTRICAL WELDING MACHINES. British Insulated and Helsby Cables, Ltd., and P. Bucher. 21,942. October 5th. (Divided application on No. 26,478 of 1910, November 15th.)
- MEANS FOR USE IN AUTOMATICALLY CONTROLLING THE TIMING IN "MAGNETO" IGNITION APPARATUS. H. DIEHL. 24,697. November 6th. (November 26th, 1910.)

**Aquadag and Oildag.**—Thanks to the courtesy of Mr. W. H. Allen, engineer and manager of the Loughborough Corporation Electricity Works, we are now enabled to state that the English agents for the Acheson graphite products are the Cromil Co., Milburn House, Newcastle-on-Tyne, to whom our numerous inquirers on this subject are referred.

**Lamp-Selling.**—As a part of their "Wotan" lamp business-extension campaign, MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, on Friday last, published a page advertisement of these lamps in the *Daily Express*. Copies of the advertisement were sent to trade customers for display on their premises.



# THE ELECTRICAL REVIEW.

VOL. LXX.

FEBRUARY 2, 1912.

No. 1,784.

## ELECTRICAL REVIEW.

## COMMERCIAL CO-OPERATION.

Vol. LXX.]	CONTENTS: February 2, 1912.	[No. 1784.	Page
Commercial Co-operation ...	...	...	161
The Electrical Profession ...	...	...	163
Electricity Supply in London and New York ...	...	...	163
Correspondence:—			
Printing "Transactions" ...	...	...	165
Old Carbon Ends ...	...	...	165
The Association of Consulting Engineers ...	...	...	165
A Suggestion to Tramway Managers and Others ...	...	...	165
The Electric Vehicle ...	...	...	166
Earthed Concentric System ...	...	...	166
"Electric Cranes and Hoists" ...	...	...	166
The Economy of Electric Cooking ...	...	...	167
Capital and Labour ...	...	...	167
The Electrical Profession as It Is ...	...	...	168
Notes from Canada ( <i>illus.</i> ) ...	...	...	168
New Diesel Plant at Kingston-on-Thames ...	...	...	169
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	...	170
Legal ...	...	...	171
Business Notes ...	...	...	172
Electric Power in Textile Mills ( <i>illus.</i> ) ...	...	...	179
On Packing Armatures for Rail Conveyance ...	...	...	181
Reviews ...	...	...	182
Notes ...	...	...	184
City Notes ...	...	...	186
Stocks and Shares ...	...	...	190
Market Quotations ...	...	...	190
Share List of Electrical Companies ...	...	...	191
Wood and Concrete Poles in Electrical Service ( <i>illus.</i> ) ...	...	...	193
Trade Statistics of the Straits Settlements, 1910 ...	...	...	195
Proceedings of Institutions:—			
The Heat Paths in Electrical Machinery ( <i>illus.</i> ) ...	...	...	195
Our Legal Query Column ...	...	...	199
Foreign and Colonial Tariffs on Electrical Goods ...	...	...	200
New Patents Applied For, 1912 ...	...	...	200
Abstracts of Published Specifications ...	...	...	200
Contractors' Column ...	Advertisement pages xxii, xxiv and xxvi		

SOME little time ago we published some remarks concerning co-operation in the electrical industries, and we feel that, in view of the present position of the electrical industry, it is worth while to revert to this subject with special reference to the steps which have been taken by our friends on the other side of the Atlantic in respect of this important matter. By the courtesy of Mr. Philip S. Dodd, the secretary of the Commercial Section of the National Electric Light Association of America, we are able to put before our readers a brief account of the very successful work which has been accomplished among the electrical interests of the United States with the object of their working together to bring the utilisation of electricity before the general public.

When Archimedes was asked whether he could move the world by leverage, he said that even this would be possible if he could find a lever long enough and a fulcrum. The English-speaking races have found the fulcrum, at any rate, for many of the largest movements in that national institution, the public dinner, and in this connection the Americans have made good use of their social organisation known as the Sons of Jove. For example, on December 13th the New York Jovian Luncheon Club met, with an attendance of 137, to hear Mr. Howlett, of the General Electric Co. of Schenectady, speaking on the co-operative come-together spirit, which was fostered by doing things of a practical and definite nature. Similar organisations exist in Cleveland, Philadelphia, Pittsburg, St. Louis, Chicago and Denver, and the co-operative movement in these organisations is interested in, for example, the co-operative electrical page, such as is being carried on at the present time in eleven different newspapers in nine American cities. There is also co-operative work being undertaken with Chambers of Commerce and various trade associations, for the betterment of local lighting conditions, and improvements in regulations regarding lighting, wiring hanging of signs, &c. Work is also being done in bringing about harmonious relations among lighting companies, manufacturers and contractors, and bringing about a better understanding between them and the insurance companies and city Inspection Bureaus. Moreover, they organise conventions, and co-operate with Chambers of Commerce and Citizen Committees for the general betterment of the cities affected, and also with national bodies such as the National Electric Light Association, and especially the Commercial Section of that body. In New York they have appointed three committees: the Membership Committee, the Press Committee and the Speakers' Committee, and from the titles of these sections the work which is being carried on can be fairly well gauged.

Reference has been made to the Commercial Section of the National Electric Light Association, and this would

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 10s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; postfree 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers.

PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE

## UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN THE PRESS.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



appear to be a feature which might be recommended to the attention of even such an august body as the Institution of Electrical Engineers. It includes the commercial men of the electrical industry of America, such as representatives of electric lighting companies, manufacturers of electrical apparatus, dealers in electrical supplies, and electrical contractors, and its work is the development of progressive policies for the enlargement of activity in the entire electrical industry. This programme is rather that of general co-operation than the establishment of a central bureau for the collection and dissemination of information. At the same time a good deal of work has been done in the preparation of two booklets, one called "Data on Electric Signs," and the other "The Electrical Equipment of the Home," which up to the present have had a combined circulation of about 65,000 copies. It is hoped in the near future to publish three or four similar compilations available for the members for general distribution, these being on Street Lighting, Industrial Lighting, Residence Lighting, and Heating and Cooking Devices for the Home. The most important section of the work will be the compilation of a "cumulative index," to give all classes of information necessary in the work of the commercial man. Included in this will be a running digest of commercial articles published in various electrical and trade journals starting from five years back, with a digest and index of papers, articles, &c., published or read before the different societies and associations whose work has any commercial bearing. Chapters will also be included on current-consuming devices, with descriptions of the devices and what each is intended to do, and complete price-lists, selling policies of the manufacturer, &c. There will also be chapters on public policy with customers, contractors, dealers, &c. Another section of the development work of this association will be the institution of an advertising exchange, concentrating in the central bureau all classes of advertising devoted to the sale of energy and energy-consuming devices contemplated or accomplished by companies represented by the membership. The membership is already 1,000, and is rapidly increasing. The names of committees are instructive as indicating the activities of this organisation; they are as follows:—Cost of Commercial Department Work; Competitive Illuminants; Steam Heating; Selling Current to Large Power-Users; Residence Business; Industrial and Commercial Lighting; Commercial Electric Refrigeration and Ventilation; Electric Advertising and Decorative Street Lighting; Contract Order Routine; Membership; Electric Vehicles; and Commercial Index.

It will be seen that the programme of this organisation is most comprehensive and complete, and, if carried into effect, will probably form one of the most remarkable and directly useful efforts ever made on behalf of the electrical industry. These provisions may therefore be recommended to the very serious consideration of those who, on this side of the water, have the interests of electrical power and lighting at heart. One must, however, be cautious, and judge this American movement rather on its ascertained results than on its problematic developments, inasmuch as not only in the United States, but also in this country, some promising schemes have been put forward which, through various causes, have never reached their full development.

Dealing, then, first of all with the book publications, we may appraise the value of this work by the character of the booklets already prepared. That on "The Electrical Equipment of the Home" shows the necessity for providing a more complete electric service in residences than has hitherto been afforded. After giving the simple points underlying practical illumination, data for the calculation of intensity of illumination, the value and use of different types of reflectors, the relation of wall coverings and hangings to the different means of lighting, and the mechanical and electrical features of lamps, fittings and reflectors, for residence lighting, are discussed. Then heating and power appliances and fittings are taken under consideration, with data as regards power consumption and cost of the apparatus usually employed. Moreover, the wiring lay-out is discussed by means of a series of diagrams, and the suggestions given as to the running of the circuits and the placing of the points are most practical.

It will therefore be seen that this book is of a strictly useful nature. The second book, giving data on electric signs, although perhaps more suitable for the United States than for this country, owing to the comparatively backward state of electric sign service in Great Britain, is also very interesting reading. The objective is the selling staff of electrical undertakings, who have to sell energy for electric advertising, and its chief value is in the balance which it secures between the competitive interests of the customer himself, the electric supply authority, the sign manufacturer, and the lamp-maker. It deals not only with the description of such signs, but discusses their cost, the value of position, daylight appearance, and the use of coloured lamps. The question of wiring for electric signs is also discussed in a very thorough manner, and, from an Englishman's point of view, a perusal of the book gives very valuable information on points of practice which, owing to the extensive sign industry in America, have been more thoroughly investigated there than in this country.

Up to the present, however, it will be seen that the above detailed points touch only what may be described as the internal organisation of the combined electrical interests. A further step has been found to be necessary in the development of active outside work among the general public, and the co-operative movement has, as indicated briefly above, been successful in establishing "electrical pages" in several of the most prominent daily newspapers of the United States. The idea apparently originated with the Cleveland Electric Illuminating Co., the first "People's Electric Page" appearing weekly in the *Cleveland News*, and being devoted entirely to popular news items on electrical methods. Financial support was obtained by small display advertisements on the same page, paid for by the local contractors, electrical supply dealers, and so on; and since that time a number of other papers have been included in the campaign. Already the combined circulation of papers conducting an electrical page is nearly 750,000, while other papers, which have a further circulation of nearly 600,000 readers, are about to join this movement. The editorial matter is couched in non-technical language, and considerable attention is paid to the display advertisements. Some of the journals head the whole page as advertising matter, but in others the style of type both of headings and text is precisely identical with that of other parts of the paper.



In developing this scheme, two alternative methods of starting were presented. One, and the most obvious, was that of working it through the commercial department of the electrical supply authority operating in the area. The other method, which is a later development, is that the advertising managers of local papers have discovered that such electrical pages are really most productive sources of revenue to the journal itself, and in some cases these papers have taken up the business themselves, with beneficial financial results. In whichever way the movement has been started, it has been found that the effect of the regular appeal to the outside public has been most encouraging, and if it were possible in this country to organise similar work, there is hardly any doubt that, notwithstanding the temperamental difference of Englishmen and Americans, some very satisfactory results could be secured.

Space does not permit of dealing with this most interesting subject at any further length at the present time. We are very much convinced that in this practical co-operation lies the ultimate secret of success in Great Britain for the electrical industry, and we hope, at later dates, to revert periodically to a discussion of the way in which this energetic campaign is being developed in the United States. It cannot, however, at the present time, be too strongly emphasised that already this matter has in America passed through the stage of the visionary ideal into that of practical working politics; and not only so, but actual results have been obtained by the participating interests. We therefore hope that British interests will not be too conservative to promote an attempt at active co-operation on somewhat similar lines for the ultimate benefit of the industry.

### The Electrical Profession.

IN our "Correspondence" columns to-day we print a letter from a modern "Diogenes," who, however, is apparently in search of a job, and utters a cry from the heart regarding the difficulty of finding it, and the iniquity of the conditions which hinder so able and accomplished a young man from attaining to a position of superior responsibility and corresponding emoluments; with an audacity which commands admiration he sweeps all the troubles and grievances of the electrical industry aside to make way for his own particular complaint, declaring that the only real and substantial injustice is the method of filling vacancies in public supply undertakings which, he says, is now in vogue, especially in connection with municipal concerns.

Wire-pulling is, naturally enough, the means by which the wasters and job-cadgers who are ousting the "shining lights" of the profession have gained their ends, with the lamentable result that these embryonic stars are transferring their distinguished abilities to Colonial "climes." The wasters, having filled the vacancies from which their victims have been ousted, appear to become reversed, for the next proceeding is the reduction of salaries, whereas we should have expected them to be increased. Despite the latent luminosity of the "best young men" who have got left, they are debarred from becoming members of the Institutions by the "absurd qualifications" demanded by the latter, which apparently are not willing to accept them at their own valuation, and are therefore branded as worthless. The unanimity of the scores of disheartened young men whose ability lacks appreciation is touching, if not convincing. Can nothing be done to remedy this deplorable state of things? Or must "Diogenes" return, disconsolate, to his lonely tub?

## ELECTRICITY SUPPLY IN LONDON AND NEW YORK.

By M. TAPPLEY

THE data on which the following remarks are based are the 1910 statistics for London and corresponding statistics for New York (the latter being reproduced in a recent issue of *l'Industrie Electrique, inter alia*). As in any comparison in which London developments are involved, we are faced with the difficulty of determining precisely which areas should be included in "London," and of estimating the population

TABLE I.

	London.		New York.
	"Inner" group.	"Outer" group.*	
Total number of street lamps ...	—	—	75,000
Number of Auer gas lamps ...	—	—	44,500
Number of petrol-gas lamps...	—	—	1,800
Number of arc lamps—Enclosed ...	100	200	—
" " —Open ...	1,750	50	—
" " —Flame ...	1,250	360	—
" " —Unclassified†	3,500	700	—
" " —Total ...	7,910		17,000
No. of incandescent lamps—Carbon...	Negligible	1,750	—
" " —Metallic	10,000	6,500	—
" " —Total ...	18,250		12,500

\* Group of towns named below.

† Mainly "open."

of these areas. As is well known, the greater part of the day population in many London areas quits the central for suburban areas at night (in the City alone it is estimated that the temporary or "day" population of the 673 acres within the boundaries exceeds 1 million). Again, in the case of a number of the London electricity supply companies and Corporations, no reliable statistics are available concerning the population served. Hence, though we can say that the area covered by New York is now about 203 sq. miles, populated by about 5 million inhabitants, we cannot regard "London" as denoting any specific area and population. The following figures may, however, be taken as approximately correct for the various districts stated:—

	Area (sq. miles).	Population.
Greater London ...	693	7,500,000
County of London ...	117	4,873,000
Met. boroughs' supply areas ...	170	3,000,000
Outer electric supply areas* ...	100	1,500,000

\* Including Barnes, Bromley, Finchley, Hornsey, Richmond, Wimbledon, Barking, Beckenham, Bexley, Croydon, East Ham, Erith, Leyton, Walthamstow, West Ham.

The first two rows of the above table are approximate census figures, and the last two rows are deduced from the published statistics of electricity supply in the areas concerned; the latter figures do not include the supply areas of, or population served by, the various London "supply companies" or "corporations"—which areas and populations considerably overlap the figures for the metropolitan boroughs and suburban areas considered.

TABLE II.

	No. of arc lamps.	No. of filament lamps
Carried on iron poles ...	8,050	2,684
" " wood posts ...	8,970	9,355
" " brackets ...	87	112
Supplied on low-tension D.C. system...	7,614	2,576
" " " " A.C. " ...	639	344
" " " " D.C. " ...	2,322	36
" " " " series A.C. system ...	6,539	9,496
Through overhead lines ...	8,812	9,558
" " underground cables...	8,802	2,893

For the purpose of the present article, it is advisable to separate the statistics for the borough and suburban areas: generally speaking, the load factor of supply is about 5 per cent. higher in the latter than in the former areas (chiefly owing to the relatively small evening load in many central areas), and street lighting supply requires a much larger



percentage of the total station output in the suburban than in the town areas (see also later).

Comparing street lighting conditions in London and New York, Table I shows the higher standard attained in the latter city. The number of arc lamps employed in New York is more than twice the number reported as in use in London, and, though the actual number of incandescent lamps is higher in the latter case, the proportional development, taking into account the greater area and population

TABLE III.

	London.	New York.
Auer lamp ... ..	—	95s. to 115s. 60 C.P.
Metallic filament lamp {	45s. to 95s.	107s. to 119s.
	mean 71s. (50 C.P.)	(69-92 watts)
Open arc ... ..	£15-£20	—
Enclosed arc ... ..	—	{ £19 5s.—£20 15s.
		(460 watts)
Flame arc ... ..	£12-£21 ; mean £17	£33 12s. (12 amps.)

served, is considerably lower. The most striking feature of the London data, considered alone, is the enormous extent to which metallic-filament lamps are now employed in street lighting. In the larger thoroughfares the predominance of the flame arc over other types is being rapidly asserted.

The analysis of street lighting supply conditions and practice in New York (Table II, from recent official report), shows the great predominance of the high-tension alternating-current system and the wide application of overhead lines—particularly to the supply of incandescent lamps. Unfortunately, no corresponding figures are available concerning London street lighting; but readers will at once recognise the characteristic features of American practice.

TABLE IV.

	Town.	Suburban.
Load Factor—L.A. undertakings (%) ...	18'98	23'04
Co. undertakings ... ..	16'58	22'09
Average ... ..	17'35	22'77
Average price per KW.-hr. (d.) ... ..	3'3	2'7
No. of public arc lamps ... ..	6,543	2,365
Ditto, incandescent lamps ... ..	5,851	12,502
Per cent. total sales public lighting ...	12	24
Town and Suburban Areas Combined.		
No. of consumers ... ..	...	157,000
Units sold, 1910 ... ..	...	288,000,000
	( = 43 units per head population per annum).	
Per cent. total sales for motors		
motors and cooking ... ..	...	32
Ditto, for lighting ... ..	...	68
Authorised capital of London		
stations ... ..	...	£25,000,000
Ditto, all stations in U.K. ... ..	...	£45,000,000

Turning to the cost of energy supply, maintenance and repairs per annum, it is clear from Table III that the annual costs in New York are from 60 per cent. to 100 per cent. higher than in London; the average candle-power per lamp is somewhat higher in New York, as also are the burning hours, but these factors alone do not account for the wide discrepancy between the two sets of figures.

In ten of the inner and three of the suburban London areas considered, street lighting is charged by meter, the price per unit ranging from 1'0 to 1'9d. per unit in the boroughs, and from 2'5 to 3'0d. per unit in the suburban areas. The corresponding averages are 1'46d. per unit and 2'8d. per unit, i.e., 34'4 per cent., and 66 per cent. of the average tariffs for private lighting, in the respective groups of undertakings. The favourable terms on which electrical energy is available for street lighting in London should rapidly lead to more liberal illumination than is at present provided.

General Supply Conditions in London.—The writer has adopted, for the purpose of the present comparisons and considerations, groups of 32 “town” and 15 “suburban” stations; a recent writer in the *Elektrotechnische Zeitschrift*, dealing with the general electrical development of London, arranged groups of 30 “town” and 39 “suburban” stations—apparently including in the latter group, the undertakings which were to have been included in the 1908 extension of the London Electricity Supply Area (see Garcke’s Manual, 1911, Map, page 10). It is interesting to note that, on the latter basis, about 70 per cent. of the

total generating capacity of suburban stations is owned by local authorities, and 80 per cent. by companies, whereas, in the town areas, these figures are almost exactly reversed (total generator capacities 70,500 kw. and 227,000 kw. respectively). Other interesting statistics from the same source are shown in Table IV.

Reverting to our present classification, it appears, from Table V, that approximately 95,000 consumers are supplied by the town stations (excluding the supply companies), and about 29,000 by the suburban stations—these figures are respectively 3'17 per cent. and 1'94 per cent. of the

TABLE V.

	“Inner” group.	“Outer” group.	Total.
No. undertakings considered ...	32	15	47
Estimated population served* ...	3,000,000	1,500,000	4,500,000
Supply area* ... ..	170	100	270
No. of consumers ... ..	95,000	29,000	124,000
No. of stations providing D.C. ...	23	12	35
“ ” ” ” A.C. ...	18	7	25
KW. capacity generating plant... ..	250,000	39,000	289,000
KW. connections... ..	360,000	52,000	412,000
KW. maximum load ... ..	150,000	19,000	169,000
H.P. motor connections... ..	120,000	19,000	139,000

\* See text.

corresponding populations. The total capacity of the generating plant installed in the “town” stations is close on 250,000 kw., while that in the “suburban” stations is nearly 39,000 kw.; this machinery supplies, approximately, 360,000 kw. and 52,000 kw. respectively of connected load and 150,000 kw. and 19,000 kw. of maximum demand. The total motor connections are 120,000 H.P. in the town and 19,000 H.P. in the suburban areas. Corresponding averages per station are :—

	Town.		Suburban.	
	Total.	Per kw. Generator capacity.	Total.	Per kw. Generator capacity.
Generator capacity, KW. ...	7,800	—	2,600	—
Connected load, KW. ...	12,000	1'54	3,500	1'34
Maximum demand, KW. ...	4,800	0'615	1,270	0'49
Motor connections, H.P. ...	4,100	0'525	1,270	0'49

Direct-current supply is available in 72 per cent. of the “town” and 80 per cent. of the “suburban” supply areas, while alternating current is provided (alone or in addition to D.C.) in 56 per cent. of the town and 47 per cent. of the suburban areas.

The average private lighting tariff in the suburban, as well as in the town, areas is 4½d. per unit (as compared with 4¾d. per unit for the whole country). Motor supply, at an average tariff of 1½d. per unit, is cheaper in the town than in the suburban districts, where the average price for power supply is 2'0d. per KW.-hour, and is thus practically identical with the average power tariff for the whole of the United Kingdom.

Though electricity for lighting purposes is available at the same average rate in suburban areas as in the inner borough areas considered, gas ranges from 2s. 5d. to 4s. 3d. in the suburbs, as against 1s. 7d. to 3s. 5d. in the Metropolitan Boroughs. The 19½ per cent. higher average price per 1,000 cb. ft. of gas in the outer, as compared with the inner, London areas (3s. 1d. as compared with 2s. 7d. per 1,000 cb. ft.), is a powerful factor favouring suburban electricity development, and should certainly be noted by all persons directly or indirectly interested in the latter.

Patent Application.—MESSRS. BAKENDALE & CO. and the WOLF SAFETY LAMP CO., LTD., have applied for the restoration of patent No. 5,542 of 1900 for “Improvements in Safety Devices for Miners’ Safety Lamps,” granted to Messrs. C. Darrah, jun., and J. G. Patterson.



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## Printing "Transactions."

In your issue of January 19th you refer to the very convenient arrangement that has been adopted by the American Society of Civil Engineers, in printing their *Transactions* in such a manner that separate papers can be removed without destroying the completeness of another paper.

It would be a great boon if the Institution of Electrical Engineers were to adopt a similar course, and I would suggest that this plan would be particularly useful if applied to the annual index to *Science Abstracts*. The different subdivisions of subjects should be able to be separated, so that one could file all the index references to each subject together.

If this were done, it would be possible to search through the index of any one subject for years back without having to open the index of each year, which process makes such a search so tedious at present.

A. J. Makower.

January 27th, 1912.

[We have frequently had the same experience, but doubt whether it would be practicable to adopt the principle in the case of an index with so many subdivisions. A better plan would be to issue a separate index at intervals of five years, combining the indexes of the corresponding volumes in one. This would be an easy thing to do, and would save an immense amount of labour, as well as wear of the bindings.—EDS. E.R.]

## Old Carbon Ends.

I have read with interest the letter by Mr. Runnett on the above subject, but am afraid that the value of the time taken by him in the process which he mentioned, would far exceed the cost of buying fresh carbons. However, I have several times been asked for an opinion as to what is the best method of using up old carbon ends, and, where the consumer has a large quantity, have always recommended that the ends should be thrown on the private coal heap; if a few are put in the fire and banked round with coal, you will find that the fire will last for some hours longer than would be the case if only coal were used.

Even if the fire has gone out, you will often find that pieces of carbon remain only slightly burnt away, and they can, of course, be used again.

W. G. Mayer.

London, N., January 24th, 1912.

## The Association of Consulting Engineers.

In your last issue you said that "a grave injustice is being attempted upon men who are outside the Civils. . . ." As I am not a member of the Civils, and as I supported the chairman at the meeting in connection with the Association of Consulting Engineers, I am writing to point out to you that I do not consider such a statement is at all justifiable. I am strongly of the opinion that an Association is needed which will concern itself with matters affecting the welfare of consulting engineers.

As the chairman pointed out at the meeting, if one starts any society or association, of which the conditions of membership are not strict, then in later years it is always found that members have been admitted whom it would have been better not to have elected.

If an association or society starts with very strict conditions of membership, then at a later date it is always quite easy to relax these conditions if found desirable.

The present Association is one that must be very careful indeed about its conditions of membership and its rules. For this reason I am strongly of the opinion that the first members of the Association should be selected on the strictest possible basis, and I am therefore in favour of the corporate membership of the Civil Engineers being made a condition of membership of the Association in addition to the other

qualifications, although this condition precludes me from joining the Association.

I consider that the Association should start life with its original members selected on the strictest possible basis. Let these members then get together, let them elect their committee, and let them get the rules into final shape. If the matter is carried out in this way, which I consider is the right way, then I am quite content to abide by their final decision as to the conditions of membership.

If they finally decide that corporate membership of the Civil Engineers is a necessary condition, I, for one, will take the necessary steps to try and qualify myself. After all, we have to remember that the Civil Engineers is the parent engineering society in this country.

The Committee has done very good spade work. Let the consulting engineers who are eligible under the strict conditions join the Association as soon as possible, elect their own committee, and give us the final copy of the rules.

W. Duddell.

Westminster, January 23rd, 1912.

## A Suggestion to Tramway Managers and Others.

There are considerable possibilities in the tramway world which have yet to be taken in hand by the tramway authorities. At present we have got as far as the "Parcel carrying" business. There should be no reason why, once having started to carry parcel traffic, they should not carry heavy merchandise between two places which happen to be on their system.

The one trouble in connection with this proposition is that of dislocating the passenger traffic: but the anxiety of all station engineers to fill up their load hollows should cause them to run a special service for the carrying of merchandise, &c., during the slack hours, so that they could bring up the load factor, and at the same time not interfere with the existing traffic.

Where a firm has two places of business on a tramway system, special tracks could be laid down so as to run the vans right into the goods shed. It is not likely that many firms would have two places of business in one town, but there are several firms who deal with one another, and if they all had the lines running into their sheds or works, very considerable business could be obtained.

With regard to the question of expense, an arrangement could be come to between the authorities and consigners for each to bear a portion of the cost of the permanent way and overhead work, while the authorities themselves would supply the electrically-driven vans or trucks: or, alternatively, these could be provided by the consigners.

It would be preferable that all drivers should come under the supervision of the authorities, and the authorities would charge for the services of the man and for the energy consumed, a meter being provided on each truck. The price charged for the energy would include for the use of the lines, wear and tear, depreciation and interest on capital.

In several districts there are a number of concerns with running powers over each others' lines, and difficulties might here arise. These difficulties, however, could be surmounted in the same manner as the interchange of the passenger traffic.

Further, if it were possible to connect the tramway system up with the railway, there would be considerable traffic that could have been taken over the tramway system from the warehouses on to the railways, which is at present carted on lorries, and at night there should be no difficulty in taking the ordinary railway truck, assuming the tramway gauge is correct. Of course, owing to the size of tramway rail, in some cases there would have to be a limit as to the weight. The electrically driven trucks could be arranged so as to draw a railway truck when required.

The above is, as the title suggests, only a suggestion, but there is no reason why a feasible scheme should not be evolved on the lines stated.

The trackless trolley has now become a fact, and this system lends itself to a much greater extent to the carrying of merchandise than the tramway system; electrically-driven vans, owned either by the authorities or by private concerns, should be allowed to take power from the overhead



lines, the power being metered on each van, and the price charged according to the current consumed. These vans could run along the system day and night, as the passenger service is usually very infrequent on these systems. No doubt the going would be slow with heavily-laden vans, but the trolley could easily be taken off the line so that a passenger van could pass, when required.

It is to be hoped that the splendid opportunities offered by the trackless trolley system will be taken up by some of the enterprising managers, and the necessary powers obtained.

L. J. Lepine, A.M.I.E.E.

Bradford, *January 26th*, 1912.

#### The Electric Vehicle.

I have read your interesting article of the 26th, "The Electric Vehicle." You cite American progress, and say, "What are we doing?—Nothing." Except here and there some financial juggling and foisting of wild cat schemes on the public. These latter—you are emphatically right—obtain the support which honest, bed-rock ventures lack.

I have nothing to-day for publication or advertisement, but I would say I have been doing something for  $2\frac{1}{2}$  years. For nearly a year I was up against the prejudice of self-sufficient ignorance in high (and, no doubt, over-paid) places. Capitalists and directors of electrical enterprises were deterred from participating in the commercial demonstration of the De Martis lead battery, by the advice of their experts, who did not trouble to investigate the invention—although it had achieved a long series of remarkable triumphs according to the varied desires of the numerous parties testing same—but dismissed it as impracticable, because the text-books said so, and on the ground also "that nothing which had not hitherto been could ever be."

Out of 400 or 500 people supposed to be more or less conversant with electrical lighting and traction, I secured two or three leading men. Others followed. Batteries were built, and three months' phenomenal testing was carried out at Faraday House. The sceptics asked for this. They have got it, and ask for more, some even hoping to come in when the commercial question is finally established for traction as well as lighting, as it was at the beginning.

No one has had any money out of the enterprise yet. What has been spent, and is in hand to spend, has been all dragged in. The indications are quite good and hopeful that a revolution will be effected in the hire of traction and town vehicles, motor-buses, vans, lorries and motor launches. But, until we can invite you to witness these achievements, my only object in replying to your article is to say that something, absolutely dependent upon hard and very uphill work, is being quietly done.

Harry E. Winter.

London, S.W., *January 29th*, 1912.

#### Earthed Concentric System.

May I point out two very serious drawbacks to the diagram of connections of a lamp fed from an earthed concentric system, accompanying "Earthed Outer's" letter to you in your issue of this week?

With the arrangement shown (1) the lamp and nearly the whole of the branch circuit is always alive; (2) the lamp will be switched on if an earth occurs anywhere between the lamp and the switch. Both these drawbacks are obviated if the Institution rule is complied with.

C. H. W.

[As regards (1), is this really a serious drawback? In ordinary installations it is a matter of pure luck whether the lamp is continuously alive or not, as it is seldom that care is taken to ensure that the switch is put on the outer rather than the neutral side of the lamp, and no inconvenience appears to result: the Rules do not refer to this point, where both leads are insulated. In any case, one of the conductors leading to the switch must necessarily be alive. Objection (2) is really an advantage, for an earth on the switch lead is at once indicated automatically, without damage to anything; if the switch were on the other pole, an earth would blow the fuse.—Eds. E.R.]

The arrangement shown by "Earthed Outer" is considered bad practice for several good reasons.

With such connections, a larger proportion of the system is in a constant state of electrical stress, the wiring being charged right through the lamps up to the switch, even when the switch is "off."

The practical disadvantages of this are: that there is more dust deposition, risk of electrolysis and general leakage. The most serious defect, however, is that putting "off" the switch does not make the lampholder "dead," and anyone touching the live terminal and any earthed object, such as a damp wall or the brass work of the fitting, gets a shock.

If the positions of lamp and switch are reversed, then only the short length of inner wire up to the switch remains "live" when the switch is "off," and the holder may be freely handled, as it is quite "dead."

It seems to me that this latter method of connection is the correct interpretation of the relative I.E.E. rule.

The diagram of connections is reminiscent of the engineer near Dublin, who fitted his stop valve on the engine's exhaust pipe, and this worked fairly well till one day he slackened the nuts on the cylinder cover.

Donald Smeaton Munro.

Edinburgh, *January 27th*, 1912.

[In considering this little problem care is necessary not to widen the issue. The method in question is only applicable when the lamp is on the run of the wiring; if the lamp is, say, in the middle of a ceiling, the switch on the wall, and the circuit in the angle between them, the unorthodox connection offers no advantage, for if it is used, then a double conductor must be run to the lamp point, to take the inner there and back again. Returning to the actual case put forward, where the lamp point is at the junction of the main and switch wires (see sketch in our last issue), the amount of wire alive is practically the same in either case. Dust deposition and electrolysis ought not to come into question with an earthed concentric system, but if they do, they are identical in the two cases. The only valid argument against the method seems to be that it keeps part of the lampholder alive; this commonly happens on insulated systems with bayonet-holders, without apparently inconveniencing anyone. Obviously the method suggested could not possibly be used with concentric holders, as the outer of the holder being earthed would keep the lamp burning continually.—Eds. E.R.]

#### "Electric Cranes and Hoists."

I do not want the reviewer of my book on "Electric Cranes and Hoists" to feel that I am turning on the hand that feeds me, but there is a matter of minor importance which should be corrected.

Referring to the last chapter, on the "Properties of Sections and Conductors," the reviewer says this "seems entirely superfluous, for every engineer possesses a pocket-book."

Apart from tables which are necessary in a complete manual, there are heavy tables on the moments of inertia of flats, rectangles and angles, remote from the neutral axis. The preparation of these tables alone took more than 12 months, and the object was to provide designers with tables which would enable them to design girders in much the same way as a busy business man uses a ready reckoner. As far as I am aware, the tables referred to are original, and I feel confident that if my reviewer looks into the matter, he will readily admit that they are unique. I thank him for his generous appreciation of my work.

H. H. Broughton.

Brighton, *January 24th*, 1912.

My attention has been called to a sentence used in reviewing Mr. Broughton's excellent book on "Electric Cranes and Hoists." (The review appeared in your issue of January 12th.) It was stated that the last chapter, on the properties of sections and conductors, seemed superfluous.



It should have been mentioned that, in addition to the tables of British Standard Sections (Engineering Standards Committee) and the tables of properties of annealed copper conductors (London Electric Wire Co.), Mr. Broughton has included original tables of moments of inertia of equal angles, of rectangles and of flats. The object of these tables is to save the designer time and trouble. While adhering to the original notion in my mind that everything possible should be done to keep the price of a text-book as low as possible, credit should have been given Mr. Broughton for his original tables. The others might, in the writer's opinion, have been omitted.

The Reviewer.

#### The Economy of Electric Cooking.

I note your correspondent's letter of last week, in which he suggests that the extra loss due to cooking by other methods than the electric way is immaterial from a nutritive point of view. As one of those who have drawn special attention to this economical feature of electric cooking, I should like to say that I differ very considerably from him. Though what is driven off, is practically all water, it is water that was previously in combination with, or physically a part of, the meat, and not actually free water in the ordinary acceptation of the term. Even your correspondent will admit that all the water should not be driven off and the joint reduced to a cinder. There is all the difference between a luscious grape and a dried skinny raisin, yet they are the same thing, except that in the latter case the water has been evaporated. Dried fruits, as sold by the grocer, are admittedly nothing like as palatable as the fresh fruit, and are only eaten as a substitute when the fresh variety cannot be obtained. Though only the water is supposed to be driven off, most of the palatability and flavour has also gone, and certain minor changes of a chemical nature have taken place. Now, as mentioned in your editorial last week, physiologists maintain that the more attractive a food is to the palate, the more good it is to the one who consumes it, for the production of digestive juices is thereby better stimulated. The human internal economy, as at present constituted, cannot exist on food in absolute tabloid form, there must be a certain amount of so-called waste material intermingled with the useful, to permit of the proper assimilation of the latter.

There is no doubt that electrically-cooked meat not only tastes better, but also looks more attractive, as compared with meat cooked in any other way. Further, it is cooked evenly and properly throughout. It is never half-burnt upon one side, undercooked on the other, and partially raw in the middle. Uniformity of cooking is, of course, a very important matter, and the electrical method provides that essential uniformity, even under the hands of an unskilled cook, in a manner that experience shows no other method can attain.

I am afraid your editorial suggestion for a thorough scientific investigation into the whole question, is not one that is likely to be adopted, as it would be by no means an easy task, as is the case with all physiological problems: yet such an investigation, even if only partly carried out, would be of very great interest and value.

R. Borlase Matthews.

London, S.W., January 23rd, 1912.

May I be allowed to say a few words more, in reply to the editorial note with which you honoured my previous letter on this subject?

Your note suggests that it is not possible to cook meat as perfectly by the older methods as by electricity, but I, in my turn, cannot agree with you. The electric cooker has many advantages, and when I can afford it, I hope to go in for one, but although, in the meantime, I have to have my meat cooked by gas or coal, I do not find that it is dried up or toughened; on the contrary, it is as juicy and succulent as meat can be, and, that being so, I fail to see how it can be less digestible or nutritious than if it had been cooked by electricity.

There is a good deal of truth in your suggestion that appetite is satisfied only by volume, but if the food is of low nutritive value, the satisfaction is only temporary, and hunger soon returns. A pound of vegetable marrow may be as satisfying at the moment as a pound of beef, although the former contains a much greater proportion of water, but one would very soon be hungry again after a meal of vegetable marrow.

I quite agree with you that further investigation of this matter is needed. The claim that electric cooking saves meat is one which, on the face of it, strikes the layman as somewhat preposterous, and unless it can be substantiated, such a claim is only likely to arouse suspicion, and to bring discredit on electric cooking and on the electrical industry in general. It seems a pity, therefore, that such a claim should be put forward by the Publicity Committee and in the technical Press unless it is proved to be thoroughly well founded.

I have been asked by the editor of the *Journal of Gas Lighting* to withdraw the aspersion cast upon his journal in my last letter. I am sorry I referred to the *Journal of Gas Lighting* in the way I did: I need hardly say that I had no serious intention of casting any reflection on the veracity of the journal, and I willingly withdraw any imputation that may have been implied by the words I used.

G. C. Allingham.

London, January 27th, 1912.

With 3½ years' experience of an electric household, I am inclined to think Mr. Good too optimistic, and to agree with Mr. Meares's friend. Without doubt, electricity at a penny will cook better and more cheaply than coal or gas. But the difficulty of heating the kitchen itself and the vast amount of water needed by the ordinary household has not yet been commercially solved by electricity. For general heating purposes, electricity is only for the rich: for who else can afford to keep a unit radiator or convector going 14 or 15 hours a day for each room that is to be inhabitable this weather? Let us not deceive ourselves. Doors cannot be kept locked in practice, and radiators cannot be turned down.

As to water-heating, what is required is a ready supply (not a trickle) of really hot water, at any time and at any tap, bath-room, bed-room, or scullery. There is no electric heater that will do this commercially, say, for about 25s. a quarter for a small household.

For myself, I solved the problem by cooking by the fire which I have to have in the kitchen in the winter, and by using a gas water-heater (Ewart's Califont), without any tank, for the hot water. This heater will give a continuous supply of water at 140° F. at full bore of a ¾-in. tap, and has averaged 17s. to 20s. a quarter for a household of three persons with frequent visitors (including 2s. meter rent, gas at 2s. 10d.). Hot water is available in a matter of seconds.

I am afraid, therefore, that Mr. Good's opinion of the gas heater must be modified. Even the devil should be given his due! Nevertheless, I am anxious to learn where the £5 electric water-heater can be bought.

F. R. C.

January 29th, 1912.

#### Capital and Labour.

At first reading it would appear that "Capitalist's" letter in your last issue was an attempt to pull someone's leg; but as it may be taken seriously, it may be as well to make his position a little clearer.

First of all, Union men will thank "Capitalist" for his frank admission that Unions have raised wages, leaving the "highly educated" (and possibly the Chinese) as the only source of "cheap labour" that "Capitalist" must have. Secondly, those of us who manage to be "really efficient men . . . at wages from ten to thirty shillings a week" will realise that it is not to "Capitalist" and his class that we must look for an amelioration of our lot.

In "Capitalist's" constantly-repeated "we" and "our" there is a subtle insinuation that he is speaking for the country at large, whereas he really is advancing the claims



of but a negligibly small, though greedy, selfish and unscrupulous, fraction of the community—the capitalists.

It would be interesting to learn whence "Capitalist" gets his confirmation of the statement that "England's trade has suffered badly through the growth of Trade Unionism." Official figures certainly do not show it.

"Capitalist" implies that the "struggling employers" have the Unions to thank for their struggles, whereas the admitted truth is that the very antithesis of Unionism, viz., competition, is the cause of their plight.

One would imagine that, as a game, keeping some seven-eighths of the population of the country overworked, underfed, badly housed, and generally in a state of cheap misery, because "in order to keep ahead of our competitors we must have cheap labour," was not worth the candle. Only one of the favoured one-eighth would pretend that it was.

So far from it being "scandalous that the Unions should be allowed to fix such a high standard of wages for the comparatively unskilled worker," the real scandal is that "really efficient men can be obtained . . . as draughtsmen, engineers, station attendants, &c. . . . at wages from 10s. to 30s. a week," though how men obviously not even self-supporting can be said to have any *efficiency* at all, from their country's point of view, is a puzzle that I must leave to your readers.

It is a despicable attempt to set class against class to say that "it is impossible to go on increasing the unskilled wages . . . without making the skilled man's lot harder." ("Skilled man" here obviously means "staff man," as everybody knows that the skilled artisan was the first to protect himself by Union.) The alternative, of course, is a rise of wage for the staff man, and it is up against him to get it. Nobody will get it for him.

I hope that "Capitalist" will write again, if only to tell us what the "proper level" of labour costs really is. With a sufficiency of premium pupils it might even become a negative quantity.

"Capitalist's" brutal frankness is valuable, inasmuch as it inevitably leads us straight to the question: Is the world's work to continue to be done for the sole benefit of an utterly insignificant and mostly undeserving fraction of the population, or shall the workers (manual and mental) have their share in the ever-increasing flood of food, shelter, warmth and luxuries of all kinds which they continue to produce? "Capitalist" may take it from me that the day of spoilt darlings (including capitalists *quâ* capitalists) is nearly over. An increasing number of professional men is beginning to consider its relation to the working classes. Personally, I can say without cant that I regret that my energies are so largely spent on providing more luxury for those who already suffer from too much. For the men who made this comfortable arm-chair, this cosy fire, this convenient typewriter, I have done nothing. In fact, I have done less than nothing, for I have patronised their employers and so have helped to exploit them.

Assistant.

P.S.—It is to be hoped that correspondents mentioning "Socialism" will first take the trouble to find out who he is.

#### The Electrical Profession as It Is.

With reference to the various articles and letters appearing lately in the REVIEW on employment, Trade Unionism, Institution matters, and such like, it appears as though most of your correspondents are missing the mark when they account for the present deplorable condition of things in the electrical profession by blaming Unions or Institutes as such. Union or non-union has nothing to do with it, especially as far as public supply undertakings are concerned.

What is the usual method of filling vacancies at present? Is it the man of experience, the man who has been "through the mill," and who is fitted by his past career and ability for the post offered? Is it he who invariably gets there? Emphatically, no. At the present day, past experience, ability, and aptitude, count but little, and in some cases not at all; it is he who can exert the most influence on the particular board or individual to whom the filling of the vacancy is entrusted.

Municipal concerns are the worst offenders in this respect.

and it is a well-known fact that 90 per cent. of the vacancies on supply staffs do not go to the most suitable applicants. It is he who can do the most political or social wire-pulling who gets there. What is the result? The really valuable men are being ousted, and the waster and job-cadger exalted. Year after year the best young men of the profession—men who, given an honest chance, would have been the future shining lights of their calling—have left these shores, disgusted at intrigue, and disappointed at failures oft repeated. I know of more than one Colonial employment agency on whose application books the names of desirable young men are to be found—men seeking a chance in some other clime, where ability, and not intrigue, is the rule by which situations are filled. Salaries have gone down, and are going down fast, as the result of jobbery and false methods.

A great deal is talked of Institutions and kindred associations. What are they doing for the desirable worker? Simply nothing. By reason of absurd qualifications, requirements and other stumbling blocks, many suitable men are debarred from becoming members of most of the so-called valuable institutions of the present day; valuable, no doubt, to him who can comply with their requests and codes, but worthless to the young man who is really wanted in the electrical profession.

During the past few years I have met scores of young men utterly disheartened by present-day methods; they all tell the same story, ability second place only, any other qualifications top of the tree. To the youth who is thinking of adopting an electrical career, I say, Don't! Better far become a member of some profession where there is, perhaps, less glamour but more reality.

What is wanted is not Institutions and Trade Unions, but a cleansing of the means and methods of employment. Give the right man his place at a living wage, and the waster, the inexperienced, and the man who works for a hobby, will be driven out, and the electrical profession will rise in the estimation of all right-minded individuals instead of being well-nigh despised as at present. I regret trespassing so far, but, on account of all that has been written and said on the matter lately, and as a warning to youth, I felt compelled to write the above.

Diogenes.

#### NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE accompanying diagram illustrates the position of the United Kingdom in relation to other countries so far as imports of "electrical apparatus" to Canada are concerned.

So far, the trade of Germany, and of all other competitors except the U.S.A., does not constitute a very serious menace to British trade with the Dominion, but the diagram clearly shows the enormous preponderance of American trade here, in this class of goods, over that of Great Britain and, indeed, over all other countries put together.

It will be interesting to watch the results of the now really serious efforts of British manufacturers to secure their share of Canadian trade. Under the heading of "Machinery and Machines" the imports from Great Britain compare even more unfavourably with those from the U.S.A.

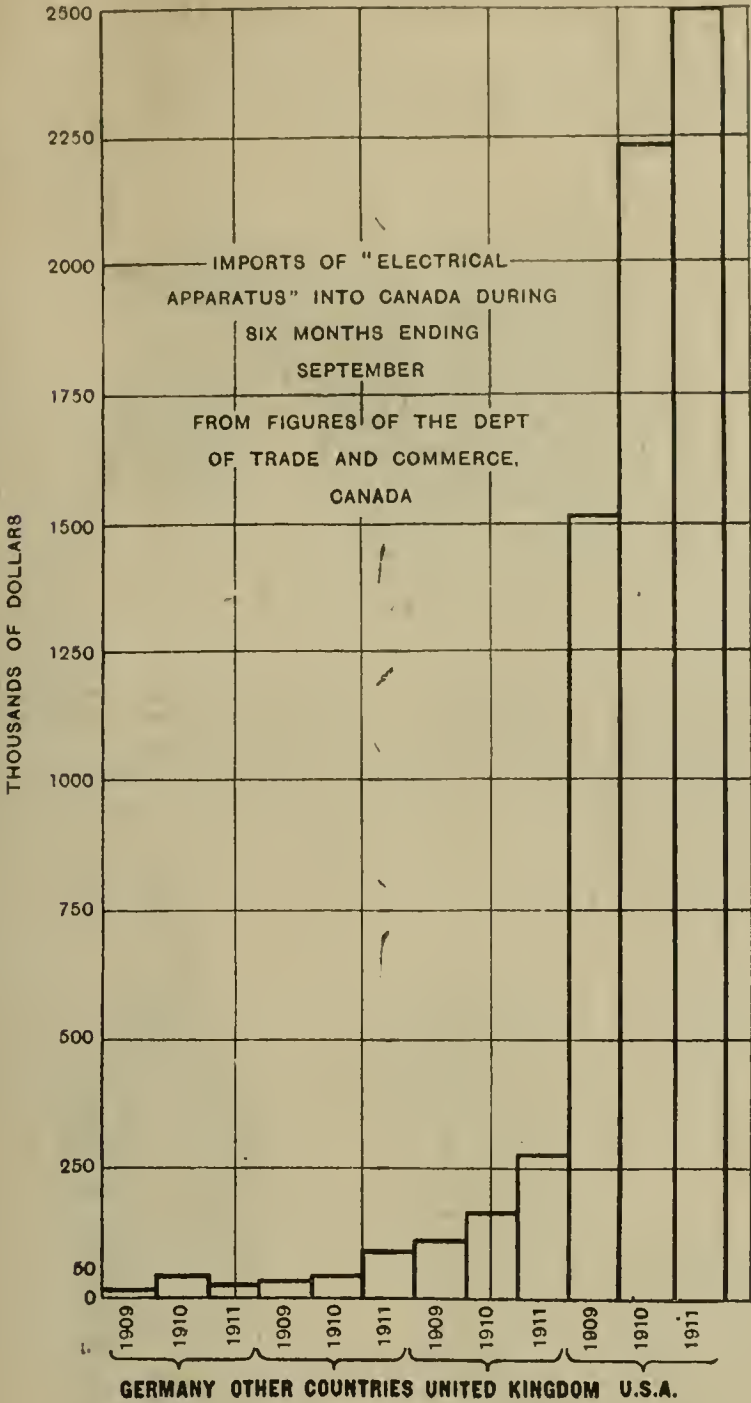
Canadian trade is certain to be greatly augmented during the next few years, owing to the opening up of new territory, the development of water powers which is taking place, and the rapid increase in population.

The credit of Canada at present stands well in the opinion of capitalists as the amount of money flowing into the country clearly indicates, and Canadians are being advised to preserve the standard which their country has reached in this respect.

The year 1911, from an engineering standpoint, has been a record one; it is said that in no one year has there ever before been so much money spent on railway work, bridge construction, building, &c., and it is confidently predicted that 1912 will show even greater expansion. Canada will have to borrow some 3½ million pounds sterling in order to carry out contemplated works during this year.



The Electric Power Co., of whose operations mention has several times been made in these notes, will be bought out by the Ontario Hydro-Electric Power Commission very shortly ; the operations of this latter body will, therefore, be extended over the south-eastern portion of the Province as well as the other parts, and the water powers on the Trent River will come under its control.



A recent editorial in the ELECTRICAL REVIEW reminds one of the story of the tribe of savages whose method of ensuring that no speaker should weary his audience, or take up time required by others, was to insist that the speaker should stand on one foot—as soon as he put the other foot down the speech had to come to a full stop !

This plan would prove more effective even than a “fire-alarm gong” and is strongly recommended to the Council of the I.E.E. for inclusion in their rules. Even the untutored savage has wisdom of his own.

**Tilling-Stevens Omnibuses.**—We are informed that as the result of the combination of MESSRS. THOMAS TILLING, LTD., and MESSRS. W. A. STEVENS, LTD., a new factory, to be equipped with the most modern type of machine tools (electrically driven) for the rapid production of the complete “Tilling-Stevens Omnibus Chassis,” is being built at Maidstone. The contracts for the constructional steelwork and the buildings have been secured by Messrs. Edward Wood & Sons, Ltd., and Messrs. R. Corben & Co. respectively. Mr. Walter Wolsey, jun., managing director of Thomas Tilling, Ltd., has joined the board of W. A. Stevens, Ltd., of which Mr. W. A. Stevens is chairman and managing director. The company has the advantage of the valuable experience of Mr. Percy H. Frost Smith, who, while retaining his position as chief engineer to Messrs. Thomas Tilling, Ltd., will have as works superintendent entire charge of the chassis construction. The chassis built at the new works will be identical with the 140 now on order for Messrs. Thomas Tilling, Ltd., and the Newcastle Corporation. The London offices of the company are at 26, Victoria Street, Westminster.

NEW DIESEL PLANT AT KINGSTON-ON-THAMES.

IN our “Lighting and Power Notes” we refer to the discussion by the Kingston Council of the recommendation by the Lighting Committee to install horizontal Diesel engine plant at the electricity works ; the recommendation, which was based on the engineer’s report, was adopted. This report pointed out that there were three alternative methods of extending the generating plant—by steam, gas or oil engine plant. In dismissing the first two, the engineer referred to the poor efficiency of the steam plant in small sets, and the higher capital cost per kW. of gas engine and producer plant as compared with Diesel engine plant ; for the gas plant the cost amounted to £19 per kW., plus £2 per kW. for a stand-by producer, and the labour would probably be double that required for Diesel engine plant.

As regards the Diesel plant, the engineer considered that two sets of from 250 to 300-kw. capacity would meet the requirements better than a single set of double the size, and his report details at considerable length the various offers for plant made by different firms. A summary of the latter is as follows, Siemens alternators and vertical engines being quoted for except where noted :—

	KW.	R.P.M.	Per KW.
Diesel Engine Co. with Carels engines	200	177	£20 11
	200	272	15 13
	300	210	16 14
Sulzer Bros. ... ..	200	165	£22 17
	243	257	17 15
Mirrlees, Bickerton & Day...	200	243	£17 1
	250	200	16 13
Burmeister & Wain ... ..	400	185	£17 5
	200	210	20 19
Willans & Robinson...	210	210	£16 1
	270	178	19 12
British Westinghouse ... ..	225	192·5	£15 6
	300	192·5	14 9
British Westinghouse, with own alternator	225	192·5	£14 11
	300	192·5	13 16

M.A.N. Co. ...

Horizontal four-cylinder four-cycle engines.

215 KW. ; 192 R.P.M. ; £3,578 ; £16 12 per KW.

270 KW. ; 192 R.P.M. ; £4,087 ; £15 2 per KW.

Horizontal two-cylinder two-cycle engine.

270 KW. ; 165 R.P.M. ; £3,936 ; £14 11 per KW.

Vertical four-cylinder four-cycle engine.

332 KW. ; 178 R.P.M. ; £4,217 ; £18 3 per KW.

The fuel consumption per KW.-hour for the M.A.N. engines is specified as follows, with a 5 per cent. margin :—

Full load, four-cycle engine, '603 lb. ; two-cycle engine, '64 lb.	
$\frac{3}{4}$ " " " " '64 lb. " " '68 lb.	
$\frac{1}{2}$ " " " " '77 lb. " " '83 lb.	
$\frac{1}{4}$ " " " " 1'14 lb. " " 1'25 lb.	

In none of the other cases was so low a fuel consumption quoted as in the case of the M.A.N. four-cycle engine, English makers giving '64·'66 lb. per KW.-hour on full load, to 1'25-1'27 lb. on quarter load.

All the firms guaranteed satisfactory parallel running of their plant.

After careful consideration of the various tenders, the engineer advised the Committee to install one horizontal M.A.N. Diesel oil engine, single-acting, four-cycle, four-cylinder, of 400 B.H.P. at 192·5 R.P.M., direct coupled to a Siemens alternator of 270 KW. at '8 power factor, and one horizontal M.A.N. Diesel oil engine, single-acting, two-cycle, two-cylinder, of 400 B.H.P. at 165 R.P.M., direct coupled to a similar machine.

He summarises the advantages of the horizontal over the vertical-type Diesel engine as follows :—

(a) Much quicker access to main bearings, connecting rod, piston and piston rings, should an inspection be necessary.

(b) Easier survey of fuel valves without climbing a ladder.

(c) Simpler and more accessible compressor.

(d) Simpler and smoother running valve gear with only two or four eccentrics against a great number of cams ; less wear and tear of valve gear, re-adjustment easier.

(e) The engines recommended are slow speed engines . . . with four cylinders vibration is likely to be set up when running over 200 R.P.M.

(f) The two-cycle two-cylinder engine gives the same number of power impulses per revolution as a four-cylinder, four-cycle engine, but has only half the parts.

(g) The horizontal engines have a much lower centre of gravity . . . and run steadier.

(h) The M.A.N. Co. have succeeded in successfully using tar oils, and have had an engine running on ordinary coke oven tar for 12 months.

As regards the space occupied, the engineer says that the area taken by the four-cycle horizontal engine is somewhat more, and that taken by the two-cycle horizontal engine somewhat less than that taken by a vertical engine of similar power.

With high-speed vertical engines the space taken is considerably less, but Mr. Edgecome adds, “I could not under any circumstances recommend the adoption of high-speed Diesel engines”



In concluding this section of the report, instances are given of foreign firms who, having the vertical type of Diesel in use, are now installing the horizontal type.

A second section of the report deals with the proposed new switchboard which would supersede the present one, also with the installation of automatic oil-break switches on the feeder cables in the sub-stations, kiosks, &c.

Tabulated statements at the end of the report show that the estimated cost of gas engine and producer plant extensions, together with new switchgear, buildings, &c., amounts to £15,601; a similar scheme, but including Mirrlees-Diesel engines, amounts to £14,538; while the chosen scheme with M.A.N. Diesel engines would cost £13,500. The estimated saving for 1911-12, on a million units generated, using steam plant for the peak load only, and the Diesel plant for other times, as compared with steam generation only, is put at £1,131; and for 1912-13, at £1,294.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Pape Electric Safety Lamps.

MESSRS. RICHARD PAPE, LTD., of Belvedere Works, Belvedere, Kent, have sent us some further particulars of their patent electric safety lamps, which were on view at the Olympia Exhibition, and were referred to in our columns at the time. These lamps are adapted for inspection purposes or for miners' use, in the various patterns shown in figs. 2, 3 and 4. The lamp consists of a metal case carrying inside a Fors accumulator, and on the top a lantern secured by means of a milled nut. The weight varies from 3 lb. for the miners' pattern to 5 lb. or more for inspection and

respectively, and are fitted with bull's-eye lenses and reflectors for projecting a powerful beam of light.

The lamps are neat in appearance, with no projections liable to damage. Several types of lamp may be had with gun-metal cases for use at sea.

The miners' lamp is light in weight, and is provided with a special strong type of accumulator and lamp-glass guard. This lamp can be supplied on maintenance contract at a fixed price per lamp per week.

### Joint Box for Conduit Work.

MESSRS. DONOVAN & CO., of 47, Cornwall Street, Birmingham, have introduced us particulars of a special joint box which they have introduced for use where a large main has to be split up to feed a number of points. The box is of cast-iron, with insulated

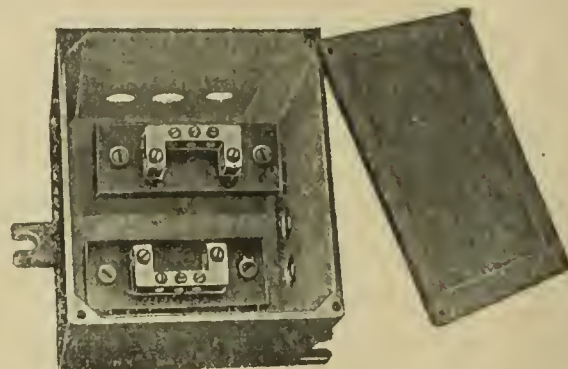


FIG. 1.—JOINT BOX FOR CONDUIT WORK.

slate bases mounted inside, carrying substantial bus-bars drilled to carry the cables. The standard cable capacity is 100 amps. for the in-going main, and 25 amps. for the outgoing circuits.

It will be noticed that the lower slate is mounted nearer the bottom than the upper one.  $\frac{1}{2}$  in. space being given in the former

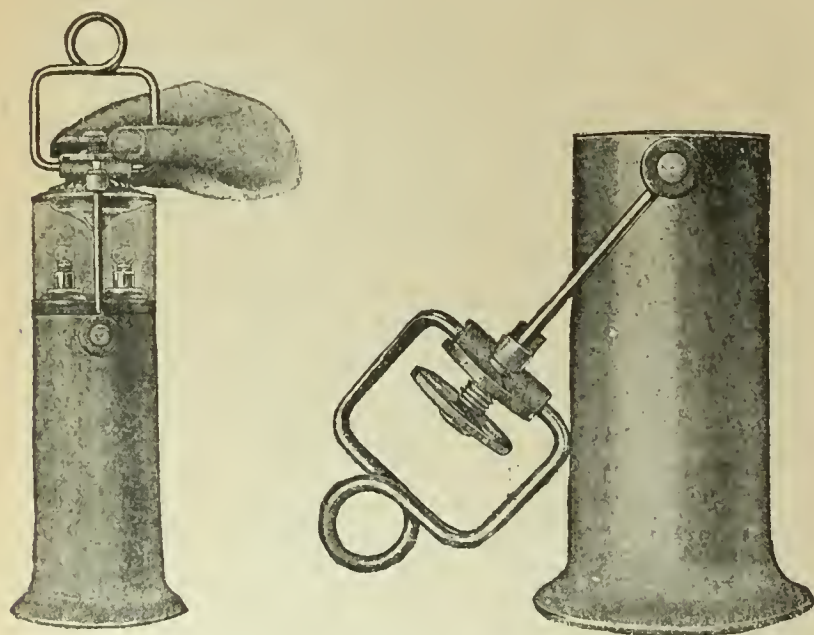


FIG. 2.—PAPE "LIGHTHOUSE" LAMP, SHOWING METHOD OF DISMANTLING.

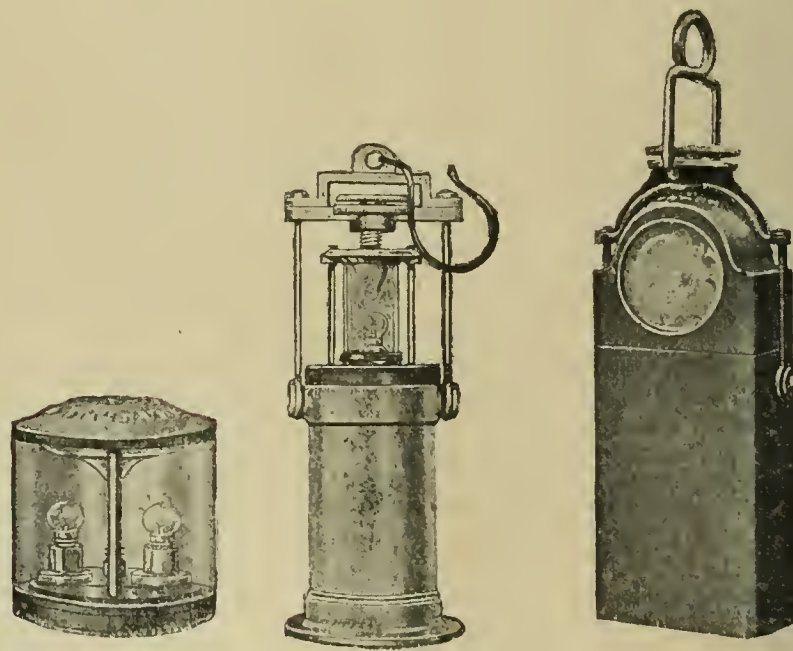


FIG. 3.—PAPE "MINER'S" SAFETY LAMP.

FIG. 4.—PAPE "INSPECTION" LAMP.

bull's-eye lanterns. Electrodes of a circular type are used in the Fors accumulators, the positive electrode being placed inside a porous pot, while the negative plate completely surrounds it. The grids of the positive plates are cast in one piece, and consist of vertical ribs and horizontal plates forming numerous small pockets. The centre of the grid is hollow, and one-half the vertical ribs extend inwardly from the outside periphery of the horizontal plates, the remaining vertical ribs extending outwardly from the inside periphery. The vertical ribs only extend for one-half the depth of the horizontal plates, so forming, when pasted, a continuous mass of active material locked in every direction by the vertical ribs. The result is a very strong plate of light weight, proof against buckling and consequent shedding of paste, with a relatively high discharge. At the rates of discharge required for electric safety lamps, from 18 to 22 watt-hours per lb. of complete cell are obtained.

The lamp cases consist of either solid-drawn aluminium tube with a foot and collar cast on, or light aluminium castings.

Trunnion-pins carrying a yoke are riveted to the cases by means of lugs, and a set screw through the centre of the yoke serves to hold a lantern firmly in position on to the case containing the battery. This construction will readily be followed by reference to the illustrations; and it is to be noted that the single set screw serves to make all joints perfectly air-tight.

Four sizes of the lamps are standardised, two being with circular cases for 2-volt batteries, and two with square cases for 4-volt batteries. The lanterns of the 2-volt sizes have circular glasses, and are rated to give one candle-power for 12 hours and three candle-power for 12 hours respectively. The 4-volt sizes give three candle-power for 12 hours and six candle-power for 12 hours

and  $2\frac{1}{2}$  in. in the latter case, as this allows circuits from the bottom panel to pass up behind the top panel, without getting near the live bus-bar of opposite polarity. The bus-bar is arranged so that a main can be joined at one end and an outgoing main at the other end, thus avoiding the necessity for crossing wires.

The box can be drilled to take any combination of tubes, and has, we understand, been highly approved by various engineers who have examined and used it.

### Sulphalium.

THE SULPHALIUM METAL CO., of Cyclops Works, Milwall, E., have introduced a new aluminium alloy called sulphalium, which is stated to have twice the strength of aluminium, and none of its drawbacks. We are assured that there is no zinc in the alloy, so that the danger of crystalline fracture, subsequent on vibration or shock, is absent. It is unaffected by the atmosphere, while a strict test in sea water extending over six months had no deleterious effect. The alloy is of the well-known silvery colour of aluminium, but possesses double its strength, while the specific gravity is only 3 per cent. more than the pure metal. In working it is somewhat similar to phosphor bronze, and is readily machined and filed. Castings run easily, and for fine pattern work it should be extremely suitable, as there are no blow holes and very slight contraction. The metal is supplied in various grades of quality and toughness; it can be had in ingots, sheet, or rod. The tensile tests show a breaking point of 9.7 tons, while the elastic limit under compression is 5.7 tons. We understand that the metal has been taken up by the Admiralty, and also by aeroplane engineers, while for electrical work and for scientific instruments it seems to be eminently suitable.



## LEGAL.

## KINGHAM v. ELLIS &amp; WARD.

ON Wednesday, January 24th, the case of Kingham v. Ellis and Ward, electric lighting and general consulting engineers, of Birmingham, was heard in the King's Bench Division before Mr. Justice Bray and a common jury. There was originally a claim by Messrs. Ellis & Ward against Mr. Kingham for £134 for work done and material supplied, and judgment was given for that amount for Messrs. Ellis & Ward. Mr. Kingham now sued on a counterclaim for damages, as he alleged that defendants had negligently advised him as to purchasing a gas engine to be used for driving a dynamo at an electric theatre at Aylesbury. This the defendant denied. Mr. Powell, K.C., and Mr. Graham Mould were for Mr. Kingham, and Mr. Hollis Walker, K.C., and Mr. A. Ward for Ellis & Ward.

Mr. POWELL said the claim was for damages for negligently advising Mr. Kingham as to the purchase of a gas engine which was removed from Edmonton to a picture theatre in which he was interested at Aylesbury. A private company was formed in February last year for the exploitation of the theatre and plaintiff was interested in it. Messrs. Ellis & Ward were instructed to see the gas engine in question and to report as to its suitability for the purpose for which it was required. They reported that the engine was suitable and efficient for the purpose of lighting the Aylesbury Electric Theatre and certain shops in the locality; that it would always be saleable and in a couple of years would be worth £250 and would enable the theatre to be lighted at less cost. Upon that advice Mr. Kingham bought the engine in question, and entered into a contract with defendants for certain works. Plaintiff now said he had found the engine wasteful and unreliable and totally inadequate to do more than light the theatre, and that only at extravagant and abnormal expense. Counsel then read a great deal of correspondence which had passed between the parties and witnesses were called in support of plaintiff's case.

Mr. WM. JUDD, consulting engineer, of Colchester, said he examined the engine in question, and it was not an engine that a careful person would have recommended for use to produce electric light in a cinematograph theatre. Many parts of it were very much worn. On one occasion it took him 15 minutes to get it started, and it was quite a matter of luck when it "went off." Personally, he should not recommend any one to buy such an engine.

Mr. HY. HALE, with 20 years' experience of gas engines, said the consumption of gas in the one in question was abnormal. He offered to give Mr. Kingham scrap-iron price for it.

Mr. KINGHAM, in evidence, said he was influenced to buy the engine by the opinion expressed by Mr. Ward and conveyed to him.

For the defence, Mr. WILLOUGHBY ELLIS said he went down to Edmonton to see the engine. Mr. Challis and Mr. Freeman were there. It was an engine of the type of 14 or 15 years ago—one of Wells Bros.' high-speed electric lighting type. Mr. Challis, who had used it, said it had been working satisfactorily on its load. Witness asked Mr. Challis if the engine had been quite satisfactory during the time it had been working there, and he said it had. There was no time to make a detailed examination, and witness then gave it as his opinion that it would be suitable for Mr. Kingham's general purposes as a temporary measure and until the question of the town lighting was settled. He denied that he ever said the engine was worth £250. The only opinion he expressed was that it would be able to light some of the shops near the theatre.

Some further evidence was given on behalf of defendants and counsel then addressed the jury. His Lordship having summed up, the jury returned a verdict for plaintiff for £150. Judgment was given for that amount, with costs; but Ellis and Ward were given costs up to judgment on the original claim on July 24th, 1911.

## NATIONAL TELEPHONE CO.

IN the Chancery Division on Monday, January 29th, Mr. Justice Joyce, on the application of Mr. Younger, K.C., fixed February 27th for the hearing of the action brought by Lord Avebury and Lord Wolverhampton against the National Telephone Co., Ltd.

## WHITE v. L.C.C.

ON Tuesday, in the King's Bench Division, Mr. Justice Avory and a common jury had before them an action by Mr. Joseph James White, a barrister's clerk and electrician, of Merton, against the London County Council, claiming damages for personal injuries due to the alleged negligence of defendants, inasmuch as they invited him to await the arrival of one of their cars on the Victoria Embankment, near Blackfriars Bridge, at a dangerous place, and failed to take proper precautions, whereby he was thrown down and injured.

Defendants, by their defence, denied any negligence and pleaded contributory negligence.

Mr. MCCALL, K.C., in opening the case for the plaintiff, said the case raised a point of considerable importance to all who used tram-cars in the city of London. Plaintiff was a barrister's clerk and a qualified electrician dealing with electrical fittings and the installation of electric light.

Mr. WALSH (for the L.C.C.): There is no loss in regard to his electrical profession in the statement of claim.

Mr. MCCALL: His Lordship will deal with that question later on. Proceeding, counsel said that on February 20th, 1910, plaintiff left his chambers in the Temple, where he was employed, and walked with a friend to the Blackfriars Bridge end of the Embankment in order to get a car to Merton. Plaintiff and others assembled on a raised platform to await the arrival of a car. As a car came up there was a rush, and plaintiff was pushed on to the tram line and a tramcar came along and struck his left foot, and he was dragged along some two or three yards. His leg was severely injured, and he was taken to St. Bartholomew's Hospital, where his injuries were attended to. The result of the accident was that he was crippled for six weeks and confined to his house. Counsel submitted that the defendants did not take reasonable care, and that the platform then in use was a dangerous platform. Mr. McCall added that the defendants had now erected a large refuge at the spot, which was properly guarded and roofed in, and when regulated would prevent the recurrence of such accidents.

PLAINTIFF and others gave evidence to the effect that in the rush the plaintiff was knocked down and a moving car injured his leg.

Mr. WALSH said he hoped to prove that there was no recognised stopping-place here at all; all cars stopped at or near the platform, but they had no actual place to stop at.

At the conclusion of plaintiff's case, Mr. WALSH submitted that on the statement of claim there was nothing for the defendants to answer. He contended that there was no case here of negligence at all. The suggestion of the plaintiff that this platform should have had handrails and guards was too absurd for words.

Mr. MCCALL said his submission was that there was ample evidence of negligence. Defendants invited the plaintiff to use this temporary shelter, and as carriers they were under the obligation to make the shelter as reasonably safe as possible.

His LORDSHIP said he would leave the case to the jury to say if the plaintiff had proved that the defendants had been guilty of negligence in the construction and management of this platform.

Mr. WALSH, for the defendants, said it appeared as if the plaintiff was a man who should go about with a nursemaid. When the plaintiff and others entered a crowd and fought to get on a car, they took the risk of accident upon themselves.

Evidence was then called to show that the defendants did all they could to regulate the traffic at Blackfriars, and made every effort to get a proper shelter erected.

On Wednesday the jury returned a verdict for the defendants, and judgment was entered for them, with costs.

## JACKSON v. WESTERN ELECTRIC CO., LTD.

AT Manchester County Court on January 24th, John Jackson of Urmston, Manchester, brought a successful claim against the Western Electric Co., Ltd., of London and Woolwich, for £42 as the balance of wages due to him. Plaintiff, it was alleged, was engaged as a foreman at £4 per week with a three months' trial. If satisfactory, the wages were to be as to ability. He was informed that the company were extending their works, whereas it appeared as though there was a strike, or that one was imminent. Six men left Manchester for the works at Woolwich and they were boycotted. After four days the six men were paid off, and the plaintiff was told that his services were no longer required. He was given a receipt for £10, his wages to date, but the receipt now bore the words "in lieu of a week's notice." It was alleged that these words were not on the receipt at the time he saw it. The defence was that plaintiff found he was not familiar with the particular class of work required, and he consented to receive £10 and his railway fare to terminate the matter. The clerk who made out the receipt declared that it was now exactly as it was when plaintiff signed it. Other witnesses said that the strike had been over for a month when the plaintiff and the six men were engaged.

## CAVEHILL AND WHITEWELL TRAMWAY.

IN the King's Bench Division, Dublin, on Monday, the matter of arbitration between the Belfast Corporation and the Cavehill and Whitewell Tramway Co. came on before Mr. Justice Boyd and Mr. Justice Kenny, on the application of the Corporation to set aside the award. The grounds were that the arbitration did not conform to the directions of the Appeal Court. Subsequently it became necessary for the parties concerned to go to the King's Bench Division, No. 1, where the Lord Chief Justice and the Lord Chief Baron were sitting, in order to have a full bench; and after a short discussion on several legal points, the Court decided to hear the case on Monday next.

## THE FLEETWOOD ESTATE CO., LTD., v. THE BLACKPOOL AND FLEETWOOD TRAMROAD CO.

AT the Manchester Assize Court on Tuesday, before the Vice-Chancellor, the trial was begun in this action, which raised the question of the rights of the parties in regard to certain lands adjacent to the tramroad of the defendant company.

Mr. GRANT, for the plaintiffs, said that in 1896 a Bill was passed by Parliament for the tramroad between Blackpool and Fleetwood. Meanwhile negotiations were carried on with the owners of the Thornton Estate, which had since become the property of the plaintiffs, and an agreement was entered into which gave the owners certain rights. The tramroad was not constructed according to the line originally contemplated, and the



result was that on the western side of the line were portions of land which formed parts of the Thornton Estate. The plaintiffs' contention was that the defendants' right was limited to an easement for a line of railway 30 ft. in width, and that they had no rights over portions of land outside those limits. Defendants said their easement extended to the western border of the Thornton Estate, which in some places was 65 ft. At a spot where the plaintiffs intended to make a road across the line the defendants had put down a shelter and made an approach to it on the plaintiffs' land, fenced it off, and made a road and footpath.

MR. SUTTON, for the defendants, said they were entitled to occupy and use for the purpose of a railway, any part of the land, and to put up the shelter was one of the things that was necessary.

MR. GRANT said that five crossings had been made and paid for by the company, and under the agreement the plaintiffs had the right to determine whether three others should be put by the tramway company.

Evidence having been given, the VICE-CHANCELLOR said he did not think that either the Act of Parliament under which the railway was constructed, or the agreement made with the owners, conferred upon the defendants the right to do what they had done, and he gave judgment for the plaintiffs, with costs. The plaintiffs would have leave to move for an injunction if the defendants did not appeal within a month.

#### ECHO OF THE ELECTROBUS LITIGATION.

MR. JUSTICE NEVILLE sitting for the disposal of companies winding up business had before him on Tuesday a petition of Mr. F. A. Fraser for the compulsory winding up of the Re-organisation and Control Syndicate which was formed to take over the affairs of the Electrobus Co.

Counsel in support of the petition said that it was presented by a creditor who was also a shareholder holding 49 fully paid shares. The petitioner's debt was only £40, but he was supported by another creditor for £45, making altogether £85. His Lordship would remember that there was considerable litigation with regard to the London Electrobus Co., and the respondent company got into difficulties. It was impossible to satisfy the petitioner's debt by execution as the company's offices were the offices of a solicitor, and there was nothing of the company's on which to distrain.

There was no opposition to the petition and His Lordship made the usual compulsory order.

#### REID-NEWFOUNDLAND CO. v. ANGLO-AMERICAN TELEGRAPH CO., LTD.

THIS appeal from a judgment of the Supreme Court of Newfoundland of February 1st, 1911, came before the Judicial Committee of the Privy Council on January 26th. According to the *Times* report the action out of which the appeal arose was brought by the present respondents, the Anglo-American Telegraph Co., against the appellants, the Reid-Newfoundland Co., in regard to the use by the latter of a special telegraph wire.

Their Lordships decided to consider their judgment.

## BUSINESS NOTES.

**Tendering for Canadian Contracts.**—The Imperial Trade Correspondent at Winnipeg (Mr. J. Appleton) reports that a good many requirements for the city of Winnipeg, respecting which British firms might be in a position to tender, are being advertised, but the notice for the return of tenders has in each case been too short to permit of advice being sent to the United Kingdom and being acted upon. It is highly necessary, adds Mr. Appleton, that British firms desiring to do business in the Canadian West should be represented by agents there.

In regard to requirements for the city of Vancouver, the Imperial Trade Correspondent there (Mr. P. G. Shallcross) writes that before applications for tenders are actually printed, those who are making a study of the business have already their plans well under way, and that there is not much chance for the firm coming in at the eleventh hour to make a successful tender.—*Board of Trade Journal*.

#### "Tantalum" Penny

**Stamps.**—We illustrate the latest type of advertising adhesive label, which we understand MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, N.E., are prepared to supply in quantities to the trade for affixing to correspondence, invoices, &c. In size it is slightly larger than a penny, and is printed in black on bronze paper, the head being a facsimile reproduction of the well-known "Satisfied Consumer" design, whilst the usual



inscription is replaced by the words, "Tantalum Lamps, my Electric Light Bill Halved."

**"Phoenix" Contracts.**—We learn that the PHOENIX DYNAMO MANUFACTURING CO., LTD., of Bradford, have increased their capital by the issue of 6 per cent. preference shares to the amount of £10,000, dated January 1st, 1912. Amongst the contracts which they have in hand are the following:—

Wolverhampton Corporation.—Two 3,600-5,000 - ampere motor - driven boosters.

Large Yorkshire Flour Mill.—Large alternator and motors.

Farnham U.D.C.—Two 150-kw. alternators driven by Mirrlees, Bickerton and Day Diesel engines.

Bradford Technical College.—Turbine generator, three steam sets, and motor equipment for the new textile department.

Birmingham Corporation.—Three booster sets, each consisting of two 2,700-ampere dynamos driven by d.c. motors. Two 350-kw. motors, three-phase. One 120-kw. motor.

Northern Shipyard.—One 3,700-ampere booster at 65 volts. One 3,000-ampere booster at 5 volts.

Bury Corporation.—One motor-booster consisting of two 1,200-ampere dynamos driven by d.c. motor

Large Textile Mill in Yorkshire.—Complete equipment comprising alternator driven by Belliss engine, and 250 B.H.P. of motors.

Irish Linen Mill.—170-kw. alternator and 200 B.H.P. of motors.

Crown Agents for the Colonies.—Two 170-kw. alternators, driven by Diesel engines.

Warney, Combe, Reid, brewers, London.—Three 150-kw. d.c. generators, and 300 B.H.P. of motors.

Birmingham Metal Works.—Electrification of two works, about 200-B.H.P. motors served from Corporation mains.

Oil Mills in Hull.—Several large motors for oil mill combination.

The Phoenix Co. have on the books at the moment electrification for seven large textile factories and several screening equipments for English colliery companies as well as two Colonial paper mill installations. Recent orders also include seven 200-B.H.P. 3,000-volt pump motors at about 1,400 R.P.M. and a large number of Phoenix patent explosion proof motors for fiery coal mines. Building extensions are in hand at the works and will be ready for occupation before the end of March.

**Electric Miner's Lamp.**—MR. COWPER-COLES informs us that he is introducing a new electric miner's lamp which has several novel features. It is capable of giving 2 C.P. for over 10 hours, and is fitted with two electric light bulbs, one arranged so as to give a diffused light, and the other placed in a parabolic mirror, which enables a concentrated beam of light to be thrown in any desired direction. The parabolic mirror is golden coloured, so as to give a yellow beam of light, which is less trying to the eyes and does not throw such deep shadows. The lamp bulbs are also provided with special screens, so that, in the event of breakage, there is no risk of inflammable gases being ignited. The complete lamp weighs 4 lb. 5 oz.

**Acheson Graphite Products.**—The process of tracing the British agents for these lubricants has advanced a stage further. We have now been informed by MR. A. W. FARNSWORTH, of The Strand, Derby, that he is the general agent for the United Kingdom for the Acheson products, and all inquiries should be addressed to him.

We also learn that MR. C. E. ABELL, of 4, Foregate Street, Worcester, is agent for the Acheson products in that district, and will be pleased to receive inquiries.

**Synchronome Clocks.**—THE SYNCHRONOME CO., of 32 and 34, Clerkenwell Road, E.C., have in hand a large number of installations of their time system. The London and North-Western Railway Co., having had experience of their system at Euston, Harrow and Pinner, are equipping their Birmingham offices, Bushey Station and their passenger and goods stations at Broad Street Station. The latter includes about 100 dials and numerous turret clocks, and will be entirely automatic, not even the master clock or controlling pendulum requiring winding. The "Synchronome" system is also being extended by the Caledonian Railway Co. from the Glasgow Central Station and Hotel to the Buchanan Street Station, and has been adopted by the Midland Railway Co. throughout their new Adelphi Hotel, Liverpool, where one electrical pendulum will be used to operate upwards of 200 dials on a single circuit. Among other installations they have in hand in London alone are electric time-circuits for the new offices of the Law Union and Rock Insurance Co., Chancery Lane, and the Royal Insurance Co., Lombard Street; also the L.C.C. School of Arts and Crafts, Royal Palace Hotel, Kensington, Cavendish Club, Piccadilly, and the Town Hall, Hackney.

**Whist Drive.**—On 27th ult., the Committee of the Electrical Installations, Ltd., Athletic Club invited their members and friends to a whist drive held at The Horns Assembly Rooms, Kennington. The rooms had been specially decorated for the occasion, and the members of the club and their guests numbered close upon 200. A handsome set of prizes had been presented by the various members of the staff, and at the close of the evening, these were presented to the successful players by the President of the club, Mr. Stanley C. Russ.

**Bankruptcy Proceedings.**—THOMAS TOPPING, electrical, &c. engineer, 361, Lord Street, Southport, Lancaster.—MR. Registrar Howarth held a sitting at the Court House, Government Buildings, Victoria Street, Liverpool, on Monday last for the adjourned public examination of the above debtor. The Official Receiver stated that the examination had been adjourned on the last occasion to enable the debtor to give information about numerous book debts which he had inserted in his statement of affairs, as many of those which he had put down as good were disputed by the debtors. The debtor had attended at the Official Receiver's office that morning for the first time, and he must ask for a further adjournment to get proper information on the subject. He had a large bundle of letters from people who disputed the accounts. A further adjournment was ordered.



**Book Notices.**—*Practical Electrician's Pocket-Book and Diary*, 1912. Edited by H. T. Crewe, M.I.Mech.E. London: S. Rentell & Co. Price 1s. and 1s. 6d. net.—The new issue of this well-known pocket-book has been much improved, besides being subjected to the customary revision. The Diesel engine section has been rewritten, the producer-gas section enlarged, and several other sections have been materially modified. New sections have been introduced on bioscope working, depreciation, illumination and railway working, and, generally, the contents have been brought well up to date.

"Depreciation and Wasting Assets." By P. D. Leake. 1912. London: Henry Good & Son. Price 10s. 6d. net.

"The Radio-Telegraphist's Guide and Log-Book." By W. H. Marchant. 1912. London: Whittaker & Co. Price 4s. 6d. net.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 1. January, 1912. Philadelphia: The Institute. Price 50 cents.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXVIII, No. 12. December, 1911. Brussels: Emile Bruylant. Price 1 fr. 75.

"Spon's Architects' and Builders' Pocket Price Book and Diary." and "Spon's Architects' and Builders' Pocket-Book, Memoranda Section." 1912. London: E. & F. N. Spon, Ltd. Price 2s. 6d. net each.

"Bulletin de la Société Internationale des Electriciens." December, 1911. Paris: Gauthier-Villars. Price 2 fr. 50.

"Proceedings of the Rugby Engineering Society." Vol. VIII. 1910-11. Rugby: The Society. Price 10s. 6d.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland." Glasgow: The Institution.

"Annales des Postes, Télégraphes et Téléphones." December, 1911. Paris: A. Dumas. Price 6 fr.

"Die Konstruktionen Elektrischer Maschinen." By W. Peineke. 1912. Brunswick: Vieweg & Son. Price M. 3.60.

"Quarterly Bulletin of the American Institute of Architects." Vol. XII, No. 3. October, 1911. Washington: The Octagon.

"Journal of the Western Society of Engineers." Vol. XVI, No. 9. November, 1911. Chicago: The Society. Price 50 cents.

"Small Greenhouses." By T. W. Sanders. London: Agricultural and Horticultural Association. 1d.

"The Russian Year Book, 1912." By Dr. Howard P. Kennard. London: Eyre & Spottiswoode, Ltd.

"Sell's Directory of Telegraphic Addresses, 1912." London: Henry Sell. 25s., including supplement.

"The Application of Hyperbolic Functions to Electrical Engineering Problems." By A. E. Kennelly. 1912. London: Hodder and Stoughton. Price 6s. net.

"Elementary Lectures on Electric Discharges, Waves and Impulses, and Other Transients." By C. P. Steinmetz. 1912. London: Hill Publishing Co. Price 8s. 6d. net.

**Small Motors.**—MR. M. W. WOODS, of 19, Devonshire Chambers, Bishopsgate, E.C., sends us a list of a number of orders received by him for small A.C. motors up to 5 H.P., single, two and three-phase, of which he makes a speciality, especially for slow speeds. He claims high efficiency for his small A.C. motors, and fits all sizes above  $\frac{1}{2}$  H.P. with ball bearings, and either totally enclosed or protected frames.

**Liquidations.**—VAUGHAN'S ENGINEERING INSTALLATIONS, LTD.—At a meeting held at 298, Goswell Road, E.C., on January 20th, it was resolved to wind up voluntarily, with Mr. W. Purchas, 1, Sidney Street, Cambridge, as liquidator. A meeting of creditors is called for February 8th.

RUGBY SCHOOL ELECTRIC LIGHTING CO., LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. A. E. Donkin, Rugby, by February 7th.

**Catalogues and Lists.**—MESSRS. W. CHRISTIE & CO., 50, Wellington Street, Glasgow.—New catalogue containing particulars, with effectively produced illustrations, of their dynamo and motor brushes, &c., including three patterns of pliable type copper and graphite self-lubricating brushes, namely, ordinary, turbo, and improved slip-ring patterns. Other features in the list are copper carbon brushes for high or low-voltage A.C. or C.C. machines; graphitic and all carbon brushes; "Galva" commutator polishers, commutator compound, galvanic metal packings, &c. Particulars will be found in the list of experiments made on some of the above-named brushes, and the results are shown by means of curves. Copies of the catalogue can be obtained on application.

MESSRS. W. T. GLOVER & CO., LTD., Trafford Park, Manchester.—List No. 9, just issued, is a strongly bound catalogue, in green cover with gilt lettering, relating to electric cable accessories. There is a colour index to the different sections of the catalogue, the coloured edge indicating, by reference to an early page, the nature of the contents at that particular point. There is also a full alphabetical index. The sections covered are these:—Standard sleeves and boxes for solid type joints; standard boxes for disconnecting link type joints; standard cable suspenders, boxes, cleats, winding drums, &c., for use in mines; standard processes and fittings for sealing the ends of cables; standard box details and jointing sundries; standard feeder pillars, frames and covers, ventilators and contract sundries. The book abounds in illustrations of the great variety of manufactures which are contained in so many sections, and both half-tones and line diagrams have been carefully prepared in order to make the contents of real value. The matter is conveniently arranged, and we have not the least doubt that the book will be a constant companion to engineers who have to do with public supply, industrial works, colliery, and other installations.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—"The Evolution of Light" is the title of a small 12-page booklet issued, with a striking cover, for the use of con-

tractors in connection with the Osram campaign. Various stages of lighting are illustrated, including moonlight, oil, rush and torch, candle, gas, electric, and finally "Osram." Contractors can have quantities of these booklets, printed with their own names and addresses, by applying to the company's publication department at the above address.

THE BRITISH PROMETHEUS CO., LTD., Salop Street Works, Highgate, Birmingham.—Twenty-four-page catalogue (No. 146) giving brief particulars, illustrations and prices of various designs of their electric heaters, chiefly of the convector pattern, also a few luminous types, combined convector and lamp, and an imitation log fire. The heaters are now guaranteed for five years. We observe from a list toward the end of the pamphlet that the Prometheus apparatus is used on board a large number of well-known ocean-going liners, at Buckingham Palace, in English theatres and railways, and in ships of a number of foreign navies.

MESSRS. CROMPTON & CO., LTD., Arc Works, Chelmsford.—Catalogue No. D32, of 20 pages, containing specification, description, shipping, price and other information relating to their A.C. induction motors, also lists of prices of their controllers, starters, &c.

MESSRS. G. WEYMOUTH PROPRIETARY, LTD., Neptune Street, Richmond, Melbourne, Australia.—Hanging wall calendar for the current year, with monthly tear-off sheets, on each of which appear half-tone illustrations of various classes of electrical machinery manufactured by them in Australia.

MESSRS. DUNCAN WATSON & CO., 62, Berners Street, London, W.—Fourteen-page booklet, giving illustrations and stating prices of the "Duncan" electric radiators made in various designs of art metal work. Those of the luminous type that are listed range from two to eight-lamp sizes. Bastian quartz heaters are also shown, and the radiators may be fitted either with these heaters, with lamps, or with other heating elements, as desired.

MESSRS. SIEMENS BROS. & CO., LTD.—We have received from the Publicity Department of this firm (on behalf of their Electric Appliances Department, Westminster, London, S.W.) a copy of the new issue of catalogue (24 pages) No. 509, "Motor-car Accessories," which supersedes the May, 1909, issue. The sections dealing with pocket instruments and electric motor horns have undergone a careful revision, with the result that the pocket instruments are now listed in several grades, and new designs have been added to the list of trumpets for motor horns. This catalogue should be useful to those who are interested in electrical accessories for motor-cars.

**Browett, Lindley Contracts.**—We are informed that MESSRS. BROWETT, LINDLEY & CO., LTD., have this week received an order for one of their 500-B.H.P. triple-expansion forced lubrication engines for the Bengal and North-Western Railway Co., Ltd., through the offices of Messrs. Sir A. Rendel & Robertson, consulting engineers. They only recently received from the British Westinghouse Co., Ltd., an order for two 400-KW. triple-expansion engines to Messrs. A. Rendel & Robertson's specification, for the Indian State Railway, North-Western section. These are now in active preparation, and a repeat order for a further two 400-KW. sets for the same station is completed, and in course of packing for shipment. They have also in hand a 2,000-H.P. three-crank compound engine for Messrs. P. Dixon & Sons' paper mills, Grimsby; a 500-KW. three-crank compound engine for Darlington Corporation; a 500-KW. steam dynamo, switchboard, condensing plant, &c., for George Town, Penang, through Messrs. Preece, Cardew & Snell, consulting engineers; a 150-KW., two-crank compound engine for the British Museum, and many other important contracts.

**Trade Announcements.**—THE ELECTRICAL APPARATUS CO., LTD., have recently opened their Manchester office at Palatine Buildings, Victoria Street, Manchester, under the management of Mr. Thos. G. Travis. All Lancashire inquiries should be sent to that address.

THE WESTMINSTER ENGINEERING CO., LTD., Victoria Road, Willesden Junction, N.W., have purchased from Messrs. Ferranti, Ltd., all the necessary drawings, plant and tools, and are prepared to carry out repairs or supply new spare parts to Ferranti alternators, rectifiers, &c. Messrs. Ferranti have advised their customers to this effect. The Westminster Engineering Co., Ltd., have for some years devoted a portion of their works to electrical repairs. They also bring machines of old design up-to-date fitting interpoles where necessary, new commutators, new brush-gear, &c.

MESSRS. W. LILEY & CO. have removed to ground floor premises at 30, Benson Street (off Mount Pleasant), Liverpool. Their telephone number and telegraphic address remain unaltered.

## LIGHTING and POWER NOTES.

**Acton.**—The Electricity Committee of the U.D.C. met specially on Tuesday, and agreed to accept the offer of the Metropolitan Electric Supply Co., Ltd., to pay £50 per annum as ground rent of the site of the works in connection with the transfer of the electricity undertaking.

Estimates for street lighting were considered at a meeting of the Highways Committee the same evening. Mr. E. C. Owen, secretary of the Metropolitan Electric Supply Co., Ltd., wrote to the effect that he confirmed Mr. Pragnell's undertaking when he interviewed the Council, viz., that the company agreed to the



1,000-C.P. lamps remaining lit until 1 a.m., instead of till midnight. As to increasing the candle-power of the lamps to 300 from 1 a.m. until dawn, that could be done at an increase of charge to £13 15s. per lamp per annum. The company were, however, of opinion that their second scheme, viz., erecting lamps on the tram poles, and extinguishing half of them at 1 a.m., would afford far better illumination than the fewer number of large candle-power lamps, and would ensure the Council's section of the main road being lighted in a superior manner to that obtaining in the boroughs of Hammersmith and Ealing. The reply of the manager of the Brentford Gas Co. was to the effect that the amended charge for 1,000-C.P. high-pressure lamps alight up to 1.30, their place then being taken by 300-C.P. lamps, would be on a 10 years' contract £13, and on a contract for five years £14. It was decided to accept the latter for lighting the by-roads, and to defer the question of lighting the main road.

**Aldeburgh.**—Good progress is being made with the electricity works, and it is anticipated that current will be available by Easter. Poles for the overhead wires are being erected in the town.

**Alloa.**—The T.C. has officially inspected the new plant installed in the electricity works, which it may be remembered were taken over from the British Electric Plant Co. in 1909. The station is suction-gas driven, and the main building was doubled in length during 1911, and a 240-B.H.P. horizontal twin-cylinder "National" gas engine, coupled to a B.E.P. dynamo was installed, together with two producer plants, either of which will run the above engine. The station "running" costs for the six months ending November 15th, 1911, are given as '842d. per unit sold, the output amounting to 115,609 in 1911, and the maximum demand to 129 kW. The fuel used is coke breeze from the adjoining gas works at 3s. per ton, and large coke at 8s. per ton.

**Argentina.**—The Direccion General de Arquitectura is authorised to invite tenders for supplying electric light and power to the district Colonial Asylums at Oliva (Province of Cordoba) and Retardados en Torres (Province of Buenos Ayres). The cost is estimated at about £22,000.—*Board of Trade Journal*.

The Compania Electricidad de la Provincia de Buenos Ayres has been definitely taken over for account of the English company as from 1st inst.

**Ashton-under-Lyne.**—The Education Committee has decided to have the electric light installed at the new Council schools.

**Baildon (near Bradford).**—The U.D.C. has decided to apply for a provisional order for the purposes of electricity supply in the township.

**Barnsley.**—The B. of G. has appointed a Committee to consider the advisability of installing electric light at the Workhouse.

**Bexhill.**—The L.G.B. has sanctioned loans of £2,000 for mains extensions and £1,200 for house services, representing the amounts required for these purposes for a period of two years from March 31st last.

**Braunton.**—According to the local papers, the new electricity plant is practically complete. The company has installed a 45-B.H.P. oil engine, running at 225 R.P.M., driving a dynamo-booster set; also a 360-ampere-hour battery of 130 cells. The company has taken over the pumping of water for the South-Western Railway Co., the price fixed being £50 per annum, and has nearly completed the public lighting installation.

**Brighton.**—The Lighting Committee of the T.C. has decided to install four oil coolers at the Southwick works to replace the old surface condensers which have been utilised for the purpose, at a cost of £760.

**Burnley.**—The Burnley R.D.C. has informed the B. of T. that it objects to the provisional order being granted to the Burnley Corporation to supply electricity in the township of Reedley Hallows, on the ground that the order does not provide at what charge electricity will be supplied. The Corporation has asked the R.D.C. to appoint a deputation to meet it to discuss the matter.

**Canada.**—A company has been formed, with a capital stock of \$30,000,000 to carry on the business of an electrical power and light company, and for other purposes.

The Imperial trade correspondent at Toronto reports that a number of municipalities in the Province of Ontario have passed by-laws to enter into contracts for the supply to them of electrical power. Most of these municipalities will, in consequence, require various electrical plant for the purpose of distributing the power. The names of the municipalities in question may be obtained at the Commercial Intelligence Branch of the B. of T.

**Canterbury.**—The B. of G. has decided to have the electric light installed at the new Nurses' House.

**Castleford.**—The U.D.C. has decided not to offer any opposition to the promotion of a provisional order by the Pontefract Corporation for the electric lighting of the borough.

**Chester.**—The T.C., January 24th, approved the scheme prepared by Mr. S. E. Britton (the Council's electrical engineer) and satisfactorily reported upon by Mr. A. C. Hurtzig, engaged as expert, for utilising the water-power of the

River Dee for the generation of electricity. The scheme will require a capital expenditure of £13,000 for the construction of the necessary works and the provision of plant (including £500 to the Dee Fishery Board for their expenses in erecting a fish pass and other works). Ald. R. C. Davies, in moving the adoption of the Electricity Committee's recommendation, explained that it is intended to erect a hydro-electric works on the site of the Old Dee Mills, and utilise the water-power by the installation of three turbines of 225 H.P. each and three dynamos. The machinery embraces no novel features, but in the opinion of the chairman of the Committee, it was correct to say the scheme is unique in this country, because it was the application of machinery to a large volume of water on a tidal river. The water rights of three other mills are being taken over, which will give an additional capacity of about 6,000 cb. ft. of water per minute. The average flow was taken as 240 million gallons per day, and the plant which it is proposed to put down will be capable of dealing with practically 600 million gallons; the units generated will be about a million per annum. The site itself is conveniently situated for the transmission of electrical energy, either to the existing mains at the Cross during heavy demands for current, or to the Crane Street electricity works, where it would be distributed or stored during light demands. It is estimated that the sale of current from the units supplied by the water plant at 1d. per unit would produce an annual income of nearly £5,000, at a working cost, including capital charges, of £1,500, showing an annual profit of nearly £3,000—sufficient to pay the capital involved within five years. The scheme was adopted with six dissentients, and application will be made to the L.G.B. for sanction to borrow £13,000. Councillor H. F. Brown, who opposed the scheme, argued that they would be well advised to follow on well known lines and develop their steam plant, either in connection with their electricity works or the refuse destructor.

**Chile.**—A decree granting to Don Felipe Gonzalez a concession for providing the town of Gorbea with electric light is announced.

**Coventry.**—At the City Council on Tuesday, the Electric Light Committee recommended that the scheme submitted for the extension of the undertaking at the total estimated cost of £16,514 be approved, and that the cost be paid out of revenue. The scheme comprised extensions to switchboard, 12 panels, with building; cooling towers; foundations; pumps and pipes; circulating water and steam pipes. The sum of £16,514 included £5,777, the value of plant already scrapped and proposed to be superseded, which amount it would be necessary to provide out of profits, and which would be transferred to capital account and applied as part of the cost of the extensions comprised in the scheme. The Committee submitted financial arrangements which would leave a balance remaining to be provided out of profits of the current year of £6,058.

**Darton.**—The Penistone R.D.C. has given its consent in connection with the application of the Electrical Distribution of Yorkshire, Ltd., to the B. of T. for an order for the lighting of the district with electric light.

**Dundee.**—The Corporation electricity department recently sought to be rated on the same basis as the gas department—namely, on one-fourth of the valuation roll entry. At a meeting last week of the Law and Finance Committee, Treasurer Soutar said this was practically a request that they should give an advantage to the electricity department at a cost of £800 to the rates, in order that the department might accumulate a greater appearance of success than was justified by the fact. The convener of the Electricity Committee pointed out that the engineer had thought it was only fair to put the two departments—gas and electricity—on the same basis, but the treasurer replied that as far as the gas department was concerned, the standard of a fourth of the assessment was statutory and binding. This, said the convener, showed the extent to which the electricity department was handicapped. It was agreed that the present practice continue.

**Falkirk.**—The T.C. seems to be very much alarmed at the Provisional Order being applied for by Mr. George Balfour, of the Scottish Central Electric Power Co., for powers to supply current to (among other places) the Larbert district for lighting purposes. Several meetings of the ratepayers have been held, and this week a plebiscite is being taken to ascertain the opinion of the electors. The question asked on the voting card is, "Are you in favour of opposing Mr. Balfour's electric lighting order by way of a burgh extension?" The T.C. points out that should the Order be passed and Mr. Balfour's powers transferred to the Scottish Central Co., the position will then be that the latter will be able to enter into competition with the T.C. in gas lighting in the Larbert district. Mr. Balfour Brown, K.C., advises the Council to oppose the Order most strenuously for the entire exclusion of the Larbert district from the Order, and, failing exclusion, for protection clauses. He is of opinion that the most effective way of opposing the Order would be by the promotion of a burgh extension scheme to include the Larbert district within the burgh, and so place the Town Council in the position to supply electricity in that district. Opponents of this view point out that since the introduction of electric lighting in Falkirk there has been a big increase in revenue to the gas department.

**Fife.**—Mr. C. A. Carlow, of the Fife Coal Co., says that that company has about 600 electric motors running in connection with its collieries. Altogether he computes that in the collieries



of Fifeshire the total number of electric motors at work is 1,000. The Fife Coal Co. has also 65 coal-cutting machines, cutting 660 000 tons of coal in the year.

**Glasgow.**—The T.C. has approved of a recommendation of the Sub-committee on Electricity Works for transforming machinery for a sub-station in Whitevale district, and the erection of sub-stations in the Maryhill and Trongate areas. The engineer has been authorised to prepare specifications for the necessary plant.

Organised by the T.C., a smoke-abatement exhibition is to be held in the city from September 20th till October 12th this year. The exhibition will follow to a certain extent the lines of the previous one held two years ago, and the most up-to-date contrivances for the complete combustion of solid fuel, and the most modern developments in heating, cooking, lighting and ventilation by means of gas and electricity, for domestic, business and manufacturing purposes, will be shown. There will also be competitions in all kinds of baking and cooking by gas and electric apparatus for girls. Among the bodies under whose auspices the exhibition is to take place is the British Electrical and Allied Manufacturers' Association.

**Heston and Isleworth.**—At the last meeting of the District Council a joint report of the clerk and surveyor was considered on the Southall, &c., Railless Traction Bill. As the promoters of the company expressed their willingness to take the whole of their electric supply from the Council, the Electricity Committee has made the following extension of the scale of its present charges for power purposes:—Consumption of 20,000 and not exceeding 25,000 units per quarter, 1d. per unit; 30,000 and not exceeding 40,000, '95d.; 40,000 and not exceeding 50,000, '90d.; 50,000 units per quarter, '85d.

**Holyhead.**—The U.D.C. has decided to lower the price of current to private consumers from 5d. to 4½d. per unit as from March 21st next, and to increase the charge for current for public lighting to 4½d. per unit from the same date.

**India.**—In connection with the Tata hydro-electric project, tests for the power required for the contracting mills, aggregating close upon 30,000 I.H.P., have been made under the guidance of Mr. H. P. Gibbs, general manager of the company, and the necessary plans for fitting the motors and general mill equipment will be shortly taken in hand. Alternating-current motors will be adopted running at from 350 to 750 R.P.M., the average horse-power per motor being reckoned at about 200; the voltage sanctioned is 6,000 inside the factory, the periodicity being 50 cycles per second.—*Indian Textile Journal*.

**Kingston-on-Thames.**—At the last meeting of the Town Council, the report and recommendations of the Lighting Committee on the electricity undertaking of the Council was presented. This recommendation is that application be made to the L.G.B. for sanction to the borrowing of £13,500 for extensions, and that the tender of the M.A.N. Co. be authorised to be accepted for Diesel engine plant and Siemens alternators at £8,328. In addition to the Committee's report, there was an exhaustive report by the electrical engineer (Mr. J. E. Edgcome) dealing with the alternative methods of carrying out the necessary extension of the generating plant. The engineer's report further gave details of the visits of himself, in company with a Sub-Committee of the Lighting Committee, to various towns in England and on the Continent, where Diesel oil engines were seen at work. In Germany, Diesel oil engines were inspected at Berlin, Tegel, Halle, Nuremberg and Augsburg, and in Belgium at Ghent.

Tenders were then invited from certain "makers and agents" in England and Germany, details of which are given elsewhere. After full consideration, the Committee found that the type of engine best suited to the needs of the Council was of the horizontal type constructed by the Maschinenfabrik Augsburg-Nürnberg Co.

In moving the adoption of the report, the Chairman of the Lighting Committee pointed out that there was only the small margin of 128 kw. between the 800 kw. capacity of the existing plant and the present maximum demand upon it, viz., 672 kw. The current year's maximum demand has exceeded that of any previous year by 80 kw., whilst during the past 10 years the units sold had more than doubled in quantity. He urged the fuel cost of the present system of generating (£3,000), as a factor in favour of adopting internal combustion engines; the cost of generating by producer plant and gas engines was lower under present working conditions, but even it was more costly than by Diesel engines.

The adoption of the report and recommendations was strongly opposed by Councillor Hall, who pleaded for "expert" advice, and by Councillor Macaulay, on the basis of "patriotism," and in support of his contention, he produced letters of the British Westinghouse Co., who, he held, had not had fair treatment in the matter of tendering. This contention was to some extent borne out by the electrical engineer in his report on the various tenders received, from which it appeared the Westinghouse Co. was not included in the firms specially invited to tender. The report says: "The British Westinghouse Co. wrote me in December asking to be allowed to tender. . . . I was not aware that this firm were manufacturers of this type of engine."

After a lengthy debate necessitating the suspension of standing orders, the report and recommendation was carried by 19 votes to 9, with three Councillors remaining neutral. It might be stated that the Lighting Committee comprises 17 members—a great majority of the Council—and it was held by the opposition to be farcical to bring up for discussion in general Council a report and

recommendation that had already been agreed to by a majority of the councillors.

**Llandaff and Dinas.**—The R.D.C. has applied to the B. of T. for permission to use overhead lines in Whitechurch at a pressure of 230 volts, alternating current, for the purpose of supply under the E.L. Orders, 1901 and 1908.

**Llandudno.**—Loans of £250 and £150 for work in connection with the electricity works have been sanctioned by the L.G.B.

**New Zealand.**—It is proposed to raise a loan for the construction in the borough of Wairoa of a suction gas plant and electricity works, and of electric lines for the purpose of supplying electricity for lighting and power purposes, at a cost of £6,000.

**Perth.**—The T.C., at a special meeting held last week, agreed to oppose a provisional order in connection with the Loch Erich water and electrical power scheme. The Lord Provost informed the meeting that petitions against the order were to be presented by the Tay District Fisheries Board and by the County Council.

**Reading.**—The B. of G. has appointed a committee to consider the advisability of having the workhouse lighted by electricity.

**South Africa.**—A serious fire occurred at the locomotive workshops of the South African Railways at Uitenhage early in January, resulting in the total destruction of the electric power house. The workshops brigade worked well, but was seriously hampered by the low pressure of the water, and by the crowd who swarmed over the works.

**Stapleton (Bristol).**—At the Stapleton Workhouse electric light is to be substituted for gas.

**Swansea.**—The T.C. at its last meeting discussed a recommendation from the Electricity Committee for the carrying out of important alterations and extensions at the electricity station, and for the purchase of new boilers and accessories. It was stated the cost would be about £46,000, and the question arose as to finding the necessary money. It was said that the T.C. had power to raise a portion under the Act of 1902, but that for the greater part it would be necessary to seek the consent of the L.G.B. The town clerk and the borough treasurer were instructed to prepare a report.

The T.C. has decided to spend £4,750 in enlarging and improving the electricity works.

**Taunton.**—A L.G.B. inquiry was held at Taunton on January 30th into an application by the T.C. for sanction to the borrowing of £2,500 for extensions to the electricity plant. There was no opposition.

**Teignmouth.**—The U.D.C. has decided not to take any action with regard to the proposed electricity scheme for the town. The proposal was that the Council should put down its own installation, and the above decision was arrived at after considering the present available borrowing powers.

**Tunbridge Wells.**—The Mayor has given notice to move at the next meeting of the T.C. a motion to oppose the Bill of the National Electric Construction Co., seeking to confirm agreements for free wiring, to which practice the Council is opposed.

**Uruguay.**—An American Consular report says a proposition has been presented to the Ministry of Public Works for utilising the rapids of the Salto Grande Falls in the Uruguay River, some 15 miles above the city of Salto, to generate electrical energy for transmission to towns on both banks of the river, and ultimately to Buenos Ayres and Monte Video. The operations are to be commenced with a proposed capitalisation of \$12,000,000, and a concession for a term of 90 years is asked, in return for which the Government is to receive 5 per cent. of the gross receipts and a given amount of electrical energy at half the current rates. As fuel is scarce and has to be imported at great cost, the realisation of this project will ultimately prove of great importance in developing the country's mineral and other resources.

**Walthamstow.**—The Public and Private Lighting Committee reports having further considered two reports by the electrical engineer with reference to the provision of additional plant at the generating station, and has decided that application should be made to the L.G.B. for sanction to the borrowing of £22,624 for the provision thereof, including condensing plant, cables, &c. Tenders are to be obtained for replating and maintaining the lighting battery at the generating station for a period of 10 years, also for the rebuilding of a switchboard. The Light Railways Committee has decided to instruct the tramways manager to equip the cars travelling between Chingford Mount and the Broadway, Stratford, with metallic-filament lamps.

**Yarmouth.**—On Saturday last the streets and business and private houses were left in darkness, owing to a steam pipe at the Corporation electricity works bursting, and by which two men were severely scalded. Lamps of various kinds and candles were used in carrying on trade, but a number of the larger shops and picture theatres were compelled to close. The entire tram service was stopped, and stranded cars had to be drawn home to the dépôt by teams of horses.



## TRAMWAY and RAILWAY NOTES.

**Argentina.**—The Rosario Municipality is preparing specifications for about 200 km. of new electric tramways. Tenders are to be called for, and a concession will be granted. The existing company, says the *Review of the River Plate*, gives little satisfaction to the inhabitants, and its service could scarcely be worse.

**Ashton.**—The lease of the Hurst D.C. to the Ashton-under-Lyne Corporation of the tramways in its area expires within the next few months. Under the terms of the lease the Ashton authority has for some years sustained a loss of £1,000 a year, and it is determined that if it again takes over the system in the urban area, it must be on terms advantageous to the Corporation. To maintain the same service as at present will mean a call on the rates of Hurst of 1s. in the £. There is a possibility that the District Council will refuse to impose such a burden on the ratepayers, and rather allow the lines and overhead equipment, of which it is the owner, to stand idle.

**Australia.**—A proposal before the Legislative Assembly recently was for the nationalisation of the Perth (W.A.) tramways service, and that negotiations be entered into with the Tramways Co. The mover urged that nationalisation was preferable to municipalisation on the ground that there were so many conflicting interests involved in the latter case.

**Blackburn.**—A report for the nine months ending December 31st, was presented to the Tramways Committee last week. This showed that the profit for the period was £2,452, compared with £1,030 for the corresponding nine months in 1910. The net receipts were £50,012, of which £47,943 was traffic revenue. The cars travelled 831,848 miles in Blackburn, and 51,074 in Accrington, and carried 8,867,577 passengers. The expenditure out of gross revenue was £18,489, including:—Traffic expenses, £11,277; general expenses, £3,234; general repairs and maintenance, £8,694; and cost of current, £8,315. Out of the balance, £6,567 was added to sinking fund, £4,625 was repaid to the Public Works Loan Commissioners, and £4,717 as interest, leaving a balance profit of £2,452.

**Brighton.**—The West Sussex County Council, at its meeting to-day, will be recommended to authorise the opposing of the Brighton District Tramways Bill, the Hove Corporation Railless Traction Bill, the Brighton Corporation Railless Traction Bill and the railless traction Bill which is being promoted by the Brighton, Hove and Preston Omnibus Co. The Urban District Council of Southwick has decided to support the Tramways Bill, but to oppose all the railless traction Bills, both as to the services, the supply of electricity and the power to run omnibuses, while the Lancing Parish Council has stated that it approves of the tramways scheme, but not of the railless traction proposals.

**Continental Notes.**—**GERMANY.**—The projected conversion of the Rhein-Hardt Railway to electrical working has started an agitation to construct a circular railway to embrace Bad Dürkheim, Friedelsheim, Gonnheim, Niederkirchen, Ruppertsberg, Königsbach and Gimmeldingen, with a connection with the State line. Neustadt-Ludwigshafen and the new line to Meckesheim. By these proposed lines the chief wine districts of the Rhine Valley, hitherto without railway conveniences, will be joined to the main line system.—*Zeitschr. für Elektr. und Maschinenbau.*

**Doncaster.**—The T.C. has decided to proceed with the tramway extension scheme to the Brodsworth model village in preference to running railless cars. The track will be laid on sleepers on one side of the road, and the cost will be about £25,000. An extension at an expenditure of £15,000 is also to be made to Warnsworth.

**East Ham.**—Application is to be made to the B. of T. for consent to duplicate the tramway track in High Street North.

**Edinburgh.**—Presiding at the annual general meeting of the shareholders of the Edinburgh and District Tramways Co., Ltd., Mr. B. Hall Blyth, chairman of the directors, said, regarding the Town Council's proposal to introduce a system of railless traction, that the company's policy was to encourage any kind of tramway, no matter what traction was used, that was not going to be in competition with the company's system, and to oppose any tramway that was going to compete with them. The directors had offered to allow their manager, Mr. Shepherd, and the assistant manager, to manage the railless system without charge. The railless cars, they believed, would be feeders for their own tramways.

**Glasgow.**—The Tramways Committee of the T.C. is to consider a proposal by Councillor Hugh Lyon, who asks that it be remitted to the Sub-committee on Finance to consider and report upon the whole question of instituting a half-yearly service of cars from 12 midnight to 3 a.m. The same committee to whom the matter was remitted has agreed to take no action in connection with a motion by Councillor Cohen proposing that the convener, "looking to the great success of the concession of two stages for ½d. on the tramway system, bring before his committee the desirability of adopting a 6d. ticket similar to those used in Continental cities, which would be available for 12 journeys and would be punched for each journey, and thus minimise the work of the conductors and cause less inconvenience to the travelling public."

**Hull.**—At a meeting of the Tramways Committee, on January 25th, it was stated that the men had accepted the new conditions drawn up by the Committee. Under this agreement the conductors get an advance of 1s. per week, and shorter hours are enjoyed by some of the men employed as car cleaners.

**Lanarkshire.**—At its last meeting the Lanark County Council approved of the proposal applying for a prov. order for power to construct three lines of tramways within its jurisdiction—(1) From near Uddingston to near Holytown; (2) from Main Street, Uddingston, to the west-end of Bellshill; and (3) from Main Street, Mossend, to a junction with the Lanarkshire Tramways at New Stevenston; and to acquire either by itself or in conjunction with the Town Councils of Hamilton, Motherwell, Wishaw, or other Corporations, the present undertaking of the Lanarkshire Tramways Co.

**London.**—Speaking at the half-yearly meeting of the Chatham Railway Co. on Tuesday, Sir Wm. Hart Dyke intimated that the question of electrification of the suburban lines had been referred to an expert by the Joint Committee. Lord Claud Hamilton, presiding at the half-yearly meeting of the East London Railway, also referred at length to the question of electrification, and stated that tenders would be opened in the first week in February, both for the equipment and electrification of the line.

**Middlesex.**—At the last meeting of the County Council a report of the Tramway Committee was adopted to the effect that a clause should be inserted in the Southall, Hounslow and Twickenham Railless Traction Bill providing for the County Council to become the purchasing authority within a given period.

**Rawtenstall.**—The T.C. has received from the B. of T. sanction to a loan of £4,668 to meet excess expenditure on cars and the electrical equipment of the tramways.

**South Africa.**—The Christmas holiday traffic between Kimberley and Alexandersfontein, the De Beers resort 6 miles out, was interfered with owing to one of the electric cars catching fire and being destroyed. The blaze occurred within a mile of Alexandersfontein Hotel, and the *débris* of the car blocked the line for some hours. Fortunately one car was on the hotel side of the obstruction, and met and brought back the passengers there.

**Sunderland.**—An influential body of local tradesmen has requested the Corporation Tramways Committee to institute a parcels-carrying system in connection with the electric cars. Before replying, the Committee decided to inquire as to the working of the system in other towns. The Outfitters' Association protested against the action of its fellow-tradesmen, on the ground that private traders should resist all municipal trading enterprise. It, however, urged that boys carrying parcels should be carried on the cars at reduced fares by means of coupons. The Tramways Committee declines to entertain this proposal.

## TELEGRAPH and TELEPHONE NOTES.

**Anglo-German Telephony.**—The Postmaster-General recently stated that it had been proved by experiment that telephonic communication between London and Germany could not be effected through France. Tests of the new Anglo-Belgian cable indicate that it may be accomplished by way of Belgium, at any rate, as far as towns in the west of Germany.

An Anglo-Swiss telephone service is likely to be opened shortly.

**Australia.**—The Marconi Co. has informed the Commonwealth Government that it intends to take such action as may be necessary to protect its patents.

The Government has ordered the material for four stations, to be erected at Hobart, Melbourne, Port Moresby and Cooktown, or Thursday Island, from the Maritime Wireless Co., Ltd., Sydney. The total cost of each station will be about £1,600, as against about £4,600 for the high-power wireless stations at Fremantle and Sydney.

**Canada-Spain.**—Wireless communication has been effected between Glace Bay, Canada, and Aranjuez, Spain, by way of Poldhu and Clifden.

**Canadian Telegraphs.**—A correspondent of the *Times* reports that the programme of the Dominion Government includes a national system of telephones and telegraphs, under the control of the Post Office Department, and the improvement of cable communication, so that Canadians will not have to get news through American channels.

**Chile.**—The *Diario* of December 13th publishes a decree granting to Senores Paul Zanartu and Carlos Matte a concession for the installation of telegraph and telephone lines between Santiago and Valparaiso, with an intermediate station at Curacavi. Twelve months are allowed for carrying out the work.—*Board of Trade Journal.*

**Coastguard Telephones.**—For the more effective watching of the coast, 63 huts, equipped with telephonic communication, and suitably manned, are about to be erected by the Government.



**Ferroconcrete Poles.**—An American Consular report states that the Government of New Zealand has adopted ferroconcrete poles for telegraph lines in place of wooden poles, and 1,265 have been made for the line between Auckland and Hamilton. The poles are 6 × 8 in. at the base, and 6 in. square at the top, the length being 26 ft. Angle poles are much stronger, and are made hollow.

**Overhead Lines.**—Sheriff Blair, Dumbarton, has granted the petition brought by the Lord Advocate, on behalf of the Postmaster-General, for authority to erect telephone poles in Clydebank, in opposition to the Clydebank Town Council, which desired that the wires should be laid underground.

**New Cable.**—The c.s. *Cambrian* this week has been laying a new submarine telephone cable between Cape Grisnez and Abbotshiff.

**New German Cables.**—The Syndicate of German South American Telegraph Companies has acquired three-fourths of the stock capital of the Compania Telefonica y Telegraphica del Rio de la Plata, which has telephone and telegraph lines in Buenos Ayres, and is also in possession of half the stock capital of the Compania Telefonica y Telegraphica del Nacional, which has several cables to Rosario. The cable of the German South America Co. ends at Pernambuco, and the company is now preparing to extend its cables to Buenos Ayres, and from there to other cities.—*Financial News*.

**Phantom Circuits.**—The phantom-circuit system, by means of which two metallic telephone lines are utilised for three lines of communication, has been improved by the electrical staff of the G.P.O., and has been successfully applied to the submarine cables between London and Brussels.

**Post Office Factories.**—The Departmental Committee appointed to consider the working of the Post Office factories recommends that the factories be maintained for purposes of repairs; that a reserve of apparatus awaiting repair be re-established and maintained, in order to equalise employment; that in England and Wales the work withdrawn from the local shops be transferred to the main factories, but that in Scotland and Ireland the work withdrawn be concentrated in repair shops in Edinburgh and Dublin, subsidiary to the main factories; that the factories be placed under the control of the stores department; that the Mount Pleasant premises of the general factory be gradually transferred to Holloway; that the work and staff of the Dalston repair shop of the National Telephone Co. be similarly transferred to Holloway, which would thus become the only London factory of the Post Office; that the proposed provincial factory be situated at Birmingham, adjacent to the stores depôt; that the Nottingham factory of the National Telephone Co. be not retained or replaced; and that the staff of the Nottingham factory be offered transfer, with payment of removal expenses, to Birmingham. The Committee also recommends that the existing establishment of the Post Office factories be revised throughout; that the proposed establishment be based as closely as possible upon the work which can be relied upon as permanent; and that the proposed establishment be arranged to afford ultimate provision for repair alone, with minor exceptions.—*Financial News*.

**Russia.**—The Department of Posts and Telegraphs is seeking the necessary powers for the installation of a new telephonic line between Moscow and St. Petersburg. The cost of this will be about £21,080.

**Spain.**—The central Marconi station at Aranjuez was officially inaugurated on Saturday last, in the presence of the King of Spain and other royalties.

**Switzerland.**—The Swiss budget for 1912 contains provision for the expenditure of £206,172 on material for telegraphic and telephonic lines, and £55,800 on telegraphic and telephonic apparatus.

**Telegraphic Error.**—Owing to a telegraph operator's mistake in transposing two figures in a message, the Postal Telegraph Co. has been called upon to pay nearly \$40,000. In 1905 a New York firm wired its New Orleans correspondent to sell 20,000 bales March cotton at 12.70 c., but the message when delivered read 12.07 c. Thereupon the firm sued to recover the loss.—*Times*.

**Uruguay.**—The Government has refused permission to the Alemana Sudamericana Cable Co. to lay cables or landlines within its jurisdiction, so as to connect up with Brazil and Europe. The concession granted in 1867, for 60 years, now held by the Western Telegraph Co., is the cause of the refusal.—*Review of the River Plate*.

**Wireless Telegraphy.**—The Post Office authorities intend to erect a wireless station on the Isle of Wight, near St. Catherine's Lighthouse.

**Wireless Time Transmission.**—The German Imperial Post Office authorities are engaged on the establishment of a central station at Fulda for the wireless transmission of time. The station is to have a range extending over the whole of Germany, and is to synchronise all the public clocks; a transmission tower of a height of 330 ft. is in course of erection. One of the three normal clocks in the station is to be arranged to send a high-pressure impulse to the transmitting antennæ every minute, when the receiving clocks throughout the country will be synchronised. It is said that the clock system is independent of foreign waves, and cannot be disturbed by atmospheric waves, and that correct transmission can be effected to the extent of one-thousandth part of a second.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—February 2nd. Electric lighting of new Council School. Mr. E. Woodhouse, architect, 33, Mosley Street, Manchester.

**Australia.**—VICTORIA.—February 13th. 50,000 incandescent lamps and 1,350 opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" January 26th.

March 12th.—Testing instruments, for the P.M.G.'s Department. See "Official Notices" January 26th.

MELBOURNE.—March 5th. Telephone material (Sch. 612); also 120 miles rubber-insulated cotton-covered tinned copper wire (Sch. 594). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

TASMANIA.—February 19th. Wire-testing machine, for the Postmaster-General's Department. See "Official Notices" January 5th.

February 26th. Five miles of cable, for the P.M.G.'s Department. See "Official Notices" January 26th.

**Austria.**—February 20th. The Austrian State Railway authorities at Villach are inviting tenders for the establishment of an electric lighting installation at the railway station at Selzthal.

VIENNA.—February 5th. Supply of insulators, 270,000 Type A; 430,000, B; 1,000,000, C; 80,000, D; 50,000, C with nose; 50,000, D with nose; 10,000 B with metal mantle; 10,000 C ditto; 600,000 large porcelain rolls; 2,000,000 ditto small. Offers, &c., to K. K. Postökonomie Verwaltung, Postgasse 17, Vienna, where forms, &c., are obtainable.

**Birkenhead.**—February 13th. Continuous-current meters, house service fuse boxes, low-tension main cable, i.r. lead-covered and armoured service cable, for the Corporation. See "Official Notices" to-day.

**Beckenham.**—February 12th. Arc lamp carbons (flame), electrical house cut-outs, and service boxes, for a year, for the U.D.C. F. Stevens, Clerk.

**Belfast.**—February 12th. One automatic coal-weighing machine, and overhead electrical equipment material, for the Corporation. See "Official Notices" January 26th.

February 5th.—Telegraph batteries, electric lamps, carbons, &c., for the Midland Railway Co., Ireland (Form 27). Mr. Ellis, Stores Superintendent, York Road Station, Belfast.

February 19th.—Stores for a year, for the City Electricity Department. See "Official Notices" to-day.

**Belgium.**—March 1st. The Belgian Direction Générale des Ponts et Chaussées in Brussels (38, Rue de Louvain) are inviting tenders for the supply and erection of a 40-ton electric crane at the port of Ostend.

BRUSSELS.—April 10th. Erection and equipment of four new telephone stations, and the supply of switchboards and accessories. Particulars, Bureau des Adjudications, Rue des Augustins, 15, Brussels.

**Blackburn.**—February 12th. Stores for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" January 26th.

**Bournemouth.**—Stores, including electrical sundries, for the Corporation tramway department for a year. Mr. I. Bulfin, general manager, Lansdowne (returnable deposit 5s. for each of nine sections).

**Bristol.**—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" January 26th.

February 20th.—Arc lamps, joint and fuse boxes, A.C. meters and D.C. mercury-type ampere-hour meters, for the Corporation. See "Official Notices" to-day.

**Cardiff.**—February 17th. The Union is inviting tenders for one 30 ft. by 8 ft. Galloway, Lancashire or Yorkshire type boiler and superheater. Specifications and forms of tender from Mr. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

**Epsom.**—February 13th. 200-KW. Diesel generating set for the U.D.C. See "Official Notices" January 26th.

**Glasgow.**—Mr. W. W. Lackie, chief engineer of the electrical department, Waterloo Street, has been instructed by the T.C. to obtain tenders for the supply of 200 flame arc lamps for street lighting.

**Halifax.**—February 5th. Stores and materials for a year, for the Corporation Electricity Department. See "Official Notices" January 12th.

February 12th.—Stores and materials required by Tramways Department during year ending March 31st, 1913. Tramways Engineer, Tramway Offices, Skircoat Road.



**Hornsey.**—February 7th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" January 19th.

**Ipswich.**—February 21st. One water-tube boiler, for the Corporation Electricity Department. Specifications and forms of tender, £1 1s. (returnable), from Mr. Frank Ayton, engineer and manager, Constantine Road, Ipswich.

**Italy.**—February 29th. H.M. Consul at Cagliari (Mr. R. H. Pernis) reports that tenders are invited by the municipal authorities at that place for the establishment of an electric generating station, the construction and working of electric tramways over a distance of 3.280 metres (about two miles), and the illumination of the principal squares and streets of the city by electricity. The installations necessary for the public lighting must be completed within nine months, and those for the tramways within two years, from the date of the grant of the contracts. Tenders to the "Segreteria Municipale," Cagliari, Sardinia. A deposit of 50,000 lire (£2,000) is required with each tender. Some further particulars may be obtained by British contractors on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal*.

**Leeds.**—February 14th and 21st. (a) 1,000 A.C. meters and (b) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 19th.

**London.**—BERMONDSEY.—February 19th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 26th.

**FULHAM.**—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**HAMMERSMITH.**—The Electricity Committee is about to invite tenders for annual stores, &c.

**POPULAR.**—February 16th. Extensions to E.H.T. and D.C. switchboards, for the B.C. See "Official Notices" to-day.

**Manchester.**—February 20th. (a) Tramcar type ampere-hour meters, and (b) general stores for a year, for the Corporation Tramways Department. See "Official Notices" to-day.

**Morocco.**—TANGIERS.—Electric and steam motors and other machinery equipment for a carriage shop. Tenderers must intimate in writing, before February 5th, their willingness to tender to the President of the Commission Générale des Adjudications where particulars and date of forwarding tenders will be supplied.

**New Zealand.**—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

**Portsmouth.**—February 20th. Stores for a year for the Corporation Tramways Department. See "Official Notices" to-day.

**Portugal.**—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes. For further particulars, see this column for January 19th.

**Rochdale.**—February 6th. Extension of electric lighting installation at the Art Gallery. Further particulars from Mr. P. W. Hathaway, Town Hall.

**Siam.**—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 kw. For further particulars, see this column for November 24th.

**Southend-on-Sea.**—February 7th. The Corporation is inviting tenders for four pier tramway trailer cars. Particulars from the Town Clerk.

**Stoke-upon-Trent.**—February 6th. Electric fire-alarm installation for the workhouse. Apply Union Offices, Stoke, for specifications and plans.

**Tunbridge Wells.**—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

**Wallasey.**—February 12th. One 500-kw. alternator and Diesel engine combined, for the Corporation. See "Official Notices" January 26th.

**Walthamstow.**—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" to-day.

**York.**—Electric shunting locomotive for the Corporation. See "Official Notices" January 12th.

**Aberbeeg (Mon.).**—The Monmouthshire County Council has accepted the tender of Messrs. A. G. Arnold & Son, Newport, for the electric lighting at the new police stations here and at Llanhilleth, Mon.

**Burnley.**—The B. of G. has accepted the tender of the Tudor Battery Co., at £458, for an electric lighting battery and the removal of the existing battery, at the workhouse.

**Eton.**—The B. of G. has accepted the tender of the Felgate Installation Co., of Sunninghill and Reading, for the electric light installation at the Workhouse.

**Fremantle (W.A.).**—The wharf electric cranes having proved such valuable adjuncts to the Port Equipment, the Harbour Trust Commissioners have asked the Government to provide a further four of the 3-ton type.

**Glasgow.**—The J. G. Brill Co. has just received an order from the Corporation Tramways for 50 Brill Standard 21 E trucks. These 50 trucks will embody the company's latest improvements—i.e., wide-wing journal boxes, noiseless half-ball brake hangers, brake castings case-hardened and steel-thimble, &c. This makes a total of 754 trucks supplied by the Brill Co. to the Glasgow Corporation Tramways.

The T.C. has accepted the following tenders:—

Scrap lead.—T. B. Campbell & Sons, Ltd.  
Scrap copper, zinc and cable.—R. M. Eardale & Co.  
Scrap rubber, bagging and rope.—Wm. M'Bain.  
Copper trolley wire.—National Conduit Cable Co.  
Brass tubing.—Leslie & Hall.  
Trolley poles.—Estler Brothers.

**Ipswich.**—The General Committee of the Ipswich Sanatorium has accepted the tender of Messrs. Mann, Egerton and Co., Ltd., for wiring and electrical work at the new buildings; that of Messrs. Reavell & Co., Ltd., Ipswich, for engines, dynamos and air compressors; that of Messrs. H. Warner & Son, for pipe work and fittings; and that of Messrs. E. R. & F. Turner, for boilers.

**London.**—SOUTHWARK.—The B.C. has received the following tenders for the supply of the following lengths of cable:—(a) 560 yds. 5 × 2 × 5 sq. in. low-tension triple-concentric lead-covered and jute-served cable; (b) 440 yds. 3 × 3 × 125 sq. in. ditto paper-insulated; (c) 880 yds. 2 × 2 × 075 sq. in. ditto paper-insulated.—

	(a)	(b)	(c)
Connolly Bros., Ltd.	£505 0	£250 0	£353 10
W. T. Glover & Co., Ltd.	515 0	257 10	362 5
Western Electric Co., Ltd.	(a) accepted 507 0	256 0	361 0
Henley's Telegraph Works Co., Ltd.	517 1	256 5	365 0
Siemens Bros. & Co., Ltd.	(c) accepted 520 0	262 0	350 0
Brit. In. and Helsby Cables, Ltd.	(b) accepted 514 10	253 0	356 10
Johnson & Phillips, Ltd.	525 0	278 0	885 0

**HAMMERSMITH.**—The Electricity Committee received the following tenders for arc lamps in connection with the scheme for hiring-out lamps to consumers:—

	50 lamps complete with choking coil.	Additional lamps.
J. & H. Grevenor	£198 15	£3 19 6
Electrical Co., Ltd.	205 0	3 15 0
Electrical Eng. and Equipment Co., Ltd.	217 10	4 0 0
General Electric Co.	220 12	4 0 0
Maxim Lamp Works, Ltd.	225 0	4 5 0
Electrical Co., Ltd.	225 0	4 3 0
Siemens Bros.	225 12	4 1 0
British Westinghouse Manfg. Co.	(accepted) 225 12	4 1 0
G. Braulik	230 0	4 12 0
Globe Electrical Co.	231 5	3 17 6
Engineering and Arc Lamps, Ltd.	236 13	4 18 8
Abbey Electric Co.	239 7	4 7 6
Electrical Co., Ltd.	241 5	4 10 0
Brilliant Arc Lamp Co.	250 0	5 12 6
Union Electric Co.	298 15	5 8 0
Engineering and Arc Lamps, Ltd.	299 3	6 3 8
Brush Electrical Engineering Co.	325 0	4 10 0
Crompton & Co.	329 10	5 19 6
Jandus Arc Lamp Co.	341 5	6 16 6
Johnson & Phillips	507 10	9 10 0

The Committee states that it has tested the various types of lamp submitted, and, in view of the type and quality of the lamp submitted, recommends for acceptance the tender of the British Westinghouse Co.

**Portsmouth.**—The E.L. Committee of the T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for a motor-generator, at £358.

**Preston.**—The Corporation Tramways Department is adopting the Brill latest design of bogie truck for three new single-deck cars. These trucks are the 39 E, swing-bolster, single-motor, maximum-traction type, the distinctive feature of which is the operation of the pony-wheels towards the platforms. It is claimed that this gives a lower step, as well as obtaining a centre pull on the brake levers. Brill noiseless brake hangers and semi-steel axle boxes will be used.

**Stalybridge.**—The Joint Tramways and Electricity Board has accepted the following tenders:—

E. Wood & Co., Ltd.—Boiler-house steelwork.  
Leech, Goodall & Co., Ltd.—Conveyors and bunkers.

**Workshop.**—For the electric light installation at the new church at Newcastle Avenue, Workshop, the tender of Messrs. J. Farr, of Nottingham, has been accepted.

(Continued on page 168.)

CLOSED.

**Australia.**—TASMANIA.—P.M.G.'s Department.—

200 telephones, magneto, wall sets, at 52s. each, £520; 75 telephones, magneto, table pattern, at 57s. 6d. each, £215 12s. 6d.; two switchboards, magneto, wall pattern 25 lines, at £12 16s. 3d. each, £25 12s. 6d.—J. Bartlam & Son Pty., Ltd., Melbourne.—*Australian Mining Standard*



## ELECTRIC POWER IN TEXTILE MILLS.

Those who have kept in touch with the progress that has been made in applying electric power to textile mills are aware that the advantages of the electric drive have been fully demonstrated; there can be no possible doubt as to the nature of the report of the Joint Committee which is considering the subject, and there is every reason to believe that the work already accomplished in this direction, admirable as it has been in quality, will prove to be a mere trifle compared with that which will be carried out during the next 10 years. In the United States, where the conditions have been very different—for there the industry is a new one, so that electric power could be adopted in the first instance, and labour difficulties have rendered it necessary to cultivate economy to the utmost—electricity is

tive at every step. First the large motors driving the main shafting—then sub-division of the motive power, leading finally to the adoption of the individual motor drive—each stage has been passed through, and at every stage the change has been justified by the improvement in excellence and quantity of the output of the mill. For it is to the steadiness of the motor drive, above all its other qualities, that its success is mainly due.

Now, by the continuance of that process of evolution, which at first hindered the adoption of electricity, but which at the same time rendered its ultimate triumph inevitable, the new method has proved its worth and has become a recognised factor in the textile industry; and it is only a matter of time for its eventual victory to be achieved.

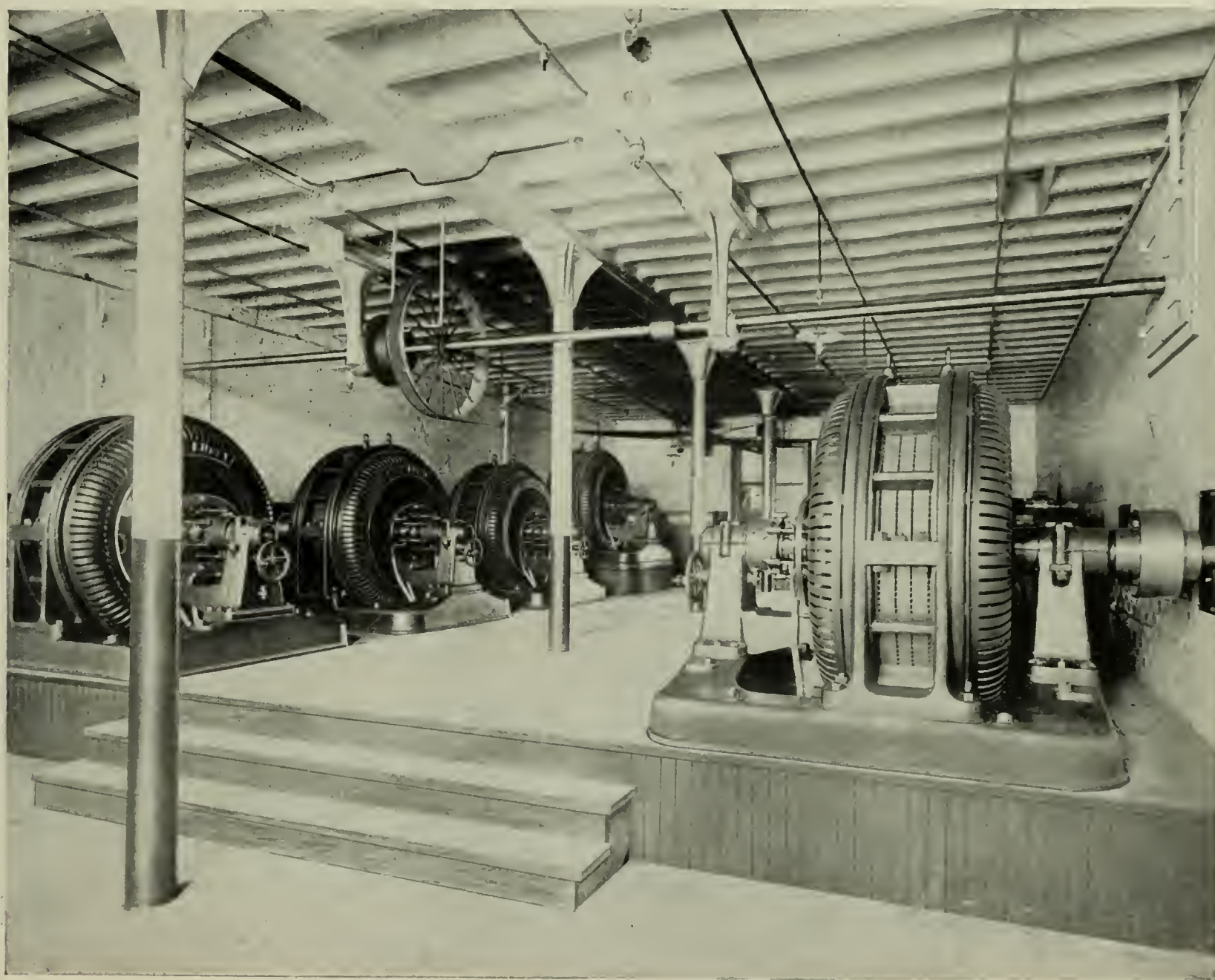


FIG. 1.—MOTOR HOUSE CONTAINING EIGHT 325-B.H.P. B.T.-H. INDUCTION MOTORS, DRIVING TEXTILE MACHINERY (MESSRS. J. & P. COATS, LTD., PAISLEY).

already very widely employed; in this country we have had to contend with the excellence of the work done by the engineers and millwrights of the northern counties, who had in the textile mill an ideal load for their steam engines, and built the latter for eternity, and thus it was at first very difficult to gain a footing except in a brand new mill. Few people outside the ranks of those engaged in the industry can realise the extraordinary degree to which standardisation has been carried in connection with textile machinery and methods; by the slow but certain process of evolution, extending through generations, weak points and unsatisfactory appliances have been eliminated until there is hardly a screw or a fillet in the whole equipment that has not been the subject of minute deliberation at one time or another. Consequently the introduction of so revolutionary a system as the electric drive has been an arduous task, watched with keen attention and some suspicion, and tenta-

We have from time to time described and illustrated examples of British mills equipped with the electric drive: by the courtesy of the British Thomson-Houston Co., Ltd., who have carried out a large number of such installations, we are now enabled to show some exceptionally interesting views in various mills, representing recent practice.

Fig. 1 shows an installation representing probably the largest power in one motor room of a textile mill in the United Kingdom. This room contains eight 325-B.H.P. slip-ring type B.T.-H. induction motors, three-phase, 50 cycles, 500 volts, running at 490 R.P.M. Each motor is direct-coupled through a coupling to a rope pulley on the other side of the wall of the motor room, driving by means of ropes in a rope race the various floors of the Atlantic and Pacific mills of Messrs. J. & P. Coats, Ltd., Ferguslie, Paisley.

Fig. 2 illustrates an interesting and somewhat unusual



drive, showing two 45-B.H.P. squirrel-cage type B.T.-H. induction motors, three-phase, 50 cycles, 500 volts, 480 R.P.M., erected in an inverted position against the ceiling, and directly coupled to a short line shaft through a B.T.-H. insulated flexible coupling. These motors each drive two pairs of twist mules. Hitherto, it has generally been considered desirable to drive mules on the group system, a number of mules being in one group. Another feature of this drive is the direct connection of the motor to the line shaft, the latter running at 480 R.P.M.

Fig. 3 is a view of the main switchboard at Messrs. Joshua Whiteley & Co.'s cotton mills at Huddersfield. This switchboard is probably unique in this country, in that each motor is started and stopped from the main switchboard. The mill is supplied with energy from the mains of the Huddersfield Corporation at a working voltage on the low-pressure side of 440 volts, three-phase, 50 cycles. All the motors in the

thrown over on to the running voltage. Bell signals to each room are arranged, so that the switchboard operator can give notice in the mill when he is about to start up any one motor.

In order to provide for emergencies in every room which is driven by a motor, there are one or more lock-up push-button switches which operate on the low-voltage releases on the main circuit switches, and enable any motor to be shut down from the room in which it is installed. In case of any motor being shut down in this manner, it is necessary for the switchboard attendant to go up to the mill and investigate the reason for the shutting-down, and to unlock the push-button switch before he can restart this motor. Further, in case of any motor being tripped in this manner, the switchboard attendant is advised of the circumstance immediately by the fact that a red light is automatically displayed on the switchboard and on the circuit in question.

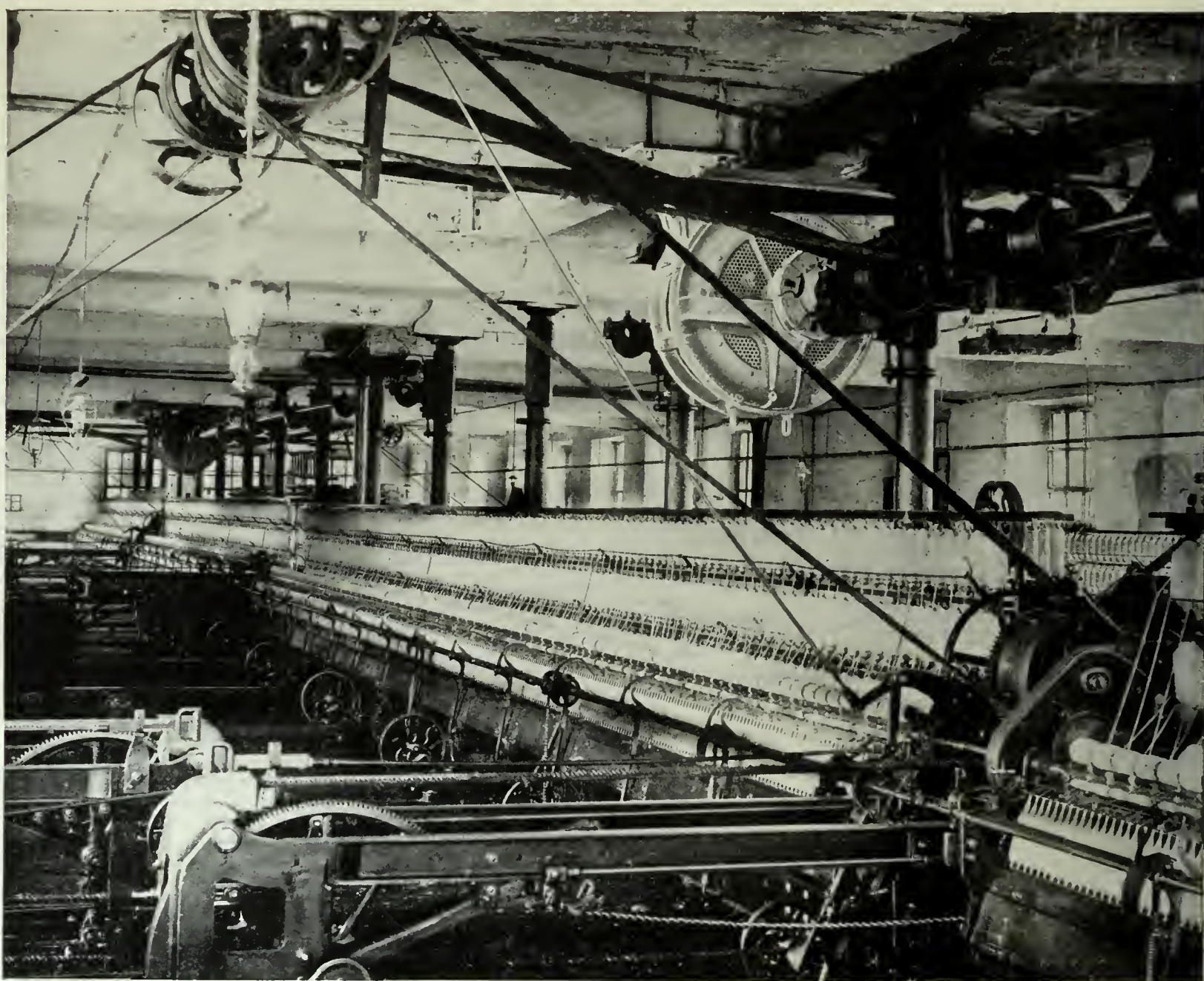


FIG. 2.—TWO PAIRS OF TWIST MULES DRIVEN BY INVERTED B.T.-H. INDUCTION MOTORS BOLTED TO THE CEILING (MESSRS. JOSHUA WHITELEY & CO., LTD., HUDDERSFIELD).

mill are of the squirrel-cage type. The Corporation transformers are arranged to give two voltages on the low-pressure side, the normal running voltage and a special low-pressure starting voltage. Each motor circuit is provided at the main switchboard with a double-throw oil-break switch, the centre contacts of which go directly to the motors. One side of the double-throw switch receives current from the special low-voltage starting bus-bars, which are connected to special tapplings on the transformer, and the other side is joined to the bus-bars connected with the running voltage. The special low-pressure tapplings from the transformers are led through a circuit-breaker on the way from the transformers to the starting bus-bars, the object of this circuit-breaker being to prevent heavy overloads being thrown on the transformers by the attendant endeavouring to start too many motors at once. On starting up, the switchboard attendant puts in first one motor switch, and then another on the starting side, and immediately these have reached full speed, as indicated by the ammeter with which each circuit is provided, the switches are

Fig. 4 illustrates a ring doubling shed in Lancashire, for which the original installation consisted of 25  $7\frac{1}{2}$ -B.H.P. squirrel-cage type B.T.-H. induction motors, three-phase, 50 cycles, 400 volts, 960 R.P.M., each directly coupled to the tin-roll shaft of the ring doubling frame; also 25 frames were driven by one 175-B.H.P. motor on the group system. As a result of this experience a further 25  $7\frac{1}{2}$ -H.P. B.T.-H. motors were subsequently ordered, the individual drive in this case being preferred to the group system; but this is a question which can only be settled on the merits of each individual case.

The resulting installation thus consists of 50  $7\frac{1}{2}$ -H.P. squirrel-cage type B.T.-H. induction motors and one 175-B.H.P. B.T.-H. induction motor, making a total of 75 frames in all, this being probably one of the largest installations existing for a doubling shed electrically driven.

Another form of drive has been adopted by Messrs. John Faulkner, Ltd., of Walkden, consisting of one 15-B.H.P. squirrel-cage type B.T.-H. induction motor, three-phase,



directly connected to two ring doubling frames, one on each side of the motor, through friction clutches. This example indicates the possibility of obtaining the advantages of the individual drive with the maximum economy of floor space. Although this method necessitates the introduction of friction clutches between the motor and the frames, this is not always essential in the case of individual motors directly connected to single frames.

While we can only show here a few examples of the work done by the British Thomson-Houston Co., it is interesting to note that they have carried out installations of electrical plant in textile mills in this country to the extent of 30,000 H.P., and have organised a special staff to deal with this class of work. At the Braidwater Spinning Co.'s Mill, Ballymena, for example, they installed a 750-KW. horizontal Curtis turbo-alternator, to supply three-phase power to the

## ON PACKING ARMATURES FOR RAIL CONVEYANCE.

BY S. LEES.

THE transit by rail of plant details, especially those of heavy concentrated weight having comparatively small bulk, is an important subject which occasions considerable concern to manufacturers in order that safe delivery at destination shall be assured, and freight and other incidental charges kept within the closest possible limits. Dynamo-electric machinery comes within this category.

Armatures, notwithstanding the solid mechanical construction which obtains at the present day, require careful



FIG. 3.—MAIN SWITCHBOARD, FROM WHICH EVERY MOTOR IN THE MILL IS STARTED AND STOPPED (MESSRS. JOSHUA WHITELEY & CO., LTD., HUDDERSFIELD).

B.T.-H. motors driving the main shafts, and their contracts have included cotton, flax, jute and woollen mills, for which they have supplied complete equipments, whether for group driving or individual motors. Statistics for 1911 show that there are in this country 56 million cotton spindles—almost twice as many as in the United States, which come second and more than 40 per cent. of the world's machinery; to drive these about half a million H.P. are required, so that it will be seen that there is a vast field to be cultivated by manufacturers of electrical machinery and suppliers of electrical energy. In addition, there is the very important woollen industry, and the minor branches of linen and jute, all of which are equally eligible customers to the electrical trades. We also manufacture immense quantities of textile machinery for export, and there is no reason why we should not supply the electrical plant with which it will be driven. The importance of the subject to electrical men, therefore, cannot be questioned, and we look for great developments in the near future.

handling, in order to guard against the detrimental contingencies ever present in carriage by rail. The armature of, say, a large power generator is not the easiest of its component parts to haul about, although presenting no exceptional difficulties in the way of slinging and lifting. But neglect of quite simple precautions may easily result in serious damage to this important part of the machine, however well packed it may originally have been. Moreover, the common packing-case method so much in vogue does not always afford the best facilities for safe and secure handling.

Returned machinery, "Damaged in transit," is an eventuality most makers deplore, as other considerations must enter which render secondary in importance that of the possibility of the carrying contractor having to bear the financial responsibility of "making good." It is a matter of far-reaching consequence to the makers for, say, a large armature forming part of a close time contract to be returned to works through mishap on rail; and such happenings are



not unheard of. Experience would seem to show that, to the average goods agent, one packing case is as good (or bad) as another: the one thing which causes any concern at all to his official mind is whether the "goods" is within the capacity of the lifting tackle available.

It is questionable indeed whether the packing-case method, however profuse and admonitory in character the labels affixed may be, affords any assurance that the contents will be delivered at destination in the condition desired.

It has often occurred to the writer that manufacturers might with very little trouble devise better methods of packing, particularly for heavy weights, for example, say, the armature of a large generator. Most armatures are of fairly symmetrical proportions and present no awkward projections, thereby rendering slinging operations straightforward and comparatively easy. Discarding the conventional wood

## REVIEWS.

*The Magnetic Circuit.* By V. KARAPETOFF. London: Hill Publishing Co. Price 8s. 6d. net.

This book, together with a companion book by the same author on the electric circuit, has been published with the idea of giving the electrical engineering student the theoretical knowledge necessary for the correct understanding of the performance of dynamo-electric machinery, transformers, transmission lines, and so on. The book also contains a good deal of information on the design and pre-determination of the performance of electrical machinery.

The whole treatment is strictly logical, and is based upon the fundamental electromagnetic relations, no use whatever being made of the old artificial concepts of unit pole,

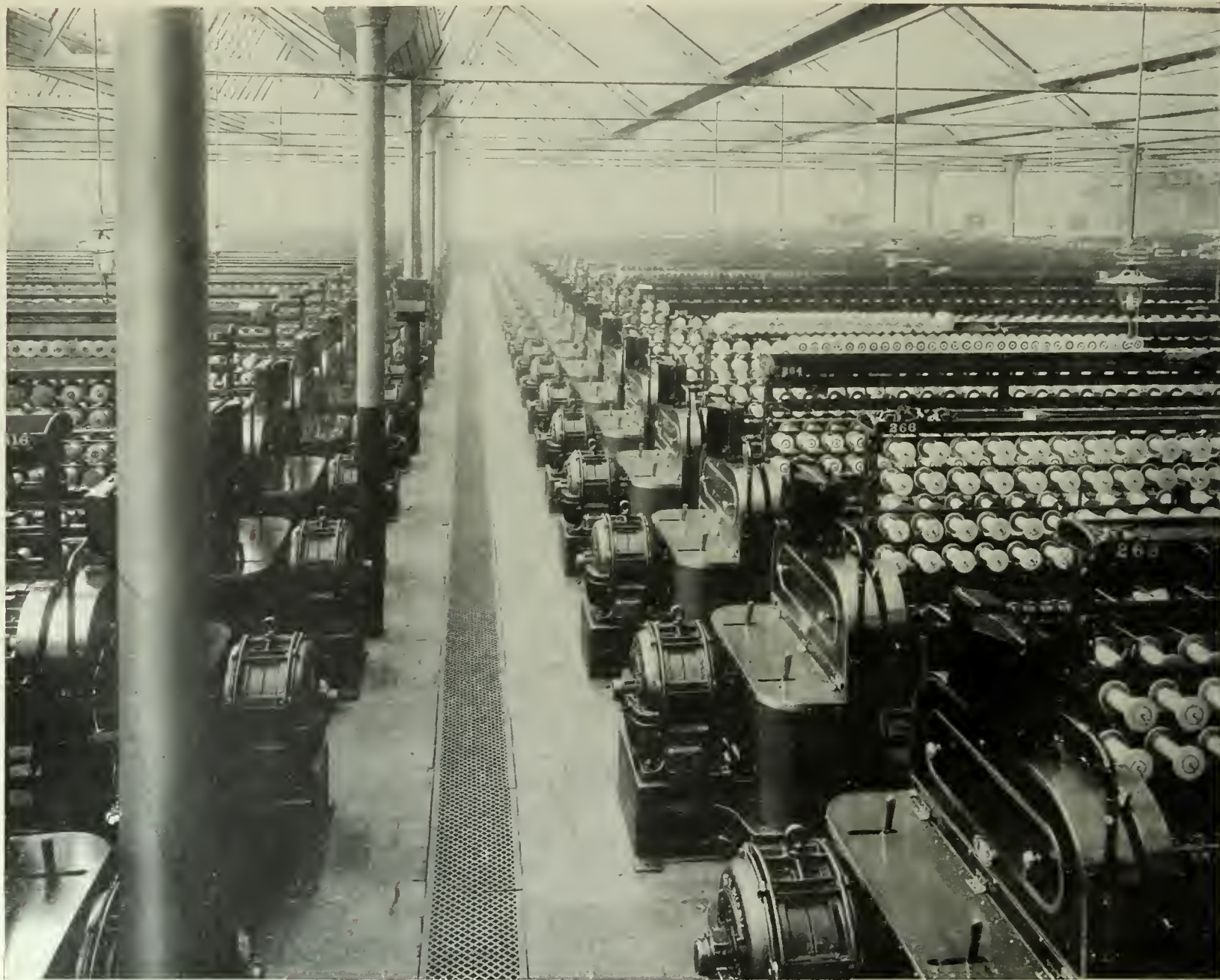


FIG. 4.--RING DOUBLING SHED CONTAINING 75 FRAMES, 50 DRIVEN BY INDIVIDUAL B.T.-H. MOTORS, AND 25 GROUP DRIVEN. (See page 180.)

packing case, why not mount the armature securely on a stoutly constructed cradle provided with suitable shackles or other devices for lifting? The provision of external protection against adverse climatic effects presents no difficulties, and is a detail well within the resources of the maker's packing department.

For very large and heavy work a special form of cradle or truck could be fitted with wheels for road work or for transferring bodily to and from the railway vehicle, as is often done in carrying special goods.

Cable makers have brought the packing of their specialties almost to an art; the modern cable drum is a simple and rough device, yet withal an efficient method, and one seldom, if ever, hears of cable being "damaged in transit," through faulty packing.

A point greatly in favour of such a system of open packing as outlined, is that the work of tracing and subsequent identification is considerably facilitated when goods overdue are advised as missing. Packing cases, as already remarked, are, externally at least, to the goods people just packing cases even when the contents are declared on the case itself.

magnetic shell, &c. The influence of Oliver Heaviside's writings is very noticeable, particularly with regard to a uniform and rational nomenclature.

The book opens with a number of sensible suggestions to teachers and a list of the principal symbols used in the work.

Chapter I deals with the fundamental relation between flux and magnetomotive force. It is clearly pointed out that Ohm's Law is merely a particular case of an experimental fact, that for a certain class of phenomena the effect is proportional to the cause. The rational names used for the various quantities will undoubtedly be somewhat unfamiliar to many engineers, *e.g.*, the word "yrneh" is used for the natural unit of reluctance. It is also somewhat startling to read of  $\mu$  being 1.25 for air.

The magnetic circuit with iron next receives attention, and some good data respecting modern alloy-steels are given. By using two scales for the abscissa the B H curves are made quite readable.

In Chapter III we have hysteresis and eddy currents in iron treated in a very thorough and accurate style. A good



mechanical analogy is given for hysteresis, and also some practical information on total iron losses which will be useful to professional designers.

Chapter IV deals with induced E.M.F. in electrical machinery. The usual formulæ are proved by rigorous methods, and the reasons for, and values of, breadth, slot and winding pitch factors are given. The chapter concludes with a discussion of the voltage ratio in a rotary converter.

Chapters V and VI are devoted to describing methods of calculating the necessary exciting ampere-turns in electrical machinery. A notable point is that Mr. F. W. Carter's exact method is given in a simplified form. The reviewer quite agrees that Mr. Carter's analysis would be out of place in a text-book of this description, since it is somewhat complex, and also involves a knowledge of conjugate functions. Some very good curves are given connecting real and apparent flux density in saturated teeth for various ratios of air to iron. An interesting method is also given for estimating the leakage between field poles.

The magnetomotive force of distributed windings receives consideration in Chapter VII, Fourier's series being made of considerable use. It is difficult to imagine how problems of this character could be solved without the use of this highly important theorem, but, fortunately, it is easy to use, although the rigorous proof is one of the most intricate pieces of modern mathematical analysis. The higher harmonics of the magnetomotive forces are given in general outline, and the student is referred to Prof. Arnold's works for a more detailed treatment.

Armature reactions in synchronous and in direct-current machines are treated in Chapters VIII and IX respectively. The treatment is clear and definite, and it may be at once said that it is vastly superior to almost all other books of a similar character to the one under consideration.

Chapter X deals with electromagnetic energy and inductance, some interesting mechanical analogies being given. The modern tendency is to push analogies too far, but those given by the author are decidedly helpful in forming a clear mental picture of electromagnetic phenomena.

The inductance of cables and of transmission lines, and of windings of electrical machines are respectively treated in the two following chapters. Some very good information is given regarding equivalent leakage permeance, quite novel methods being used in several cases.

The concluding chapter deals with mechanical force and torque due to electromagnetic energy, the treatment being largely new, and some interesting results are proved. The book finishes with two appendices on units.

Treated on its merits, the book is an exceptionally good one, a special feature being the large number of examples at the end of each chapter. Ability to work examples is a real test of the progress of a student, and many of those proposed are of considerable difficulty. It need scarcely be said that a working knowledge of differential and integral calculus is a necessity for reading this book.

Although there can be no question as to which is the best system of units from a purely logical point of view, the reviewer is somewhat sceptical as to the chance of this rational system coming into general use—at any rate, with the present generation of engineers.

The book is well printed and bound, and is also provided with a complete index.—H.G.S.

**West Hartlepool.**—The T.C. has accepted the following tenders for the construction of the Park section of the tramway, which it has recently bought :—

J. W. Pearce, Morecambe.—Paving of track, £1,731; laying the permanent way, £960.

North-Eastern Steel Co.—Rails, £1,259.

Hadfields.—Points and crossings, £445.

Mr. Paterson, the chairman of the Committee, stated that the borough engineer's estimate of the cost of reconstruction was £4,682; the tenders amounted to £1,427, and it was estimated that the old material would realise £600, so that the net cost of the new track would be £3,827.

## FORTHCOMING EVENTS.

**Royal Institution.**—Friday, February 2nd. At 9 p.m. Discourse on "Vital Effects of Radium and other Rays," by Sir J. M. Davidson.

Friday, February 9th.—At 9 p.m. Discourse on "Very High Temperatures" (with electric furnace experiments), by Dr. J. A. Harker.

**North-East Coast Institution of Engineers and Shipbuilders (Graduates' Section).**—Saturday, February 3rd. At 6.45 p.m. At the Technical College, Sunderland. Paper on "The Early Growth of the Steam Engine," by Mr. F. H. Dugdale.

**Association of Mining Electrical Engineers (Newcastle Branch).**—Saturday, February 3rd. At 6 p.m. At Armstrong College. The following papers will be discussed:—"Pit-Shaft Signalling," by E. E. Beadsmoore; "Earthing, Earth-Plates, and Leakage Detectors," by Chris. Jones.

**Society of Engineers.**—Monday, February 5th. At 7.30 p.m. At the I.E.E., Embankment, W.C. Presidential address by Mr. J. Kennedy, and presentation of premiums.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, February 5th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Notes on the Maintenance of Secondary Batteries," by Mr. T. R. Farry.

**Royal Society of Arts.**—Wednesday, February 7th. At 8 p.m. Paper on "The Influence of Ozone in Ventilation," by Messrs. L. Hill and M. Flack.

**Institution of Electrical Engineers (London).**—Thursday, February 8th. At 8 p.m. Paper on "High-Voltage Tests and Energy Losses in Insulating Materials," by Mr. E. H. Rayner.

**Institution of Electrical Engineers (Dublin Local Section).**—Thursday, February 8th. Meeting at 8 p.m. At the New Royal College of Science, Dublin.

**Institution of Civil Engineers (Students' Meeting).**—Friday, February 9th. At 8 p.m. Lecture on "Steam Turbines," by Capt. H. Riall Sankey.

**Northampton Institute Engineering Society.**—Friday, February 9th. Paper on "Radio-Telegraphic Detectors," by Mr. W. Gilbert.

**Institution of Electrical Engineers (Scottish Local Section).**—Saturday, February 10th. At the Grosvenor, Glasgow. Annual smoking concert.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued :—

Monday, February 5th.—"A" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Tuesday, February 6th.—"B" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Thursday, February 8th.—"C" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction (standard tests), 9 to 10 p.m.

Friday, February 9th.—"D" Company. Lecture on "Military Telephones," 8 to 9 p.m. Technical work and musketry instruction, 9 to 10 p.m.

Saturday, February 10th.—Mobilisation week-end run. Members wishing to attend will notify O.C.'s Company as early as possible. The party will parade at Fenchurch Street Railway Station at 3.10 p.m. Dress: Service dress, greatcoats, haversacks and belts; no arms will be taken.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

## NOTES.

**Tramway Dinner.**—The sixth annual dinner of employés of Blackpool, St. Annes and Lytham Tramway Co. was held on January 24th, at South Shore. The general manager, Mr. H. W. Laing, presided, and Mr. C. E. Riding, secretary of the company, was also present. Mr. Laing mentioned that three records had been made during the past year:—(1) Receipts had been higher than in any previous year, though the two preceding years had each been records; (2) current consumption per mile was a record for the country, and he spoke highly of the attention of motor-men to this point; (3) they also had a record in the fact that during the 12 months not a single man had been discharged from the company's employ, though several very efficient men had left the company's employ to obtain positions of greater responsibility, either abroad or at home.

Mr. Laing presented ambulance certificates and badges to several men, and mentioned that 25 of the staff now possessed these certificates. A hand-bag was presented to each member who had provided the entertainment.

## CONTRACTS CLOSED.

(Continued from page 178.)

**Tantalum Lamp Contracts.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contracts for the supply of tantalum traction lamps to the following railway and steamship companies:—Great Eastern Railway, Aberdeen White Star Line, Messrs. Bullard, King & Co., the Natal Line, and the Allan Line. They have also received a contract for supplying tantalum traction lamps to the London County Council for use on their tramway cars; and one for the supply of "Wotan" lamps for the complete street lighting scheme of Brighton Corporation.



**Association of Consulting Engineers.**—The following letter appears in the "Times Engineering Supplement" of Wednesday last, in reply to the criticism which we reprinted last week:—

"From your article on the Association of Consulting Engineers in last week's issue, it is obvious that the object of the Association has not been made clear to you.

"If the aim were merely to form a body of expert engineers to read papers and discuss matters of engineering interest, it is apparent that the field is already covered and such an Association is unnecessary.

"The existing Association of Municipal Engineers is an Association of duly qualified engineers who are connected with municipal work: in the same way, the Association of Consulting Engineers is composed of expert engineers who are engaged in consulting work.

"The Association is of opinion that the question as to whether a man is an expert engineer or not is very well dealt with by the existing Institutions; but it will not be contended for one moment that all, or even an appreciable percentage of the Corporate Members of the Institution of Civil Engineers are also consulting engineers.

"The consulting engineers themselves are obviously the people best qualified to judge whether an engineer is in addition professionally a consulting engineer.

"A great deal of the difficulty and misunderstanding at present existing is due to people attaching different meanings to the term 'consulting engineer.'

"Of course, any expert engineer who is consulted on an engineering point is, in one sense of the word, a consulting engineer, and it is to be deplored that there is no more definite term which describes an expert engineer who devotes himself to advising the public on engineering works, has his own office and staff for that purpose, and is, in addition, free from any commercial or manufacturing interests.

"It is such men as these whom the Association seeks to bring together for their mutual advantage, and for the advantage of the public, and it is difficult to see what real objection can possibly be taken to such a course.

"The Association does not claim for one moment that its members are more highly trained than any other expert engineers, but merely that they devote themselves to consulting work in the same way that others devote themselves to manufacturing, contracting or municipal work.

"For the ASSOCIATION OF CONSULTING ENGINEERS,

"A. H. DYKES, *Hon. Sec.*"

**A Manchester Electro-Harmonic Society.**—On Friday last, January 26th, a smoking concert and social evening, under the auspices of the Manchester Branch of the Electrical Contractors' Association, Inc., was held in the Marble Hall, Albion Hotel, Manchester, Mr. James Hill (chairman of the Branch) in the chair. We learn that it was proposed, and carried with great enthusiasm, that an Electro-Harmonic Society should be formed in Manchester, to be run on similar lines to the one which has been so successful, and carried on for such a long time in London, to the enjoyment of everyone concerned. The following gentlemen were appointed on the Committee:—Mr. F. Sells, General Electric Co.; Mr. J. H. Greaves, Ferranti, Ltd.; Mr. J. Gibson, Westinghouse Co.; Mr. Wooller, W. T. Glover & Co., Ltd.; Mr. W. J. Smith, Sloan Electrical Co., Ltd.; Mr. R. S. Page, W. T. Henley & Co., Ltd.; Mr. F. Beech, Sunbeam Electric Lamp Co., Ltd.; Mr. T. Nunwick; Mr. Hall, Eckstein, Heap & Co.; Mr. L. E. Wilson, L. E. Wilson and Co.; Mr. L. A. O'Brien, R. O'Brien & Co.; Mr. P. Allman, P. Allman & Co.; Mr. W. P. Theerman, W. P. Theerman & Co., Ltd.; Mr. C. E. Beckett, C. E. Beckett & Co.; Mr. E. J. Dugdill, Dugdills, Ltd.; Mr. J. Jackson, J. Jackson & Co.; Mr. J. Hill, Sharples, Hill & Co.; with power to add. Mr. J. Hill was appointed hon. secretary, *pro tem.*

We are pleased to hear that the concert was a huge success, the artists being:—Messrs. Holt and Ditchburn (Manchester Cathedral), Messrs. Suffield and Wright (humorists), Messrs. F. Crawford, O. Moon and Wilson (General Electric Co.), Mr. Muller (British Westinghouse), Messrs. Lawe and Greaves (Ferranti, Ltd.), Mr. H. Underwood, and Mr. L. A. O'Brien. Mr. W. J. Smith presided at the piano, and the usual votes of thanks having been proposed and seconded, the concert terminated after a most enjoyable evening.

We congratulate our Manchester friends on the inauguration of their Electro-Harmonic Society, for which we wish a long and successful record.

**L.C.C. Conditions of Contract.**—A Committee of the L.C.C. has had under consideration certain representations made with regard to the conditions of contracts for the supply of tramway parts and equipments, and reports that it has come to the conclusion that some of the present conditions are somewhat onerous upon contractors. The clauses to which exception has been taken are those relating to (i) the quantity of goods taken; (ii) the purchase of materials from firms other than those whose tenders for the materials in question have been accepted; and (iii) arbitration. In the report it is stated as follows:—

"After careful consideration, the Highways Committee have decided that the clauses relating to the quantity of goods taken and to the purchase of materials from other firms which obtain in the schedules prepared under the direction of the Stores and Contracts Committee should be adopted in lieu of those now inserted in the schedules prepared under the direction of the Highways Committee, and they have made arrangements accordingly.

"As regards the clauses relating to arbitration, it appears to

the Highways Committee that the analogous clause obtaining in contracts arranged by the Stores and Contracts Committee is scarcely applicable to the electrical and mechanical tramway parts embraced in the schedules prepared under the direction of the Highways Committee, as such parts have to be specially manufactured. They are of opinion, therefore, that a modification of the arbitration clause for engineering contracts should be inserted in the schedule for tramway parts prepared under their direction. We concur and recommend—

"(a) That the following be a standing order of the Council:—The following clause shall be inserted in all contracts for the supply of electrical and mechanical tramway parts and equipment. If any dispute shall arise between the Council and the contractor as to the construction of the contract, or as to the rights, duties or liabilities of the contractor or the Council thereunder, or as to the due performance by the contractor of this contract, or as to any materials or workmanship or any matter or thing arising out of this contract or in relation thereto, the same shall be referred to the award and final decision of the chief officer of tramways or (at the option of the contractor) of some other person to be mutually agreed upon, or, failing agreement, of some engineer to be appointed by the president for the time being of the Institution of Civil Engineers. The provisions of the Arbitration Act, 1889, shall apply to any arbitration under this clause.

"(b) That Standing Order No. 278, specifying the arbitration clause to be inserted in contracts for stores, be amended by the insertion after the word 'stores' in line 2 of the words 'other than electrical and mechanical tramway parts and equipment.'"

**Electrical Workers' Strike.**—Some time ago the electrical workers in the Clyde shipyards were granted an advance on their wages of  $\frac{1}{4}$ d. per hour, bringing the total to 8 $\frac{1}{4}$ d. per hour. In consequence, the workers in Glasgow in the employment of the Electrical Contractors' Association—who are chiefly engaged by the building trade—asked for an increase of  $\frac{1}{2}$ d. to bring their wages to 8 $\frac{1}{2}$ d. per hour. After negotiations, the employers offered  $\frac{1}{4}$ d., but this was refused, and subsequently all the firms with the exception of two acceded to the demand. The men with those two firms struck work immediately, and in later negotiations  $\frac{1}{4}$ d. at once and another  $\frac{1}{4}$ d. on February 1st was offered. This also was deemed unsatisfactory, and after considering a notice from their union all the men in the employment of the Association in Glasgow, to the number of over 200, ceased work, insisting upon a  $\frac{1}{2}$ d. per hour increase. The strike still proceeds (January 30th).

**The National Telephone Journal.**—It is with sincere regret that we bid farewell to the official *Journal* of the National Telephone Co., of which the final issue has appeared, for January, 1912, being the seventieth number, and prematurely concluding the sixth volume. Throughout its career the *Journal* has been conducted in a most admirable fashion; its contents and its production have been of the highest class, and by its decease a serious loss has been inflicted upon technical journalism. Amongst other interesting features of this, the last issue, are the conclusion of a history of the company by Mr. Albert Anns; a report of the great "final muster" on December 30th; the reports of presentations to Mr. Anns (secretary), Mr. S. J. Goddard (general superintendent), and Mr. Frank Gill (engineer-in-chief), of souvenirs by their respective staffs; and a farewell letter signed by the Editing Committee—Messrs. Anns, Clay, Gill and Goddard—who express their gratitude to Mr. H. Laws Webb for valuable assistance during the early years, and to Mr. W. H. Gunston, who for the last four years has practically managed and edited the *Journal* for the Committee. Presentations were also made to Mr. W. W. Cook (assistant engineer-in-chief), Mr. R. Shepherd (superintendent N.-W. province), Mr. Clay (Metropolitan superintendent), and other leading members of the staff.

In an editorial the belief is expressed that on the whole the company has deserved well of the country, and will die regretted. We cordially endorse this view, and we hold the same opinion with regard to our late esteemed contemporary.

**National Insurance Act, 1911.—Advisory Council.**—The National Insurance Advisory Council, of 3, Northampton Square, London, E.C., is prepared to advise inquirers, whether employers or employed, male or female, who are desirous of ascertaining their position under the National Insurance Act. Special attention will be given to inquiries from registered friendly societies of less than 5,000 members and unregistered societies, slate clubs and yearly clubs, &c., as to the best manner in which to become approved; arrangements can be made for speakers to be sent if desired. Any person desirous of making an inquiry, whether on his own behalf or on behalf of any other person of either sex, or any society or club, should forward a letter containing full particulars, and a stamped addressed envelope for reply, to the Secretary at the above address. No charge will be made for information given in response to any inquiry.

**Electrical Training for Ironmongers.**—According to a note in the *Times*, a scheme is on foot for the establishment of a school for technical education in the ironmongery and hardware trades. A two or three years' course of instruction is proposed which shall include, among other things, heating and ventilating systems, gas and electric lighting. It is stated that both the wholesale and retail sections of the trades referred to are taking an interest in the scheme.

**Concert.**—To-morrow evening, at 7.30 p.m., at the Oval Concert Hall, Kennington, S.E., the first annual Bohemian concert of the G.E.C. Athletic Club will be held.



**Fatalities.**—In the Hamilton Sheriff Court, on January 24th, Sheriff Hay Shennan and a jury inquired into the circumstances attending the death of John Kelly, miner, who was killed in No. 1 Bardykes Colliery, belonging to the Summerlee Iron and Coal Co., on December 21st last. Mr. Robert McLaren and Mr. A. H. Steele, H.M. Inspectors of Mines, appeared on behalf of the Home Office.

James Davidson, colliery fireman, Cambuslang, explained that on the night of the accident he was in the hump coal seam of the colliery. He was assisting the deceased and some others to shift the position of a bar coal-cutting machine. This was being done by means of a bogie. When the machine had reached the place where it was intended to be located, it was partly lifted off the bogie. The current was then immediately switched on, the idea being that the machine by its own force would get entirely clear of the bogie and land on the pavement, as was desired. At this particular part of the workings water was constantly dropping from the roof on to the machine, and when the latter was made entirely free from the bogie it completely "loaded up." All the men felt two distinct shocks—the second being worse than the first—and deceased was instantly killed. Witness, in reply to Mr. McLaren, stated that water was falling from the roof on to the plug of the machine. The plug and bat of the machine were, in his opinion, tightly screwed up.

David Macgregor, who operated the coal-cutter, gave it as his opinion that it was the water dropping on the machine which caused it to get "loaded up." Deceased was about 2 ft. from the machine when he got the fatal shock; that showed that a large portion of the pavement surrounding the coal-cutter had become "live" with electricity. Witness, in answer to Mr. G. L. Kerr (who represented the employers), gave it as his opinion that the water had conducted the current from the machine to the pavement. He was positive that he screwed up the pin at the plug properly.

Thomas Black, the electrical engineer at the colliery, said he examined the coal-cutter on the day following the accident; he found everything about the machine in order. Asked for his opinion as to the cause of the fatality, witness replied that the machine was standing in water. If the deceased was in a state of perspiration he would be a good subject for receiving a shock.

Replying to Mr. McLaren, witness stated that the system at Bardykes was three-phase, 500 volts. Double-armoured cables were laid from the generator at the surface to the face. The earthing system was through armouring to the earth-plate at the surface. In ordinary circumstances any leakage occurring in any part of the machine should go back to earth. In this case it did not do so, and he could find no explanation accounting for the cause. The only defect he had found about the earth connection was that the earth-pin was somewhat bent; that prevented it from being screwed in fully. He could not admit that there was anything wrong with the plug connection, but he believed the presence of water and the fact that the earth-pin had been bent were important factors in causing the deceased's death. In further reply to Mr. G. L. Kerr, witness said he was forced to admit that the fact that there was an earth-plate on the surface was, in the present instance, no remedy.

Samuel Agnew, manager at the colliery, said that the presence of water would have the effect of conveying the current on to the body of the machine. In his opinion, the pin at the plug connection was not screwed in as tightly as it might have been. At the same time, there was a good local earth at the point of the accident, and it ought to have taken the current away. The earth-wire from the machine to the surface was in order, and, even supposing the plug was not sufficiently screwed up, the leakage should have been taken off.

The jury, acting on the suggestion of the Sheriff, returned a formal verdict.

An inquest was held on January 23rd into the death of William Lee, 21, a coke oven labourer of Rotherham, which occurred on the previous Saturday at Silverwood Pit. According to the evidence, deceased climbed over a fence to the coke box instead of going by the proper approach, and in that way he came into contact with live wires, near which his duties did not require him to go. The manager of the colliery said that the current was medium pressure, and so safeguarded as to reduce the danger of shock to a minimum. He considered that if the deceased came over the fence he was guilty of misconduct, and he also had no business to be on the bar where he was seen, or to go there in the event of anything being wrong with the machinery. By being on the bar deceased had been guilty of serious and wilful misconduct. In his opinion, deceased, in descending from the ovens, had got over the fence for a short cut instead of descending the steps. The jury returned a verdict that death was due to shock, through coming in contact with electric wires accidentally.

**Institution and Lecture Notes.**—**INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE LOCAL SECTION).**—At a meeting to be held at the University, Leeds, on Wednesday, February 14th, a discussion on the paper by Mr. A. H. Seabrook, on "Residence Tariffs," will be opened by Mr. S. Z. de Ferranti, president. The annual dinner takes place in the Hotel Metropole, King Street, Leeds, on Friday, February 16th, at 6.30 p.m.

At a meeting of the SHEFFIELD ELECTRO-METALLURGICAL SOCIETY last week, Mr. Frank Mason read a paper on "The Applications of Electro-Metallurgy." He stated that in large quantities alloys could be melted under the present unfavourable conditions at the cost of 1d. per 11·7 lb. of metal by means of the electric furnace. Prof. Arnold, during the discussion, said that they were paying 6d. per unit for energy in Sheffield, while Newcastle could get it for 4d. The price would very much interfere with the general use of electrical energy, unless the Corporation altered it. The name

of the Society has been altered to "Sheffield Society of Applied Metallurgy."

**INSTITUTION OF ELECTRICAL ENGINEERS.**—It is announced that the Council having decided not to place before the members, when the new articles are considered, any proposals which would affect the subscriptions of existing members for 1912, the subscription notices for the current year will be sent out shortly.

**DERBY SOCIETY OF ENGINEERS.**—An error unfortunately occurred in our report of the paper by Mr. Sayers on "The Use of Electricity for the Control of Railways"; the Society before which the paper was read was not the Derby Society of Engineers and Telegraph Superintendents of the Midland Railway, but the Derby Society of Engineers, which is not connected with the Midland Co. We have received from Mr. C. G. Conradi, the hon. secretary, a copy of the Syllabus for the current season, which shows that an excellent programme of papers has been prepared, and that the Society is admirably organised and conducted.

**Appointments Vacant.**—Assistant lecturer and demonstrator in electrical engineering, for the University of Liverpool (£200); shift engineer, for the Guildford Electricity Supply Co. (30s.). See our advertisement pages in this issue.

**Tunbridge Wells Electricity Department.**—The eighth annual dinner of the Tunbridge Wells Corporation Electricity Department was held at Carpenter's Restaurant on January 24th. Mr. J. W. Beauchamp, the borough electrical engineer, presided. Mr. Horace Boot, the consulting engineer, proposed the toast of "The Lighting Committee," and Alderman Carpenter responded. Councillor Dennis proposed "Tunbridge Wells Electricity Works' Staff and Employés." In the course of his remarks he said that the continued success of the undertaking was due, in a large measure, to the great efforts put forth by Mr. Beauchamp in keeping in touch with all the consumers and instructing them in the latest developments and phases of electrical use. The chief assistant engineer, Mr. J. Bemrose replied, and among other things, he said that he had met a good many beginners, who after a few years of work reached a certain point and stopped, and regretted entering the electrical profession, but to-day the future outlook was much better for everybody, provided they worked hard. He referred to Mr. Beauchamp's ability to quickly realise the particular value of a man to put him in the right place, and to draw the best out of him. He thanked him on behalf of his *confrères* for the manner in which he helped and encouraged them in their duties. Mr. Hayden also made similar references to the chief. Mr. Beauchamp, who met with a very hearty reception, said he was pleased to see so many on the staff present, also the representatives of the Lighting Committee and of the local wiring contractors. The number of new consumers and extensions would constitute the record of their undertaking, and show the enormous vitality of electricity. He made a strong patriotic appeal to all young men present regarding the duty they owed to their country. His reason for bringing this matter forward was the receipt of a letter from Mr. D. R. Salomons (son of Sir David Salomons) regarding the new Drill Hall, &c., which was to be built at Southborough if sufficient support were forthcoming. Messrs. Cross and Stonham briefly responded to a toast "The Visitors," and they alluded to the amicable relations which existed between the whole of the contractors and the electricity staff, and the help they always received from Mr. Beauchamp. During the evening members of the staff contributed musical and other items.

**A B.T.H. Staff Dinner.**—Will any interested past member of the B.T.H. staff who has not received notice of the informal dinner to be held in London on February 24th, communicate with the hon. secretaries, Mr. W. J. Larke, Rugby office, and Mr. T. Stevens, 83, Cannon Street, London, E.C.?

**The Census of Production.**—The *Times* states that the Board of Trade have appointed the following gentlemen as members of the General Advisory Committee in connection with the second Census of Production:—Sir Hugh Bell, Sir Charles Macara, Sir T. Ratcliffe Ellis, Mr. J. H. C. Crockett, Mr. B. Harmer, Mr. W. H. Mitchell, J.P., Mr. Alexander Siemens, and Mr. J. W. White. Mr. G. A. G. Stanley will act as secretary to the Committee. The second Census will be taken in the year 1913, on particulars relating to the year 1912.

**Will.**—The *Times* states that the late Mr. Ebenezzer Stiff, of the London Pottery, Lambeth, left estate valued at £52,152 gross, with £8,492 net personalty.

**Commercial Electric Motor Vehicles in America.**—In connection with the leader in our last issue on the subject of electric vehicles, it is interesting to note that out of 127 machines shown at the Exhibition of Commercial Motor Vehicles just held in New York, no fewer than 33, or 27 per cent., were electrically propelled.

**Inquiry.**—A correspondent asks for the name of a maker of rolls of paper perforated on the edges, as used in recording instruments.

**Walking Club.**—In connection with the formation of the Clapham and Hackney Walking Clubs, mentioned in a recent issue, a general meeting will be held on Saturday, February 3rd, at 6 p.m., at the Alexandra Hotel, Clapham Common, for the purpose of inaugurating the Clapham Walking Club, and all who are interested are asked to communicate at once with the hon. sec., *pro tem.*, Mr. A. R. Edwards, 303, Amhurst Road, London, N. It is proposed to hold an open walking race from London to Southend (40 miles) on Good Friday, and to offer a special prize or prizes to those engaged in the electrical trades.



## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Horsham U.D.C. has decided to increase the salary of MR. J. B. MORGAN, electrical engineer, from £250 to £275 per annum, as from January 31st.

MR. GEORGE BRANDER, of the Arbroath Electric Light and Power Co., has been appointed superintendent of the central generating station at Townhill, under the Fife Electric Power Co.

The Huddersfield T.C. has increased the salary of MR. J. A. SWIFT, chief clerk at the electric light station, to £170 per annum.

The Electricity Committee of the Bury T.C. has recommended the Council to increase the salary of the electrical engineer from £450 to £550 per annum.

The Salaries Committee of the Bristol T.C. has recommended the following increases of salary of members of the electricity staff: MR. H. FARADAY PROCTOR, electrical engineer, from £800 to £850 per annum; MR. C. M. DAVIS, publicity engineer, from £156 to £175; MR. A. J. OSTLER, sub-station superintendent, from £156 to £175.

MR. STUPART, shift engineer at Guildford, is leaving to take up a responsible post in Chile.

The salary of MR. V. G. ALLEN, shift engineer at Southampton Corporation electricity works, has been increased by £13 per annum.

**General.**—A baronetcy has been conferred upon MR. JOHN HENNIKER HEATON in recognition of his persistent and successful efforts to secure postal and telegraphic reforms. Sir Henniker Heaton in 1885 represented Tasmania at the Berlin Telegraph Conference.

We regret to learn that MR. GUY BURNEY, managing director of the Sterling Telephone and Electric Co., Ltd., has recently undergone a serious operation, but we are glad to inform his numerous friends that he is now making satisfactory progress towards recovery.

SIR WILLIAM RAMSAY has resigned the Chair of General Chemistry at University College, London University, as from the end of the current session.

MR. CHAS. FORGAN has resigned the position of power house superintendent to the Central London Railway, which he has held during the past 11 years. He leaves the service of the Central London on February 17th, to take up an appointment with Messrs. Joseph Rank, Ltd., Baltic House, Leadenhall Street, E.C.

MR. ALLAN R. CONNALL has been appointed assistant manager to the National Electric Construction Co., Ltd.

## CITY NOTES.

## Chatham and District Light Railways Co.

THE directors' report for the half-year ended December 31st, 1911, says that the revenue for the period was £23,964, and the expenses were £12,862, leaving £11,102. From this are deducted:—Rent of Rochester Corporation lines, £1,872; interest on debentures, £1,234; interest account, £177, leaving £7,819, plus balance brought forward £1,707, making £9,526. Of this amount £4,500 has been transferred to reserve for depreciation. The directors recommend dividends at the rate of 5 per cent. per annum on the preference shares, requiring £2,940, and at the rate of 3 per cent. per annum on the ordinary shares, requiring £1,590, leaving £496 to carry to revenue new account. The traffic receipts show a decrease of £77, and the expenses a decrease of £145, as compared with the receipts and expenses for the corresponding half-year of 1910.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1910 ..	11.98	4,347,656	£21,029	1.16	556,218	45
Dec., „ ..	14.98	4,869,431	23,699	1.17	586,902	45
June, 1911 ..	14.98	4,372,850	21,101	1.16	551,834	45
Dec., „ ..	14.98	4,843,236	23,622	1.17	571,790	45

**Edmundsons' Electricity Corporation, Ltd.**—The *Financial Times* understands that the trustees of the £100,000 5 per cent. prior lien debenture stock have received notice of the company's intention to redeem the outstanding stock on July 12th next.

**Westminster Electric Supply Corporation, Ltd.**—The directors have declared a dividend at the rate of 10 per cent. per annum for the half-year to December 31st. This makes the total for the year 10 per cent., the same as in 1910.

**Central London Railway Co.**—The directors have declared a dividend on the deferred ordinary stock of 2 per cent. for the past year. £2,250 is placed to the renewal account, making the total of that account and the reserve fund £110,211. £26,152 is to be carried forward.

**Held Over.**—Owing to great pressure upon our space this week, several City reports are held over.

## London Electric Railway Co.

THE directors' report for the half-year ending December 31st, 1911, shows that the capital expenditure during that period amounted to £16,466. The gross receipts on revenue account amounted to £366,190, being an increase of £13,295 on the receipts for the corresponding half of last year. The working expenses amounted to £170,941, being an increase of £3,973. After providing for interest and rents, and reserving £7,500 for contingencies and renewals, there remains a balance of £112,092, available for dividends, and the directors recommend that a dividend at the rate of 4 per cent. per annum be declared on the 4 per cent. preference stock, and that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving a balance of £2,452 to be carried forward. The directors recommend that these dividends shall be payable on February 7th. The following gives a summary of comparative figures for the corresponding half years of 1911 and 1910:—

	Half-year Dec., 1911.	Half-year Dec., 1910.	Inc.	Dec.	Per cent.
Gross revenue ..	£366,190	£352,895	£13,295	—	+ 3.767
Working expenditure ..	£170,941	£166,968	£3,973	—	+ 2.380
Passenger receipts ..	£342,451	£332,563	£9,888	—	+ 2.973
Train-mileage ..	2,741,309	2,814,635	—	73,326	— 2.605
Car-mileage ..	9,121,677	8,636,749	484,928	—	+ 5.615

Half-year ending—	Passengers, inc. season ticket holders.	Receipts.
December, 1910 ..	46,665,279	£332,563
June, 1911 ..	52,548,384	369,326
December, 1911 ..	48,666,842	342,451

The traffic was adversely affected owing to the weather conditions during the summer months, and the dislocation of the whole of the railway traffic in London caused by the strike in August last. Contracts for the construction of the Charing Cross and Paddington Extensions have been entered into, and the work is progressing satisfactorily. The escalator (or moving stairway) at Earl's Court Station was brought into use on October 4th, 1911, and has proved a very popular and convenient means of interchange between the Great Northern, Piccadilly and Brompton and Metropolitan District Railways at that point. The Lot's Road power house undertaking, to which reference has been made in previous reports, became vested in the Lot's Road power house Joint Committee from January 1st, 1912, and was thereupon leased by the Joint Committee to the Metropolitan District and London Electric Railway Companies. The property has, therefore, become part of the undertakings of these companies.

Miles constructed, 22 m. 19.43 ch.; constructing 1 m. 3.70 ch.

Train-mileage, 2,741,309 (1910 half-year, 2,814,635).

Car-mileage, 9,121,677 (1910 half-year, 8,636,749).

## London United Tramways Co.

MR. C. J. CATER SCOTT (Chairman) presided, on Tuesday, at Winchester House, E.C., over the tenth annual general meeting of the shareholders of the above company.

In moving the adoption of the report, the CHAIRMAN said the accounts for 1911 showed an improvement over 1910, but they did not see their way to meet their preference dividend. It was satisfactory that they were gradually improving, and were working their way up from the low-water mark of 1909. The total receipts for the past year were £343,987, which was £10,328 better than 1910, and £25,761 better than in 1909. The fine weather helped them very much, but at the same time it helped the motor-buses, and the competition was infinitely more serious and keen than it was ever before. There was scarcely a mile of their track to-day over which they had not to meet the competition of the motor-buses. This was especially true of the parts of their system where the traffic was densest and the prospects of traffic were good. So far as the Coronation was concerned, the effect on their receipts was a disappointment. In traction expenses they had made a saving of £2,570 compared with 1910, and the whole of that saving was due to economies in coal, as the result of experiments following the expenditure which they had incurred on the power house in the last two years. The saving would have been greater, but for the fact that when they were threatened with the very serious railway strike last summer they looked ahead and bought more coal because they thought it incumbent on them at any reasonable cost to maintain their service. Traffic expenses were up by £1,888, which was accounted for as to £2,414 by increases of wages to the staff. It was also partly due to increased mileage run, and to the better conditions they gave their men. They were now giving them seven days' holiday every year with full pay, and also made arrangements by which they had at least a part of Sunday to themselves. This meant extra cost to the company, but he believed the shareholders would support the board in doing what they could to improve the conditions of service of their employés on whom the company depended so largely, and who could do so much for the comfort of the travelling public. The compensation and legal expenses were £11,711, against £8,711. Last year he told them that the claims were about £3,000 less, and this year they had gone up again. He hoped he was justified in saying that during the current year they would save on that item. In general expenses and contingencies there was a considerable increase in the item of advertising. They had increased this by



£1,345 in the hope that it would lead to increased traffic, and they would see if it did so. If not, they could go back to the figure of previous years. When they came to the maintenance and renewals, they found some striking changes. First, the rolling stock and power plant were down £11,801, and permanent way £4,913. This was not that they had been starving the line or the plant, for, on the contrary, their line to-day was in better condition than for many years past, and they were now seeing the advantage of the expenditure of the last two years in putting the property into better working order. The total saving in maintenance and repairs came to £17,386, which was a very appreciable sum. The total expenses of the company showed a total saving of £15,178, and as the receipts showed an increase of £10,328 there was £25,506 more carried to the net revenue account than last year. This enabled them to meet the interest on the debenture stock and the income-tax, to place £25,000 to reserve for renewals and contingencies, which was the amount they had come to the conclusion, after very mature consideration, was proper to be put on one side every year if they were to maintain the property in proper working order. The £30,000 put to the special reserve would have been practically sufficient to have paid 2½ per cent. dividend on the preference stock; but after careful consideration, they had come to the conclusion that the time was not ripe for it. They felt that it would be unfortunate to pay a dividend which might lead to an increase in the price of the stock, and then afterwards find they could not continue it. They wanted to see their position a little more assured before they commenced payments on the preference stock. They might, of course, have carried the amount forward, but they thought a better plan was to place it to a general reserve which would be available for paying dividends to the preference shareholders in future, or for the other purposes of the company. Their reserve for renewals and contingencies would now stand at £76,000, and the general reserve at £30,000. In conclusion, the chairman said that the company had placed its case in regard to the purchase of the Hammersmith lines by the London County Council before the arbitrator, but the matter was *sub judice*.

The HON. SYDNEY HOLLAND seconded the motion.

The CHAIRMAN, in reply to a number of observations from the meeting, said that no part of the expense of promoting Bills was included in the item of advertising. There was no desire on the part of the board to incur unnecessary expenditure in promoting Bills, but where concessions ran out they had to renew them. With regard to the £30,000 they had utilised £25,000 for reducing the temporary loans, and he thought that was better than purchasing trustee securities. He told them frankly that so long as he was chairman he would do what he thought was in the interests of the company.

It was ruled that an amendment that the report be not adopted was simply a direct negative, and accordingly the motion was put to the meeting and carried with three dissentients.

At a subsequent extraordinary meeting a resolution was passed approving of the company's Bill before Parliament.

### City and South London Railway Co.

THE meeting of this company was held on Tuesday at the offices, 71, Finsbury Pavement, E.C., the Right Hon. C. B. Stuart Wortley, K.C., M.P., in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 147), said that the receipts for the half-year were less by £508, and the expenses were more by £1,380. Had it not been for the strike in August, they would have taken some £620 more than they did, and come out with gross receipts increased instead of decreased. Taking into account the increased sum brought into account at the end of the first half of the year, the disappearance of bank interest and the increased amount required for preference dividends, owing to the issue last summer of the remaining balance of the 1903 stock, they showed a balance available for dividend on the ordinary stock less by £823 than a year ago. They then carried forward £1,788, so that on the face of the figures they could, without now carrying forward less than £965, pay on the ordinary stock at the same rate of 1½ per cent. as they did last January. Having regard, however, to the weighty considerations which appeared in the report, they had decided to recommend that they should take a conservative course, and exercise restraint in the distribution of profits, to the extent of paying at the rate of 5s. per cent. less than they did last year, and carrying forward £1,026 more. Capital expenditure in the half-year had amounted to £5,289. Of this sum, rather more than £4,000 arose from the falling due of their one-half share of the cost of the new high-level subway at the Bank, which was opened in May last, and had proved of great advantage to their customers and to the general public. They had spent £1,000 more on train working than a year ago; but, on the other hand, they had run 52,000 more train-miles, so that their costs of running per train-mile had fallen from 5'43d. to 5'38d. Similarly, the total expenses per train had gone down by '54d.; but, on the other hand, the receipts per train-mile had, unfortunately, fallen by 2'44d. Receipts per passenger were accordingly down from 1'62d. to 1'60d. But though they were down by '02d., against December, 1910, they were '01d. better than at June, 1911. Receipts per passenger were affected by the increase in through bookings with other companies. During the half-year they had tried to obviate the waste of power that resulted during the midday hours from running trains with a large proportion of empty seats. This object they sought to achieve by running four-coach trains instead of five-coach trains from July 14th to September 29th. Unfortu-

nately, this had to be done, if at all, throughout the day, for as yet they had not shunting space to enable them to detach superfluous coaches in the daytime without interrupting the continuity of the service. The four-coach trains, though they still gave more accommodation than was wanted in the midday hours, proved inadequate in capacity to take the bread-winners' traffic of the morning and evening hours. They had consequently had to revert gradually to the five-coach trains. The experiment had given yet further proof of their great need for added land and lines for shunting space, either below or above ground. This had not been the only improvement they had been seeking to effect. He told them at the meeting six months ago that they contemplated an experimental improvement to one of their locomotives. This would shortly have been carried out, and its result would soon have been ascertained. Should that result be such as they had been advised was possible, they would be in the way of greatly improving the speed of their trains. A very moderate increase of speed would very likely greatly help as against surface competitors so to turn in their favour the balance of advantage, that any expenditure they might resolve to incur, might be well justified by the increased traffic obtained. An important work chargeable to the renewal fund was the relaying of the original line between Borough and Stockwell Stations, by replacing old rails with new. This work was now practically completed, and therefore that portion of the system was not merely as good as new, but was actually new. The strike in August paralysed the system for nearly two days, and caused a loss in diminished receipts and exceptional expenses of about £700. Their men, anxious to remain at their posts, were prevented from doing so by the grossest intimidation, barefaced and unashamed, mainly on the part of outsiders, but for which they would have had no strike on their system at all. They would know before very long whether the London General Omnibus Co.'s shareholders had accepted the proposed arrangement with the Underground Electric Railway Co. of London, Ltd. If this arrangement went through it might be expected to result in a more systematised method of so working the underground and 'bus services as to afford the greatest possible facilities to the public. So that even without resorting to the raising of fares, which he had no reason to suppose was contemplated, it was to be expected that through a linking up of the several services, more traffic would be obtained in response to the improved facilities offered. The shareholders might be anxious to hear whether they were going to secure like advantages and improvements for them. It must be obvious that their position was in some respects not one of such freedom as was enjoyed by the District and London Electric Companies: and it would not be advantageous to emphasise in public discussion the special conditions in which their working was carried on. He mentioned the subject, however, that he might show that it did not escape their attention, and that he might take occasion to say that they would lose no chance of making any like improved arrangement with competitors, in any direction in which, and with any parties by whom, such opportunity might be presented.

MR. S. BARCLAY HEWARD seconded the motion.

MR. PORTER described the report as most pessimistic. He suggested that they might be able to make arrangements to work with the L.C.C. tramways in preference to motor-buses, as their line would form a very good link with the Council's tramways north and south. If some working arrangement could be come to he thought that it might lead to increased receipts.

The CHAIRMAN, in reply, said that there would be some increases in wages during the current year, but he could not say what they would amount to. As to coming to an arrangement with the L.C.C., if that body would initiate a proposal for an increase of fares they would not meet with any opposition from them.

The report was adopted.

**Smithfield Markets Electric Supply Co., Ltd.**—The net profit for 1911 was £1,383, as compared with £446. The directors recommend a dividend of 2 per cent. on the ordinary shares, carrying forward £629.

**Liverpool Overhead Railway Co.**—An extraordinary general meeting is to be held at Liverpool on February 13th, at which the following resolution will be submitted:—

That the company, in exercise of the power conferred by the Liverpool Overhead Railway Act, 1911, be authorised to raise the sum of £226,500 by the creation and issue of debenture stock for that amount, carrying interest at the rate of 4½ per cent. per annum, subject to the provisions of the said Act and of the agreement dated April 3rd, 1911, made between the Mersey Docks and Harbour Board of the one part, and the company of the other part, scheduled to the said Act, and accordingly that the directors of the company be empowered, subject to the provisions aforesaid, to issue such debenture stock in such amounts and manner, at such times and on such terms as they think fit.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Calgary Power Co., Ltd.—Further issue of £51,200 5 per cent. 80-year first mortgage bonds of £100 each (Nos. A 3,290 to 3,301).

Consolidated Gas, Electric Light and Power Co., of Baltimore.—\$7,100,000 common stock in shares of \$100 each; and \$6,860,000 6 per cent. preferred stock in shares of \$100 each.

Metropolitan District and London Electric Railways.—£1,533,700 Joint Power House 4 per cent. rent charge stock, in lieu of the scrip, together with £11,300 additional stock.

Mississippi River Power Co.—\$3,500,000 first mortgage 5 per cent. 40-year gold bonds (Nos. C 101 to 2,101 and C 2,193 to 2,205 of \$100 and D 167 to 5,369 and D 5,410 to 6,804 of \$500 each), in lieu of the scrip.

**Belgium.**—L'Air Electrique Société Electro-Mecanique Belge-Francaise (Ancienne Maison Taillander et Argentiini) is the title of a new company which has just been formed in Brussels, with a capital of £20,000.



**Urban Electric Supply Co., Ltd.**

THE directors have now issued, as was foreshadowed at an extraordinary general meeting and at the annual general meeting, a scheme for dealing with the company's capital account, so as to facilitate the payment of dividends on the preference shares. This scheme has been submitted to, and approved by, some of the largest holders of preference and ordinary shares, and to-day at Salisbury House, E.C., an extraordinary general meeting will be held, at which a series of resolutions dealing with the matter will be brought forward. The proposals are:—

1. To limit the cumulative preferential dividend to 2 per cent. for 1911, 3 per cent. for 1912 and 4 per cent. for 1913, the balance of the 5 per cent. dividend for each of these years being satisfied by the issue of funded dividend certificates redeemable by annual appropriations of £1,250 out of the profits of each year after payment of the full dividend on the preference shares, but before payment of any dividend on the ordinary shares for such year.

2. To reduce the paid-up capital by £160,000 by writing £2 per share off the 80,000 ordinary shares of £5 each.

3. To increase the borrowing powers.

4. To increase the share capital by the creation of £150,000 of new shares.

The following are the principal grounds on which the proposals are put forward:—

*As to the Preferential Dividend.*—The directors estimate that after meeting interest and sinking fund on the debenture stock and interest on advances, and after making an annual provision of not less than £10,000 for depreciation, the available surplus will be, for 1911, £6,000; for 1912, £9,000; and for 1913, £12,000. The issued preference share capital is £250,000, requiring a sum of £2,500 for each 1 per cent. dividend paid. Allowing a reasonable margin for contingencies and carry forward, the above amounts will, therefore, only admit of the payment of cash dividends on the preference shares of 2 per cent., 3 per cent., and 4 per cent. respectively for these three years, leaving arrears of dividend of £15,000 in all to be satisfied by the issue of funded dividend certificates.

*As to the Proposed Reduction of Capital.*—The reserve for depreciation as at December 31st, 1910, amounted to no more than £6,336 on a capital expenditure at that date of over £1,200,000, of which £135,177 was represented by wiring and motors on hire. The balance-sheet for 1910 also included items of £9,586 suspense account for loss on wiring, and motors on hire, and plant dismantled; and of £7,617 discount on debenture stock issued. The former item is likely to be substantially increased from year to year for a good many years, whilst the latter item will be increased by some £60,000 or £70,000 when the existing and further advances of Edmundsons are satisfied by the allotment to them of first and second debenture stocks in accordance with the existing agreements.

Under these circumstances, the directors believe that the majority of the shareholders will prefer to deal with the situation by reducing the ordinary share capital by £2 per share, and so creating a fund of £160,000, against which the above and other similar items can be written off as occasion requires, rather than to adopt the alternative course of indefinitely postponing the payment of dividends owing to the necessity of making heavy annual appropriations out of profits over and above those required to meet current depreciation.

*As to the Proposed Increase of Borrowing Powers.*—The company is at present dependent on its borrowing power to enable it not only to develop its business, but also to meet its actual statutory obligations, and since the existing borrowing powers of the directors are almost exhausted and will be considerably exceeded, when Edmundsons' further advance of £100,000 under the agreement of January last is added to their previous advance, and when the whole comes to be satisfied by the allotment of first and second debenture stocks at a discount, increased borrowing powers are imperative. It is, therefore, proposed to increase the borrowing powers, as set out in a notice issued to the shareholders.

*As to the Proposed Increase of Share Capital.*—Although there is no immediate necessity for an issue of additional share capital, yet, taking a comprehensive view of the future, and of the probable development of electrical undertakings, the directors feel that it is desirable to make provision for future capital requirements in excess of the provision afforded by the proposed increase of borrowing powers.

Without such increased facilities, the directors would hesitate, at the present juncture, to continue the payment of the preference dividend, inasmuch as they would feel bound to retain the profits to provide for capital outlays, whereas, with them they have no doubt of their ability to finance the company into the assured position which they are confident it will occupy a few years hence.

The proposals do not affect the existing first mortgage debenture stock of the company, except in so far as the proposed reduction of capital, *ipso facto*, reduces the amount of first mortgage debenture stock which the company is entitled to issue under the terms of the debenture trust deed, such debenture stock being limited to the amount of the share capital for the time being issued and paid up.

**Clontarf and Hill of Howth Tramroad Co., Ltd.**

—The directors announce a dividend at the rate of 3 per cent. per annum, and a bonus of 1s. per share out of the accumulated surplus profits. £279 is carried forward.

**Parsons Marine Steam Turbine Co., Ltd.**—The directors have declared an interim dividend of 5 per cent.

**Anglo-American Telegraph Co., Ltd.**

THE directors have issued the following statement to the stockholders:—

"In view of the agreement for leasing the company's cables and property to the Western Union Co., the balance-sheet and accounts to the end of 1911 are the last which will be made out on the basis of the company's operating its own cables, and it is desirable that they should, as far as possible, be final in this respect, so that the accounts for 1912 may be made out on the basis of the lease. The preparation of the balance-sheet and accounts will, in consequence, take longer than usual, but they will be submitted to the stockholders for approval as soon as practicable. This, however, will involve the holding of the ordinary meeting on a later date than usual. In the meantime the rent receivable under the agreement with the Western Union Co. allows payment of the following dividends to the close of the year 1911:—(1) A balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year ending December 31st, 1911; (2) a balance dividend of £1 10s. per cent. upon the preferred stock for the year ending December 31st, 1911; (3) a first and final dividend of £1 10s. per cent. upon the deferred stock for the year ending December 31st, 1911, all payable on February 10th next, less income-tax, to the stockholders registered on the books of the company on January 25th. The above dividends, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock, for the year 1911, being the full dividends for that year, which are provided for by the agreement with the Western Union Co. Under the foregoing circumstances, the directors have decided to pay the above dividends without waiting for the ordinary meeting to be held, as they believe this will meet the wishes of the stockholders. The register of transfers will remain closed till February 9th."

**Norwegian Hydro-Electrical Nitrate Co.**—The report of this company for the first half of the year 1911 states that the distributing basin, which is located near the Svalgfos power station, has been completed, as well as the Lienfos power station. The latter has been equipped with plant capable of dealing with 15,000 H.P. The buildings, with the foundations and the receiving chambers for the reserve power station at Svalgfos, have also been completed, and the Rjukan Works are now operating on a scale corresponding to one-third of the complete programme. The German group, which previously had a controlling interest in this and the other companies associated with it, has now been partly paid out, and has transferred all its patented and unpatented methods for the manufacture of nitrogenous products by direct combustion of the nitrogen from the air to the present company, which has been reconstructed. The assets of the company, according to the books, represent a total amount of about £3,417,000. The Rjukan Co., which is associated with this company, has decided to increase its capital by £666,667, making a total of £2,370,000, and it has also decided on the borrowing of £1,400,000. These sums are necessary in order to provide for the completion of the Rjukan Works after paying out the sum of £555,555 to the German group.

**Prospectuses.**—*Lytham Electric Light and Power Co., Ltd.*—This week the prospectus of this company has been issued. The capital of the company is £20,000, divided into 20,000 shares of £1 each, and 10,000 shares are offered to the public. The directors are Mr. J. B. Catlow, Fairhaven; Mr. W. E. Garlick, Ansdell; Mr. J. Marcus B. Rea, Lytham; and Mr. W. E. Mellor, Lytham. In 1907. Parliamentary powers were granted for the supply of electricity for all public and private purposes within the area of Lytham. The company has been formed for the purpose of taking over and working these powers. Mr. Tiddeman, consulting engineer, estimates that a sum of £10,000 will enable the company to carry out the necessary works.

*Vancouver Power Co., Ltd.*—The list was to close on Wednesday of applications for an issue of £800,000 4½ per cent. perpetual guarantee debenture stock of the above-named company, guaranteed unconditionally, both as to principal and interest, by the British Columbia Electric Railway Co., Ltd., the price of issue being 96 per cent. The Vancouver Power Co. has a share capital of \$7,000,000, the whole of which has been subscribed and paid up. It owns "a magnificent hydro-electric power plant, the water for which is taken from Lake Buntzen and Lake Coquitlam." The plant was originally installed in 1903, and owing to the increasing requirements of the business, the present capacity of 42,000 H.P. is being increased to approximately 82,500 H.P. To accomplish this, a higher dam at Lake Coquitlam is being constructed. The proceeds of the present issue are required mainly to meet the cost of the above works, to extend the electric generating plant and the distributing system, and for the general purposes of the power company. Our readers will find particulars of the developments in the report of the directors of the British Columbia Electric Railway Co., which appeared in our issue of December 1st, 1911.

**Dublin United Tramways Co. (1896), Ltd.**—The report states that the amount available for division is £68,076, out of which it is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares, together with a bonus of 1s. per share, less income-tax, on the ordinary shares; and that £14,000 be set aside towards the renewal of permanent way, £2,000 to accident insurance reserve, and £3,000 towards renewal of cars. The dividends, bonus, and sums set aside, will absorb £57,702 leaving £10,374 to be carried forward.



# Metropolitan Railway Co.

THE report of the directors shows that the total receipts for the half-year ending December 31st, 1911, amount to £396,980, and the expenses to £195,789, leaving a profit of £201,191. Compared with the corresponding half-year of 1910 the receipts show a decrease of £6,189, and the expenses a decrease of £1,358. The net revenue account, after providing for the interest upon the debenture stocks and other fixed charges, and placing £5,000 to the electrical renewal and depreciation fund, shows a balance of £164,677, which will permit of the payment of the dividends upon the preference stocks, and leave a balance of £59,373 available for dividend upon the ordinary stock. The directors recommend the proprietors to declare a dividend upon the ordinary stock for the past half-year at the rate of £1 15s. per cent. per annum, and to carry forward the balance of £9,218. The Surplus Lands Committee announce that the dividend on the surplus lands stock, for the past half-year will be at the rate of £2 15s. per cent. per annum. The passenger traffic for the past half-year has been adversely affected by the increased motor-omnibus and tram competition, and by the large falling-off in the number of visitors to the Exhibition at Shepherd's Bush as compared with the previous year. The season ticket traffic, on the other hand, shows a considerable increase, while the goods, mineral and parcels business continues to exhibit satisfactory development. A Bill has been promoted in the ensuing Session of Parliament for the construction of a branch line from Rickmansworth to Watford, for the widening of the existing railway between Finchley Road and Wembley Park, for the construction of a short line to connect the Hammersmith and City Railway with the Great Western Co.'s authorised Ealing and Shepherd's Bush Railway, and for other purposes. The object of the last-named line is to enable the company to run an electrical service between Ealing and the City. A Bill has been deposited by the Great Eastern Railway Co., which includes—in accordance with an agreement between the lessee companies—powers for the electrification of the East London Railway. These Bills were to be submitted for approval at the special meeting which followed the half-yearly meeting on Wednesday, January 31st. Any Bills deposited by other companies which are likely to be prejudicial to the interests of this company will receive the careful attention of the directors, and will be opposed where necessary. The replacement of the electrical plant originally installed at Neasden by improved machinery is progressing, whereby the cost of the production of current has already been considerably reduced and the capacity of the installation increased. Additional plant is also being provided at the Finchley Road sub-station to meet the requirements of the increasing train service. The work in progress at Baker Street for the enlargement of the station and for improving the connection between the extension line and the Inner Circle Railway are in a forward state. The reconstruction of the station at King's Cross is approaching completion, and the new public road bridge across the station will be ready for opening at an early date. The arcade over the railway at Liverpool Street Station is practically completed, and a number of the shops have already been let. The contract for the construction of subways at Moorgate Street to connect this company's station with those of the City and South London and Great Northern and City Railways has been let, and the contractors have commenced operations. Preliminary steps are being taken for commencing the work of electrifying the East London Railway by the lessee companies, and it is expected that this work will be completed during the present year, when the through running of trains over this company's lines will be resumed. The board are carefully considering the position of the company in relation to the proposals which have been recently announced in the Press for a union of interests between the various transit companies in the metropolis. It is proposed to increase the number of directors from seven to eight. The board recommend the proprietors to elect Mr. Paul Speak, of Mountain Mills, Bradford, to the additional seat created.

Year.	Number of passengers.	Gross receipts for passengers, goods, minerals and tolls.
1908 .. .. .	99,846,735	£680,357
1909 .. .. .	99,961,997	696,881
1910 .. .. .	102,849,458	718,089
1911 .. .. .	101,620,653	720,745

The meeting was held on Wednesday. Our report of the proceedings will appear next week.

# Underground Electric Railways Co. of London, Ltd.

SIR EDWARD SPEYER presided on Friday last at the offices, Broadway, Westminster, over an extraordinary general meeting of the shareholders of the above company held to consider and approve of a resolution altering the articles so as to enable the company to carry on business as proprietors and manufacturers of and dealers in omnibuses.

SIR ALGERNON WEST seconded the motion, and it was carried without discussion.

The CHAIRMAN said that the combined earnings of the London General Omnibus Co. and the Underground Co. based as regarded the former on the net revenue of the year ended September 30th, 1911, after allowing £195,000 for depreciation, and as regarded the latter on the amount earned in the half-year ended December 31st, showed 6 per cent. per annum earned on, say, £1,300,000 income debenture stock, and about 4 per cent. free of tax on £6,188,000 income bonds, which was tantamount to nearly 11 per cent. on the London General Omnibus stock. There was little reason to doubt according to indications existing that both companies would show increased earnings in the current year.

# Metropolitan District Railway Co.

THE directors' report for the half-year ending December 31st, 1911, shows that the expenditure on capital account during the half-year was £51,037. The gross receipts on revenue account amounted to £315,606 being an increase of £14,800 on the receipts for the corresponding half of last year. The working expenses have amounted to £150,853, being an increase of £260. After providing for interest and other charges and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £85,492, out of which the directors recommend that the following dividends be declared and be payable on February 7th, viz.:—At the rate of £4 per cent. per annum on the 4 per cent. guaranteed stock, at the rate of £4 10s. per cent. per annum on the 4½ per cent. first preference stock, at the rate of £2 per cent. per annum on the 5 per cent. second preference stock. The following table gives a summary of comparative figures for the second halves of the years 1911 and 1910:—

	Half-year Dec., 1911.	Half-year Dec., 1910.	Inc. or dec.	Or per cent.
Gross revenue .. .. .	£315,606	£290,806	£24,800	4.92
Working expenditure .. .. .	£150,853	£150,593	£260	0.17
Passengers, including workmen and season ticket holders' journeys ..	39,051,528	36,552,304	2,499,224	6.84
Passengers at workmen's fares ..	7,110,816	6,984,060	126,756	1.81
Passenger receipts .. .. .	£293,481	£280,051	£13,430	4.80
Average receipt per passenger ..	1.80d.	1.84d.	—0.04d.	—2.17d.
Train-mileage on District Railway ..	1,816,997	1,723,881	93,116	5.40
Car-mileage on District Railway ..	7,389,525	6,801,374	498,151	7.22

Notwithstanding the weather conditions during the summer months and the dislocation of the working of the railway caused by the strike in August last, the traffic continues to show satisfactory and substantial increase. The widening of the London and South-Western and the company's railways between Studland Road and Acton Lane Junction, whereby the company has the exclusive use of a separate pair of rails between these points, was practically completed and opened for traffic on December 3rd. This improvement will enable the company to work a more frequent and faster service of trains to the rapidly growing districts served by the Western extensions. Of the 65 new carriages referred to in the last report, 20 more have been placed in service during the last half-year, making a total of 51 now in use. In the report for December, 1908, it was stated that the company had sold 74 carriages to the London, Tilbury and Southend Railway Co. for the sum of £130,000. At that time it was not estimated that the traffic would require any increase in rolling stock for some time, but, fortunately, the traffic has increased much more rapidly than was anticipated, and the company has found it necessary to purchase additional carriages. Since 1908 the company has expended the £130,000 referred to for various improvements to the undertaking, as authorised by the Act of 1908, and has withheld issuing prior lien debenture stock to that amount, and it is now proposed to issue this prior lien stock to pay for the new rolling stock and for other capital purposes. The Lot's Road Power House undertaking, to which reference has been made in previous reports, became vested in the Lot's Road Power House Joint Committee from January 1st, 1912, and was thereupon leased by the Joint Committee to the Metropolitan District and London Electric Railway Companies. The property has, therefore, become part of the undertakings of these companies.

The following table shows the passengers carried, inclusive of the estimated journeys made by season ticket holders, and receipts for passenger traffic:—

Half-year ended—	PASSENGERS.				RECEIPTS.			
	1st class.	3rd class.	Season tickets.	Est. Total.	1st class.	3rd class.	Season tickets.	Total.
June, 1910	1,165,026	30,340,066	4,675,216	36,180,308	£17,250	£226,395	£36,838	£280,483
Dec., 1910	1,044,220	30,949,110	4,558,944	36,552,304	£15,381	£228,763	£35,902	£280,051
June, 1911	1,234,404	33,646,420	5,658,640	40,539,464	£17,504	£244,133	£44,786	£306,423
Dec., 1911	1,070,322	32,545,126	5,436,030	39,051,528	£14,764	£236,321	£42,395	£293,481

# STOCKS AND SHARES

Tuesday Evening.

THE record of the past week almost centres itself round two or three specialities in which there has been fast and furious dealing. Amongst these, Marconi's, West India and Panama, and London General Omnibus stock stand out as the most prominent examples. In the other departments, business, as usual, is spasmodic, the Latin-Canadian Light and Power bonds getting certainly their full share of the trade that there is going on.

Home Railway stocks recovered substantially on Monday, upon its becoming known that the outlook as regards the coal situation had brightened by the hope that the negotiations between masters and men in the coal trade would result, after all, in peace. To some extent, the market was oversold, and this of course, helped the rally. Of the Undergrounds, Central London Ordinary and Deferred were the principal gainers, rises of 1 and 2 respectively being established. Metropolitan at first eased off ½, the dividend declaration still causing some little disappointment, although, as a matter of fact, it was up to the market's best expectations, and a modicum of buying sufficed to bring about a smart recovery. Districts have been moving erratically, on balance showing a rise of 1. Underground Electric shares have taken their cue from the movements in London General Omnibus stock, and small declines are shown both in the shares and the Income bonds—the latter at one time fell to 77, but have since regained part of the fall. It is assumed in the Stock Exchange that the amalgamation between the 'Bus Company and the Tubes will go through, but the



general impression is that it will be very much in favour of the latter. Great Northern and City Preferred have fallen back  $\frac{1}{2}$  after their rise, and can now be picked up at about 28s. The report shows a slight improvement this time. Metropolitan Tramways Ordinary are  $\frac{1}{8}$  down, and the Preference lost  $\frac{3}{4}$ , while the 5 per cent. Debenture eased off to 101 $\frac{1}{2}$ , the declines being associated with the issue of the new Tramways (M.E.T.) Omnibus Debenture stock, of which the company guarantees the interest and principal. London United Tramways Preference recovered their  $\frac{3}{4}$  fall of last week, the report being read with a good deal of satisfaction; and it is pleasant to note that it makes a favourable showing as compared with the performances in recent years, although the company is some way from a strong position yet. Hastings Trams Preference are harder, but the Debenture stock fell 2.

English Electricity Supply shares are with a strong tendency. Rises of  $\frac{1}{2}$  or  $\frac{3}{4}$  have been secured by Charing Cross, County, Metropolitan and Westminster Ordinary. St. James's Preference, London Preference and Edmundsons' Preference rose  $\frac{1}{2}$  each. Urban issues are unchanged, in spite of trenchant criticism directed against the proposed scheme of reconstruction. The rise in Westminster was certainly overdue, for the shares pay handsomely at the present price. The St. James's and Pall Mall Company has declared its regular final dividend of 5s. per share, making 10 per cent. for the year, and a good deal of interest centres in what will be declared by the County of London and the City of London Companies in respect of the second half of their twelvemonth.

Marconis have enjoyed another meteoric rise, the Ordinary gaining no less than 10s., and the Preference 8s. 9d. The latest story is that the company has recently secured important and remunerative contracts for foreign work, and the shares are talked even to double their present quotation. There was much less difficulty on the Contango Day in carrying over the shares than on previous occasions, but it is still obvious enough that a heavy bull account exists in them. The new shares have, of course, participated in the rise of the Ordinary, but Canadian Marconis remain rather sticky about 19s. 3d.

The sister excitement is in West India and Panama shares. Reports got into circulation to the effect that the company had been bid £6 per share by an American syndicate desirous of acquiring the property, and the denial of this merely served to fan bullish enthusiasm. The shares, too, are being recommended by powerful interests as cheap at the present price, but there are many cautious people who fail to see the attraction after the huge rise that has taken place just lately.

West Coast of America, following up their rise of  $\frac{3}{8}$  last week, have put on another 12s. 6d.—here again, the coming opening of the Panama Canal being the cause for extensive buying upon a freely circulated tip. The company, of course, pays dividends on its shares, which are of the value of £2 10s. each, and as there is nothing in front of these except £15,000 4 per cent. Debentures—the interest on which is guaranteed by the Brazilian Submarine Telegraph Company, now the Western Telegraph Company—there is fair scope for the gamble here. Upon the dividend declaration of 30s. on Anglo-American Telegraph Deferred, the stock moved up to 27, this bringing in profit takers, with the net result that the price shows  $\frac{1}{2}$  rise on the week. American Telephone and Telegraph capital stock fell 2 upon the threatened suit against the company for its dissolution on the ground that it is a combination in restraint of trade—the same formula as is charged against most of the other Trusts which are being attacked in the United States. Mackay Preferred are recovering a little from their recent flatness. Cuba Telegraphs are harder, and Direct Spanish Preference  $\frac{1}{2}$  easier. The Eastern group is steady, without special change.

National Telephone descriptions continue to recede, and speculation in them has to a great extent died away. The Deferred came back to 122, while the 6 per cent. Preferred eased off to a shade above par, this movement causing a sympathetic dwindling of the Third Preference shares. The company's two Debenture stocks have been removed from the Stock Exchange Official List this week, their existence being practically at an end.

Amongst Manufacturing shares, General Electric Preference hardened up again, and Telegraph Constructions are 10s. higher. The feature, however, is a rise of 10s. in Willans & Robinson Preference upon a small inquiry. Holders are not disposed to sell at the present flat quotation, and therefore it does not take much demand to put the price up. Electric Construction Ordinary and Preference are better, and both issues of Babcock & Wilcox shares have improved, the Ordinary regaining its slight decline of last week. Edison & Swan 4 per cent. Debenture moved on to a 5 per cent. basis, and British Westinghouse 6 per cent. Prior Lien stock rose a point to 102 middle.

British Columbia Electric Railway descriptions have given way a little on the new issue of Debenture stock, the advance notice of which appeared here last week. The Deferred stock fell 1, but the Preferred is a point to the good. Mexico Trams are a good market, and the Mexican Light group is steady. Shawinigan Water and Toronto Debenture registered small gains, while Vera Cruz Debenture rose  $\frac{1}{2}$ . Montreal Light, Heat and Power has at last reached 200 middle, showing a rise of 2 on the week. Rio Trams, after being dull, recovered partially to 116 $\frac{1}{2}$ . United Electric Trams, of Monte Video, have again eased off. On the other hand, Para Electric Railways Ordinary put on  $\frac{3}{4}$  after their rise of last week, though the Preference are the turn easier. Several new issues are reported to be on the way in this department, and February will probably see at least half-a-dozen make their appearance.

Interest in the Rubber share market has tended to subside a little, Tuesday's sales at Mincing Lane producing rather lower prices than had been expected by the more optimistic bulls, but the authorities say that the market is firm enough in its undercurrent.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 31st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	" Nitric .. .. per cwt.	22/-	..
a	" Oxalic .. .. per lb.	2 $\frac{3}{4}$ d.	..
a	" Sulphuric .. .. per cwt.	5/6	..
a	Ammoniac Sal .. .. per ton	42/-	..
a	Ammonia, Muriate (large crystal) .. ..	£29 10	..
a	Bleaching powder .. ..	£5 10	..
a	Bisulphide of Carbon .. ..	£18	..
a	Borax .. ..	£16 10	..
a	Ferro-Silicon (50 %) (basis 45 %) .. ..	£12 12 6	..
a	Copper Sulphate .. ..	£23 10	..
a	Lead, Nitrate .. ..	£25	10/- dec.
a	" White Sugar .. ..	£22 15	..
a	" Peroxide .. ..	£32	..
e	Methylated Spirit .. .. per gal.	2/6	..
a	Potassium, Bichromate, in casks .. ..	3d.	..
a	Potash, Caustic (80/82 %) .. ..	£20 5	..
a	" Chlorate .. .. per lb.	3d.	..
a	" Perchlorate .. ..	4 $\frac{1}{2}$ d.	..
a	Potassium, Cyanide (98/100 %) .. ..	7 $\frac{1}{2}$ d.	..
a	Shellac .. .. per cwt.	63/-	..
a	Sulphate of Magnesia .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. ..	£6 10	..
a	" Recovered .. ..	£5 10	..
a	" Lump .. ..	£5 5	..
a	Soda, Caustic (white 70/72 %) .. ..	£10 5	..
a	" Chlorate .. .. per lb.	3 $\frac{3}{4}$ d.	..
a	" Crystals .. .. per ton	£3 5	..
a	Sodium Bichromate, casks .. ..	3d.	..
a	" Cyanide { (128/130 %) } .. ..	7d.	..
METALS, &c.			
b	Aluminium Ingots, in ton lots .. ..	£65	..
b	" Wire, in ton lots .. ..	£102	..
b	" Sheet, in ton lots .. ..	£120	..
p	Babbitt's metal ingots .. ..	£38 10 £145	..
c	Brass (rolled metal 2" to 12" basis) .. ..	7 $\frac{3}{4}$ d.	$\frac{1}{2}$ d. dec.
c	" Tube (brazed) .. ..	10 $\frac{1}{2}$ d.	..
c	" (solid drawn) .. ..	8 $\frac{1}{2}$ d.	..
c	" Wire, basis .. ..	7 $\frac{3}{4}$ d.	$\frac{1}{2}$ d. dec.
c	Copper Tubes (brazed) .. ..	10 $\frac{3}{4}$ d.	..
c	" (solid drawn) .. ..	10d.	..
g	" Bars (best selected) .. .. per ton	£77	£3 dec.
g	" Sheet .. ..	£77	£3 dec.
g	" Rod .. ..	£77	£3 dec.
d	" (Electrolytic) Bars .. ..	£65 10	£1 dec.
d	" Sheets .. ..	£82 10	£1 dec.
d	" Rods .. ..	£70 10	£1 dec.
d	" H.C. Wire .. ..	8 $\frac{1}{2}$ d.	..
f	Ebonite Rod .. ..	5/3	..
f	" Sheet .. ..	4/9	..
n	German Silver Wire .. ..	1/11	..
h	Gutta-percha, fine .. ..	..	..
h	India-rubber, Para fine .. ..	4/7	..
i	Iron Pig (Cleveland warrants) .. .. per ton	49/2	8 $\frac{1}{2}$ d. dec.
i	" Wire, galv. No. 8, P.O. qual. .. ..	£14	..
g	Lead, English Pig .. ..	£15 15 to £15 17 6	10/- inc.
m	Manganin Wire No. 28 .. .. per lb.	6/6	..
g	Mercury .. .. per bot.	£8 5	5/- inc.
e	Mica (in original cases) small .. ..	6d. to 2s.	..
e	" " " medium .. ..	2/6 to 4/-	..
e	" " " large .. ..	4/6 to 8/6	..
p	Phosphor Bronze, plain castings .. ..	11d.	..
p	" " rolled bars & rods .. ..	1/0 $\frac{1}{2}$	..
p	" " rolled strip & sheet .. ..	1/1	..
o	Platinum .. .. per oz.	185/-	..
d	Silicium Bronze Wire .. .. per lb.	9 $\frac{1}{2}$ d.	..
r	Steel Magnet, in bars .. .. per ton	£55	..
g	Tin, Block (English) .. ..	£196 to £198 nom.	£3 inc.
n	" Wire, Nos. 1 to 16 .. .. per lb.	2/4	..
p	White Anti-friction Metals .. .. per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.) .. ..	£30 7 6	15/- dec.

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Shakspeare.	r W. F. Dennis & Co.
h Edward Till & Co.	

**Great Northern and City Railway Co.**—The directors' report for the half-year ended Dec. 31st, 1911, states that the total revenue receipts for the six months amounted to £40,713, and the cost of working to £20,968, being at the rate of 51·50 per cent. The net revenue amounted to £19,744, which is insufficient to meet the company's fixed charges for the half-year. A sum of £3,184, provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months under review, including season ticket-holders, was 6,119,506, as against 5,855,829 for the corresponding period last year. The number of local season tickets issued during the half-year was 2,327, as against 2,342 for the half-year ended December 31st, 1910. The number of three-route season ticket-holders during the past half-year was 3,013, as against 2,558 for the corresponding half-year. The meeting was held on Wednesday.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 30th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations Jan. 30th.	Rise or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	7½—8½	..	6 5 9	Kensington & Knightsbridge, Ord	5	9 8½	6½—7½	..	6 4 2
Do. 4½ % Pref. ....	10	4½ 4½	8½—9½	..	4 12 4	Do. 4 % Deb. ....	Stock	4 4	91—96	..	4 3 4
Do. Second 5 % Pref. ....	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	78—82 xd	..	5 9 9
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	109—102	..	4 8 8	London Electric, Ord. ....	3	2	12—1½	..	3 12 0
Brompton & Kensington, Ord. ....	5	10 9½	8—8½	..	5 17 8	Do. 6 % Pref. ....	5	6 6	42—5	+ ½	6 0 0
Do. 7 % Cum. Pref. ....	5	7 7	7½—8	..	4 7 6	Do. 4 % First Mort. Deb. ..	Stock	4 4	85—91	..	4 4 0
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	98—101	..	3 19 8	Metropolitan ..	5	5 4½	8½—4½	+ ½	5 17 8
Charing Cross, West End & City	5	5 5½	8½—4½	+ ½	6 1 3	Do. 4½ % Cum. Pref. ....	5	4½ 4½	4—4½	..	4 17 4
Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½—4½	..	4 14 9	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	99—104	..	4 3 7
Do. "City Undertaking" }	5	4½ 4½	8½—4½	..	5 9 1	Do. 8½ % Mort. Deb. ....	Stock	8½ 8½	84—87	..	4 0 6
Do. 4½ % Cum. Pref. }	100	4 4	93—96	..	4 8 4	Midland Electric Corporation }	100	4½ 4½	95—97	..	4 12 9
Do. Do. 4 % Deb. ....	5	5 4½	4—4½	..	5 11 1	4½ % First Mort. Deb. }	5	4 4½	8½—4	..	5 0 0
Chelsea, Ord. ....	Stock	4½ 4½	98—101	..	4 9 1	Newcastle-on-Tyne ..	5	4 4½	4—4½	..	5 11 1
Do. 4½ % Deb. ....	10	7 6½	18½—19½	..	5 2 9	Do. 5 % Pref., Non-Cum. ..	5	5 5	4—4½	..	5 11 1
City of London, Ord. ....	10	6 6	12—13	..	4 12 4	North Metropolitan Power Sup- }	100	5 5	99—102	..	4 15 0
Do. 6 % Cum. Pref. ....	Stock	5 5	117—121	..	4 2 8	ply, 5 % Mortgages (Red.) }	10	..	9½—10½	..	..
Do. 5 % Deb. ....	100	4½ 4½	100—103	..	4 7 5	Notting Hill, 6 % Non-Cum. }	5	7½ 6½	6½—6½	..	5 9 5
Do. 4½ % Second Deb. ....	Stock	5 5	87—89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10 10½	8—8½	..	5 17 8
County of Durham, 5 % First }	10	5 4½	9½—9½	+ ½	5 3 11	Do. 7 % Pref. ....	5	7 7	6½—7½	+ ½	4 16 7
Mort. Deb. }	10	6 6	11—11½	..	5 4 4	Do. 8½ % Deb. ....	100	3½ 8½	85—87	..	4 0 6
County of London, Ord. ....	Stock	4½ 4½	107—109	..	4 2 7	Smithfield Markets, Ord. ....	5	Nil	12—1½	..	Nil
Do. 6 % Pref. ....	Stock	4½ 4½	100—103	..	4 7 5	South London, Ord. ....	4	5	2½—3½	..	6 3 1
Do. 4½ % Deb. ....	5	Nil	..	..	Nil	Do. 5 % First Mort. Deb. ..	100	5 5	98—101	..	4 19 0
Do. 4½ % Second Deb. ....	5	Nil	..	..	Nil	South Metropolitan, 7 % Pref. ....	1	7 7	1—1½	..	6 4 5
Edmundson's, Ord. ....	100	4½ 4½	83—86	..	5 4 8	Do. 4½ % First Deb. Stock ..	100	4½ 4½	96—99	..	4 10 11
Do. 6 % Cum. Pref. ....	5	6 6½	4½—5	..	6 0 0	Urban, Ord. ....	5	5	1—1½	..	..
Do. 4½ % First Mort. Deb. ....	5	5 5	4½—5½	..	4 17 7	Do. 5 % Cum. Pref. ....	5	5	2—2½	..	..
Folkestone ..	100	4½ 4½	95—98	..	4 11 10	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	88—90	..	5 0 0
Do. 5 % Cum. Pref. ....	5	9 8½	6½—7½	..	6 4 2	Westminster, Ord. ....	5	10 10½	7½—8½	+ ½	5 19 5
Do. 4½ % First Deb. ....	5	..	..	..	..	Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½—5½	..	4 6 9
Hove ..	5	..	..	..	..						

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	6	6 6	5½—5½	..	5 4 4	Monterey Rly. Light & Power, }	100	5 5	89½—91½ xd	+ ½	5 9 3
Calcutta, Ord. ....	5	8½ 7½	6½—6½	..	6 6 0	5 % 1st Mort. Deb. }	\$100	7 8	197—202	+2	3 9 4
Do. 5 % Pref. ....	5	5 5	4½—5½	— ½	4 17 7	Montreal, Lt., H. and Power ..	\$500	5 ..	30—41	..	12 3 10
Calgary Power, 1st Mort. Bds. ....	100	5 5	93½—95½	..	5 4 9	Northern, Lt., Power and Coal, }	Stock	10 ..	250—260	..	3 16 11
Canadian Gen. El. Com. ....	\$100	7 7½	116—120	..	5 16 8	5 % 1st Mort. Bonds }	Do.	6 6	107—113	..	5 7 2
Do. 7 % Pref. ....	\$100	7 7	117—121	..	5 15 8	Do. 5 % Deb. Stock ..	Do.	5 5	100½—102½	..	4 17 7
Cordoba Lt., Power and T., Ord. ....	1	8 3½	7—1	..	3 0 0	Roy. Elec. Co., Montreal, 4½ % }	100	4½ 4½	100—102	+1	4 8 3
Do. 5 % Deb. ....	100	5 ..	94—97	..	5 3 1	1st Mort. Deb. }	\$100	4 5½	129—131 xd	+1	5 1 1
Elec. Lt. and P. of Cochabamba, }	100	6 6	91—93	..	6 9 0	Do. 5 % Con. 1st Mort. Bonds }	\$500	5 5	106—108	+ ½	4 12 7
6 % Bonds }	100	5 5	83—86	..	5 16 3	Do. 4½ % Per. Deb. ....	Stock	4½ 4½	103—105	..	4 5 9
Elec. Supply Victoria, 5 % 1st }	100	5 5	92—94	..	5 6 5	Toronto Power, 4½ % Deb. ....	Do.	4½ 4½	99½—101½	+ ½	4 8 8
Mort. Deb. }	\$500	5 5	92—94	..	5 6 5	Vera Cruz Lt., P. and T., 5 % }	100	5 5	92½—94½	+1½	5 5 10
Elec. Dev. Ontario, 5 % 1st }	10/-	Nil ..	..	..	Nil	1st Mort. Deb. }	1	Nil	11½d. 1½—1½	..	..
Mort. Bonds }	1	6 6	..	..	7 7 8	Victoria Falls Power, Pref. ....	100	6 6	106½—108½	..	5 10 7
Kalgoorlie Elec. P. and L., Ord. ....	\$500	5 5	102—104	..	4 16 2	West Kootenay Power and Lt., }	100	6 6	..	..	..
Do. 6 % Pref. ....	5	..	2½—9½	..	4 17 1	1st Mort. 6 % Gold }	..	..	..	..	..
Kaministiquia Power, 5 % G. Bs. ....	5	..	86½—88½	— ½	5 13 0						
Madras, Ord. ....	100	5 5	101—103	..	4 9 5						
Melbourne, 5 % 1st Mort. Deb. ....	\$100	4 4½	67½—69½	..	6 7 10						
Mexican El. Lt., 5 % 1st M. Bds. ....	\$100	7 7	107½—109½	..	5 0 0						
Mexican Lt. & Power, Common ..	\$100	5 5	98—100	..	..						
Do. 7 % Cum. Pref. ....	..	..	..	..	..						
Do. 5 % 1st Mort. Gold Bds. ....	..	..	..	..	..						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½ 7—7½	..	..	Monte Video Telephone, Ord. ....	1	6 6	1½—1½	..	12 11
Do. 5 % Deb. Red. ....	Stock	5 6	97—99	..	5 1 0	Do. 5 % Pref. ....	1	5 5	1½—1½	..	5 6 8
American Telep. & Teleg., Cap. ....	\$100	8 8½	142—144	—2	5 11 1	National Telephone, Pref. ....	Stock	6 6½	99—103 xd	—1	5 17 8
Do. Collat. Trust ..	\$1000	4 4	93—95	..	4 4 3	Do. Def. ....	Do.	6 6½	121—123 xd	— ½	4 17 7
Anglo-American Telegraph ..	Stock	3½ 3½	67—69	..	5 8 8	Do. 6 % Cum. 1st Pref. ....	10	6 6	94—10 xd	..	6 0 0
Do. 6 % Pref. ....	Do.	6 6	111—112	..	5 7 2	Do. 6 % Cum. 2nd Pref. ....	10	6 6	94—10 xd	..	6 0 0
Do. Def. ....	Do.	80/-	26½—27½	+ ½	5 10 7	Do. 5 % Non-cum. 3rd Pref. ....	5	5 5	5½—5½ xd	— ½	4 9 11
Anglo-Portuguese Tel., 5 % }	100	5 5	101½—103½	..	4 16 7	New York Telep., 4½ % Gen. Bnds. ....	100	4½ 4½	102½—103½	..	4 7 0
Mort. Deb. }	5	7 ..	7½—7½ xd	+ ½	4 13 4	Oriental Telep. and Elec. ....	1	8 ..	1½—1½	..	4 18 6
Chili Telephone ..	Stock	4 4	86—88	..	4 10 11	Do. 6 % Cum. Pref. ....	1	6 6	1½—1½	..	4 18 8
Commercial Cable, Stlg. 4 % Deb. ....	10	6 6½	10½—11½	+ ½	5 6 8	Do. 4 % Red. Deb. ....	Stock	4 4	8½—8½	..	4 9 11
Cuba Telegraph ..	10	10 10	17—18	..	5 11 1	Pacific and European Tel., 4 % }	Do.	4 4	98½—100½	..	3 19 7
Do. 10 % Pref. ....	10	10 10	17—18	..	5 11 1	Guar. Debs. }	8	5 5½	8½—9½	..	4 6 6
Direct Spanish Telegraph, Ord. ....	5	4 4½	8½—9½	..	5 6 8	Reuter's ..	Cert.	6 6	130—133	..	4 10 3
Do. 10 % Cum. Pref. ....	5	10 10	8—8½	— ½	5 17 8	Submarine Cables Trust ..	Stock	4½ 4½	98—100	..	4 10 0
Do. 4½ % Debs. ....	50	4½ 4½	98½—100½	..	4 9 7	Telephone Co. of Egypt, 4½ % }	100	4½ 4½	98—100	..	4 10 0
Direct United States Cable ..	10	4½ ..	7½—9½	..	5 9 1	Deb. Red. }	5	8 8	7½—7½	..	5 4 11
Direct W. India Cable, 4½ % }	100	4½ 4½	98½—100½	..	4 9 7	Do. 5 % Cum. Pref. ....	5	5 5	5½—5½	..	4 8 11
Reg. Deb. }	Stock	7 5½	186—137 xd	..	5 0 9	West Coast of America ..	2½	2½ 2½	1½—2½	+ ½	2 18 10
Eastern Telegraph, Ord. Stock	Do.	3½ 3½	83—85 xd	..	4 3 4	Do. 4 % Debs., 1 to 1,500 }	100	4 4	98½—100½	..	3 19 7
Do. 8½ % Pref. Stock. ....	Do.	4 4	100—102	..	3 18 5	guar. by Braz. Sub. Tel. }	10	1½ 1½	5½—5½	+ ½	..
Do. 4 % Mort. Deb. ....	Do.	3½ 3½	83—83	..	5 1 10	Do. 6 % Cum. 1st Pref. ....	10	6 6	10½—11	..	5 9 1
Eastern Extension ..	10	7 5½	18½—13½ xd	..	3 18 1	Do. 6 % Cum. 2nd Pref. ....	10	6 6	10—10½	..	5 14 4
Do. 4 % Deb. ....	Stock	4 4	100½—102½	..	3 19 3	Do. 5 % Debs. ....	100	5 5	103—104	..	4 16 3
East and S. Africa Tel. 4 % }	25	4 4	99—101	..	5 6 8	Western Telegraph, Ltd. ....	10	7 6½	13½—14	..	5 0 0
Mt. Db. Mauritius Sub. }	10	5½ 6½	10½—11½	..	4 9 0	Do. 4 % Deb. ....	Stock	4 4	99—101	..	3 19 3
Globe Telegraph and Trust ..	10	6 6	13—13½	..	5 9 1	Western Union Tel., 4 % Bnds. A }	\$1000	4 4	106—109	..	8 18 5
Do. 6 % Pref. ....	10	18 5½	63½—68½	..	6 5 0	Do. 4½ % Fdg. Bonds ..	\$1000	4½ 4½	101—104	..	4 6 7
Great Northern Telegraph ..	25	18 5½	63½—68½	..	5 8 1						
Indo-European Telegraph ..	\$100	5 5½	78—80	..	..						
Mackay Companies Common ..	\$100	4 4	71—74	+2	..						
Do. 4 % Cum. Pref. ....	1	5 ..	4½—4½	+ ½	..						
Marconi's Wireless Telegraph	1	16 ..	3½—8½	+ ½	..						
Do. 7 % Cum. Partic. Pref. ....	1	..	..	..	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 30th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 30th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil Nil	1 — 1	..	Nil	Metropolitan Railway Consol. ..	100	12 2+	46 1/2 — 47 1/2	+ 3/4	2 18 2
Do. 5 % Pref. ..	1	5 5	7 — 7 1/2	..	7 5 6	Do. Surplus Lands ..	100	2 1/2	67 — 69	+ 1	3 19 9
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	80 — 85	..	5 5 11	Do. 8 1/2 % Deb. ..	100	8 1/2	90 — 92 xd	..	3 16 1
Brit. Elec. Trac., 6 % Pref. ..	100	.. ..	14 — 18	..	..	Do. 8 1/2 % Pref. ..	100	8 1/2	86 — 88	..	3 19 7
Do. Do. Deferred ..	100	.. ..	5 — 8	..	..	Do. 8 1/2 % Con. Pref. ..	100	8 1/2	85 — 87	..	4 0 6
Do. Do. 6 % Cum. Pr'f. ..	100	.. ..	84 — 87	..	..	Metropolitan District Ord. ..	100	Nil	34 1/2 — 35	+ 1	Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100	.. ..	37 — 41	..	..	Do. 6 % Deb. ..	100	6	14 1/2 — 14 1/2	..	4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5 5	95 — 98	..	5 2 0	Do. 4 % Deb. ..	100	4	95 — 97	..	4 2 6
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2 4 1/2	79 — 83	..	5 8 5	Do. 4 % Prior Lien ..	100	4	100 — 102	..	8 18 5
Central London Railway, Ord.	100	3 3+	68 — 70	+ 1	4 5 9	Do. 4 1/2 % First Pref. ..	100	8 1/2	91 — 93	..	8 10 0
Do. Pref. ..	100	4 4	84 — 86	..	4 13 0	Do. 3 1/2 % Gtd. ..	100	3 1/2	76 — 78	..	4 9 9
Do. Def. ..	100	2 ..	58 — 60	+ 2	8 6 8	Metropolitan Elec. Trams, Ord.	1	5 1/2	37 — 37 1/2	— 1/8	5 13 6
Do. 4 % Deb. ..	100	4 4	100 — 102 xd	..	8 18 5	Do. Def. ..	1	Nil	37 1/2 — 37 1/2	..	Nil
City & South London, Ord.	100	1 1/2 1 1/2	28 1/2 — 29 1/2	..	5 1 8	Do. 5 % Pref. ..	1	5	37 1/2 — 37 1/2	— 3/4	5 6 8
Do. 5 % Pref., 1891 ..	100	5 5	108 — 110	..	4 11 0	Do. 4 1/2 % Deb. ..	100	4 1/2	99 — 101	..	4 9 1
Do. Do. 1896 ..	100	5 5	104 — 106	..	4 14 4	Do. 5 % Deb. ..	100	5	100 1/2 — 102 1/2	— 1/2	4 17 7
Do. Do. 1901 ..	100	5 5	103 — 105	..	4 15 3	Potteries, Ord. ..	1	2	78 — 78 1/2	..	6 19 3
Do. Do. 1903 ..	100	5 5	103 — 105	..	4 15 3	Do. 5 % Pref. ..	1	5	78 — 78 1/2	..	6 17 2
Do. 4 % Deb. ..	100	4 4	101 — 103	..	3 17 8	Do. 4 1/2 % Deb. ..	100	4 1/2	90 — 93	..	4 16 9
Dublin United Trams, 6 % Pref.	10	6 6	11 — 12	..	5 0 0	South Metro. Trams, 6 % Pref.	1	6	75 — 75 1/2	..	5 6 8
Great Northern & City, Pr'f. Ord	10	Nil ..	1 1/2 — 1 1/2	+ 1/8	Nil	Do. 4 % Deb. ..	100	4	70 — 75	..	5 6 8
Hastings Trams, 6 % Pref. ..	5	Nil 3+	1 — 1 1/2	+ 1/8	..	Underground Elec. Railways	10	..	2 1/2 — 2 1/2	— 1/8	..
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	73 — 78	— 2 1/8	5 15 5	Do. 4 1/2 % Bonds ..	100	4 1/2	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	28 — 27	..	4 6 11	Do. 6 % Income ..	100	1 1 1/2	78 — 80	— 1/8	..
Do. 4 % Deb. ..	100	4 4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil ..	1 — 1 1/2	..	Nil
Lancashire United, 5 % Deb. ..	100	5 5	79 — 81	+ 2 1/2	6 3 5	Do. 6 % Pref. ..	5	Nil ..	2 1/2 — 3 1/2	+ 1/4	Nil
London Elec. Railw'ys, 4 % Deb.	100	4 4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	81 — 85	..	5 5 11
London United Trams, 5 % Pref.	10	Nil ..	3 1/2 — 4	+ 8	..						
Do. 4 % Deb. ..	100	4 4	75 — 78	..	5 2 7						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	6	5	5 1/2	5 1/2 — 5 5/8	..	5 3 6	La Plata Elec. Trms, Ord.	..	1	..	1 1/2 — 1 1/8	..	..	..	
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2 — 5 1/8	..	5 3 6	Do. Pref. ..	..	1	6	5 — 1	..	6	0 0	
Do. 4 % Deb. ..	100	4	4	94 — 95 1/2	..	4 3 9	Lisbon Elec. Trams, Ord.	..	1	5 1/2	6 1/2 — 1 1/2	..	4	8 0	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100 1/2 — 102 1/2	+ 1/2	4 7 10	Do. 6 % Pref. ..	..	1	6	6 — 1 1/2	..	4	16 0	
Do. 5 % Deb. ..	100	5	5	101 1/2 — 103 1/2	..	4 16 7	Do. 5 % Deb. ..	..	100	5	5	93 1/2 — 97 1/2	..	5	2 7
Auckland Trams, 5 % Deb.	100	5	5	102 — 105	..	4 15 8	Madras Elec. Tr. (1904), Deb.	..	100	5	5	93 1/2 — 96 1/2	..	5	3 8
Bombay Elec. S. & Trams, Pref.	10	6	6	107 1/2 — 11 1/2	..	5 5 6	Manaos Trams & Lt., 1st Deb.	..	100	5	5	91 1/2 — 93 1/2	+ 1	5	6 11
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	96 — 98	..	4 11 10	Manila Elec. R. and Lt., Bonds	\$1000	5	5	101 — 103	..	4	17 1	
Do. 5 % 2nd Deb. ..	100	5	5	98 — 100	+ 1	5 0 0	Mexico Trams Com.	..	\$100	7	7 1/2	123 — 125 xd	— 1/2	5	12 0
Brisbane Trams Inv't., Ord.	5	8	8 1/2	8 1/2 — 9 1/2	..	4 6 6	Do. Gen. Con. 5 % Bonds ..	..	..	5	5	100 — 102	+ 1/2	4	18 0
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2	..	4 15 8	Do. 6 % Bonds ..	..	100	6	6	101 — 103	..	5	16 6
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	101 — 104	..	4 1 7	Para Elec. Rlys. & Lt., Ord.	..	5	10	10 1/2	7 1/2 — 7 1/8	+ 1 3/8	6	10 1
B. Columbia Elec. Rly., Def.	100	8	8 1/2	135 — 140	— 1	5 14 4	Do. 6 % Pref. ..	..	5	6	6	5 — 5 1/2	— 1/8	5	9 1
Do. Pref. Ord. ..	100	6	6	119 — 123	+ 1	4 17 7	Do. 5 % 1st Deb. ..	..	100	5	5	97 1/2 — 99 1/2	..	5	0 6
Do. 5 % Pref. ..	100	5	5	107 1/2 — 110 1/2	..	4 10 6	Perth (W.A.) Elec. Tr., Ord.	..	1	2 1/2	..	1 1/2 — 1 1/8	+ 1/4	1	15 7
Do. 4 1/2 % 1st Mort. Deb.	40	4 1/2	4 1/2	100 — 103	..	4 7 5	Do. 5 % 1st Deb. ..	..	100	5	5	99 — 101	..	4	19 0
Do. 4 1/2 % Vancouver Deb.	100	4 1/2	4 1/2	102 — 104 xd	..	4 6 7	Rangoon El. Tr. & Sup., Pref.	..	5	6	6	5 1/2 — 5 1/8	..	5	2 2
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	101 1/2 — 102 1/2	— 1/2	4 7 10	Do. 4 1/2 % 1st Deb. ..	..	100	4 1/2	4 1/2	98 — 101	..	4	9 1
Calcutta Trams, Ord.	5	6	..	5 — 6	..	5 0 0	Rio de Janeiro Trams	..	\$100	4 1/2	5 1/2	116 — 117	— 1/2	3	16 11
Do. 5 % Pref. ..	5	5	5	5 — 5 1/2	..	4 15 8	Do. 1st Mort. 5 % Bonds ..	..	..	5	5	101 — 102	..	4	18 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds ..	..	100	5	5	97 1/2 — 84	+ 1/4	5	1 9
Cape Electric Trams	1	Nil	2 1/2	1 — 3 1/2	..	..	Sao Paulo Tram, Lt. and P.	..	\$100	10	10 1/2	195 — 190	— 1	5	1 0
City Buenos Aires Trams (1904)	5	5	5	5 1/2 — 5 1/4	..	4 5 1	Do. 5 % 1st Deb. ..	..	\$500	5	5	102 — 104	..	4	16 2
Do. 4 % Deb. ..	100	5	5	95 — 98	..	5 2 0	Singapore Trams, 5 % Deb.	..	100	5	5	81 — 84	..	5	19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	..	100	5	5	95 1/2 — 97 1/2	..	5	2 7
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 103 xd	..	4 17 1	Un. Elec. Trams Monte Video ..	..	5	6	7	5 — 5 1/2	— 1/4	5	9 1
Kalgoorlie Elec. Trams ..	1	Nil	..	1 — 3 1/2	..	Nil	Do. 6 % Pref. ..	..	5	6	6	5 — 5 1/2	— 1/8	5	14 3
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. ..	..	100	5	5	98 1/2 — 101 1/2	..	4	18 6
Do. 6 % B Deb. ..	100	5	6 1/2	58 — 62	..	8 1 4	Winnipeg Elec. Rly., 4 1/2 % Deb.	..	100	4 1/2	4 1/2	104 — 106	..	4	4 11

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	5 — 3	..	..	Dick, Kerr ..	1	5	..	27 — 3 1/2	..	5 3 1
Do. 6 % Pref. ..	1	9	6	3 1/2 — 2 1/2	..	7 2 2	Do. Pref. ..	1	6	6	1 1/2 — 1 1/2	..	5 12 11
Babcock & Wilcox ..	1	26	24 1/2	6 1/2 — 6 1/2	+ 1 1/2	4 0 0	Do. Deb. ..	100	4 1/2	4 1/2	92 1/2 — 95 1/2	..	4 14 3
Do. Pref. ..	1	6	6	1 1/2 — 1 1/2	+ 1 1/2	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	1 — 1	..	Nil
B.I. & Helsby Cables ..	5	10	8 1/2	6 1/2 — 7 1/2	..	7 0 4	Do. fully paid ..	5	Nil	..	1 1/2 — 2 1/2	..	Nil
Do. Pref. ..	5	8	6	5 1/2 — 6 1/2	..	4 16 0	Do. 4 % Deb. ..	100	4	4	71 — 75	+ 1	5 6 8
Do. Deb. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	94 — 97	..	4 12 9	Electric Construction ..	2	Nil	2 1/2	1 1/2 — 1	+ 1/4	..
British Westinghouse, Pref.	8	Nil	..	1 — 1 1/2	..	Nil	Do. Pref. ..	2	7	7	1 1/2 — 1 1/2	+ 1/8	7 4 6
Do. Deb. ..	100	4	4	54 — 57	..	7 0 4	Greenwood & Batley, Pref.	10	7	7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	101 — 103	+ 1	5 16 6	Do. Deb. ..	100	5	5	94 — 96	..	5 4 2
Browett, Lindeley, Ord.	1	Nil	..	1 1/2 — 2	..	Nil	General Electric, Pref.	10	5	5	9 — 12	+ 1/2	5 5 3
Do. Pref. ..	1	Nil	..	5 1/2 — 6 1/2	..	Nil	Do. Deb. ..	100	4	4	85 — 90	..	4 8 11
Brush, Ord. ..	2	Nil	..	0 — 1 1/2	..	Nil	Henley's, Ord.	5	15	10 1/2	11 1/2 — 12 1/2	..	6 2 5
Do. 7 % Pref. ..	2	Nil	..	0 — 1 1/2	..	Nil	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2 — 5 1/2	..	4 5 11
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	56 — 61	..	7 7 7	Do. Deb. ..	100	4 1/2	4 1/2	104 — 106	..	4 4 11
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	37 — 42	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	10 — 12	..	..
Callender's Cable ..	5	15	10 1/2	9 — 9 1/2	..	7 13 10	Do. Pref. ..	10	5	5	9 1/2 — 10 1/2	..	4 17 7
Do. Pref. ..	5	5	5	5 — 5 1/2	..	4 15 3	Telegraph Construction ..	12	20	10 1/2	85 — 37	+ 1/2	6 7 2
Do. Deb. ..	100	4 1/2	4 1/2	98 — 100	..	4 10 0	Do. Deb. ..	100	4	4	99 1/2 — 101 1/2	..	3 18 10
Castner-Kellner ..	1	17 1/2	20	8 1/2 — 8 1/2	..	4 11 10	Willans & Robinson ..	1	Nil	..	1 — 1 1/2	..	Nil
Do. Deb. ..	100	4 1/2	4 1/2	106 — 110	..	4 1 10	Do. Pref. ..	5	Nil	..	1 — 1 1/2	+ 1/2	Nil
Crompton & Co. ..	8	Nil	Nil	1 — 3	..	Nil	Do. Deb. ..	100	4	4	53 — 63	..	7 2 10
Do. Deb. ..	100	5	5	58 — 68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.



## WOOD AND CONCRETE POLES IN ELECTRICAL SERVICE.

BY W. MANKTELOW.

THOUGH wooden poles are still mainly used for the support of telegraph and telephone lines, the rapidly increasing number of pole lines, the decreasing supply of timber and the upgrowth of new services, such as high-tension transmissions and medium voltage central station distribution schemes, have led to elaborate trials of other pole materials and constructions.

Wood, as a pole material, has the advantages of being cheap, easily worked and widely available. If used without protective treatment, it is subject to rapid decay—accelerated or retarded, as the case may be, by local circumstances—but, by the use of various impregnating materials, its life may be greatly extended and the initial cost of the protective treatment is fully justified by the lower annual maintenance, repair and depreciation charges involved.

Though impregnation increases the durability of pole timbers, there are no means available for radically increasing their mechanical strength, hence, for very heavy loads, such as are met with in high-tension power transmission schemes, lattice steel poles have already become standard practice. These poles offer a maximum of durability and strength, and since they can be put together at or near the point of their erection, transport difficulties are reduced to a minimum. The design of these poles proceeds along practically the same lines as that of bridge members (the pole being essentially a cantilever up-ended and subject to certain concentrated loads at the cross arms, and to a distributed load due to wind pressure). Owing to the special circumstances under which they are used and the widely diversified constructions at present employed, it is not proposed to give lattice steel poles more than this passing notice.

There are many duties for which wooden poles are sufficiently strong, but in which they are nevertheless being replaced by reinforced concrete structures on account of the much greater durability of the latter, and, further—in such cases as the carrying of street lamps, trolley wires, urban distribution lines, and so on—on account of the more pleasing appearance of the concrete construction. Reinforced concrete structures are in limited use for the support of high-tension transmission lines, but, in most cases, lattice steel towers, though needing more frequent overhaul, are preferred on account of their lower cost and easier transport and erection.

## WOODEN POLES.

At the present day there are probably about  $1\frac{1}{2}$ -2 millions of wooden poles in use in the United Kingdom for telegraph and telephone work alone, and the latest U.S.A. timber census shows some  $3\frac{3}{4}$  millions of wooden poles to be annually used in that country for various purposes—about 80 per cent. of the total number being used by telegraph and telephone companies and the remainder by railway, light and power companies.

In England, Scotch pine or "redwood" poles are almost exclusively used, Spanish chestnut and oak being employed to a very limited extent, but in the U.S.A. cedar is the most popular timber (see Table I). White Michigan cedar is, undoubtedly, the best quality\* (being durable, strong, straight, light and easily worked), but both supply and quality are now falling off. The price of this timber has been doubled during the past few years, and its very slow growth† makes reforestation impracticable. Western cedar is, therefore, being widely adopted as the next best grade available, but, unfortunately, its locality of growth is such that the freight charges to the chief centres of demand in the Eastern States range from 15s. to 18s. per 40-ft. pole (*i.e.*, roughly double the cost of the pole itself).‡

\* So highly is it esteemed that considerable amounts have been exported to Egypt, South America, and various other countries.

† To obtain a 25-35 ft. pole, 7 in. diameter at the top—the size most favoured by telegraph and telephone companies—takes 90-100 years.

‡ With the increasing distances of transport, water carriage has become almost extinct; about 90 per cent. of the U.S.A. poles are now said to be rail-borne from the forest to the timber yard.

Pending the evolution of a standardised modern construction for poles (reinforced concrete for small and medium poles and lattice steel for the largest structures), every effort is being made to economise pole timber consumption by restricting the felling of small trees, and by the use of inferior kinds wherever possible. Great wastage has resulted in the past from unreasonable specifications endeavouring to control too closely the length and top and bottom diameters of the poles used. The repair of decayed wooden poles by the reinforced concrete construction described later, is of great economic importance.

*Causes of Deterioration.*—It has been estimated that no less than 90 per cent. of the total number of wooden poles in use fail by the rotting at, and somewhat below, the ground level. The deleterious effects of alternate moisture and dryness on untreated wood are well known, and are obviously greatest near the ground level. Apart from the

TABLE I.

	No. of poles used, as per cent. of total (8,789,000).	Average price per pole.
Cedar ... ..	65	7s. 8d.
Chestnut ... ..	16	9s. 2½d.
Oak* ... ..	6½	2s. 4d.
Pine ... ..	5	11s. 7d.
Grand average ... ..	—	7s. 7d.

\* It is worth noticing that the use of oak poles is rapidly increasing; only 76,000 (2.8 per cent. of total) were marketed in 1907, as against 237,000 in 1909.

effects of damp alone, the buried butt of the pole is subject to the attack of various fungi—such as the "house fungus," specially favoured by rapid alternations of dryness and moisture, and the "hyphen" fungus, the thread-like growth of which penetrates the longitudinal fissures of the pole, and is favoured by a quickly drying earth. In the tropics, the attack of insects, notably the white ant, is most destructive, and the deep cavities dug by woodpeckers in the "staff" of poles form a serious minor cause of pole failure.

*Preservative Measures* may be roughly classified under "prevention" and "cure," and their application is of greatest importance at the butt of the pole. Treatments preventing decay include mere painting of the wood—a relatively ineffective precaution—and more or less complete impregnation of the material.

A means of mechanically protecting the pole butt from injury consists in the use of a concrete or brimstone sleeve cast between the pole and a galvanised sheet metal "former," as shown in fig. 1. A somewhat similar method of repairing

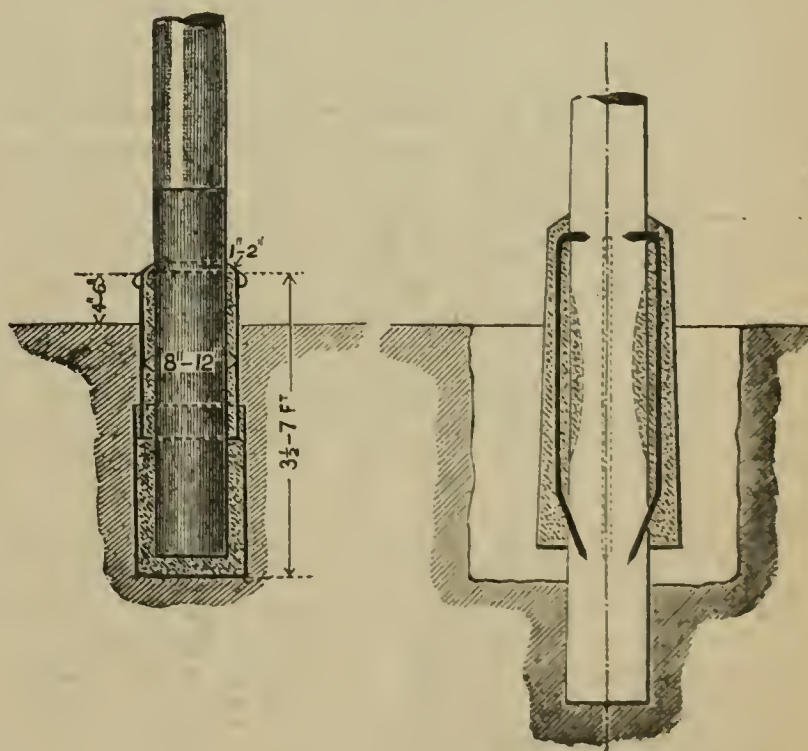


FIG. 1.

FIG. 2.

damage is illustrated in fig. 2. The damaged pole is first guyed, and the surrounding earth is then dug away for about 18 in. round the butt and to such a depth as completely exposes the damaged wood. The rotted portions are next chopped or scraped away and, according to the length of the damaged portion, ½ in. steel bars or rods, from 3 to 6 ft. long and pointed at both ends, are used as bridge pieces. The lower ends of the rods (of which four to six usually suffice)



are driven in at an angle, and the tops, which are already bent at right-angles about 6 in. from the end, are driven home. The wood and steel are then filled round with a concrete mixture, cast in a mould, forming a conical sleeve completely enclosing the steel, and varying from 3 in. to 4 in. in thickness at the base and from 1½ in. to 2 in. at the top. In very bad cases, the pole may have to be plugged with a concrete block or placed on a concrete pedestal, reinforcing "bridges" being still used as above. By this means, the life of a damaged pole is indefinitely extended and there is no need to dismantle the pole during the repair.

**Impregnating Processes.**—By far the most generally adopted measure for the preservation of wooden poles consists in the more or less complete saturation of the timber with one of a number of waterproofing germicides and fungicides. Among the materials most commonly employed may be noted creosote (a tar oil), copper sulphate, zinc chloride and corrosive sublimate of mercury. The following notes explain the general means of application and the relative values of these substances.

**Tar Processes.**—The simplest method, of any value, of utilising the protective influence of tar consists in charring the butt of the pole up to 1 ft. above the ground line and immediately applying hot tar with a stiff brush. A more effective measure is to immerse 6 or 8 ft. of the butt for from 10 minutes to an hour or more in an open tank containing tar, or a tar compound, at 200-250° F. By capillary attraction the hot liquid is sucked to an appreciable depth into the pores of the timber, but, to realise the full benefits of tar treatment, it is necessary to forcibly inject the preservative (usually in the form of creosote), preferably after emptying the surface pores by natural or artificial seasoning.

For a considerable number of years the standard (Bethell) creosoting process consisted in exposing the timber treated to 40-50 lb. per sq. in. steam pressure for, say, four hours, after which a 20-in. vacuum was maintained in the containing cylinder till sap ceased to flow from the wood. The tanks were then filled with creosote at a pressure of about 120 lb. per sq. in. till from 12 to 20 lb. of oil, according to needs, had been absorbed per cb. ft. of timber. (After such treatment, poles should be allowed to season for 3 to 12 months before use. If the timber be air-seasoned before treatment, the steaming stage may be omitted.)

Though the above process is still largely employed, prolonged experiments have evolved means whereby the total consumption of creosote may be materially decreased without sacrificing the efficacy of its application.

In the Ruping process—which is very successful on the Continent, and has lately been adopted by Messrs. Wade and Sons, of Hull—the timber is subjected to a preliminary air pressure of 50 lb. per sq. in., after which the treating tanks are filled with creosote, the pressure being maintained and gradually brought up to 85 lb. per sq. in. After the desired injection is completed, the pressure is reduced and the air first forced into the wood escapes, carrying with it the surplus oil. This process is applicable even to hard white woods, and has the further advantage that it leaves the timber dry and "clean"; and whereas in the Bethell or "full cell" process the pores are clogged with surplus oil, all free oil is removed in the final stage of the Ruping process, which is therefore known as the "partially full" or "empty" cell process.

Successful experiments have been conducted on the Continent as to the practicability of partially impregnating poles by injecting creosote into the butt only, a number of small radial perforations being drilled to facilitate deep penetration of the oil. This process can be applied to all resinous timbers, and about 6 lb. of oil per cb. ft. of butt is found to be a convenient and suitable saturation.

The efficacy of creosoting cannot be doubted. While its effect is more pronounced in the case of soft than hard timbers (see Table II), the cost of the treatment (varying from 50 per cent. to 100 per cent. of the cost of the timber in the U.S.A., and amounting to a much lower percentage in this country) is justified in practically every case where wooden poles are employed. In the absence of definite data, it may be hazarded that fully 70 per cent. to 80 per cent. of the wooden poles used in England are creosoted, and though the percentage treated in the States is considerably lower

(12½ per cent. in 1907, 10 per cent. in 1908, 16 per cent. in 1909), it shows a marked tendency to rise.

According to local circumstances of soil and climate, the life of poles is increased three to ten-fold by creosoting

TABLE II.—AVERAGE LIFE TO 25 PER CENT. DECAY.

		Untreated.	Treated.	Ratio of increase.
Beech	...	3	24	8'00
Pine	...	4	15½	3'88
Oak	...	13½	17	1'26

(Tables II and III), and so far from the effect of the treatment rapidly diminishing with time, it is automatically maintained for a number of years by the gradual settlement of creosote towards the butt.\*

According to Henley, about one-third of the original amount of creosote remains in the butt of poles after a number of years; one-seventh remains in the staff, and the bulk of the remaining 50 per cent. is diffused as a gummy tar in the surrounding soil, where it exercises a most useful waterproofing action. Other observers claim a considerably higher

TABLE III.—EFFICACY AND COST OF VARIOUS TREATMENTS.

		Life of treated pole.	Cost of treatment per cb. ft.	per yr. life.
Creosoting	...	22-25 years	0'93d.	0'042d.
Corrosive sublimate	...	13-17 "	1'03d.	0'079-0'061d.
Copper sulphate	...	14 "	1'16d.	0'083d.
Improved ditto*	...	15½ "	2'05d.	0'136d.
Zinc chloride	...	12 "	1'33d.	0'111d.

\*Collette.

residue in the butt, and tests on poles subjected to radial butt injection (total absorption 5½ lb. per cb. ft., half in butt, half in staff), show the full butt saturation for a number of years, and 33 per cent. of the original saturation after a further term of years.

Against ground line decay creosoting is specially effective; in a certain American concern, chestnut poles showing a decrease in circumference at ground level of 1¾ in. to 2¼ in. in eight years, when used untreated, showed no decrease during the same period when creosoted. The English G.P.O., using none but creosoted poles, requires only 50,000 renewals per annum (about 5 per cent.), as against 7·8 per cent. renewals in the States, where creosoting is much less common.

A minor disadvantage attached to the use of creosote, and attributable to its vigorous nature, is the sharp inflammation set up by the oil and its fumes on the face and hands of workmen handling the poles shortly after their treatment. To cover this discomfort, it is found necessary by some American companies to pay specially liberal wages to men on this duty. This trouble, and that of surface oozing of the creosote, are less pronounced where the Ruping process is employed, and, in any case, they may be obviated by storing the treated poles for a few months before use. In tropical climates these disadvantages are naturally accentuated.

(To be concluded.)

**Electric Lift Contracts.**—In connection with extensions and additions now being carried out at Messrs. Peek, Frean and Co.'s premises at Bermondsey, MESSRS. SMITH, MAJOR AND STEVENS, LTD., of London and Northampton, have received instructions for the installation of one of their full automatic push-button electric passenger lifts and one large electrically-operated goods lift. Among other important contracts at present in the hands of the same firm are the following:—For the Admiralty: Six full automatic button-controlled passenger lifts for each of H.M. battleships *Ajax*, *Thunderer*, *Monarch* and *Conqueror*; similar machines have recently been completed by them on H.M. battleships *Neptune* and *Orion*; two electric passenger lifts for Messrs. Boots' premises at Bath and Derby; two electric passenger lifts for the Swansea General Hospital; two electric lifts for Messrs. Anderson, Son & Hedley's new premises, Newcastle-on-Tyne; 12 machines for export to Australia; two machines for Wellington, New Zealand; and six for South America.

\* This action is a strong argument in favour of impregnation of the whole, or a considerable portion, of the length of the pole, instead of merely the butt section.



TRADE STATISTICS OF THE STRAITS SETTLEMENTS, 1910.

THE following statement, showing the imports of electrical and other materials into the various Straits Settlement ports in 1910, is taken from the recently issued trade statistics. The figures for 1909 are given for purposes of comparison, and notes of any increases or decreases have been added :—

IMPORTS INTO SINGAPORE.			
	1909. Dollars.	1910. Dollars.	Increase or decrease. Dollars.
<i>Electrical goods (not otherwise shown).—</i>			
From Great Britain ...	140,000	114,000	— 26,000
„ British India ...	2,000	16,000	+ 14,000
„ Belgium ...	—	1,000	+ 1,000
„ Germany ...	3,000	6,000	+ 3,000
„ Italy ...	2,000	5,000	+ 3,000
„ Other countries ...	2,000	5,000	+ 3,000
Total ...	149,000	147,000	— 2,000
<i>Gas and electric lighting materials.—</i>			
From Germany ...	5,000	9,000	+ 4,000
„ Great Britain ...	80,000	64,000	— 16,000
„ United States ...	1,000	1,000	—
„ Other countries ...	2,000	—	— 2,000
Total ...	88,000	74,000	— 14,000
<i>Telegraph and telephone materials.—</i>			
From Belgium ...	12,000	10,000	— 2,000
„ Germany ...	1,000	1,000	—
„ Great Britain ...	104,000	162,000	+ 58,000
„ Other countries ...	8,000	5,000	— 3,000
Total ...	125,000	178,000	+ 53,000
<i>Tramway and railway materials.—</i>			
From Belgium ...	35,000	21,000	— 14,000
„ Germany ...	1,000	—	— 1,000
„ Great Britain ...	330,000	254,000	— 76,000
„ Australia ...	31,000	51,000	+ 20,000
„ Other countries ...	18,000	2,000	— 16,000
Total ...	415,000	328,000	— 87,000
<i>Machinery.—</i>			
From Belgium ...	—	1,000	+ 1,000
„ Denmark ...	—	1,000	+ 1,000
„ France ...	2,000	21,000	+ 19,000
„ Germany ...	39,000	93,000	+ 54,000
„ Holland ...	13,000	6,000	— 7,000
„ Great Britain ...	1,598,000	1,242,000	— 356,000
„ United States ...	43,000	97,000	+ 54,000
„ Other countries ...	159,000	145,000	— 14,000
Total ...	1,854,000	1,606,000	— 248,000
<i>Lamps and lampware.—</i>			
From Belgium ...	10,000	10,000	—
„ Germany ...	144,000	264,000	+ 120,000
„ Great Britain ...	75,000	103,000	+ 28,000
„ United States ...	9,000	12,000	+ 3,000
„ Other countries ...	12,000	34,000	+ 22,000
Total ...	250,000	423,000	+ 173,000
IMPORTS INTO PENANG.			
<i>Electrical goods (not otherwise shown).—</i>			
From Great Britain ...	21,000	21,000	—
„ Germany ...	4,000	30,000	+ 26,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	26,000	53,000	+ 27,000
<i>Machinery.—</i>			
From Belgium ...	—	18,000	+ 18,000
„ Germany ...	35,000	22,000	— 13,000
„ Great Britain ...	313,000	322,000	+ 9,000
„ United States ...	5,000	14,000	+ 9,000
„ Other countries ...	22,000	35,000	+ 13,000
Total ...	375,000	411,000	+ 36,000
<i>Lamps and lampware.—</i>			
From Austria ...	2,000	2,000	—
„ Belgium ...	1,000	1,000	—
„ Germany ...	37,000	43,000	+ 6,000
„ Great Britain ...	31,000	48,000	+ 17,000
„ Other countries ...	4,000	6,000	+ 2,000
Total ...	75,000	100,000	+ 25,000

	1909. Dollars.	1910. Dollars.	Increase or decr ase. Dollars.
<i>Gas and electric lighting materials.—</i>			
From Great Britain ...	2,000	—	— 2,000
<i>Telegraph and telephone materials.—</i>			
From Great Britain ...	1,000	4,000	+ 3,000
IMPORTS INTO MALACCA.			
<i>Electrical goods (not otherwise shown).—</i>			
From Great Britain ...	1,000	—	— 1,000
<i>Telegraph and telephone materials.—</i>			
From Great Britain ...	2,000	1,000	— 1,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	2,000	2,000	—
<i>Tramway and railway materials.—</i>			
Total ...	1,000	—	— 1,000
<i>Machinery.—</i>			
From Great Britain ...	6,000	5,000	— 1,000
„ Other countries ...	2,000	11,000	+ 9,000
Total ...	8,000	16,000	+ 8,000

IMPORTS INTO LABUAN.			
<i>Electrical goods (not otherwise shown).—</i>			
From Great Britain ...	18,000	—	— 18,000
<i>Machinery.—</i>			
From Great Britain ...	19,000	72,000	+ 53,000
„ Holland ...	36,000	—	— 36,000
Total ...	55,000	72,000	+ 17,000

N.B.—Dollar = 2s. 4d.

PROCEEDINGS OF INSTITUTIONS.

The Heat Paths in Electrical Machinery.

By HAROLD D. SYMONS, A.M.I.E.E., and MILES WALKER, M.I.E.E.  
(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, Manchester, December 12th, 1911, and London, January 25th, 1912.)

IF we wish to get the largest possible output from an electric generator or motor of given cost, we must make a very close study of the possible methods of carrying away the heat which is produced in the iron and copper. The heat produced in any part (be it from I<sup>2</sup>R loss or iron loss) has a definite path from the point of origin to the place where it is thrown out from the machine. Thus some of the I<sup>2</sup>R losses in the armature conductors may have only to pass through a certain thickness of insulation to the air surrounding the coils, while the heat generated in the copper in the slots passes through the insulation to the iron, where it meets with the heat produced in the iron, and both together are conducted to the ventilating ducts and carried by the air to the exterior.

It is desirable that the designer should have specific data as to the heat conductivity of every part of the machine, in order that he may know what difference of temperature to expect between any two points in the heat path.

The authors have not been able to find any direct data on the heat conductivity of electric insulating materials mounted in the same way as one usually finds them in electrical machines. They, therefore, thought that it would be worth while to make measurements both of the specific conductivity of the commonly employed insulating materials, and of the effect on the conductivity of introducing the air-spaces and gaps such as are often unavoidable in electrical machines.

Tests were made by means of laboratory apparatus on the specific heat conductivity of materials mounted in different ways, and on electric generators under actual running conditions.

The table on p. 196 gives the heat conductivity of various insulating materials as measured, the materials being wound on a copper cylinder. The fourth column gives the heat conductivity in gramme-calories of a centimetre cube of the material per °C. difference of temperature between opposite faces of the cube. The fifth gives the conductivity expressed in watts per sq. cm., and the sixth column gives the watts per sq. in. passing through a 1-in. cube of the material for 1° C. difference of temperature between opposite faces of the 1-in. cube.

It was found that all the cellulose materials, such as cotton, paper, &c., had a considerable temperature coefficient, the heat conductivity at a temperature of 100° being about 12 per cent. higher than at 30° C. The heat conductivity of mica was not found to change between 20° and 100° C.

Of all the fibrous materials commonly used in insulation, the one having the highest thermal conductivity is empire cloth pressed



Material.	How mounted.	Thickness of material tested. Centimetres.	Thermal conductivity.		
			Per sq. cm. per °C. of diff. of temp. per cm. length of path.		Per sq. in. per °C. of diff. of temp. per in. length of path. In watts.
			In calories per sec.	In watts.	
Varnished cloth (Empire cloth)	16 turns, each 0.0175 cm. thick, very tightly wrapped	0.285	0.000604	0.00249	0.00634
Presspahn, untreated	2 pieces, each 0.16 cm. (Bacon's method)	0.320	0.000410	0.00170	0.00420
Rope paper, untreated	24 turns, 0.014 cm. thick, tightly wound	0.350	0.000278	0.00115	0.00292
Rope paper and oil	24 turns, 0.014 cm. thick, tightly wound	0.350	0.000341	0.00142	0.00371
Rope paper, treated with sterling varnish	Successive turns, 0.019 cm. thick, tightly wrapped	0.280	0.000405	0.00170	0.00420
Fullerboard, varnished	Successive turns, 0.028 cm. thick, tightly wound	0.410	0.000339	0.00140	0.00350
Empire cloth and mica	Alternate turns of Empire cloth, 0.018 cm. thick; and mica, 0.075 cm. thick, tightly wound	0.310	0.000500	0.00209	0.00530
Empire cloth, mica and tape	As in slot, containing air spaces	0.450	0.000270	0.00112	0.00285
Pure mica ...	3 pieces, each about 0.13 cm. thick, tested by Bacon's method	0.401	0.000870	0.00360	0.00915
Built-up mica ...	Micanite tube containing 19 per cent. shellac	0.330	0.000246	0.00103	0.00260
Built-up mica ...	Micanite tube containing 11 per cent. shellac	0.360	0.000293	0.00120	0.00310
Linen tape, treated	Treated in insulating varnish and baked	0.390	0.000350	0.00146	0.00370

into a solid mass free from air-spaces. This is probably because the fibres of the empire cloth are completely filled with oxidised varnish, whereas many of the papers, even when closely compressed, contain air-spaces. The difference in the conductivity obtained by winding the insulation on the copper cylinder very tightly and by winding it on loosely was very marked. It was found that micanite built up in the form of tubes containing about 11 per cent. of shellac had a very poor conductivity as compared with pure mica.

Very often a field coil insulated on the inside with layers of insulating material does not fit tight upon the pole, so that a short air-space exists between the insulation and the iron of the pole. A number of experiments were made, in which air-spaces of different thicknesses were made between the copper tube in the testing apparatus and the insulating tube. These spaces were made by winding twine of different thicknesses in a wide spiral round the tube, and then winding the insulating material above the spiral. The thickness of the twine gave approximately the size of the air-space. It is to be expected that a very narrow air-space will have a greater thermal resistance per centimetre of thickness than a wider air-space, and as the space is widened out we come at last to a constant resistance (for 1 sq. cm. area of surface) which is the reciprocal of the cooling constant ( $h = 0.0011$ ) for surfaces exposed to still air.

For wide air-spaces the resistance will depend on whether the space is vertical or horizontal, and if vertical it will depend on the number of horizontal baffles. In our case the air-spaces were vertical, and the pieces of twine which would have acted as baffles were spaced about  $\frac{1}{2}$  in. apart. Fig. 1, p. 197, embodies the results of the tests.

Suppose that we have a field coil which is insulated on the inside next the pole with treated fuller-board of a thickness of 0.2 cm. From the table we find the thermal conductivity of this material (in watts per sq. cm., &c.) is 0.0014. The thermal resistance of 1 sq. cm. is, therefore,  $0.2 \div 0.0014 = 142$ , so that if there were no air-space, and we were passing to the pole 0.15 watt per sq. cm., the difference in temperature of pole and coil would be only 23° C. If now we introduce an air-space of 1 mm., whose resistance from fig. 1 is about 200, the total resistance is raised to 342, and the difference in temperature for the same heat flow would be 55° C.

A test was made on a 5,000-KW. three-phase generator by means of thermo-couples placed in the armature coils during the course of construction. The generator was run at full speed with the armature short-circuited, the field current being increased until the armature current was 328 amperes. The run was continued until the temperatures of all parts were constant. The temperature of the air admitted to the machine was 23° C., and the temperature rise of the copper inside the slot was 39°, of the iron surrounding the slot 18.4°, of the outside of the coil 24.6°, and of the copper 6 in. from the iron 38°.

The total thickness of slot insulation amounted to 0.177 in. The various insulating materials were present in the following proportions:—Empire cloth, 0.07; mica, 0.03; varnish and air, 0.02; paper, 0.017; tape, 0.04. The heat conductivity of the insulation is easily calculated from the above figures. The total loss in the copper conductors per foot run of coil was 27.2 watts, including the loss due to the eddy currents produced in the conductors. The difference of temperature between the copper and iron is 20.6° C. The mean perimeter is 6.8 in., so that the total area of insulation per foot run is 82 sq. in. With 27.2 watts per foot run this gives just over 3 sq. in. per watt. The specific conductivity for heat of the insulation works out at 0.00112 watt per centimetre cube per degree. This conductivity is considerably lower than the figure (0.002) found from tests on empire cloth and mica wound on a copper cylinder with the fewest possible air-spaces, as can be easily understood.

With coils of rectangular section wrapped with empire cloth and mica, or paper and mica, in the ordinary method, one may expect to have a heat conductivity not higher than 0.00112 watt per cubic centimetre per degree. This figure is useful in enabling us to calculate the difference of temperature between the copper conductors in a slot and the surrounding iron, and checks very well with other results found in practice.

It sometimes happens that the copper conductors on an armature or field magnet are grouped together so closely that very little air can circulate between them, and the total cooling surface of the group is too small to dissipate the heat generated in it. In this case one relies mainly for cooling upon the conduction of heat along the conductors to parts of the coils where the cooling conditions are better. A good illustration of this case is offered by the end windings of a two-pole field magnet for a turbo-generator.

It is necessary sometimes to calculate what the temperature gradient will be, and what the maximum temperature rise will be in the centre of the group. The problem is complicated by the fact that the resistance of copper changes with temperature, and makes the watts lost increase according to a compound interest law.

A formula has been obtained by the authors for this case in the form  $T_x = T_{\max} \cos(4.43 \times 10^{-6} \times I \times x)$ , where—

$I$  is the current density in amperes per sq. cm.,  
 $x$  is the distance from the hottest point in cm.,  
 $T_x$  is the absolute temperature at any point  $x$ ,  
 $T_{\max}$  the absolute temperature at the hottest point.

The angle is expressed in radians. Suppose that we have a hot-bed of conductors so bulky that we can assume that the centre conductor parts with no heat laterally. All heat generated in it passes by conduction to points 20 cm. away from the centre, which we will suppose are maintained at 40° C. Each conductor is 0.1 sq. in. section, and carries a current of 250 amperes. What is the temperature of the hottest point?

$$I = 388 \text{ amperes per sq. cm.}$$

$$T_x = (40 + 273) = 313 = T_{\max} \cos(4.43 \times 10^{-6} \times 388 \times 20) = 0.941 T_{\max}.$$

$$T_{\max} = 332.$$

$$332 - 273 = 59^\circ \text{ C. is the temperature of the hottest point.}$$

In the case where part of the heat generated is radiated from the surface of the group of conductors, and part is conducted to the ends, the temperature rise of the hottest point will be lower than if no heat were lost laterally.

There are three main cases occurring in electrical machinery in which it is necessary to calculate the rate of convection of heat from a solid surface to the surrounding air:—

1. An armature or field magnet of approximately cylindrical shape revolving within the stationary part of the machine. (Cooling coefficient denoted by  $h_y$ )

2. A field coil against which a draught of air is blowing. (Cooling coefficient denoted by  $h_d$ )

3. The iron surface of a ventilating duct, through which the air is passing at a certain velocity. (Cooling coefficient denoted by  $h_v$ )

The laws of cooling of the solid surface are different in the three cases. The first case (the cooling of the revolving cylinder) is very complicated.

For ordinary direct-current armatures surrounded by ordinary field magnets, with normal air-gaps, and with no more interchange of air than is naturally produced by the rotation of the armature, the formula given by Kapp—

$$t^\circ = \frac{550}{0.7W \times (1 + 0.1v)}$$

gives good practical results. Here  $0$  is the area of the cylindrical surface,  $W$  the watts to be dissipated,  $v$  the peripheral velocity in meters per second, and  $t^\circ$  the °C. rise above the surrounding air.

Other writers give different values of the numerator 550, and change the value of the coefficient of  $v$ . Others change the index of the power of  $v$ .

For an ordinary armature surrounded by its field magnet the coefficient 0.1 seems to be about right. For the numerator the figure 550 seems to be rather high for ironclad armatures. The figure 333 given by Dr. Ott seems to give good results for turbo-generators with forced ventilation.

In the case of field coils, an increase in the velocity of the current of air not only increases the intimacy of contact between the air and the surface of the coil, but at the same time increases the quantity of air passing the coil in a given time. We, therefore, have the index of the power of  $v$  greater than for the case of a revolving cylinder, the air surrounding which is not necessarily changed at a rate proportional to  $v$ .

In cases 1 and 2 there is a cooling of the surface by radiation.



apart altogether from the passage of air; the formulae should therefore give a value to  $h$  when  $v$  equals 0. In case 3, where two sides of a ventilating duct face one another, there is no dissipation of heat unless the air moves through the duct.

For the purpose of determining the relation between the cooling coefficient  $h_a$ , in case 2, and the velocity of the draught blowing on the sides of the coil, a number of experiments were made. In the case of cotton-covered wire the law is approximately—

$$h_a = 0.0011 (1 + 0.54 v^2).$$

In the experiments the draught did not exceed 700 ft. per minute, or 3.5 metres per second. It is possible that at higher velocities the law may change, but the velocities investigated cover those generally obtaining in electrical machines.

The third case, the cooling of the sides of a ventilating duct, was investigated in some experiments on a turbo-generator. We know that  $h_a$  must be zero when no air passes along the duct, and it seems to be almost proportional to  $v$ . Probably the line in fig. 3 may be taken to give the law of  $h_a$  for the ventilating ducts for a turbo-generator.

In predetermining the temperature rise of a wire-wound coil, we must first find the temperature rise of the external and internal surfaces of the coil. These will be the temperatures at which the coil can dissipate to the surrounding medium all the heat generated within it. In the next place we must find the rise of temperature of the hottest part above the external surface by taking into account the heat conductivity of the layers of insulated wire and the watts per cubic centimetre generated within the coil.

Where the coil is entirely air cooled, some rough estimate should be made of the mean velocities of air passing over the external surface and along the ventilating ducts, and from these the specific cooling constants can be arrived at from fig. 2.

Where the coil is a fairly tight fit on the pole, we should take account of the thickness and nature of the insulation and calculate the number of watts which will be conducted to the pole for a given temperature difference in the manner indicated in the example given in conjunction with fig. 1. It is useful to remember that a temperature gradient of 1° C. per centimetre in wrought-iron causes heat to flow at the rate of 0.7 watt per sq. centimetre. Account must also be taken of the means that are available for dissipating the heat from the pole itself.

By taking account of these matters and knowing the total watts lost in any particular coil it is not difficult to apportion the loss between the outside, the inside, and the ends of the coil, and come to a fairly accurate estimate of the temperature which the outside surfaces must attain in order to get rid of the heat. The next question that arises is: How much higher is the temperature inside the coil?

Most valuable data on the heating of shunt coils are given by Mr. E. M. Rayner in his "Report on Temperature Experiments at the National Physical Laboratory." The curves and figures given show that the distribution of temperature inside a wire-wound coil

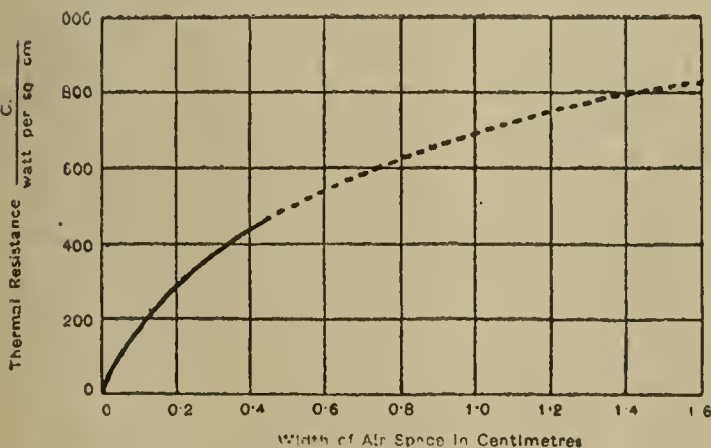


FIG. 1.—THERMAL RESISTANCES OF AIR-SPACES OF DIFFERENT THICKNESSES.

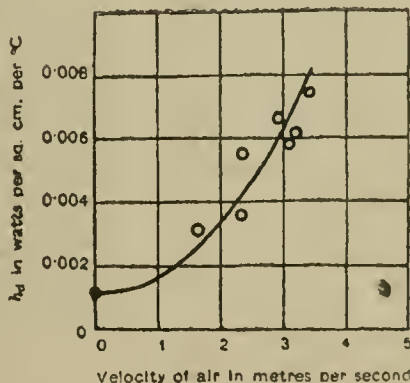


FIG. 2.—RELATION BETWEEN  $h_a$ , THE WATTS PER SQ. CM. PER °C., AND VELOCITY OF AIR WHEN AIR BLOWS UPON A CYLINDRICAL COIL.

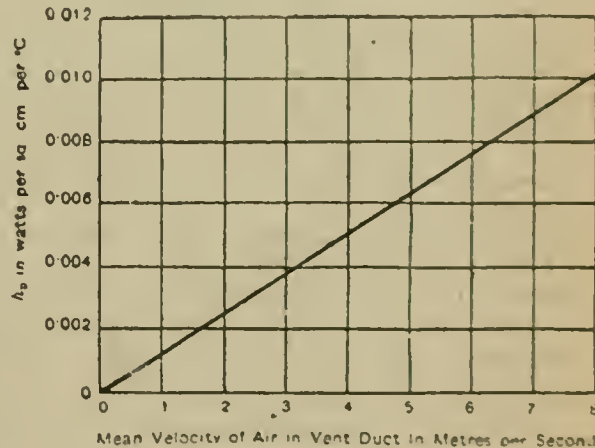


FIG. 3.—RELATION BETWEEN  $h_a$ , THE WATTS PER SQ. CM. PER °C. (DIFFERENCE IN TEMPERATURE BETWEEN IRON AND AIR) AND VELOCITY OF AIR IN VENTILATING DUCT.

follows definite laws. The problem is somewhat analogous to the case already considered where the heat is conducted along copper conductors, and the law of distribution of temperature takes the same general form—

$$T_x = T_{max} \cos p_1 x,$$

where  $T_{max}$  is the temperature of the hottest point measured from the absolute zero, and  $T_x$  is the temperature of any point distant  $x$  centimetres from the hottest point along a line drawn in the direction of the flow of heat at right angles to the cooling surface.

- If  $l$  = length of bobbin in centimetres.
- $d$  = depth of winding in centimetres.
- $C_d$  = current density in amperes per square centimetre.
- $C_x = C_d \sqrt{l(l + d)}$ .
- $\sigma$  = copper space factor.
- $i_n$  = thickness of insulation per centimetre of depth of winding.
- $h_a$  = heat conductivity of insulation in watts per square centimetre per °C. per centimetre of path.

Then—
$$p_1 = C_x \sqrt{\frac{1.6 \times 10^{-6} \times \sigma \times i_n}{h_a \times 273}}$$

In order to ascertain the values of  $h_a$ , the authors made direct experiments on the heat conductivity of cotton-covered wire windings. The results are given in the following table:—

VALUE OF  $h_a$  FOR WIRE-WOUND COILS.

Kind of wire.	How treated.	Dia. of wire. Inches.	$h_a$ Inches.
Square wire double cotton-covered	Made solid with electro enamel	0.114	0.00120 to 0.00140
	Untreated	0.114	0.00090 to 0.00100
	Impregnated and made into solid block	0.03 to 0.114	0.00085 to 0.00095
Round wire double cotton-covered	Treated with enamel	0.03 to 0.114	0.00065 to 0.00090
	Untreated, tightly wound	0.07 to 0.114	0.00050 to 0.00060
	Untreated, tightly wound	0.03 to 0.070	0.00040 to 0.00050
	Untreated, loosely wound	—	0.00020 to 0.00035

The quantity  $i_n$  is obtained by multiplying the number of layers per centimetre with the double thickness of cotton covering on each wire.

After we have provided sufficiently well for the conduction of the heat through the insulation either to the air or to the iron surrounding it, the next question is how to provide sufficient cooling surface so that the heat may be communicated to the air and carried away by it.

We know that 1 cb. ft. of air per second if raised in temperature 27° C., will carry away 1 KW. As a good deal of air sometimes passes through a machine without being raised much in temperature, it is usual to allow 100 cb. ft. of air per minute for each KW. loss.

In the open type of machine, where the quantity of air passing is usually unknown, only the very roughest empirical rules can be used for determining the temperature rise. Where, however, the definite paths for the air are provided in the machine, and where the quantity of air passing is known, the cooling effectiveness of the surfaces can be approximately calculated.

Experiments were made to determine exactly how the air received its heat as it passed through a turbo-generator and to determine the value of  $h_a$  (the watts per sq. cm. per °C. difference of tem-

perature between surface and air). As the value of  $h_a$  is dependent upon the  $v$ , and as it is the velocity of the air in intimate contact with the surface that is of chief importance, for a given quantity of air passed through the machine, narrow ducts will be more effective than wide holes. The ducts, however, must not be too narrow, or they will be liable to be stopped up by the accumulation of dirt. Ventilating ducts from 0.3 in. to 0.4 in. wide, having smooth iron walls, will keep clean for a great number of years if the velocity of air passing through them is sufficiently great. A velocity of from 5 to 10 m. per sec. is sufficient to prevent the accumulation of dust, in the absence of oil spray. Round axial ventilating holes, 2 in. or 3 in. in diameter, whose walls are formed from the rough punchings, accumulate the dirt very rapidly.

The radial ventilating duct is very effective: it enables an exceedingly large surface to be provided without unduly increasing the cost of the machine.

Tests were carried out on a totally enclosed turbo-generator of 1,875 K.V.A. capacity, ventilated by means of fans at each end.

The amount of air passed through the machine per minute was measured in two different ways: (1) An anemometer was used to find



the mean velocity of air at the exit in feet per minute, and this, multiplied by the area of the exit in square ft., gave roughly the cubic feet per minute. (2) The total rise in temperature of the air in passing through the machine was measured, and from the known losses causing the heating, the flow of air could be calculated. The first method was not as accurate as the second. It gave on the average an air velocity from 5 to 7 per cent. too high. We have therefore adopted the figures given by the second method. These are probably right within 5 per cent.

The total losses going to warm up the air were:—Windage, 22.8 KW.; excitation, 8.5 KW.; and iron loss, 43.5 KW.; total, 74.8 KW.

The air entered the machine at an average temperature of 21.7° C., and was expelled at an average temperature of 53.2° C., giving a temperature rise of 31.5°. Let us say that 4 KW. was lost by the frame. Then we have 70.8 KW. carried away by the air.

The temperature of the air in the various ventilating ducts and in the air-gap was measured by a pair of thermo-couples, mounted on a long wooden rod, which could be moved about in the ducts while the machine was running.

In the end bells the temperature had risen 9.8° C. and 10.2° C. respectively. The mean temperature rise of the air entering the ducts was 20.5° C., representing 46 KW.

The windage amounted to 22.8 KW. and the  $I^2R$  in the field to 8.5, so that we have 14.7 KW. in addition which must have been supplied by the iron loss, and communicated to the air mainly on the cylindrical face of the armature. A small amount—probably about 3 KW.—would be supplied to the air from the end plates of the armature. Deducting this, we have about 11.7 KW. conveyed to the air by the cylindrical face of the armature.

As the air passes along the vent ducts the temperature rises, the mean being about 10.2° rise, representing 23 KW.

Passing into the annular space in the frame the air picks up a little more heat from the punchings, giving a total temperature rise of 31.5°.

The temperature rise of the iron was, on the whole, from 10.5 to 8.5° above that of the air passing through the ducts.

These experiments show that  $h$  (the watts per square centimetre of cooling surface per °C. difference of temperature between surface and air) is almost exactly proportional to the velocity of the air, and is given by the equation  $h = 0.00145 v$ , where  $v$  is the velocity of the air in the ventilation duct in metres per second.

The heat conductivity across the laminations was found to be 0.0174 watt per sq. cm. per °C. per cm., or 0.0042 calories per second per sq. cm. per °C. per cm., the thickness of iron being 0.041 cm. and that of paper 0.0033 cm.

The loss per cb. cm. of iron was 0.055 watt, the machine being run at 30 per cent. above its normal field excitation. A more usual figure for 50 cycles would be 0.045 watt per cb. cm.; for a packet 4.5 cm. thick the excess of temperature would be 6.5° C. and the mean temperature of the iron above the surface only 4.5° C. It is seen that unless the packets are made much thicker than is usual in practice, the temperature rise in the centre due to the poor heat conductivity across the laminations is not of very great importance.

#### DISCUSSION IN LONDON.

MR. A. H. LAW, in opening the discussion, commented on the relatively small difference between the results for thermal conductivity for different classes of insulation, as shown in the author's tables; the lowest and highest figures were both for mica. The higher figure was for practically pure mica, and the mean of the figures for mica brought that material in line with the others, so that the difference was not very great. The different methods of ventilation shown in the paper were of interest; he had used the same system as that employed by the authors on their test machine—employing radial ducts—on machines up to 6,000 KW., and found it quite satisfactory. The question of cooling fans was rather a vexed one, owing to the inefficiency of the ordinary size fan. He gathered from the author's test machine results that that efficiency was about 2½ per cent. with a small amount of air, and 19 per cent. with a large amount, and these figures were usual. If an external fan were used, an efficiency with motor drive of about 60 per cent. could be obtained, and it represented a saving of 16 or 20 KW., and an increased rating of the machine. The system provided the greatest cooling in the rotor copper, then came the stator copper, and finally the iron. From the curves showing temperature of air and iron loss, it seemed that the iron loss was less at the centre than at the ends.

MR. E. H. RAYNER said he was told that if air was passed through a heated tube, the temperature of the air was very largely independent of velocity, so that a large range of velocity had little effect on temperature. The author mentioned that 300 lb. of air per minute were required for cooling, and the necessity of providing for this volume of air introduced difficulties in design and increased the size and cost. If it were possible to introduce a system of water-cooling, the volume of water required would be insignificant in comparison, and a saving in various directions would result. Other possible methods of cooling were the immersion of the machine or the stator in oil, or the use of hollow conductors with water or oil circulating through them. He questioned the accuracy of the anemometer results.

MR. A. R. EVEREST said that as a result of tests made on fibrous materials, he obtained figures for thermal conductivity much in excess of those mentioned in the paper, mentioning, as examples, 230° C. rise per watt per sq. in. for a taped and varnished coil, and 400° C. for micanite insulation. Pure mica had a high conductivity, but it could not be used. Many of the author's figures seemed to vary from those he had obtained.

MR. T. J. SACK noticed that high results for thermal conductivity were probably due to the method adopted, and in the case of some of the results, would be effected by air spaces. A good machine-wound tube of micanite should only have 5 per cent. of shellac and no air spaces, and it should give a better result.

MR. S. E. GLENDENNING said water-cooled motors were not quite new, but most users seemed to prefer air-cooled machines. The centrifugal effect of the cooling air in ducts should be remembered, as it led to the deposit of dust in corners.

MR. MILES WALKER, in replying, did not agree that the use of a separate fan would lead to any considerable increase in overall efficiency; the efficiency of the built-in fan was certainly low, and with a large machine a separate fan might be worth while. He agreed that temperature rise in the centre of long machines was greater than at the ends, due to the incoming air getting heated up, and this partly accounted for the small difference of temperature between the iron and air where the velocity of the air was high. The A.E.G. had built a machine with water cooling in the frame, and he thought that method might be used in large machines: oil immersion was also possible, and internally cooled conductors had also been employed. As regarded the criticism of the conductivity figures contained in the paper, he was rather surprised that they agreed so well with other people's results, as it so much depended on the methods employed and class or construction of material or apparatus employed.

#### DISCUSSION AT MANCHESTER.

DR. E. ROSENBERG said that in the absence of better knowledge regarding internal temperatures, electrical engineers had allowed a high factor of safety. Untreated cotton was not carbonised when subjected continuously to a temperature of 125° C.; paper and mica, of course, would stand much higher temperatures. With a room at 25° C., the limit for temperature rise would be 100° C., and specifying 40° C. measurable temperature rise at full load, this would allow a factor of safety of 2½. If the internal temperature differences were known, a greater temperature rise could be allowed with safer conditions. In order to keep the factor of safety the same in all cases, the allowable temperature rise should be decided by the external or room temperature. The authors had shown how detrimental air pockets were from a heating point of view, and it was generally understood also how detrimental they were from an insulation point of view. This pointed to the necessity of thorough impregnation.

DR. E. W. MARCHANT said with regard to heat conductivities that the best given in the paper for insulation was .009 for pure mica. The figure for copper on the same basis was 4.2, giving a ratio of heat conductivity between copper and mica of about 400. Referring to the effect of air velocities, Kennelly made some experiments which showed that the rate at which heat was lost was approximately proportional to the velocity with which the wire moved through the air. The temperature rise of a coil supplied with a constant amount of power, and in which the heat loss was assumed to be proportional to the temperature rise, was given by the

formula  $\theta = \theta_f \left(1 - e^{-\frac{t}{\tau}}\right)$ , where  $\theta$  is the temperature rise

at time  $t$ ,  $\theta_f$  is the final temperature rise,  $\tau$  = quantity usually called the "heating time-constant," and depends upon the mass and specific heat of the coil and on the radiating surface. The value of  $\tau$  might be found approximately, for a transformer or other similar machine, by observing the rate of decrease of temperature of the coils per degree of temperature rise. The heating time-constant was the reciprocal of this quantity. In order to estimate it the transformer might be run for a short time, the former supply to it shut off, but all cooling arrangements left working, and the rate of decrease of temperature observed. In a given case the temperature rise of a transformer was 20° C.; the power supply was cut off and the machine allowed to cool. The temperature fell 2° C. in 10 minutes, therefore—

$$\text{Time constant} = \frac{1}{\text{rate of cooling per } ^\circ\text{C.}} = 100 \text{ minutes.}$$

Theoretically, the temperature rise at the end of a time equal to the heating time constant would be 63.6 per cent. of the final rise. At the end of a time three times as great as the heating time constant, this temperature rise would be 95 per cent. of the final rise, and this time for a heat run was ample for all practical purposes.

MR. J. S. PECK said the question of predetermining the temperature rise in a new machine had been and was still a most difficult one. Differences of 50 per cent. in the temperature rise from the calculated values were not uncommon, and in most cases the temperature rise of a new machine was predicted from previous tests on a similar machines rather than from calculations of heat conductivity and radiation. The authors' paper brought them a step nearer that position in the design of electrical machinery when empirical rules would be replaced by exact mathematical formulae.

MR. CATTERSON SMITH referred to the empirical temperature formula given for the final temperature rise of the surface of an armature, which he understood had been checked by the authors for turbo-machines at 92 metres per second peripheral velocity. He did not think it was permissible to use that expression as it stood for other types of machines, and very different values of velocity, for, as was stated in the paper, the cooling depended greatly upon the design of the structure for ventilation, and he thought that was the explanation of the difference for the various expressions quoted. He was not quite prepared to agree that the formula for finding the temperature rise of the surface of wire-wound coils was suitable for use in machine calculations, owing to the practical impossibility of



estimating the air velocity with accuracy, and therefore he thought an expression of the same form as those previously taken for armatures had something in its favour. He gave some empirical linear law equations taken from tests on the field coils of multipolar dynamos; they referred to coils of the ordinary type wound in bobbins, and not split into ventilated sections. The surface  $o$  was the outside cylindrical surface, and  $v$  the peripheral velocity of the armature in metres per second.

$$\text{Small machines } t^{\circ}\text{C} = \frac{450}{o/w \times (1 + 0.02 v)};$$

$$\text{Medium size machines } t^{\circ}\text{C} = \frac{500}{o/w \times (1 + 0.026 v)};$$

$$\text{Large machines } t^{\circ}\text{C} = \frac{540}{o/w \times (1 + 0.024 v)}.$$

In the case of totally-enclosed machines it was found that as all the heat had to be dissipated eventually from the outside surface of the carcass, the laws of temperature rise appeared to be different. The temperature rise of electrical machinery was often of the form given by Dr. Marchant, but it very often departed greatly from the simple law owing to the complex nature of a machine when considered as a heating body.

MR. J. FRITH said that this paper had shown how important a part ventilation played in the design of an electrical machine. Some people, even including certain consulting engineers, seemed to look upon a fan in a machine with distrust, as if the machine had come out hot on test and the fan had been added as an after-thought. Throughout the paper it had been assumed that nothing could be done with the heat until it appeared at the surface. Could not some method be found for controlling the position of the isothermal surfaces, say by putting copper foil between the layers of a shunt winding in some such way as grading the insulation of a cable? The paper had not touched upon the resistance to the passage of air through an annular space, one side of which is revolving—e.g., the air-gap of a dynamo. Another point worth considering was the use of something other than atmospheric air for cooling entirely enclosed machines, such as turbo-generators. If compressed and cooled air was admitted into the case of such machines, the final temperature, at any rate, could be controlled; or if any imperfect gas, such as  $\text{CO}_2$ , were employed there would be a possibility of utilising some of the energy expended in the compression by allowing it to expand into the case, and so cool itself.

MR. K. FAYE-HANSEN referring to the resistance of air space as shown in fig. 1, suggested that the curve be drawn asymptotic to the horizontal line at the value of 1,800 and not 900, as 900 was a heat resistance between one surface and air, whereas when the air had to pass from one surface to another, it would have to overcome heat resistance from surface "to air," and again from air to the outside surface. The calculation of the heat conductivity along conductors was made on the assumption that there were no eddy current losses in the windings, hence in practice the temperature difference would be somewhat greater than that given in the paper. Neglecting the radiation by heat waves, there was no reason why the figures for armatures and field coils should not be the same if they could be reduced to the same basis, i.e., the actual air temperature, and the actual speed relative to the surface. The speaker believed that on this basis the cooling constants would depend upon the speed of the air, the conditions of the surface, and to some extent upon the temperature and the specific heat of the air, but would not be influenced by the way in which the relative speed between the air and the surface was obtained. In the case of a cylindrical rotor, rotating in a cylindrical stator, the relative speed between the surfaces and the air could probably be taken as approximately half the speed of the rotor. He had made some careful tests regarding the cooling effects of ventilating ducts in air-blast transformers, and the results agreed with those obtained by the authors in so far that at a given loss the cooling coefficient  $h_r$  was approximately proportional to the mean velocity of the air in the ventilating ducts (within the limits measured 3-20 m./sec.), the ventilating ducts in iron being from  $\frac{3}{8}$  in. to  $\frac{1}{2}$  in. wide. He found, however, that the more watts to be dissipated per sq. cm., i.e., the higher the temperature difference, the higher became the cooling coefficient. In calculating the amount of heat taken away by the air from the punchings, the authors assumed that all the increase in the temperature of the air in going through the ducts was due to the heat taken away from the iron, whereas a part of it must be due to the friction of the air on the side of the punchings. In this respect the authors had over-estimated the cooling coefficients. Regarding the measurement of air temperature, it seemed probable that the reading of the thermocouples would be influenced somewhat by radiation from the iron, so that the actual air temperature in the slots was probably somewhat smaller than that measured. A small error in temperature measurement would largely affect the result, and an error of  $1^{\circ}\text{C}$ . in air or in iron temperature might correspond to a difference in the coefficient  $h_r$  of approximately 50 per cent. It seemed that the authors' tests regarding the actual coefficient to be used in calculating the watts per sq. cm. of cooling surface and per degree C. difference of temperature between surface and air were not conclusive, but that further independent tests were necessary. The tests of both the authors and the speaker did prove conclusively, however, that with a given quantity of air passing through the machine the cooling effect would be better the higher the speed employed, so that from a theoretical point of view it was advisable to make the cooling slots as narrow as possible in order to obtain a high speed.

MR. W. POLLARD DIGBY asked whether there was any risk of the values obtained for tightly-wound fibrous materials being vitiated by the infiltration of films of oil. Further, was there not

a risk of uncertainty being introduced by the effect of the infinitesimal air film between them and thick material? Could it be assumed that the thermal conductivity of insulating materials was independent of temperature within the limits expected by designers of machines?

MR. J. G. CUNLIFFE said that football matches had accounted for very heavy loading on certain Manchester tramway routes, and in one district it was found necessary to load the trolley wire to the limit of its carrying capacity. The period of loading being very short, neither percentage energy loss nor pressure drop was of any importance, and the limit was controlled by the melting-point of the solder which secured the line to the ears. This experience led to a very careful investigation into the thermal characteristics of heavy copper conductors at high current densities, and in one particular at least the result touched the present paper. It was not generally realised how important it was to provide a dull black surface in order to assist in dissipating heat, as illustrated by the following comparison of new and old trolley wire:—

Nature.	Sectional area.	Amps. per sq. in.	Temp. rise after 30 min.	Remarks.
New copper wire	0.125 sq. in.	4,800	360° F.	Surface bright.
Old worn do. ...	0.12 "	5,000	285° F.	Upper surface black

The old wire which had been in service had a dull black deposit of atmospheric impurity on its upper surface, and the difference in temperature rise of  $75^{\circ}\text{F}$ . was due to the superior radiating properties of the black film.

MR. W. CRAMP said that the authors had set out to construct heat circuit equations, but having established some of the relationships necessary for these equations, they did not proceed to calculate probable temperature rises on these lines. There did not appear to be any reason why simple machines should not be so worked out, and then tested to ascertain how near the theoretical was to the practical result. With regard to the formula recommended at the end of the paper, containing a constant divided by a term involving the velocity, it was not clear whether the figure 333 had been compared with the theoretical result in the first part of the paper. He had worked out the result published by the National Physical Laboratory, and found that although 333 might be taken as a mean value, there were many cases where the constant varied nearly 100 per cent. It was misleading to suggest as a solution a formula which might have such an error. The results of tests at the National Physical Laboratory gave the following ratios of mean temperature rise to rise by thermometer:—3

Taped coils, machine light ...	...	1.7—2.3
" " loaded ...	...	1.9—2.5
Varnished coils, machine standing ...	...	1.4—1.8
" " loaded ...	...	1.8—2.2
Coils with taping removed, machine light ...	1.2	...
" " loaded ...	1.4	...

That was to say that the change of ratio due to varnish alone was about 10 per cent., and in some cases amounted to 20 per cent., which was an extraordinary result. He thought that anemometers were totally unreliable instruments for measuring air quantities. He agreed with the previous speaker that the paper formed a starting point towards the solution of problems involved in that which was now the real limit of continuous-current machine design, viz., temperature rise.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"B. E. E." writes:—"I shall be obliged if you can give me the date of your legal contributor's article on a case which was decided in the Courts some four years ago, referring to a gas company in London supplying a consumer within the area of supply of another authority; the case was, I believe, decided against the company."

\* \* The case alluded to was *Gas Light and Coke Co. v. South Metropolitan Gas Co.*, 62 L. T. 126. It appeared that by the *Metropolis Gas Act, 1890, Sec. 6*, the limits of each gas company then supplying the metropolis were defined, and in the result, each company enjoyed a practical monopoly in its own district. One of these companies, at the request of a railway company, placed a meter on a part of a railway station lying within the company's limits, and through it supplied gas to other parts of the premises situated outside the company's limits, and within the limits of another company. The Court of Appeal held this to be lawful, on the ground that the sale and delivery of the gas took place at the meter; but the House of Lords reversed this decision, holding that the gas was supplied where it was consumed, and, therefore, that the company were transgressing their authorised limits. It is to be observed that by the *Electric Lighting Act, 1909*, the supply of electricity outside the area of supply may now, under certain conditions, be allowed by the Board of Trade.



## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**SPAIN.**—The following statement shows the rates of duty leviable under the new Spanish tariff, which came into force on January 1st last, in so far as it affects electrical and similar goods. The rates under the old tariff are also given for purposes of comparison.

	Old tariff. Pesetas per 100 kg.	New tariff.
Insulating articles of mica or micanite or asbestos for electrotechnical purposes ( <i>so long as the Treaty with Switzerland remains in force</i> ) ...	25	25
Dynamos, electromotors, induction coils, resistance boxes, transformers and governors, weighing up to 100 kg. inclusive, and component parts of the same ...	75	75
Ditto, from 101 to 400 kg. ...	75	71
Switchboards and cut-outs, weighing up to 400 kg., and component parts of the same ...	75	75
Dynamos, electromotors, induction coils, resistance boxes, transformers, governors, switchboards and cut-outs, weighing—		
From 401 to 2,500 kg. ...	37.50	37.50
" 2,501 „ 5,000 „ ...	30	30
" 5,001 kg. upwards ...	20	20
(All three classes <i>so long as the Treaty with Switzerland remains in force.</i> )		
Accumulators and electric cells, and component parts of the same ...	25	25
Cable and wire for the conduction of electricity, covered with textile fibres, with or without insulating materials, the total thickness being 1 cm. or more ...	45	45
Other cables and wires, less than 1 cm. thick ...	120	100
Apparatus for telegraphs and telephones, electric meters and the like, including separate parts of the same ( <i>so long as the Treaty with Switzerland remains in force</i> ) ...	2	2
Arc lamps, and parts for the same, except carbons ...	2	1.60
Carbons for arc lamps ...	1	1
Electrodes for metallurgy and other similar uses ...	10	10
Incandescent lamps, mounted ...	8	8
Ditto, unmounted ...	10	10
	100 kg.	100 kg.
Winches, and separate parts of the same ...	22	20

NOTE.—25 pesetas = £1. Kilog. = 2.204 lb.

**UNITED STATES.**—In view of the many questions which have arisen as to the interpretation of the United States Government decision regarding the free entry of samples, the Treasury have more specifically defined the scope of the decision, and have laid down that it is not to be construed to permit free entry of articles suitable for use or sale as merchandise in the condition in which imported. Such articles cannot be admitted as samples unless they are cut or punched or conspicuously and indelibly stamped or printed with the word "sample," in such manner as to prevent their use or sale. Articles not so cut or stamped will be assessed with duty as merchandise. Articles imported for free distribution as advertising matter rather than as commercial samples, if suitable for use or sale as merchandise, will be assessed with duty. Articles reported by the Appraiser as samples not fit for use or sale as merchandise will be admitted free, notwithstanding the same may have an invoiced or entered value.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 1,121. "Electric motor starters." F. B. COX. January 15th.
- 1,157. "Telephone service meters." P. W. WALL. January 15th.
- 1,165. "Method of, and apparatus for, producing mezzotint stipple and other printing plates and autographic facsimile and other telegraphic records." H. S. BRIDGWATER. January 15th.
- 1,166. "Holders for electric lamps." A. R. MULLER. January 15th.
- 1,168. "Circuit interrupters for the transmitters of electric telephones." W. A. LOOAN. January 16th. (Complete.)
- 1,178. "Electric lamps." E. J. WILSON. January 15th.
- 1,179. "Electric lamps." E. J. WILSON. January 15th.
- 1,180. "Incandescent electric lamps." T. W. LOWDEN. January 15th.
- 1,186. "Appliances or means for mounting incandescent electric lamps and reflectors therefor." A. W. BEUTTELL. January 16th.
- 1,198. "Manufacture of hard electrodes for secondary batteries." A. WEDEKIND. January 15th. (Complete.)
- 1,203. "Fuse wire carrier." H. WHITTLE. January 16th.
- 1,205. "Combined electric wire connection and cord-grip." G. ST. J. DAY. January 16th.

1,224. "Safety devices for electrical apparatus used in mines, explosive works and the like." H. G. COTSWORTH. January 16th.

1,250. "Single-phase alternating-current repulsion motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, January 16th, 1911, Germany.) January 16th. (Complete.)

1,257. "Method for making electrical connection to the outer conductor of an electric wire or cable." F. NEWMAN and DRAKE & GORHAM, LTD. January 16th.

1,264. "Electric circuits and fittings therefor." J. H. CAVE. January 16th. (Complete.)

1,274. "Electric arc welding." A. P. STROMENGER. (Convention date, August 28th, 1911, Germany.) January 16th. (Complete.)

1,280. "Transmitting switch apparatus for the control of electric motors." VICKERS, LTD., and H. J. CREEFIELD. January 16th.

1,288. "Electromagnetic speed indicators." J. SCHUSTER. (Convention date, January 17th, 1911, Germany.) January 16th. (Complete.)

1,295. "Microphones." J. E. GERARD. (Convention date, January 18th, 1911, France.) January 16th. (Complete.)

1,302. "Arrangement of electric generator chiefly suited to the lighting of rail and road vehicles." A. E. BREWERTON. January 17th.

1,308. "Hoisting gear, winches, or the like operated by electric motors." D. WILSON. January 17th.

1,336. "Shades of electric incandescent lamps." J. FARLEY. January 17th.

1,365. "Operation of direct-current electric motors." J. S. PECK and S. ECKMANN. January 17th.

1,381. "Current inducing apparatus." C. O. BRETHERICK. (Convention date, January 17th, 1911, United States.) January 17th. (Complete.)

1,389. "Electric fuses." C. H. WORDINGHAM and E. R. GROTE. January 17th.

1,395. "Magneto-electric ignition apparatus." W. HEYER. January 17th.

1,435. "Electrical vaporiser for internal combustion engines." A. W. SCLATER. January 18th.

1,449. "Starting switches for the rotor circuits of alternating-current motors having wound rotors and slip-rings." J. G. SHAW and C. R. SHAW. January 18th.

1,453. "Sparking plugs." W. A. HARBER and H. FOWLER. January 18th.

1,454. "Electro-therapeutic appliances." C. J. WILSON. January 18th.

1,472. "Means for regulating dynamos and electric circuits." H. LEITNER. January 18th.

1,474. "Variable speed dynamos." H. LEITNER. January 18th.

1,528. "Miners' electric safety lamp." S. FRY. January 19th.

1,538. "Self-igniting switch electric lampholder." P. A. DE OTANDY-MENDY. January 19th.

1,541. "Means for controlling electrical apparatus from a distance." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, January 20th, 1911, Germany.) January 19th. (Complete.)

1,554. "Methods of neutralising electric charges formed on textile or other materials during the working process." SIEMENS BROS. & CO., LTD. (Siemens and Halske Akt.-Ges., Germany.) January 19th.

1,555. "Method of neutralising electric charges formed on textile or other materials during the working process." SIEMENS BROS. & CO., LTD. (Siemens and Halske Akt.-Ges., Germany.) January 19th.

1,569. "Means for controlling electrically-driven apparatus." H. T. HOLMES and AUTOMATIC ADVERTISING CO., LTD. January 19th.

1,609. "Means for holding globes in the galleries of gas and electric light fittings." G. HARROP. January 20th.

1,646. "Electric switch or nd fuseboards, or electric switches." E. J. SELBY and W. PRESTON, trading as W. Sanders & Co. January 20th.

1,658. "Registering calls between local telephone exchanges provided with automatic selectors." SIEMENS BROS. & CO., LTD. (Siemens & Halske, Akt.-Ges., Germany.) January 20th. (Complete.)

1,671. "Electrolytic apparatus." J. T. NIBLFTT. January 20th.

1,680. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD., and E. GARTON. January 20th.

1,681. "Voltage regulating systems." BRITISH THOMSON-HOUSTON CO., LTD., and E. GARTON. January 20th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

CIRCUIT SUITABLE FOR USE IN CONNECTION WITH AUTOMATIC TELEPHONE SYSTEMS. Western Electric Co. (Telephon Apparat Fabrik E. Zwietsch & Co.) 24,995. October 27th.

METHODS OF AND MEANS FOR CLEARING FAULTS ON HIGH-TENSION ALTERNATING-CURRENT SYSTEMS. R. TAYLOR. 27,312. October 8th. (Cognate applications, No. 23,511 of 1910 and No. 1,766 of 1911.)

BRUSH-HOLDERS FOR DYNAMO-ELECTRIC MACHINES. J. L. Manufacturing Co., and T. L. R. Reed-Cooper. 27,419. November 25th.

TELEPHONES. P. CLIMENT. 29,685. December 21st. (May 27th, 1910.)

SMALL-ARMS WITH ELECTRIC FIRING MECHANISM. A. TEPINS. 29,714. December 21st.

MULTIPLEX TELEPHONY AND TELEGRAPHY. G. O. SQUIER. 30,003. December 24th. MAGNETIC LIFTING APPLIANCES USED WITH CRANES. Steel, Peech & Tozer, Ltd., and H. E. BOWEN. 30,075. December 24th.

SETTING OF ANY APPARATUS FROM A DISTANCE. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 30,292. December 30th.

FLAMING ARC LAMPS. J. L. DINSMOOR. 30,319. December 30th.

PORTABLE ELECTRIC CLUSTER LAMPS. F. KIRBY. 30,343. December 31st.

### 1911.

GAS-PENDANTS AND ELECTROLIERS. J. J. PASLEY. 738. January 11th.

CONSTRUCTION OF ELECTRIC LAMP SIGNALLING APPARATUS, SPECIALLY APPLICABLE FOR MILITARY PURPOSES. R. STEWART and N. STODLEY. 2,690. February 2nd.

DYNAMO-ELECTRIC MACHINERY. Lancashire Dynamo and Motor Co. and R. McLeod. 2,867. February 4th.

ELECTRIC FIRING DEVICES FOR ORDNANCE. William Beardmore & Co., A. Bremberg and A. Banks. 6,117. March 10th.

ELECTRIC MOTOR STARTING AND PROTECTIVE DEVICES. British Thomson-Houston Co. (General Electric Co.) 6,168. March 11th.

ELECTRIC METERS. British Thomson-Houston Co. (Allgemeine Elektrizitäts Ges.) 7,669. April 3rd.

ELECTRIC TIME-RELAYS. British Thomson-Houston Co. (Allgemeine Elektrizitäts Ges.) 7,894. April 4th.



# THE ELECTRICAL REVIEW.

Vol. LXX.

FEBRUARY 9, 1912.

No. 1,785.

## ELECTRICAL REVIEW.

Vol. LXX.]	CONTENTS: February 9, 1912.	[No. 1785.	Page
	The Civils and the Consulting Engineer...	...	201
	The Telephone Service ...	...	202
	A Question Important to Tramway Companies...	...	202
	A Contract to Supply Motive Power in New South Wales ...	...	202
	Wood and Concrete Poles in Electrical Service ( <i>concluded</i> ) ...	...	203
	Railless Tramways ...	...	204
	A New Electrical Ship's Telegraph Apparatus ( <i>illus.</i> )...	...	205
	Correspondence :—		
	The Electric Vehicle ...	...	206
	The Economy of Electric Cooking ...	...	207
	The Electrical Profession as It Is ...	...	207
	Earthed Concentric System ...	...	208
	Legal ...	...	208
	New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	209
	Business Notes ...	...	210
	Notes ...	...	217
	City Notes ...	...	221
	Stocks and Shares ...	...	227
	Electric Tramway and Railway Traffic Returns ...	...	228
	Share List of Electrical Companies ...	...	229
	Metal Market.—Fluctuations in January ...	...	231
	Construction and Characteristics of the Neon Lamp ...	...	231
	Electric Power for the Panama Canal.—III. ( <i>illus.</i> ) ...	...	232
	Proceedings of Institutions :—		
	The Electrical Driving of Rolling Mills ( <i>illus.</i> ) ...	...	235
	The British Electrical and Allied Manufacturers' Association ...	...	238
	New Power Station at Bury ( <i>illus.</i> ) ...	...	239
	New Patents Applied For, 1912 ...	...	240
	Abstracts of Published Specifications ...	...	240
	Contractors' Column... Advertisement pages xxii and xxiv		

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: J. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers.

PARIS: BOUYEAU & CHEVILLET, 22, Rue de la Banque.

BERLIN: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION READY  
NEXT WEEK.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.

## THE CIVILS AND THE CONSULTING ENGINEER.

THERE is an old proverb, generally honoured in the observance, to the effect that one should speak well of the dead; or, at the least, that no ill should be spoken of them. It is somewhat in this spirit that we again refer to the Association of Consulting Engineers, for although its death has not yet been officially announced, it has received its death blow at the hands of its friends.

Having apotheosised the Institution of Civil Engineers as the fount of honour and the custodian of all the engineering virtues, it has sought to arrogate to itself a ray of the divine effulgence and to claim a lawful kinship with the "parent Institution."

From the first, the promoters of the Association have kow-towed and pandered to the Civils, and they have made corporate membership of that Institution an essential qualification for membership of the proposed Association; although, in deference to our criticisms, this condition was for a time waived, it was subsequently restored, doubtless as an act of filial penitence in the hope of receiving the parental benediction, which, as it now appears, had been previously withheld.

"It's a wise child that knows its own father," and from the letter which we reproduce below, it is very clear that the Institution of Civil Engineers disowns all paternal responsibility in connection with the precocious youngster.

At the recent inaugural meeting of the Association a question was asked as to the attitude of the Institution, and considerable importance appeared to be attached to this. In reply to the question the chairman, Mr. Swinburne, commenced to read a letter which he had received from the Council, but, after reading the opening paragraph, he discovered that the letter was marked "private and confidential," so the contents were not made public; the chairman remarked however, that the gist of the letter was that the Institution did not quite see the necessity for the new Association. This was putting the matter somewhat more mildly than the letter warranted. Apparently the intention of the Council was to indicate as gently and as courteously as possible its disapproval of the proposals of the Association, and it was no doubt thought that in view of this opinion the matter would proceed no further.

Seeing, however, that the gentle hint conveyed in the letter was ignored, and that the promoters of the Association persevered in their attempts to form a boycotting clique, the Council of the Civils has now issued a copy of the letter to all the Corporate members of the Institution. This letter, copies of which have reached us from several sources, reads as follows :—

The Institution of Civil Engineers,  
Great George Street, Westminster, S.W.

30 January, 1912.

Dear Sir,—In view of numerous inquiries addressed by members to the Council and this office as to the position of the Institution with respect to the formation of the Association of Consulting Engineers, the Council consider that it is now desirable that their views on the subject, as expressed in a letter written by their instructions in October last, should be made known to the Institution generally. The letter referred to was treated as at that time confidential to those identified with the proposal to form the Association; but for the reasons above stated the Council have directed that a copy of it (appended) should be communicated to the members.

I am, yours faithfully,  
J. H. T. TUDSBERY, *Secretary*.



[Copy of the Letter referred to.]

A. H. DYKES, Esq.,  
1, Victoria Street, S.W.

28 October, 1911.

PROPOSED ASSOCIATION OF CONSULTING ENGINEERS.

Dear Sir,—Referring to the communications received from you on behalf of the proposed Association of Consulting Engineers, and to the views expressed by members of the deputation which was received by the Council, I am desired to say that the Council have considered very carefully the proposals of the Association and the representations submitted by the deputation.

The Council are in cordial sympathy with the objects of the deputation in so far as they are directed to the maintenance of a high professional tone among engineers and to the prevention of abuses which operate to the disadvantage of engineers occupied in private practice.

The definition of a "consulting engineer" obviously presents no small difficulty, and apparently no complete conditions have been laid down, the fulfilment of which would entitle an individual to claim the distinctive title of consulting engineer which members of the Association propose to adopt.

The Council hold the view that no body or organisation can be in a position to give a better and more satisfactory professional qualification than the Institution itself; and it is obvious that, when possessed of such a qualification, any member of the Institution who duly adheres to its rules of professional conduct, should be able to exercise freely any professional engineering functions.

The Council also observe that the proposals of the Association involve the omission from the category of consulting engineers of persons who occupy at the time official positions, although they may be at the same time frequently called upon to act in a consultative capacity in engineering matters of no less importance than those dealt with by engineers who do not hold such posts.

It is thought that any step tending to exclude from advisory and consultative work engineers who hold official positions in the various branches of the profession, and whose experience may specially qualify them to give advice on matters with which they are conversant, would be an injustice to them and a serious loss to the public interest.

The Council feel obliged to express the view that, under the conditions put before them, it would be undesirable for the Institution to lend its official support to the proposed organisation.

I am, dear Sir, yours faithfully,

J. H. T. TUDSBURY, *Secretary*.

This communication, then, assuredly sounds the death-knell of the Association as a responsible body, and it would be more polite than truthful to say that we regretted to have to announce its passing away. Possibly from its ashes may arise an association established on a broader basis, which shall command the confidence and support of the whole body of technical practitioners.

**The Telephone Service.**

SINCE the transfer of the National Telephone Co.'s undertaking to the Post Office, there has been a singular outburst of complaints against the service in the public Press, and it is freely asserted that it has greatly degenerated in efficiency. Specific instances of delay in connection and other faults are quoted, and a Telephone Users' Association has already been formed for the protection of the subscribers.

We have throughout consistently opposed the absorption of the company's system by the State, holding that efficiency and progress were more likely to be achieved by the former than the latter, and that the multiplication of Civil Servants was a grave error. Our attitude on this question is unchanged, but we cannot help feeling that the present agitation is grossly unfair to the Post Office. Be it remembered that the staff, the operators and the apparatus so recently taken over from the company are, with few exceptions, absolutely the same as under the old régime. Are we to believe that the Government service is so demoralising that within one month the system has been reduced to a state of chaos, and that the operators have become utterly indifferent to the efficient performance of their duty? Surely this is an incredible and unworthy suggestion.

We have for years used both the National Telephone Co.'s service and that of the Post Office, and while we have certainly found the former quicker and more satisfactory than the latter, we have not detected the slightest difference between the service in December and that given in January. It is no better—but it is no worse.

It is, we believe, generally admitted that State service, like municipal service, is not conducive to the display of energy and smartness on the part of the employés; we do not wish to cast aspersions on the character of a large body of our fellow-citizens, but the fact is notorious, and is the inevitable outcome of the conditions of service, in which, as a rule, reasonably good conduct and a moderate output are sufficient to enable an employé to remain on the establishment for life; but we cannot suppose that in one month the habits of years can be changed, and that the company's staff has lost its keenness so quickly. In common fairness, at least a year should be given to the Post Office to show its mettle; the present attacks can only be ascribed to political or other extraneous motives.

**A Question important to Tramway Companies.**

A CASE which involved a small sum of money, but a large and important principle, was recently decided by the Registrar of the Birmingham County Court. We are all accustomed to notices along a tramway route, "Cars stop here if required," &c. The question was:—Is the corporation or company responsible for the running the trams bound to carry out the promise conveyed by such a notice? In the case in question a Mr. Alfred Crane, who lives at Handsworth, desired to go with a party of friends to play golf. In order to get to the railway station they desired to use the Birmingham Corporation Tramways, and waited accordingly at an occasional stopping place. The tram which was due failed to stop, with the result that Mr. Crane and his friends lost their train, and were compelled to hire a wagonette, thus incurring additional expense to the amount of 18s. For this sum he brought the suit in the County Court. It appeared that on the day in question the car had been delayed owing to the road being under repair, and an inspector who was on board had told the driver to run past the spot without stopping. The Registrar gave judgment for the Corporation, saying:—"I do not think there was any obligation for the car to stop at Whitehall Road. I am quite satisfied that the inspector did what was reasonable in sending the car to the next compulsory stop. There is no liability to run to time. If there was, the liability of the Corporation through persons missing trains because a car was late would be unlimited." The decision is satisfactory for the tramway authority. It is manifest that no one responsible for the working of a tramway system could guarantee the running of cars to time, having regard to the exigencies of traffic; but the legal point, now decided by the Registrar, is that the posting of a notice in the street, and the usual practice of running cars at regular intervals or otherwise, raises no implication, and amounts to no warranty. While respecting the decision of the learned Registrar, we can see that there is a great deal to be said in support of the plaintiff's case, and tramway companies might be well advised to devote some of the advertising space on the backs of tickets to a disclaimer of all responsibility for the consequences of unpunctuality.

**A Contract to Supply Motive Power in New South Wales.**

IT is not often that the Law Reports for New South Wales contain anything which throws light upon, or assists the interpretation of, the English law relating to electricity. In the case of *The Electric Light and Power Supply Corporation, Ltd., v. Cormack*, which was heard in the colony last year, and is now reported in Vol. XI of the New South Wales State Reports at page 350, it appeared that the defendant contracted with the plaintiffs to use their power supply for his works for two years, and not to install any other form of motive power during that period. During the two years the defendant sold his works to a company, of which he became the manager; and the company installed motive power other than that supplied by the plaintiffs. It was held that the company was guilty of no wrong in installing other motive power, and there was no reason for restraining the defendant from doing, as the servant of the company, such acts as the company might lawfully do.



WOOD AND CONCRETE POLES IN ELECTRICAL SERVICE.

By W. MANKTELOW.

(Concluded from page 194.)

**Copper Sulphate Process (Boucherie).**—In this process sap is expelled from the wood under high pressure, and a strong solution of copper sulphate is then injected from the end of the wood. After very extensive and prolonged trials, particularly on the Continent, this system of preservation has fallen into general disfavour. Copper sulphate is much inferior to creosote, mercuric chloride, and even zinc chloride as a germicide and fungicide ; weight for weight, the copper salt is fifty times as costly and roughly half as effective as creosote. By this process, timber must be treated within a few days of its felling, and it is exceedingly difficult to work with lengths greater than 16-20 ft. The general inferiority of the protection afforded, to that given by creosote, is shown by the following official data :—

AVERAGE LIFE OF POLES IMPREGNATED WITH COPPER SULPHATE.				
Austria—	Life in 9 districts varies from 8·9 to 21·9 years.			
	Average life for whole country	12·8	"	
Germany—	"	14·5	"	
France & Holland	"	15·0	"	

**Corrosive Sublimate Process (Kyan).**—Protection here depends upon the formation of a very stable substance by the interaction of a weak mercuric chloride solution with the albumen of the wood treated. A solution of corrosive sublimate in water (1 lb. of sublimate to 10-15 gallons of water), is placed in a wooden vat so built that no metallic parts can come into contact with the solution. Though one of the earliest protective processes evolved (patented 1832), this system has proved very effective, and, under favourable circumstances, is a close rival to creosote (Table III). A serious disadvantage is the possibility of surplus sublimate being washed out by rain, thus endangering the purity of well water in the neighbourhood besides reducing the efficacy of the pole protection.

**Zinc Chloride Process (Burnett).**—Consists in forcing an aqueous solution of zinc chloride into the pores of the wood, under considerable pressure. This salt is a good germicide and exerts a considerable waterproofing action ; its use will double the life of most pole timbers (see Table III.)

With the object of preventing the leaching out of zinc chloride from the treated timber, *Rutgers* has introduced a modification of the original Burnett process, in which an emulsion of zinc chloride and creosote oil is injected under pressure, being meanwhile kept in uniform mixture by a centrifugal pump. The theory of the process is that the oil should remain in the surface pores, there forming a waterproof coating. There seems great difficulty in securing sufficient penetration of the emulsion, and the process has so far had but limited application.

**Miscellaneous Impregnating Processes.**—Among the older processes may be noted Blythe's (in which crude carbolic acid is forced into the dried timber), and a process which simply exposes the wood to live steam at about 200 lb. per sq. in. Under the combined influence of heat and pressure, the sap in the wood is chemically changed, and acquires a certain preservative value.

The Austrian Postal and Telegraph Bureau claimed to have secured results equal to, or better than, those given by creosote by treating pine fir and spruce poles with acidic zinc fluoride (ZnF<sub>2</sub> 2HF). Favourable reports are also current respecting the value of "bellite" (sodium fluoride + dinitrophenol + aniline oil) as an impregnator.

**Cost of Treatment.**—The data shown in Table III are compiled from exhaustive reports by the German postal authorities and various American bodies ; though actual costs vary considerably with locality, soil and climate, the relative values shown are representative.

With these figures may be compared the experience of a large American traction company concerning the treatment of track ties (which are subject to much the same conditions as pole butts). The lives reached by zinc chloride

and creosote treatment, and the relative costs of these processes, were as follows :—

	Average life.		Relative cost.	
Untreated	...	5 years	1·00	
Zinc chloride	...	11 "	1·20	
Creosote	...	16 "	1·53	

The cost of creosoted southern pine poles to the Birmingham Railway Light and Power Co. during 1910, was :—

Length.	Top diameter.		Cost per pole.	
30 ft.	8 in.	...	27s. 10d.	
30 ft.	10 in.	...	33s. 2d.	
30 ft.	13 in.	...	45s. 5d.	
35 ft.	8 in.	...	31s. 5d.	
35 ft.	10 in.	...	39s. 7d.	

(The average cost per pole for 180,000 untreated pine poles of various lengths used in the U.S.A. during 1909 was 11s. 7d.)

CONCRETE POLES.

In the construction of these poles, from 4 to 12 reinforcing members are fixed symmetrically in a horizontal wooden or metallic mould to form a skeleton round which a suitable concrete mixture is then well tamped. The most common pole sections are circular, square and hexagonal, and it is usual to taper the poles at the rate of 1 in from 100 to 200, (1 in 120 is very common). By casting the pole with a central tunnel, an improved utilisation of material is secured, and a very convenient duct is provided in which to carry electrical conductors away from all risk of mechanical or climatic damage.

A suitable concrete mixture is one part of cement to two of sand and three or four of crushed marble, limestone or other aggregate (in  $\frac{1}{4}$  in. to  $\frac{1}{2}$  in. pieces). As reinforcement,  $\frac{1}{4}$  in. to  $\frac{3}{4}$  in. steel rods or bars may be employed. These should *never* be oiled or painted, as has been suggested by some misguided persons ; such preliminary protection is quite unnecessary, and merely reduces the bond between the concrete and the steel from 300-800 lb. per sq. in. to 10-100 lb. per sq. in., *i.e.*, to a negligible value. To increase the total cohesion between the concrete and the steel rods, the latter may be twisted. Excellent results have been secured in Oklahoma by reinforcing concrete distribution line poles with 12  $\frac{1}{4}$ -in. twisted bars, each placed under 11,000 lb. tension till the concrete has set thoroughly.

TABLE IV.—AMERICAN CONCRETE POLES (cf. TABLE I).

Purpose.	No. used.	Length ft.	Diameter. Base.	Top.	Section.	Weight lb.	Cost per pole
Tungsten lamps	—	12	—	—	Circular Hollow	—	16s.
"	—	25	8 in.	5 in.	Square	1,185	30s.
"	—	35	11 in.	7 in.	Circular	—	34s.
"	—	35	14 in.	6 in.	Square	2,500	60s.
Heavy 'graph and 'phone	200	35	Taper	1/120	Sq. Chamfered	5,300	—
	—	65	Taper	1/120	Sq. Chamfered	17,300	—
Transmission line	1,000	35	16 in.	7 in.	{ Hexagonal 9 in. to 2 in. centre hole. }	2,000	34s.
	—	25	—	—		—	24s.

The moulds or "forms" used (which are, of course, in two parts) may be of wood or  $\frac{1}{4}$ -in. galvanised iron, with stiffeners at intervals. If it is desired to cast hollow poles, a tapered, preferably telescopic, core piece must be used, and this must be removed directly the surrounding concrete will bear its own weight ; otherwise it may be impossible to release it later. The number of cores required is only half the number of forms in use.

The "walls" of hollow poles should be at least 2-3 in. thick, and, in any case, the reinforcing steel should at no point be covered with less than 1 in. of concrete. A considerable economy may be realised by casting such bolt holes as may be required for attachments to the pole, during the manufacture of the latter ; ragged bolts, and even cross-arm structures (galvanised or plain rolled sections) can be cast in the pole at negligible cost.

**Costs and Erection.**—According to size and design, the cost of a pair of "forms" may range from £9 to £20. A gang of five men working on 12-16 forms should make 6-8 poles per day. The poles "set" in the moulds for two days, and, after lying for a further four days, they are seasoned for



not less than ten days before use; a longer seasoning period is very desirable. Strengthening of the pole with age goes on for a very long time, poles which have been in use for some years being considerably stronger than those newly erected.

The erection of concrete poles is effected by the same means as are employed for wooden poles. Main strength alone suffices for the smaller sizes, but a derrick is necessary for larger poles. From 5 to 7 ft. of the pole-butt is buried according to the nature of the foundation; in marshy districts, a deeper submersion may be necessary, and, in such a case, it is desirable to brace the pole to a creosoted rough timber foundation raft or grill (from 5 to 8 ft. sq.), placed about 5 ft. below ground level; the pole may penetrate this grill to any desired depth, and the footing should be filled in with rock and clay. A span of 100 to 150 ft. is suitable for small poles, rising to 200, 300, or even 500, ft. on heavy line and high-tension transmission routes.

Owing to their weight and indivisibility, concrete poles should be built as near as possible to the site of their utilisation.

Some idea of the weight and cost of concrete poles for various purposes may be gleaned from Table IV summarising the equipment used in a number of American towns where this type of pole has been more or less widely adopted; it is interesting to note that in Oklahoma, concrete poles for ordinary central station distribution service have been adopted as standard, after careful trials extending over the past four years.

The weight of reinforced concrete, as used in the present service, varies from 100 to 160 lb. per cb. ft., the corresponding weights of various timbers being:—

Fir, red larch, pine	...	...	30—42 lb. per cb. ft.
White cedar, new	...	...	39 "
Ditto, seasoned one year	...	...	25 "
Chestnut...	...	...	34—43 "
Oak	...	...	50—60 "

The initial outlay on reinforced concrete poles of the class here considered, usually lies between 1s. and 2s. per ft. of length, and averages 1s. 3d. per ft. (U.S.A. values, since little work has yet been done in England in this direction). Now, the mean price of cedar poles in the States was 7s. 8d. each in 1909 (see Table I)—*i.e.*, about 4d. per ft., assuming a mean length of 25 ft. Thus the cost of concrete poles appears to be three or four times as great as that of wooden poles, but it must be remembered that, in this comparison, the concrete poles are artistic products, ready for immediate erection in any surroundings and provided with all the necessary attachment sockets, bolts, &c., whereas the wooden poles are as delivered untreated from the timber yard. Much lower relative costs of concrete poles are claimed by some American makers, but it is not clear, in such cases, to what stage of the manufacture the estimates refer. Taking the overall cost from raw material to finished pole placed in service, it appears that concrete construction is 50—100 per cent. more costly than wood, but the additional outlay is justified by the more pleasing result and by the negligible cost of attending to and repairing the concrete poles. No estimate can yet be made of the life of well-made reinforced concrete poles, but the demolition of certain poles which had been in use for seven years showed no trace of surface or internal deterioration or moisture infiltration at any point.

Briefly reviewing the advantages and disadvantages of reinforced concrete poles—for telegraph and telephone lines, central station distribution lines, lamp-posts and trolley-poles—as apparent from the present state of their development, we may say that:—

Reinforced concrete poles are applicable to any special requirements, mechanical or architectural. They are dear and heavy, but they can be built as near as desired to the site of the erection, and being practically everlasting, their net annual cost is probably less than that of wooden poles. For a number of years the strength of the pole actually increases, and should failure occur at any time, the pole will rarely actually fall. A surprising degree of flexibility is attainable. Thus, a certain type of hollow pole, 30 ft. long, tapering from 16 in. to 7 in. diameter and having  $2\frac{3}{4}$ -in. walls and  $12\frac{1}{4}$ -in. twisted bars as reinforcement, gave  $2\frac{1}{2}$  ft. deflection without sustaining injury, when subjected to 1,500 lb. lateral top pull.

In short, reinforced concrete construction affords an excellent and economical substitute for wood in every pole service to which the latter is at present applied, but the concrete must at no point be expected to act as an electrical insulator or the reinforcing bars will be speedily destroyed and the entire replacement of the pole will be necessary.

## RAILLESS TRAMWAYS.

[FROM A LEGAL CONTRIBUTOR.]

IN view of the interest that is being taken in so many parts of the kingdom in railless "tramways," consideration may be given to the legality of this form of locomotion. Could it be established without the sanction of an Act of Parliament?

A moment's reflection will show that this particular form of "tramway"—one adopts the word for want of a better—is wholly different from that with which we are generally familiar. In the first place, it need involve no interference with the surface of the street—a matter of importance both from the legal and the practical point of view. In law the rights of a highway authority are such as to enable that body to prevent any person laying tramlines in a roadway, because the works must inevitably involve interference with traffic. Again, in the case of an ordinary electric tramway worked on the overhead system which involved the use of poles embedded in the footway, it is clear that such poles would interfere with the use of the street for vehicular or foot traffic, and would be prevented by the Courts at the suit of the local authority. It is, however, important to remember that the overhead part of an electric tramway system may conceivably be erected, and be allowed to remain in position, without involving any interference with the rights of persons using the road in the ordinary way. The soil of a highway belongs to each owner of the soil on either side *usque ad medium filum viae*, and each such owner is entitled to make use of his property as he chooses, provided he does not interfere with the right of the public to pass and repass along the road. In the enjoyment of his right he would be at liberty to allow wires to be suspended over his freehold. Cross wires, which at the present time are often used for suspending trolley wires, might be affixed to the walls of adjoining houses or to poles in the gardens of the frontagers. By this means the trolley wires could be suspended over the highway without any interference, temporary or permanent, with the traffic passing beneath. Leaving out of consideration the question of feeders, which might conceivably be laid on property adjoining the highway, it will be seen that, so far as the highway authority is concerned, the main part of a railless tramway could be laid by private individuals without any interference by the highway authority as such.

The fact that a highway or other local authority which does not own the soil of the roadway is unable to prohibit the erection of wires in the manner above described, is well established by numerous decisions. For instance, in *Finchley Electric Light Co. v. Finchley Urban District Council* (1903) 1 Ch. 437, the plaintiffs were a limited company supplying electricity, but without any statutory powers. The defendants cut the wires and threatened to cut any wires which the plaintiffs should carry over any street within their district. Upon their bringing an action for an injunction and damages, it was held that the local authority had no right to interfere. No statute since passed has modified the rigour of this decision.

So long as the regulations of a local authority made pursuant to the Public Health Acts Amendment Act, 1890, as to overhead wires, the requirements of the Postmaster-General for the protection of telegraph and telephone wires, and the Regulations of the Board of Trade, made pursuant to the Electric Lighting Act, 1888, are complied with, it seems that the overhead part of a railless tramway system could be set up without any special Act of Parliament. It has been decided, of course, that a tramway company which

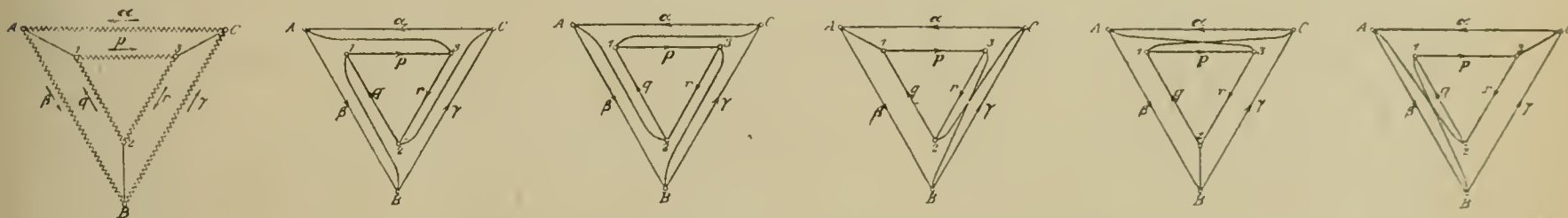


lays down unauthorised lines is guilty of a trespass, and may be sued accordingly (*Bideford U.D.C. v. Bideford and Appledore Railway* (1903), 68 J.P. 123); but, as has been shown above, such interference with the surface is not absolutely necessary in the case of a railless system.

The foregoing statement of the law applies only to the case of a railless tramway proposed to be worked by a private company. A municipality could not expend any part of the ratepayers' money in promoting a railless scheme. Nor, indeed, would the establishment of such a system be very feasible without the consent and co-operation of the local authority.

## A NEW ELECTRICAL SHIP'S TELEGRAPH APPARATUS.

THE electric transmission of signals is in widespread use on war ships as well as merchant ships, in railway and mining work, in electric generating stations and in many similar situations. It is generally worked by direct current, but many cases occur in which the use of alternating current would be a convenience, and the following apparatus, due to Herr Carl Meyer, of Hamburg, enables this to be done, and is said to form a more certain and quick transmission scheme than those hitherto used. The arrangement\*



FIGS. 1-6.—CONNECTIONS OF CONTROLLER TYPE OF APPARATUS.

is based on the same principle as that of the ordinary rotary synchroniser, viz., the interaction between the rotor and stator of an induction motor in which both rotor and stator are supplied from outside with independent currents of the same frequency.

If, for instance, an induction motor is constructed with an ordinary three-phase stator connected to a three-phase supply and with a rotor carrying a single coil supplied from one phase of the same supply, the rotor, if left free to move, will automatically set itself in such a position that at the instant when the flux produced by the rotor coil is a maximum, the direction of this flux coincides with the direction occupied at that instant by the steadily rotating field set up by the stator. A pointer fixed to the rotor will, therefore, come to rest at a definite point on the periphery. If the phase relation of the rotor and stator currents is changed, for instance, by connecting the rotor to a different phase of the supply, or by inserting a choking coil in the rotor circuit, the rotor and its pointer will move into another definite position, and come to rest there again.

The receiver of the new apparatus, then, consists in principle of a small two-pole induction motor with single-phase rotor winding supplied through two flexible leads or through two collector rings.

The stator is supplied from a two or three-phase supply if this is available, or, if preferred, from a single-phase supply with the necessary phase-splitting device, as used in single-phase induction motors, for producing a rotating field. The rotor is supplied permanently from one phase of the same supply.

The transmitting device may take the form of a small drum controller, which serves to vary the connections of the stator to the supply generator. With a three-phase supply six such variations are possible, as is shown in figs. 1 to 6, where A B, B C and C A represent the supply generator windings, and 1-2, 2-3 and 3-1 represent the receiver stator windings.

If six positions of the indicator are insufficient, the writer shows that this number may be doubled by simply making the controller at one point reverse the connections of the receiver rotor to the supply, provided that some lag is present between the currents and the voltages of the receiver stator coils—a condition which is generally present, or can be easily arranged for artificially.

The number of positions can be still further increased by 12 or multiples of 12 by the simple device of introducing various values of inductance into the receiver rotor circuit at definite points in the rotation of the transmitting controller.

Where, however, such large numbers of positions are required a simpler arrangement is usually employed. This consists in replacing the transmitting controller by a small induction motor with single-phase rotor carrying the transmitting pointer. The stator of this transmitter is connected to the same supply as the stator of the receiver, whilst the rotor winding of the transmitter is connected electrically to the rotor winding of the receiver and supplies the latter with its working current. The transmitter rotor being held at rest at any point in its rotation is cut by the flux of the revolving field set up by its stator, and has an alternating current induced in it which reaches its maximum instantaneous value at a different instant (relatively to the supply alternations) for each position of the rotor. The transmitter is, in fact, nothing else than the well-known phase-shifting transformer. By its use, theoretically, an infinite number of indicator positions is obtainable, since the receiving rotor will move

into exactly the same position in its stator as that occupied by the transmitting rotor at any given time.

The number of leads required between the transmitting and receiving stations is also reduced, but, on the other hand, the weight, cost and power consumption of the transmitter are increased, so that, unless the number of indicator positions is very large or unless the signals are to be simultaneously

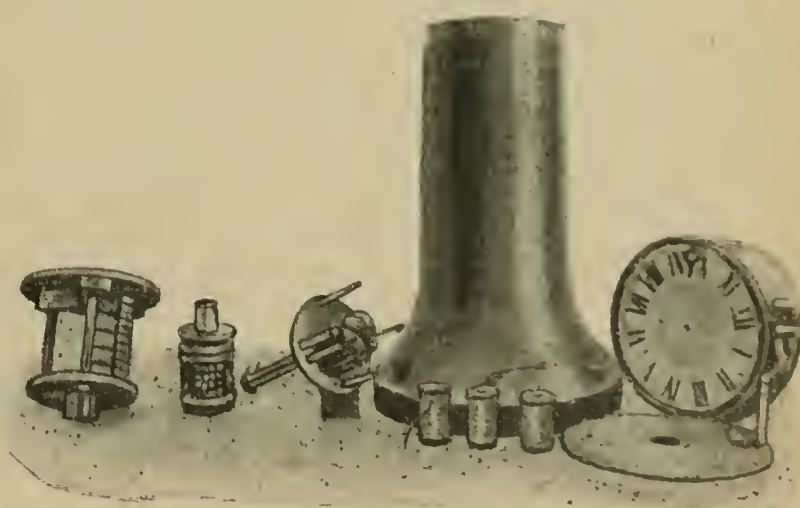


FIG. 7.—COMPONENT PARTS OF COMBINED RECEIVER AND TRANSMITTER.

delivered at a large number of receiving stations, the controller type of transmitter is usually preferred.

It is common in telegraph installations to require the signals received to be repeated to the transmitting station as a check on the accuracy. For this purpose, a receiver and a transmitter are generally combined together in a single stand. Fig. 7 shows the component parts of such a combined set dismantled. In this case a controller form of transmitter has been employed and the signals are indicated on a large clock face fixed horizontally on the top of the stand.

Fig. 8 shows the connections for an installation consisting of four motor-transmitters and four receivers. A three-phase

\* E.T.Z., May 25th and June 1st, 1911.



supply is shown, and one of the three supply mains is used as a common return for all the rotor circuits, so that only a single lead per instrument is required besides the three mains running round the whole system, which would normally form part of the ordinary lighting system of the building or

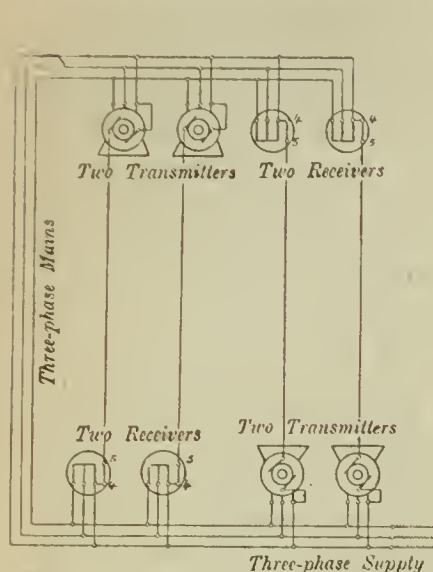


FIG. 8.

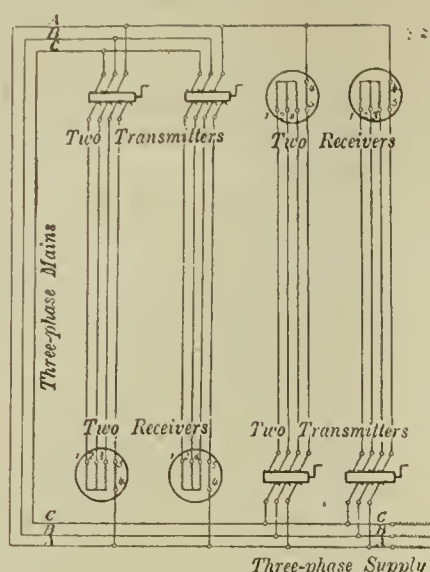


FIG. 9.

ship. Fig. 9 shows the same installation worked with controller transmitters. In this case four leads per instrument are necessary.

The apparatus has proved quick and reliable in practice, even when working over long distances, *e.g.*,  $3\frac{1}{2}$  miles, using only telephone wire of .0016 sq. in. section. Variations of voltage or frequency of  $\pm 10$  per cent. have no appreciable effect. The power consumed is only about 50 watts.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Electric Vehicle.

I have read with the greatest interest the leading article in your issue of January 26th, and on behalf of my company I thank you for your thorough, yet brief, exposition of what you truly call the immense field for development offered by the electromobile.

I thoroughly appreciate the brevity with which you have touched on the field, and the method in which you have endeavoured to explain the many points which touch upon the history of the development of the electric vehicle and the handicap, both commercially and otherwise, to which the development of the electric vehicle has been subjected. I will endeavour to join forces with you on a question of brevity, and I, therefore, propose to set out certain points which may be of interest to your readers and yourselves.

I think on this first point I must regretfully join issue with you on the question of comparing the business of the electric vehicle here with that of the States. Most certainly is the electric vehicle widely adopted in the States, but the reasons for its adoption in the States to a much greater extent *pro rata* than in Great Britain, are, I think, obvious.

Companies which originated electrically propelled vehicles in England, did so only half-heartedly—they did not do it with the whole-hearted endeavour which accompanied such propositions in the States. Here they seemed to be originated merely with a view to gathering in public money, and not with even a substratum of idea behind the endeavour with any initial belief in the eventual success of the ventures.

Their faith in the electric vehicle companies they produced, was only a temporary faith, and as a temporary faith was bound to fail; to put the matter in a nutshell, the United States of America knowing and proclaiming their modern and up-to-date methods, believed whole-heartedly in electric traction. Here, our faith in electricity, as our faith in everything else modern and novel, is only feeble. It is

with that lack of faith that the electric vehicle has had to contend throughout the course of its existence. In your article you have used facts—undeniable facts—as to the number of electric vehicles used in the States, and here I would again respectfully join issue with you. You use the word “electromobiles,” may I point out that the term “electromobile” over here is generally and consistently held to apply only to the private electric brongham which this company hires out. Now in this country I think I may say without fear of contradiction that the Electromobile Co. of 7, Hertford Street, Mayfair, holds sway in the field of hiring out private electrically-propelled carriages known as “electromobiles.”

At first we lived through a period of initial success, and then came a severe struggle, due, I think, to the fact that at the period of which I speak, the electric vehicle was serving no purpose of financial increment to other industrial communities of this country. I will put the matter as briefly, and bluntly, as possible. For one concrete instance, the electrically propelled vehicle was not adequate in supplying the needs of the advertising press. The electrically propelled vehicle was stated to be considered as not proportionately playing its part in the advancement, industrially and technically, of self-propelled vehicles; therefore the motor industry had no use for the electrically-propelled vehicle in this country. I was not personally at that time interested in the electrical industry. I was serving a very useful apprenticeship indeed under the directorship of Messrs. S. F. Edge, Ltd., and was chiefly concerned in petrol-propelled vehicles, but I studied with interest at that period the time of stress through which the electric vehicle passed. I think no one will join issue with me if I say definitely that the only company concerned in the business of the hiring out of electric-propelled vehicles which passed successfully through that period, was the Electromobile Co., Ltd.; and that is the position to-day. Before I deal further with your report, I think I ought to justify my writing at such length, and my case is this. This company owns in the centre of Mayfair, in the metropolis of London, one of the largest garages in Great Britain. It occupies 55,000 ft. of space. Every day in and out of the garage pass over 100 electrically-propelled vehicles. We employ more than 300 people, who are employed solely with the electrically-propelled vehicles. Our current consumption for over nine years has exceeded 5 million units. And all this, I think, gives us the right to discuss the problem of electric traction, because if electric traction dies, it dies hard; in fact, it would be almost fairer to say it is an industry temporarily stifled, and we say this with the certain knowledge that electricity as a motive power is bound to come. The petrol vehicle owes its initial power and introduction to electricity. The aeroplane owes its initial power of propulsion equally to electricity. Most of the modern developments, including wireless telegraphy, are based simply and solely on electricity.

You speak in your article of vast possibilities to be achieved and successes already achieved. You speak certainly of the United States of America, but what the United States of America already realise to a limited extent, Great Britain will, in course of time, realise to an even greater extent. In this industry, as in practically every other industry in its initial developments, Great Britain is behind, but when it has proved its worth, Great Britain is always to the fore.

Once again I join issue with you. You ask with regard to this industry, “What are we doing?” You answer, “Nothing.” You state that the electrical enterprise in this country has been one continual record of distinct failure. With this latter statement I can hardly agree. I can only tell you that all we are giving you are hard facts. I believe, rightly or wrongly, that this company represents the general enterprise you mention, which—however it has lacked support in the past—will not lack support in the future. And I tell you this with the more assurance, because in the past few months we have for the first time for years surpassed the turn-over in the hiring of electric carriages which, in the initial years, was considerable. This company, for some time now has determined to retrieve the electric hiring business. It realised that if the electric hiring business was to be saved, or to be revived as an industrial concern, and by that I mean a profitable concern, this company surely



stood the best chance of success; it had the field left practically to itself. It had a fleet of carriages which you yourself describe as second to none—as you say, our lead storage batteries are as good as any made elsewhere—as you say again, our cars are unexcelled—as you say, nowhere in the world is electrical energy so cheaply available as in this country, and in all this you are irrefutably correct, and I make no excuse for giving you our company as a practical instance of what can be done in electrical hire. We have passed through our bad time; we hope to be opening out in our time of prosperity.

With regard to any company which opens up the field of electric traction, we are only too pleased to be of use and service. The more companies running electrically-propelled vehicles, the better we shall be pleased.

Briefly, there is a certain class which has decreed that for certain uses—and essential uses at that—the electrically-propelled vehicle is ideal. In that direction it has the assent of the Automobile Club, which decided years ago that the “electromobile” was the *perfect town carriage*, when it awarded it the gold medal from every possible point of view which went to make up the perfect town carriage—for ease in starting, for ease in manipulation, for absolute silence, for cleanliness and reliability. With all that behind us, surely we have every reason to believe with you that electric road vehicles will not fail here, and that we may think that this big business, with the livelihoods of hundreds of men behind us, will not fail in reviving what in time must be one of the best industries of this country.

I would like to conclude this already lengthy letter here, but for the fact that I have not touched upon the electric commercial vehicle. I think it is hardly reasonable to compare the difference between electric *wagons* here and those obtaining in the States. In the cities of the United States of America the electrically-propelled vehicle works in a circumscribed area which does not obtain here. Our centres of industry here in our big towns have larger radii. The roads in the cities of America are circumscribed simply by the fact that the roads outside its cities are such that heavily-laden “trucks” could not venture to use them. In this country the services of our roads present no such limitations. For this reason I think that the heavily-laden commercial vehicles fail, and the work must be at present left to the petrol-propelled wagon, and I say this whilst yielding nothing to, but claiming everything in advance of, the petrol vehicles in everything in respect of town use. By “town use” we do not mean to limit the field purely to pleasure vehicles. Our City electric ambulances give—have given for years past—and will continue to give, yeoman service to the City of London.

Obviously, for such a service, where reliability, smoothness, silence, and essential ease of manipulation, constitute the vital requirements, the electric vehicle cannot be surpassed. Finally, we claim the electric brougham to be the perfect town carriage for use for shopping, or in the park, or balls, or functions in town; and in that direction alone there is a sufficient field in the many towns in Great Britain or in the Metropolis alone for a tremendous industry. We rely to no extent on the light, and in our opinion inadequate, American “run-about,” which alone enables those abroad to claim excessive mileage, with batteries unsuited to any carriages except such “run-about,” which are totally unsuited to our conditions and requirements.

We build in Great Britain, with British machinery and British workmen, carriages which comply with British requirements.

The Electromobile Co., Ltd.,

S. JANSON, *Manager and Secretary*.

London, W., February 2nd, 1912.

[Our correspondent agrees with us that the development of the electric vehicle in this country has been hampered by the promotion of unsound ventures for the purpose of extracting money from the pockets of the public rather than genuine industrial enterprise. As regards the word “electromobile,” while we acknowledge the value of the excellent work done by the Electromobile Co., we must point out that the Courts have ruled that the word is not specific, but generic, and therefore cannot be restricted to any particular

class or make of electric vehicle. We do not quite follow Mr. Janson’s explanation of the difficulties met with by the electric automobile, but are very glad to learn that his company has over 100 electromobiles in daily service. We welcome also our correspondent’s remarks concerning the multiplication of electric vehicle companies; he is perfectly correct in believing, as we gather he does, that this would hasten the development of the industry, and would materially benefit his own company in the long run.

Turning to the commercial electric vehicle, we did not compare its development here with that to which it has attained in the United States, for the simple reason that here it is non-existent, and therefore cannot be compared with anything. But we cannot agree that it has no chance of development here. There is no difficulty in equipping such a vehicle for a 40-mile run, which is sufficient even for so large an area as that of the Metropolis, with few exceptions, and our excellent roads afford every opportunity for success to be achieved—when the problem is attacked with energy and determination.—Eps. E.R.]

### The Economy of Electric Cooking.

I think that Mr. Borlase Matthews has done a real service to electric cooking by his instructive letter in your issue of February 2nd. In my opinion, Mr. Allingham misses the point when he says that his meat is not dried up or toughened when cooked by gas or coal, and that, therefore, electricity cannot claim superiority over gas and coal in this respect.

Where electricity beats gas and coal is in the fact (pointed out by Mr. Borlase Matthews) that an electric oven “provides that essential uniformity even *under the hands of an unskilled cook*.” The italics are mine. It is just the “human element” which makes all the difference between having the meat “juicy and succulent” or “dried up and toughened” when gas or coal is used. In electrical cooking, the “human element” plays a far less important part, and as it is the experience, I believe, of most housekeepers (I use the word in its broadest sense) that a good cook is a *rara avis*, the meat is much more likely to be “juicy and succulent” when cooked by electricity than by gas or coal. Human nature being what it is, the above feature of electrical cooking is, to my mind, a very valuable one, and should be emphasised when dealing with this subject.

With reference to “F. R. C.’s” letter, I do not consider that Mr. Good was unduly optimistic. In my opinion, one of the causes of the present unsatisfactory state of the electrical industry is the pessimistic and “can’t be done” attitude adopted by “F. R. C.,” which seems somewhat prevalent among electrical men. To borrow Mr. Good’s metaphor, if electricity can’t go the “whole hog” in dealing with the heating and cooking arrangement of a house, let electric power be used where it is admittedly superior to anything else, and where the extra cost is worth incurring.

The idea seems to be abroad that every mortal thing which can be done by electricity in a house must be accomplished by this means. “Half a loaf is better than no bread.”

In conclusion, what the electrical industry needs (as, indeed, this old country as a whole requires) is men with more “grit” and greater business capacity.

Christopher Silver.

Faraday House.

### The Electrical Profession as It Is.

Your correspondent who seeks obscurity behind the *nom de plume* of “Diogenes,” is apparently an exceedingly accomplished individual in his own estimation; at least, the heartrending wail which is manifest throughout his letter indicates self-consciousness.

No doubt many berths in supply companies are filled more by influence than ability, but these companies only form a minor portion of the electrical industry, and if these brilliant shining lights referred to are really useful to their profession,



and are genuine electrical engineers, thoroughly trained and experienced, they should have no difficulty in securing a satisfactory berth in one of the innumerable sections of electrical engineering. Neither would they experience any difficulty in becoming members of the Institutions now existing, as they would not be debarred by absurd qualifications, seeing that it is only necessary to be an efficient engineer with proofs of thorough practical and technical training, and the support of members who could testify as to ability.

Of course, your correspondent must understand that the institutions referred to are not open to unemployed or unemployable; a prospective member must show proofs of being in a position of superior responsibility, this latter, no doubt, being the absurd qualification referred to.

The concluding part of his letter suggests what is wanted to elevate the profession to the high position of which it is worthy, but does so in a very vague manner, so perhaps the following will cause him to reflect, and if needed, to retreat to his primitive abode, away from the ignorant mankind who will not appreciate his talent and that of the scores of young men to whom he refers.

At the beginning of any session in a splendidly equipped technical institute in the heart of London, these glowing individuals from all branches of the profession, after enrolment, swarm into the lecture rooms and workshops, crowd round the laboratory test benches, &c. Let "Diogenes" be among them, and toward the end of the session note the attendance. He will be able to undertake any experiment on the laboratory list, being almost the sole occupant of the laboratory; at the lectures he will miss many, while some will be peacefully sleeping. If he reasons he will ask what has become of his fellow students, and will discover that they are busy in some section of the electrical profession posing as technical trained men.

Then there are builders, gasfitters, undertakers, amateurs who can fix and wire an electric bell, and other individuals, all of whom classify themselves as electrical engineers.

Here is the root of the evil, and the only remedy applicable is a standardisation or classifying of the individual in relation to the industry. This done, there would be fewer electrical engineers, and the so-called best young men would be, of necessity, in some other profession.

W. Ellerd-Styles.

London, N.E., February 4th, 1912.

#### Earthed Concentric System.

In reply to your editorial comments on my letter last week, I think it is distinctly a drawback not to be able to render a lampholder dead, especially when the supply is alternating at 220 volts, and the person changing a lamp is liable to make good earth. Unless it be necessary to effect any repair to the switch, there does not appear to be any objection to the lead up to it being alive; when necessary to do anything to the switch the lead can, of course, be made dead by taking out the fuse at the distribution box.

With regard to your criticism on the second point, I venture to think that the blowing of a fuse is quite as much an automatic indication of an earth as the lighting of a lamp, and it has the advantage that it compels attention to the matter, whereas a lighted lamp merely relieves a lazy person of the trouble of switching it on; I do not think that damage to a fuse by its blowing to cut off an earth, and so fulfil its mission in life, should be regarded as a drawback. The last sentence of your comment appears to me strongly to support my contention.

C. H. W.

**A Brewer's Novel Motor-Lorry.**—A novel petrol motor-lorry designed for the use of brewers was exhibited at the recent Motor-Car Exhibition in Brussels, by the Delahaye Co., of Paris. Above the platform of the lorry is mounted a rail which carries a miniature electric travelling crane. Combined with the engine of the vehicle is a small dynamo which furnishes the necessary current to operate the electric motor combined with the crane, the result being that one man is able to load and unload the lorry in a minimum of time, and with a minimum of trouble.

## LEGAL.

MARCONI v. SIEMENS BROS. & CO., LTD., AND ALFRED HOLT & CO.

ON Friday, February 2nd, this action came before Lord Justice Fletcher Moulton and Lord Justice Buckley in the Appeal Court.

Mr. A. J. Walter, K.C., and Mr. A. J. Gray appeared for the plaintiffs, and Mr. Bousfield and Mr. Hume represented defendants.

MR. BOUSFIELD said this was an appeal from a decision of Mr. Justice Neville in Chancery refusing to order plaintiffs to deliver further and better particulars of the breaches they alleged of the patent specifications 11,575 of 1897, and particulars of the claiming clauses which they alleged were infringed. Defendants also desired further and better particulars in regard to the allegations by plaintiffs of infringement of Marconi's patent of 1900 by Messrs. Siemens offering to A. Holt & Co. a wireless apparatus for their ships. The principal patent in question was the Lodge patent 11,575 of 1897, a prolongation of which had been granted by Mr. Justice Parker last year. There were 11 claims in the 1897 patent, and Mr. Justice Parker had prolonged seven of them for a further period. What defendants wanted to know was whether the plaintiffs were suing on the old specification or on the new one. Plaintiffs said their action was based on both, and defendants wanted clear particulars, as the defences would be different in each case.

MR. WALTER said plaintiffs were suing on the specification with seven claims, and they contended that its validity dated back to the date of the original patent.

LORD JUSTICE F. MOULTON: And you allege that every one of those seven claims are infringed?

MR. WALTER: Yes.

MR. BOUSFIELD said his view was that plaintiffs' rights under the old and the new specification were quite different. Defendants would plead invalidity of the old specification if plaintiffs relied on that, and he understood that plaintiffs were complaining of infringements committed before the specification was amended.

LORD JUSTICE MOULTON: Mr. Walter, are you alleging infringement of the old specification before the expiration of the old patent?

MR. WALTER said he was, but only on the amended specification. There were no other claims.

LORD JUSTICE MOULTON: I think you must make that clear.

MR. WALTER said he was suing solely on the amended specification.

LORD JUSTICE MOULTON: You maintain that the amendment goes back to the date of the original specification?

MR. WALTER: Yes; and I say that under the Act I am entitled to sue on the amended specification in respect of breaches committed before the amendment was made.

MR. BOUSFIELD asked that plaintiffs' case should be clearly defined, as very complicated questions of law would arise, and the pleadings would be very complicated.

LORD JUSTICE MOULTON said the Court did not trouble much about pleadings in a patent action. He could draw up such pleadings without ever knowing what the patent specification was about.

MR. WALTER said he would make everything as clear as he could for his learned friend, and would put it in writing.

MR. BOUSFIELD expressed himself satisfied with this assurance, and the Court made certain orders expediting delivery of particulars and defence, so that there should be no undue delay in preparing for trial.

THE CITY OF LONDON ELECTRIC LIGHTING CO., LTD., v.  
E. W. RUDD, LTD.

IN the King's Bench Division last week, Mr. Justice Banks heard this action. It appeared that plaintiffs were suing for injury done to two electric lamp standards belonging to them, by motor lorries of the defendants. The accidents occurred on two different dates. The amount of the damages were agreed, the only question for his Lordship being whether the defendants were liable. The first accident was in Newgate Street, where, on February 24th last, one of defendants' motor-lorries knocked one of plaintiffs' lamp standards on one side, and the other, a similar accident, occurred on Snow Hill on June 16th.

After hearing the parties, his LORDSHIP awarded the plaintiffs £50 damages, £20 in the case of the first accident, and £30 in the case of the second, with costs.

**A 60,000-volt Railway Cable.**—Two underground cables for a pressure of 60,000 volts have been laid on the German railway between Muldenstein and Bitterfeld for the supply of power to the electric railway proceeding from the latter town. As such high pressures have hitherto been exclusively used in connection with overhead lines, it is considered that the present experiments will be of particular interest in regard to the future development of electric railway working. One of the cables has aluminium for the conductors, and has been made by the Siemens-Schuckert Works, whilst the other is a copper cable made by the Felten and Guillaume Co. The cables are laid in conduits filled with dry sand.



## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Arc Lamp Winch.

A simple but effective patent arc lamp winch has been introduced by THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109-111, New Oxford Street, W.C. It is of the direct-winding type, with removable handle, and is self-sustaining in every position, but offers no resistance to the raising or lowering of the lamp. The accompanying illustrations show the appearance and construction of the device. The automatic locking of the drum when the handle is released, or when the lamp is lowered too fast, is effected by means of two loose plates having a lateral movement along the drum spindle, which is cast with the drum itself. The outer loose plate has two inclined planes *IP*, upon which a steel pin *P* passing through the winch spindle engages. When the operator

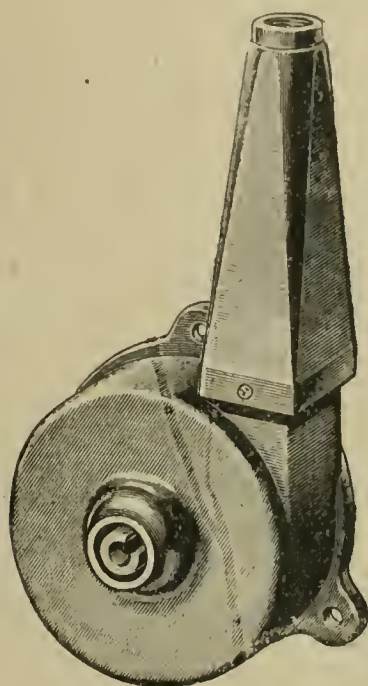


FIG. 1.—ARC LAMP WINCH.

is taking the strain of the lamp which is being lowered, a lug on the key portion on the handle engages with a stop *S* on the outer loose plate and prevents the steel pin travelling up the inclined planes and locking the centre loose plate between itself and the end of the drum. The centre loose plate is fixed by four lugs *L*, fitting into recesses in the cover of the winch in such a manner that it cannot revolve. Should the handle be released, the weight of the lamp

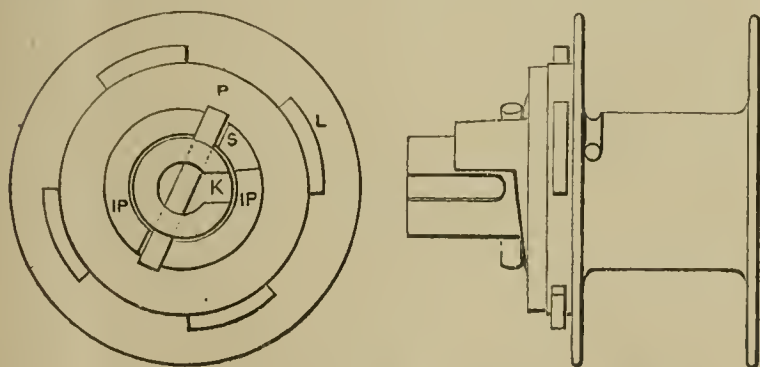


FIG. 2.—CONSTRUCTION OF WINDING DRUM.

causes the pin to ride up the inclined planes on the outer loose plate and clutch the fixed centre plate, effectively locking the drum. There is no sudden jar tending to break the steel wire suspension cable which carries the lamp, and there are no pawls, ratchets or springs in the winch, which is very substantial in construction and appears to be foolproof.

### Theatre Electric Sign.

In the accompanying illustration we show an interesting and, we believe, unique electric sign that has for the past five or six weeks been in position at Terry's Theatre, in the Strand. The usefulness of this sign as an advertising medium is evidenced by the maker's description of it as "The sign that stopped the traffic in the Strand." It seems to us to point the way to a very wide scope of application of the electric sign—a department in which it often has to be confessed we are so backward compared with the United States. It was erected by the FRANCO-BRITISH ELECTRICAL CO., LTD., of 50, Oxford Street, London, W., and comprises their No. 1 and No. 2 "Franco" signs in connection with a "Franco" flasher. The body portion of the two clowns and tripod is made up with the firm's miniature 1-C.P. lamps and patent holders, the detail being painted in and the lamps coloured to give the requisite effect. In order to get the best effect for the heads, shaped boxes were made of leaded steel, fitted with glass cut and coloured, and illuminated inside with small bulb-lamps; the hat part is removable for the replacement of lamps. The height of the clowns is 8 ft.

The balls of the throw on the tripod consist of deep cylindrical reflectors, each fitted with a single lamp. The number of wires from sign to flasher has been reduced as far as possible—namely, 50. The flasher operating the sign is a "Franco" type, size 36 in. by 18 in., operated by a  $\frac{1}{2}$ -H.P. motor having 52 contacts, which when working gives the operation as follows:—Lamp lights up in right clown's hand, travels rapidly across to the second clown



FIG. 3.—THE "FRANCO" SIGNS.

waits an instant in hand, then extinguishes, one lamp immediately coming alight on the tripod; this is repeated 10 times, until the whole of the lamps are alight on the table. After a slight interval the top lamp of the pyramid extinguishes, and the one becomes alight in the second clown's hand, and after an instant travels rapidly towards the sign "Cinema," appearing to illuminate a tenth part of this sign. This operation is repeated until all the balls on the table appear to have been taken and the word "Cinema" is fully alight. The whole is then extinguished and recommences. There are 427 1-C.P. lamps, 111 2-C.P. lamps, and 25 10-C.P. metallic lamps; the consumption per hour is  $1\frac{1}{2}$  units.

The first day the device was alight, complaints were made by the police on account of the crowds of people in the Strand watching the sign, and in consequence for the first fortnight it was necessary to keep a man in attendance on the roof switching the sign off as soon as a crowd collected. We have no doubt that central-station engineers and all interested in electric sign work will find it convenient to make the fullest possible use of this successful experience.

### Self-Oiling Plummer Blocks.

MESSRS. JOHN JARDINE, of Deering Street, Nottingham, have brought out a new type of self-oiling bearing, the principle of which is shown in the accompanying figure. As will be seen, it is a modification of the ring-lubricated bearing, the ring being replaced by a patent splasher *B* sprung upon the shaft *A*, which

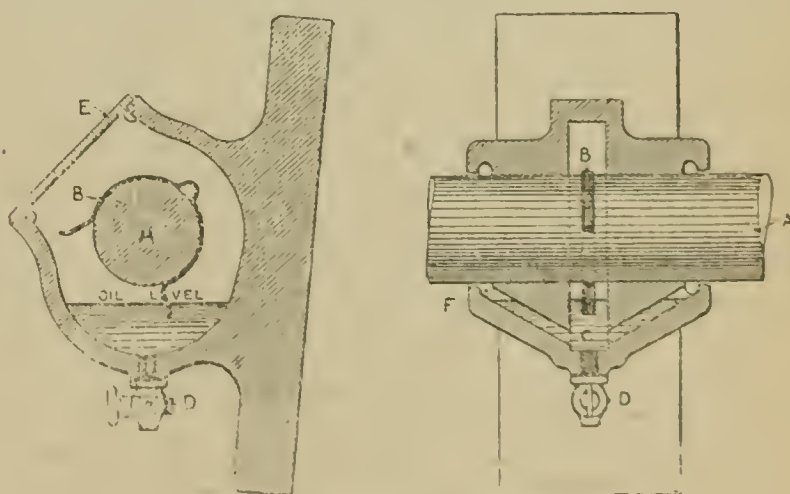


FIG. 4.—SELF-OILING BEARING.

picks up the oil and carries it to the upper side of the shaft. The waste oil returns through the channels *F* to the reservoir *C*. The oil-hole cover *E* is closed to keep out dirt, and the tap *D* allows the old oil to be run out. The makers state that they have had bearings of this type running for six months without any attention whatever and without any trouble, but they recommend oiling once in three months. Plummer blocks fitted with the oil-lifter are made in a variety of patterns and sizes.

### Woodhouse Steel Casing.

THE WOODHOUSE STEEL CASING CO., of Kingsway, W.C., have received a report from the Electrical Standardising, Testing and Training Institution, showing that under a test, to discover its



electrical continuity, of five lengths of the casing and capping, 22 ft. 10 in. long in all, the resistance of either the capping or casing was under 1 ohm. A further test, made after the casing and capping had been roughly used and bent, showed no appreciably different result. This test appears to confirm the company's claim that an electrical bond is made merely by assembling the parts.

## BUSINESS NOTES.

**Acheson Graphite Products.**—The following communication will, we hope, finally settle the vexed question of the agency for these lubricants:—

"We have noticed in recent publications of your paper inquiries as to the firm through whom the above products are being sold; it may therefore interest you to know that the agent for Oildag, Aquadag and Gredag is Mr. A. W. Farnsworth, of Derby, for whom we are acting as sub-agents in our district, while the agent for the International Acheson Graphite Co. is this firm, for whom, in turn, Mr. Farnsworth is acting as sub-agent.

"We trust that this will clear up any doubt which may be in the minds of your readers.—Yours faithfully,

"For 'CROMIL' ENGINEERING CO., LTD.,  
"S. H. MARSHALL.

"Milburn House, Newcastle-on-Tyne."

**Book Notices.**—*Sell's Directory of Registered Telegraphic Addresses.* 1912. Twenty-seventh annual edition. London: Henry Sell. Price 25s.—This very serviceable directory of telephone numbers and telegraphic addresses throughout the United Kingdom has been compiled with the assistance of information given by authority of the Postmaster-General, and its rapid growth in bulk until it has now reached some 2,300 pages, can only serve to indicate the increased value of the contents to business firms in these days when telegraphic and telephonic messages are the commonest of all servants of the business man. All information respecting telegraphic addresses received from the Post Office up to January 1st this year is included in the new volume. Its old-established and well-known features are as follows:—Alphabetical list of 85,000 important firms (the "Upper Ten Thousand" of the commercial world); index to telegraphic addresses; classified trades lists; and Colonial and foreign cable addresses. Every name in the volume is numbered in the margin to enable code users to cable names and addresses cheaply. The book shows a great increase in the number of telegraphic addresses registered during the year. The telephone numbers are given as well as the telegraphic addresses of registrants throughout the whole of the United Kingdom, and this should be found of convenience to those using the trunk telephone lines. There is a classified trades list containing upwards of 3,000 separate trade headings, and the names and addresses of the chief firms of the United Kingdom in every branch of business are grouped under these headings. Of course, there is a great deal of other information in the volume that is of interest to traders, such as the Post Office Telegraph Regulations, telegraph charges to all parts of the world, a list of Consuls in foreign countries, and so on.

*The Russian Year-Book,* 1912. By Dr. Howard P. Kennard. London: Eyre & Spottiswoode, Ltd. Price 10s. 6d. net.—This is the second edition of a work which contains such a vast amount of information regarding the resources and activity of the Russian Empire, that it must be of great value to many people. It should be of service to the many firms and individuals in this country who either already have trade and other similar relationships with, or financial interests in, that vast Empire, or are desirous to take advantage of the development spirit of the present day and join in the meeting of its enormous requirements. The opening chapters discuss matters of administration, commercial law (laws affecting trade), the rights of foreigners, population, education, postal service, and later there are sections relating to natural resources, mining and minerals, ways and communications, ports and shipping, and exports and imports. More than 80 pages are occupied with trade reports, and among these we find a brief but interesting report on "Electricity in Russia," and an equally brief one on "Machinery." There are hints to importers of Russian produce; full notes regarding Customs regulations and tariff arrangements; particulars regarding municipal progress; also a very long chapter—the longest of all—relating to finance. Other features that call for mention here are tables and diagrams relating to trade, and a useful section imparting information for the use of travellers to Russia. There is an alphabetical index at the end. We can only spare space to give this general indication of the contents of this volume of over 800 pages, but we think it will suffice to recommend it to those of our readers who know that we ought to be trying to do more to develop British electrical and engineering trade connections with Russia, and who knowing, propose to take action.

"The Engineer's Year Book for 1912." By H. R. Kenape. London: Crosby Lockwood & Son. Price 10s. 6d.

"Motors and Motoring." By Henry J. Spooner. 1912. London: T. C. & E. C. Jack. Price 2s. net.

"Proceedings of the American Society of Civil Engineers." Vol. XXXVIII, No. 1. January, 1912. New York: The Society.

"Bulletin of the Imperial Institute." Vol. IX, No. 4. 1911. London: Eyre & Spottiswoode, Ltd. Price 1s.

"Atti della Associazione Elettrotecnica Italiana." December, 1911. With index to Vol. XV. Milan: Stucchi, Ceretti e C.

"Bulletin of the Bureau of Standards." Vol. VII, No. 4. December 15th, 1911. Washington: Government Printing Office.

"Statistica degli Impianti Elettrici Attivati od Ampliati in Italia nel decennio 1899-1908." 1911. Rome: G. Berteno e C.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Speciales." December, 1911. Liège: Lahaye & Co. Price 0.75 fr.

"Kitchen Boiler Explosions." 1896. Manchester: The Manchester Steam Users' Association.

"Status of Trade Unions: Legal Recognition. The Trend of Labour Negotiations." By Fred. N. Henderson. London: Geo. Outram and Co., Ltd.

"Patents and Marks in all Republics of Latin America, 1912." From Leclerc & Co., Rio de Janeiro.

"Notes on the Fiscal Controversy." By E. G. Brunner. London: Free Trade Union. 6d.

"The Everyday Uses of Portland Cement." 1912. London: The Association of Portland Cement Manufacturers (1900), Ltd. Price 2s. 6d. net.

"Four-Place Tables of Logarithms and Trigonometric Functions." By E. V. Huntington. 1912. London: E. & F. N. Spon, Ltd. Price 3s. net.

We have received from Mr. H. D. Boret, of 9, Billiter Square, E.C., a handbook of some 80 pages relating to the sailings of the German-Australian Steamship Co., of Hamburg, for South Africa, Australia and New Zealand. Freight terms, tariffs, goods classification and other particulars are included.

Messrs. Constable & Co. will commence the publication in April next of a new periodical, to be entitled "Bedrock," "a quarterly review of scientific thought," price 2s. 6d.

A special number of "The Motor Boat and Marine Oil and Gas Engine," recently published, deals exhaustively with the latest developments in the building of high-power Diesel engines.

**Staff Dinner.**—The annual staff dinner of CROMPTON AND Co., LTD., Chelmsford, was held on Saturday evening in the club room, Writtle Road, Chelmsford. Mr. A. J. Hodgson, joint general manager, presided, and was supported by his colleague, Mr. E. Reeves, and the shop managers (Messrs. J. C. Macfarlane and Claude Crompton). Mr. W. J. F. Freeland proposed "The Firm," and alluded to the many changes in the staff which had occurred during the past 12 months. The chairman, in responding, said that owing to increased competition, the firm was passing through difficult and trying times. Trade had, however, improved of late, and he was glad to say that the outlook was now a little more hopeful. It was satisfactory that Chelmsford was free from labour troubles. He feared that members of Parliament, of whatever party, did little to foster the industries of the country; there was too much vote-catching legislation. As regards the National Insurance Act, while all were probably in favour of the principle of national insurance, he thought the incidence of the proposed tax was unfair. In many instances it would have to be paid out of capital, and it was a direct tax upon the employment of labour. In the case of their own company, which was not making any profit, there would be an additional burden of from £800 to £1,000 per annum, which would have to be paid out of capital so long as there was not sufficient profit to cover it. The tax, he thought, should fall upon the income of the community as a whole.

**Patent Notices.**—An order has been made dated February 1st restoring Patent No. 4,557 of 1903, granted to Frank Michael Lewis for "Improvements in or connected with electric arc lamps." Application has been made by Mr. John Gordon, receiver for the debenture-holders of Middleton and Barker, Ltd., for the restoration of Patent No. 20,975 of 1903, for "Improved apparatus for heating water and circulating the heated water," granted to A. H. Barker.

**Electricity for Scarborough Cliff Lift.**—The directors of the Scarborough South Cliff Tramway Co. state in their annual report that they feel the time has arrived when a practical reconstruction of the tramway will have to be seriously considered, the cost of running by the present method being too great. "Experience shows," adds the report, "that working by electricity enables a much larger profit to be obtained. It will be necessary to prepare plans and obtain estimates. The work of reconstruction ought to start immediately after the cars cease running in November next."

**Post Office Regulations and Sticky Backs.**—Some weeks ago it was announced in the daily papers that the Post Office authorities deprecated the use of adhesive stamps on envelopes which were of similar size to the ordinary postage stamp, or which might tend to confusion in cancelling the postage stamps. It was stated that such letters might be delayed in the post. The practice of using adhesive labels on correspondence has been adopted by several of the metal-lamp concerns. MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, who early adopted this method of advertising, inform us that they have communicated with the G.P.O. authorities on this subject, submitting the various types of adhesive labels used by them with a view of ascertaining whether such labels would infringe the postal regulations in any way, and have received a reply stating that the labels submitted are not of such a character as would render postal packets to which they were affixed liable to be stopped. Hence all types of adhesive labels now issued to contractors by the Siemens Lamp Department may be used with safety by members of the trade on their outgoing mail, although care should be taken not to affix them in such a manner as to interfere with the addressing of the postal packets.



**Foreign Contracts and Labour Clauses.**—At the Blackburn T.C. meeting on February 1st, Councillor Hartley referred to a contract for the supply of steel tram rails which had been given to an American firm, and asked if the chairman of the Tramways Committee had made arrangements for someone to go over to the States to see whether this firm were paying the standard rate of wages as required by the Corporation regulations. Whatever conditions were imposed on English firms ought to apply equally well to foreign firms, he added.

**Electrical Manufacturing in Japan.**—H.M. Vice-Consul at Osaka (Mr. E. H. Holmes) reports that a Japanese joint stock company has recently been formed at that place, under the name of the Osaka Denki Seizo Kabushiki Kaisha (Osaka Electrical Machinery Manufacturing Co., Ltd.), for the manufacture of dynamos and other electrical machinery. The authorised capital is 1,000,000 yen (about £102,000), of which it is proposed to call up one-fourth at once. As a result of inquiries made by Mr. Holmes, it would appear that the direction of orders for plant for the new works is already settled. H.M. Vice-Consul states that the demand for such goods of every description is a constantly increasing one, but he points out that considerable progress has been made of late years in the manufacture of electrical machinery in Japan, and that Japanese manufacturers will have the advantage of considerable tariff protection.—*Board of Trade Journal*.

**India.**—An American Consul, reporting on Indian trade, makes the following remarks: "An active and industrious commercial agent, who has been all over India and studied the needs of the people and the business methods, said that he regarded India as the best field for American foreign trade in the Near or Far East. He returned to the United States for the purpose of getting together a line of samples with a view to returning to India and making it a permanent field of commercial operation. He stated emphatically that the only way to work India as a commercial field was to visit every store and every bazaar, exhibiting samples of superior goods and prices that would compete with English, German and French prices for the same class of goods. This young man's conclusion was no different from the conclusions reached by many other commercial men. It is safe to say that 95 per cent. of the trade in American commodities in India that have been introduced and sold here during the last six years have been the result of personal representation. Circulars and catalogues rarely get original business. After goods have been introduced and have gained a foothold, advertising literature is necessary to hold and enlarge trade."

**Catalogues and Lists.**—MESSRS. BAYLISS, JONES AND BAYLISS, LTD., Wolverhampton.—Catalogue No. 11B (88 pages) containing illustrations and tabulated prices of bolts and nuts, and a variety of telegraph ironwork black and galvanised, including spindles, cupholders, stay swivels, swan-neck bolts, straining eye-bolts, &c.

MESSRS. WALLACH BROS., LTD., Royal London House, Finsbury Square, London, E.C.—Small booklet of 48 pages, entitled "The Care of Belting." Belt troubles and how to avoid them, directions for making double belts endless on the pulleys, directions for lacing belts, also for covering iron pulleys with leather, are all discussed, and particulars follow of the firm's "Spartan" and "Neptune" brands of leather belting. The former is specially prepared to withstand the effects of steam, oil, acid fumes, &c., and is adapted for hard service; the latter is a special waterproof belt to withstand severe work and all effects of moisture or water. Prices are given.

THE LONDON ELECTRIC FIRM, George Street, Croydon.—This is a very full catalogue of the firm's "One-working part" arc and metal-filament lamp lowering gear, self-sustaining winches and other manufactures. These include numerous details which should interest all who have to do with street and other open space lighting, and a host of photographic illustrations appears showing the application of the devices to different kinds of service in a variety of positions. Particular attention is directed to the pages devoted to lowering gear applied in connection with metal-filament lamps and clusters of lamps used for street illumination. A large sheet of illustrations of the manufactures, and street views, accompanies the catalogue.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Publication No. 185 (16 pages), containing brief descriptions, with illustrations and prices, of their mining telephones, magneto and battery ringing respectively; miner's pocket telephone, mining indicator, mining telephone switchboard, electric blasting machines, electric motor syrens, trembling, motor-driven and other bells, ringing and signalling keys, and batteries.

THE FRANCO-BRITISH ELECTRICAL CO., LTD., 50, Oxford Street, London, W.C.—Two new leaflets relating to their electric signs, one of which is described in our "New Devices" section to-day.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, N.E.—New list, No. D3 (16 pages), containing excellent illustrations, with notes of prices of a number of luminous radiators with attractive designs in art metal, black and polished iron and copper, antique brass, copper and silver, satin gilt, oxidised silver and oxidised copper.

MESSRS. ALFRED H. GIBBINGS & CIA, 564, Cangallo 564, Buenos Ayres.—Eight-page catalogue in Spanish, containing illustrated particulars of combined engines and dynamos, electric pumps, switchboards, measuring instruments, &c.

MESSRS. GALSWORTHY, LTD., 15 and 16, Newman Street, Oxford Street, London, W.—New catalogue of 160 pages (art paper throughout) containing excellently-executed illustrations of a fine collection of their electric light fittings. All of the fittings are illustrated to scale, and the spread and length are given, a reference being also

made to the page where the bracket or electrolier, as the case may be, can be found to match a given fitting. This is, of course, a time-saving element. Beginning with wall brackets and sconces, counterweight pendants and shade lights, and proceeding with electroliers, crystal pendants, bowl and ceiling fittings, billiard and small fancy pendants, there later follow lanterns, newel standards, watertight fittings, floor and table standards. Some pages toward the end are occupied with switchplates, lamp radiators, and "Gilco" patent screw clamp, and sundries. The catalogue has a neat binding. Messrs. Galsworthy will be pleased to send a copy of the book to anyone in the trade who may not have received one.

MESSRS. SWITCHGEAR & COWANS (1911), LTD., Victoria Works, Springfield Lane, Salford.—A number of current leaflets have been issued, brought together in a folder, giving illustrated information relating to their standard manufactures. These include switchboards, H.T. enclosed panels for consumers' premises, regulating transformers; spring break, isolating, house service, Admiralty enclosed, lin it, field breaking and other switches; rheostats, circuit-breakers, wall type motor panels; oil circuit breakers; motor starters; Star-Delta switches; relays, switch fuses, magnetic blow-out fuses, the Statler time-lag, and so on.

MR. H. C. SLINGSBY, Old Street House, London, E.C.—New revised catalogue, No. 135 (498 pages) containing illustrations and prices of a very large variety of trucks, handcarts, &c., suitable for use in all classes of business.

**The Aluminium Industry.**—According to a Berlin newspaper, the negotiations for the establishment of a fresh international understanding in the aluminium manufacturing industry, which have never been entirely abandoned, have now led to the conclusion of an arrangement between the French works and the Neuhausen Aluminium Industry Co. This implies that a step has been taken in connection with the revival of the international syndicate, although it remains to be seen whether the combination will actually be constituted. On the one hand, it seems, the newspaper declares, that the English industry is not ripe for inclusion, whilst, on the other, an understanding is for the time being not possible with the American industry, the principal representative of which is also suffering from the campaign against trusts. In any case, prices in the market have recently hardened, and further progress is expected as the French works and the Neuhausen Co. are said to have already withdrawn from the market.

The formation was recently mentioned of the Société Aluminium Française for the working of a process for the simultaneous recovery of an ammonia fertiliser as a by-product in the production of alumin-kryolit for the manufacture of aluminium. The working rights have been obtained from the Société Générale des Nitrures, and are said to permit of a substantial reduction in the cost of production. It is understood that the Société Aluminium Française has water-powers ranging from 40,000 H.P. to 50,000 H.P. at its disposal, and as its output of alumin-kryolit is to be shared with the French aluminium companies, it would appear as if the former had been formed by the latter expressly for the purpose.

**Bankruptcy Proceedings.**—OSWALD CARR, electrical engineer, Oak Works, Headingley, and 31, Estcourt Terrace, Headingley.—At the Leeds Bankruptcy Court last week this examination was closed. The statement of affairs showed liabilities £375, and a deficiency of £62.

HENRY JAMES DALE, electrician, 15, New Oxford Street, W.C., and 166, Pentonville Road, N.—Release of trustee (official receiver) December 21st, 1911.

**For Sale.**—The Coventy City Council has for disposal one 600-kw. McLaren-Schuckert generating set. The Dundee T.C. has for sale five tons of old cable copper. Messrs. Wheatley Kirk, Price & Co., will, on Friday, February 23rd, sell by auction, the plant and effects of the Cowper-Coles Engineering Co., Ltd. (in liquidation). For further particulars see our advertisement pages to-day.

**Trade Announcements.**—Premises at 4, Townwall Street, Dover, have been opened by MR. E. ARTHUR PINTO, electrical engineer.

The A.E.G. ELECTRIC CO. has opened showrooms at 2, Station Road West, Canterbury, with Mr. E. F. Turner as representative.

Having, during a recent business tour in U.S.A., ascertained that there was a considerable demand for many of his new types of electrical standard and testing instruments, MR. ROBERT W. PAUL has opened a branch laboratory and showroom at 1, East 42nd Street, New York, which will be in charge of Mr. C. J. Brown, formerly at the firm's London works.

**Dissolutions and Liquidations.**—BOHM LENS LAMP CO., LTD.—Creditors must send particulars of debts, &c., by March 18th to the liquidator, Mr. E. S. Neave, 15, Great St. Helens, E.C.

WAKELIN BROS., LTD., 7, Tottenham Street, Tottenham Court Road, London.—Meeting of creditors and contributories will be held on February 16th at Carey Street, W.C.

**Battery Contracts.**—MESSRS PRITCHETTS & GOLD, LTD., of Westminster, have recently supplied one of their well-known storage batteries to H.R.H. Prince Christian, K.G., P.C., G.C.V.O., at Cumberland House, Windsor. Another recent order was placed with this firm by H.R.H. the Duchess of Albany for replacing the existing battery at Claremont, Esher, with a new battery of 1,000 ampere-hours capacity. The same firm are also supplying a battery to Sir Alexander M. Rendel, K.C.I.E., for his country house



**New Steel Works at Swansea.**—The *Times* reports that MESSRS. BALDWIN & CO. are going to put down immediately an extensive steel-making plant on the Burrows, Swansea, where they have already large tinplate works. "The new steel works will have an output of 5,000 tons weekly, and the expenditure involved is between £100,000 and £150,000. It is Messrs. Baldwin's intention to follow on with the erection of blast furnaces."

## LIGHTING and POWER NOTES.

**Abingdon.**—A petition is being signed at Abingdon in favour of facilities being given to a company to provide an E.L. installation for the town. The T.C., it will be remembered, has decided to apply for a prov. order.

**Accrington.**—Mr. Percy Allen, of the Castner-Kellner Alkali Co., has accepted the engagement as consulting engineer in connection with the installation of a gas generating plant for the electricity works extensions, at a fee of 50 guineas, plus expenses.

**Australia.**—The North Sydney Council is moving to secure electric lighting powers, the idea being to prepare a joint scheme for all the North Shore municipalities.

The purchase of the gas company's undertaking (which includes electricity supply) has been practically concluded by the Perth (W.A.) Council, the arbitration award fixing the price at £419,312. A loan of £525,000 is to be raised for purchasing the property.

It is interesting to note that the suburbs of North Perth, Subiaco and Leederville have their own electric lighting plants, also that Claremont, situated between Perth and Fremantle, has its own plant.

**Bantry.**—Last year terms were arranged between a Mr. Nugent and the local Commissioners, by which that gentleman supplied an electric street lighting installation in the town, which has now been in satisfactory operation for a week or so.

**Barrow-in-Furness.**—At the T.C. meeting on Monday it was decided that the town clerk, treasurer, surveyor, gas and water manager, and electrical engineer be instructed to confer on the question of formulating a scheme to prevent the frequent breaking up of carriage-ways and footpaths for the purpose of laying new mains, &c.

**Beckenham.**—At its last meeting, the U.D.C. decided to ask the B. of T. to consider the revocation of the powers of the electricity company entitled to supply the West Wickham district, but which has not exercised its right. If the Board agrees to that course the Council will take steps to obtain powers to supply the district. The Council found it impossible recently to supply in West Wickham on reasonable terms, and that is the basis of the action.

**Biddulph.**—With reference to the proposed electrical scheme, the U.D.C. has decided not to pay more than 5 per cent. on the cost of the works (£5,000), except the cost of the ordnance survey plans, to the experts engaged, Messrs. Crews & Handford. The latter asked to be allowed certain travelling and other expenses.

**Bognor.**—The U.D.C. has decided to offer no opposition to the Bognor electricity prov. order, but to lodge a petition against the Bognor Gas Co.'s Electricity Bill, on the following grounds:—That it is not desirable that a monopoly for supplying two illuminants should be in the hands of one company; that there is no clause in the Bill authorising the Council to purchase the undertaking; that the maximum price to be charged for current is excessive; and that the time within which mains should be laid in the compulsory area was extended to three years instead of two years, as in the case of the prov. order.

**Bolton.**—At a meeting of the Electricity Committee held on February 1st, the proceedings of the special Sub-Committee appointed by the Electricity Committee with reference to the scheme of the electrical engineer for the proposed new station at Back-oth-Bank were approved, which thereby recommends the adoption of the scheme.

**Bridlington.**—The T.C. has received from the L.G.B. sanction to loans of £1,900 for mains and £800 for services.

**Bury.**—The Corporation has lodged an objection with the Board of Trade against the granting of a provisional order to the Lancashire Electric Power Co. for supplying electricity in Radcliffe.

**Canada.**—From present indications, the scheme of the Long Sault Development Co. to dam the St. Lawrence is again in the air. J. Wesley Allison, Morrisburg, whose efforts in opposition to the scheme aided in its defeat before Congress last year, left for Washington at the end of last week to confer with the interests connected with the scheme as to the basis upon which work will be allowed to go on so far as Canada is concerned. It is not, however, considered likely that the Dominion Government will withdraw a single one of its objections already advanced against the proposal. That the opposition is not confined to Canada is evident from the fact that it is understood that Governor Dix, of New York, will suggest

that the Bill of the Long Sault Development Co., in so far as it gives power to the promoters throughout New York State to develop power on the St. Lawrence, be repealed. Governor Dix will further suggest that if it is found necessary to develop power on the St. Lawrence, that the State vote an appropriation for that purpose, and that power be delivered to the people direct from the State, and that no lease be granted to private companies or corporations.

The Calgary, Albt., Council has approved of a total of \$200,000 for electric lighting extensions for 1912, and \$168,000 for extensions to the city power plant during the coming year.

**Cheltenham.**—The T.C. has decided to give private consumers the option of a flat rate of 5d per unit, with a discount of 5 per cent.

By a three years' agreement, the Light Railway Co. is to pay 1'3552d. per unit for a minimum of 600,000 units, and ¾d. per unit beyond.

**Continental Notes.**—AUSTRIA.—Great activity prevails in the districts lying around Salzburg in the erection of local generating stations. One firm only—F. Papouschek—in the past year have carried out, or have in hand, as many as eight such schemes, viz., at Wald, Hollersbach, Reitdorf, Lungötz, Russbach, St. Michael Markt, Thalgau and Materndorf, the last-named being a reconstruction and re-equipment of an existing station. The installations of electric plant in various industries have also been numerous, and, altogether, the past year is considered to have been a very prosperous one.

A high-pressure transmission service, many miles in length, is being set up between Kolin and Newbydzow, in Bohemia, to serve Konigstahl and all the villages within the Konigstahl circuit. Temporarily, current is being supplied by a private firm at Chlumetz, but eventually a power station to be built at Kolin will serve the network.—*Der Elektrotechniker*.

It is announced that the municipal authorities of Vienna have just purchased a colliery at Zellingsdorf, Lower Austria. It is proposed to establish an electricity generating station in conjunction with the pits and to transmit the current generated to Vienna for electric lighting and power purposes.

GERMANY.—The municipal electricity undertaking at Altona is being taken over by a new company, which has just been formed, with a capital of £175,000, and the title the Electricitätswerk Unterelbe Gesellschaft.

An international rural generating station, to serve clients on both sides of the Dutch and German frontiers in the Bourtanger Moor district, and stretching from Meppen to Wegener on the left bank of the Ems River, is about to be established. The districts to be served are mainly agricultural, and include the circuits of Aschendorf, Hümmling, Lingen and Meppen. The Dutch districts are warmly interested in the scheme, the negotiations for the realisation of which are approaching a conclusion.—*Zeitschr. für Elektro. und Maschinenbau*.

BELGIUM.—La Société d'Electricité du Borinage is now supplying current to 20 small towns and villages, the number of clients connected to the supply mains being 2,200.

La Société d'Electricité de l'Est de la Belgique has secured the concession for the supply of electrical energy for lighting and power purposes in the town of Lambermont.

RUSSIA.—The Compagnie d'Electricité de Bialystock reports a large increase in the demand for current for power purposes. There are a large number of textile mills in the town of Bialystock, the proprietors of many of which have decided, owing to the high cost of coal in the district, to adopt electrical driving of the spinning and weaving machinery.

The work of establishing the new central station in Odessa of the Société d'Electricité d'Odessa is being pushed ahead as rapidly as possible, as the demand for current for lighting and power purposes is in excess of what can be supplied from the existing plant, which is furnishing current to 85,000 lamps and 82 electric motors.

A loan is being arranged for a Russian municipality, the proceeds to be devoted to various public works, including electrification of tramways and purchase of rolling stock. Further particulars may be obtained on application to the B. of T.

A new system of mains, for the supply of electrical energy for lighting and power purposes, is being laid down in the town of Simferopol by the Société des Tramways et Eclairage de Simferopol.

SPAIN.—The municipal authorities of Moncofar (province of Castellon), have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

FRANCE.—It is proposed to erect a large hydro-electric station utilising the River Doubs. A barrage is to be constructed above Soubey, and thence water will be taken through a 38-km. tunnel, penetrating the Clos du Doubs, to the village of Ocourt. Soubey being 485 m. above sea level and Ocourt only 435 m., there is a gross difference of level of 50 m. A velocity of flow of 1'70 m. per second through the tunnel, which is to be of 5'25 sq. m. cross-section, will yield a discharge of about 6 cb. m. per second. The power station is to be erected at Ocourt, and will contain three hydro-electric generators of 1,250 kw. each. The maximum total output of the station will fall from 3,600 kw. to 1,000 kw. in periods of drought, when the flow of the Doubs is only 19 cb. m. per second. The barrage will cause a considerable rise in the level of the Doubs up-stream to Clairbie—about 3 km. away and near the French frontier—and the scheme when completed will be the most important in the Jura district.

La Société Generale d'Electricité, Paris-Province, is the name of a new company which has lately been formed in Paris, with a capital of £10,000.



**Dartford.**—The U.D.C. has applied to the L.G.B. for a loan of £10,000 for the following purposes:—"Uniflow" engine and balancer, £3,300; switchboard, £600; superheaters and piping, £800; feed pump, £160; buildings, £2,290; boiler, £1,600; contingencies, £250; three years' mains and services, £1,000.

**Darwen.**—The subject of electricity as a motive power was raised at the meeting of the Corporation on February 5th, when Councillor Butterworth referred to the erection of new mills in the town, and asked what progress was being made with regard to the owners using electricity for the running of the machinery. Councillor Thornley replied that the matter had received careful attention, but he did not think it was advisable to enter into details at that stage. Everything was being done to produce current as cheaply as possible, with a view to encouraging cotton mill owners, but not at a loss to the Corporation.

**Dublin.**—At a recent meeting of the City Council, Alderman M'Walter moved that the 10 per cent. which was added to the price of electricity, to make up for losses sometime ago, should now be taken off. An amendment was, however, carried that the resolution be sent to the Electricity Committee for consideration and report, on the ground that there was no demand by the consumers for any reduction.

**Eccles.**—The Electricity Committee has received a communication from the L.G.B., in which it was stated that for reasons therein mentioned, the Board does not consider that it would be justified in complying with the application for sanction to borrow £666 for the purpose of lighting certain streets in the vicinity of Cromwell Road, by electricity.

**Falkirk.**—The outcome of the plebiscite of the ratepayers, taken on the question as to whether the Linlithgow and Falkirk District Electric Lighting order, now being promoted by Mr. George Balfour, London, should be opposed by the promotion of another burgh extension order, has resulted in the advice of Mr. Balfour Browne, K.C., London, being adopted. It will be recalled that he advised the extension of the burgh boundaries as the most effective means of opposing the order. The vote resulted in a majority for this of 1,363 : 77 per cent. of the electorate voted.

**Halifax.**—Members of the T.C. on Monday made a tour of inspection, and at the electricity works a new 1,500-kw. turbo-alternator, which has been installed to meet the increased demand for electrical energy for motive-power purposes, was started up.

**Headington.**—The B. of G. is to discuss the appointment of a Committee to consider the lighting by electricity or otherwise, of the workhouse, where at present oil lamps are used.

**Lancaster.**—A conference is to be held between members of the Electricity and Lighting Committees in reference to the question of cost and other matters connected with street lighting by electricity.

**Liverpool.**—In pursuance of a resolution passed by the Electricity Committee in December last, the consulting electrical engineer (Mr. A. Bromley Holmes) and the city treasurer, have reported to the Committee on the position of the electrical undertaking with a view to the reduction of charges to consumers. After reviewing the financial position of the undertaking, the report points out that last year in Liverpool there were sold 37,765,203 units, with an income of £265,475, these figures including 15,149,005 units for lighting and power (£165,966), and 22,616,198 units for tramways (£99,509). The average price received was 1'687d. per unit. As regards the '349d. per unit for works cost, it was reported that "very little reduction on the cost of production can be anticipated from increased output, as the last published works cost of the two undertakings which alone have a larger output than Liverpool—namely, Manchester, with an output of 83,308,848 units, and Glasgow, with an output of 40,823,090, somewhat exceed the Liverpool works cost, where the output is 37,765,203 units." So long as the Committee was able to continue the policy of replacing old by modern plant of greater capacity out of reserve and renewals fund, the cost per unit of the interest and sinking fund would decrease with the increased output. The flat rate scale for lighting runs from 3½d. per unit to 2½d., and for power from 2d. to 1d. according to the quantity taken. The maximum demand scale for lighting is a fixed quarterly charge of £2 per kW. on maximum demand (as registered by a demand indicator), and 1½d. per unit; and for power £1 per kW. on rated capacity of plant installed and ½d. per unit. The rateable value scale of charges is a fixed quarterly charge of 4½ per cent. on the rateable value of the premises and 1d. per unit. Details are then given of certain suggested concessions, which may be summarised thus:—(1) The charge for the supply of private houses on the rateable value system to be reduced to 2½ per cent. per quarter and 1d. per unit; (2) for shop lighting and other trade uses, a reduction from 4½ per cent. to 3½ per cent. per quarter; (3) for consumers requiring a "long-hour" service, the present power rate of £8 per kW. per quarter, and '5d. per unit to be reduced to £6 per kW., and '4d. per unit.

The Committee at the meeting on February 2nd approved the concessions recommended in the special report.

It is reported that the net balance on the Corporation electric supply for 1911 amounts to £48,141. The Electricity Committee has allocated £3,141 to the reserve fund, £20,000 to the renewal fund, and £25,000 to the relief of the general rate.

**London.**—BERMONDSEY.—A loan of £2,782 is to be taken up from the L.C.C. for electric lighting purposes, made up

as follows: £2,000 for mains, £32 for plant, (switchboard), and £250 for house services.

**STEPNEY.**—The Electricity Supply Committee has adopted the recommendation of the electrical engineer and manager as to offering lower terms for electric lighting purposes in factories, workshops and warehouses, the proposed rate to be, as from the dates of the meter readings upon which the monthly accounts for March, 1912, are based, 4d. per unit, for 300 hours' use per annum of the maximum demand, and ½d. per unit for all further consumption per annum, upon the following conditions, viz.: (a) That all artificial lighting used on the premises, as defined above, be derived from the Council's electricity supply mains; (b) that all power (exclusive of heating) used on the premises, as defined above, be derived from the Council's electricity supply mains; (c) that the mean "maximum demand" for power purposes (as defined and applied in Clause 4 (4) of the Council's general conditions) be not less than thirty electrical horse-power; and (d) that the consumer's total accounts (calculated on the rates upon which they are rendered) for any half-year ending on the dates of the meter readings upon which the monthly accounts for June and December are based, amount to at least £60, or that the consumer guarantees this amount as a minimum payment for each such period. In calculating the total amount of a consumer's half-yearly bill for the purpose of arriving at the minimum above mentioned, the accounts for lighting, power and other purposes, on the same or different premises, to be added together; provided that where the accounts of different premises are so added together, the average half-yearly account per service shall not be less than £15. This matter came under consideration owing to certain large consumers in the district who carried on business in factories and closed about 7 p.m., contending that under the Council's existing tariff the average charge per unit was too high to warrant them extending their lighting installation or even continuing the use of their existing installation. The Committee points out that although the recommendation would at the moment result in a decrease in revenue, there was little or no doubt that this also would, in view of the anticipated demand likely to ensue therefrom, be of a temporary character only.

**Loughborough.**—The T.C. has consented to a proposed bulk supply of electricity to the Brush Co. Negotiations between the Corporation and the company have been in progress since August last, when the company made a proposal that the Corporation should supply them with the whole of the electricity required for their works for light and power. The company estimated their requirements at not less than 1,000,000 units per annum, for which they were prepared to pay "something under ½d. per unit." Subsequently the company offered to give a guarantee for a consumption of 1,250,000 units per annum on a 10 years' agreement at ½d. per unit. The Electricity Committee recommended the Corporation to give a supply on these terms, with an increase of '0ld. per unit for every 6d. per ton increase in the price of coal, on the company agreeing to supply the turbo-generator and other plant on a hire-purchase system as suggested by them. The report was approved, together with a recommendation that application be made to the L.G.B. for sanction to a loan for the necessary extensions to buildings, plant, &c., estimated at £14,000.

**Maidstone.**—The B. of T. has sent the T.C. an order enabling it to supply current to Springfield Mill, which is outside the borough.

The T.C. has decided to hold a series of demonstrations of electrical cooking during the month: it has also applied to the L.G.B. for a loan of £550 for a motor-generator.

**New Zealand.**—It is proposed by the Napier B.C. to raise a loan of £15,000 for the construction of electric power and lighting works and electric tramways which have been approved on a poll of the ratepayers of the borough.—*Board of Trade Journal.*

**North Berwick.**—Further particulars of the proposal to introduce a scheme of electric lighting into North Berwick were brought before a meeting of property owners and other residents at the Royal Hotel. Mention was made of the fact that an agreement had been entered into between Messrs. Crompton & Co. and the Corporation, and that it was intended to float a company to carry out the scheme. Mr. J. C. Ivens, as representing the company, gave a general outline of the proposed installation, together with details of the cost. For purposes of comparison a statement was submitted showing the cost and results of similar undertakings in 10 towns of varying population, and the estimate afforded was favourable to North Berwick.

**Reigate.**—The T.C. has sanctioned the conversion of 30 gas lamps to electric lighting during the year.

**Rochdale.**—The Corporation has applied to the L.G.B. for sanction to borrow £8,700 for extensions of buildings and plant at the Dane Street electricity generating station, and an inquiry has been fixed for the 13th inst.

**Salisbury Plain.**—It is stated that the Army estimates for the financial year of 1912-13 will contain a large provision for electric lighting of barracks in various parts—particularly where new barracks have been erected in recent years. A sum of £50,000, it is said, will be spent at Salisbury Plain and the adjacent camps. A considerable time has elapsed since the Army authorities found out that one of the causes of discontent amongst the soldiers in those remote camps was the ill-lighting of their quarters and the vicinity.



**Shipley.**—A decision by the Electricity Committee of the U.D.C. that the engineer should prepare plans and estimates for the submission of a scheme to the L.G.B. providing for alteration to buildings at the electricity works, extension of condensing, boiler and turbine plant, and extension of mains, was not adopted by the Council at its meeting last week, it being agreed that the matter should be more fully considered. The financial statement of the Electricity Department for the nine months ended December last showed an income of £8,199, compared with £6,974 in the corresponding period of the previous year, and an expenditure of £5,158, compared with £3,580.

**Southampton.**—The electrical engineer has been instructed to obtain quotations for a standard motor for the locomotive used in the haulage of coal trucks to the electricity works. Application is to be made to the Local Government Board for sanction to borrow £5,000 for general mains. In reply to a letter suggesting the desirability of wiring houses free, or at a very nominal cost, the town clerk has been instructed by the Electricity Committee to reply to the effect that the suggestion could not be entertained, but that the Council would be prepared to put in installations on the assisted wiring system.

**Southgate.**—The North Metropolitan Electric Power Supply Co. is to be asked to submit for the Council's consideration terms for the lighting of the Green Lanes main road, and to arrange with the surveyor for the erection at certain points of sample lamps.

**Stoke-on-Trent.**—The Education Committee has appointed a Sub-Committee to discuss with a Committee of the T.C. the advisability of installing the electric light in schools in the Hanley and Tunstall areas.

**Sunderland.**—The Electricity and Lighting Committee of the T.C., in its estimate of revenue and expenditure for the year, anticipates a credit balance on the year's working of £5,006, compared with £1,194 for the previous year. The total expenditure is estimated at £55,269, and embraces the following chief items: £12,488, cost of generating current; £5,747 distribution expenses; £4,393, management and general expenses; £11,806, interest on loans; and £16,630, sinking fund contribution. There is an increase in the cost of generating current of £1,063, chiefly due to the increased expenditure on coal, the total for which is £8,204, as compared with £7,375, but the total output, it should be noted, estimated at 11,721,956 units, exceeds that of the previous year, by 1½ million units. The revenue is estimated at £60,275, against £55,253 for the previous year. The revenue from current for power purposes is estimated at £29,668, an increase on the previous year of £4,713. With a view to encouraging the use of current for heating and cooking, the Council has under consideration a proposal to reduce the price per unit to those consumers who are under the domestic rate, where they pay a fixed charge, according to rental. The reduction suggested is from ¾d. to ½d. per unit.

The Electricity Committee has decided to recommend the installation of a 5,000-KW. turbine with new cooling tower, cables, travelling crane, two new boilers, &c., at a total cost of £22,207. In December, 1911, there was a maximum demand of 5,740 KW. on the Hylton Road plant. Further power customers bring the demand up to 6,165 KW.

**Taunton.**—Mr. T. C. Ekin, the L.G.B. inspector, has held an inquiry relative to the application of the T.C. for sanction to borrow £2,500 for the purposes of the electricity undertaking. Mr. G. Spiller, chairman of the Electricity Committee of the Corporation, said he was convinced that the loan would tend to the more successful working of the undertaking. The application was not opposed.

**Wakefield.**—The Corporation has given notice that an application has been made to the B. of T. for consent to the placing of certain electric lines above ground, along various routes in the city, for the transmission of electrical energy at a pressure of 230 volts for the purposes of supply under the Wakefield Corporation Electric Lighting Order, 1894.

**Wednesbury.**—In consequence of the increasing demand for electric current in the borough, the Lighting Committee has recommended the purchase of a 230-KW. engine and dynamo at a cost of £3,500. A special arc lighting main is to be laid for the convenience of shopkeepers in the market place at a cost of £200. This, as well as the above recommendation, was confirmed at a meeting of the T.C. on Monday, when it was stated that 75 new customers had been obtained during the year, and that the electricity manufactured has gone up from 400 to 528 KW. It was also stated that £40,000 was now vested in the electricity undertaking of the town.

**Whitworth.**—The Rochdale Gas and Electricity Committee recommends, in reply to a request, that the Whitworth Council be informed that the Committee is willing to give the supply of electricity in bulk at the Rochdale borough boundary in Whitworth Road on the same terms as the supply to Littleboro', and with the addition of the Whitworth Council guaranteeing a minimum annual payment.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—The Perth (W.A.) Council is stated to be going to purchase 32 motor-omnibuses at a cost of £40,000, to run in competition with the Perth electric tramways, owing to the failure to adjust terms of purchase as between the Council and company.

A movement is on foot by Fitzroy, Northcote, and Preston, suburbs of Melbourne (V.) to secure tramway communication with the latter city.

**Blackpool.**—A proposal to establish an interesting postal innovation came before the Council on January 31st, the Postmaster suggesting, as the result of a request from several tradesmen, that letter boxes should be fixed on cars, as at Bradford, so that persons missing the last connection in their own neighbourhood may thus be able to catch the general post. The suggestion is that anyone may post a letter in this way at an "All cars stop" station, but that if a car is specially stopped at a "By request" station, a fee of 1d. shall be paid. The proposal was referred to the Tramway Committee. It is probable the system will be adopted.

For the financial year to date, the net revenue increase from the tramways shows the satisfactory amount of £7,828; the greatest advance being on the Promenade, £3,211; Marton, £1,009; and circular route, £2,782. The receipts per car-mile were 1s. 5¾d., against 1s. 3½d. last year. There had been an increase in the number of passengers carried of 1,342,595.

**Continental Notes.**—**AUSTRIA.**—It is stated that the French group competing for the financing of the projected underground and city railway in Vienna recently held out the prospect of the presentation of a binding offer within a very short time, so that a decision as to its acceptance could be arrived at up to May. This fact has induced the Vienna banks and electrical companies to meet and decide that the latter should prepare a general scheme up to May, when the banks will submit their financial proposals based upon the project.

Plans are being prepared in respect of a projected light electric railway between Oderburg and Deutschleuten.

The Austrian State Railways Administration has granted to the Silesian Provincial authorities at Troppau, permission to draw up plans for the construction of a narrow-gauge electric railway from Oderberg to Deutschleuten, passing by way of Skrzeczon.

**ITALY.**—The *Gazzetta Ufficiale* publishes decrees granting to the "Società Anonima Ferrovie e Tramvie Padane" a concession for the construction and working of a railway from Fano to Fermignano: authorising the Turin Communal authorities to construct and work (a) an extension of the Barriera San Paula—Barriera Casale electric tramway as far as the Trombetta Bridge, and (b) a section designed to connect the Borgo San Paulo—Barriera Grande line with the Pozzo Strada—Barriera Casale line.

**Hull.**—As the result of a poll on the proposed Parliamentary Bill, the Bill was rejected. Out of 57,000 electors, only 7,000 odd voted, and the vote cost £500. The principal items in the Bill were the extension of the tramways to Stoneferry and the erection of a new North Bridge, the estimated cost of the whole of the improvements being £250,000.

**Leicester.**—It is stated that the electric tramways system is about to be extended by running a line through King Richard's Road, thus linking up the Fosse Road section with West Bridges. The capital expenditure involved will, it is understood, come out of revenue, except so much as is allocated from the tramways reserve fund.

**Lowestoft.**—The T.C., at a special meeting on Monday, decided to apply for a loan of £10,000 for tramway purposes, £1,080 being for track foundation work; £2,337 for rails, joints and anchors; £5,901 for paving Lorne Park Road in Jarrah wood; and £682 for contingencies.

**Lytham.**—Owing, it is stated, to lack of local financial support, the electric light scheme projected here by the Lytham Electric Light and Power Co. will not be proceeded with.

**North-Eastern Railway.**—The half-yearly report of the directors shows that, for the half-year ended December last, the electric trains ran 598,988 miles, or slightly more than 2,000,000 car-miles; electric goods trains account for an additional 2,700 train-miles. The cost of electric train working is given as £16,726, made up of £12,842 for electrical energy and £3,884 wages of trainmen.

**Nuneaton.**—With reference to the proposed electric tramway scheme, the Highways Committee of the T.C. has reported that the institution of a tramway service would be of great benefit, and that railless traction would be admirably suited to local requirements. A route of 3½ miles has been selected, and the estimated total capital cost is £9,000.

**Oldham.**—The Tramways Committee is considering the advisability of running railless cars from Moorside to Grains Bar.

**Ramsbottom.**—A poll of the ratepayers of the urban district of Ramsbottom (Lancs.) was taken at the beginning of last week on the proposal of the local D.C. to institute a system of railless cars. The number of voters in the urban area is 4,029, but only about 1,400 took the trouble to vote. For the cars there voted 991; against, 407.



**Oldbury and Blackheath.**—At a meeting of the U.D.C. last week, considerable dissatisfaction was expressed respecting the position of the question of tramways to Blackheath. Councillor Green introduced the matter, and suggested it was high time the Council moved again, as the question had been under consideration for six months. The deputy clerk said they were waiting for the Tramway Co. Councillor Green said he did not think the Tramway Co. wanted to take the matter up. He added that there ought to be tramways running to Blackheath to-day. Ultimately the clerk was instructed to write again to the company.

**Reading.**—The T.C. has applied to the B. of T. for a loan of £3,000, to meet the cost of removing the tramway standards from the carriage-ways to the side pavements, and the provision of new cables, fittings, wires, &c.

**Rotherham.**—The T.C. has decided to purchase three railless cars for the Maltby section at a cost of £725 each.

**Scarborough.**—The South Cliff Tramway Co. is stated to be considering the advisability of operating its inclined tramway by electric instead of hydraulic power.

**Stretford.**—The District Council has under consideration the laying of a tramway track along Seymour Grove, Chorlton.

**Sunderland.**—The Tramways Committee of the T.C. has just issued its estimate of income and expenditure for the year ending March 31st, 1912. The income is expected to be £68,581 (including £67,300 traffic receipts), as against £59,920 total income for 1910-11. Traffic expenses are put down at £18,511, compared with £17,409 for the previous year. General expenses £5,827, compared with £5,330; repairs and maintenance £4,400, as against £3,770; power, &c., £10,700, against £10,677; £6,015 is placed to the reserve and renewal fund. It is estimated there will be a balance in favour of the borough fund of £5,000, which, with the allocation to the reserve, represents a net profit of £11,015, compared with £3,941 for the previous year.

**Todmorden.**—The T.C. on January 30th considered a suggestion for the adoption of railless traction. A sub-committee reported that before visiting Bradford and Leeds it had been very sceptical as to the suitability of the railless system for Todmorden, but it was now fully satisfied it was in every way suitable. The cost of running was about 6d. or 6½d. per car-mile, compared with 13d. per car-mile for the motor-omnibuses now in use. The ease, comfort, silence of running and absence of jerks were great advantages. The report was adopted, and the Council decided to discuss the question further in committee.

## TELEGRAPH and TELEPHONE NOTES.

**"All-Red Route."**—It is reported that a definite contract between the P.M.G. and the Marconi Co. for the erection of wireless stations, in connection with an Imperial wireless system, is about to be concluded.

**Anglo-Dutch Telephony.**—Last week London was placed in telephonic communication with Amsterdam, for experimental purposes, and speech was transmitted very distinctly.

**P.O. Telephone Factory.**—The recommendation of the Departmental Committee that the telephone repairs factory at Nottingham, taken over from the National Telephone Co., should be removed to Birmingham, where the Post Office stores are situated, has aroused the Nottingham people to a vigorous protest. The change would mean a heavy loss to the city.

**South Africa.**—Two new telegraph lines are to be run from Capetown to Johannesburg, and a third from Capetown to Durban, while others are contemplated.—*British and South African Export Gazette.*

**Telephone Assessments.**—At a meeting of representatives of Scottish rating authorities, held at Glasgow on January 30th, a resolution was passed reaffirming the principle that until the whole basis of local rating was revised, the Government telephone undertaking should be subject to contributions in lieu of rates based upon the actual valuation thereof, and it was agreed that a deputation should wait upon the Postmaster-General to discuss the subject.

**The Telephone Service.**—As the result of numerous complaints regarding the telephone service, a Telephone Users' Protection Association has been formed, with Mr. C. S. Goldman, M.P., as chairman. Mr. A. E. Bale, of Dunedin House, Basinghall Avenue, E.C., points out that such an Association was formed in 1907, and still exists, in a state of suspended animation.

**Uruguay.**—The Government has issued a regulation requiring all vessels that carry passengers to or from Uruguay to be provided with wireless telegraph apparatus by May 1st, 1912.

**Wires Cut by Meteorite.**—According to a note in the *Daily Mail* of February 2nd, the telegraphic apparatus in connection with the signal station at Finisterre was destroyed on January 25th by the fall of a meteorite.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—March 12th. Testing instruments for the P.M.G.'s Department Melbourne. See "Official Notices" January 26th.

MELBOURNE.—March 5th. Telephone material (Sch. 612); also 120 miles rubber-insulated cotton-covered tinned copper wire (Sch. 594). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

February 26th.—Five miles of cable, for the P.M.G.'s Department. See "Official Notices" January 26th.

**Austria.**—February 15th. The Austrian Post and Telegraph authorities in Vienna are inviting tenders for the supply of 4,845,000 metres of insulated cable.

**Beckenham.**—February 12th. Arc lamp carbons (flame), electrical house cut-outs, and service boxes, for a year, for the U.D.C. F. Stevens, Clerk.

**Belfast.**—February 12th. One automatic coal-weighing machine, and overhead electrical equipment material, for the Corporation. See "Official Notices" January 26th.

February 19th.—Stores for a year, for the City Electricity Department. See "Official Notices" February 2nd.

**Belgium.**—February 28th. The Belgian State Railway authorities at La Bourse, Brussels, are inviting tenders for the supply of a 25-ton electric travelling-crane for the railway workshops at Cuesmes.

**Birkenhead.**—February 13th. Continuous-current meters, house service fuse boxes, low-tension main cable, I.R. lead-covered and armoured service cable, for the Corporation. See "Official Notices" February 2nd.

**Blackburn.**—February 12th. Stores for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" January 26th.

**Bolton.**—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" to-day.

**Bournemouth.**—February 20th. Coal for the Corporation Tramways Department, for three or 12 months, from April 1st. I. Bulfin, general manager, Lansdowne Crescent (returnable deposit of £1 ls.).

**Bristol.**—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" January 26th.

February 20th.—Arc lamp carbons, joint and fuse boxes, A.C. meters and D.C. mercury-type ampere-hour meters, for a year, for the Corporation. See "Official Notices" to-day.

**Cardiff.**—February 17th. The Union is inviting tenders for one 30 ft. by 8 ft. Galloway, Lancashire or Yorkshire type boiler and superheater. Specifications and forms of tender from Mr. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

**Coventry.**—February 22nd. Water-cooling plant of a capacity of 250,000 gallons per hour, for the City Electricity Department. See "Official Notices" to-day.

**Croydon.**—February 19th. General stores and goods, for tramways department, for a year, for the T.C. Tramways Manager, Thornton Heath.

**Dublin.**—February 14th. Arc lamp carbons, for the Corporation. See "Official Notices" to-day.

**Epsom.**—February 13th. 200-kw. Diesel generating set for the U.D.C. See "Official Notices" January 26th.

**Halifax.**—The Electricity Committee has decided to invite tenders for the supply of a 3,000-kw. turbo-alternator for the electricity works.

**H.M. Office of Works.**—February 21st. Fuse and switchboards, for a year. See "Official Notices" to-day.

**Hungary.**—PECS.—February 28th. Erection of a new power station. Particulars, Municipality.

MOR.—Erection of a power station. Particulars, Elektrizitäts-Direktion.

**Ilford.**—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" to-day.

**Ipswich.**—February 21st. One water-tube boiler, for the Corporation Electricity Department. Specifications and forms of tender, £1 ls. (returnable), from Mr. Frank Ayton, engineer and manager, Constantine Road, Ipswich.



**Italy.**—February 29th. H.M. Consul at Cagliari (Mr. R. H. Pernis) reports that tenders are invited by the municipal authorities at that place for the establishment of an electric generating station, the construction and working of electric tramways over a distance of 3,280 metres (about two miles), and the illumination of the principal squares and streets of the city by electricity. For further particulars, see this column last week.

**Kirkcaldy.**—February 29th. 1,000-KW. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" to-day.

**Leeds.**—February 14th and 21st. (a) 1,000 A.C. meters and (b) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 19th. March 9th.—6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" to-day.

**London.**—BERMONDSEY.—February 19th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 26th.

**BATTERSEA.**—February 20th. Materials and stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**FULHAM.**—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 2nd.

**HAMMERSMITH.**—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**POPULAR.**—February 16th. Extensions to E.H.T. and D.C. switchboards, for the B.C. See "Official Notices" February 2nd.

**ST. PANCRAS.**—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" to-day.

**Manchester.**—February 20th. (a) Tramcar type ampere-hour meters, and (b) general stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

February 14th.—For supply, delivery and erection at Stuart Street electricity works, of (a) high-pressure steam and feed pipes and supports connected to two marine-type boilers; (b) work required in connection with the installation of a battery of 16 patent sand filter units in roof tank. Specifications and forms of tender from F. E. Hughes, Secretary, Electricity Department, Town Hall.

**New Zealand.**—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

**Pontypridd.**—February 21st. Stores and materials for a year, for the U.D.C. Electric Light and Tramways Department. See "Official Notices" to-day.

**Portsmouth.**—February 20th. Stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

**Portugal.**—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes. For further particulars, see this column for January 19th.

**Rhodesia.**—A complete electrical plant is to be installed at the Shamva property, Rhodesia, and orders for both surface and underground machinery and accessories will shortly be on offer.—*The British and South African Export Gazette.*

**Rugby.**—February 10th. Willaus-Diesel oil engines and Victoria turbo-pumps, with variable speed, for the U.D.C. D. G. Macdonald, water engineer.

**Sheffield.**—February 12th. Electrical fittings for two years for the Health Committee of the T.C. Cleansing Superintendent (returnable deposit of 10s.).

**Siam.**—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

**Tunbridge Wells.**—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

**Wallasey.**—February 12th. One 500-KW. alternator and Diesel engine combined, for the Corporation. See "Official Notices" January 26th.

**Walthamstow.**—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

**Warlingham.**—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

**York.**—Electric shunting locomotive for the Corporation. See "Official Notices" January 12th.

## CLOSED.

**Accrington.**—Messrs. Mather & Platt, Ltd., have just been instructed to proceed with a large contract for the Accrington and Church Outfall Sewage Board, which comprises 24 of their pipe-arm type of revolving distributors, each 62 ft. in diameter, complete with all appurtenances, as well as a sewage pump, screening mechanism, motors to drive the machines, and also the lighting work.

**Belgium.**—Six concerns submitted tenders last week to the municipal authorities of Ghent for the supply of a steam turbine-alternator generating set at the central electric lighting station, the lowest offer being that of a local firm of engineers, Messrs. Vanderkerkhor.

**Birmingham.**—The Tramways Committee received the following tenders for steel tramway rails and fishplates:—

Bolling & Lowe (representing Phoenix Steel Works, Ruhrort, Germany)	(recommended)	£11,461
Lorain Steel Co. (whose rails are manufactured in America)		12,494
Walter Scott, Ltd.	(accepted)	13,155

"It will be observed," says the report, "that the German tender is £1,694 lower than the English tender, and that the American tender is lower by £661. Your Committee, after giving the matter most careful consideration, particularly with regard to the actual experience in Birmingham of the wear of both German and English rails, feel bound to recommend the Council to authorise the acceptance of the tender of Messrs. Bolling & Lowe (as representing the German firm above named) at the sum of £11,461."

The above tenders were under discussion at the Council meeting on Tuesday, and by 43 votes to 29 the Committee's recommendation was rejected; the tender of Messrs. Walter Scott, Ltd., of Leeds, at £1,700 above the German tender, being accepted. According to a newspaper report, one of the speakers who opposed the recommendation said that German firms could afford to sell more cheaply than British firms owing to the bounty on exports and to the cheap carriage by waterway.

**Bolton.**—The Tramways Committee has accepted the following tenders:—

Robinson & Sons, Sagar & Co., Cowley & Co.—Woodworking machinery for new repair shop.	
Hadfield's Steel Foundry Co., E. Allen & Co.—Special trackwork.	
J. W. Witter.—Heating apparatus.	

**Bristol.**—The Docks Committee of the T.C. has accepted the tender of Messrs. Herbert Morris, Ltd., for the electrification of a gantry crane; and that of Messrs. Holt & Willetts for two lifts for the cold stores.

**Burnley.**—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., to supply 800 yards of cable required in connection with the supply of electricity to the Burnley Barracks and the Burnley Ironworks.

The Board of Guardians has accepted the tender of the Tudor Battery Co. for the supply and erection at the workhouse of a lighting battery and the removal of the existing battery, for £458. There is also a maintenance contract of £41 10s. per year for 10 or 15 years.

**Dartford.**—The U.D.C. has entered into an agreement with the Electrical Power Storage Co., Ltd., for the maintenance of the storage battery for a further five years, at £75 per annum, with the option of a further renewal for five years.

**Douglas (I. of M.).**—The T.C. has accepted the tender of Mr. Hanson Perry, of Douglas, for the electric light installation at the Villa Marina. The installation will consist of a 12-H.P. oil engine, of the Diesel type, with a 9-KW. generator.

**Louth.**—The County Council received the following tenders for installing electrical fittings in Dundalk Court House:—

J. M. Gowdy	£77
Dundalk Motor Works	180
J. O. Meldon	89
E. Gallagher	91
Gaskin Bros.	(accepted) 90

**Mersey.**—The Diesel Engine Co., Ltd., of London, have received an order from the Worthington Pump Co., Ltd., of London, for five Diesel engines, of 1,000 B.H.P. each, for the Mersey Docks and Harbour Board. These engines are for use in connection with the new Gladstone Dock now being built, and will be direct coupled to five 54-in. Worthington centrifugal pumps, running at a speed of 180 revs. per min., and having an aggregate capacity of 47,000 cb. ft. per min. The engines, which will be built by Messrs. Carels Bros., of Ghent, will consist of four cylinders each, of their latest two-stroke type, fitted with outside crosshead, and very similar in design to the Carels-Diesel marine engines, which are now being so widely adopted both in this country and on the Continent. This will be by far the largest installation of Diesel engines in this country. The whole of the above work will be carried out to the specifications of Mr. Anthony G. Lyster, engineer-in-chief to the Mersey Docks and Harbour Board.

**Northampton.**—The T.C. has accepted the tender of Messrs. Davey, Paxman & Co., Ltd., at £1,190, for a boiler, superheater and all accessories, for the tramways power station.

**Perth.**—Messrs. Chamberlain & Hookham, Ltd., have received an order for car meters.



**London.**—**POPULAR.**—The B.C. has accepted the following tenders in connection with the electricity undertaking:—Erection and completion of superstructure of extension of generating station, Thomas & Edge, £4,668; steelwork in connection therewith, Fairweather & Ranger, £2,485; supply and erection of ash elevator, New Conveyor Co., £250. This was the second lowest tender of five, and was recommended by the engineer on the grounds that the gearing could be more conveniently enclosed than any other form of driving gear; the worm gear was enclosed in a cast-iron dust-tight box, was fitted with ball bearings, and was constantly immersed in oil.

**L.C.C.**—The following were the tenders submitted for (1) 3,550 tons of track rails and fastenings, and (2) 1,050 tons of slot rails and 400 tons of conductor tees:—

## (1) TRACK RAILS AND FASTENINGS.

	Rails of carbon steel.	Rails of Sandberg high-silicon steel.
Bolling & Lowe (manufactured at Phoenix Works, Ruhrort, Germany) .. ..	£ 21,849	£ 22,564
Scholey & Co., Ltd. (manufactured at Phoenix Works, Ruhrort, Germany) ..	21,849	22,564
P. & W. MacLellan, Ltd. (manufactured at Phoenix Works, Ruhrort, Germany) ..	22,190	22,915
P. & W. MacLellan, Ltd. (manufactured by the North-Eastern Steel Co., Ltd., Middlesbrough) (alternative tender)	27,260	29,035
Walter Scott, Ltd. .. (recommended)	24,867	26,592
Bolckow, Vaughan & Co., Ltd. .. ..	26,166	27,941
Barrow Haematite Steel Co., Ltd. .. ..	28,052	—
Cammell Laird & Co., Ltd. .. ..	34,849	36,624

The chief engineer's estimates comparable were £24,612 for rails of carbon steel, and £26,769 for rails of high-silicon steel.

## (2) SLOT RAILS AND CONDUCTOR TEES.

Frodingham Iron and Steel Co., Ltd. .. .. (recommended)	£12,607
Walter Scott, Ltd. .. ..	12,849
P. & W. MacLellan, Ltd. (manufactured by North-Eastern Steel Co., Ltd.) .. ..	13,405
Steel, Peck & Tozer, Ltd. .. ..	13,925
Bolling & Lowe, Ltd. (manufactured at Phoenix Works, Ruhrort, Germany) .. ..	13,992

The chief engineer's estimate comparable was £12,345.

The Committee reported as follows:—"The tenders have been carefully examined. As regards the track rails and fastenings, the three lowest tenders provide for the manufacture of the rails in Germany, at the Phoenix Works, Ruhrort. We would point out that the difficulties of inspection during manufacture are greatly increased when the rails are made abroad, and the same control cannot be exercised over the work. Considerable extra cost has also to be incurred when the work extends over a long period. We are advised that to have the rails delivered direct to the work in progress, in quantities as required, is of considerable advantage, and saves the expense of storage and second handling. Moreover, when rails are obtained from abroad there is always risk of delay to work and consequent loss and inconvenience to the public, owing to rails not being available as the street work is opened up. We understand that the best results have been obtained from rails made of high-silicon steel, and we therefore think that the rails should be of this manufacture. In all the circumstances, we think that the lowest offer submitted by a British firm for rails of high-silicon steel, that of Walter Scott, Ltd., amounting to £26,592, should be accepted. In addition, a sum of 5s. a ton will have to be paid to Mr. Sandberg for royalty and supervision charges. The expenditure under this head will amount to about £863. As regards the slot rails and conductor tees, we think that the lowest tender submitted, that of the Frodingham Iron and Steel Co., Ltd., amounting to £12,607, should be accepted."

For the supply of 50 car sets of truss plates, the tenders received were as follows:—

Hurst, Nelson & Co., Ltd. .. .. (accepted)	£487
United Electric Car Co., Ltd. .. ..	650
Brush Electrical Engineering Co., Ltd. .. ..	700
East Ferry Road Engineering Works Co., Ltd. .. ..	750
S. H. Heywood & Co., Ltd. .. ..	1,150

**STEPNEY.**—The B.C. Electricity Committee received the following tenders for one E.H.T. converting plant at the Limehouse and Whitechapel stations:—

General Electric Co., Ltd. .. ..	£4,787
Do. do. (alternative tender, not to specification)	4,410
B. Peebles & Co., Ltd. .. ..	4,942
Brush Electrical Engineering Co., Ltd. .. ..	4,995
British Westinghouse Electric and Mfg. Co., Ltd. .. ..	5,290
Spagnoletti, Ltd. .. ..	5,606
Dick, Kerr & Co., Ltd. .. ..	6,282
Electric Construction Co., Ltd. .. ..	6,338
Siemens Bros. Dynamo Works, Ltd. .. ..	4,909
Do. do. (alternative tender, not to specification)	4,569

The alternative tender of the General Electric Co. does not comply with the specification, and both tenders of Messrs. Siemens Bros. Dynamo Works, Ltd., do not include all the plant specified. The formal tender of the General Electric Co. offers plant too long for the space available, and the price originally quoted does not include all the auxiliaries necessary, for which they require an extra of £80, which has been added to their tender.

Messrs. B. Peebles & Co.'s machine would, with the exception of one or two minor details, be a duplicate of the existing 1,500-kw. machine at Osborn Street, and spare parts, &c., could therefore be dispensed with, thus reducing the tender of Messrs. B. Peebles and Co., Ltd., to £4,847.

Mr. Tapper, the engineer, in his report, says that he has compared the relative guaranteed efficiencies of the machines included in the two lowest tenders. The guaranteed efficiency of the Peebles machine is from 3 per cent. to 7½ per cent. higher than that of the

General Electric machine, which will result in an annual saving of approximately £60, which, capitalised at say 7 per cent., is equivalent to over £800, thus making the Peebles machine actually the cheaper of the two. He therefore has no hesitation in recommending the acceptance of the tender of Messrs. B. Peebles & Co., Ltd., £4,942, less £95 for spare parts, &c., not required.

**Post Office.**—The General Electric Co., Ltd., have again secured the Post Office contract for the supply of metal-filament lamps for the forthcoming six months, all lamps to be English made. This contract has been secured after exhaustive Post Office tests on both English and foreign lamps, and it includes every type for which the firm have tendered from 25 v., 5 c.p.

**Salford.**—For the supply and erection complete of 20 outside covers for bogie cars, the T.C. has accepted the tender of Messrs. Hurst, Nelson & Co., Ltd., at £151 per cover.

**Southampton.**—The T.C. has received the following tenders for the supply of one motor-alternator:—

Lancashire Dynamo & Motor Co., Ltd. .. ..	£1,065
Electric Construction Co., Ltd. .. .. (accepted)	1,266
Dick, Kerr & Co., Ltd. .. ..	1,376

The Electricity Committee has accepted the offer of Messrs. Dick, Kerr & Co., Ltd., at £8,090, to supply a duplicate of the steam generator with a Cole, Marchant engine and surface condensing plant installed by them two years ago. The contracts with Ferranti, Ltd., and the British Thomson-Houston Co. for the supply of 600 and 400 meters respectively, are to be extended for a further period of 12 months each, delivery to be made as required.

**Staffs.**—The Education Committee has accepted the tender of the General Electric Co., Ltd., for the renewal of electric lamps in the Council schools.

**Swindon.**—The tender of the Diesel Engine Co., Ltd., for a Diesel generating plant for the electricity works, at £6,376, has been accepted by the T.C.

**Winchester.**—The T.C. has accepted the tender of Messrs. Leroy & Co. for re-covering all steam apparatus at the electricity works with standard plastic non-conducting composition, at £90; and that of Messrs. W. & T. Avery, Ltd., for a weigh-bridge, at £62.

## FORTHCOMING EVENTS.

**Institution of Civil Engineers (Students' Meeting).**—Friday, February 9th. At 8 p.m. Lecture on "Steam Turbines," by Capt. H. Riall Sankey.

**Northampton Institute Engineering Society.**—Friday, February 9th. Paper on "Radio-Telegraphic Detectors," by Mr. W. Gilbert. Friday, February 16th.—Paper on "Water Turbines," by Mr. D. Cne.

**Physical Society.**—Friday, February 9th. At 8 p.m. At the Imperial College of Science, South Kensington. Annual general meeting. Presidential address by Prof. A. Schuster.

**Institution of Electrical Engineers (Scottish Local Section).**—Saturday, February 10th. At the Grosvenor, Glasgow. Annual smoking concert. Tuesday, February 13th.—Meeting at Edinburgh.

**Association of Engineers-in-Charge.**—Saturday, February 10th. At St. Bride's Institute, E.C. Social. Dance. Wednesday, February 14th.—At 8 p.m. At St. Bride's Institute, E.C. Paper on "Steam Turbine Machinery," by Mr. A. A. A. Wynne.

**Institution of Post Office Electrical Engineers (Metropolitan Centre).**—Monday, February 12th. At 6 p.m. At the I.E.E. Paper on "Economies of Telephone Transmission," by Mr. A. W. Martin.

**Institution of Electrical Engineers (Newcastle Local Section).**—Monday, February 12th. Meeting at 7.30 p.m.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, February 12th. At 8 p.m. Lecture on "Recent Researches at the National Physical Laboratory," by Dr. T. E. Stanton.

**Institution of Electrical Engineers (Manchester Local Section).**—Tuesday, February 13th. At 7.30 p.m. At the University, Manchester. Paper on "Specifications," by Mr. F. S. Sells.

**Institution of Electrical Engineers (Birmingham Local Section).**—Wednesday, February 14th. At 7.30 p.m. At the University, Birmingham. Paper on "Automatic Reversible Battery Boosters," by Mr. R. Rankin.

**Institution of Electrical Engineers (Yorkshire Local Section).**—Wednesday, February 14th. At 7 p.m. At the University, Leeds. Paper on "Residence Tariffs," by Mr. A. H. Seabrook.

**Institution of Mechanical Engineers.**—Friday, February 16th. At 8 p.m. Annual general meeting.

**Junior Institution of Engineers.**—Saturday, February 17th. At 6.30 for 7 p.m. At the Hotel Cecil, London, W.C. Annual dinner.

**Finsbury Technical College O.S.A. Dance.**—The fifth annual dance run by the Old Students of this College was held on Saturday last, February 3rd, at Caxton Hall, Westminster. Those present claim that a more enjoyable evening was never spent. The President, Mr. R. J. Wallis-Jones, and his wife received the guests, and the arrangements were under Mr. P. V. McMahon's able care. Mr. W. M. Mordey and many other old Finsbury men turned up, as also did Mr. P. F. Rowell and his wife. With Pritchard's Band, all went exceedingly well, and everyone spent a very jolly time.

**Police Hand Lamps.**—The Watching Committee of the Aberdeen Town Council has resolved to provide 20 electric hand lamps for the night police, by way of experiment.



## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued:—

Monday, February 12th.—"A" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Tuesday, February 13th.—"B" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Thursday, February 15th.—"C" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Friday, February 16th.—"D" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Saturday, February 17th.—Mobilisation week-end run at Dover. The party for this run will parade at Charing Cross Station, S.E. and C. Railway, at 2.10 p.m. for the 2.22 p.m. train, sharp. Dress: Service dress, putties, greatcoats, belts and haversacks; no arms will be taken.

(Signed) J. H. S. PHILLIPS, Major,  
For Officer commanding L.E.E.

### NOTES.

**The Electrical Engineers' Ball.**—This annual function, which is to take place at the Hotel Cecil on Friday, the 16th inst., promises to be a great success. We are asked to state that all who have not as yet secured tickets and made arrangements for attending should do so promptly, through some member of the Committee, or the Hon. Secretaries, Messrs. A. M. Sillar and H. Alabaster.

**The Thomas Transmission and the Dewar Trophy.**—We have been informed by the Thomas Transmission, Ltd., of 14, Leonard Place, Kensington, W., that the Royal Automobile Club Committee has awarded them the Dewar Trophy for the most meritorious performance in connection with the certified trials held under the regulations and observation of the club during 1911. This award was in respect of the trials carried out with a lorry (see ELEC. REV., May 5th and June 23rd, 1911) and touring car, fitted with the Thomas electro-mechanical transmission, which was fully described in the issue mentioned above. Our readers will join with us in congratulating the Thomas Transmission, Ltd., on this official recognition of the excellent qualities of electrical speed control, the more so because automobile manufacturers in this country appear to have a rooted objection to any form of speed control which does not include an inflexible and un-mechanical arrangement of gearing. Possibly this recognition on the part of the R.A.C. will open the eyes of the manufacturers to possible and much-needed improvements in their cars.

**Glasgow Smoke Abatement Exhibition.**—We have received a prospectus of this Corporation exhibition, which has been arranged for September 20th to October 12th next. The exhibition will be under the auspices of the Corporation, the British Electrical and Allied Manufacturers' Association, the Coal Smoke Abatement Society and the Smoke Abatement League of Great Britain. The exhibits will comprise appliances for lighting, heating, cooking, power, &c. A copy of this pamphlet, containing full information regarding the classification of exhibits, demonstrations, competitions and other matters, can be obtained from the general manager, Mr. James M. Freer, 38, Bath Street, Glasgow.

**Walking Club.**—We are informed that the Clapham Walking Club was duly inaugurated at last Saturday's meeting held at the Alexandra Hotel, Clapham Common, and the secretarial work is now in the hands of Mr. E. H. Rooft, 2, The Oval, Kennington. The annual subscription is 5s. with 1s. extra first year for nomination fee. The general meeting for the purpose of forming the Hackney Walking Club will be held on Saturday, February 17th, at 6 p.m., at the Farleigh Hotel, Amhurst Road, Stoke Newington, and all interested are asked to communicate at once with Mr. S. C. Haynes, hon. sec. (*pro tem.*), 20, Penda Road, Clapton Park, N.E. The inquiries from those engaged in the electrical trades in London and the provinces have been so satisfactory that it is now proposed to form an Electrical Trades Walking Club, with London headquarters central to the majority of the members. All the clubs will join a proposed National Walking Union, which in turn will affiliate to the National Athletic Union. All particulars can be obtained from Mr. A. R. Edwards, 303, Amhurst Road, London, N. We understand that arrangements are going ahead for the London to Southend Walking Race to be held on Good Friday, and offers of assistance will be welcomed.

**A New Tramway Track.**—The Bradford city engineer, Mr. W. H. S. Dawson, has produced a tramway track foundation which it is believed will prove six times stronger than the best at present in existence in Bradford. A specimen section has been laid at Bowling. The adoption of the new foundation will involve an increase of £100 per mile on the cost, but it is claimed that advantages will accrue more than compensating for the extra cost, in the increased length of life of the track and the smoother running of cars.

**The Telephone Service.**—Since our leaderette on this subject went to press, we have seen in the *Times* a letter from Lord Devonport, chairman of the Port of London Authority, asking the P.M.G. when he hopes to restore the telephone service to its normal state of efficiency and usefulness—for at present, "so far as the Port Authority is concerned, it has ceased to be a reliable aid to business." Coming from such a source, this complaint must be taken seriously; it is probably due to the impending change-over of the Avenue exchange, which is situated in a district presenting exceptional difficulties. Where no such change has taken place or is contemplated, there should be no deterioration in the service.

**Electric Baking.**—The Skiles Bakery, of Milwaukee, Wis., which has had a 10-KW. 80-loaf electric oven in service several months, is now preparing to install a 30-KW. 360-loaf oven. The local experience with the smaller apparatus has convinced Mr. Skiles that, compared with the ordinary coal-heated affair, the electric oven has the advantages of saving coal and ash storage space, the expense, labour, dirt and annoyance of handling coal and ashes, unpleasant heat in the workrooms, &c. The electric ovens, which are built on the multi-storey plan, occupy only one-fifth the space of the old ovens, and can be started up much more quickly, attaining a baking temperature within 45 minutes after the heat is applied.

The new 360-loaf oven, which is being built by the Westinghouse Co., will have a maximum demand of 30 KW. and a running demand of 20 KW. It will be in use 20 hours a day, as in the case of the present unit, assuring a consumption of about 20,000 KW.-hours per month. Under these conditions the bakeshops will earn a rate of 2½ cents to 3 cents per KW.-hour, the energy cost for baking amounting to about ¼ cent per loaf. Wheat bread requires 30 minutes to bake, so that the large oven will produce 720 loaves per hour, or 14,400 per day.

One of the greatest attractions of electric baking in the case of the Skiles Bakery has been the advertising afforded, and the increased business which resulted following the announcement of the use of the electric oven. This advantage is felt to have offset fully the slightly higher cost of operation of the electric oven. Final proof that the owner considers it a good investment is afforded by the present plan to install an additional and much larger apparatus, giving a total capacity of more than 15,000 electrically-baked loaves per day.—*Electrical World.*

**A Large Electrical Project in Norway.**—In the parish of Aurland, at the Sognefjord, in the neighbourhood of Bergen, there is an immense amount of water-power available, which it is now proposed to make use of for industrial purposes. There are in all five rivers, flowing through five separate valleys. Natural water reservoirs are provided by 33 lakes, of various sizes, in the mountains. All the water rights have been collected, and options thereon acquired by Director Hiorth, of Christiania. During last summer and autumn engineers were constantly busy surveying the district and making the necessary calculations and estimates for the regulation and harnessing of the water-power. The estimates are nearly complete, and are based upon two alternatives. The whole quantity of water will be conducted through Laaidalen, one of the valleys. In either case it is proposed to conduct the water through a tunnel, and the expenditure for each alternative will largely depend on the cost of the particular tunnel chosen. One of the alternatives will require a capital expenditure of £777,777, with a height of fall of 800 m. The second alternative will require an amount of £1,111,111, with a height of fall of 900 m. In the latter case the available power will amount to 150,000 H.P. There were about 70 owners of water rights, who have disposed of the same for £16,667. There is no information available as yet as to the purpose for which the power will be used, although it is almost a certainty that electrical ironworks will be erected.

**Electrical Installation at the New Whitehall Club.**—The new Whitehall Club, Princes Street, Westminster, recently built to the plans of Mr. H. Chatfield Clarke, F.R.I.B.A., is fitted throughout with electric light, the installation having been designed with a view to combining the highest possible illuminating efficiency with economy both in first cost and in energy consumption. The fittings employed have been carefully chosen to suit the style and purpose of the various rooms; the metal work of the fittings is finished throughout in real bronze colour, and the same remark applies to the switch and bell-push plates, portable standards, &c. In the main entrance-hall use has been made of the well-known Holophane spherical fittings: these are of 16 in. diameter, and carry each one 100-c.p. metallic-filament lamp. Similar fittings, but of smaller size, were selected for the staircase and landings. In the dining-room large electroliers carrying six lamps each are used, with Holophane prismatic shades, giving, in conjunction with frosted lamps, a soft but adequate illuminating effect. The general lighting in the room is supplemented by a number of wall brackets designed to match the electroliers. In the smoking-room electroliers of a lighter pattern, also carrying six lamps each and Holophane satin-finished shades, are used, while in the adjoining card-room each card-table is lit by means of an ornamental three-cord counterweight pendant fitted with a moss-green silk shade. The billiard-room, situated on the third floor, is fitted with specially designed billiard-table fittings carrying six high-candle-power lamps; each lamp is placed under a moss-green silk shade lined with white cardboard, and the lighting of the tables is most successful. A telephone installation enables the members to communicate directly from any floor with



the public exchange. The wiring work was carried out by Messrs. Foote & Milne, Ltd., with C.M.A. v.r. insulated conductors enclosed in solid-drawn screwed steel conduits. The switch and fuse distribution boards are of Messrs. Spagnoletti & Co.'s manufacture. The ornamental fittings were supplied by the General Electric Co., Ltd., and Messrs. Veritys, Ltd., respectively, the special billiard-table fittings being designed by the first-named. The installation includes a number of electric fans, a sewage-pump motor, a Waygood electric passenger lift from ground to third floor, and three electric goods lifts. The consulting engineer for the electrical work was Mr. Reginald J. Wallis-Jones.

**Copper.**—The general impression that the consumption of copper is increasing is borne out by Messrs. H. R. Merton's statistical circular for mid-January. The visible supplies have dropped to 55,583 tons, a decrease of 1,700 tons from the end of December, and deliveries stand at 22,617 tons for the fortnight, thus promising to exceed last year's average monthly European consumption of 41,080 tons. Supplies from North America promise to be well above average; from Spain and Portugal just on average; Chile shipments promise low, and Australian are about as usual. The stocks in Rotterdam have dropped 150 tons to 5,150, and in Hamburg are estimated to have increased 200 tons to 8,300. French stocks remain steady, at 5,240 tons. Resuming the position for last year, a writer in the *Financial News* points out that in 1911 prices practically reversed the course they took in 1910; whereas in the former they rose from £53½ to over £64; in 1910 they fell from £62 in January to £56 in December. In 1910 the frequent reports of an amalgamation may have held the market up against falling demand.

The world's consumption, estimated by Messrs. Lewis at 875,000 tons, shows an increase of 155,000 tons in four years, in spite of reduction of output on the part of a few producers. The United States contributed just under 500,000 tons, increasing in the past year by 15,020 tons, or over 3 per cent., the falling off in the yields from Lake Superior and Montana being considerably more than balanced by those of Arizona and other States, chiefly Utah, Nevada and New Mexico. Other producing countries have not done much in increased output except Queensland, which has sent 6,500 tons more metal to this country, and Mexico, which has increased its figure by about half that amount. Consumptions, as far as can be estimated, run as follows:—United States, 325,431 tons; England, 97,192 tons; France, 80,837 tons; Germany, 135,487 tons. The United States consumption is thus lower than for the year 1910, and Germany's increased 48,700 tons.

Supplies, as shown by Messrs. Merton's statistical circular for January, were brisker during the month, thus preventing very heavy withdrawals from stocks. The reduction in visible supplies for the month was 1,713 tons, the figure for Europe being now 55,570 tons. Supplies to European ports, and especially to English ports, from North America were high, and to English ports from Spain and Portugal the same remark applies, though the supply to other countries from these producers was not up to average. Shipments from Chile are above average, but from Australia rather below. Demand has been strong, total deliveries reaching 48,808 tons.

Havre has increased stocks by 234 tons, while Rotterdam is lower with 4,900 tons and Hamburg 100 tons higher at 8,200. The combined visible supply (excluding Holland and Germany) for the end of December was 97,218 tons, American stocks being only 39,935 tons.

**Institution of Electrical Engineers: Annual Dinner.**—On Thursday last week the annual dinner and reunion of the Institution took place at the Hotel Cecil, with the President, Mr. S. Z. de Ferranti, in the chair. The attendance was rather below the average, being about 340, but was representative not only of the Institution and its Local Sections, but also of many other important societies and of Government Departments, educational institutions, local authorities, and the great professions. Amongst those present were the Lord Chief Justice, the High Commissioner for the Commonwealth of Australia, Lord Justice Fletcher Moulton, Lord Justice Buckley, Prof. Unwin (President Inst. C.E.), Sir James Crichton-Browne, Sir T. Barlow (President Royal College of Physicians), Sir N. J. Moore (Agent-General for West Australia), Sir W. Ramsay (President British Association), Sir H. Monro (Permanent Secretary to the L.G.B.), Sir A. King (Secretary G.P.O.), Sir J. W. Taverner (Agent-General for Victoria), Sir L. Gomme (Clerk to the L.C.C.), Sir P. Magnus, the Lord Mayor of Dublin, the President of the Elektrotechnischer Verein, Sir J. Larmor, Sir H. J. Donaldson, Mr. R. J. Godlee (President Royal College of Surgeons), Sir A. Keogh, Sir B. A. Whitelegge, Sir R. Hunter, Mr. Justice Parker, Sir Norman Lockyer, Sir H. Truman Wood, Mr. E. E. Ellington (President Institution of Mechanical Engineers), Mr. G. Wilkinson (President Inc. M.E.A.), Prof. H. L. Callender (President Physical Society), Dr. R. Messel (President Society of Chemical Industry), and many members of the Council.

It was understood that the toasts would be few in number, and the speeches short, an arrangement usually hoped for, but seldom realised: on this occasion, however, the programme was carried out with admirable precision, and as the President claimed at 9.45, when he announced the adjournment to the Victoria Hall, a new record was established. After the loyal toasts, the Right Hon. Lord Alverstone proposed "The Institution of Electrical Engineers," recalling some amusing incidents which he had experienced at previous gatherings of the Institution. He wished prosperity to the Institution, which, he said, he joined as a life member, in the hope that it would soon come to an end and distribute its assets, but in that he was disappointed. It had already had a distinguished career, largely because it adapted itself to modern progress, and

had commanded the support of the most distinguished members of the profession, such as Sir William Siemens, Latimer Clarke, Sir Charles Bright, Dr. John Hopkinson, Prof. Ayrton, and, above all, Lord Kelvin, thrice President. He had no doubt its future would be as successful as its past. The toast was coupled with the name of the President, and was received with great enthusiasm and musical honours.

Mr. Ferranti said he appreciated the honour of occupying the chair during his second term of office as president. The members of Council bore a great responsibility, as electrical engineering was passing through new phases of development, and a different state of affairs now prevailed. Electricity was not merely a scientific matter nowadays, and the Institution must be the guardian of the interests of the electrical industry as a whole. The first thing to be done was to persuade the industry that it contained no divergent interests, and develop a feeling of union amongst all branches. They were now experiencing the good results of the policy which led them to acquire the Institution building; it enabled all the different interests to meet at headquarters, and thus showed them that they were all striving for the same end. It was most fortunate that they as the Institution of Electrical Engineers had been able to promote the development and harmony of the numerous branches meeting there. The Institution had always had the power to include as members eminent men who were not actually electrical engineers, but had not fully exercised it. They wanted to broaden the basis of the Institution and include all whose work was the development and progress of electrical enterprise, with immense benefit to the electrical industry. That question had received the consideration of the Council, and when the plan was carried out the Institution would be greatly strengthened. In this country electricity had been handicapped in many ways—for instance, by the difficulty of obtaining way-leaves, one of the greatest obstacles to progress, and one without any valid reason. The Council was considering how matters could be improved in this connection. They would have to educate the community to a better feeling. Another important question was the price of electricity, which was higher than it should be, due to the unfair way in which electrical enterprise had been treated. There was no one to look after the industry in this country, so a Committee for the protection of electrical interests was formed: that Committee was now in collaboration with them, so that the work would be pushed on with the whole weight of the Institution. His view was that it was the business of the Council to exert the whole influence of the Institution for the furtherance of the interests of the various sections which it represented. He hoped they would all work together in the cause, and all would benefit from the result.

Prof. S. P. Thompson proposed "Our Guests," of whom so many of great eminence were present. He cordially supported the policy of which the president had laid down the lines, to develop the Institution and make it of more use in the world, and said the Council wished to associate with them those who exercised influence in the larger walks of life. They must enlist the services of such eminent men as the Lords Justices who were present, the Agents-General for the Colonies, the representatives of great Government departments, and prominent officials in the public service. Sir George Reid responded, and expressed his appreciation of the reform in the matter of speeches. He referred to the great achievements of electrical science, dwelling in particular upon the fact that, thanks to electricity, the cry of those in peril on the sea could rise above the tumult of the waves and guide the rescuers to the spot.

The company then adjourned to the Victoria Hall, where the customary reunion took place. This is a most popular feature of the occasion, and a large number of members remained until a late hour, renewing old friendships and forming new acquaintanceships.

**Social Events.**—By invitation of Mr. J. W. Meares, Electrical Adviser to the Government of India, an "Old Cromptonian Dinner" was held at Calcutta on January 11th. The toast list was as follows:—"The Junior Partner," S. G. L. Eustace; "The Consulting Engineer," H. H. Reynolds; "Plant," E. A. Saunders; "Cable Department," C. H. R. Thorne; "Town Lighting," J. T. Mertens; "Rope Gearing," F. Powell Williams; "Rubber Goods," W. T. Jennings; "The Old Firm," G. Rackstraw; "The Projector," J. W. Meares.

The first annual Bohemian Concert of the G.E.C. Athletic Club was held on Saturday evening last at the Oval Concert Hall, County Cricket Ground, Kennington Oval, S.E. A large attendance and an excellent programme combined to make the event a great success. Mr. Leonard Byng took the chair, and during the evening the "Davis Challenge Cup" and medals were presented to the winners. The St. James' Electric Supply Club was successful in the football competition, carrying off the prize for 4 goals to 0.

On Friday evening, February 2nd, the "Siemens's Supplies Smoker," organised by the staff at 39, Upper Thames Street, E.C., took place in the Pillar Hall, at Cannon Street Hotel. The chair was taken by Mr. C. Koettgen, managing director of Siemens Bros. Dynamo Works, Ltd. Those present were edified with literature regarding the "Zed" fuses, and while entertained with an excellent programme, were also soothed by "Special Zed" smokes—all high voltage—brown colour carrying 4 amperes and white 50 amperes.

**Institution and Lecture Notes.**—INSTITUTION OF MUNICIPAL ENGINEERS.—At a general meeting to be held on Saturday, February 24th, a paper on "Superannuation and Security of Tenure: the National Association of Local Government Officers and its Bill" will be read by Mr. A. W. Gray. The discussion will be an open one.



**THE SOCIETY OF ENGINEERS.**—The first ordinary meeting of the present Session was held on February 5th, at the Institution of Electrical Engineers. The retiring President, Mr. F. G. Blyd, presented the premiums awarded for papers published in the *Journal* during 1911, and then vacated the chair in favour of Mr. John Kennedy, the President for 1912, who delivered his Inaugural Address, dealing with shipbuilding and marine engineering.

**NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.**—On January 26th, 1912, Mr. J. O. Ruscoe read a paper on "The Silent Knight Engine." As at present built the engine has two sleeves sliding one within the other, and both within the cylinder. These sleeves, which contain the ports, are driven by eccentrics from a half-time shaft, which, in turn, is driven from the main crankshaft by a silent chain drive. These engines were subjected by the Technical Committee of the Royal Automobile Club at the request of the Daimler Co. to 132 hours' continuous bench test, 2,000 miles' running test on Brooklands track in not more than 60 hours of running time, and a 5 hours' bench test; the tests were carried out in a very satisfactory manner by the two engines selected by the judges, and it was found that no part showed any appreciable wear at the completion of the test.

On February 2nd a paper on "Steam Turbines Utilising the Impulse Principle, with special reference to the Disc and Drum Type." was read by Messrs. T. R. Houston and F. G. Parnell.

**ROYAL INSTITUTION.**—On Friday a lecture was delivered by Sir J. Mackenzie Davidson on "Vital Effects of Radium and Other Rays." He said that the Finsen arc had recently been superseded by the quartz mercury vapour lamp, but with both, the effects were confined to the surface. The skin-burns experienced by workers with X-rays were largely contributed to by the secondary rays, which were much more easily absorbed than the primary ones. He showed a comparatively large amount of radium made from pitchblende in this country.

**JUNIOR INSTITUTION OF ENGINEERS.**—A party of members of this Institution, through the kind permission of Mr. G. E. Pingree, managing director, paid a visit recently to the works of the Western Electric Co. at North Woolwich, and were shown over the various departments. On February 12th the Institution is holding a combined meeting with the Architectural Association, to hear and discuss a paper by Mr. P. Waterhouse on "Bridges," and on February 17th the annual dinner is to be held.

On February 1st Mr. T. R. Smith, electrical engineer to the Leicester Corporation, delivered a lecture to the LEICESTER AND DISTRICT WORKERS' EDUCATIONAL ASSOCIATION on "Electricity for Light, Heat and Power."

**Johannesburg Tramcar Contracts.**—According to the *British and South African Export Gazette*, at the request of the Transvaal Manufacturers' Association, the Johannesburg Municipality has decided to throw open the tendering for 10 new tramcars to Colonial coach and wagon builders.

**Kingston-on-Thames Diesel Engines.**—In connection with our remarks in the "Lighting Notes" section last week (page 175), Mr. J. E. Edgcome, the Council's engineer, writes to point out that the British Westinghouse Co. were invited to tender for the Diesel engines, although from the note he thinks it might appear that this was not the case. The fact that their tender was considered is, however, shown on page 169, where particulars of the Westinghouse tender are set out, together with those of six other firms. Mr. Edgcome assures us that these were carefully considered by his committee, and that the report was carried by 19 votes to 6, and 5 neutral, not 19 votes to 9, and 3 neutral, as mentioned by our news correspondent.

**Contract Conditions for Pretoria.**—The *British and South African Export Gazette* says that the Pretoria Municipality has decided that tenderers for municipal contracts shall in future provide two sureties, that every tender shall hold good for 30 days, that any tenderer who withdraws a tender after it has been opened, or who fails to take up a contract when called upon to do so, shall be debarred from tendering for further work for two years, and that the practice of requiring a deposit with a tender is to be abolished.

**Appointments Vacant.**—Foreman cable jointer and overhead linesman, for the Lancaster Corporation (40s.); canvasser (£3) and draughtsman (£3), for the Sunderland Corporation Electricity Supply; traffic superintendent, for the Darlington Corporation Tramways (£130). See our advertisement pages in this issue.

**Fatality.**—It is reported that John Black, an electrical engineer, was killed at Hartford Colliery, Northumberland, on Monday, through coming in contact with a live wire. The fatality was the subject of a coroner's inquiry on the 6th inst., at Hartford Colliery, Northumberland. Mr. Black was an electrical engineer engaged by the British Westinghouse Co., and on the 3rd inst. he was engaged at the Scott Pit, Hartford Colliery, when he was killed.

Robert Hudspeth, an electric fitter employed by the British Westinghouse Co., stated that on the 3rd inst. he was engaged making some alterations to the switch-handles at the bottom of the shaft. Mr. Black, who was in charge of the work, descended the pit later, and came to look at the switch which had been finished. Black asked for the current to be turned off. Witness isolated the switch, and Black looked inside it and then took hold of the handle. When, a little later, witness looked at Black again, the latter was standing straight up, with his hand on the switch, staring, and he appeared to have had a shock. Witness caught hold of Black's coat-tails, and the colliery electrician threw coat over him, and they pulled him off. Black then collapsed, and died in about half-an-hour. In reply to Mr.

Atkinson, H.M. Inspector of Mines, witness said that when he got to the pit he asked for the current to be cut off, but when the assistant "rapped" a message they could get no reply, and they decided it was quite safe to work with the current on. He could not say whether Black knew or not that the current was on.

Percy McDermott, chief electrical engineer at the colliery, said he thought that the fact that the deceased kept in contact with the switch for some moments showed that he thought the current was off.

Medical evidence having been given that death was due to electrical shock, a verdict was returned that Black died from such shock accidentally received while examining machinery. The jury also suggested that in future it would be better to have the current turned off when such work was being done.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. R. B. LEACH, electrical engineer to the Turton Council, has been appointed consulting electrical engineer to the Swinton and Pendlebury Council, to advise it upon the future of its electricity undertaking, &c.

With reference to a note that appeared in this section in our issue of January 26th, MR. F. H. EDWARDS asks us to state that he has not gone to be chief electrical engineer of the Cornwall Electric Power Co., but station superintendent at Hayle.

The Stoke-on-Trent T.C. has appointed MR. JAS. MACHIN, of Chesterfield, as mains superintendent at Burslem.

The Erith U.D.C. has appointed MR. R. N. MAYNE, assistant engineer at the St. Helens electricity works, as chief assistant engineer. The salary is £200 a year, and there were 108 applicants.

The Bridlington T.C. has decided to increase the salary of MR. A. J. BECKETT, electrical engineer, from £300 to £350 per annum. The Committee had recommended an increase to £350 with further increases of £25 a year on January 1st, 1913, and January 1st, 1914, on Mr. Beckett agreeing to forego, for work done after the end of 1911, any commission to which, as consulting engineer, he would otherwise have been entitled. An amendment that the increase granted should include work done in connection with any other committee of the Corporation was rejected by 13 votes to 7.

As a mark of appreciation of the able and efficient way in which the electrical engineer (MR. BRYDGES) has fulfilled his duties, and of the success which the electricity undertaking has attained since his appointment, the Eastbourne T.C. has decided to increase his salary of £500 by £25 per annum from April 1st next by annual increments of £25 on approved service, to £600 per annum.

At the request of the charge engineers the Electric Lighting Committee of Leyton U.D.C. has decided that the maximum of the present scale applicable to this position shall be increased from £150 to £156.

The Parliamentary and General Purposes Committee of St. Pancras B.C. have recommended that the salary of MR. J. T. BABON, resident and supervising engineer at the electric light stations, be increased from £450 to £475 per annum, and further increased in 12 months' time to a maximum of £500 per annum.

The Bristol City Council on January 30th discussed the proposal to increase certain salaries in the electricity department. Alderman Pearson, who moved the adoption of the Committee's recommendations, said that MR. FARADAY PROCTOR had been for 10 years without an increase, and it was proposed now to raise his salary from £800 to £850. The discussion was lengthy, and while there was almost a unanimous eulogy of the chief engineer, it was resolved, on a division, by 35 votes to 32, to omit his name from the resolution.

The maximum salaries of the engineers-in-charge at the electricity works of Salford are to be increased from £180 to £190 per annum, and the three present engineers are to have their salaries increased to meet this resolution.

MR. R. J. WATMUFF has resigned his position as shift engineer at the Rawtenstall electricity works in order to take up a position of draughtsman with Messrs. Greens, engineers, Cononley. MR. NICKLIN, of Falkirk, has been appointed to fill the vacancy.

On Monday afternoon, MR. W. B. CLARKE, shift engineer at Kirkealdy, was presented by the staff with a handsome dressing case and Gillette safety razor case, on the occasion of his leaving to take up a situation in South Africa. The presentation was made by Mr. O. F. Francis.

**Tramway Officials.**—In view of additional work that has devolved upon certain officials, and in recognition of efficient performance of their duties, the Birmingham Corporation Tramways Committee has recommended the following advances of salary:—MR. C. E. S. BILL (permanent way engineer), from £300 to £350 per annum; MR. R. H. DICKINSON (rolling stock superintendent), from £300 to £350; MR. A. C. BAKER (electrical engineer), from £200 to £250 per annum.

Accrington Electricity Committee has adopted a resolution to dispense with the services of MR. JAMES WILDING, the overhead linesman, under the new management. Mr. Wilding has been offered £50, with one month's notice, to terminate his services. In the event of non-acceptance, he will be given a month's notice without compensation. The Committee considered the position of INSPECTOR DUTTON, whose services are also not now required. It was resolved that he be given notice to terminate his services, a sum of £20 being given as compensation for loss of office.



**General.**—MR. J. H. BIGLAND, of the National Telephone Co.'s London contract staff, has been appointed contract manager to the Constantinople Telephone Co. (Société Anonyme des Téléphones de Constantinople), and will shortly proceed to Constantinople to take up his duties.

MESSRS. G. J. WELLS & A. J. WALLIS-TAYLER have commenced business as consulting engineers at 78, Fleet Street, London, E.C., as Wells & Tayler. Mr. Wells, who served his time with Messrs. Thornycroft, has since held positions on the staffs of Messrs. Willans & Robinson, Easton, Anderson & Goolden, the British Westinghouse Co., and Yates & Thom. Mr. Tayler served his time with a well-known firm of saw mill engineers, has had a considerable experience in charge of extensive sugar estates and works in the West Indies, and for a number of years has devoted himself to the subject of refrigeration, upon which he has written several textbooks.

MR. G. A. TRUBE, who has been associated with the British Westinghouse Co. since its inception in this country, lastly as manager of the engine sales department, has just resigned this position to take up the managership of the Société Anonyme Westinghouse, of Paris and Le Havre. Mr. Trube, whose address henceforward for all business communications will be 7, Rue de Berlin, Paris, has, in addition to his Westinghouse connections, a host of friends in the engineering world, and he will start out on his new enterprise with the good wishes of them all.

MR. J. KELLY, who is retiring from the position of senior in charge of the tool department of the Western Electric Co., North Woolwich, has been presented by the employés with a gold watch.

*Indian Engineering* says that "MR. T. D. D. BERRINGTON, C.I.E., M.I.E.E., Director-General of Telegraphs, Indian Telegraph Department, is permitted to retire from the service of Government."

We are asked to state that the dissolution of partnership hitherto existing between MR. G. HOOGHWINDEL and MR. THURSFIELD, of Leeds, does not in any way affect the partnership of Mr. Hooghwinkel and MR. WM. ANTHONY BROWN, who are continuing to carry on business as civil and electrical engineers at 24, Martin's Lane, Cannon Street, E.C., and at Mexico City and Rio de Janeiro.

**Obituary.**—The death took place at Woodford, Essex, on Sunday last, of MR. P. M. S. BRODIE, who, for the past 11 years, was works manager of The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E. He joined the company nearly 40 years ago, and had been manager of the Sheffield, Bradford and Glasgow branches. He was in his 65th year.

## NEW COMPANIES REGISTERED.

**Fox, Ltd. (119,891).**—This company was registered on January 26th, with a capital of £1,000 in £1 shares, to carry on the business of equippers of private houses and other premises with plant and accessories for supplying light, heat and power, manufacturers of electrical heating and regulating devices, machinery, accessories, &c. The subscribers (with one share each) are:—J. Fox, 43, Clifton Road, Aston, Birmingham, mechanic; R. J. Hall, 28, Douglas Road, Handsworth, Birmingham, insurance superintendent. Private company; the number of directors is not to be less than two or more than five; J. Fox is the first; qualification, £100; remuneration as fixed by the company. Registered office, 23, Temple Row, Birmingham.

**Hydro-Electric Lift and Crane Co., Ltd. (119,852).**—This company was registered on January 24th, with a capital of £600 in 2s. shares, to carry on the business of lift and crane makers, hydraulic engineers, electric supply engineers, makers, builders and erectors of hydraulic and electrical machinery, &c. The subscribers (with one share each) are:—E. M. T. Boddam, 27, Old Jewry, E.C., engineer; H. B. Vogel, 27, Old Jewry, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are E. M. T. Boddam and H. B. Vogel; W. B. Townsend is the first secretary. Registered by W. B. Townsend, 27, Old Jewry, E.C.

**Brilliant Arc Lamp and Engineering Co., Ltd. (119,811).**—This company was registered on January 22nd, with a capital of £2,500, in £1 shares (500 5 per cent. cumulative preference), to acquire from B. A. Quint a licence to manufacture and sell certain inventions and patent rights in regard to electric arc lamps and otherwise, and to carry on the business of founders, engineers, &c. The subscribers (with one ordinary share each) are:—J. W. Begg, 26, Park Road, S. Wanstead, clerk; N. A. Corke, 24, Birdhurst Road, Croydon, article clerk. Private company. Table "A" mainly applies. Registered office, 1, Lonsdale Road, West Kilburn, N.W.

**Venner's Signs, Ltd. (120,015).**—This company was registered on February 1st, with a capital of £11,000 in £1 shares, to acquire certain patents relating to illuminated signs and the trade mark "Veni," together with the business of a manufacturer and seller of illuminated signs carried on by R. F. Venner, and to adopt an agreement with R. F. Venner and A. R. Jenkins. The subscribers (with one share each) are:—A. R. Jenkins, 2, Coleman Street, E.C., merchant; R. F. Venner, 6, Old Queen Street, E.C., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are R. F. Venner (chairman), and A. R. Jenkins (both permanent, subject to holding 2,000 shares each), and two other directors to be appointed by them; qualification of ordinary directors 100 shares; remuneration of R. F. Venner as chairman, £150 per annum; of other directors £25 per annum. Registered office, 6, Old Queen Street, Westminster.

**Homer Earphone Co., Ltd. (120,026).**—This company was registered on February 2nd, with a capital of £1,000, in 900 ordinary shares of £1 each, and 2,000 deferred shares of 1s. each, to take over the goodwill for the British Empire of the business of the Homer Earphone Co., to carry on the business of manufacturers of and dealers in aural, surgical, electrical and scientific instruments, &c. The subscribers (with one deferred share each) are:—J. L. Jones, 76, Selwyn Road, Upton Manor, E., managing clerk; A. R. Hawdon, York Hill, Loughton, Essex, clerk. Private company. The number of directors is not to be more than five; the subscribers are to appoint the first; qualification, 500 deferred shares. Registered by Owen Jones & Co., 88, Fleet Street, E.C.

**Fletcher Jackson & Co., Ltd. (119,942).**—This company was registered on January 30th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and mechanical engineers, electricians, manufacturers of and dealers in electrical apparatus, &c. The subscribers (with five shares each) are:—A. Fletcher, 89, Hamlet Court Road, Westcliff, engineer; A. G. Jackson, Kingscote, Hodford Road, Golder's Green, N.W., engineer. Private company; the number of directors is not to be less than two or more than five; the first are A. Fletcher (chairman), and A. G. Jackson (both permanent); qualification, five shares. Registered by Wansey Stammers & Co., 28, Moorgate Street, E.C.

**Telephone Accessories Co., Ltd. (120,914).**—This company was registered on February 1st, with a capital of £1,500 in £1 shares (600 preference), to carry on the business indicated by the title, and that of stationers, advertising contractors and agents, &c., and to adopt agreements (1) with H. O. Quinn and N. Medawar; and (2) with E. C. Digby. The subscribers are:—D. S. Frupp, 90, Cannon Street, E.C., chartered accountant, 50 preference shares; W. P. A. Banks, 101, Bethune Road, Stoke Newington, N., chartered accountant, 25 preference shares. Private company. The number of directors is not to be less than four or more than six; the first are C. C. Tollitt, D. S. Frupp, J. S. Patmore and H. O. Quinn; qualification, 25 shares; remuneration of chairman, £40 per annum; of other directors £20 each per annum. Registered office, 90, Cannon Street, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Brush Electrical Engineering Co., Ltd. (29,533).**—Particulars of £75,000 prior lien debentures, created December 28th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and land and buildings at Loughborough and Cricklewood. No trustees.

**Bankfoot Power Co., Ltd. (98,134).**—Issue on January 16th, 1912, of £2,800 debentures, part of a series of which particulars have already been filed.

**Evershed & Vignoles, Ltd. (43,206).**—Issue on January 17th, 1912, of £200 debentures, part of a series of which particulars have already been filed.

**Rural Electricity Supply Co., Ltd. (107,281).**—Particulars of £500 debentures, created January 22nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Blackpool and Garstang Electric Light Railway Co., Ltd. (62,150).**—Return dated December 29th, 1911, filed January 1st, 1912. Capital £10,000 in £5 shares; 361 shares taken up; £4 per share called up; £1,707 paid, including £323 received on application for further shares not allotted, leaving £60 in arrears. Mortgages and charges: Nil.

**Electrical Installations, Ltd. (91,050).**—A memorandum of satisfaction to the extent of £50 on January 9th, 1912, of debentures dated December 5th, 1906, securing £1,500, has been filed.

**Allen, West & Co., Ltd. (108,870).**—Particulars of £6,000 debentures, created January 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustee.

**Dennison, Kett & Co., Ltd. (100,769).**—A memorandum of satisfaction in full on January 31st, 1912, of debenture dated January 26th, 1909, securing £500, has been filed.

## CITY NOTES.

### Metropolitan District Railway Co.

The half-yearly meeting was held on February 1st at Westminster Palace Hotel, Lord George Hamilton in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 189), said, although the traffic had been adversely affected owing to unfavourable weather conditions for underground travel during the summer months, and to the interruptions during the strike, the traffic showed a substantial increase. The employés who went on strike in August last did not do so on account of any dissatisfaction or through any grievance of any kind with the company, but because they were ordered out by their Union officials. A majority of employés were loyal to the company. The total capital expenditure amounted to £51,036, a large part of which had been expended upon new rolling stock required for the rapidly growing traffic. The estimated further capital requirement was £150,000. This sum would provide for additional rolling stock, for a fly-over junction at Earl's Court and for other improvements made necessary by the expanding traffic. The gross receipts showed an increase of £14,800. The receipts from passenger traffic showed an increase of £13,430, of which £6,494, or nearly 50 per cent., was from season tickets. Receipts from first-class traffic showed a small decrease over the corresponding period in 1910, although more passengers were carried. This was due to a slight adjustment in first-class fares made during the half-year, and which partly explained the slight decrease in the average receipt per passenger from 1'84d. to 1'80d. The train service had been substantially improved, as the train and car-mileage showed, but notwithstanding an increase of 498,151 car-miles, equivalent to 7'23 per cent., the earnings per car-mile had decreased only from 9'584d. to 9'409d., which justified the policy of working a rapid and frequent service of trains. To-day they were working, during the heavy hours of traffic, 40 trains per hour, and this number would be increased when improvements, now under consideration, had been effected. Although nearly 2½ million more passengers were carried, and notwithstanding the increase in wages and the additional expense through the strike, and the very substantial increase in rates and taxes, the expenditure side of the account showed a very slight increase. Savings had been effected in the cost of current and in the maintenance of stations. The percentage of working expenses to gross receipts was 47'8. This included interest on the cost of the power house. Assuming that the power house had been built out of capital raised by the company, the interest would not have been included in the working expenses. Deducting the interest from the working expenses, they were



reduced to 41'87, which was a low rate of working, and corresponded with the forecast made when it was decided to electrify the railway. After providing for all fixed charges and setting aside £10,000 for renewals, there remained a balance of £85,491 payable for dividends, an increase of over £22,000. This balance was sufficient to pay a dividend on the second preference stock at the rate of 2 per cent. per annum. This was the first dividend paid on this stock, and he thought they could safely look forward to a gradual increase upon this rate in the future. The £6,250 in payment of a warrant on the 4 per cent. guaranteed stock was the fourth and final payment, and the holders of this stock seemed to him to have good reason to be satisfied with their bargain. The directors had given careful consideration to the subject of depreciation, and, in view of the information from the engineers, they were satisfied that the amount now set aside for this purpose was sufficient. The Lot's Road power house undertaking became vested in the Lot's Road Power House Joint Committee on January 1st, 1912, and was thereupon leased to the company and the London Electric Railway Co. This valuable property, which was most essential to these railways, had therefore become part of the undertakings of these companies. The bargain was a good one for the company, and they would, he was satisfied, profit by this arrangement. The widening of the London and South-Western and this company's railways between Studland Road and Acton Lane Junction, whereby the company secured in perpetuity the exclusive use of separate lines between those points, was practically completed, and was opened for traffic on December 3rd. This improvement had enabled them to make substantial improvements to the service on the lines west of Hammersmith, which ought to prove remunerative. These increases in the service necessitated the purchase of additional rolling stock. In 1908 the company obtained powers to create and issue £750,000 prior lien debenture stock. In the same year they sold to the London, Tilbury and Southend Railway 74 carriages, which it required for working the electric line to East Ham and Barking. For these carriages they received £130,000. When these carriages were sold it was not anticipated that the company's traffic would for some time increase sufficiently to require additional rolling stock, and inasmuch as the £130,000 from the Tilbury Co. was received after the amount required for capital purposes had been fixed and the amount of prior lien stock to be created agreed, the then chairman—Sir George Gibb—stated to the shareholders that this additional amount would not be used before communicating with the debenture-holders and obtaining their consent. Since that time they had issued £550,000 of the prior lien stock, and had used nearly the whole of the £130,000 for purchasing rolling stock to replace that sold to the Tilbury Co. and in improving their old stock. It was now proposed to make a further issue of prior lien debenture stock to replace the £130,000 used for purchasing new carriages, and a meeting of debenture-holders in accordance with the promise given would be held. The company's Bill before Parliament dealt with two important objects. First, with regard to the widening of the London and South-Western Co.'s Wimbledon and Fulham line between East Putney and Wimbledon. By agreement with the South-Western, the company worked a through service of trains to Wimbledon by the Putney line. The line between East Putney and Wimbledon was used jointly, and their company's service was always subject to the requirements of the South-Western. This arrangement restricted and interfered with the company's working, and as the traffic was increasing it had been deemed advisable by both companies that their company should have the free and uninterrupted use of separate lines between East Putney and Wimbledon. A provisional agreement had accordingly been made with the South-Western, who have agreed that their company should seek the necessary powers authorising the widening. The cost of the improvement, estimated at £250,000, would be borne by the South-Western Co., and their company was to contribute as a working expense such a yearly sum not exceeding £4,000 as would, with the increased earnings of the widened lines, make up a sum equal to interest at 4 per cent. per annum on the cost incurred by the South-Western. This was another and important step towards relieving the working of the railway from any interference by other companies' trains, which was absolutely essential for the successful working of the railway. The other subject was with regard to the prior lien debenture stock to which he had previously made reference. When this £750,000 prior lien stock was authorised, the net revenue was not sufficient for payment of debenture interest, and it was then estimated that £60,000 would be required to meet deficiencies in future half-years. Therefore, £60,000 of the total amount created was reserved for this purpose. Fortunately, this provision was far more than had been required, for there had only been one half-year, *i.e.*, June, 1908, when the net revenue was not sufficient to meet the deficiency. Only £19,889 of the prior lien stock had been sold for this purpose, leaving a balance of £40,111 out of the £60,000 referred to. It was extremely unlikely that this balance would be required in the future for the special purpose for which it was authorised, and it was therefore proposed to apply this amount to the general purposes of the company. The Bill also sought powers to authorise the company to limit the amount of personal luggage which a passenger might bring on to the railway. Another provision in the Bill was power to the company and the London Electric Railway Co. to supply electrical energy from the Lot's Road power house to the North Metropolitan and Richmond Electric Light and Power Companies. They had a large reserve supply at this station, and it was important that they should find customers for its use. The Great Eastern Co.'s Bill sought power on behalf of the East London Railway for the electrification of that line and to empower the Great Eastern Co. to raise, by the issue of 4 per cent. debenture stock, a sum not exceeding £90,000 to cover the cost of electrification and to confirm an agreement between the East

London Co. and the six lessee companies. The District Co. was one of the lessees and, as the net receipts from the line were insufficient to meet the annual rental of £30,000, they were required to make good its share of the loss. The lessee companies were hopeful that by electrifying the line and reinstating a through service of trains and improving the service generally, the receipts would increase sufficiently to justify the cost of electrification. He would say a few words as to their past and future. Three years ago the profits available for the half-year ending December, 1908, after paying fixed charges, were £11,612; now they were £85,500. They were then only able to pay 1½ per cent. on the guaranteed stock; now they paid the full 4 per cent. upon that stock, the full 4½ per cent. upon the first preferred, and 2 per cent. on the second preferred stock. They had achieved these results mainly from the remarkable and continuous improvements effected in the speed, multiplication and regularity of the service. The highest credit was due to the staff for these improvements, and they had been achieved by assiduous and unceasing attention to every detail of the traffic and to anything that could conduce to the comfort and safety of the passengers. Whilst, therefore, they could contemplate the immediate past with some satisfaction, they had good reason for believing that the various schemes in course of promotion by the Underground Co. (who were by far the largest stockholders in their company), in addition to what they were doing themselves, ought not only to expand their existing *clientèle*, but ought also to open up fresh sources of profit in the future of the company.

MR. W. H. BROWN seconded the motion, and the report was agreed to without discussion.

An extraordinary meeting was afterwards held, when a resolution was passed approving of the company's Bill in Parliament.

Replying to MR. LUMB, the CHAIRMAN said the company had everything to gain, and nothing to lose by the proposed arrangement with the omnibus company.

### Liverpool Overhead Railway Co.

THE directors' report for the half-year ended December 31st, 1911, shows that the gross revenue receipts amount to £40,791, and the working expenses to £27,688. The number of passengers carried during the last two years is as follows:—

	Half-year ending—			
	June, 1910.	Dec., 1910.	June, 1911.	Dec., 1911.
First class .....	546,742	567,911	579,328	617,097
Third class (including tramways)	3,013,785	3,260,261	3,113,073	3,398,069
Workmen (special return tickets.)	1,529,553	1,563,128	1,701,196	1,723,340
Total ..	5,090,080	5,391,300	5,393,597	5,738,506

The traffic again shows a satisfactory increase in all classes, notwithstanding the railway strike in August last. The revenue account shows that the receipts from passenger traffic amount to £39,361, plus miscellaneous receipts and interest £1,430, making £40,791, less working expenses and transfer to renewal fund £27,688, leaving £13,103. Deducting interest on mortgage debentures and on calls paid in advance, £4,329, leaving £8,774, and adding the balance brought forward, £4,665, there remains available for dividend £13,439. Out of this balance the directors recommend the declaration of dividends at the rates of 5 per cent per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, payable on and after February 16th next, leaving a balance of £4,763 to be carried forward.

### London Electric Railway Co.

THE half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, Lord George Hamilton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 186), said that the expenditure on capital had amounted to £16,465, mainly for the cost of the Charing Cross and Paddington extension and the addition to rolling stock and equipment. The estimated further capital expenditure was a rather larger figure, and amounted to £530,000, but this was mainly for the two extensions for which they were asking Parliamentary powers, and it ought to be a source of additional profit to the company. It also provided for the installation of escalators at Oxford Circus Station and for other small improvements to the undertaking necessitated by the increased traffic. The gross receipts showed an increase of £13,295. A satisfactory feature of the report was the growth of the season ticket traffic. The traffic was adversely affected by the extraordinary fine weather in the summer months, and also by the general strike in August last. In connection with the strike he was glad to have the opportunity of expressing the appreciation of the board of the excellent services rendered by those in their employ who remained loyal to the company, and he was happy to say that they were in a very large majority. He should like particularly to mention the drivers, who were almost universally loyal and maintained the service practically free from any interruption. With regard to the few men who did come out on strike, it was not because they had any grievance against the company, but because they were ordered to do so by their Unions. It was to be regretted that the men should do anything to prejudice the undertaking in which they had a substantial interest, without reason for so doing. Working expenses showed a slight increase due to the rise in the rates, amounting to £5,290, which was due to their increased property. Repairs and renewals to the rolling stock showed a slight increase. The ratio of working expenses to gross receipts was only 46'68 per cent., and if the interest charges in connection with Lot's Road station were



deducted, the ratio was reduced to 41.76. It was proposed to pay the full dividend at the rate of 4 per cent. on the preference stock, and of 1 per cent. on the ordinary shares. The dividend for the corresponding period of last year on the ordinary shares was at the rate of  $\frac{3}{4}$  per cent., so that they had shown some improvement this year by paying 1 per cent. The number of passengers carried exhibited some remarkably large figures. Last half-year they carried 48,566,000 persons, and in the preceding six months 52,545,000, or in the 12 months over 101 million passengers. Those huge figures gave some idea of how their undertaking contributed to the convenience and economy of a vast number of persons living in London. Having referred to the new arrangements for Lot's Road power house, the chairman said that by the company's Bill it was proposed to make two important extensions of the railway. One was from the authorised extension of the Baker Street and Waterloo line at Paddington Station, through Paddington to Queen's Park Station on the L. & N.W. Railway, where a physical junction would be made with that company's electrified line to Watford. When that extension was accomplished, a service of electric trains could be run from the Elephant and Castle to Watford. A provisional arrangement was being made whereby the L. & N.W. Railway would pay for the cost of the construction and equipment of this extension, and for the rolling stock necessary for working the through service. The rolling stock required for the local service would be paid for by their company. The district which would be served by the extension was densely populated, and required additional railway facilities. The extension, however, would not depend alone on the local traffic, since the connection at Queen's Park with the L. & N.W. system would bring a large and constantly growing traffic to the line. A scheme to connect up the tube railways with the electrified suburban system of a large steam railway company was a new departure for tube lines, and undoubtedly would be not only a convenience, but would rapidly develop the districts served. The other extension was the amalgamation of the Euston and Hampstead Railway Co. with their company. That railway had been authorised for seven years, but no part of it had been constructed. It would serve a territory which, given proper facilities, would develop very rapidly, as was illustrated in the case of Golder's Green. The line would be an extension of the Charing Cross, Euston and Hampstead Railway from Golder's Green to Edgware, a distance of  $4\frac{1}{2}$  miles. The additional capital asked for in the Bill was £700,000. They attached considerable importance to both those extensions. A steady centrifugal movement of the population of London was taking place—the population in the central sections was diminishing, but, on the other hand, it was growing with increasing rapidity in outer London. A visit to Golder's Green would illustrate the dimensions which that movement had attained. The future prospects of their company depended more, perhaps, on the outer than upon the inner circle of London population, and they were, therefore, shaping their course accordingly.

SIR ALGERNON WEST seconded the motion.

MR. WALFORD asked whether it would be possible to arrange for a subway at Holborn to give access to the Central London Railway.

The CHAIRMAN said they must remember that subways were costly things, and also that the stations at that point were not on the same level.

The report was adopted.

The following Bills were submitted for the consideration of the proprietors at a special general meeting held immediately after the ordinary meeting, viz. :—

"A Bill to empower the London Electric Railway Company to construct new railways; and for other purposes."

The additional capital sought by the Bill is £700,000 with the usual borrowing powers.

"A Bill to make further provision respecting the undertaking of the Metropolitan District Railway; to empower the London and South-Western Railway Co. to widen their Wimbledon and Fulham Railway; to confirm the agreement between those companies with reference to that railway; and for other purposes."

### Bristol Tramways and Carriage Co., Ltd.

THE directors' report for the year ending December 31st, 1911, states that the gross receipts amount to £335,738, and the working and general expenses and renewals to £270,574, leaving a net revenue of £65,164. From the net revenue the following amounts have been distributed, viz. :—Interest for the year on 4 per cent. mortgage debenture stock,  $4\frac{1}{2}$  per cent. mortgage debenture stock and on deposits and bankers' interest, £22,501; dividend on 4 per cent. preference shares for the year (subject to income-tax), £18,833; interim dividend at the rate of 4 per cent. per annum (subject to income-tax), for the half-year ending June 30th, £9,417 = £50,751, and it is proposed to appropriate the balance as follows :—Final dividend for half-year at the rate of 4 per cent. per annum (subject to income-tax), £9,417; addition to reserve fund for contingencies and renewals, £4,997 = £14,413. The interest on investments has been carried direct to the credit of the reserve fund, thus raising that fund to £216,234. The values of the securities have as usual been adjusted to market prices at December 31st. With the addition now proposed of £4,997, the reserve fund will be further augmented to £221,231. The receipts from the tramways department show an increase of £7,472, or  $3\frac{1}{2}$  per cent., whilst those of the carriage department have increased by £18,084, being no less than 20 per cent. The total number of

passengers carried during the year on the company's cars and omnibuses was 49,561,001, as compared with 47,454,569 in the previous year, an increase of 2,106,441. Additional motor omnibus routes have been opened during the past year with satisfactory results, whilst the policy of developing the company's general motor carriage business has also been attended with much success. A number of leading firms in London and the provinces are already hiring motor vehicles for commercial purposes from the company, and a further number of such vehicles of varying tonnage are now being built to supply the growing demand. The expansion of all departments in Bath and Weston-super-Mare has continued throughout the year. The work of relaying the tramway lines in Bristol has been steadily proceeded with during the past year and a further mileage will be similarly dealt with this year. The Bill promoted by the company in the last session of Parliament to further extend the time for the construction of the remaining authorised extensions, received the Royal Assent on August 18th, 1911.

**Company Registrations in 1911.**—The *Investors' Guardian* in reviewing the statistics of company registrations in 1911, publishes the following comparative figures :—

English Registrations.	1909.	1910.	1911.
Electric ... ..	£3,253,920	£2,408,457	£3,166,645
Engineering and hardware	9,638,343	5,889,442	8,424,402
Gas ... ..	919,500	1,013,362	838,125
Motor, cycle and carriage	4,225,299	3,293,050	2,721,345
Railways and tramways ...	2,931,740	9,952,660	5,186,855
Rubber ... ..	13,736,014	44,046,015	9,458,775

### City of Buenos Ayres Tramways Co. (1904). Ltd.

—The directors have declared for the year to December 31st a balance dividend of 1s. 3d. per share, £3,650 being transferred to the general amortisation fund, and £76 carried forward.

**Central Electric Supply Co., Ltd.**—The report of the directors for the year ending December 31st, 1911, states that energy has been supplied to the Westminster Electric Supply Corporation, Ltd., and the St. James' and Pall Mall Electric Light Co., Ltd., throughout the year, to an amount of 18,102,440 units. After making a full allowance for sinking fund and depreciation the net balance for the year 1911 is £4,978, plus £27 brought forward. The directors propose to pay a dividend at the rate of 5 per cent. on the ordinary shares for the year absorbing £5,000, and to carry forward £5. The directors regret the death of Mr. Edmund Boulnois, the deputy chairman, and Captain Edmund I. Bax has been elected a director during the year.

**National Boiler and General Insurance Co.**—The directors have declared an interim dividend of 6s. per share, free of income-tax, on the ordinary shares for the half-year ended December 31st.

**National Gas Engine Co., Ltd.**—The directors have presented the first accounts of the company as reconstituted. They cover the period from June 30th (when the old company terminated its existence) to December 31st, 1911. After providing for salaries of administration, and for depreciation of buildings, plant and machinery, the profit for the period amounts to £43,369. The new company did not obtain its certificate to commence business until September 2nd, and the directors are advised that the profits earned prior to that date (from June 30th) cannot be legally disposed of in the way of dividend. It has, therefore, been decided that the sum of £8,800, being the estimated profit during the period mentioned, be placed to reserve account. This will leave an amount of £34,569 available for disposal. It is recommended that this sum be applied as to £6,000 to the payment of a dividend at the rate of 5 per cent. per annum in respect of the preference shares, and as to £22,500, in the payment of a dividend of 9d. per share on the ordinary shares, both less income-tax. These payments will, subject to directors' remuneration, leave £6,069 to be carried forward. The directors purpose holding the annual general meeting of the company in February of each year.

**Great Northern and City Railway Co.**—The half-yearly meeting was held on January 31st, Lord Lauderdale presiding. In moving the adoption of the report (see ELECTRICAL REVIEW, page 190), the chairman said that the new subway from the company's station at Moorgate Street to that of the Metropolitan Railway Co. would be finished during the current half-year, and the easier access thus provided would increase the flow of traffic. The passengers carried during the half-year, as compared with the corresponding half of the previous year, were 6,119,506, as against 5,856,829. During the last three years the receipts from passengers had been £74,690 for 1909, £75,000 for 1910, and £78,500 for 1911. The average receipt per passenger during the same three years was 1.53d., 1.52d. and 1.51d. respectively, while working expenses were 52.91 per cent. of revenue, 50.60 per cent. and 49.82 per cent. Economy had been steadily and uniformly exercised. The gradual reduction of the efficiency in the company's accounts was encouraging. In the three years it had been £8,900, £7,000, and for the last year £4,300. The chairman said that this improvement had been effected in spite of strenuous competition of the L.C.C. tramways. During the busy hours of the day the railway was running 40 trains per hour. Though they were taking no part in the amalgamation of the tubes and the L.G.O., they were naturally watching it with sympathetic interest. The report was adopted.



### Urban Electric Supply Co.

AN extraordinary general meeting of the above company was held at Salisbury House, E.C., on Friday, under the chairmanship of Mr. Tuckett, for the purpose of considering a series of resolutions having for their object the rearrangement of the capital of the company. The object of the resolutions was given in the last issue of the ELECTRICAL REVIEW.

The CHAIRMAN said that the meeting had been called in order to deal with a situation which unfortunately existed and had to be faced. For some years it had been obvious that the position of the company on the expiry of Edmundson's guarantee would be such as to call for some sacrifice on the part of the shareholders, and on more than one occasion he had explained the main causes which had brought about this disappointing result. He intended, therefore, to-day to restrict his remarks to that which constituted the essential business of the meeting—viz., the consideration of the present position of the company and of the scheme for dealing with it. In considering the position, three main features stood out prominently:—(1) The profits were inadequate; (2) the assets were depreciated; (3) the capital resources were insufficient. The inadequacy of the profits was the feature which probably concerned them most directly, and he was therefore glad to be able to assure them once more that, in their opinion, it was only a question of time and careful administration for this deficiency to be largely made good. The business showed every indication of steady development, and no care or effort would be wanting on their part to ensure from such development a satisfactory increase of profit. In the meantime, their estimates of profit for the past year, for the current year, and for next year, only admitted of the payment of cash dividends on the preference shares of 2 per cent., 3 per cent., and 4 per cent. respectively for those three years. There was, however, nothing in the resolutions before them to prevent their paying larger cash dividends in respect of those years, should the circumstances warrant it; but he was bound to say that he thought it was most improbable that they would be in a position to do so. On the other hand, he felt no serious anxiety as to their ability to pay the minimum dividends mentioned, although they must, of course, be dependent on their estimates being approximately realised. In any event, however, they remained cumulative, and it was only in respect of the balance of the dividends for those three years that they were asking the preference shareholders to modify their cumulative rights. These balances, amounting to £15,000 in all, they proposed to satisfy by certificates redeemable at the rate of £1,250 per annum out of the first profits of each year after payment in cash of the full preference dividend for such year and before payment of any dividend on the ordinary shares. The second of the three prominent features to which he had alluded was the depreciation of their assets, and this arose from two causes—one largely temporary, the other permanent. The temporary cause was the present low earning capacity of a considerable portion of the capital, and it was this which was principally responsible for the low market value of the shares. The second cause was the permanent depreciation in value, to a large extent arising from their inability during the past 10 years to make more than a nominal provision for depreciation on a total capital expenditure of over £1,200,000, and it was with this that they were concerned in their proposal to reduce the capital by writing £2 per share off the 80,000 ordinary shares. They believed that the majority of the shareholders would prefer to deal with the situation by accepting the loss and getting rid of it in this way rather than by making it good in the only way in which it could be made good, namely, out of revenue. It was true that in the present uncertainty of the law on the subject it could not definitely be laid down that depreciation of assets in the case of a company like theirs necessarily precluded the payment of dividends, but there was no question that until this essential charge on revenue had been met, there could be no profits in any true sense of the term, and he thought it would be generally conceded that where there was such undoubted depreciation as existed in their case, the board would incur a grave responsibility if they were to continue the payment of dividends without in any way providing for it. Permanent depreciation of capital, particularly where it was accompanied by a lack of earning capacity, could not safely be ignored, if a company was to go forward with confidence in its future, and they felt sure that it was in the best interests of both classes of shareholders that they should make the sacrifices which they were asked to make in order to bring the balance-sheet into closer conformity with the actual position. In neither case was the sacrifice really great, whilst in both cases the gain was substantial. They would readily understand that in arriving at the figure of £160,000 as the proper amount to be written off, it was impossible for them or anyone else to say with certainty that that figure represented the exact amount of the existing permanent depreciation, but they were satisfied that it was as close an approximation to the exact amount as could be made, and it was consequently the amount which they recommended the shareholders to write off. If this amount was written off, they believed that they would in due course be able to pay a reasonable dividend on the reduced ordinary share capital without impairing the adequacy of the annual reserve provision necessary to maintain the capital intact. They were proposing to deal with this sum of £160,000, by which the capital would be reduced, in a somewhat unusual manner. Instead of applying it at once in its entirety to the writing down of the assets, a course which it would be both difficult and undesirable for them to adopt, they proposed to write off only those capital losses which had actually been ascertained, such as the item of £9,586 appearing on the last balance-sheet as "Suspense account for loss on wiring and motors on hire and plant dismantled," and to carry the balance to a capital reserve

fund against which the existing depreciation could be written off from time to time as it materialised. In adopting this course there was no intention to relieve themselves of the obligation to provide for future depreciation or to throw on this fund the burden of charges properly falling on future revenue. It was essentially a fund to provide for a potential loss which already existed, but of which only a small part had yet been realised. And this brought him to an aspect of the case to which it was desirable that he should call their attention. So far as he was aware, there was no precedent of an electric supply company having reduced its capital, and owing to the powers of purchase possessed by the local authorities the case was in this respect distinct from that of any other industrial undertaking. Now it was sometimes argued that, because they were liable to purchase, it was therefore impossible for them ever safely to reduce their capital, and that for the same reason it was impossible for them to know whether they had in fact lost any of the capital until they saw the outcome of the ultimate purchase by the local authorities. There was, of course, a certain substratum of possibility underlying this argument, and in an age of miracles it might be that their plant would be worth twice as much 30 years hence as it was to-day, or that the local authorities would elect to purchase at an early date, on a 6 per cent. basis, undertakings which at present, and for some time to come, were likely to yield only 2 per cent., 3 per cent., or 4 per cent., but he thought they would agree that these were not the sort of possibilities on which practical business men were justified in building their policy, and even if the possibility of their assets some day realising something more than the figure they now placed on them was somewhat less remote, he still thought that that afforded an insufficient reason for burdening the company indefinitely with a weight of dead capital. Similarly, with reference to the danger of prejudicially affecting the purchase value of their undertakings by a reduction of their capital, they were advised, and were certainly of opinion, that in their case and dealing with the matter in the way they proposed, the reality of the danger was easily exaggerated. Because the shareholders in a company operating 23 provisional orders decided for their own convenience, and as a matter of internal arrangement, to write down their capital by £160,000, and to appropriate that sum to a special capital reserve fund, it was surely very difficult to argue that that was going prejudicially to affect the "then value" of any particular undertaking some 30 years hence, nor in the event of purchase in the intervening period "as a going concern," or on the basis of "capital expenditure plus a percentage," could they believe that there was any serious risk involved, and indeed they were so advised. He now came to the last of the three prominent features to which he had referred, viz., the insufficiency of their capital resources, and for this the scheme provided by increasing the board's borrowing powers and by creating additional share capital. The position, so far as the borrowing powers were concerned, was stated with sufficient clearness in the circular accompanying the notice, but he proceeded to briefly re-state it. It was only by the judicious expenditure of capital that they could substantially increase their profits, and if the shareholders were to deny them the resources which the additional capital could provide, they would have no alternative but to withhold the payment of dividends. With these additional resources, however, they had no doubt of their ability to provide for the company's financial requirements for many years to come, whilst they were equally confident that they would enable them to attain for the company a position in which its profits would show a satisfactory return on the reduced ordinary share capital. They need have no fear that the grant of these additional powers would tempt them to be improvident or that the administration of the company's finances would be any less careful than would otherwise be the case. The powers were required to secure the future, not to enable them to embark on a policy of adventure. The new capital would only be issued as and when required by the growth of the company's business, and there was no expectation of their having to issue any part of it for some years. The chairman then dealt with the proposed alterations in the articles of association, dealing with each article, and continuing, he referred to the general merits of the scheme, and to the question of its fairness as between preference and ordinary shareholders. The outstanding feature of the scheme was its extreme simplicity and the small extent to which it disturbed the existing rights of the shareholders. Indeed, so much was this the case, that it might possibly occur to some that it did not go far enough, that it would be more valuable if it were more drastic. To such criticism his answer would be that they had to deal with the position as it existed, and that without injustice to the shareholders the position did not warrant their dealing with it in a more drastic way. By the adoption of more drastic proposals they might, no doubt, have found a shorter road to an ordinary dividend, but any such goal could only have been attained by a correspondingly increased sacrifice on the part of the ordinary shareholders, and by a needlessly extended interference with the rights of the preference shareholders, and for neither of these could they see that there was any valid or adequate reason, for the scheme before them completely fulfilled all the objects they had in view. The proposed capital reduction provided for existing capital depreciation, and, combined with the later financial provisions, justified the continued payment of the preference dividend and the earlier payment of an ordinary dividend than would otherwise be the case. The deferred payment of part of the preference dividend for the years 1911, 1912, and 1913, got over the difficulty resulting from the temporary deficiency in the profits, whilst the financial provisions were required to make good the insufficiency of their capital resources, and thereby to safeguard the future. In estimating the merits of this scheme, and generally in considering the financial



position of the company, they wanted to bear in mind the fact that they had Edmundson's behind them. They were, fortunately, so largely interested in the company that they could always rely on their assistance, and that constituted a factor of the situation of the utmost importance to them. The speaker next referred to the sacrifices which the ordinary and preference shareholders were respectively asked to make. In the board's view, in a case like this capital reduction properly fell on the ordinary shareholders, and on the ordinary shareholders alone, and in agreeing to extinguish £160,000 of their capital, they did little more than decide to abandon what was already lost, in preference to the alternative course of making good such loss over a series of years at the expense of future dividends. Nevertheless, in agreeing to the scheme, the ordinary shareholders were making a real and substantial sacrifice for the benefit of the preference shareholders, which amply justified the very slight sacrifice the latter were being asked to make; for, apart from the definite abandonment of £160,000 of capital, they were, under the scheme, agreeing to the payment during the next five years of some £50,000 in dividends to the preference shareholders, the withholding of which would not only have given the company the use of this money without interest, but would also have relieved it of the necessity of raising that amount of capital on more onerous terms than were likely to be exacted five years hence, when the position and financial standing of the company should be much improved. In other words, by accepting the scheme, and thereby enabling payment of the preference dividends to be continued, the ordinary shareholders were likely to be worse off by over £15,000, than would be the case were the dividends to be withheld. If, therefore, the preference shareholders had been asked to forego altogether the whole of the £15,000, the payment of which it was proposed to postpone, they would still have had the best of the bargain, so far as the actual cash sacrifice was concerned. As it was they were being asked to consent merely to the postponement of the cash payment of a few shillings per share of dividend, which must in any other event be postponed for a still longer period. The sacrifice which they were being asked to make, could not, therefore, well be less, and some sacrifice on their part was required, if this or any other scheme was to be carried. No one questioned the right of the preference holders to be paid their arrears of cumulative dividends before the ordinary shareholders were entitled to participate in the distribution of profits, but he more than questioned the wisdom of their insisting on a strict adherence to their strict legal rights. Were they to do so, instead of enjoying the continued payment of dividends, with the prospect of seeing the price of their shares standing between 4 and 5 some two years hence, they would deprive themselves of dividends for an indefinite period, and probably for some years to come would see the price of their shares standing as low, or lower, than it did to-day; and when that time came, instead of being better off, he had very little doubt that most of them would be only too ready to accept very much less satisfactory terms than those now proposed. Apart from the increase of borrowing powers, which was essential, it was a matter of comparative indifference to the board, as a board, whether they decided to adopt the scheme, and thereby admit of the continued payment of dividends, or whether they decided to reject it and so forego the payment of dividends until the capital depreciation had been made good. As individual shareholders, however, they should much regret the rejection of a scheme which had been most carefully thought out, which was essentially fair and which would undoubtedly tend to strengthen and generally improve the position of the company. The chairman then moved the adoption of the resolutions.

MR. H. B. GROTRIAN seconded the resolution.

MR. HEDGES generally approved of the scheme, but read a letter from a large shareholder who suggested there was a chance of the new capital being issued to nominees of the directors at a large discount. He also questioned the advisability of altering rule 48, by which directors who had interests in other companies might vote where contracts were being entered into with such companies.

Replying to these and other questions, the CHAIRMAN said the company could not issue shares at a discount. They could pay a commission up to 20 per cent. for underwriting. If the article was retained by which all new capital must be offered to the shareholders, the company might be prejudiced. If such capital was so offered, and the shareholders did not take it up, obviously they could get far less favourable terms when they went to a financial house. At the same time, if the board thought the shareholders would take up the capital, naturally they would give them the chance. The power with regard to the voting was really necessary, as the directors were also directors of the companies associated with them, and contracts were frequently entered into between these companies.

The resolutions were then carried.

Owing to there being only 64 persons present, the separate meeting of the preference shareholders stood adjourned for a week at the same time and place. By the articles 72 preference shareholders were required to be present.

### Metropolitan Railway Co.

THE half-yearly meeting was held on Wednesday, January 31st, at the Great Eastern Hotel, Liverpool Street, E.C., Lord Aberconway presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 189), the CHAIRMAN said that the expenditure showed a decrease of £4,358, notwithstanding that it included about £2,600 special expenditure in connection with the strike of last August, and

about £2,000 for improvements in the electrical rolling stock. There was a reduction of about £9,000 in rates and taxes. The receipts showed very satisfactory increases in merchandise, mineral and parcels traffic, but there was a falling off of £9,000 in passenger receipts. That was due to four causes:—The increase in the motor-bus and tram competition; the very large falling off in the attendance at the Shepherd's Bush Exhibition, due, no doubt, to the large number of other attractions there were in London during the Coronation year; to the partial suspension of the train services for several days in August in consequence of the strike; and to the exceptionally hot weather of July and August last, which was all in favour of surface conveyance as against underground. They were placing £5,000 to the electrical renewal and depreciation fund, as against £10,000 in the corresponding period. As explained six months ago, they regarded £10,000 per annum as a sufficient provision for electrical renewal purposes under present circumstances. When they had paid for the renewal of their generating plant which was now going on at Neasden they would still have about £50,000 left to the credit of this fund, and that appeared to them to be a quite sufficient nucleus, seeing that they would then have not only a practically new installation, but one that produced current in far greater quantity and at a much lower cost than the old one that it replaced. After debiting the cost of the strike to the general reserve fund, this still stood at about £60,000. For each half-year during the last three years they had been able to show a small advance in the dividend, and the improvement in their position, though not rapid, had been sure, and there appeared to be every prospect of it continuing. He had had some figures prepared showing their receipts, expenses, &c., for each year since 1907. The total receipts from all sources in the latter year were £807,452, and last year they were £902,586, showing an increase of £95,134. The working expenses in 1907 were £385,000, and in 1911 £391,000, an increase of only £6,000, so that they had earned £95,134 additional for the expenditure of only £6,000 more. The percentage of expenses to receipts had fallen from 55.59 to 49.07, and the expenditure per train-mile had fallen from 2s. 4½d. to 1s. 11½d. Those figures showed not only that they had been successful in adding to the revenue, but that they had kept the expenditure well in hand, and were working much more economically than they were a few years ago. Dealing with some of the works they had in hand, he would refer first to the renewal of their electrical machinery at Neasden now taking place. They had two of the reconstructed machines already in use, and there was every prospect that when the final details in connection with them were finished they would come fully up to their expectations. So far they had enabled them to reduce the consumption of coal per unit of current produced from about 3.3 lb. to 2.9 lb., which was a considerable item when it was borne in mind that their output of current was now over 160,000 units per day. This was very satisfactory, and the saving would form a very valuable set-off against the higher price they were now having to pay for fuel. The cost per unit of current produced, exclusive of interest on capital, was now just below one farthing. This was a very low figure, and compared favourably with almost any other power station in and around London. They had entered into a contract for the ensuing 12 months for their power house coal, and had had to pay over 1s. per ton advance. Although coal was costing them more, they had turned out current at the lowest cost at which they had yet produced it since their power station had been in operation. That was almost entirely due to the economies effected in the new plant, and also to the great care that they took in getting the very best possible fuel for their purposes. The traffic to and from their outlying districts, namely, on the Aylesbury and Uxbridge lines, continued to grow in a satisfactory manner, and it had become evident that they must take some steps for improving their facilities for dealing with it. As he stated at the last meeting, they had ordered four new trains of the latest type of compartment stock for the longer distance traffic, and these trains were now being delivered, and were being put into work as they came. To keep pace with the competition they would have to put themselves in a position to run their trains from these lines without stopping between Harrow and Baker Street, and so on to the City. It was physically impossible to do this over their existing two pairs of rails if they were to keep up an adequate service to meet the ever-increasing bus competition to and from the intermediate stations. They were therefore seeking powers in the ensuing session of Parliament to widen the railway for a distance of nearly 3½ miles between Finchley Road and Wembley Park with a view to providing express lines between those points for the accommodation of the trains from Harrow and beyond. The engineering works that they had in hand at the present time were all proceeding satisfactorily, and in one or two cases they were fast approaching completion. The new arcade at Liverpool Street Station would form a short cut for foot passengers between the Bishopsgate Street end of Liverpool Street and New Broad Street. The 25 or 26 shops they had built in the arcade would command substantial rents, and a considerable number of them were already let. It was by the development of valuable building sites like this that they had increased the company's rentals from £65,287 in 1907 to £76,443 in the past year. At King's Cross the new station buildings on the street level had been brought into use, and they hoped very soon to have the works on the platforms completed also. The ferro-concrete bridge which they were building over the lines by arrangement with the County Council was well in hand, and would be opened during the half-year. Seeing that the trams would then come directly past their station, and had by agreement with the County Council to stop in front of their entrance to the station, this should mean a considerable accession of traffic to them. The very heavy works that



they had in hand at Baker Street were moving on well. He was glad to be able to tell them that arrangements had now been made for the electrification by the lessee companies of the East London Railway. It was expected that this work would be carried out during the present year, and as soon as it was completed they should commence the running of a through electrical service to New Cross. When they previously worked through to this line it was a valuable feeder to their traffic, and they confidently expected that under electrical conditions the line would again do a good business. In regard to the strike amongst railway servants in August last, out of a total of 3,300 staff, 924 of their men went out. This was, of course, not a high percentage, but unfortunately the proportions were greatest among the men engaged in the actual working of the trains, such as motor-men, guards, &c. They had no grievances as to pay or otherwise, and only a few days before the strike they officially expressed to the general manager their satisfaction with the conditions under which they were employed. Throughout the three days they were able to keep a fairly satisfactory service of trains running on all sections of the line. Reference was made in the report to the proposed absorption of the London General Omnibus Co. and its business by the Underground Electric Railways Co. of London. It was, of course, not known definitely at the moment whether that arrangement would be made, but in view of the possibility of its coming about they were very carefully considering how the position of this company was likely to be affected. It would not be prudent for him to say more on this subject except that they did not view the new situation that might be created with any apprehension, and they were certainly in no way hostile to it.

LORD FURNESS seconded the motion.

The report was adopted.

MR. C. POWNALL moved a resolution to the effect that a sum of £100 be paid as an annual subscription to the Anti-Socialist Union for the express purpose of enabling that body to carry out their proposed scheme for dealing with Socialism in the railway industry. In a long speech, Mr. Pownall contended that the railway directors were not doing their duty to the shareholders in sitting down quietly while Socialists in and out of Parliament slandered the companies by making untrue statements regarding the treatment of their employés. There were 700,000 railway shareholders in the United Kingdom, and there was a great opportunity for them to weld themselves together into a powerful body to resist the deliberate attempt now being made to deprive them of their property.

COL. PERRY seconded the proposition.

The CHAIRMAN said he did not wish to rule the resolution out of order, but the solicitor had given it as his opinion that it was not possible to pass such a motion unless specific notice had previously been given. If the meeting passed the resolution, the board would have to consider whether they could give effect to it. They were thoroughly alive to the evils of Socialistic propaganda amongst railway men, and he was quite sure the public was. As to strikes, probably no men had had more experience of strikes than Lord Furness and himself during the last 30 years. They knew the difficulties of dealing with these labour questions, and they would do all they possibly could to prevent these attacks upon the property of railway shareholders. They needed no spurring up by the shareholders to induce them to do their duty. Perhaps with that expression of sympathy the mover would withdraw his resolution.

MR. POWNALL said he must press the motion, in view of the urgency of something definite being done in the matter.

On a show of hands the resolution was carried by a large majority.

Subsequently a special meeting was held, at which a resolution was passed approving of the company's Bills promoted for the ensuing session of Parliament.

### Lanarkshire Tramways Co.

THE directors' report for the half-year ended December 31st, 1911, states that the revenue was £40,016, and the expenses were £20,243, leaving £19,773, less contributions payable to local authorities, £2,013; interest on debentures, £825; interest account, £496; discount and expenses of debenture issue, £762; amounts written off; as per revenue account, £849 = £14,945; leaving £14,828, plus £7,073 brought forward = £21,901. Of this amount £9,000 has been placed to reserve for depreciation, and the directors recommend that the balance be disposed of as follows:—£11,147 to dividend at the rate of 6½ per cent. per annum for the half-year on the issued share capital; £368 to directors, being 10 per cent. of net profits after payment of 5 per cent. dividend for the year; £1,385 to revenue new account. The traffic receipts for the half-year show an increase of £2,250, and the expenses an increase of £310, as compared with the receipts and expenses for the corresponding half-year of 1910. The increase in receipts is mainly due to the New Stevenston extension, which was opened for public traffic on July 31st. The results of the working of this extension are satisfactory. The capital expenditure during the half-year has amounted to £17,759. The New Stevenston extension cost £10,682, and four additional cars £2,761. The payment of £3,500 for local authorities was made to the burgh of Motherwell towards the cost of building a new bridge over the Calder. The line to New Stevenston runs over the new bridge. Four £50 debentures have been allotted since July 1st last, making a total issue during the year of £14,650 in £50 debentures. The discount and expenses of the issue, aggregating £762, have been written off. The directors have transferred £9,000 to reserve for depreciation. Interest has also

been credited to the reserve, making a total contribution for the year of £10,555. A dividend for the half-year at the rate of 6½ per cent. per annum is recommended, making 6 per cent. for the year. This dividend involves payments to the local authorities for the year of £2,892. The Lanark County Council has promoted a Bill to construct tramways from Uddingston to Bellshill and Mossend to connect up with the company's lines, and also to acquire the company's undertaking forthwith. It is the company's intention to oppose the Bill.

Half-year ended—	Gross profit.	Contributions to local authorities.	Int. charges. Deb.	Gen.	Cap. exp. written off.	Reserve for depreciation.	Dividends. Rate %	Amount.
June, 1910	£15,582	£825	£608	£—	£—	£—	5½	£9,433
Dec., „	17,795	825	608	1,115	698	9,760	6	10,290
June, 1911	17,173	879	674	614	—	763	5½	9,433
Dec., „	19,773	2,013	825	496	849	9,792	6½	11,147

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1910	21.28	6,926,878	£35,681	1.23d.	890,689	60
Dec., „	21.28	7,266,852	37,227	1.24d.	907,632	60
June, 1911	21.28	7,074,121	36,002	1.22d.	885,322	60
Dec., „	22.80	7,757,442	39,476	1.22d.	940,607	64

### Yorkshire Electric Power Co.

THE directors have issued their accounts for the 12 months ending December 31st, 1911, and a report on the progress made by the company during that period. The gross profit on the revenue account for the three corresponding yearly periods ending December 31st is as follows: 1911, £12,572; 1910, £11,308; 1909, £6,087. The net profit, after payment of mortgage interest for the same periods, is: 1911, £7,784; 1910, £6,503; 1909, £2,665. The net profit of £7,784, with £9,476 brought forward from 1910 after payment of the dividend due on the cumulative preference shares up to December 31st of that year, makes a total of £17,259. After deducting the dividend paid on the preference shares up to June 30th, 1911, a balance of £16,123 remains, and the directors recommend that this amount should be disposed of as follows: To pay a dividend (less income-tax) for the half-year ending December 31st, 1911, at the rate of 6 per cent. per annum on the amount paid up on the cumulative preference shares amounting to £1,746; to write off administration and development expenses, £14,047; and to carry forward £330. The effect of the breakdown mentioned at the shareholders' meeting in September last is reflected in the accounts, which show a smaller increase of profits than was anticipated. Considerable extra expense was incurred due to the special arrangements made, and the temporary plant installed, to maintain the company's supply. The supply to customers was maintained without any serious inconvenience to them, but to secure further the reliability of the company's supply and to give a larger margin of safety, additional generating plant has been ordered. During the past year an agreement has been made with the Heckmondwike Urban District Council for a bulk supply. The company is now giving a bulk supply to the Corporations of Brighouse, Dewsbury (Ravensthorpe) and Pudsey; and to the Urban District Councils of Mirfield and Whitwood. The company is also giving to the distribution company a supply in Calverley, Castleford, Farsley, Gomersal, Hipperholme, Horsforth, Liversedge, Ossett and Sowerby Bridge, for tramways, power and lighting purposes. The supply to the distribution company is steadily increasing, and it has now become one of the largest customers of the power company. In order to assist in its development, the power company has taken up shares in it under the powers contained in the Yorkshire Electric Power Act, 1910. In addition to considerable extensions made by customers of the company to their existing installations (which is gratifying evidence of their appreciation of the advantages of the company's supply), further important supply agreements have been made with colliery-owners, textile manufacturers, engineers and others. The increasing adoption of electricity for street lighting in all parts of the country is well marked in Yorkshire. The company's supply is now being used by the Mirfield, Horsforth and Whitwood District Councils, and an agreement has been made with the Halifax Rural District Council for a supply at Hartshead. Considerable extensions have again been made to the company's system to supply new demands, and further generating plant has been ordered to meet these new demands. Further applications for cumulative preference shares have been received, and at the date of this report £95,990 has been applied for out of the £100,000 authorised.

**Smithfield Markets Electric Supply Co., Ltd.**—The directors report that, for the year 1911, the gross profit amounts to £3,869, compared with £3,094, and the net profit to £1,383 compared with £446. A sum of £400 has been placed to the sinking fund for the redemption of the debenture stock, and £500 to depreciation and general reserve fund accounts. The available balance, including the amount brought in from 1910 is £1,829. The directors recommend a dividend at the rate of 2 per cent. on the ordinary shares, absorbing £1,200, carrying forward £629. The output of current shows a satisfactory increase over the previous year, and a reduction has also been effected in the costs per unit. The plant and machinery has been fully maintained out of revenue. The value of the plant taken out has been written off depreciation and general reserve fund account, which now shows a credit balance of £15,590.



**Central London Railway Co.**

THE directors' report for the half-year ended December 31st, 1911, states that the capital expended during the half-year was £65,288. The financial results of the half-year's working are as under:—

	1911.	1910.	Inc. or dec.
Traffic receipts .. ..	£125,806	£143,433	— £17,627
Miscellaneous receipts .. ..	12,746	12,156	+ 590
Gross receipts .. ..	£138,552	£155,589	— £17,037
Less working expenses .. ..	73,696	88,529	— 14,833
Balance to net revenue account ..	£61,856	£67,060	— £2,204

After providing for interest on the debenture stock, and other payments, the net revenue account shows that, including the amount brought forward from last half-year, there is an available balance of £83,170, as compared with £94,371 in the corresponding period. After deducting £6,136 for interest on the 4½ per cent. preference stock there remains a balance of £77,035, out of which the directors recommend the declaration of the following dividends:—On the undivided ordinary stock at the rate of 3 per cent. per annum for the half-year; on the preferred ordinary stock at the rate of 4 per cent. per annum for the half-year; on the deferred ordinary stock at the rate of 2 per cent. per annum for the whole year. These payments will require £50,883, leaving a balance of £26,152. The number of passengers carried for the last three years, including those using season tickets, through tickets, and the cheap return tickets issued before 7.30 a.m., is as follows:—

	June.	December.	Total.
1909 .. ..	18,989,109	19,394,285	38,383,394
1910 .. ..	20,664,896	19,995,960	40,660,856
1911 .. ..	20,006,287	18,076,996	38,083,283

The diminished traffic receipts are due to the severe motor-bus competition, but it is satisfactory to note that against this decrease in passenger traffic a very considerable reduction in the working expenses has been brought about as a result of economies effected, although the sums expended on maintenance and renovation are in excess of those spent during any corresponding period of the history of the railway. The construction of the Liverpool Street extension is progressing satisfactorily, and it is hoped that the line will be open for traffic about the middle of the year. The company's Bill for through running to the Ealing Broadway Station of the Great Western Railway has received the Royal Assent, and plans for the constructional work have been agreed to between both companies. During the national railway strike in August last, practically all the motor-drivers and a few men in each of the other grades deserted the company, but fortunately owing to previous arrangements this caused the railway little inconvenience. The men stated that they had no grievances of any kind, but went out in sympathy with the other strikers. In consequence of the intervention of the Board of Trade, they were subsequently reinstated. The expense involved in providing for emergencies, including the rewards given to the loyal servants, amounted to £1,756.

**Mersey Railway Co.**

THE directors report that, for the half-year ended December 31st, 1911, the train-mileage run was 301,685 miles, as compared with 332,437 during the corresponding six months of 1910. The number of passengers conveyed has been 5,914,743, as against 6,026,032, exclusive of season ticket holders. The total receipts from all sources for the half-year have been £54,150, as compared with £55,419 for the corresponding period of 1910. The working expenses, exclusive of the charges for pumping, ventilation, and lifts, have been £27,065, equal to 49.98 per cent., as against £27,796, equal to 50.16 per cent. for the corresponding six months. These charges for pumping, ventilation and hydraulic lifts, for the past half-year, amounted to £3,125, equal to 5.77 per cent., as compared with £2,913, or at the rate of 5.26 per cent. for the corresponding period of 1910. During the months of July, August and September the receipts were adversely affected by the exceptionally hot weather and the serious labour troubles in the district, but during the remaining months they again showed a substantial increase over those of the previous year. Under the scheme of arrangement scheduled to the Mersey Railway Act, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz., 1866, 1871, 1882-3-5 and B, is contingent on the revenue of the company available therefor in each separate year. The auditors have certified that the revenue available for this purpose for the year ending December 31st, 1911, amounts to £13,644, which is accordingly being distributed to the debenture-holders as follows: Interest at 4 per cent. on the 1866 debenture stock, £4,664; interest at 3 per cent. on the 1871 debenture stock, £2,999; interest at £1 13s. 2½d. per cent. on the 1882-3-5 debenture stock, £5,978; balance carried forward, £3. The interest on these debenture stocks was duly paid to the debenture-holders on January 29th, 1912.

**St. James' and Pall Mall Electric Light Co., Ltd.**

THE directors' report for the year ending December 31st, 1911, states that supply has been distributed on a total connection of 13,975 kw., being an increase of 976 kw. For this purpose 10,708,689 units were supplied to consumers. The Central Electric Supply Co. has declared a dividend of 5 per cent. on the ordinary shares, in respect of which £2,500 will, in due course, be payable to the company. The new equipment of the Mason's Yard Works as a transformer sub-station for the high pressure supply derived from the Central Electric Supply Co. has now been completed, and a large battery of accumulators has been added to form an efficient

reserve. The results hereby obtained are most satisfactory and promise further improvement. The directors have therefore decided to re-equip part of the Carnaby Street works on the same lines. In view of the obsolescence of plant which will be superseded by this re-equipment an extra amount has been written off for depreciation during the year under review, and the directors have carried a sum of £4,500 from net revenue account to the credit of Contingency fund. The net profits for the year 1911 applicable to dividends on shares amount to £27,178, plus £2,116 brought forward; less interim dividend paid in August last for half-year ending June 30th, at the rate of 7 per cent. on preference shares, £3,500; 10 cent. on ordinary shares, £10,000; leaving £15,794 to be dealt with. The directors propose to pay a dividend at the rate of 7 per cent. on the preference shares for the second half-year, £3,500; to pay a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid in August last, a total distribution of 10 per cent. for the year, £10,000; carrying forward £2,294. The directors regret the loss by death of their esteemed colleague, Colonel Eustace Balfour, who was for 20 years chairman of the company. The Rt. Hon. Gerald William Balfour has been elected a director during the year. Mr. Balfour previously held a seat on the board, which he resigned in 1895 on his appointment as Chief Secretary for Ireland.

Units generated and purchased .. ..	12,925,053
Quantity utilised—Private supply .. ..	10,708,689
Used on works .. ..	403,531
Total .. ..	11,112,220
Quantity expended in distribution .. ..	1,812,833
Total connections in kw. Dec. 31st, 1911 .. ..	13,975

**The Russian A.E.G. Co.**—The close association of German banking interests with Russian undertakings is again illustrated by the fact that the total ordinary share capital and bonds of the Russian A.E.G. Co. have just been admitted to the Berlin Stock Exchange on the proposal of the Dresden Bank, the Darmstadt Bank, the banking firm of S. Bleichroder, the Disconto Gesellschaft, and the National Bank for Germany. As indicated by its title, the Russian company is connected with the Berlin A.E.G., although the Berlin Handels Gesellschaft, which is one of the banking associations of the A.E.G., does not appear to be directly interested in the present transaction. The prospectus, which notifies the admission of the whole of the 32,000 shares of 250 roubles, or 8,000,000 roubles, and of 5 per cent. bonds of 1,768,500 roubles, states that the shares are offered for subscription at 135 per cent. plus 4 per cent. interest from January 1st, 1911, and the bonds at 97 per cent. plus 5 per cent. interest from January 1st, 1912. It is, therefore, intended that a market for the company's entire capital should be created in Germany, although it is not stated where the capital has hitherto been held. The company, which was formed in 1901, with a share capital of 1,000,000 roubles, acquired the assets and liabilities of another undertaking in 1902, and the largest portion of the assets of the Russian Union Co. in 1905. These and other operations have raised the share capital to its present total, whilst the bonds were issued in 1905. The company has manufacturing works in Riga, where 1,360 workers are employed, possesses installation departments in St. Petersburg, Moscow, Warsaw, Odessa, and several other towns, and holds one-third of the shares in the United Cable Works Co., of St. Petersburg, which was formed in 1906 in association with the Russian Siemens & Halske Co. and the Felten & Guillaume Co. The dividends paid for 1909 and 1910 were 6 per cent. and 7 per cent. respectively, on a share capital of 7,000,000 roubles.

**Stock Exchange Notices.**—The Committee have appointed a special settling day as under:—

Wednesday, February 21st.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each (issued at £1 premium), £1 paid (of which 5s. is capital and 15s. premium), Nos. 750,001 to 1,000,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—Further issue of 10,000 7 per cent. first cumulative preference shares of £5 each, fully paid (Nos. 50,001 to 60,000).

**South London Electric Supply Corporation, Ltd.**—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1911 at the rate of 5 per cent. per annum. For 1910 the dividend was at the same rate.

**South Metropolitan Electric Light and Power Co., Ltd.**—The transfer books and register will be closed from 15th to 28th inst. (both days inclusive) for the preparation of warrants for dividends payable 28th inst.

**Western Electric Co. (U.S.A.).**—According to a report in the *Times*, the American Telephone and Telegraph Co. has purchased 5,000 shares of \$100 par value of the Western Electric Co. at 225. "This increases the Telephone Co.'s holdings of this stock to 125,000 shares out of 150,000, and it is expected that it will soon make an offer for the remainder of the minority stock."

**Bank Rate.**—The Bank Rate was yesterday reduced from 4 to 3½ per cent.

**STOCKS AND SHARES**

Tuesday Evening.

IN spite of the fact that the Bank Rate still remains high for this time of the year, Stock Exchange markets are in the main steady, and there is a good deal of business going on in one part and



another. So far as speculation is concerned, activity centres round a few small groups, in which dealings are fast and furious. One of these, of course, is the Marconi market, and another is that section affected by the Metropolitan transport arrangements. Investment shook its head disappointedly over the absence of anything in the speech of Mr. Lloyd George last Saturday from which comfort might be derived by the holders of Consols. Home Railway stocks, however, have for the time being shaken off their allegiance to the Funds, and are moving on their own axis, of which the labour problems constitute the hub.

Of the Electric Railway stocks, the Central London trio is the chief feature this week. Both Ordinary and Deferred stocks jumped 4, and the Preferred put on a point in anticipation of the opening of the Liverpool Street extension this summer. Moreover, it is being pointed out that the traffic will be fed from the East London Railway; and, in consequence of this, East Londons rose  $\frac{1}{2}$  to  $7\frac{1}{2}$ . Central Londons have not moved to any extent for so long a time that a rise was overdue. City and South London, *ex* dividend, is practically unchanged, but Great Northern and City Preferred recovered their fall of 7s. 6d. which occurred last week, London United Tramways Preference putting on 5s., while the Debenture stock rose 2. A rise of  $\frac{1}{2}$  in Metropolitan Ordinary carried the price to 47 $\frac{3}{4}$ , and the Surplus Lands stock at 69 is again a point higher. Districts firmed up to 35. In the Underground Electric Railways issues there is a fair amount of activity. The dividend announcement, making 2 per cent. on the Income Bonds for the year, did not come up to general expectations, but there is little change in the price of the bonds. Considerable gambling is going on in the shares that are to be created in the carving up of the London General Omnibus Company by the Underground Electric, and these "Fusion" shares, as they are called, which are to be of the nominal value of 1s. each, are being dealt in on the basis of 6s. 6d. for special settlement.

These rises have drawn attention to the newly-quoted British Electric Traction issues, the price of which appeared here last week. The Deferred rose to  $7\frac{1}{2}$ , and the 6 per cent. Preferred at 88 is  $2\frac{1}{2}$  higher, while the First Debenture hardened. There has also been a little inquiry for Potteries Ordinary, and at 8s. 9d. the price shows  $\frac{1}{16}$  rise.

In the list of English Electricity Supply shares, the buying movement manifests itself in advances that have occurred in some half-dozen cases. Improvements of  $\frac{1}{4}$  are shown by Bournemouth and Poole Ordinary and Westminster Ordinary, while Edmundson's and Urban Preference gained 7s. 6d., and smaller rises are registered by Chelsea Ordinary and St. James' Ordinary. The improvement in Westminster underlines the opinion expressed here last week that the shares at their then price were undeniably cheap. Edmundson's Debenture moved up along with the Preference, and is 4 points higher. There is a good deal of pleasure in noting these steady improvements, for the market has been too long neglected, and the better-class shares got down too low.

Telegraphs and Telephones have been animated, though most of the interest revolved round a few specialities. Of these, Marconi's continue to take first place, and once more substantial rises were secured by the Ordinary and Preference shares, although the Ordinary gave way later on. A statement as to the agreement between the British Government and the Marconi Company is imminent. West India and Panama Telegraphs, after being  $5\frac{1}{4}$  buyers, slipped back to  $4\frac{1}{2}$  upon appreciation of the view expressed that £5 a share discounts a good deal of what may be expected to happen by reason of the opening of the Panama Canal. Moving with Panamas, West Coast of America fell back  $\frac{3}{4}$  after their jump of  $\frac{1}{2}$  last week. Amazon Telegraphs are  $\frac{1}{4}$  better. The Anglo-American Telegraph group, marked *ex* dividend last Wednesday, shows practically no change, allowing for the deductions; while the Eastern group continues steady, without attracting any particular attention. National Telephones are a rather better market, the Deferred recovering  $1\frac{1}{2}$ , but dealings in the stocks are now comparatively few. Reuters shares at 9 $\frac{3}{4}$  are  $\frac{3}{4}$  better, for which the approach of the dividend time is responsible.

The market in Colonial and foreign electricity issues is a trifle erratic, but the changes do not amount to much in either direction. British Columbia Electric Railway stocks are a better market, the Deferred and Preferred both showing rises. Rio Trams and Mexico Trams are easier, although the bonds of each company have improved slightly. Shawinigan Water is another example in which the capital stock shows a small loss, counter-balanced by a rise in the First Mortgage bonds. Anglo-Argentine Tramways are still being absorbed by the investor, and the prices of the two junior Debenture stocks, with the First Preference, have responded to the demand. Brisbanes are easier, and Calcutta Trams lost  $\frac{1}{4}$ . On the other hand, Capes continue to improve. The new issues promised in this department are slow in making their appearance, but are probably being held back by the comparative stringency in the money market.

Manufacturing descriptions are very quiet. The feature is an improvement of  $\frac{1}{4}$  in Willans & Robinson Preference, following upon the rise of 10s. last week. The Debenture stock is nominally  $3\frac{1}{2}$  points down, although the market in it is so narrow that the precise fall is not so severe as this. British Insulated Preferences at 6, *ex* dividend, have regained the amount deducted when the price was so marked. Castner-Kellner Debenture is also *ex* dividend, and has recovered the full amount of  $2\frac{1}{4}$  taken off. The recent activity in Rubber shares continues to fade away, and business has once more dwindled to a material extent. Mincing Lane authorities look for a further advance in the price of the raw stuff, but their prophecies have not always been correct in the past, and speculators in Rubber shares are not inclined to trust the share-market very far.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Aberdeen ..	Jan. 31	2,681	+ 253	85	52,959	+ 8,145	14.4
Ayr ..	Feb. 3	352	— 2	38	11,978	+ 186	8
Bath ..	Jan. 31	1,237	— 22	5	3,364	+ 127	14.75
Birkenhead ..	Feb. 4	2,141	+ 112	44	50,701	+ 1,826	13.68
Birmingham Corp.	Jan. 27	20,120	+ 6,329	43	380,661	+ 81,778	56.4
Blackburn ..	" 31	1,884	+ 39	44 $\frac{1}{2}$	51,411	+ 4,162	14.6
Blackpool Corp.	Feb. 1	886	+ 58	..	60,785	+ 7,891	11.87
Blackpool-Fleetw'd	" 3	515	+ 20	4	1,244	+ 39	8
+Bolton ..	Dec. 2	2,412	+ 172	36	90,575	+ 6,040	26
Bournemouth ..	Jan. 31	2,760	+ 230	44	78,938	+ 595	21.95
Bradford ..	" 27	10,109	+ 591	43	236,514	+ 14,795	56
Brighton ..	Feb. 4	1,402	— 14	44 $\frac{1}{2}$	45,875	+ 2,501	9.5
Bristol ..	" 2	11,164	+ 432	5	80,063	+ 2,508	30.5
Brit. Elec. Trac. Co.							
Airdrie ..	Jan. 26	517	+ 101	4	1,053	+ 232	8.65
Barnsley ..	" 26	371	+ 40	"	669	+ 73	..
Barrow ..	" 26	194	+ 156	"	1,029	+ 287	5.37
Devonport ..	" 26	917	+ 162	"	1,879	+ 284	8.85
Gateshead ..	" 26	1,985	+ 51	"	3,761	+ 119	11.25
Gravesend ..	" 26	392	+ 52	"	738	+ 92	6.5
Greenock ..	" 26	1,306	+ 144	"	2,443	+ 284	7.25
Hartlepool ..	" 26	463	+ 56	"	879	+ 118	6.72
Kidderminster ..	" 26	172	+ 16	"	320	+ 23	..
+Leamington ..	" 26	379	+ 23	"	520	+ 33	..
Merthyr ..	" 26	377	+ 23	"	708	+ 54	2.9
Metropolitan ..	" 26	16,237	+ 1,516	"	80,451	+ 8,027	22
Middleton ..	" 26	518	— 15	"	992	— 18	8.6
Mid. Joint Com'tee	" 26	5,399	— 235	"	10,379	+ 25	..
Oldham—Ashton	" 26	1,069	+ 59	"	2,003	+ 124	9.13
Peterborough ..	" 26	218	+ 30	"	407	+ 56	5.31
Potteries ..	" 26	3,788	+ 15	"	7,182	+ 240	29
Rothsay ..	" 26	81	+ 6	"	215	+ 37	2.75
Southport ..	" 26	433	— 9	"	863	+ 14	8.17
S. Metropolitan ..	" 26	1,309	+ 28	"	2,595	+ 106	..
Swansea ..	" 26	2,108	— 77	"	4,018	+ 83	12.5
Tynemouth ..	" 26	253	— 25	"	505	— 38	3.75
Weston-s-Mare ..	" 26	46	+ 18	"	98	+ 39	3
+Worcester ..	" 26	457	+ 7	"	893	+ 24	5.75
Wrexham ..	" 26	177	— 2	"	339	+ 16	..
Yorks. Wool. Dist.	" 26	2,003	+ 71	"	3,859	+ 170	17
Miscellaneous ..	" 26	390	+ 18	"	733	+ 37	..
Burnley ..	Feb. 3	2,392	— 137	..	..	..	11.73
Burton-on-Trent ..	" 4	486	+ 32	44	12,743	+ 671	6.6
Bury ..	" 4	2,113	— 17	44 $\frac{1}{2}$	56,489	+ 4,885	22.5
Cardiff ..	" 3	4,251	+ 130	44	108,188	+ 7,874	17.85
Chatham and Dist.	Jan. 25	1,515	+ 44	4	2,819	— 21	14.9c
Cork ..	Feb. 1	797	— 17	5	1,973	+ 13	9.89
+Croydon ..	Jan. 19	1,580	+ 104	42	76,026	+ 5,208	11.64
Darlington ..	Feb. 3	411	+ 29	45	9,934	+ 927	4.87
Darwen ..	" 3	441	— 2	44	11,802	+ 804	4.36
Dover ..	Jan. 27	370	+ 31	43	11,066	+ 1,469	4.75
Dublin ..	Feb. 3	10,021	+ 213	5	25,040	+ 1,866	54.25
Dundee ..	Dec. 22	2,212	+ 57	27	32,513	— 760	15
East Ham ..	Feb. 3	1,493	+ 148	44	48,666	+ 2,335	7.87
Exeter ..	" 2	497	+ 2	44	15,002	+ 967	5.6
Glasgow ..	" 3	33,774	— 238	33	671,347	+ 37,641	98
Hastings ..	" 1	1,323	— 27	..	..	+ 186	19.3
Huddersfield ..	" 3	3,437	+ 32	44	84,628	+ 7,593	28.0
Hull ..	" 3	5,804	+ 343	44	130,011	+ 7,230	14.6
Ilkeston ..	" 1	281	+ 11	44	5,793	+ 164	3.8
Ipswich ..	" 3	683	— 1	44	19,540	+ 1,014	10.5
Kilmarnock ..	Jan. 27	235	+ 3	37	6,123	+ 445	4.25
Lancashire United	" 31	2,325	— 42	5	5,432	— 18	39
Leeds ..	" 27	14,147	+ 764	43	325,214	+ 23,007	57.5
Leicester ..	Feb. 3	4,770	+ 342	..	..	..	20
Leith ..	" 3	1,108	+ 35	37 $\frac{1}{2}$	24,633	+ 1,895	8.72
Liverpool ..	Jan. 27	22,249	+ 1,122	37 $\frac{1}{2}$	45,611	+ 3,165	116
+L.C.O. ..	" 24	84,988	+ 5,187	42	1,887,449	+ 96,398	138.4
London United ..	Feb. 3	9,875	— 50	6	25,624	+ 593	..
Lowestoft ..	" 3	254	— 21	18	3,015	+ 24	8.5
Manchester ..	" 3	29,913	+ 296	44	717,258	+ 86,123	105
Newcastle ..	" 3	7,984	+ 223	..	189,863	+ 14,576	31.3
+Newport ..	Jan. 27	631	— 10	43	30,634	+ 1,007	7.25
Oldham ..	Feb. 4	3,344	— 131	45	86,950	+ 3,788	28
Pontypridd ..	" 3	745	— 46	44	18,855	+ 10	6.5
Portsmouth ..	Jan. 27	8,315	+ 191	43	95,764	+ 8,960	15.25
Preston ..	" 31	1,295	+ 5	44	34,532	+ 2,369	10
Rotherham ..	Feb. 1	1,907	+ 73	43 $\frac{1}{2}$	30,478	+ 2,446	12
Salford ..	Jan. 29	8,903	+ 13	43 $\frac{1}{2}$	212,347	+ 9,024	41
Sheffield ..	Feb. 6	12,697	+ 640	44 $\frac{1}{2}$	292,747	+ 18,621	40
Southampton ..	Jan. 31	2,151	+ 218	44	54,580	+ 6,231	11
Southend-on-Sea ..	" 31	850	+ 120	44	30,202	+ 4,611	7
South Shields ..	Feb. 3	1,073	+ 42	44	27,637	+ 2,929	10.25
Swindon ..	Jan. 31	285	+ 42	..	7,121	+ 803	8.7
Tyneside ..	" 31	814	+ 56	5	1,835	+ 137	11
Wallasey ..	" 27	1,850	+ 177	43 $\frac{1}{2}$	47,841	+ 6,211	8.72
Walthamstow ..	Feb. 8	1,219	+ 95	44	83,007	+ 1,900	9
West Ham ..	Jan. 26	5,264	+ 703	43	117,634	+ 10,462	15.25
Wolverhampton ..	" 31	1,639	— 62	44	43,452	+ 2,025	25
Gen. London Rly.	Feb. 3	10,846	— 415	5	25,821	— 1,747	6.82
City & S. Lon. Rly.	" 4	6,885	— 48	5	17,234	— 561	7.23
Dublin-Lucan Rly.	" 3	220	+ 12	5	618	+ 15	7
G.N. and City Rly.	" 3	8,483	+ 282	5	8,594	+ 544	8.5
L'pool Overh'd Rly.	" 4	8,081	+ 823	5	7,449	+ 548	8.5
Llandudno-Col. Bay	" 2	297	+ 18	9.5	1,240	+ 148	6.6
Lond. Elec. Ry. Co.	" 8	29,960	+ 1,960	5	75,545	+ 3,610	21.25
Mersey Railway ..	" 8	4,189	+ 132	5	10,581	+ 263	4.5
Metropolitan Rly.	" 4	84,185	+ 893	5	84,980	+ 886	25.75
Met. District Rly.	" 3	25,199	+ 1,590	5	63,252	+ 3,318	25
Anglo-Argentine ..	" 4	100,674	+ 5,779	5	251,218	+ 8,358	..
+Ankland ..	Jan. 12	19,820	+ 1,761	6 $\frac{1}{2}$	119,299	+ 9,814	28.8
+Bombay (B.E.T.) ..	" 5	6,090	+ 575	..	..	..	..
+Brisbane ..	Dec. 2	24,330	+ 3,105	52	252,100	+ 80,555	..
Brit. Columbia Rly.	Feb. 8	7,729	+ 539	..	..	+ 3,959	1..
Calcutta ..	" 8	..	..	..	..	..	..
Cape Electric T.Ld.	Dec. 2	8,389	..	..	41,833	..	20.5
+Kalgoorlie, W.A. ..	" 2	..	..	..	..	..	..
+Lisbon ..	" 2	..	..	..	..	..	..
+Madras ..	Jan. 31	1,638	+ 106	4	8,178	+ 4	..
+Montevideo ..	Jan. 2	85,051	+ 3,106	3	90,768	+ 8,053	..
+Perth (W.A.) ..	Feb. 2	8,952	+ 553	5	9,417	+ 1,363	29

\* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts.

§ One month.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 6th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 6th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	8 — 9	+ ¼	6 2 3	Kensington & Knightsbridge, Ord	5	9 8½	62 — 7½	..	5 4 2
Do. 4½ % Pref. ..	10	4½ 4½	82 — 9½	..	4 12 4	Do. 4 % Deb. ..	Stock	4 4	92 — 95 xd	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½ — 11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	78 — 82	..	5 9 9
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	101 — 102	..	4 8 3	London Electric, Ord. ..	3	2 2	1½ — 1½	..	3 12 0
Brompton & Kensington, Ord. ..	5	10 9½	8 — 8½	..	5 17 8	Do. 6 % Pref. ..	5	6 6	42 — 5	..	6 0 0
Do. 7 % Cum. Pref. ..	5	7 7	7½ — 8	..	4 7 6	Do. 4 % First Mort. Deb. ..	Stock	4 4	85 — 91	..	4 8 0
Central Electric Supply, 4 %	100	4 4	98 — 101	..	3 19 3	Metropolitan ..	5	5 4½	83 — 4½	..	5 17 8
Charing Cross, West End & City	5	5 5½	9½ — 4½	+ ½	5 17 8	Do. 4½ % Cum. Pref. ..	5	4½ 4½	42 — 4½	..	4 17 4
Do. 4½ % Cum. Pref. ..	5	4½ 4½	42 — 4½	..	4 14 9	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	99 — 104	..	4 6 7
Do. "City Undertaking" ..	5	4½ 4½	83 — 4½	..	5 9 1	Do. 3½ % Mort. Deb. ..	Stock	3½ 3½	84 — 87	..	4 0 6
Do. 4½ % Cum. Pref. ..	100	4 4	93 — 96	..	4 3 4	Midland Electric Corporation	100	4½ 4½	95 — 97	..	4 12 9
Chelsea, Ord. ..	5	5 4½	42 — 4½	+ ½	5 8 1	4½ % First Mort. Deb. ..	5	4 4½	8½ — 4	..	5 0 0
Do. 4½ % Deb. ..	Stock	4½ 4½	98 — 101	..	4 9 1	Newcastle-on-Tyne ..	5	5 5	4 — 4½	..	5 11 1
City of London, Ord. ..	10	7 6½	13½ — 13½	..	5 2 9	Do. 5 % Pref., Non-Cum. ..	5	5 5	..	..	..
Do. 6 % Cum. Pref. ..	10	6 6	12 — 13	..	4 12 4	North Metropolitan Power Sup-	100	5 5	99 — 102	..	4 18 0
Do. 5 % Deb. ..	Stock	5 5	117 — 121	..	4 2 8	ply, 5 % Mortgages (Red.)	10	..	92 — 102	..	..
Do. 4½ % Second Deb. ..	100	4½ 4½	100 — 103	..	4 7 5	Notting Hill, 6 % Non-Cum.	5	7½ 6½	6½ — 6½	..	5 9 5
County of Durham, 5 % First	Stock	5 5	87 — 89	..	5 12 4	Oxford ..	5	10 10½	8½ — 8½	+ ½	5 16 0
Mort. Deb. ..	5	5 4½	9½ — 9½	..	5 8 11	St. James' and Pall Mall, Ord.	5	7 7	6½ — 7½	..	4 16 7
County of London, Ord. ..	10	6 6	11 — 11½	..	5 4 4	Do. 7 % Pref. ..	100	3½ 3½	85 — 87	..	4 0 6
Do. 6 % Pref. ..	Stock	4½ 4½	107 — 109	..	4 2 7	Do. 3½ % Deb. ..	5	Nil 2	12 — 1½	..	Nil
Do. 4½ % Deb. ..	Stock	4½ 4½	100 — 103	..	4 7 5	Smithfield Markets, Ord. ..	4	5 5	2½ — 3½	..	6 3 1
Do. 4½ % Second Deb. ..	5	Nil Nil	2 — 3	..	Nil	South London, Ord. ..	100	5 5	98 — 101	..	4 19 0
Edmundson's, Ord. ..	5	Nil Nil	2 — 3	..	Nil	Do. 5 % First Mort. Deb. ..	1	7 7	1 — ½	..	6 4 5
Do. 6 % Cum. Pref. ..	100	4½ 4½	87 — 90	+ ½	5 0 0	South Metropolitan, 7 % Pref. ..	100	4½ 4½	96 — 99	..	4 10 11
Do. 4½ % First Mort. Deb. ..	5	6 6	42 — 5	..	6 0 0	Do. 4½ % First Deb. Stock ..	5	5 5	2½ — 2½	..	..
Folkestone ..	6	5 5	48 — 5½	..	4 17 7	Urban, Ord. ..	5	5 5	2½ — 2½	..	..
Do. 5 % Cum. Pref. ..	100	4½ 4½	93 — 96 xd	..	4 13 9	Do. 5 % Cum. Pref. ..	100	4½ 4½	88 — 90	..	5 0 0
Do. 4½ % First Deb. ..	5	9 8½	62 — 7½	..	6 4 2	Do. 4½ % First Mort. Deb. ..	5	10 10½	8½ — 8½	+ ½	5 16 0
Hove ..	5	9 8½	62 — 7½	..	6 4 2	Westminster, Ord. ..	5	4½ 4½	4½ — 5½	..	4 6 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½ — 6	+ ¼	5 0 0	Monterey Rly. Light & Power, }	100	5 5	89½ — 91½	+ ½	5 9 3
Calcutta, Ord. ..	5	8½ 7½	6½ — 6½	..	6 6 0	5 % 1st Mort. Deb. ..	\$100	7 8	193 — 198 xd	-2	3 9 4
Do. 5 % Pref. ..	5	5 5	42 — 5½	..	4 17 7	Montreal, Lt., H. and Power ..	\$500	5 ..	39 — 41	..	12 8 10
Calgary Power, 1st Mort. Bds.	100	5 5	93 — 95	- ½	5 5 3	Northern, Lt., Power and Coal,	Stock	10 ..	250 — 260	..	3 16 11
Canadian Gen. El. Com. ..	\$100	7 7½	116 — 120	..	5 16 8	5 % 1st Mort. Bonds ..	Do.	6 6	107 — 113	..	5 7 2
Do. 7 % Pref. ..	\$100	7 7	117 — 121	..	5 15 8	River Plate, Ord. ..	Do.	5 5	100½ — 102½	..	4 17 7
Cordoba Lt., Power and T., Ord.	1	3 3½	7 — 1	..	3 0 0	Do. 6 % Non-Cum. Pref. ..	100	4½ 4½	100 — 102	..	4 8 3
Do. 5 % Deb. ..	100	5 ..	94 — 97	..	5 3 1	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	100 — 102	..	4 8 3
Elec. Lt. and P. of Cochabamba,	100	6 6	91 — 93	..	6 9 0	1st Mort. Deb. ..	\$100	4 5½	128 — 130	-1	3 16 11
6 % Bonds ..	100	5 5	83 — 86	..	5 16 3	Shawinigan Water, Capital ..	\$500	5 5	107 — 109	+1	4 11 9
Elec. Supply Victoria, 5 % 1st	\$500	5 5	92½ — 94½	+ ½	5 5 10	Do. 5 % Con. 1st Mort. Bonds	Stock	4½ 4½	103 — 105	..	4 5 9
Mort. Deb. ..	10	Nil ..	5 — 3½	..	Nil	Do. 4½ % Per. Deb. ..	Do.	4½ 4½	99½ — 101½	..	4 8 8
Elec. Dev. Ontario, 5 % 1st	1	6 6	7 — 7½	..	7 7 8	Toronto Power, 4½ % Deb. ..	100	5 5	92½ — 94½	..	5 5 10
Mort. Bonds ..	\$500	5 5	102 — 104	..	4 16 2	Vera Cruz Lt., P. and T., 5 %	1	Nil 11½d.	1½ — 1½	..	..
Kalgoorlie Elec. P. and L., Ord.	10½	Nil ..	5 — 3½	..	Nil	1st Mort. Deb. ..	100	6 6	106½ — 108½	..	5 10 7
Do. 6 % Pref. ..	1	6 6	7 — 7½	..	7 7 8	Victoria Falls Power, Pref. ..	1	Nil 11½d.	1½ — 1½	..	..
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	102 — 104	..	4 16 2	West Kootenay Power and Lt., }	100	6 6	106½ — 108½	..	5 10 7
Madras, Ord. ..	5	5 5	101 — 103	..	4 17 1	1st Mort. 6 % Gold ..	100	6 6	106½ — 108½	..	5 10 7
Melbourne, 5 % 1st Mort. Deb.	100	5 5	86½ — 88½	..	5 13 0						
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	87½ — 89½	..	4 9 5						
Mexican Lt. & Power, Common	\$100	4 4½	107½ — 109½	..	6 7 10						
Do. 7 % Cum. Pref. ..	\$100	7 7	95 — 97 xd	..	5 3 1						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	..	..	..						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil 4½	7½ — 7½	+ ¼	..	Monte Video Telephone, Ord. ..	1	6 6	1 — 1½	..	12 11
Do. 5 % Deb. Red. ..	Stock	5 5	97 — 99	..	5 1 0	Do. 5 % Pref. ..	1	5 5	99½ — 102½	+ ½	5 6 8
American Telep. & Teleg., Cap.	\$100	8 8½	141½ — 143½	- ½	5 11 6	National Telephone, Pref. ..	Stock	6 6½	122½ — 124½	+1½	4 16 5
Do. Collat. Trust ..	\$1000	4 4	93 — 95	..	4 4 3	Do. Def. ..	Do.	6 6	94 — 10	..	6 0 0
Anglo-American Telegraph ..	Stock	8½ 8½	65½ — 67½ xd	..	4 8 11	Do. 6 % Cum. 1st Pref. ..	10	6 6	94 — 10	..	6 0 0
Do. 6 % Pref. ..	Do.	6 6	109½ — 110½ xd	..	5 8 4	Do. 6 % Cum. 2nd Pref. ..	10	6 6	94 — 10	..	6 0 0
Do. Def. ..	Do.	30½ 30½	25½ — 25½ xd	..	5 15 11	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½ — 5½	..	4 9 11
Anglo-Portuguese Tel., 5 %	100	5 5	101½ — 103½	..	4 16 7	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	102½ — 103½	..	4 7 0
Mort. Deb. ..	5	7 ..	7½ — 7½	..	4 13 4	Oriental Telep. and Elec. ..	1	8 8	1 — 1½	..	4 18 6
Chili Telephone ..	Stock	4 4	86 — 88	..	4 10 11	Do. 6 % Cum. Pref. ..	1	6 6	1 — 1½	..	4 13 8
Commercial Cable, Stlg. 4½ % Deb.	10	6 6½	10½ — 11½	..	5 6 8	Do. 4 % Red. Deb. ..	Stock	4 4	87½ — 89½	+ ½	4 9 5
Cuba Telegraph ..	10	10 10	17 — 18	..	5 11 1	Pacific and European Tel., 4 %	Do.	4 4	98½ — 100½	..	3 19 7
Do. 10 % Pref. ..	10	10 10	17 — 18	..	5 11 1	Guar. Deb. ..	8	5 5½	91 — 9½	+ ½	4 3 8
Direct Spanish Telegraph, Ord.	5	4 4½	8½ — 8½	..	5 6 8	Reuter's ..	Cert.	6 6	130 — 133	..	4 10 3
Do. 10 % Cum. Pref. ..	5	10 10	8 — 8½	..	5 17 8	Submarine Cables Trust ..	Stock	4½ 4½	98½ — 100½	+ ½	4 9 7
Do. 4½ % Debs. ..	50	4½ 4½	98½ — 100½	..	4 9 7	Telephone Co. of Egypt, 4½ %	100	4 4	98½ — 100½	..	3 19 7
Direct United States Cable ..	10	4½ ..	7½ — 8½ xd	..	5 10 5	Deb. Red. ..	5	8 8	7½ — 7½	..	5 4 11
Direct W. India Cable, 4½ %	100	4½ 4½	99 — 101	+ ½	4 9 1	United River Plate Telephone	5	5 5	9½ — 10	..	4 8 11
Reg. Deb. ..	Stock	7 5½	136 — 139	..	5 0 9	Do. 5 % Cum. Pref. ..	2½	2½ 2½	1½ — 1½	- ½	3 11 5
Eastern Telegraph, Ord. Stock	Do.	8½ 8½	83 — 85	..	4 2 4	West Coast of America ..	100	4 4	98½ — 100½	..	3 19 7
Do. 3½ % Pref. Stock ..	Do.	4 4	100 — 102	..	3 18 5	Do. 4 % Debs., 1 to 1,500	10	1½ 1½	4 — 4½	..	5 7 10
Do. 4 % Mort. Deb. ..	10	7 5½	13½ — 13½	..	5 1 10	guar. by Braz. Sub. Tel.	10	6 6	10 — 11	+ ½	5 15 8
Eastern Extension ..	Stock	4 4	99 — 101 xd	..	3 19 3	Do. 6 % Cum. 1st Pref. ..	10	6 6	9½ — 10	..	4 16 2
Do. 4 % Deb. ..	25	4 4	99 — 101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ..	100	5 5	102 — 104	- ½	4 0 0
East and S. Africa Tel. 4 %	10	5½ 6½	10½ — 11½	..	5 6 8	Do. 5 % Debs. ..	10	7 6½	13½ — 14	..	5 0 0
Mt. Db. Mauritius Sub. ..	10	6 6	13 — 13½	..	4 9 0	Western Telegraph, Ltd. ..	Stock	4 4	99 — 101	..	3 19 3
Globe Telegraph and Trust ..	10	18 5½	32 — 33	..	5 9 1	Do. 4 % Deb. ..	\$1000	4 4	106 — 109	..	3 13 5
Great Northern Telegraph ..	25	18 5½	56½ — 58½	..	5 10 2	Western Union Tel., 4½ % Bnds. A	\$1000	4½ 4½	101 — 104	..	4 6 7
Indo-European Telegraph ..	\$100	5 5½	77 — 80	..	6 5 0	Do. 4½ % Fdg. Bonds ..	100	4½ 4½	101 — 104	..	4 6 7
Mackay Companies Common ..	\$100	4 4	70 — 72	-1½	5 11 1						
Do. 4 % Cum. Pref. ..	1	5 ..	4 — 4½	..	..						
Marconi's Wireless Telegraph	1	16 ..	3½ — 3½	+ ½	..						
Do. 7 % Cum. Partic. Pref.	1	16 ..	3½ — 3½	+ ½	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 6th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 6th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil	$\frac{1}{2}$ —	..	Nil	Metropolitan Railway Consol. ..	100	13	17 $\frac{1}{2}$	47 $\frac{1}{2}$ —48	+ $\frac{3}{4}$	3 18 2
Do. 5 % Pref. ..	1	5	5	$\frac{1}{2}$ —	..	7 5 6	Do. Surplus Lands ..	100	2 $\frac{1}{2}$	2 $\frac{1}{2}$	68—70	+1	3 18 7
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	80—85	..	5 5 11	Do. 8 $\frac{1}{2}$ % Deb. ..	100	3 $\frac{1}{2}$	3 $\frac{1}{2}$	90—92	..	3 16 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	14—18	..	..	Do. 3 $\frac{1}{2}$ % Pref. ..	100	3 $\frac{1}{2}$	3 $\frac{1}{2}$	86—88	..	3 19 7
Do. Do. Deferred ..	100	..	..	6—9	+1	..	Do. 3 $\frac{1}{2}$ % Con. Pref. ..	100	3 $\frac{1}{2}$	3 $\frac{1}{2}$	85—87	..	4 0 6
Do. Do. 6 % Cum. Pr'f. ..	100	..	..	87—89	+2 $\frac{1}{2}$	..	Metropolitan District Ord. ..	100	Nil	..	34 $\frac{1}{2}$ —35 $\frac{1}{2}$	+ $\frac{1}{2}$	Nil
Do. 7 % Non-Cum. Pr'f. ..	100	..	..	37—41	..	..	Do. 6 % Deb. ..	100	6	6	144—146	..	4 2 2
Do. 5 % Perp. Deb. ..	100	5	5	96—99	+1	5 1 0	Do. 4 % Deb. ..	100	4	4	95—97	..	4 2 6
Do. 4 $\frac{1}{2}$ % 2nd Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	79—83	..	5 8 5	Do. 4 % Prior Lien ..	100	4	4	100—102	..	3 18 5
Central London Railway, Ord.	100	3	8 $\frac{1}{2}$	72—74	+4	4 1 1	Do. 4 $\frac{1}{2}$ % First Pref. ..	100	8 $\frac{1}{2}$	4 $\frac{1}{2}$	91—93	..	3 10 0
Do. Pref. ..	100	4	4	85—87	+1	4 12 0	Do. 3 $\frac{1}{2}$ % Gtd. ..	100	8 $\frac{1}{2}$	9 $\frac{1}{2}$	75—77 xd	+ $\frac{3}{4}$	4 10 11
Do. Def. ..	100	2	..	62—64	+4	3 2 6	Metropolitan Elec. Trams, Ord.	1	5 $\frac{1}{2}$	5 $\frac{1}{2}$	..	..	6 13 6
Do. 4 % Deb. ..	100	4	4	100—102	..	3 18 5	Do. Def. ..	1	Nil	..	..	..	Nil
City & South London, Ord.	100	1 $\frac{1}{2}$	1 $\frac{1}{2}$	28—29 xd	..	5 12 1	Do. 5 % Pref. ..	1	5	5	..	..	5 10 2
Do. 5 % Pref., 1891 ..	100	5	5	106—108 xd	..	4 12 7	Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	99—101	..	4 9 1
Do. Do. 1896 ..	100	5	5	102—104 xd	..	4 16 2	Do. 5 % Deb. ..	100	5	5	100 $\frac{1}{2}$ —102 $\frac{1}{2}$	..	4 17 7
Do. Do. 1901 ..	100	5	5	101—103 xd	..	4 17 1	Potteries, Ord. ..	1	2	..	..	..	..
Do. Do. 1903 ..	100	5	5	101—103 xd	..	4 17 1	Do. 5 % Pref. ..	1	5	5	..	..	6 19 3
Do. 4 % Deb. ..	100	4	4	101—103	..	8 17 3	Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	90—93	..	4 16 9
Dublin United Trams, 6 % Pref.	10	6	6	11—12	..	5 0 0	South Metro. Trams, 6 % Pref.	1	6	..	..	..	6 17 2
Great Northern & City, Pr'f. Ord	10	Nil	..	12 $\frac{1}{2}$ —17 $\frac{1}{2}$	+ $\frac{3}{4}$	Nil	Do. 4 % Deb. ..	100	4	4	70—75	..	5 6 8
Hastings Trams, 6 % Pref. ..	5	Nil	3 $\frac{1}{2}$	..	..	..	Underground Elec. Railways	10	..	..	2 $\frac{1}{2}$ —2 $\frac{3}{4}$	..	..
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	73—78	..	5 15 5	Do. 4 $\frac{1}{2}$ % Bonds ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	99—101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 $\frac{1}{2}$	2 $\frac{1}{2}$	28 $\frac{1}{2}$ —27 $\frac{1}{2}$	..	4 6 11	Do. 6 % Income ..	100	1	1 $\frac{1}{2}$	78—80	..	..
Do. 4 % Deb. ..	100	4	4	75—80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil	..	..	..	Nil
Lancashire United, 5 % Deb. ..	100	5	5	80—82	+1	6 2 0	Do. 6 % Pref. ..	5	Nil	..	..	..	Nil
London Elec. Railways, 4 % Deb.	100	4	4	97—99	..	4 0 10	Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	81—85	..	5 5 11
London United Trams, 5 % Pref.	10	Nil	..	3 $\frac{1}{2}$ —4 $\frac{1}{2}$	+ $\frac{1}{2}$	..							
Do. 4 % Deb. ..	100	4	4	77—80	+2	5 0 0							

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 $\frac{1}{2}$	5 $\frac{1}{2}$ —5 $\frac{3}{4}$	+ $\frac{1}{8}$	5 2 4	La Plata Elec. Trms, Ord.	1	..	..	1 $\frac{1}{2}$ —1 $\frac{3}{4}$	..	..
Do. 2nd Pref. ..	5	5	5 $\frac{1}{2}$	4 $\frac{1}{2}$ —5 $\frac{3}{4}$	..	5 3 6	Do. Pref. ..	1	6	6	3 $\frac{1}{2}$ —1	..	6 0 0
Do. 4 % Deb. ..	100	4	4	94—95 $\frac{1}{2}$	..	4 3 9	Lisbon Elec. Trams, Ord.	1	5 $\frac{1}{2}$	6 $\frac{1}{2}$	1—1 $\frac{1}{2}$	..	4 8 0
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	101—103	+ $\frac{1}{2}$	4 7 5	Do. 6 % Pref. ..	1	6	6	1—1 $\frac{1}{2}$	..	4 16 0
Do. 5 % Deb. ..	100	5	5	102—104	+ $\frac{1}{2}$	4 16 7	Do. 5 % Deb. ..	100	5	5	93 $\frac{1}{2}$ —97 $\frac{1}{2}$	..	5 2 7
Auckland Trams, 5 % Deb.	100	5	5	102—105	..	4 15 3	Madras Elec. Tr. (1904), Deb.	100	5	5	93 $\frac{1}{2}$ —96 $\frac{1}{2}$	..	5 3 8
Bombay Elec. S. & Trams, Pref.	10	6	6	10 $\frac{1}{2}$ —11 $\frac{1}{2}$ xd	..	5 7 10	Manaos Trams & Lt., 1st Deb.	100	5	5	91 $\frac{1}{2}$ —93 $\frac{1}{2}$	..	5 6 11
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	96—98	..	4 11 10	Manila Elec. R. and Lt., Bonds	\$1000	5	5	101—103	..	4 17 1
Do. 5 % 2nd Deb. ..	100	5	5	98—100	..	5 0 0	Mexico Trams Com. ..	\$100	7	7 $\frac{1}{2}$	122—124	—1	5 13 0
Brisbane Trams Inv't., Ord.	5	8	8 $\frac{1}{2}$	8 $\frac{1}{2}$ —8 $\frac{3}{4}$	— $\frac{1}{2}$	4 11 5	Do. Gen. Con. 5 % Bonds ..	..	5	5	101—103	+1	4 17 1
Do. 5 % Pref. ..	5	5	5	4 $\frac{1}{2}$ —5 $\frac{1}{4}$	..	4 15 3	Do. 6 % Bonds ..	100	6	6	101—103	..	5 16 6
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	100—103	—1	4 7 6	Para Elec. Rlys. & Lt., Ord.	5	10	10 $\frac{1}{2}$	7 $\frac{1}{2}$ —7 $\frac{1}{4}$	..	6 10 1
B. Columbia Elec. Rly., Def.	100	8	8 $\frac{1}{2}$	136—141	+1	5 13 0	Do. 6 % Pref. ..	5	6	6	5—5 $\frac{1}{2}$	..	5 9 1
Do. Pref. Ord. ..	100	6	6	118—122 xd	+2	4 18 4	Do. 5 % 1st Deb. ..	100	5	5	97 $\frac{1}{2}$ —99 $\frac{1}{2}$	..	5 0 6
Do. 5 % Pref. ..	100	5	5	107 $\frac{1}{2}$ —110 $\frac{1}{2}$	..	4 10 6	Perth (W.A.) Elec. Tr., Ord.	1	2 $\frac{1}{2}$	..	1 $\frac{1}{2}$ —1	..	1 15 7
Do. 4 $\frac{1}{2}$ % 1st Mort. Deb.	40	4 $\frac{1}{2}$	4 $\frac{1}{2}$	100—103	..	4 7 5	Do. 5 % 1st Deb. ..	100	5	5	99—101	..	4 19 0
Do. 4 $\frac{1}{2}$ % Vancouver Deb.	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	102—104	..	4 6 7	Rangoon El. Tr. & Sup., Pref.	5	6	6	5 $\frac{1}{2}$ —5 $\frac{1}{4}$	..	5 2 2
Do. 4 $\frac{1}{2}$ % Con. Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	101—103	..	4 7 5	Do. 4 $\frac{1}{2}$ % 1st Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	98—101	..	4 9 1
Calcutta Trams, Ord.	5	6	..	5 $\frac{1}{2}$ —5 $\frac{3}{4}$	— $\frac{1}{2}$	5 4 4	Rio de Janeiro Trams ..	\$100	4 $\frac{1}{2}$	5 $\frac{1}{2}$	115—116	—1	4 6 2
Do. 5 % Pref. ..	5	5	5	5—5 $\frac{1}{4}$	..	4 15 3	Do. 1st Mort. 5 % Bonds ..	..	5	5	101 $\frac{1}{2}$ —102 $\frac{1}{2}$	+ $\frac{1}{4}$	4 17 10
Do. 4 $\frac{1}{2}$ % Deb. ..	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	100—103	..	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	97 $\frac{1}{2}$ —98 $\frac{1}{2}$	+ $\frac{1}{4}$	5 1 6
Cape Electric Trams ..	1	Nil	2 $\frac{1}{2}$	..	+ $\frac{1}{2}$	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 $\frac{1}{2}$	197—199	+1	5 0 6
City Buenos Aires Trams (1904)	5	5	5	58—57 $\frac{1}{2}$	..	4 5 1	Do. 5 % 1st Deb. ..	\$500	5	5	102—104	..	4 16 2
Do. 4 % Deb. ..	100	5	5	95—98	..	5 2 0	Singapore Trams, 5 % Deb.	100	5	5	81—84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95 xd	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100—103	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5—5 $\frac{1}{2}$	..	5 9 1
Kalgoorlie Elec. Trams ..	1	Nil	..	3 $\frac{1}{2}$ —5 $\frac{1}{2}$	..	Nil	Do. 6 % Pref. ..	5	6	6	5 $\frac{1}{2}$ —5 $\frac{3}{4}$	+ $\frac{1}{8}$	5 11 7
Do. 5 % A Deb. ..	100	5	5	91—94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	98 $\frac{1}{2}$ —101 $\frac{1}{2}$	..	4 18 6
Do. 6 % B Deb. ..	100	5	6 $\frac{1}{2}$	58—62	..	8 1 4	Winnipeg Elec. Rly., 4 $\frac{1}{2}$ % Deb.	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	104—106	..	4 4 11

MANUFACTURING COMPANIES.

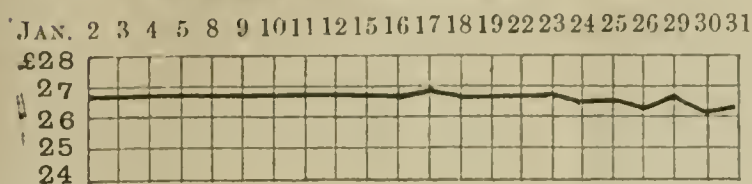
Aron, Ord. . . . .	1	Nil	6	5 — 3	..	..	Dick, Kerr .. . . .	1	5	..	27 — 3 $\frac{1}{2}$	..	5 3 1
Do. 6 % Pref. . . . .	1	9	6	2 $\frac{1}{2}$ — 2 $\frac{3}{4}$	..	7 2 2	Do. Pref. . . . .	1	6	6	4 $\frac{1}{2}$ — 1 $\frac{1}{2}$	..	5 12 11
Babcock & Wilcox . . . . .	1	26	24 $\frac{1}{2}$	6 $\frac{1}{2}$ — 6 $\frac{3}{4}$	..	4 0 0	Do. Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	92 $\frac{1}{2}$ — 95 $\frac{1}{2}$	..	4 14 3
Do. Pref. . . . .	1	6	6	1 $\frac{1}{2}$ — 1 $\frac{1}{4}$	..	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	1 $\frac{1}{2}$ — 1	..	Nil
B.I. & Helsby Cables . . . . .	5	10	8 $\frac{1}{2}$	6 $\frac{1}{2}$ — 7 $\frac{1}{2}$	..	7 0 4	Do. fully paid . . . . .	5	Nil	..	1 $\frac{1}{2}$ — 2 $\frac{1}{2}$	..	Nil
Do. Pref. . . . .	5	6	6	5 $\frac{1}{2}$ — 6 $\frac{1}{2}$ xd	+ $\frac{1}{8}$	4 16 0	Do. 4 % Deb. . . . .	100	4	4	71 — 75	..	5 6 8
Do. Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	101 — 103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	94 — 97	..	4 12 9	Electric Construction . . . . .	2	Nil	2 $\frac{1}{2}$	1 $\frac{1}{2}$ — 1	+ $\frac{1}{4}$	..
British Westinghouse, Pref.	3	Nil	..	8 $\frac{1}{2}$ — 9 $\frac{1}{2}$	+ $\frac{1}{8}$	Nil	Do. Pref. . . . .	2	7	7	1 $\frac{1}{2}$ — 1 $\frac{1}{4}$ xd	..	7 9 4
Do. Deb. . . . .	100	4	4	55 — 58	+ 1	6 17 11	Greenwood & Batley, Prof.	10	7	7	7 $\frac{1}{2}$ — 8 $\frac{1}{4}$	..	8 5 8
Do. 6 % Prior Lien . . . . .	100	6	6	101 — 103	..	5 16 6	Do. Deb. . . . .	100	5	5	94 — 96	..	5 4 2
Browett, Lindley, Ord. . . . .	1	Nil	..	1/6 — 2/-	..	Nil	General Electric, Pref. . . . .	10	5	5	9 — 9 $\frac{1}{2}$	..	5 5 3
Do. Pref. . . . .	1	Nil	..	5/- — 6/-	..	Nil	Do. Deb. . . . .	100	4	4	85 — 90	..	4 8 11
Brush, Ord. . . . .	2	Nil	..	0 —	..	Nil	Henley's, Ord. . . . .	5	15	10 $\frac{1}{2}$	11 $\frac{1}{2}$ — 12 $\frac{1}{2}$	..	6 2 5
Do. 7 % Pref. . . . .	2	Nil	..	0 —	..	Nil	Do. Pref. . . . .	5	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$ — 5 $\frac{1}{4}$	..	4 5 11
Do. 4 $\frac{1}{2}$ % Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	56 — 61	..	7 7 7	Do. Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	104 — 106	..	4 4 11
Do. 4 $\frac{1}{2}$ % Second Deb.	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	97 — 42	..	10 14 4	India-Rubber, G. & T. . . . .	10	10	..	10 — 12	..	..
Callender's Cable . . . . .	5	15	10 $\frac{1}{2}$	9 — 9 $\frac{3}{4}$	..	7 13 10	Do. Pref. . . . .	10	5	5	9 $\frac{1}{2}$ — 10 $\frac{1}{2}$	..	4 17 7
Do. Pref. . . . .	5	5	5	5 — 5 $\frac{1}{2}$	..	4 15 3	Telegraph Construction . . . . .	12	20	10 $\frac{1}{2}$	35 — 37	..	6 7 2
Do. Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	98 — 100	..	4 10 0	Do. Deb. . . . .	100	4	4	99 $\frac{1}{2}$ — 101 $\frac{1}{2}$	..	3 18 10
Castner-Kellner . . . . .	1	17 $\frac{1}{2}$	20	3 $\frac{1}{2}$ — 3 $\frac{3}{4}$	..	4 11 10	Willans & Robinson . . . . .	1	Nil	..	..	..	Nil
Do. Deb. . . . .	100	4 $\frac{1}{2}$	4 $\frac{1}{2}$	106 — 110 xd	+ 2 $\frac{1}{4}$	4 1 10	Do. Pref. . . . .	5	Nil	..	..	+ $\frac{1}{2}$	Nil
Crompton & Co. . . . .	3	Nil	Nil	8 — 8	..	Nil	Do. Deb. . . . .	100	4	4	52 — 57	+ 3 $\frac{1}{2}$	7 0 4
Do. Deb. . . . .	100	5	5	58 — 68	..	7 7 1							



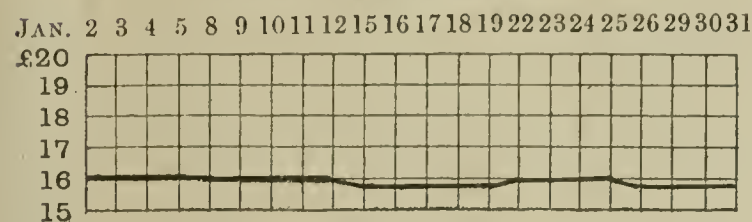
## METAL MARKET.

Fluctuations in January.

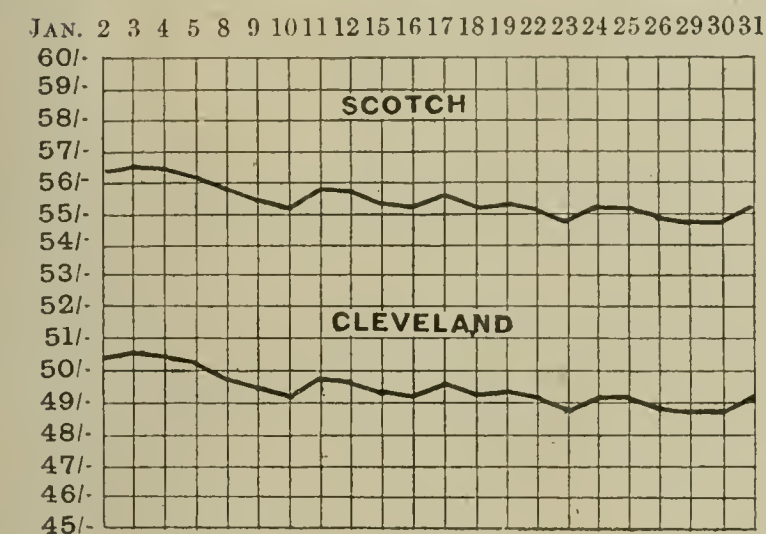
## SPELTER (G.O.B's.).



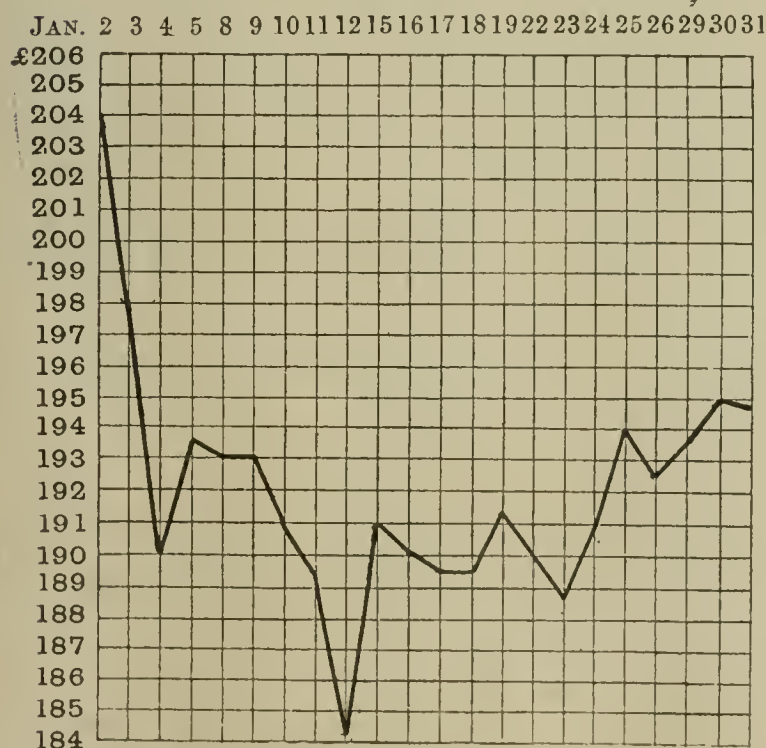
## LEAD (ENGLISH).



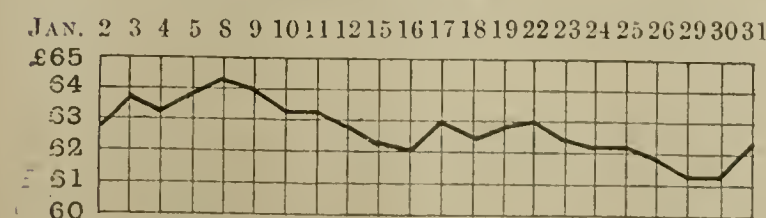
## IRON.



## TIN.



## COPPER (G.M.B's.).



## CONSTRUCTION AND CHARACTERISTICS OF THE NEON LAMP.

THE extraordinary inefficiency of all lamps depending upon high temperature incandescence has been realised for a number of years. The cause of this inefficiency is the high percentage of the total radiations which occur outside the visible spectrum, and, though certain progress has been made in increasing the luminous radiations by raising the working temperature of the incandescent source (thereby also increasing the heat radiations), really high luminous efficiencies can only be attained by the evolution of a "cold light," i.e., by reducing the heat radiations. Such a "cold" lamp is specially desirable since the high specific brilliancy of incandescent filaments and the like compels the use of diffusing media which absorb from 20 to 40 per cent. of the incident light, thus sacrificing much of the gain in efficiency resulting from high incandescence.

A Geissler tube, as ordinarily used, is a cold source, but were it possible to concentrate within the tube a discharge comparable in total candle-power with the lamps now in commercial use, it would be found that the lamp was extremely hot. The results obtained by Moore in this direction are too well known to call for detailed mention. No extraordinary efficiencies have been attained by Moore lamps, and the differences between lamps filled with various gases are quite compatible without theories concerning the mechanism of the electrical incandescence of gases.

Though there is no known gas yielding pure yellow rays under the influence of an electric discharge, there are reasonable approximations to this ideal to be found among the rare gases of the atmosphere. In the course of separating atmospheric gases for industrial purposes, M. Claude\* uses apparatus yielding 50 cb. m. of oxygen per hour, and over 100 litres of neon per day. The latter amount, though apparently insignificant, suffices for the filling of 1,000 neon tubes each of 1,000 c.p., so that the rarity of the gas need form no obstacle to the commercial use of neon lamps.

The spectrum of neon is one of rare beauty, comprising a number of brilliant red and yellow bands and three fine green lines; the absence of blue rays is regrettable, but the concentration of the radiations in the region of the spectrum most affecting our eyes makes for high luminous efficiency.

Bouty has shown the extraordinarily low dielectric cohesion of neon. Thus, if 1,000 volts breaks down a certain layer of air, 40 volts suffices for the same thickness of helium and 13 volts for the same thickness of neon.

There are considerable difficulties in the way of using neon in Geissler tubes. Though the neon originally introduced be specially pure, gases occluded by the glass and the electrodes (particularly if nitrogen or hydrogen) and liberated by the passage of current, completely destroy the incandescence of the neon after a few seconds' working. It is therefore necessary to "form" the tubes at the works by absorbing all gases other than neon and helium by wood charcoal placed in a side tube plunged in liquid air, meanwhile aiding the emission of occluded gases by intermittent electric discharges. This "forming" process occupies several hours.

Despite the chemical inertness of neon, the gas is absorbed by disintegration of the electrodes so readily that the effective life of the first tubes built was from five to six hours. The degree of purity required in the neon precludes the use of any such "breathing" valve as is used in the Moore lamp, but, by fitting very large electrodes, the life of a 5-m. neon tube has been extended to 1,000 hours. Longer tubes prove yet more durable.

At present, neon tubes must be supplied with high-tension alternating current, but it is hoped to adapt short tubes to direct-current operation. A 2-kw. transformer, delivering a steady pressure of 3,200 volts, will light up three 6-m. neon tubes in series, whereas a single 6-m. nitrogen Moore tube would require over 3,000 volts.

There is a pressure drop of about 150 volts at each electrode of a neon tube; this is relatively more serious in short than in long tubes. The pressure drop in the gas column is about 80-100 volts per m. Whatever its length, a 45-mm. neon tube takes about 1 ampere current. By aid of series inductance, the current consumption can be varied from 0.6 to 1.3 amperes, with little variation in terminal P.D. and little loss of efficiency. This property is interesting and valuable. As the current is reduced, the light becomes redder in hue.

A 6-m. neon tube (5 m. useful length) yields about 900 c.p., i.e., 200 c.p. per metre, as against 50 c.p. per m. in the Moore lamp. Allowing for the power factor of the lamp (0.8, due to deformation of the current wave), the efficiency of the tube is 0.72 watt per c.p. or, taking into account the transformer and inductance losses, 0.9 watt per c.p. The actual luminous column dissipates  $500 \times 0.8$  watts, i.e., works at about 0.45 watt per c.p., and very long tubes approach this limiting efficiency. Where neon tubes can be connected directly to high-tension lines, not only is the overall efficiency increased but also the cost of installation of the lighting equipment is greatly reduced.

The above efficiencies are not at all striking as compared with the efficiencies of 0.15 watt per c.p. and 0.25 watt per c.p. claimed for flame and quartz-mercury arcs respectively. It must be remembered, however, that the neon figures are of necessity results which can be equalled in everyday working, whereas the others are taken under specially favourable conditions, and are, in fact, "snatch" readings. The practical efficiencies of flame arcs and silica mercury lamps are more nearly 0.3 watt per c.p., and 0.4 watt per c.p. The neon figures refer to spherical candle-power, and are not subject to the 20-40 per cent. absorption loss

**Ebonite.**—MESSRS. CARSON & EVANS, of Fenchurch Buildings, E.C., who make a speciality of vulcanite and ebonite turned and moulded work to clients' own drawings, patterns, &c., have recently supplied these goods to some of the largest firms in this country.

\* Bulletin de la Soc. Internationale des Electriciens, November 1911.



occasioned by arc lamp globes. With 1'0-1'2 watt per c.p. metallic-filament lamps daily replaoing arcs on account of their low maintenance costs, convenience, and low candle-power per lamp, it is only reasonable to suppose that neon tubes will prove formidable competitors to arc lamps of all descriptions.

The neon lamp is easily transported and erected in its finished state; it requires no attention of any sort, and its efficiency is practically constant during its life: diffusion is excellent, and though the light is useless for colour matching (blue being entirely absent), it gives excellent results in exterior and architectural illumination, and is much preferable, in indoor service, to the greenish hue of the mercury light. A luxurious rose-coloured light is given by neon tubes in conjunction with metallic-filament lamps, and by placing a 600-800-c.p. mercury lamp at the centre of a rectangular neon tube ( $4 \times 2\frac{1}{2}$  m.), both being placed at a reasonable height, almost perfect mutual colour correction is obtained. Attempts to correct the mercury light by the introduction of neon into the tube have so far failed by reason of the impossibility of making both gases vibrate simultaneously to the desired extent.

Visual acuity is remarkably keen under neon light, and Broca and Sulzer state that the latter has distinct physiological value; reports of mental or moral injury caused by red light may be regarded as puerile. The utility of the new lamp is by no means confined to special cases, or to those in which economy is specially desirable, and the Paz and Silva firm have already carried out a number of interesting installations in various parts of France.

### ELECTRIC POWER FOR THE PANAMA CANAL.—III.

By JOHN GEO. LEIGH.

NOT a few of the upper, or filling, valves for the main culverts, which are being installed in the side walls of the various locks of the Panama Canal, will be required to operate under a head of about 60 ft., and to remain tight under a head of at least 80 ft. Consequently, great strength in the various parts has been demanded, resulting in a weight, per valve, of the moving nickel-steel parts alone, of 10'05 tons. The maximum water pressure on each valve is 314 tons, at rest, and, in the case of the lower valves, the operating pressure may reach 281 tons. The waterways, each 8 ft.  $\times$  18 ft., controlled by these valves are opened or closed by means of a rising valve stem, connected at the lower end to the valve and at the upper end to a crosshead, which is actuated by two vertical, revolving, non-rising screws, motor-driven by reducing gear from the horizontal shaft, through a friction cut-off coupling. The motor is provided with a solenoid brake, whereby the revolving parts may be brought to rest immediately after interruption of the line current; a limit switch cuts off the current at the proper time in the travel of the crosshead, and the friction coupling has been introduced to prevent injury to the mechanism in the event of over-travel.

The duty of the cylindrical valves is to control the flow of water from the centre wall culverts into the lateral culverts beneath the lock floors, whence it rises through wells into the lock chambers. Such control is necessary in the case of the middle walls, in order that the twin chambers on either side may be used independently of one another. Owing to the position of these valves at a somewhat higher level than those installed in the side wall culverts, the maximum pressure to which they will be subjected is less. They will also, under ordinary conditions, operate under a comparatively low head, it being intended, as a general rule, to use the middle culvert only towards the close of a lockage, when the difference in level between the two pools has been considerably reduced through the operation of the side wall main and lateral culverts. Having regard, however, to the fact that they may receive pressure from either direction, their strength is proportionately equal to that of the Stoney gate valves, the moving parts of each valve weighing in air not less than 3'4 tons.

These valves consist primarily of two concentric hollow cylinders, one stationary and the other moving within it, having a diameter of 7 ft.  $1\frac{3}{4}$  in. The diameter of the culvert below the valve is  $6\frac{1}{2}$  ft., and this opening is closed when the movable cylinder is at its lowest position, pressing against a turned metal surface, known as the valve seat. The stem by which the movable cylinder is raised or lowered

passes through a metal casing to the operating machine, and has fastened to its upper end a non-revolving nut, which, together with the valve stem and valve, is moved vertically through a distance of 3 ft. 3 in. by means of a revolving screw, actuated by a bevel gear, driven by a pinion on an extension of the motor shaft. A combination casing and bedplate carries the motor, limit switch, bearings and all moving parts; and a small oil pump, geared to the motor shaft, lubricates the thrust and motor shaft extension bearings.

At the preliminary test of two of these valve machines, to which I referred in a preceding article, the machines were operated under various conditions, with weights of 9,000 and 14,000 lb., and through 100 cycles at intervals of from one to three minutes. It was then found that turbine oil, used as a lubricant, proved so light that it was thrown or squeezed out by the centrifugal pressure, and accordingly a heavier oil was substituted. The following were the results of the tests for a machine subsequently mounted in the centre wall of the upper locks at Gatun:—

	Up.	Down.	Up.	Down.
	9,000 lb.	9,000 lb.	14,000 lb.	14,000 lb.
Stroke...	36 in.	36 in.	$35\frac{1}{2} + 1\frac{3}{8}$ in.	$35\frac{1}{2} + 1\frac{3}{8}$ in.
Time ...	—	—	11'4 sec.	9'4 sec.
Running torque ...	86	—	112	—
H.P. at coupling ...	10'8	—	13'0	—
Amperes ...	34	18'5	44	20
Kw. at motor terminals ...	10'9	*0	14'1	1'27
Machine efficiency ...	—	—	51'5 %	—

\* Efficiency is the ratio of energy input to the motor, divided by actual energy output. This accounts for both electrical and mechanical losses.

For operating the lock-valve machinery, the Canal Commission have expressed a special desire to secure motors which have been developed and successfully used for at least a year in connection with steel-rolling mills—the service deemed best comparable with that required in the Isthmian locks. This, of course, will be intermittent, and the motors will be worked necessarily under conditions demanding more than the ordinary safeguards against the excessive moisture of the Isthmus and its deteriorating influences. Upon arrival in the Canal Zone, the eight motors purchased from three manufacturers were placed in a dry room in the storehouse at Gatun, and there subjected to the following tests:—

(a) Measurement of their insulation resistance and the application for one minute of a 1,500-volt high potential test;

(b) Measurement of their insulation resistance immediately prior to turning on steam and, subsequently, at intervals of six hours;

(c) The removal of the handhole covers to admit to the room saturated steam, with a view to increasing the temperature of the air to 50° C.; and

(d) The application of a high potential test of 1,000 volts during 10 seconds every 24 hours.

The effects of these trials, which were to be continued during a week, are yet unknown, and probably will not be disclosed until after the two further series of tests resolved upon, should the data obtained from the first series fail to show quite definite results. The second and third stages have been thus described:—

(2) The tests to be continued, but in a temperature of 75° C. In addition, the motors will be immersed in water at normal air temperature, and the insulation resistance will be measured just prior to and after immersion. At intervals of six hours during two days just prior to removal from the water a high potential test of 500 volts will be applied for 10 seconds.

(3) Internal heat will be applied by running the motors on regular or at higher pressure to produce the desired heating effect. This test will show the rapidity with which the moisture in the insulation will be driven off, and will also render the insulation more porous and finally weaken it as to its insulating properties.

Much interest attaches to the plans and regulations adopted by the Canal Commission to ensure the safety of the locks and of shipping during its transit of the latter. Experience has shown that accidents in such connection have resulted almost invariably from misunderstood signals in the



engine room; and the obvious remedy, therefore, seems to be to eliminate the dangerous factor by conferring upon the Canal authorities control of all vessels while passing through the locks. This, as a consequence, demands the assumption by the United States Government of responsibility to ship-owners in the event of damage, and to this end legislation at Washington is urgently necessary. Congress, however, despite the prospect of an early completion of the undertaking, continues conspicuously negligent of its duties in the matter, and, as in connection with the more important question of dues, refuses consistently to disclose its views.

The system adopted for lock navigation has been devised and patented by Mr. Edward Schildhauer, of the Canal engineering staff, the United States Government having the right to use it without remuneration. It provides for the passage of a ship through the locks at a speed of 2 miles an hour, the vessel being controlled and held steady between four lines of taut hawsers. These will be attached, two forward and two aft, when the ship, according to regulations, has come to a full stop in a lock forebay. Each of these hawsers at its other end will be connected to the windlass of an electric towing locomotive, with the result that two

being 3.13 in., and they will be so formed that lubricant shall not fall upon the concrete or water collect where likely to serve as a breeding place for mosquitoes. After hauling a ship through the last gate and into the lock approach, the escorting locomotives will coil their hawsers and return, or take control of a vessel proceeding in the opposite direction.

As will be seen from the drawings accompanying this article, each locomotive consists of three parts—two tractors and, between them, a windlass. The last will not be mounted upon a truck, but be supported by two arms extending from each side of the two ends and resting upon bearings immediately over the rear wheels of the tractors. The ends of these arms will be equipped with rollers to permit free horizontal movement of the members when the locomotive is rounding a horizontal curve; and, in order to ensure free movement of the parts when the locomotive is on a vertical curve, the windlass is connected with the tractors by a drawbar and trunnion, having the effect of a universal joint. The two tractors are alike in every particular, and will run as rack or friction locomotives at the will of the operator, by whom the whole locomotive can be controlled from either cab.

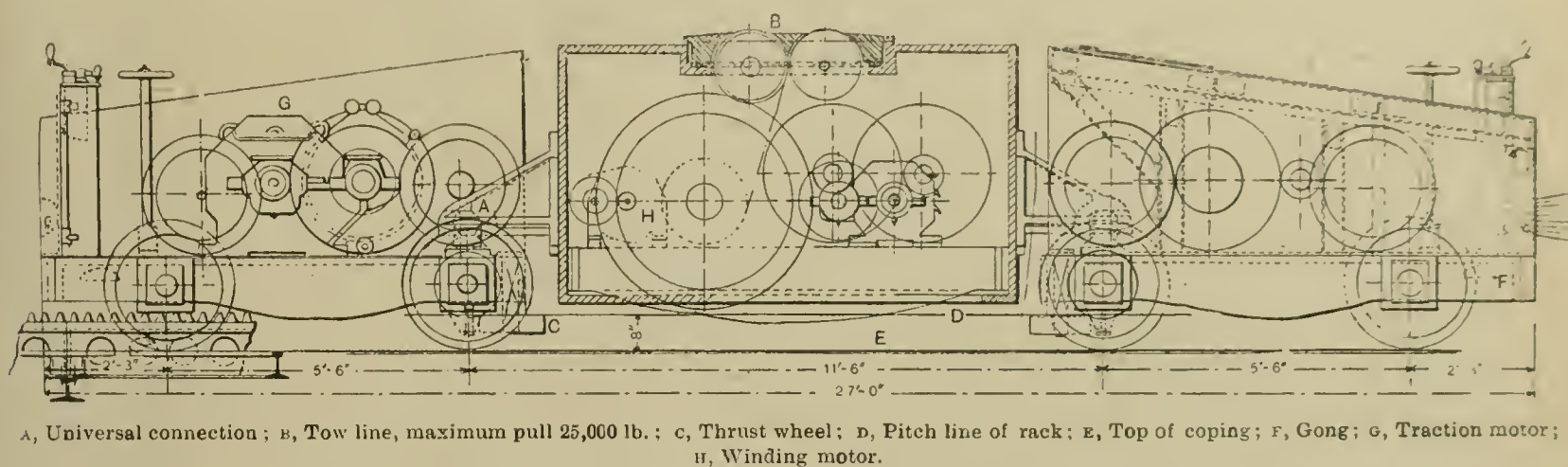


FIG. 8.—ELECTRIC TOWING LOCOMOTIVE. SIDE ELEVATION.

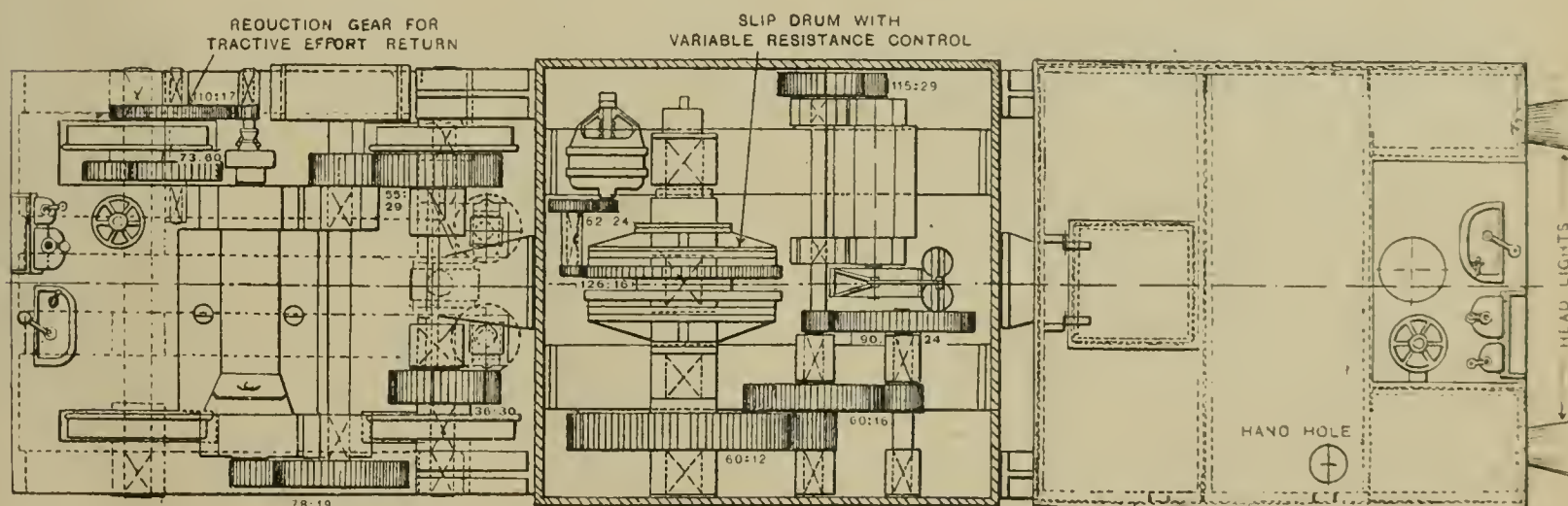


FIG. 9. ELECTRIC TOWING LOCOMOTIVE. GENERAL PLAN.

locomotives, moving on rails on opposing lock walls, will tow the vessel, and two others similarly placed will be towed by their hawsers, and thus steady the ship. The locomotives will run on a level, except in a flight where they pass from one lock to another. In such cases, as, for example, between the lower and intermediate locks at Gatun, where there is a difference in elevation of 29 ft. 7 in., they will be required to climb heavy grades.

There will be on the three lock walls two systems of rails, one for towing and the other for the return of the locomotives, and the only crossovers between them will be at the lock ends. The gauge will be 5 ft. P.R.R., and the rails, of open-hearth steel, laid on Carnegie steel sleepers, each anchored into the concrete by a bolt on the side further from the lock chamber. On the centre wall there will be, of necessity, two sets of towing rails with a return track, common to both, between them. Throughout their length the towing tracks will be provided with a centre rack, and on this when towing, and also when returning on an incline between locks, the locomotives will always operate; elsewhere, however, they will run by friction. The racks will be of cast-steel, the distance from centre to centre of adjoining teeth

When towing, and on the inclines between locks, the tractor will run as a rack locomotive, motion being communicated from the motor to the rack pinions by means of a system of gear reduction absolutely without clutches. This train of gears cannot be disconnected in any way, and, as a result, the rack pinions will be in motion only simultaneously with the motors. A solenoid brake, closing upon a brake wheel when the current is cut off from the motors, provides against accident in such event, while the locomotive is on an incline. Should the current be then cut off, the locomotive would come to a stop instantly and be held fast until the release of the brake. Each rack pinion is of quill construction, and so mounted upon the back axle of each truck as to run free from the motor when the locomotive is on the return rails and travelling by friction. For such travel—at a rate of 5 miles an hour—the tractors will be fitted with jaw clutches, operated by solenoids and connecting the traction motor with the driving wheels.

The electrical equipment for each tractor consists of one traction motor with control apparatus. The motor will be three-phase, induction, totally enclosed, high torque, or mill type, 25 cycles per second, with 220 volts between lines. It



will have a full speed torque of 840 lb. at 1 ft. radius, full load speed at no less than 470 R.P.M., and be capable of developing 75 per cent. greater torque for a period of one minute. Alternating current will be used, with the effect that synchronous speed will be maintained by all four locomotives engaged in a tow. The motors on the tractors of each locomotive will be operated in parallel, and controlled by resistance in the secondary circuit, this being accomplished by contactors in the primary and secondary circuits operated by master controllers of the drum type, one in each cab. There will be not fewer than seven points in each direction, and between these and the braking position will be a coasting point, available when power is turned off from either forward or reverse direction. Current will be collected by each tractor by means of a plough carrying two contact shoes, each operating on a separate power rail carried in an open conduit, one for each of two phases, the third being carried by the two outer rails. The maximum load which will be thrown upon the traction motors will occur when the locomotive is ascending an incline, and this will be greater than the load of towing a ship. Consequently, as weight is not required for tractive effort, the locomotives, as designed, will be as light as possible, the estimated weight of each being approximately  $31\frac{1}{4}$  tons.

The duty of the centre unit, all the movements of which will be controlled by rotary switches in either tractor cab, will be to pay out or haul in the towing line. For this purpose there is provided a winding drum, 18 in. in diameter, which will be prevented by a friction clutch from ever sustaining a pull of over 25,000 lb. In this unit there will be two motors, one for operating the windlass under load, and the other for rapidly coiling the hawser. The former will have a full-speed torque of 120 lb. at 1 ft. radius, be capable of 50 per cent. greater torque for one minute, and have a minimum full-head speed of 630 R.P.M. The coiling motor will have 30-lb. torque, be capable of exerting an addition of 50 per cent. for one minute, and have a full-load speed of 630 R.P.M. Except that they will be of the squirrel cage type, these motors will have the same classification as those in the tractors.

The towing line will be of plough-steel wire, composed of six strands of 37 wires each, have a hemp centre, and be 1 in. in diameter. The wires, according to specification, must have a minimum tensile strength of 225,000 lb. per sq. in., and the hawser, as a whole, must have an ultimate breaking strength of not less than 70,000 lb. At the ship end there will be a 4-ft. loop, and the length of the line from the centre of this to the windlass drum will be 215 ft.

A steel housing will enclose all the machinery for both tractors and windlass, that of the latter consisting of a steel frame covered with  $\frac{3}{8}$ -in. plate. The top sheeting must be capable of sustaining a strain of 85 lb. per sq. in., and the upper side edges of the housing the concentrated load of 12,000 lb. which may be placed upon it when the hawser is used to warp a vessel up to the lock wall, and the line is at right angles to the locomotive, and the chock of the ship considerably below the latter.

About 11,000 tons of material will, it is estimated, be used in the construction of the permanent way for the towing locomotives. The larger items making up this total are 2,000 tons of steel rails, 1,434 tons of steel sleepers, 2,923½ tons of carbon steel rack castings, 859 tons of rolled steel conductor-slot covers, 568½ tons of steel channels, 831,744 lb. of copper conductor rails, 721,250 lb. of steel conductor rails, and 445,000 lb. of malleable iron castings, with smaller quantities of sleeper clips, bolts, nuts, splice bars, rivets, insulators, &c. Of the copper conductor rails 127,000 ft. will be required. They will be made by the extrusion process in modified "T" sections, 22½ ft. long, with straight sides and a return at the base—2½ in. wide at the base, 3½ in. leg, and weighing 6.07 lb. per ft. Five tenders were opened recently at Washington for the supply of 40 electric locomotives—one sample and 39 others if the first proves satisfactory. The prices quoted ranged from £170,600 to £100,600, and the order was placed with the General Electric Co., the lowest bidder.

For this survey of the more important applications of electrical power to the operation and navigation of the Panama Canal, it has been found necessary to exclude reference to many uses and details which might possibly have

proved of equal interest to the electrical engineer and student of electrical progress. Sufficient, however, has surely been said to justify the primary purpose of the articles, namely, that of indicating the very pronounced position, greater even than that held during the period of construction, which electricity will occupy in the practical working of the canal. That the latter, when completed, will prove to be the greatest triumph of civil and mechanical engineering the world has yet seen, goes without saying. It must not, however, be forgotten that to this triumph there have been many contributories—that it would have been well-nigh impossible under other political and economic conditions; without the sanitary

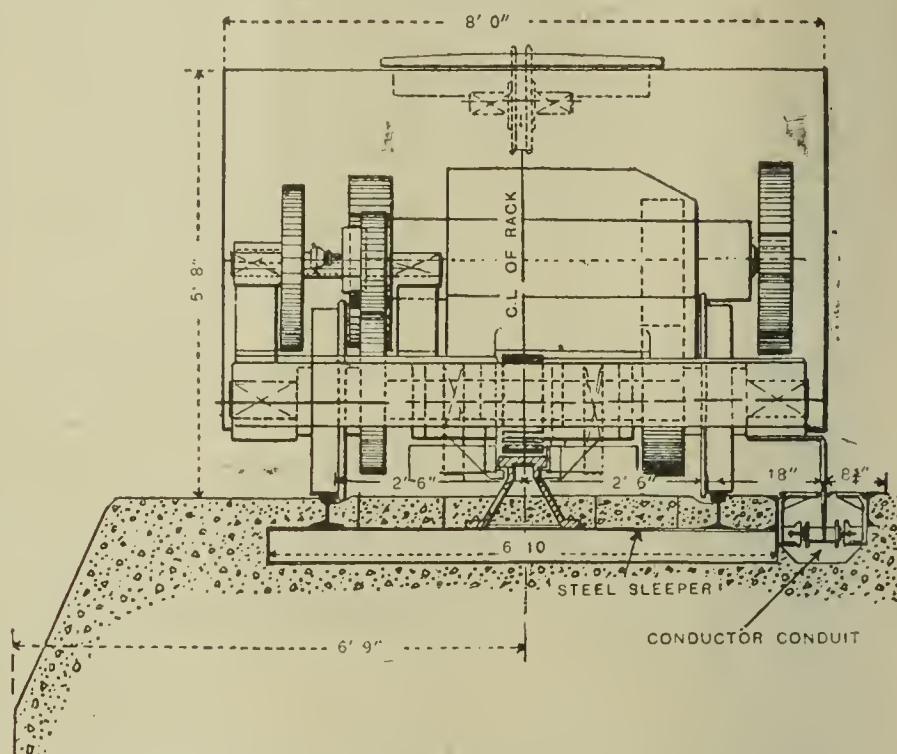


FIG. 10.—ELECTRIC TOWING LOCOMOTIVE. END ELEVATION, COVER REMOVED.

organisation which has made the Canal Zone not only habitable but conspicuously healthy; without the far-reaching administration which has fed, clothed and housed and held itself responsible for the physical and moral well-being, at work and during leisure, of a labour army often exceeding 40,000 strong.

A similarly expansive view should be taken of the canal when opened for traffic. We must cease to regard it merely as a great maritime highway; for the future has in store for it other services to mankind. Allied to it will be facilities destined, in the writer's opinion, to make the Canal region foremost among the world's coaling stations and general trade distributing centres. Were this result beyond the bounds of possibility, there would be scant excuse for the large outlay involved in the harbour extensions now in progress and contemplated near each ocean terminal. To the already considerable dock and harbour facilities at Colon and Cristobal there are being added, on the Atlantic side, five reinforced concrete docks, absolutely protected from "northerners," and capable of accommodating at one time 10 1,000-ton vessels, or 20 ships of the type now engaged in the Isthmian trade. Even more significant are the plans for creating at Balboa, a few miles inland from Panama Bay, great lumber, coal and other docks, at which the largest vessels afloat may tie up and load or discharge cargo. Here also will be built a dry dock, 1,000 ft. long, 100 ft. wide at the floor, and 140 ft.—21 ft. greater than the corresponding dimensions of the two largest similar structures at the Admiralty Dockyard at Portsmouth—wide at the coping level. Quite pertinent to these articles is reference to the above-mentioned works, for at the dry dock at Balboa will be erected gates similar to the largest of the lock gates and electrically operated in the same manner, and throughout all the docks electric power will be almost exclusively used. And the same remark probably will be found justified in relation to the fortifications and batteries now in course of construction near each terminal for the defence of the Canal against naval attack.

**Radio-Telegraphic Convention.**—The Portuguese Government has notified the German Government of the adherence of its colonies and dependencies to the Convention.



## PROCEEDINGS OF INSTITUTIONS.

## The Electrical Driving of Rolling Mills.

By C. A. ABLETT, B.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Sheffield, January 10th, and London, January 11th, 1912.)

THE power which is required to drive a rolling mill generally varies rapidly between wide limits, while the condition that power should be generated cheaply is that the demand made for power on the generating plant should be maintained steadily at the full capacity of that generating plant. To ensure that the working costs of a rolling mill should be low, means must be found for reducing the fluctuations in the power required to drive the mill, care being taken in doing this that the capital cost of the plant is not unduly increased nor is the possible output reduced. Any reduction of the possible output is equivalent to an increase in the working cost, as the capital charges per ton are increased.

The variations in power are reduced by employing a fly-wheel in conjunction with the electric motor which is used to drive the rolling mill, and by providing some device for reducing the speed of the motor and fly-wheel to enable the fly-wheel to give out some of its stored energy when the demand for power is great, so as to reduce the power which has to be furnished by the motor. When the demand for power is small the motor will speed up the fly-wheel, thereby replacing its stored energy; this increases the power which the motor has to supply when the demand made by the mill is small, and therefore reduces the total variation in power.

Leaving large reversing rolling mills out of consideration, the largest variations in power occur in tin-plate and sheet mills. With merchant mills and bar mills the variations in power are less, while in the ordinary looping mill for rolling wire rod, where the rod may be in six pairs of rolls at once, and where a fresh rod is entered while the previous one is still in the rolls, the power required to drive the mill does not vary much.

The ordinary direct-current shunt-wound motor, or three-phase induction motor running at light load, will fall in speed by, say, 2 per cent. when it is required to give its full power. The stored energy of the fly-wheel varies as the square of the speed at which it is running, so that if a fly-wheel were used in conjunction with this motor it would only give up 4 per cent. of its stored energy as the power increased from light load to the full power of the motor.

If the mill required a power equal to four times the normal full load of the motor, the latter could give twice its normal load for a few seconds, falling 5 to 6 per cent. in speed, and the fly-wheel has to furnish the remainder, but would only give up 10 or 12 per cent. of its stored energy.

It is therefore necessary artificially to increase the fall in speed of the motor as the power which it has to give increases. If the speed falls by, say, 10 per cent. as the power increases from zero to full load, and, say, by 22 per cent. as the power increases to the double full-load power, the fly-wheel would have given up 39 per cent. of its stored energy by the time that the motor was giving double its normal full-load power, instead of from 10 to 12 per cent.

There are two possible devices for artificially increasing the fall in speed of the motor as the power demanded increases. These are commonly spoken of as the permanent-slip regulator, and the automatic-slip regulator, but both devices perform their functions automatically, and it would be better to call them the continuous-slip regulator, and the intermittent-slip regulator. The former is the more commonly used in practice.

In the case of the direct-current motor the continuous-slip regulator consists of an ordinary compound winding provided for the field-poles, while the intermittent-slip regulator consists of a system of relays which successively short-circuit resistances in series with the shunt field winding, thus increasing the field and causing the speed to fall when the power has reached a certain predetermined point.

In the case of the three-phase motor, the continuous-slip regulator consists of a resistance, liquid or metallic, permanently inserted in the rotor circuit, while the intermittent-slip regulator may consist either of a liquid resistance, the moving plates of which are controlled by a motor relay, so that the plates are raised and the rotor resistance increases when the current has reached a predetermined point, or a metallic resistance which has its various sections short-circuited by a series of relays, so arranged that these relays cut the resistance into the rotor circuit when the current has reached the predetermined limit.

*Continuous-slip Regulator.*—Within the limits of fall in speed or slip of the motor it can be assumed that the stored energy given up by the fly-wheel is proportional to the slip, without involving any large error, therefore the power given by the fly-wheel is proportional to the rate of change of the slip—that is, to the rate of change of the motor power. It will thus be seen that if a sudden increase of load is imposed on the motor and fly-wheel by entering a bar between the rolls, and a curve is constructed showing the increase of motor power with the time, this curve will be a logarithm curve; while if the power required by the mill suddenly decreases owing to the bar leaving the rolls, the motor power decreases according to a logarithm curve. The curves showing the rise and fall in speed of the motor and fly-wheel are also corresponding logarithm curves.

If  $I$  = moment of inertia of fly-wheel,  $v$  = the speed, and  $K$  the

motor power, the expression  $\frac{I v}{K}$  expressing the relation of motor

power to fly-wheel capacity is the "time constant" in this case and is exactly analogous to the "time constant" in the case of the heating or cooling of electrical machinery.

The value of the time constant for a motor and fly-wheel, however, does not usually exceed about 33 seconds. The value of the time constant to be selected naturally depends on the type of mill. In a sheet mill, where the duration of the passes is very short, the time constant need not be so big as in the case of a bar mill, where the finishing passes may take a considerable time. The greatest time constants are found in the case of motor and fly-wheel for the motor-generator set of an Ilgner electrically-driven reversing rolling mill.

The following table shows how the percentage variation in power changes with different weights of fly-wheel and with various durations of pass and interval:—

	Average power, H.P.	Percentage variation of power, 50-ton wheel.	25-ton wheel.	12½-ton wheel.
Pass 5 sec., interval 5 sec....	350	14.2	28.2	54.5
Pass 5 sec., interval 2½ sec.	433	7.7	15.3	30.0
Pass 2½ sec., interval 5 sec.	267	12.6	25.0	48.5
Pass 15 sec., interval 15 sec.	350	41.8	76.0	120.0

In this table the percentage variation is expressed with relation to the average power; it is thus possible to obtain variations greater than 100 per cent.

The table shows that the percentage variation of the power increases as the weight and consequently the stored energy of the fly-wheel decreases, but that this increase is not proportional to the decrease of stored energy, but increases at a slower rate than the stored energy decreases.

Although for each particular figure the average power remains the same whether a light or a heavy fly-wheel is employed, a somewhat larger motor would be required with the light fly-wheel than with the heavy wheel, because the motor size is settled by the root-mean-square current and not by the average current, and where the variation of power is great the root-mean-square value is naturally greater than where the variation is small.

Alarm is raised from time to time in cases where work is being carried on very rapidly, so that there is only a very short interval between passes, to the effect that the fly-wheel may not have time to recover itself between the intervals and passes. Such alarm is entirely without foundation. If the intervals are short, then naturally the average power increases, while the percentage variation of power is reduced. As the average power is increased the motor is supplying greater power to the fly-wheel during the interval, and although this interval may be short it is able to restore the stored energy of the fly-wheel.

Where the passes are long the fly-wheels are less effective in reducing variations of power than where the passes are short, and heavy fly-wheels are required if the percentage variation in power is to be kept small.

The following general conclusion may be drawn from these curves, namely:—

Where the time of the interval is short a light fly-wheel will enable the percentage variation of power to be kept moderate, but if the time of the interval is long, the heavier fly-wheels must be used.

In practice the question is not so simple, because the various passes in rolling down a billet to a definite section require widely differing powers, while the times of the passes and of the intervals also differ widely.

In certain cases a heavier fly-wheel must be used in conjunction with a three-phase motor than with a direct-current motor, in order to obtain the same results.

In any mill the bar is elongated in each pass, so that each successive pass taken in the same pair of rolls takes a longer time than the previous pass. Frequently less draught is taken in each succeeding pass than in the previous pass, so that the tendency is for the power diagram to consist in the earlier passes of large powers lasting for a short time, and for the power gradually to diminish and the time to become longer as the later passes are reached. There are many exceptions to this.

Fig. 1 (p. 236) is an illustration of a practical case, being a series of curves obtained for a bar mill, and this serves to show the sort of variation of power and speed to be found in practice. The bar mill had two stands of rolls, a roughing stand and a finishing stand, and as bars may be in both stands at the same time, account has to be taken of the power required when two passes come simultaneously.

The motor power reaches 620 H.P. as a maximum, although in one case, where two bars are in the rolls together, the mill requires 1,220 H.P., while the minimum value is 295 H.P. As the mean H.P. is 434, the percentage variation is 76 per cent. If no fly-wheel were used, the percentage variation would be 267 per cent. This practical example illustrates the benefit of the fly-wheel in a striking manner.

Speed variations of 22 per cent. between no load and double full load have been mentioned, but no such variation may be expected in practice where the work at the mill is being carried out fairly steadily, because, with steady working, the power never comes down to no load, neither does it reach double full load except in very exceptional conditions.

In the case of fig. 1 the speed variation of the motor is 20 per cent. between no load and full load, but in the curve the speed variation does not exceed 11.2 per cent.

*Intermittent-Slip Regulator.*—A type of intermittent-slip regulator suitable for direct-current motors, consists of a small motor



relay, the field of which is excited by the main current passing through the mill motor armature. The armature of the motor relay is excited by a pressure winding which is placed across the mains supplying the main mill motor. The armature is restrained from moving by means of a spring, so arranged that when the current in the main circuit exceeds a certain value, the turning moment of the armature of the motor relay overbalances the spring, so that the armature makes a slight movement. This movement of the armature successively makes contact with a number of fingers, which energise relays, which successively connect resistances in parallel with the resistance in the main motor shunt field.

A form of intermittent-slip regulator adapted for use with three-phase motors consists of three liquid resistances with movable plates, one placed in each phase of the rotor circuit. A motor relay is provided in this case, the windings of the motor stator being either in series with the mains supplying the main mill motor, or

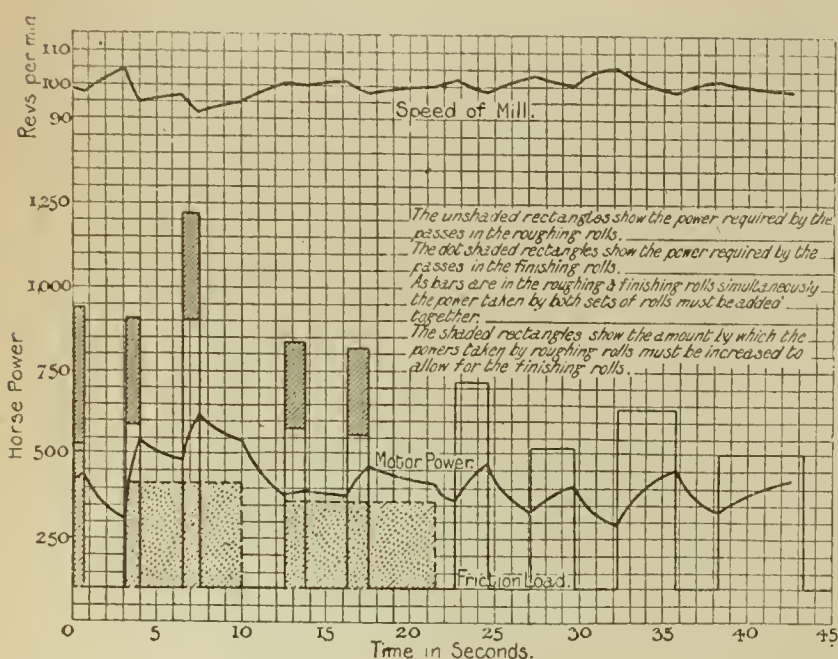


FIG. 1.—TYPICAL EXAMPLE OF THE VARIATION OF THE POWER AND SPEED OF A ROLLING-MILL MOTOR UNDER PRACTICAL CONDITIONS.

else supplied through a current transformer. The rotor of the motor relay is prevented from moving, either by a spring or by a weight slung from a band passing over a pulley on the motor shaft. When the current in the main motor exceeds a certain predetermined value, the turning moment given by the motor relay overbalances either the spring or the weights, allowing the armature to turn a certain amount, thereby raising the plates in the liquid resistance by means of a belt passing over another pulley on the motor shaft. The raising of these plates increases the resistance in the rotor circuit of the mill motor, thereby causing it to fall in speed.

The action of the intermittent-slip regulator is very different from that of the continuous-slip regulator. This intermittent regulator comes into action when the power given by the motor attains a certain value, and when this point is reached a very slight increase in power indeed will cause the intermittent-slip regulator to act to its fullest extent.

Theoretically speaking, therefore, the power can be maintained at its average value with a deviation of perhaps less than 1 per cent., so that the power curve is practically a straight line, and does not rise and fall in accordance with logarithm curves, as is the case with the continuous-slip regulator.

The speed will fall during the pass, and will rise again in the interval between passes, in accordance with the straight-line law, and there will be no logarithm curves for the rise and fall in speed. On theoretical grounds, it appears to be a very ideal mechanism as compared with the continuous-slip regulator.

In practice the great difficulty with the intermittent-slip regulator is that it is comparatively slow in coming into operation on account of the inertia of the various moving parts. Instead of reducing the power to the mean value, it actually is the means of producing very bad peaks indeed.

In many cases, particularly the earlier passes of a roughing mill, which is roughing down the billets in order to feed an ordinary merchant mill, the passes may easily be of less than one second duration. In such a case the intermittent-slip regulator would be absolutely useless, and unless a very large motor were provided the circuit-breaker would be continually coming out.

The case of a looping mill rolling wire rod would be a good one for the installation of the intermittent-slip regulator, because the power demanded from the motor does not rise suddenly but gradually as the rod is looped into the various pairs of rolls, and the power demanded also increases gradually, so that it gives time for the intermittent-slip regulator to come into operation.

The intermittent-slip regulator also finds application for regulating the speed of the fly-wheel motor-generator set for supplying an electrically-driven reversing rolling mill on the Ilgner system.

Where a three-phase rolling-mill motor is used the use of resistances entails a certain waste of power proportional to the amount by which the speed falls. Careful tests have shown that there is practically no difference between the loss of power taking place in either form of slip regulator.

The choice of the power of a rolling-mill motor and of the weight of the fly-wheel used in conjunction with it, so as to obtain that relation between motor power and weight of fly-wheel that will reduce the cost of power to a minimum, depends on whether power is being generated in the works, or purchased from outside; in the latter case there are various systems of charging for power which materially affect the most favourable proportions between motor and fly-wheel to be adopted.

Where there are a number of rolling mills in one works, all doing somewhat similar work, and usually all working together, the probability is greatly in favour of the variations in the power taken by the various rolling-mill motors balancing one another, so that the total power required remains at a fairly constant value, even though fly-wheels of quite moderate weight are used with the mill motors. This fact of natural balancing is fully borne out by practical experience, and such a case is an ideal one for cheap electrical driving.

*Power Generated within Works.*—In this case the power to be supplied by the power station should be kept as constant as possible. If there are only one or two rolling-mill motors and a considerable amount of small machinery of which the power demand will keep fairly constant, heavy fly-wheels should be used with the mill motors, and the slip regulators arranged so as to allow as much fall in speed as is consistent with obtaining the output from the mills, so that as much of the stored energy of the fly-wheels as possible may be available for reducing fluctuations in the power.

There is a definite economic limit to the weight which may be adopted for the fly-wheels because increase in the weight increases both the frictional losses and the capital charges on the plant, and a point will be reached where the increase in running costs due to these frictional losses and increased capital charges will balance the saving effected by running the generating plant at constant load.

If, on the other hand, there are a large number of rolling mills, all of which are likely to be working simultaneously, it would be advantageous to reduce the fly-wheel weight, relying on the natural balancing effect to keep the load constant.

*Power purchased from a Supply Authority on the Maximum Demand System where Instantaneous Peaks are Registered.*—This case is similar to the above, as means must be adopted for keeping the power as near to the average value as practicable.

*Power purchased from a Supply Authority at a Flat Rate for the Number of Units Consumed.*—In this case all friction losses should be kept as low as possible in order to reduce the total number of units consumed, while there is no object in attempting to prevent variations in the power. But motors large enough to deal with the largest power required by the rolling mill would prove more expensive in capital cost than a more moderate size motor used in conjunction with a fly-wheel of moderate weight.

*Power Purchased from a Supply Authority on the Maximum Demand System where Peaks of Several Minutes' Duration only are Taken Account of.*—This system of charging is much in favour with the various supply authorities, and the remarks made with regard to the last case apply to this case also. The variations in power required by most rolling-mill motors are very rapid, and the peaks last for a matter of a few seconds only, so that they will not be registered by the maximum-demand indicator.

#### THE ILGNER SYSTEM FOR DRIVING LARGE THREE-HIGH MILLS.

During the first passes in the roughing rolls, the billet is very short. While the actual power taken may be large, the time of the pass is short, so that the amount of energy consumed is comparatively small and the fly-wheel does not have to give up much stored energy. In the last passes, where high speed is most desirable to get the bar through the rolls quickly on account of its great length, the speed of the motor has fallen to the lowest limit, and this causes reduction of the tonnage which it is possible to roll.

To overcome this difficulty, several steel works have adopted the Ilgner system for driving large three-high mills—the same type of electrical plant which is generally employed for driving reversing rolling mills. In this system, the fly-wheel is not coupled to the mill, but is coupled to a motor-generator set which supplies current to the mill motor. As the mill motor runs at a constant speed whatever power it is required to give, there is no reduction in tonnage owing to reduction in speed in the mill, but the motor-generator set, instead of the rolling-mill motor, varies in speed so that the fly-wheel can give up its stored energy when the power demand is great, and absorb energy when the demand is small, so as to reduce the variation in power taken from the supply system to a reasonable value.

In such a case the motor driving the motor-generator set and the fly-wheel shows variations of speed and power similar to those described in the earlier part of this paper for a mill motor and fly-wheel, except that in this case the variations in power are very much reduced; partly because the motor-generator set runs at a comparatively high speed, so that the stored energy of the fly-wheel is very much increased, although its weight and cost may be much reduced, and partly because a much larger variation in speed is permissible, as there is no fear of reducing the tonnage of the mill by allowing the variations in speed to be too great, so that a much greater proportion of the stored energy of the fly-wheel can be utilised to reduce power variations.

By regulating the field current of the generator of the motor-generator set, the voltage of this machine may be varied, causing the speed of the mill motor to increase or decrease correspondingly, and as there is no fly-wheel coupled to the mill motor the speed of the latter may be increased or decreased very rapidly. In rolling down a billet or bloom, therefore, it is possible to drive the mill at such a speed that while the first passes are being made the billet can easily be handled, and then to increase the speed con-



siderably for later passes when the billet has been rolled into a long bar, and when each pass takes a considerable time, so that the times of these long passes can be reduced.

In this way the total time for rolling down each billet can be reduced, and the tonnage can be increased. The time taken by these later passes can still further be reduced by increasing the speed after the bar has entered the rolls and then decreasing the speed again before the bar leaves the rolls, so that it is not thrown out at too high a speed. By using the Ilgner system, therefore, the possible output from the mill can be increased beyond that which would be obtained if the mill motor were driven at a constant speed.

Where the Ilgner system is adopted, it is always possible to use the mill as a reversing mill if a section has to be rolled which is difficult to manage in a three-high mill.

The Ilgner system has been adopted, amongst other examples, for driving a three-high mill having three stands of rolls and rolling heavy beams, driven by a direct-coupled motor of 12,600 H.P. normal output. The fly-wheel motor-generator set, which is provided with a 55-ton fly-wheel, runs at a maximum speed of 428 R.P.M., and is driven by a 2,600-H.P. motor.

The roughing rolls of a merchant mill should be run at the highest speed at which it is found practicable for the men to catch the comparatively short billet, and as in most cases about the same size of billet is being rolled, the speed should remain constant. The finishing rolls, on the contrary, should be capable of running at a large number of different speeds according to the shape and weight of section being rolled.

The ideal drive, therefore, is to provide a constant-speed motor for the roughing mill and a separate variable-speed motor for the finishing mill. Where the power available is direct current, this arrangement presents no difficulty, but where three-phase current must be used, the means of providing a variable-speed drive for the finishing mill needs some consideration.

An arrangement which can only be used where a rope drive can be employed is to provide an ordinary three-phase motor having three rope pulleys of different sizes on its shaft, and to change the ropes from one pulley to another when different speeds are required for the mill.

This only enables three possible speeds to be obtained, and has also proved itself to be very wasteful in power. A better plan is to convert the three-phase current to direct current, and then to provide a direct-current rolling-mill motor, so that the speed can be varied to suit all conditions without wasting power.

A still more economical arrangement for obtaining variable speed has been adopted for three merchant mills in this country. This consists of employing a three-phase motor direct coupled to a direct-current motor for driving the mill. A rotary converter is connected to the rotor circuit of the three-phase motor, so that when the set is run at reduced speed the power, which would otherwise be wasted in resistances in the rotor circuit is converted by the rotary converter from three-phase to direct current, and then used usefully to supply the direct-current motor.

The conversion losses are reckoned on a fraction of the power, and not on the entire power, so that the arrangement is much more efficient and is cheaper in capital cost. With this arrangement the direct-current motor is provided with a compound winding to act as a continuous-slip regulator, and the combination behaves like an ordinary compound-wound direct-current motor, the speed being varied by altering the resistance of the shunt field circuit of the direct-current motor.

Generally speaking, where there is a choice between direct current and three-phase for driving a mill for which variable speed is desirable, and there is little or no difference in the cost of current, direct current will be found the most economical.

Particular care should be taken to reduce as much as possible the friction losses, or other such losses which have a constant steady value independent of the power which the rolling mill may be giving. If the average power of a rolling-mill motor is one-third of its rated output, as is often the case, a friction loss which may be only 10 per cent. of the rated output will increase the total units consumed in a given time by 30 per cent. These remarks apply particularly to rope drives when used for rolling mills, as it is usually stated that a rope drive involves 10 per cent. loss of power, but this only applies to the case of a motor which is constantly transmitting its full power through the rope drive.

In many mills the power consumed by the friction of the mill itself is about one-fifth or one-sixth of the normal rated output of the motor which is installed to drive the mill, so that nearly 50 per cent. of the units of electricity used per ton rolled are wasted in friction. This shows how great an opportunity there is for improvements and for effecting economies in the cost of rolling.

Various economies can be effected by electrical driving when properly applied, but one of the principal economies is that of the cost of power. The electrical drive often enables cheap power to be used when it could not be transmitted or applied in any other way, and also in many cases it affords a means of enabling power to be generated cheaply, so that in planning an electrical drive every care should be taken to make use of its natural advantages as far as possible.

#### DISCUSSION AT SHEFFIELD.

MR. S. ECKMANN said that where the passes were long and the intervals short, the motor energy approached the load on the rolling-mill shaft very closely. The fly-wheel therefore did very little work, and was hardly worth the money or the space or the additional running costs caused through friction. British firms nowadays built motors which could be connected directly to finishing rolls without the insertion of either a fly-wheel or an elastic

coupling, and therefore a fly-wheel was not even necessary for protecting the motor. The curves showing the action of the fly-wheel were somewhat misleading, as the horse-power taken by the rolls had been assumed constant during one pass, whereas the horse-power was proportional to the speed. The figures giving the percentage variation of power therefore should be read with caution. The reason why automatic slip regulators were not used more frequently was that the regulator at one time could only be adjusted for a certain average load. The average load on a mill was dependent chiefly on the sections rolled, the temperature and the output of the mill, so when the rollers were working hard they were hampered by a slip regulator. A rolling mill drive should be able to follow the fluctuations of the output. Such a drive was given, for example, by an A.C. motor with constant resistance in the secondary or by a compound motor. With regard to the statement of the author that the arrangement with rope drive was wasteful, he did not see why this arrangement should be very wasteful. There was a slip-ring motor with, say, 92 per cent. efficiency at full load, there was a permanent resistance in the motor which brought the efficiency down to about 87 per cent., and there was finally the rope or belt drive. If a belt drive was chosen as being the more efficient of the two, the efficiency at full load would go down to about 84 per cent. This figure did not include the fly-wheel friction losses. The belt drive naturally involved a certain loss, say 4 per cent., but, on the other hand, a directly-coupled motor was a slower speed motor, and less efficient. He believed that, taking costs and overall efficiency into account, the indirect drive was often justified. The three-step belt drive was considerably more efficient than the Ilgner system. Careful investigations had shown that the rotary converter with one direct-current mill motor and the Kramer system were very much alike, both as regards efficiency and first cost. The former had only two revolving machines, whereas the Kramer system involved five rotating machines for one mill. The former required less space on the mill, and one rotary could be used for more than one mill. Thus for three mills there would be required four revolving machines, whereas with the Kramer system at least 11 revolving machines were required. Again, with the former the current taken from the line was always at unity power factor, whereas with the mixed motor system the power factor could not be kept at unity. There would be heating trouble when the rotary ran at low speed. He would like to ask what provisions were made in the Kramer system in order to obtain good compounding at low speed. In his opinion the efficiency of the electrical drive had been somewhat overrated. It did not matter much whether the electrical drive was 1 or 2 per cent. higher or lower as long as the overall efficiency of the mill was absolutely dominated by the friction losses in the mill itself and by the output.

MR. A. DU PASQUIER took exception to Mr. Ablett's remarks with regard to three-phase motors rope driving merchant mills of medium size, arranged with pulleys to give three efficient speeds. He knew of mills so operated with highly satisfactory results. Unquestionably a system of drive giving economic uniform speed control was preferable, if the extra capital outlay to secure it could be justified, but the question of the return on outlay had always to be borne in mind. Further, he thought Mr. Ablett was not correct in his comments on the respective merits of a rotary-converter D.C. motor drive, and the system described in the paper. There seemed to be a considerable advantage on the rotary-D.C. motor side. Mr. Ablett talked about the rotary and D.C. motor in his system being proportioned for a fraction of the A.C. motor rating; it was a fairly large fraction, as such machines must be rated at from one-third to one-half the capacity of the main A.C. motor, according to the speed variation required. Moreover, the machines had to be built on fairly large frames, as the D.C. motor must give its full output at the minimum mill speed. The rotary converter had always to carry the full rotor current of the main motor, even when running at a speed corresponding to, say, 3 per cent. of the supply frequency, which would certainly call for a considerably larger frame than necessary for the actual kw. output on account of the heating difficulties. These drawbacks were accentuated on a 25-period supply. The advantage would be with the first system every time. Dealing with the question of relative efficiencies, there was really very little difference where only one mill was considered. Where there were two or more to be operated, there was of course a very solid advantage with the D.C. motor drive both in first cost and overall efficiency. Mr. Ablett was rather hard on the rope drive. He would certainly not put the loss at 10 per cent. There would be some gain in efficiency for the direct drive, but it was usually nothing like so great as the paper would show.

MR. R. J. KAULA was rather surprised that the author had not made any reference to variable speed, or, rather, multi-speed, three-phase motors. A combination of cascade and pole-changing arrangements did away with a three-pulley drive with equally good results, and at the same time eliminated the complication of rotary converters described. Mr. Ablett made no reference to the power factor. Whilst the power factor had no appreciable bearing on the power consumption, it materially affected the capital cost of the installation. It would, no doubt, also have some effect on the terms obtainable from a supply authority, or on the cost of the generator, especially in the case of turbo-alternators.

MR. H. E. YERBURY said that for rolling mills one must admit that an exceedingly good proposition could be brought forward for steam plant. He had a case in mind where the waste gases from the furnaces were utilised for the generation of steam, and where the waste gases of a lower temperature were utilised for heating the feed water. Unless electricity could be purchased or generated at less than 5d. per unit, it would not compare favourably with modern steam or gas-driven plant for all-round efficiency with a



high load factor. From the maintenance standpoint the cost of an electrical installation would be lower than that of steam plant. Where coal could be purchased, as in Sheffield at 6s. to 7s. per ton, and gas at 11d. per 1,000 cb. ft., it would be readily seen that electricity had formidable rivals.

MR. W. E. BURNAND said the value of the electric drive, at any rate in the large powers, was to a great extent due to its being not only the most efficient but the cheapest and most readily controlled gearing between the power generator and power-using machines. Taking the case of the 12,000-H.P. motor; to get this power to the mill would be an extremely awkward job for any mechanical engineer, and he did not see how it could be done to give the acceleration and reversing powers that had been pointed out. Most rolling mills had plenty of heat going to waste that could be used for steam generation on quite a large scale at a comparatively low cost, and he thought the most advantageous way of utilising this steam would be by means of a steam turbine coupled to a homopolar generator. This was a hopeless machine for most present-day uses, but when they got up to 12,000 H.P. at turbine speeds for short-distance transmission, he thought it could easily hold the field to the exclusion of all others; 600 volts could be obtained with about four pairs of slip-rings; and whilst the design of the machine was a bigish problem to work out, it was feasible, whilst the ordinary commutator machine of that size for turbine speed most decidedly was not. With this combination of cheap steam and low cost of generating plant, he did not see how any outside supply could compete, especially as the load factor was far from good. Given a steam turbine as prime mover, and in view of the cheapness of steam in these places, the fly-wheel might with advantage be coupled to the turbine, and this allowed to vary in speed by the requisite amount to enable the fly-wheel energy to be utilised; though this reduced the efficiency of the turbine, it saved capital and complication, and some conversion losses. He thought it would pay to wind this fly-wheel with rectangular steel wire like a gun, as with the higher peripheral speed that could then be utilised, this would permit a much lighter wheel to do the work. The series system was worthy of more attention than it had so far obtained for this class of work. For instance, with a series-wound generator and motor it was possible to obtain almost any desired performance as regards speed variation between generator and motor with load, without external appliances. If both generator and motor had similar characteristic curves, they would maintain substantially the same speed relationship with varying load, precisely like two shunt-wound machines. If now the motor field was shunted by a non-inductive resistance, the speed would at first increase with increased load, and then come down to its first value. If the motor field were worked nearer saturation than the generator, the motor would increase in speed with increase of load, with constant speed on the generator, or it could maintain a substantially constant speed, with a falling speed on the generator, enabling the fly-wheel energy to be utilised without additional apparatus. An additional fly-wheel machine could be utilised just as easily as with the parallel system, the extra machine armature being in parallel with the motor armature, and the field in series.

#### DISCUSSION IN LONDON.

DR. E. ROSENBERG agreed with most of the author's conclusions. He proceeded to compare the merits of A.C. and D.C. motors for rolling mill work, and mentioned that the author appeared to prefer an arrangement of A.C. motor, rotary converter, and D.C. motor in cascade, to the use of a D.C. motor on the mill, supplied direct by a rotary converter. He could not follow the author's reasons, and did not think the arrangement would be so efficient, except in the case of smaller variations of speed than usual.

DR. WIESENGRUND referred to the possibility of employing an efficient mechanical drive, with gearing between motor and mill; there were many cases where the overall efficiency with such an arrangement would be better than for a direct drive, particularly where slow-speed mills were employed. He illustrated a 350-H.P. geared drive with a motor flexibly coupled to a fly-wheel, the latter being flexibly coupled through double helical gearing to the rolls. The speed reduction was 10 to 1, and a much smaller fly-wheel was required. He advocated such drives up to 1,500 H.P., pointing out that gearing had been produced with an efficiency of 98 per cent., and that the higher-speed motors employed also had a better efficiency.

MR. HOWARD suggested the use of one pair of rolls only for roughing and finishing, as was common practice in America.

MR. R. BORLASE MATTHEWS said that tinplate and bar rolling-mill drives presented a difficulty owing to the frequency of the passes; with the old steam drive the mill often lagged behind the men, but with the electric drive the mill speed had to be kept down. He did not believe that the S. Wales tinplate manufacturers would agree that the American system was better than their own. The author apparently credited the rope drive with greater losses than it actually had; it had proved a very useful method of driving. The author also favoured the D.C. motor, while in America the induction motor was preferred.

MR. J. FASOLA suggested that an improved efficiency would be obtained by using cascade motor drives, when the two and three-speed features could be utilised. Such motors would have a higher power factor than induction motors; the power factor of slow-speed motors was relatively very poor, and this was one reason why high-speed motors and geared drives had been used. He concluded by emphasising the smaller cost and efficiency of a cascade motor driving equipment as compared with a drive involving A.C.-D.C. converting machinery.

MR. G. C. ALLINGHAM referred to the possibilities of the storage battery for load equalising. For regular cyclic variations, the fly-wheel was the best equaliser, but, for irregular variations, the storage battery was better, and it had the advantage in capacity and no-load losses. The slip regulator involved a considerable waste of energy, and the mill output was reduced at reduced speeds.

MR. A. WILLIAMS agreed with the author in preferring the direct drive. With high speed drives the gearing and bearings gave trouble. The C.M.B. system had been adapted for rolling mill driving, and it did away with slip resistances, &c., giving an improved efficiency at low speeds.

The AUTHOR then briefly replied to the various points raised.

### THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

WE have received the following report of the annual general meeting of this Association, which was held at the office, 36, Kingsway, London, W.C., on Thursday last week. About 50 members were present, Mr. F. H. Nalder, chairman of the Council, presiding.

Before moving the adoption of the report and balance-sheet to September 30th, 1911, the chairman referred briefly to the work of the reorganisation of the Association, which, he said, had necessarily occupied much of the time and attention of the Council during the period under review. Members could see before them, in the room where they were sitting, a small part of the results attained. They now had offices and a staff which, he thought, could be regarded as worthy of the industry and of the Association representing it. They had to thank the retiring Council, as a whole, for that work. Their time and energies had been freely given to it. But it could not have been done at all without the support of the great body of manufacturers, and in the necessary work of putting before manufacturers the advantages of possessing such an Association, no one had done better service, or met with greater success, than his friend, Mr. Longbottom (Electromotors, Ltd.), the vice-chairman of the Council. As a result of their efforts, whereas a couple of years ago they had 40 members, they had last year doubled the number, and now the list was but a few units short of 100, and it was steadily increasing. They were not going to stop at that. To make the Association a thoroughly strong organisation, they needed every electrical manufacturer and his allies, and they expected and invited the whole industry to come in.

The other subject which had made inroads upon the energies of the Council and the work of the Association was the Electrical Exhibition promoted by themselves and held at Olympia during September and October last year. That Exhibition had certainly been a financial success. He believed the report referred to the good-tempered, if severe, criticism levelled at it by the Press. They would profit by what had been said, and he hoped that their next exhibition would be an improvement in every way. While on that subject, and in view of members wishing to raise the question, he might say that the Association had for some time found it necessary to set its face against the lavish promotion of exhibitions. The industry had been almost submerged with applications from all sorts of people for support for all sorts of schemes, and had in the past even spent a great deal of time and money without any adequate return. They did not discountenance large and creditable undertakings promoted by such people as the supply authorities; and one such Exhibition—the forthcoming Smoke-Abatement Exhibition—they were recommending those of their members who were specially interested, to support. Considering the activity of the gas interests and the public interest in the smoke-abatement question, they could not afford to neglect such Exhibitions. The secretary would make a statement in this connection.

Turning to the internal business of the Association, he would particularly like to refer to the work of the Sections, into which, for better division of labour, the Association was divided, and within which the main work of the Association was carried on. He said that members who took part in those Sections would appreciate the value of the work done in them. Their proceedings were not for general publication.

Equitable conditions of contract was another important subject which had long occupied their attention, and the Institution of Electrical Engineers had given them an opportunity of submitting proposals in regard to the *Model General Conditions of Contract*, of which they had availed themselves, and they would shortly be in a position to lay their suggestions before the Parliamentary Committee of the Institution.

The subject of electrical standards was also engaging their attention. He must not, however, occupy their time with a detailed catalogue of what had been done and what still remained to be done before they could feel that they had fully vindicated their position. Members would, no doubt, wish to raise some questions on the report and accounts. They would notice that a somewhat small balance had been carried forward from the period preceding the reorganisation. They were now, he was happy to say, in a very different financial position. He moved the adoption of the report. The motion was seconded by Mr. Longbottom.

Mr. Justus Eck (Union Electric Co., Ltd.) expressed the hope that in the final distribution of the Exhibition surplus the Electrical Trades Benevolent Institution would benefit.

On the motion of Mr. A. B. Anderson (Ferranti, Ltd.) the matter was referred to the new Council.



On the invitation of the chairman the meeting then proceeded to the election of the Council, and the result of the ballot was declared as follows: Belliss & Morcom, Ltd.; British Thomson-Houston Co., Ltd.; British Westinghouse Electric and Manufacturing Co., Ltd.; Browett, Lindley & Co., Ltd.; Dick, Kerr & Co., Ltd.; D.P. Battery Co., Ltd.; Electromotors, Ltd.; Elliott Bros.; Ferranti, Ltd.; General Electric Co., Ltd.; Lancashire Dynamo and Motor Co., Ltd.; Nalder Bros. & Thompson, Ltd.; Siemens Bros. Dynamo Works, Ltd.; Vickers, Ltd.; Willans & Robinson, Ltd.

After the election of Messrs. Price, Waterhouse and Co. as auditors for the year, the secretary stated that arrangements had been made between the supply authorities and the manufacturers for a joint exhibit at the forthcoming Smoke-Abatement Exhibition, on conditions more favourable to the latter than had hitherto existed. A meeting of manufacturers, specially interested in lighting, heating and cooking apparatus, would be called at an early date to go into the business, and he expressed the hope that any manufacturers of such apparatus still outside the Association would make it their business to communicate with him.

The secretary then dealt at some length with the sectional and other activities of the Association, and a vote of thanks to the chairman for his work during the year, proposed by Mr. Anderson, having been carried unanimously, the proceedings terminated.

The Council of the Association have fixed Thursday, February 15th, for their first meeting.

## NEW POWER STATION AT BURY.

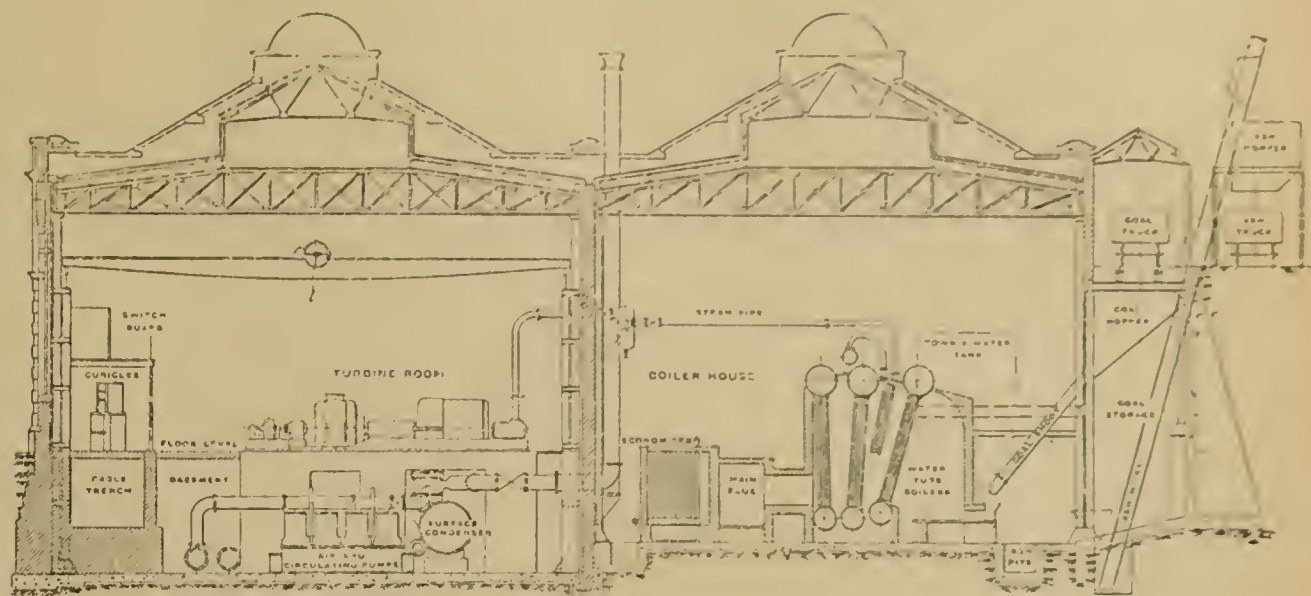
FROM time to time we have referred to the progress made with the new Chamber Hall power station of the Bury Corporation, which was to have been officially opened on January 10th last.

The site of the station adjoins the Lancashire and Yorkshire

buildings are steel framed, with roofs carried on lattice girder principals.

The boiler house at present contains three "Woodeson" boilers, and space is left for a fourth between those installed and a 200-ft. chimney, which will ultimately occupy the centre of a range of eight boilers.

The boilers each have an evaporative capacity of 25,000 lb. of water per hour at 200 lb. pressure, and by means of superheaters 150° F. can be added to the steam temperature.



CROSS SECTION, CHAMBER HALL POWER STATION, BURY CORPORATION.

Mechanical stokers of the coking type are fitted, the hoppers being fed through spouts from steel bunkers, which in turn are fed from coal wagons on the siding above.

The steel bunkers have a capacity of 100 tons, but the space below them to the boiler house floor level gives an additional 650 tons storage.

The ashes are raked out of the dumping pits into a skip, operated by an electric crab on a runway over the firing floor, by means of which and a hoist, the ashes can be lifted into a hopper over the railway siding.

A 480-tube economiser arranged in two parts is situated behind the boilers; feed pumps, two in number, of the "Woodeson" type each of 100,000 lb. capacity, are provided in the boiler house drawing their supply from either a 16,000-gallon town water storage tank or (usually) the hot-well in the engine-room basement.

The engine room plant consists of two 2,100-KW. three-phase turbo-alternators generating 50-cycle current at 6,000/6,600 volts.

These sets were supplied as to the turbines, which are of the Zoelly type, and condensing plant by Messrs. Musgrave, and the electrical plant by Messrs. Siemens.

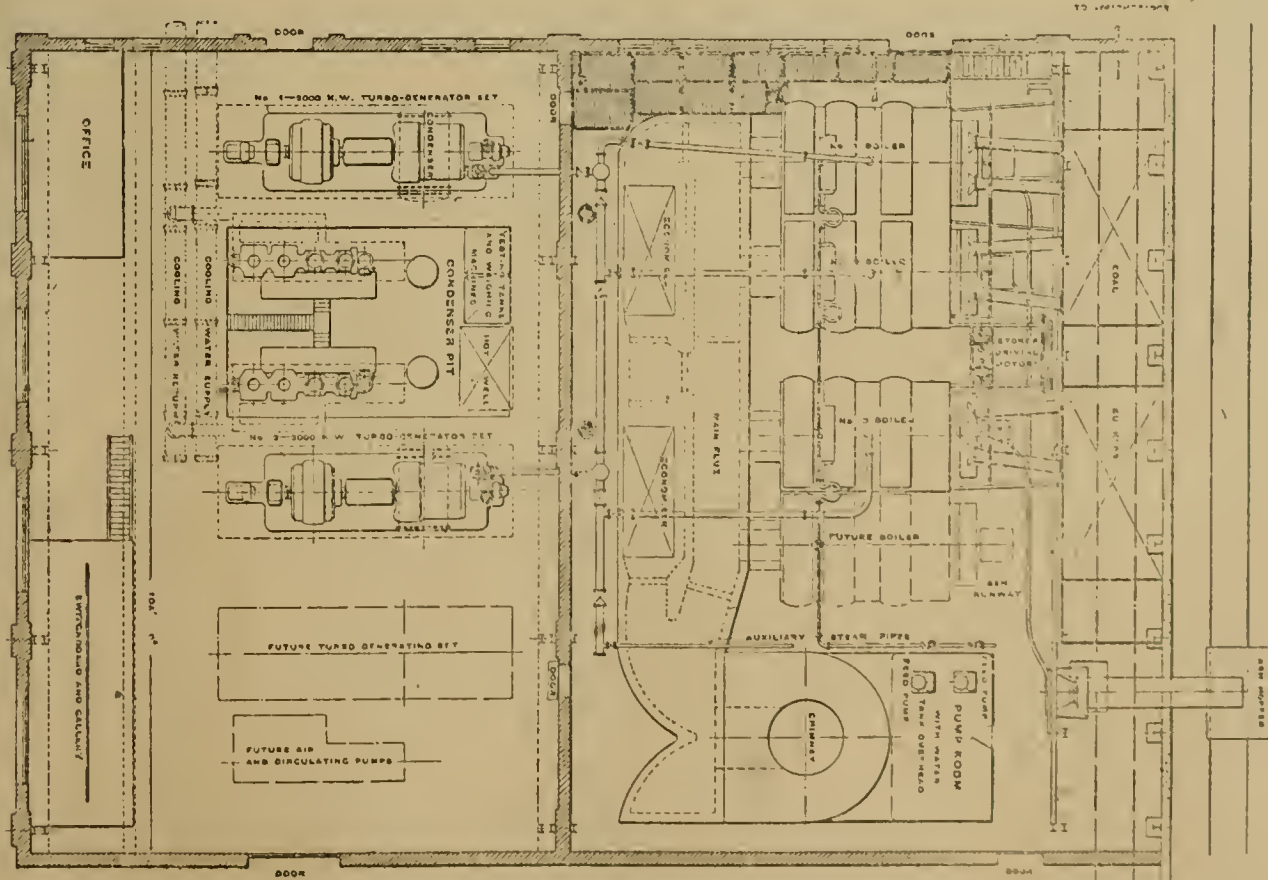
The turbines are fitted with speed limiting gear on the governor, motor-driven oil pumps for flushing the main bearings before starting up, motor-driven governor regulating gear controlled from the main switchboard, and motor-operated 48-in. exhaust valves between turbines and condensers.

The governor is capable of holding the speed to within ½ per cent. for normal load changes; the runaway attachment to the governor comes into use if the speed increases 10 per cent. above the normal.

The efficiency of the alternators on an inductive load with power factor .8 is 91 per cent. on full load, 89.5 per cent. for three-quarter, 85.5 per cent. for half, and 75 per cent. for quarter load. Special air circulation is provided, approximately 8,000 cb. ft. per min. being circulated through each machine.

The condensers are of the surface type, and the air and circulating pumps, of the steam-driven reciprocating type with two 23-in. diameter Edwards air pumps, two 18-in. diameter double-acting circulating pumps and a compound engine, all driving one crankshaft, the H.P. and L.P. cylinders of the engine being at opposite ends. Two fly-wheels are provided, and two smaller pumps are operated by suitable motion from this plant.

The L.P. exhaust steam is passed through a Baker oil separator



PLAN OF THE NEW CHAMBER HALL POWER STATION, BURY.

Railway, in connection with which there is a double-track coal siding for supplying the bunker; the site is also adjacent to several large reservoirs covering seven acres, and supplied from the River Irwell, which, by arrangement with the occupiers, have been made available for condensing purposes at the power station.

The buildings, which have been constructed in local bricks on concrete foundations, comprise a turbine room 69 ft. wide and a parallel boiler house, 64 ft. wide, both being 104 ft. long; the



and thence to the L.P. end of the turbine. To enable continuous steam consumption tests to be carried out, two galvanised tanks on weighing machines are provided, into either of which the air-pump discharge can be diverted by suitable three-way valves.

The extra-high-tension switchgear, by Messrs. Ferranti, is arranged in cubicles at engine-room floor level, with an operating gallery overhead. The switchgear is divided equally by a centre cubicle containing a large capacity bus-bar dividing oil switch, and each half controls one generator, two-feeder circuits, and a station circuit, while spare cubicles are provided for additional two-generator and two-feeder switches.

The switches for the generators, station circuits, and bus-bar dividers are hand-operated only, but the feeder oil switches are fitted with adjustable overload time limit trip gear.

As the neutrals of the generators are not connected to earth, three earth indicating voltmeters have been provided. The feeder cables (by Messrs. Siemens) running from the new station are in duplicate, of the three-core type, with 15 sq. in. conductors, paper insulated, lead covered and wire armoured, laid in Howard troughing, and supply a sub-station at the old Rochdale Road works.

The switchgear installed is similar to that in the power station, and controls three feeders and three motor-generators, one of the feeders supplying through transformers to an adjacent factory.

The motor-generators are each of 500 kW. capacity and G.E.C. manufacture, with interpoles on the D.C. side. They are started up from the D.C. bus-bars, and can be used reversed, if necessary, to supply A.C. The machines give their full output when working either at 440-480 volts or 500-550 volts.

The power station was designed by, and erected under the supervision of, Mr. S. J. Watson, the borough electrical engineer, to whom we are indebted for these particulars.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,693. "Electric clock mechanism for time switches and other purposes." F. T. REID. January 22nd.

1,698. "Means for the manufacture of bushes or bearings for shafts, axles, self-propelled vehicles, engines, electric motors or the like." W. G. HANNA, jun. January 22nd.

1,721. "Telephones." F. C. SHARDLOW. January 22nd.

1,724. "Accessories for vapour, gas and the like lamps, gas brackets, gas pendants, hall light pendants, kitchen pendants or electric lamps and the like." A. C. DAINESI. January 22nd.

1,753. "Electrical systems for automobiles." J. BIJUR. (Convention date, February 2nd, 1911, United States.) February 22nd. (Complete.)

1,755. "Feeding mechanism for the electrodes of electric arc lamps." F. STEINERT. January 22nd. (Complete.)

1,817. "Electric switch mechanism." J. W. RECORD. January 23rd.

1,829. "Electrically-driven hydraulic lifts." E. M. T. BODDAM. January 23rd. (Complete.)

1,839. "Induction furnaces." H. G. SOLOMON. (Addition to No. 903, of 1911.) January 23rd.

1,852. "Electric tablet systems for working single lines of railway." A. T. BLACKALL and C. M. JACOBS. January 23rd.

1,861. "Electric synchronisation of clocks by signals from observatories or distributing centres." W. J. POLYBLANK. January 23rd.

1,864. "Electrical condensers." MARCONI'S WIRELESS TELEGRAPH CO., LTD. January 23rd.

1,871. "Integrating electric meters." S. G. S. DICKEER. (Chicago Electric Meter Co., United States.) January 23rd. (Complete.)

1,888. "Incandescent electric lamps." F. S. DINENAGE. January 24th.

1,901. "Hunting gear for electrically controlling guns on ships and ashore, steering gear on ships, swing bridges, hydraulic accumulators, cranes, capstans and the like." A. MARTIN, H. JACKSON, A. J. CAMPBELL, T. B. CAMPBELL and W. CAMPBELL. January 24th.

1,902. "Socket connectors for electrical cooking utensils." D. S. MUNRO. January 24th.

1,923. "Electric switches and cut-outs." F. SHEPHERD and I. LEVY. January 24th.

1,957. "Distributors for magneto-electric machines." C. PARROT. (Convention date, May 18th, 1911, Belgium.) January 24th. (Complete.)

1,961. "Linings or coverings for electrical furnaces." Soc. GENERALE DES NITRURES. (Convention date, January 26th, 1911, France.) January 24th. (Complete.)

1,965. "Apparatus for the control of electric circuits." H. LEITNER. January 24th.

1,968. "Blackleading machines for the use of electrotypers." R. HOE and Co., LTD., and F. GRAFTON LOUGEE. January 24th.

1,969. "Blackleading-machines for the use of electrotypers." R. HOE and Co., LTD., and F. GRAFTON LOUGEE. January 24th.

1,979. "Control of alternating-current electric motors." E. ROSENBERG. January 24th.

1,980. "Electric arc lamps." E. E. PRESTWICH. January 24th.

1,983. "Electric heaters for liquids." J. P. BLAND and E. G. SIMESTER. January 24th. (Complete.)

1,999. "Dynamo-electric machinery." H. C. SIDDELEY. January 25th.

2,001. "Multiple contact in the thermo-electric elements." P. FERRA. January 25th.

2,020. "Spring shade-holder for electric lamps." J. S. MUNRO, jun. January 25th.

2,028. "Electric surface resistances." C. A. ALLISON (Compagnie de L'Industrie Electrique et Mecanique, Switzerland.) January 25th. (Complete.)

2,040. "Gas-electric trains." R. F. MILLANE. January 25th.

2,042. "Speed control of direct-current series electric motors." SIEMENS BROS. DYNAMO WORKS, LTD., and F. LYDALL. January 25th. (Complete.)

2,048. "Shade carriers for electric incandescent lampholders." A. P. TULLETT. January 25th.

2,049. "Electric telegraphy." A. MUIRHEAD and MUIRHEAD & Co., LTD. January 25th. (Complete.)

2,063. "Means for heating liquids by the aid of electricity." C. W. RAFFETY. January 25th.

2,081. "Electric metallurgical furnaces." V. STOBIE. January 26th.

2,098. "Electric heating apparatus." F. B. COX. January 26th.

2,124. "Electrolytic apparatus." L. H. A. B. M. HAZARD-FLAMAND. (Convention date, February 6th, 1911, United States.) January 26th. (Complete.)

2,125. "Means applicable for use in controlling the transmission of rotary motion." PETO & RADFORD, LTD., and H. M. GENESE. January 26th.

2,126. "Electric plug connectors." W. PETO and PETO & RADFORD, LTD. January 6th.

2,155. "Process for the manufacture, isolation, and enrichment of radium and other radio-active substances." G. EBLER. (Convention date, March 6th, 1911, Germany.) January 26th. (Complete.)

2,159. "Filaments for electric incandescent lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 26th. (Complete.)

2,160. "Power-transmission devices." E. S. LOUIS. January 26th.

2,180. "Mechanical and electrical interlocking gear for the shafts or cage gates or doors of lifts." W. REID. January 27th.

2,189. "Suspensory anti-vibrators for metallo-filament lamps." MAXWELLS (DUNDEE), LTD., and S. PONSFORD. January 27th.

2,205. "Electric light and other like fittings." C. J. THURSFIELD. January 27th.

2,216. "Electric clock systems." A. R. UPWARD. January 27th.

2,221. "Electrically heated flat-irons." K. KALTSCHMIDT, jun. January 27th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ELECTRIC WALL-PLUGS AND SOCKETS. R. Hirst and N. Chapman. 8,375. April 5th.

ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co.) 10,254. April 27th.

SWITCH-HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. A. V. Downton and A. R. Kibblewhite. 10,527. May 1st.

ELECTRIC RADIATION FURNACES. E. C. R. Marks. (Geb. Siemens & Co.) 11,982. May 17th.

CONDUCTOR POINTS OF ELECTRIC RAILROADS ON THE OVERHEAD CONDUCTOR SYSTEM. A. Nicholson and N. Nicholson. 13,970. June 8th.

APPARATUS FOR STERILISING LIQUIDS BY MEANS OF ULTRA-VIOLET RAYS. Soc. Anon. Française Dite Banque du Radium. 15,010. June 27th. (October 15th, 1910. Addition to No. 14,912 of 1911.)

LIQUID ELECTRIC CONTROLLERS. Allen, West & Co. and R. Moggridge. 16,871. July 24th.

HIGH-PRESSURE CURRENT DISTRIBUTORS FOR ELECTRIC IGNITION APPARATUS. W. Heyer. 16,968. July 24th. (July 23rd, 1910.)

ELECTRIC ALARM CLOCKS. F. Goss. 17,051. July 25th.

MAKE-AND-BREAK DEVICE FOR THE PRIMARY CIRCUIT OF ELECTROMAGNETIC IGNITION. W. Heyer. 17,053. July 25th. (July 25th, 1910.)

ELECTRIC HORNS. E. Lucas and R. Edwards. 19,085. July 28th.

CIRCUIT ARRANGEMENTS FOR AUTOMATIC TELEPHONE SYSTEMS. Siemens and Halske Akt.-Ges. 19,187. July 28th. (August 27th, 1910.)

ELECTRICALLY-CONTROLLED RAILWAY SIGNALS AND THE LIKE. Siemens & Halske Akt.-Ges. 21,873. October 4th. (November 4th, 1910.)

AUTOMATIC REGULATING APPARATUS FOR ELECTRIC SUPPLY SYSTEMS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 24,105. October 31st.

MEANS FOR USE IN AUTOMATICALLY REGULATING THE TIMING IN MAGNETO-ELECTRIC APPARATUS. H. Wiehl. 24,970. November 9th. (November 9th, 1910.)

CONTROLLING MECHANISM OF ALTERNATING-CURRENT ARC LAMPS. A. Ogilvy-Webb, H. J. Booker and R. C. A. Reinecke. 46. January 2nd.

ELECTRIC GENERATING SYSTEMS OF VEHICLES, PARTICULARLY FOR LIGHTING-UP MOTOR-CARS. W. Seal. 452. January 7th.

GALVANIC BATTERIES. A. Heil. 473. January 7th. (March 14th, 1910. Addition to No. 207 of 1911.)

ELECTRIC MOTORS AND PUMPS CONNECTED THERETO. Gwynnes, Ltd., J. F. Breeze and R. Macdonald. 594. January 9th.

ELECTRIC MOTOR REVERSING SWITCHES. V. Stobie. 672. January 10th.

APPARATUS FOR HEATING AIR OR OTHER MEDIA BY MEANS OF ELECTRICITY. C. G. Bell. 683. January 10th.

ELECTRIC TRANSFORMERS. British Thomson-Houston Co. (General Electric Co.) 711. January 10th.

VACUUM TUBE. R. Whiddington. 1,292. January 17th.

BOXES FOR USE WITH ELECTRIC CABLES, TELEGRAPH, TELEPHONES AND THE LIKE, APPLICABLE ALSO FOR OTHER PURPOSES. H. Dickinson. 1,302. January 18th. (Cognate application, No. 5,745 of 1911.)

WALL-BOX WITH ADJUSTABLE COVER FOR CONTAINING ELECTRICAL SWITCHES AND PLUGS AND THE LIKE. J. W. Brooks and A. E. Read. 1,699. January 23rd.

POLYPHASE ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES OF THE COMMUTATOR TYPE. Allgemeine Elektrizitäts Ges. 1,942. January 25th. (January 26th, 1910.)

RESISTANCES FOR ELECTRICAL HEATING AND COOKING APPARATUS AND OTHER PURPOSES. G. Cooper. 3,745. February 14th.

CIRCUIT CONNECTIONS FOR ELECTRIC CURRENT DISTRIBUTION WITH AUTO-TRANSFORMERS. F. Kesselring. 4,618. February 23rd.

MANUFACTURE OF METAL TUBE PARTICULARLY OF USE AS AN ELECTRICAL CONDUIT. J. Evans. 6,460. March 15th.

ELECTRIC LIGHTING ARRANGEMENTS FOR BILLIARD TABLES, SHOPS AND THE LIKE. H. Mitchell. 7,344. March 24th.

SPARKING-PLUGS FOR INTERNAL-COMBUSTION ENGINES. N. Player and B. Hill. 7,789. April 3rd.

ELECTRIC TIME-SWITCHES. J. G. Mehne. 11,238. May 9th. (Patent of Addition not granted.)

COMBUSTION BRIDGE FOR ARC-LIGHT ELECTRODES. R. W. James. (Ges. für Verwertung technischer Patente.) 11,436. May 11th.

ELECTROMAGNETIC IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES. A. Ritter. 12,369. May 22nd.

SWITCH FOR ELECTRIC ILLUMINATING DEVICES. C. Graebe and C. Lehrbach. 13,341. June 2nd.

CONSTRUCTION OF MAGNETO-ELECTRIC IGNITION MACHINES. Firm of Robert Bosch. 13,705. June 3rd. (August 27th, 1910.)

ELECTRICAL WALL-SOCKETS AND THE LIKE. R. Tucker. 14,110. June 20th.

PROCESS AND ARRANGEMENT FOR FORMING AN ELECTRICAL ARC. B. Duschnitz. 16,992. July 23rd. (July 29th, 1910.)

HOLDERS FOR ELECTRIC LAMPS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 17,869. August 5th.



# THE ELECTRICAL REVIEW.

Vol. LXX.

FEBRUARY 16, 1912.

No. 1,786.

## ELECTRICAL REVIEW.

## THE ENGINEER IN THE MINE.

Vol. LXX.]	CONTENTS: February 16, 1912.	[No. 1786.	Page
The Engineer in the Mine ...	...	...	241
Wanted: British Fairness in the Canadian Market ...	...	...	242
Conditions of Contract ...	...	...	243
The New Elevator Regulations in South Africa ...	...	...	243
The Rating of Tramways ...	...	...	243
The I.E.E. ...	...	...	244
Electrical Law in the British Dominions ...	...	...	244
Notes from Canada ...	...	...	245
Notes on Renewing Tubes in Babcock & Wilcox Boilers ...	...	...	245
Correspondence:—			
The Economy of Electric Cooking ...	...	...	246
Arc Lamp (Span Wire) Lowering Gear ...	...	...	246
Kingston Diesel Engines ...	...	...	247
The Electrical Profession as It Is ...	...	...	247
Our Progressing Manufacturing Firms ...	...	...	247
The Telephone Service ...	...	...	247
South African Regulations respecting Elevators ...	...	...	248
Legal ...	...	...	248
Our Legal Query Column ...	...	...	251
Business Notes ...	...	...	251
Notes ...	...	...	259
Electric Power in South-East Kent ( <i>illus.</i> ) ...	...	...	261
Reviews ...	...	...	266
City Notes ...	...	...	268
Stocks and Shares ...	...	...	272
Market Quotations ...	...	...	272
Share List of Electrical Companies ...	...	...	273
Opal Shades ...	...	...	275
The Formation of Deposit by Transformer Oils ...	...	...	275
Trade Statistics of Canada ...	...	...	277
Proceedings of Institutions:—			
The Evolution and Present Development of the Turbine Pump ( <i>illus.</i> ) ...	...	...	279
The Institute of Metals ...	...	...	280
Dynamos for Motor Road Vehicle Lighting ( <i>illus.</i> ) ...	...	...	281
New Patents Applied For, 1912 ...	...	...	284
Abstracts of Published Specifications ...	...	...	284
Contractors' Column ...	Advertisement pages xxvi, xxviii and xxx		

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

A VERY interesting position has arisen in South Africa regarding the status of the electrical engineer in the Rand gold mines. It is well known that the mining industry in that district has reached a very high state of efficiency, due largely to the intelligent use of the latest mechanical appliances and scientific processes. It is not easy to obtain a sufficiency of native labour, and, therefore, labour-saving devices receive careful attention, and—if successful—are often adopted on a large scale.

The mechanical engineer to the mine is, consequently, an important person, and in the past when electricity was only used for lighting and, perhaps, driving a few motors, the electrician was necessarily a subordinate. During the past few years the position has been considerably modified. Electrical energy at extra-high pressure is brought to the mine from an outside source; it is then transformed to a medium pressure, distributed to different parts of the mine, again transformed, and, finally, is made use of in nearly every process of the work.

The electrician has to be an engineer, with a correspondingly wider sphere of work. The mechanical engineer naturally enough strives to maintain his official superiority, while the electrical engineer refuses to accept responsibility.

The Transvaal Government has recognised the danger of such a state of affairs in the principal industry of the country, and has tried to heal the breach by issuing regulations insisting on mining machinery being under the direct responsible charge of properly certificated persons. These regulations provide for two classes of certificates, one for mechanical and the other for electrical engineers, and as some doubt arose as to their precise interpretation, a deputation from the South African Institute of Electrical Engineers recently waited upon the Government to discuss them.

The deputation consisted of Mr. J. H. Rider, the President of the Institute—well known in this country as the late tramways electrical engineer to the London County Council—Mr. Perrow, and Mr. Rowland, the secretary of the Institute; they were received by Mr. Kotzé, the acting Government Mining Inspector, and Mr. Vaughan, the Chief Inspector of Machinery.

As it is only a question of time and progress—largely the latter—before a somewhat similar state of affairs may arise in this country, it is interesting to note the questions put by the deputation, and the attitude taken up in reply.

The regulations insist that all machinery shall be in charge of a responsible certificated person, and the mine manager must appoint persons with the requisite qualifications. The first query was whether an electrical engineer, who after examination had had his certificate endorsed for mining machinery, would be eligible for taking full control of, and responsibility for, the mine machinery. The reply was

## THE

## UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.



that if the endorsement extended to all classes of mining machinery, and was not restricted to merely *electrical* mining appliances, he would be. It was, however, open to the examiners granting the certificate to limit it in accordance with the results of the examination, while it was open to the electrical engineer to claim to be allowed to sit for the whole of the examination. In like manner the holder of a mechanical engineer's certificate could qualify for one as an electrical engineer. It was then made clear that without an endorsement regarding *electrical* mining machinery, no electrical engineer would be recognised for employment in a responsible position in a mine.

The next point referred to what might happen if two engineers were appointed, and here it was stated that both would have clearly marked duties, so that neither would interfere with the other or overlap as regards responsibility.

If the electrical engineer is responsible for the high-tension network, ought those who may be his official superiors to have the right to enter sub-stations where high-tension switchgear is placed, without his knowledge and presence? The deputation pointed out that in some cases the mechanical engineer or the mine manager, nominally in charge of the whole of the mine, kept the keys, and might even operate the switches, while the electrical engineer was legally responsible. It was pointed out how difficult it would be to debar these officials from examining any part of the machinery under their care, but that if experience showed it to be advisable, a stipulation that such officials must be accompanied by the electrical engineer would be added in a year's time.

One of the requirements for obtaining a certificate demanded that a candidate should have been "in charge" of plant of at least 250 H.P. for not less than three years. In a mine in which the mining engineer has in the past been rated as the higher official, would he *ex officio* be regarded as in charge, or would his subordinate electrical engineer, who had actually been responsible, be now eligible to apply for examination for his certificate? If not, would the mechanical engineer who was nominally in charge be allowed to count this as a qualification in applying for an extended certificate? It was agreed that the aim of the regulation was not to disqualify any competent worker, and that *ex officio* charge alone would not be recognised by the examiners. A further query related to a slight difference in the wording of the qualifications necessary for obtaining the two classes of certificates. In the case of mechanical engineers, apprenticeship or pupilage is demanded; in that of electrical engineers, the words "practical experience equivalent thereto" have been inserted. The fear was expressed that this might make it easier for a mechanical engineer to get an electrical, than for an electrical engineer to get a mechanical engineer's certificate. It was shown that this fear was groundless, as was also that with regard to the relative proportions of mechanical and electrical engineers upon the Board of Examiners.

It was felt on all sides that the points dealt with were only of a temporary nature, and that in a comparatively short time all mining engineers on the Rand would have both electrical and mechanical attainments, which hitherto had largely been held by distinct persons.

This will only be following what has been the trend in other directions: the specialised electrician in whatever groove—if the work on which he is engaged is important and successful—must either qualify as an all-round engineer for that particular branch of engineering, or allow the smarter

engineers of the industry to oust him by themselves acquiring—in addition to their general information—the special knowledge which he possesses. Electrical knowledge forms an excellent entrance into many engineering fields, but it is only an entrance. An electrician or a purely electrical engineer has in the industrial world a certain not very high value; if he wishes to win his way to a high and thoroughly responsible position he must be ready to qualify in all the details of the department of engineering of which his specialised knowledge forms a part, and not be content with his electrical attainments.

---

**Wanted: British Fairness in the Canadian Market.**

ON one or two occasions we have felt compelled to criticise those responsible for giving out public contracts for electrical and engineering work in some of our Colonies, for their lack of elementary fairness towards outside tenderers. We need not recall the details in these pages, but they are brought vividly before our minds once again by some comments appearing in the editorial notes of our contemporary the *Canadian Electrical News*, under the title "Bad Business Form." We have no information to tell us what particular contract is here referred to, nor do we know whether the successful tenderer was a Canadian or an English firm; but that can make no difference, for obviously there has been a transgression in breach of one of the commonest of business principles. Our contemporary occasionally hears complaints from manufacturers and others who deal in electrical apparatus "that they do not receive fair treatment when tendering for municipal or other work in Canada." We were under the impression that when we uttered a complaint on behalf of British tenderers regarding the same Dominion our contemporary failed to see the reason for our protest. That our information, on the whole, was not far from the truth is, however, borne out now by the rumours that reach the editor first-hand in Toronto. An aggrieved manufacturer has placed before him the circumstances of a recent experience in which, "following the submission of a tender for the supplies required, further and confidential information was asked *after the contracts were let*—this latter fact being kept secret from this particular tenderer." The firm happens to be located in the United States, but it solemnly asserts that after such treatment as this it will not again tender for Canadian business. No doubt there will be some who will feel satisfied with this result, whether they so express themselves or not; but our contemporary obviously regrets that "our municipalities and private companies in general thus lose the benefit of this healthy competition." The *Electrical News* goes on to add the opinion that such practices are not in accord with the most approved business methods of the present century, and, quite apart from the moral side of the question, they will "in many ways tend to retard the progress of electrical operations in our Dominion." "That these negotiations were in charge of a recognised electrical engineer intensifies rather than condones the objectionableness of such a course. Professional self-respect, we think, should be sufficiently strong to render any engineer superior to the pursuit of a line of action that smacks of sharp practice."

We are entirely at one with our contemporary in its criticism, and we hope that its protest will help toward ensuring a larger degree of fairness in the future.

Experience has shown beyond all dispute that British electrical manufacturers—excepting, perhaps, in one or two specialised cases—must be "right there" with technical and commercial representatives capable of submitting tenders speedily and in complete form, because the period for which contracts are open is short. But the suspicion that all is not fair and above board may form another argument, not so far previously employed, in favour of being on the spot: first, so as to keep on the track of a contract until it has passed through critical stages, and, secondly, in order to see that no information is divulged after the "other man" has secured a success. But it may have yet another effect by leading British firms to adopt the attitude of the U.S. firm



mentioned above, and leave the market severely alone! Our manufacturers can make the best of electrical and other machinery and goods suitable for Canadian service, at lower prices than obtain in a country where wages are so high. They are anxious to compete for the classes of business for which they are well fitted; they have shown in a number of cases that they can successfully do so. We have it, on the authority of our own special representative in Canada, that British manufactures can be obtained promptly, notwithstanding the thousands of miles of ocean to be traversed. Our promises, it is found, can be relied upon for specially-made lines, and for standard lines our firms could compete by keeping stocks there. British electrical manufacturers *want* to do a better business with Canada. The curve recently published in our "Canadian Notes," and the statistics which appear on another page of this issue, show just where we stand. We all recognise the vastness of the electrical opportunity that is coming, consequent upon present-day developments, but Britishers certainly will expect of their Canadian kith and kin that they will not play them false.

#### Conditions of Contract.

OUR contemporary, the *Brisbane Courier*, waxes sarcastic about certain conditions of contract put forward by the Metropolitan Water and Sewerage Board, and deduces that the advisers of that Board have been influenced by reading "Alice in Wonderland."

The fact that the condition in question has appeared in connection with most of the public tenders in this country for many years, together with other conditions equally fantastic and iniquitous, does not seem to be known to our contemporary, which approaches the question with the open mind and fresh judgment which one would naturally expect in a new and breezy country. The authority in question in inviting offers for the construction of a dam, lays down the conditions, familiar, alas, to our readers, but apparently novel in Australia:—

If in the execution of the works it shall be found that anything has been omitted or misstated, either in the drawings or specification, which is necessary for the proper performance and completion of any part or parts of the works, the contractor shall, at his own expense, execute the same and provide whatever may be requisite for so doing.

Our contemporary speaks of it as "an exquisite little bit of fun."

It does not mention whether the engineer to the authority is sole arbitrator as between itself and the wretched contractor; but if the conditions are, as we expect, modelled upon the highest English practice, we should think that important provision will not have been omitted. The *Brisbane Courier* remarks that "Any contractor who signs such a clause must do so with a firm reliance upon the good offices of some 'friends at court.'"

Therein doubtless lies the grand secret which keeps a select few of the contracting or constructive men, the "master builders" of the age, outside the Bankruptcy Court.

We are glad to reflect that the "Model Conditions of Contract" of the I.E.E. exclude these scandalously unfair conditions, and we hope to live to see the day when no Court of Law will enforce them. Even now there is hope, for the Courts have recently found that an "engineer" may not hinder a contractor from laying tram-rails and at the same time, as sole arbitrator, fine him for delay in carrying out the work.

Also it has been found that by going to law and calling the engineer as a witness, you can thereby deprive him of the privilege of being judge in his own cause.

We look forward to the time when municipal and consulting engineers will design and specify their works correctly, and consequently be able to dispense with conditions which throw all the responsibility for their own work, in addition to his proper duties, upon the unfortunate contractor. They will then have to be trained more as broad-minded and capable engineers, and less as narrow pettifogging lawyers. And, of course, they will have to be given remuneration which will render them independent of the inducements to be just, at which our contemporary hints.

#### The New Elevator Regulations in South Africa.

THE New Mines and Works Act, 1911, introduced by the South African Government last year, contains regulations dealing with elevators, lifts or hoists, as they are variously termed, and the control of these now comes under the Mines Department. In South Africa, as well as in Australia, the Mines Department has two classes of Inspectors, one a mining engineer, and the other a mechanical and electrical engineer who is called an Inspector of Machinery. It is the latter who is to be responsible in future for the safe working of all elevators wherever they may be employed.

So far as the Regulations themselves are concerned, we do not think there is anything that is not already included in the specifications of first-class makers of hoists, and, as a matter of fact, they seem to apply more to the owners of elevators, to ensure that they shall be properly worked and cared for, and under the Act the Inspectors are given a good deal of power in this respect. Every elevator, for instance, is to be in charge of a competent person of not less than 16 years of age, with at least one month's training by another competent person; he must not leave his post unless relieved by another operator; and he must be removed by the owner if the Inspector deems him incompetent or disqualified to work the elevator.

Due notice must be given to the Inspector of all new elevators to be installed, old ones replaced, or repairs effected, and they are not to be put to work until they have been inspected and a certificate has been granted. This certificate is to be placed in a framed and glazed locked case fixed inside the elevator car, and must have on it the date of the inspection and the maximum number of persons allowed to ride on the car. The maker's name must also be fixed in the car, so as to be easily observable. A number of rules deal with the construction of hatchways, all guarding against the possibility of persons falling into them, the construction of gates, locking or fastening the same, efficiently substantial construction of overhead work, guide-rails, &c.

In the case of "push-button" elevators, it is, of course, not necessary for an operator to be in attendance, but the doors or gates at landings are to be so secured that no door or gate can be opened, or remain open, except when the car is at that landing; which is, of course, the usual method of construction.

The rules are very particular in regard to ropes, and each elevator must have at least two ropes, either independently connected or connected through a hinged bracket. The rules relating to the ropes and inspection, which appear elsewhere in this issue, will, we think, be of interest.

With regard to speed, the maximum is 400 ft. per minute, except in the case of an elevator which runs 80 ft. or more without a stop, which may run up to 600 ft. per minute. A clear space of 3 ft. must be left between the bottom of the hatchway and the underside of the car when it is at the bottom landing, and "there shall be placed substantial buffer springs." The same distance must be allowed at the top, which is increased to 5 ft. when the car runs at a speed of 350 ft. per minute.

Safety devices in the shape of speed control, safety catches for catching and holding the car—these to be capable of holding the car and twice its maximum load—and automatic stops, which must stop the car either at the top or the bottom before it has passed the landing by a distance of 2 ft., must all be provided.

The same regulations practically apply to goods elevators, with the addition that, if fitted with rails on the floor, these must be countersunk, and they must be provided with gates, bars or doors to prevent goods rolling out.

#### The Rating of Tramways.

It is not often that a decision which has remained unquestioned for nearly 20 years is overruled by the Court of Appeal. Such, however, has been the fate of Swansea Improvements and Tramway Co. v. Swansea Urban Sanitary Authority (1892), Q.B. 357, where it was laid down that the land occupied by a tramway was not "used only as a railway"



within the meaning of the Public Health Act, and that the appellants were *not* entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. As many of our readers are aware, land used as a railway is relieved of rates by being charged thereto at only one quarter of its rateable value. In 1892 tramways were held not to be entitled to the same privilege on the ground that tramways were something essentially different from railways, and that the Legislature could not have intended to include both under the term railway.

This decision, however, has been much blown upon in recent years, and is now finally overruled by a case reported in our "Legal" columns this week—namely, *Metropolitan Electric Tramways, Ltd., v. Tottenham U.D.C.* It appeared that the tramway property of the company in Tottenham was rated at £4,575, upon which a rate of £496 was demanded. The company refused to pay more than a quarter of this sum, and the case eventually reached the Court of Appeal. It transpired that certain light railways of the company in the same district were rated at the lower figure, as it was admitted that they were "railways" in the sense of the Act of 1875. In arriving at the conclusion expressed in the judgment of the Court, Lord Justice Farwell adopted the view of Sir Gorell Barnes upon the question whether a tramway is a railway:—"Physically it seems to me that it is a railway; it is a road containing rails on which vehicles must travel in the ordinary way in which railway traffic is conducted." Those observations applied to the facts of the present case. Further on he said, "I have difficulty in appreciating exactly what is meant by putting in the words 'constructed as a railway.' If it means constructed as a railway in fact, it seems to me that their own statement in argument shows that this case comes within that definition. If it is meant to say that it must be constructed as a railway to which all the railway legislation applies, I do not find those words there, and it does not seem to me that it is necessary to put such a construction upon the Act."

This decision appears to us to be consonant with justice and common sense. The general scheme of a well-developed rating system should be to make the occupiers of property most benefited by the expenditure of the district rates liable to be rated at the higher rate, while the occupiers of classes of property less benefited should be rated at the lower rate. The decision, too, is of enormous importance to companies like that which was courageous enough to prosecute the appeal.

**The I.E.E.** WE are glad to announce elsewhere in this issue that the Institution of Electrical Engineers will this year hold a summer meeting: this is one of the items of the programme of progress which has been before the Council for some time past, and will be welcomed as a foretaste of the benefits to follow. It is true that the Institution has on several previous occasions organised summer excursions, but these, with one exception, have taken the form of tours abroad, and all have involved an expenditure which has necessarily limited the numbers of the party to a very small percentage of the membership. Moreover, each tour has been special in itself, and the practice has not been regarded as a normal feature of the year's doings.

Now, however, we take it that the holding of a summer meeting is to become a matter of routine, and we hope that the experience gained this year will prove that the opportunity of passing a few days together for profit and pleasure is heartily welcomed by the members, and that a very large attendance will be recorded. The great popularity of the Institution's annual dinner, which this year especially was so admirably planned and conducted, is no doubt largely due to the feature by which it is distinguished from other functions of a like nature—the provision for a social reunion—and this augurs well for the success of the summer meeting.

Beyond the fact that it will take place at Glasgow, in the middle of June, no details have been announced—we do not know, indeed, that a programme has yet been formulated. However, there is no lack of interesting material for visits in the neighbourhood, and we do not suppose there will be a shortage of papers for discussion.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

THE above subject is of increasing importance to English manufacturers of electrical machinery, in view of the largeness of their volume of exports to the markets of the Dominions.

Although questions relating to the legal authority under which electricity may be supplied are of local rather than of Imperial interest, it may be sometimes important for those who are connected with electrical manufacturing to be informed as to how far, and by what authority, electricity may be supplied in various parts of the Empire. Such information, especially with regard to our more distant and less well-known Dependencies, is not easily obtained. No doubt copies of every ordinance and Act may be seen and studied at the Colonial Office; but those august precincts are not within the reach of all. Further, in order to find all the legislation concerning electricity in any particular colony, it is necessary to wade through all the statutes and ordinances for the colony; for it often happens that earlier measures are much modified by later legislation, and in many cases the labour of the student is not saved by reliable indices.

In these circumstances a synopsis of electrical legislation in the more important colonies of the Empire may be found useful to readers of the *ELECTRICAL REVIEW*. It does not purport to be an exhaustive treatment of all the material statutes and ordinances relating to electricity ever passed in every dependency. Thus it makes but casual reference to the various measures which have been rendered necessary for the purpose of introducing the use of electrical power on tramways, and it does not deal in any way with telegraphic or telephonic legislation. It is hoped, however, that the summary will be found useful to any person who desires to know something of the law relating to electric light and power in all the more important colonies.

It is proposed to deal with the various Dominions in the following order:—

1, New South Wales; 2, Queensland; 3, Victoria; 4, South Australia; 5, Western Australia; 6, British Columbia; 7, British Guiana; 8, Canada; 9, New Brunswick; 10, Ontario; 11, Quebec; 12, Nova Scotia; 13, Cape Colony; 14, Ceylon; 15, Jamaica; 16, Orange River Colony; 17, Natal; 18, New Zealand; 19, Southern Rhodesia; 20, Tasmania; 21, Trinidad and Tobago.

1. *New South Wales*.—There does not seem to be any general legislation relating to the supply of electricity on the statute book of New South Wales. The treatment which is likely to be accorded to electrical undertakers whether private or municipal, may, however, be gathered from the Municipal Council of Sydney Electric Lighting Act, No. 23, of 1896. That Act is entitled "an Act to enable the Municipal Council of Sydney to light the streets, also private and public places of the City of Sydney with the electric light, and also places outside the said city, and to exercise all powers necessary for such purposes, and for the above purposes to raise by debentures the sum of £250,000." Sec. 3 of the Act provides that "it shall be lawful for the Council to generate and supply electricity for any public or private purposes, or for any public purposes, and any private purposes within the limits of the City of Sydney. Provided that electricity may be supplied outside the said limits in manner hereinafter set forth." Secs. 14-18 confer upon the Council the right to break up streets, &c., for the purpose of laying their installation. In the course of this work they are bound to give all the notices, &c., which are rendered obligatory upon undertakers who supply electricity under provisional order in this country. Sec. 19 contains a provision to the effect that in the exercise of their powers the Council must do as little damage as possible, and must pay compensation for all damage. A similar clause appears in provisional orders in England; but the statute under notice contains the following proviso:—"Provided that the Council may in all cases be at liberty to set up by way of defence or in mitigation of damages, as the case may be, that the person claiming compensation has by his own act,



neglect or default caused or contributed to the damages in respect of which he claims to be compensated." The provisions of this Act which render it obligatory upon the Council to furnish a supply "without fear or favour," follow closely upon the lines of our Electric Lighting Acts.

(To be continued.)

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

MANITOBA is about to appoint a "Public Service Commission" for the Province, which is to look after steam and electric railways, gas and electric lighting, telegraphs, telephones and other "public utilities" as they are called in this country.

A proposal is on foot to make a canal commencing at Lake St. Francis, at a point about 40 miles south-west of Montreal, which would divert practically the whole of the St. Lawrence River at that point, and run it into the Ottawa River, close to Isle Perrot. This canal would be about 12 miles long, and there would be one lock for navigation purposes. The total fall would be about 85 ft., and the theoretical power available would be something like 960,000 H.P.

So far as electrical engineers and manufacturers are concerned, it may be said that in this country there seems to be, at the present time, a general awakening to the fact that electrical work here is not at its best, and that much of the apparatus and many of the methods employed are neither so satisfactory nor so safe as they might be.

The proposed formation of "Commissions" in various parts of the country to control electrical work is an evidence of this recognition, and that the next few years will see a great improvement in the standard of work cannot be doubted.

The present rules governing practically all installation work in Canada are those of the Canadian Fire Underwriters' Association, a body which itself has borrowed these rules from a similar association in the United States. Now, while it is true that these same rules are approved by the American Institute of Electrical Engineers and others, a careful perusal of them already shows that only materials, fittings, &c., which are standard in America are taken into serious consideration, and, besides this, a separate pamphlet is published of "approved" apparatus and fittings made by various firms—every one of these firms being American.

As an instance, it may be stated that metal conduit is required to have a minimum wall thickness equal to that of gas and water pipes, whereas the Engineering Standards Committee in England, even for the "heavy" class of conduit, require a wall which is much thinner than this.

Fire insurance companies are, naturally, not especially interested in furthering the interest of the electrical industry, and therefore they only consider in their rules such materials and methods as are to hand. Again, the average contractor does not go out of his way to find materials or to adopt methods which, if he went to the trouble of inquiring, *might* (or might not) receive the approval of the fire underwriters. He also takes what is ready to his hand, and the importers of electrical apparatus, seeing the rules, do not risk losing over a lot of material which, for all they know, might not be allowed.

There is a probability, however, that before long other rules may be published by some recognised public body on lines to which the fire insurance companies can hardly take exception, which will give electrical manufacturers wider opportunities, and it will be then that the British manufacturers should be able to step in with ready-made material and apparatus which can comply with such rules, as there is a growing tendency to favour European practice in many respects.

The writer of these notes is trying to arouse public opinion, though the technical Press, on the desirability of an Engineering Standards Committee being formed in Canada on the lines of the British one, so that definite standards, international in character wherever possible, may be adopted,

as in a few years the present system of framing and adopting standards in this country will tend to serious confusion.

Further than this, American imports of engineering materials and apparatus to Canada preponderate so largely over British that, if this state of things continues for several years longer, almost everything will become automatically standardised on American lines, to the great disadvantage of the British manufacturer.

The question of putting all overhead wires underground in the busy parts of the larger towns and cities here, which has already been referred to in these notes, is being dealt with in a more businesslike way than hitherto.

The Dominion Government is considering the question, and in Ontario several of the more important places such as Toronto, Hamilton, &c., are seeking powers from the Legislature to enable them to compel all electric light, telegraph and telephone companies to put their wires underground. The method proposed is that the municipalities should build the conduit subways and that the various companies should pay a rental for such portions as they need.

In regard to water-powers, a new phase seems to be developing itself here. Formerly, the making of canals was one thing and the utilisation of the water-power thereby secured was another and secondary consideration. Now, however, it is probable that the two items will be looked at in their relation to each other, and a canal will be built on such lines as will provide the maximum amount of water-power possible under any given circumstances. The sale of such water-power will, in many cases, go towards repaying the cost of making the canal. Undoubtedly it is high-tension transmission at potentials in the region of 100,000 volts which renders such an idea possible, as only by this means could a large amount of power, itself located, perhaps, in a sparsely-populated district, be utilised.

## NOTES ON RENEWING TUBES IN BABCOCK & WILCOX BOILERS.

By WALTER E. ROGERS, A.M.I.E.E.

So universal and world-wide has become the adoption and use of the Babcock water-tube boiler, that it is no unusual thing for us of the electrical profession to find ourselves, in some outlandish quarter of the world, suddenly called upon to take charge of, or supervise, the repairs to a battery of the above type of steam generators.

Assuming that the necessary tools and materials are available, and that a tube in the lower row of a nest has blistered and punctured, proceed as follows:—From inside the furnace chamber, with the aid of a chain-wheel tube cutter, cut the faulty tube immediately below the blister, *i.e.*, at the side of the blister remote from the boiler front. Repeat the cutting operation as close up to the front of the boiler as is possible: we thus have the portion of the tube containing the blister completely free for removal through the furnace door. The remaining portion of the tube should then be cut each side of the flame bridges or compartments. Finally, the header caps, back and front opposite the particular tube concerned, having been removed, the ends of the tube should be split with a hammer and chisel, care being taken not to damage the seatings in the headers whilst carrying out the splitting process. Usually, after two slits have been made in the ends of the tube, approximately 2 in. apart, it is an easy matter, with a bar some 2 ft. long, to depress or bend in the ends of the split tube, using the front or edge of the header as the fulcrum point for the bar above mentioned. The point where a tube generally blisters or fails, is approximately 1 ft. 6 in. to 2 ft. in front of the flame bridge.

After having examined the header seatings to see that they are undamaged and clean, ready for a new tube to be expanded, the new tube may be inserted through the front header. Care must now be taken, before commencing to expand the tube on to the seating in the header, to see that the ends of the tube project at least  $\frac{1}{2}$  in. through the seats,



to allow for bellmouthing over after the tube has been well expanded. Also, the tube should be securely chocked or scotched between its end and the inner side of the headers facing a cap joint: this prevents the tube being driven too far through the seating when the mandrel is driven into the expanding tool. Incidentally, when withdrawing an old or inserting a new tube, care must be exercised not to damage the flame bridges.

So far I have described what is quite a simple proceeding, involving no great difficulty. Unfortunately, it is not always a tube in the accessible lower row which it is necessary to renew. Should a tube in the second row be at fault, I consider it prudent on economical grounds to scrap the one below as well; we thus have two tubes to renew, but the additional cost of the extra tube will generally be less than that disclosed by an examination of the time sheets after a second row tube has been renewed without scrapping its lower neighbour. Of course, I am only here referring to bad cases, where the tubes are badly hogged, blistered or "skellerd," as a Yorkshireman would say. Assuming, however, that we intend to remove the faulty tube without interfering with others, commence by splitting both ends of the faulty tube, as already described, then from the rear end punch the tube forward until the tube projects sufficiently far through the front header to enable it to be turned round by means of pipe tongs, or a bar punched right through the projecting end. Thus, the tube can be held in such a position that men in the furnace chamber, with a long punch and a striking hammer, can so reduce the dimensions of the blister, that the tube will pass completely through the front seating orifice on its way to the scrap heap. Incidentally, the aforesaid bar punched through the end of the tube serves as a useful means for attaching a set of chain blocks to assist the removal, and punching from the rear greatly facilitates this.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Economy of Electric Cooking.

May I trespass on your space to reply to "F. R. C.," who thinks I am an enthusiast and too optimistic about the future of electric heating?

I am quite ready to agree that it does seem as if electric heating of rooms is an expensive luxury; but gas fires are much more expensive than coal, yet they are largely used by the middle classes in spite of that and for obvious reasons. These same reasons apply, but with more force to electric heating.

This middle class used not so long ago to be satisfied with a house without a bathroom and with outside closets of an unhealthy type, but in spite of the higher cost they now demand porcelain enamelled baths, porcelain hand basins in the bedrooms and perfect sanitary arrangements indoors. For the same reasons electric heating will certainly supersede gas heating. Further, the apparent high cost of the hygienic improvements is more than counterbalanced in saving of life and doctors' bills. For these reasons, and others as weighty, I am optimistic.

My chief point was, however, that if electric cooking is adopted the kitchen or a gas water heater is neither necessary nor desirable. In spite of "F. R. C.'s" affection for the gas, I know in my own circle of two catastrophes nearly ending fatally due to a gas geyser, and I do not think I am either unique or particularly unfortunate as to my friends. I willingly credit gas with the ability to heat water, but I can also honestly credit it with enormous damage to life and property. I also demand that the devil shall have his due, but I fear that if this particular one gets his, he will have a bad time of it.

Destructive criticism is, however, easy, and I should like again to give figures which should dispel any feelings that electricity is incompetent to heat water with reasonable economy. The average amount of water used per person

per day in London is 30 gallons, so that a household of five persons may reasonably be assumed to require 150 gallons per day. I assume that half of this at 110° will meet the requirements for hot water, which I think is reasonable—perhaps liberal.

The electric light account for such a household might be about £6 at 4d. per unit, or 360 units per annum, equivalent to 42 watts taken day and night all the year round.

To produce the required amount of hot water will require about 600 watts, so that the requirements of the house will be met with a continuous supply of about 640 watts, which at 6d. per watt per annum would cost £16, or £10 for hot water supply.

This supply could be laid on to every room and any sized tap desired by "F. R. C." There would be hot water any time of the day or night, and not so very much dearer than the kitchener, taking it all round.

If any of my figures are unfair, the calculation can be used for the new ones.

I shall be happy to supply heaters for such a quantity of hot water at less than the £5; most makers will quote a lot less.

Percy Good.

London, S.E., February 10th, 1912.

In reply to Mr. Silver's letter, I really must deny being pessimistic or indulging in a "can't-be-done" attitude. But I do not believe that this attitude is the cause of "the unsatisfactory state of the electrical industry." (The expression is Mr. Silver's.) It would be better for the electrical industry if the young optimists of the advertising and sales departments paid more attention to detail, and made fewer preposterous claims for their wares. These glib enthusiasts (there were hundreds at the exhibition) have created a vast army of disappointed and disgusted consumers, who, of course, spread the mischief by warning all their friends.

I agree with Mr. Silver that electricity should be used where commercially possible, and this is my precept and practice. My letter was merely to point out that, at a penny a unit, electricity was out of the running for house-warming and for the domestic hot-water supply. Evidence to the contrary will be very useful to many of us. I have in mind two or three consumers who tried electric house-warming. It would be very difficult now to persuade those victims of good salesmanship that electric cooking is successful from every point of view and a boon and a blessing to women. I am glad that I do not know anyone who has ever tried electric water-heating. By the ordinary formula, it takes about 0.25 unit to raise a gallon of water from 60° to 140° F. My gas heater does it for 1.3 cb. ft., i.e., 0.045d. and supplies the taps in bedroom, bathroom and scullery.

Mr. Silver's last paragraph cannot be over-emphasised. It is business ability that is required—not the smart, insolent irresponsibility that now passes for it in so many instances.

F. R. C.

### Arc Lamp (Span Wire) Lowering Gear.

We noted with some surprise your correspondent's letter on the above subject in your issue of January 26th. Surely it would have been wiser if "N. D. W.," before assuming the rôle of critic, had put himself into communication with us and sought enlightenment on the points he so superficially criticises and condemns, instead of rushing into print and misleading your readers. Fortunately for us, the class of men who are immediately interested are too cautious and well informed to accept so hasty a condemnation from an anonymous pen in a matter of this nature, and can judge for themselves from your very concise and general descriptive article on our appliances. We do not wish to encroach unduly on your courtesy by entering into a comparative controversy, and would ask those interested to reserve judgment and put themselves into communication with us for further particulars. We do not despair, if your correspondent is a *bona fide* "anxious inquirer," of counting him among our converts. Surely we are not so utterly stupid as to risk our business reputation by putting on the market so crude an appliance as your correspondent "N. D. W."



conjuges up as a basis for his criticism. A little foresight, invention, and careful attention to details, can get over many of the imaginary difficulties "N. D. W." foresees. We assure him we have solved the difficulties referred to, and our gears, by a simple arrangement, will operate satisfactorily in a gale of wind and rain if need be, without skill in operation. He confuses two separate arrangements, and tries to deal with both at once. Surely it is better in busy streets like those of London to bring the lamp, securely suspended, to the side for lowering, and out of the way of the traffic, and not to endanger the lives of the passers-by by starting to lower in the centre.

The cable is permanently fixed at the centre, and the alignment of the contacts is absolutely assured in the set first illustrated. In No. 2, the trouble "N. D. W." foresees is forestalled and overcome, and the arrangement has much to recommend it for simplicity, efficiency, and cheapness. "N. D. W." must know, as a rule, that you cannot get two distinct movements combined in one without sacrificing some essential advantage.

#### The North-Western Electrical Appliance Co.

Darlington.

#### Kingston Diesel Engines.

With reference to my report of the above in your recent issue, and Mr. Edgcome's notes referring thereto, I enclose folio 15 of Mr. Edgcome's report for your inspection (and kind return), from which you will see that the British Westinghouse Co. were *not* invited to tender, but asked to be allowed to tender. A quotation from the folio would, perhaps, be the best evidence—if you could afford the space.

As regards the voting, a reference to my notes gives:—For the amendment 8, against 19, with 5 neutral; for the recommendation 19, against 9, with 4 neutral. This was announced by the town clerk on a show of hands, but when Councillor Macaulay moved that the "names be taken," and this was agreed to, some of the 9 had not the courage of their convictions to be shown in print, and remained "neutral."

On the first show of hands, therefore, which was the "legal" voting on the matter, your news correspondent was right.

#### Your Correspondent.

Extract from report: "Messrs. the British Westinghouse Co. wrote me in December asking to be allowed to tender for combined sets of Diesel engines and alternators of their manufacture. They had not previously been asked to tender, as I was not aware that the firm were manufacturers of this type of engine."

[It will be seen that our correspondent was literally accurate in his facts, while Mr. Edgcome's claim that the British Westinghouse Co.'s tender received fair treatment is clearly substantiated by the article on page 169 of our issue of February 2nd.—Eds. E.R.]

#### The Electrical Profession as It Is.

I read with great interest the letter in your issue of February 2nd, signed by "Diogenes," and the somewhat scathing reply made by Mr. W. Ellerd-Styles, and should be glad if you could spare me some of your valuable space in which to express my humble opinion on the subject under discussion. Speaking as one who has been through the mill, I agree with "Diogenes" with regard to his remarks about the top dogs in municipal concerns, but how about the men in the smaller positions, the men who have all the responsibilities and have to do the brain work? Surely, these must be the right men in the right place, otherwise what would become of the municipal concerns? But perhaps "Diogenes" means that these men ought to be in receipt of the big salaries? Probably they should, but they haven't all got a father-in-law or uncle, or other relation who can simply place them in the position, and, provided they hold their tongues, let them stop there. But "Diogenes," don't run away with the idea that the electrical profession is the only one in which big positions are obtained through influence,

it is unfortunately the way of the world. With reference to the Institutions, I must agree with Mr. Ellerd-Styles that these are quite open to a really responsible man: of course, there must be restrictions, but these in no way get in the path of the genuine electrical engineer. I can also agree with Mr. Ellerd-Styles on his remarks about the technical institutions; I have been through their courses and seen and heard the actual things that he describes, but it is the last few lines of his letter that I should be glad heartily to support. The question is, How is it going to be done? I am afraid we should find several so-called Electrical Engineers (big letters please) in a very bad plight.

Inquirer.

#### Our Progressing Manufacturing Firms.

In May, 1911, one of the largest electrical supply firms in the kingdom supplied over 100 street lighting fittings complete with globes. At the beginning of November last an order was given for spare globes for these fittings. Totally different globes were sent. The would-be customer then wrote asking that they should send a man from the local office to see the globes required. A representative duly arrived from the local office and took particulars of the globes. As the second lot of globes were also wrong, the unfortunate would-be customer again asked the representative to call. The representative called again, and took drawings and dimensions of globes. Then the would-be-customer gave an order for two fittings complete, with similar globes. The fittings duly arrived complete with the two right globes, together with a third lot of spare globes—all wrong! The order was then cancelled, but on the local representative stating that correct spare globes were sent off, the poor customer waited until February 9th, 1912, only to receive a fourth lot nothing like those ordered.

The order given on November 7th was, therefore, cancelled on February 9th, for the second and last time! Is it not wonderful?

N. D. G.

#### The Telephone Service.

With reference to your remarks on the telephone service, it is curious to note that, from the beginning of this year, the service on the village exchanges round here, which has always been run by the Post Office, has all gone to pieces. The instruments are always out of order, and no trunk connections can be got. To-day a man came to attend to an instrument that had gone wrong, and after pulling it all to pieces, he announced that it was connected up wrong, although it had worked all right all last year!

The wiring is often done in a very slovenly and incompetent manner. Four people here have applied for the "Farmer's telephone" as promised by Mr. Buxton when Postmaster-General, but beyond an intimation that "the matter was under consideration," the Post Office has refused to give any information about it. I understand that this system is in use in some parts of the country, but do not see why the Post Office should refuse to give information, unless, as is freely stated here, the political views of applicants have something to do with it.

The Post Office should never have been allowed to touch the telephones. If the Government get hold of the railways too, goodness knows what will happen.

R. B. Verney.

Warwick, February 12th, 1912.

**Social Event.**—The 10th annual tramway employees' social was held at Darwen on February 9th. Alderman James Tomlinson, who presided, spoke of the good feeling existing between the Corporation and its employees, and mentioned that last year the cars carried 2,388,408 passengers, and only a sum of £3 was spent in compensation; this showed how well the cars were controlled. Last year the receipts were £200 more than during the preceding year.

**Radium in Austria.**—It is announced that the Austrian Government will shortly purchase the pitchblende mines of Joachimstal at a cost of about £100,000, from which an output of 5 grammes of radium per annum is expected.



## SOUTH AFRICAN REGULATIONS RESPECTING ELEVATORS.

THE following are included in the new Regulations of the South African Government referred to in our leaderette pages to-day:—

252. (1) No rope shall be used for supporting an elevator car or counter-weight unless it is of good quality and manufacture, and free from any defect and of adequate strength.

(2) Every such rope shall be made of wire, and the gauge of the wires used in the construction thereof shall be suited to the diameter of the sheaves and drums fitted.

(3) No rope shall be used for supporting an elevator car or counter-weight when the breaking load at any point therein has become reduced to less than five times the maximum working load, the supporting effect of the other rope, if any, being ignored; provided always that in the case of elevators in which the cars or counter-weights are suspended by more than two ropes fitted with appliances for equally distributing the load a minimum factor of safety of ten will be allowed on the aggregate strength of all the ropes, but no rope shall have a lower factor of safety than three with respect to the maximum working load.

(4) The following particulars of ropes used in operating an elevator shall be recorded in a book termed the "Elevator Record Book":

(a) Maker's data of rope when new, or a copy thereof, certified to by the user:—Name and address of manufacturer; date of manufacture; date of purchase; length of rope in feet; diameter of rope in inches; weight per foot in pounds.

Construction of Rope:—Number of strands; class of core.

Construction of Strands: Number of wires; diameter of wires (decimals of an inch); class of core; material of which wire is made; breaking stress of material (tons of 2,000 lb. per sq. in.); breaking load of rope (tons of 2,000 lb.)

(b) History of Rope in Use:—Date on which rope was put on; dates of re-capping, shortening, or turning end for end; date on which rope was taken off.

253. Before renewing ropes on any elevator, full particulars of the construction, &c., of the new ropes shall be supplied to the Inspector of Mines.

254. (1) A responsible person, or more than one, specially deputed by the user for the purpose, and whose name or names must be registered by him in the elevator record book, shall carefully examine:—

(a) At least once each day the engine or motor, all drums and sheaves and all safety appliances.

(b) At least twice in each week the guides and ropes.

(c) At least once in each month the entire elevator plant and all fittings and appliances in connection therewith.

(2) At this monthly examination the rope, or ropes, supporting the elevator car and counter-weight shall be thoroughly cleaned for the purpose of discovering the amount of deterioration therein, and the strength remaining in each rope shall be assessed.

(3) This monthly examination shall not be carried out by any person other than a qualified mechanic approved by the Inspector of Machinery.

(4) A true report of the result of every examination above mentioned shall be recorded without delay in the elevator record book, which must be kept on the premises, and shall be signed by the person who made the inspection. This register shall be at all times open for the inspection of the Inspector of Mines or his representative. Should, as the result of such examination, any weakness or defect be discovered by which life or limb may be endangered, the defect shall be immediately reported to the user, and no person shall be raised or lowered until the defect is made good.

(5) All bar and chain connections shall, when practicable, be annealed at least once in every 12 months.

## LEGAL.

### TRAMCAR ACCIDENT: CLAIM AGAINST L.C.C.

ON the 8th inst., in the King's Bench Division, Mr. Justice Ivory gave judgment in an action in which a common jury awarded Mrs. Walsh £250, and her children £250, as compensation for the loss of Mr. Walsh, the husband and father, who was killed, it was alleged, through a London County Council tramcar colliding with the dray he was driving at Grove Road, Mile End Road. Mrs. Walsh and her three children sued the Council for damages for the death of her husband, due, she alleged, to the negligent driving of a tramcar in August last. Mr. Walsh was driving a dray, with three horses, towards his master's stables in Rotherhithe, when, in going under the railway bridge in Grove Road, a car ran into the dray and caused him to fall from his seat, with the result that one of the wheels of his dray passed over him and killed him. Defendants denied negligence and pleaded contributory negligence on the part of the dead man.

His LORDSHIP entered judgment for plaintiff for £500, and costs.

MR. WALSH applied for leave to appeal on the ground of misdirection of the jury by his Lordship on the point of the dray continuing on the metals after warning.

His LORDSHIP did not think there had been any misdirection of the jury, and as the case appeared clear, he was not going to encourage the Council in spending the ratepayers' money in appeals when the grounds were so flimsy.

### TRAMWAY OR RAILWAY?—IMPORTANT RATING APPEAL.

THE question of whether an electric tramway should be treated as a railway for the purposes of rating, was raised in the case of the Metropolitan Electric Tramways, Ltd., v. The Tottenham Urban District Council, which last week came before the Court of Appeal, composed of Lords Justices Farwell and Kennedy, and Mr. Justice Warrington. Under Sec. 211 of the Public Health Act, 1875, a railway is assessable to the local rates at not more than one-fourth part of the net annual value. In the present case the plaintiffs were the owners of both a tramway and a light railway within the defendants' district. As to the mode of construction and the materials used therein, they were identical, while the carriages used upon them were the same, and they were worked as one connected system. The electrical energy for working the tramway and the light railway was generated at the same power station. The plaintiffs, in respect of the light railway, were rated in the proportion of one-fourth part only of the net annual value thereof, but in respect of the tramway they were rated at the full amount, making a difference in the annual rate on the tramways of £371 14s. 4d. A Divisional Court composed of the Lord Chief Justice and Justices Darling and Bankes, held that they were bound by a decision of the Divisional Court in 1892 in the case of the Swansea Improvements and Tramway Co. v. Swansea Urban Sanitary Authority, and that the tramway as such did not come within the exemption under the Public Health Act. From this ruling the tramway company now appealed.

MR. DANCKWERTS, K.C., for the appellants, said that since the decision in 1892 a great deal of water had flowed under London Bridge, and he submitted that that decision was inconsistent with recent judgments given in the House of Lords, bringing light railways within the exemption.

LORD JUSTICE FARWELL: If this tramway is really a railway within the meaning of the Statute you are entitled to the relief you ask, and you press us to say it is a railway?

MR. DANCKWERTS: Yes, a species of railway which under recent decisions must be treated as a railway for the purposes of local taxation. Counsel pointed out that though tramways and light railways were constructed under different Acts of Parliament they were, at all events in this instance, identical so far as form of constructing and running arrangements were concerned. In support of this statement he handed up to the Bench photographs of the tramway and light railway in question, and invited their Lordships to say which was which.

LORD JUSTICE KENNEDY observed that the photographs before him were marked, but he agreed that without some such indication it would be difficult to tell the difference.

MR. HUTCHINSON, K.C., following on the same side, also submitted that, for the purpose of rating, tramways came within the decision which declared light railways to be within the exemption under the Statute.

MR. MACMORRAN, K.C., for the respondents, argued that the decision of the Court below, supported as it was by authority, was right and ought to be affirmed. A tramway, he said, was constructed as a tramway and not as a light railway, and that was the test. Because the House of Lords had laid it down that a light railway was a railway for the purposes of rating, it did not follow that a tramway was a railway for the same purposes. It would be quite impossible to argue that a light railway was not a light railway; therefore why should it be said that a tramway was not a tramway?

MR. RYDE, K.C., also for the respondents, thought their Lordships should hesitate before giving a decision which would involve considerable loss to local rates.

LORD JUSTICE FARWELL remarked that he had been hesitating all the morning. Was not that long enough?

MR. RYDE said that many local authorities in the belief that, under existing decisions, they would receive from tramway companies, as compensation for the disturbance of their streets, the full rates, had refrained from opposing tramway schemes in the past. If local authorities were now to be told that they were to receive one-quarter only of the rates, tramway companies would be placed in the position of having been granted concessions which they would not otherwise have obtained.

LORD JUSTICE FARWELL: You must remember that many local authorities are tramway owners.

Without calling upon Mr. Danckwerts in reply, LORD JUSTICE FARWELL gave judgment. He said that the Court below, without expressing any opinion of their own, considered themselves bound by the judgment of the Divisional Court in 1892, and followed it without demur. This Court was now asked to overrule that decision. The question turned on the construction of Sec. 211 of the Public Health Act, 1875, which, so far as was material, provided:—"The occupier of any land . . . used . . . as a railway constructed under the powers of any Act of Parliament for public conveyance shall be assessed in respect of the same in the proportion of one-fourth part only of such net annual value thereof." The section had received a good deal of judicial consideration of recent years. He thought the meaning of it had been explained by Mr. Justice Erle in *South Wales Railway Co. v. Swansea Local Board of Health*, thus:—"The general scheme of the enactment is that the occupiers of the classes of property most benefited by the expenditure of the district rates shall be liable to be rated at a higher rate, the occupiers of the



classes less benefited at a lower rate; and the class of property most benefited is that which is occupied immediately for the purposes of residence; and the kinds of property not so occupied are not to be rated so highly. Such is the general object of the Act; and we are now to apply its language to the particular case." Bearing in mind the Act, and the explanation given by Mr. Justice Erle, he thought the present case was best stated by reading Paragraph 8 of the special case. That paragraph stated:—"The tramway and light railway, as to the mode of construction and the materials used therein, are identical, and consist of lines of iron or steel grooved or slotted rails laid with the uppermost surface thereof level with the surface of the highway, and overhead wires suspended from posts placed alongside of, or in the middle of the streets, convey the electric power required for moving the carriages thereon. The carriages used upon the tramway and the light railway are the same carriages, and have flanged wheels running on the rails, and the same carriages used on the tramway run through and over the light railway for the conveyance of passengers and parcels thereon, as part of the common system. The charges authorised by the Acts and orders aforesaid, or some of them, are also applicable to both the tramway and light railway. The same carriages are moved along the rails, both of the tramway and the light railway, by electrical power on what is commonly called the overhead system." That showed, continued his Lordship, that the tramway and the light railway were identical so far as physical construction and appearance were concerned. The question which had to be considered was the meaning of the words in Sec. 211, "land used as a railway constructed under the powers of any Act of Parliament." There had been many decisions as to the meaning of "tramways." He thought the meaning had nowhere been better expressed than by Lord Shand in a passage which was quoted by Lord Dundas in *Glasgow Corporation v. Assessor of Railways and Canals*, and which was as follows:—"A tramway is a species of railway, and railway and tram undertakings respectively take their name as such from the fact that they possess and use for the purposes of conveyance rails fixed in the ground but differing somewhat in form of construction. In the sense of the Valuation Acts, the Lord Ordinary is of opinion that a tramway company is included under the term railway company, which term is not limited to such railway companies as use locomotive power." It was true that that was a decision on a Scotch Valuation Act, but the subject matter of it was germane to the present case. There was another definition or statement by Lord Justice A. L. Smith in *Williams v. London and North-Western Railway Co.*, which he also thought was a very good synonym. It was as follows:—"When the Legislature deals with land used as a railway, is it conceivable that it was intended to include a warehouse or shed not connected with a railway? Speaking for myself, I cannot put that construction on the Act. What was meant was a railway in the ordinary sense, that is, a line of rails connecting one place with another, over which goods and passengers are carried, and not such rails as those within these four walls." When the present case was brought within that definition it made no difference, as a matter of phraseology, whether the tramway was called a railway or not. Here the facts were that so far as the nature of the undertaking and its physical appearance were concerned, the tramway and the light railway were absolutely identical. There was no doubt that light railways were entitled to exemption under the section, because it had been so decided in terms by the House of Lords in *Wakefield Corporation v. Wakefield and District Light Railway*. It was said that the decision in that case depended on certain specific Acts dealing with light railways, and on the order authorising the particular railway. But that did not prevent the application of that case to the present one. In the first place, one of the points to be considered was a physical one—namely, as to the nature and appearance of the tramway. In its nature it was virtually a construction laid on rails, and it was not less a railway because it was light. The fact was that there was now no difference between light railways and other railways. Then it was said that the case of *Swansea Improvements and Tramway Co. v. Swansea Urban Sanitary Authority* was against the appellants' contention. He thought, however, that that decision could no longer stand. He thought the reasoning there was inconsistent with later authorities. The Swansea case was a case of a tramway communicating by points and switches with a railway. In that case Mr. Justice Wills said:—"The objection which has been taken on the part of the urban sanitary authority, and which, in my opinion, is a good one, is that tramways are something essentially different from railways, and that in the legislation of 1875, where railways are spoken of, they cannot possibly be supposed to include tramways." With all respect to the learned judge, he (the Lord Justice) could not agree that tramways were essentially different from railways. When the user of land was considered with regard to the exemption from rating, he thought it was immaterial to consider what would be the user of a particular line of rails, except that it was to be for a railway—namely, for the purpose for which a railway was used. He was unable to find any ground for saying that the reasoning of the decisions in the Court of Appeal and the House of Lords did not govern the present case. When one had once arrived at the fact that the "way" in question was used exactly as a railway, and there was nothing in any of the Acts of Parliament in express terms to show that it was not to be regarded as that which it in fact was, he was of opinion that he was bound to follow the later authorities, and overrule the decision in the Swansea case of 1892. The case must accordingly be allowed.

LORD JUSTICE KENNEDY, in concurring, said that no doubt the decision in the Swansea case was in favour of the respondents, but in his view it was impossible satisfactorily to reconcile it with the later decisions of this Court, affirmed by the House of Lords.

MR. JUSTICE WARRINGTON also agreed. He said the user was

the user of the occupier, and they had to consider, not whether this was a tramway or a light railway, but whether it was used as a railway. It was beyond argument that the part of the system which was called a light railway was used only within the meaning of Sec. 211, and that being so, he failed to see how it could be said that that which was used in identically the same manner was not used as a railway. The Public Health Act did not say that a railway should be exempt and a tramway should not be exempt. What it did say was that land used in a particular way should enjoy this particular exemption. The decision of this case depended upon the fact found here—the identity of the user of the two parts. But it was said there was this distinction to exclude tramways from the exemption—that in one case the "way" was constructed under the Light Railways Act, and in the other case under the Tramways Act. The Public Health Act said nothing whatever as to the particular Act under which the "way" was to be constructed. It was simply to be constructed under some Act, and it seemed to him they would be introducing a false method of construction of the Public Health Act if they were to read into it some narrower meaning of the word "railway" than that which he had indicated. Obviously no person who did not know under which Act of Parliament this railway and this tramway had been constructed would be able to say whether one was a light railway or a tramway. He agreed that in view of more recent decisions the decision of 1892 could not stand.

The appeal was accordingly allowed with costs.

#### BAXTER v. MOUNTSTEPHEN.

IN the City of London Court last week, before Mr. Registrar Wild, a claim was made by Mr. Thomas Baxter, factor, Crosby House, Great St. Helens, against Mr. L. Mountstephen, trading in the name of L. Mountstephen & Co., electrical engineers, 51, High Street, Hounslow, Middlesex, for the price of three metal-filament lamps supplied.

The PLAINTIFF said he had obtained the order for the electric lamps in question from the defendant's wife, who managed the business while the defendant was away. He afterwards saw the defendant about the lamps and was told they suited him, and said if given a month's time he thought he would have a big order for him (plaintiff). On a subsequent occasion he called upon the defendant, who said he had no money for him. He (plaintiff) then said he either wanted the money or the lamps back. The defendant then said, "Not in these trousers," and danced round his shop, saying, "You will never get any money out of me."

The DEFENDANT said the lamps in question were left as samples, and were not to be paid for. His wife had no authority to give any orders in his business, and if he had given any orders he would not have ordered three lamps.

The PLAINTIFF said that all lamps left as samples were to be paid for. That was the custom of the trade; he had evidence in Court to prove it.

After considerable discussion, the Registrar gave judgment for the defendant, and allowed him 10s. expenses.

#### CLAGUE v. BURNLEY CORPORATION.

AT Burnley County Court on Friday, Judge Graham delivered judgment in the arbitration between John Clague, Castletown, I.O.M., and Burnley Corporation. The case arose out of the death of the son of the applicant, the first mentioned having been burned to death in June, 1911, whilst repairing overhead wires as a worker in the electricity department. Compensation was claimed by the father on the ground of partial dependency. A sum of £130 was awarded.

#### YOUNG v. SOUTH SHIELDS CORPORATION.

AT South Shields County Court on 8th inst., before Judge Bonsey, John William Young and his wife, Eleanor Ann Young, sought to recover £80 damages for alleged shock received by Mrs. Young through a flash of electricity caused by the fusing of an overhead tramway wire, on July 8th last.

Mr. H. S. Mundahl was for the plaintiffs, and Mr. E. Meynell was for the Corporation.

MR. MUNDAHL, for the plaintiffs, said that on July 8th Mrs. Young was proceeding along the pavement round the corner of Fowler Street and King Street, and, as she was nearing the tramway standard there, a Corporation tramcar turned into Fowler Street from Ocean Road, when the trolley pole of the car came off the wire, and something happened, with a big flashing on the overhead wires. Mrs. Young was so alarmed that she almost immediately fainted, and she received a severe shock.

In reply to JUDGE BONSEY, MR. MUNDAHL said he did not contend that it was an electric shock.

MR. MUNDAHL, continuing, said that Mrs. Young became unconscious, and had to be taken home. She was under the care of a doctor for a considerable time, and was unable to resume her household duties for about four months. The plaintiffs had, in consequence, suffered loss through having to provide extra nourishment, medical attendance, and household assistance. The chief question that arose was, Were the defendants responsible for the damage? Counsel suggested that they were, because it was through negligence that the flashing was caused. A police officer, who was on duty near the spot, had made a report to the effect that the tramcar was rounding the corner when the



trolley came off and caught the "live" wire, causing sparks to fly. The trolley then caught the span wire, which broke, the end hanging about 6 ft. from the ground. Mrs. Young was about 10 yards away when she fainted, and on coming round she explained that it was the shock of seeing the sparks flying that caused her to faint. Correspondence had taken place, and the Town Clerk in a letter had stated:—"I am informed that the falling of the span wire was due to the trolley head getting accidentally jammed in one of the hangers or supports, and short-circuiting part of the overhead apparatus, with the result that the span wire was fused close to the pole, and was burned off and hung down loose from the hanger in the centre of the road. The mishap, I am instructed, was unavoidable." That, Mr. Mundahl said, plainly indicated negligence in two respects. There was quite obviously a possibility of the trolley wheel leaving the wire on rounding the corner, and the proper and usual precaution was for the conductor to pull down the trolley either by means of the rope, or by getting hold of the trolley itself from the top of the car while rounding the curve. Had that been done it would have been impossible for the trolley head to have got jammed in the hanger. Secondly, even admitting the fusing of the wire, this should have been harmless had the system been properly insulated.

MRS. YOUNG, the plaintiff, gave evidence, and stated that as she was turning the corner from Fowler into King Street, she noticed what seemed like a flash of lightning on her right side, and she remembered nothing more until she found herself at home. She was still in a very weak state as a result of the accident. She went to Harrogate to recuperate, and her holiday there cost £7 10s. She was unable to do her household work after the shock, and had to employ a maid.

MR. YOUNG also gave evidence.

DR. SUTHERLAND, police surgeon, said he was called in to see Mrs. Young, and found her suffering from acute nervous derangement. This was likely to be due to a severe fright in the case of a highly-strung person like Mrs. Young. He examined her on Saturday last in company with Dr. Gowans, and they came to the conclusion that she was practically recovered.

As it was intimated that the case was likely to last a considerable time, the hearing was adjourned till another Court.

#### TRAMWAY ACCIDENT CLAIM.

AN action has been settled in the Court of Session, in which the wife of an engineer sued the Dumbarton Burgh and County Tramways Co., Ltd., Dumbarton, for £500 damages for injuries received by her in a collision between two of the defenders' electric tramway cars north of the passing place at Millburn Brae. The pursuer has accepted £51 and expenses in full.

#### Re DAVIS ELECTRICAL COMPANY (IN LIQ.): CORRECTION.

WITH reference to our report of the proceedings in *re* Davis Electrical Co., Ltd. (ELECTRICAL REVIEW, January 19th, 1912), Mr. Howlett writes from Canada stating that the words "entitled to 7s. a week" are inaccurate. We have made inquiries from the solicitors to the petitioners in the case (Messrs. H. H. Wells & Sons, 17, Paternoster Row, London, E.C.), and we find that the correct amount was *seventy* not *seven* shillings. We regret that our reporter evidently misheard the statement of counsel.

The correct figure was given in our report of the meeting of creditors (see ELECTRICAL REVIEW, November 3rd, 1911, p. 735).

#### ATTORNEY-GENERAL v. SHEFFIELD CORPORATION.

[Municipal Trading in Electric Fittings.]

ON February 13th the action of the Attorney-General at the relation of Albert Davidson, engineer, of Norfolk Street, Sheffield, v. the Lord Mayor, Aldermen and Citizens of the City of Sheffield, came before Justice Eve in the Chancery Division.

Plaintiffs claimed a declaration that the defendants had no power to carry on the trade or business of erecting and installing electric light fittings and wires and electric bell fittings and wires in houses and other buildings or any part of such trade or business; a declaration that the defendants have no power to carry on the trade or business of selling motors outside the city of Sheffield; and a declaration that the defendants have no power to expend their moneys and use their plant, premises, machinery or servants for such purposes. Plaintiffs also claimed an injunction restraining defendants from carrying on such trades and from expending or using for such purposes any of the money, plant, premises, property or servants of the Corporation.

Mr. P. O. Lawrence, K.C., and Mr. M. Druequer appeared for the plaintiffs, and Mr. Danckwerts, K.C., and Mr. Sargent represented defendants, instructed by Mr. Rd. M. Prescott, the Town Clerk of Sheffield.

MR. LAWRENCE, in opening, said the case involved a question that had been agitating the Courts before, namely, whether a Corporation under their powers could carry on the business of electric fittings contractors. What the Corporation had done in Sheffield was

to open a showroom, practically a shop, in the municipal buildings, to which anybody could go and buy a lamp, a cigar-lighter and anything connected with electricity. It was not for the benefit of the inhabitants and ratepayers, because, if an American visited the town, he could go into the shop just the same as anybody else. They advertised, and this was the grievance of the whole thing which was taken up by the Contractors' Association. Defendants contracted with private individuals for the purpose of wiring their houses. As incidental to that, they not only did it for wiring for electric light, but they fixed up bell services, which was quite unconnected with electrical supply. They had done this inside and outside their area. By their defence they disclaimed any right to do it outside their area, but they had done it, and he should ask for an undertaking or injunction in respect of that. They had under an Act which they got in 1903 acquired power to supply electric motors in connection with the supplying of electric power. That was a special clause in a special Act of Parliament. The Bill sought to give them the powers which plaintiff said they could not exercise; but in consequence of opposition that was cut out, and it was confined to motors, and by virtue of their Act they had no right to supply them outside their area. In other words, they were carrying on trade in competition with the ordinary traders in the country, and, of course, at a great disadvantage to the traders, because defendants had the whole of the ratepayers' money behind them. It was quite immaterial whether they made a profit or loss, and they could under-cut, as plaintiffs alleged they had, all the contractors in the town for this kind of work. They might be able to do it at a profit. They said they did, but plaintiffs said they did it at a loss. That was a matter which might give rise to a great many difficult questions, because they did not know what money to allocate to what. In these big Corporation accounts it was very difficult to say whether, on a particular branch, any loss was shown or not shown. That was an outline of the story. It depended on Acts of Parliament and other matters. The same question arose before Mr. Justice Neville with the Corporation of Leicester, and Mr. Justice Neville gave his decision there in favour of persons in the same position as plaintiffs in this action. The same arguments would, no doubt, be repeated here. As he understood the case was not to rest there, but was to be taken up by either side as a test case of the matter to the House of Lords upon the main point that arose, which was the same as in Mr. Justice Neville's case, he apprehended his Lordship would adopt Mr. Justice Neville's construction, with or without an expression from his Lordship as to whether he approved of it or not. Then there was a further point in this case that was not in Mr. Justice Neville's case. The Corporation of Leicester were the original undertakers. In this case the Corporation of Sheffield had taken this undertaking over from a company which obtained a provisional order in 1892 under the Electric Lighting Acts, of 1882 and 1888. That company had carried on a wider business than was authorised by the statutory powers conferred on the Corporation, so a question might arise how far the Corporation, as successor of that company, were entitled to go beyond the statutory powers conferred by the Acts of 1882 and 1888. That was a point independent of Mr. Justice Neville's decision.

COUNSEL then referred to the sections of the Electric Lighting Acts of 1882 and 1888, relating to the matter, and said the plaintiffs' case was that the obligations of the Corporation ceased at the consumers' terminals. He exhibited a diagram showing the supply of current to the consumers' houses, and explained that the apparatus which was incidental to the supply was distinguishable from the fittings which were supplied for the use of the current.

At this stage the hearing was adjourned until February 15th.

#### CAVEHILL AND WHITEWELL TRAMWAYS.

IN the matter of an arbitration between the Corporation of Belfast and the Cavehill and Whitewell Tramway Co. which was at hearing for two days in the King's Bench, before Mr. Justice Gibson, Mr. Justice Boyd and Mr. Justice Kenny, judgment was given last week refusing to set aside an award made by Mr. Lynden Macassey, of London, by which he declared, after hearing evidence, that the price which the Corporation of Belfast ought to pay for the tramway undertaking of the company was £56,155. Mr. Macassey made and published an award in March, 1911, in which he declared that in arriving at the sum of £56,155 he had regard, not merely to the circumstances of the maintainable revenue which the transferred undertaking was capable of producing, and to the proper number of years' purchase of such maintainable revenue, but to all the other circumstances of the case to which he could properly have regard. Assuming that the construction contended for by counsel for the Corporation was the true construction of Article 1 of his agreement, and that the value of the said transferred undertaking was the value of it as a going concern, as contended for by counsel for the Corporation, he was unable, without further evidence, to decide what was the value of the undertaking as a going concern. The Corporation questioned the award, and the King's Bench Court made an order sending it back to the arbitrator, with directions to base his award on its value as a going concern. The arbitrator accordingly heard counsel on both sides, but no further evidence, and he made his second award, deciding that the value of the undertaking as a going concern—that was to say, as a rent or profit-producing or saleable undertaking—was £56,155, the exact figure of the first award. The Court refused the motion to set aside the award, with costs.



## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"M.O.W." writes:—"When an electricity meter has been tested by the supply company, and the result shows the meter to be registering in excess of the  $2\frac{1}{2}$  per cent. permitted by the Board of Trade for a 5-amp. meter, can the consumer claim the full error, or only that in excess of the  $2\frac{1}{2}$  per cent.?"

\* \* This question is to be answered by reference to the contract between the parties. It is obvious that if A pays 3d. a unit for electricity, he expects to get full value for his money—no more and no less. If the meter registers 5 units whereas only 4 have been consumed, he need only pay for 4. So long as the error does not amount to more than  $2\frac{1}{2}$  per cent. he has no remedy; but if it exceeds that amount, he is entitled to recover the whole amount which he has overpaid.

## BUSINESS NOTES.

**Pumping Machinery Contracts.**—We have received a lengthy list of some of the orders recently booked by the WORTHINGTON PUMP CO., LTD., of London and Newark-on-Trent. The following are included:—

One complete condensing plant of the sub-base type having vertical triplex Edwards air-pump and lift pump. Also 14-in. twin centrifugal circulating pump for 8,000 gallons per minute, against 60 ft. head, driven by B.T.H., of Rugby, steam turbine, for the Bradford Corporation Electric Light Station. This is the third condensing set supplied by the company for the same station.

One surface-condensing outfit for 16,900 lb. of exhaust steam per hour, with complete Worthington patent rotary combination of air and circulating pumps, for export to Japan.

Two low-level jet condensing outfits, complete with Worthington rotative dry vacuum pumps and centrifugal circulating pumps, driven by vertical engines for 19,500 lb. of exhaust steam per hour with 28-in. vacuum, for shipment to Japan.

Two rectangular surface condensers, with single combined air and circulating pumps, together with one vertical single double-acting air-pump, ordered through the company's Berlin office.

Four natural-draught steel cooling towers, each to cool 125,000 gallons per hour, for Lister Drive power station of the Liverpool Corporation.

Three natural-draught cooling towers—two for 8,800 lb. of exhaust steam per hour, and one for 6,600 lb. of exhaust steam per hour—and one fan tower for 13,800 gallons per hour, ordered through the firm's Buda-Pesth office.

One forced-draught cooling tower, to deal with 6,500 gallons per hour, for gold mine service.

One Worthington centrifugal boiler feed pump, for Dudley Corporation.

**Stoker Contracts.**—The following are included in a list just received of recent sales of stokers by the UNDERFEED STOKER CO., LTD.:—

	No. of stokers.	Class.
Rosyth Pumping Station	6	E
Central Electric Supply Co., St. John's Wood	4	E
Heckmondwike Urban District Council	3	E
Poplar Borough Council	2	E
Newcastle Electric Supply Co., Philadelphia	1	E
Yorkshire Power Co.	2	E
Belliss & Morcom	1	D
London General Omnibus Co., Walthamstow	2	B3
Hyderabad Mint	3	E
Cossipore	1	E
Gebrüder Sulzer, Winterthur	3	D

**Prices Advance.**—THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, announce that, owing to the increase in the cost of raw materials, they are increasing their selling prices by reducing the discounts hitherto applying on their standard lists. A new index, giving particulars of price lists and discounts, is in preparation, and will be ready for distribution shortly. In the meantime, they will quote specially on application.

THE GENERAL ELECTRIC CO., LTD., also announce that, on account of the increase in the cost of raw materials, they are, from February 5th, charging a 10 per cent. advance on all prices contained in sections of their catalogue relating to the following:—Low and medium tension switchgear, switchboards, high-tension switchgear, starters and controllers.

**Railway and Tramway Map for the Session of 1912.**—MR. EDWARD STANFORD, of Long Acre, W.C., has, in accordance with his usual custom, published a coloured map showing the metropolitan railways, tramways and miscellaneous improvements of which particulars were deposited at the L.C.C. up to November 30th, 1911, and which will occupy the attention of Parliament in the approaching session. The price is 2s. in sheet, and 4s. 6d. mounted in case.

**Rubber-Covered Wire for Canada.**—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that the Canadian Fire Underwriters' Association, of Toronto, have decided that after January 1st, 1913, they will not accept any electric wire except the new code rubber wire as specified in the 1911 National Electrical Code. This rule, Mr. Field understands, will probably be adopted by the other fire underwriters' associations throughout Canada.—*Board of Trade Journal.*

A copy of the 1911 National Electrical Code may be seen at the ELECTRICAL REVIEW office.

**France.**—La Société Française des Lampes Reparables "Sol" is the name of a new company which has lately been formed in Paris with a capital of £20,000, to manufacture an improved metal-filament lamp. At first an annual output of 200,000 lamps is being arranged for, but it is hoped to quickly increase this to a million.

**Consular Notes.—Paraguay.**—The British Consul at Asuncion reports that the market for British goods of certain kinds is no doubt capable of considerable expansion. In most branches goods of a low grade are in demand, but there is also some demand for goods of better quality. The greater part of the import trade is carried on at Asuncion, the provincial towns being dealt with by the travellers of the Asuncion houses, but a few of the other towns are worth the attention of British travellers. Commercial travellers require to take out a licence, the fee for which varies from £17 to £78, according to the importance of the firm represented. The travellers of firms who are already represented by agents do not require a licence. British firms doing business with Paraguay would be well advised to have their names and trade-marks registered at the office established for the purpose, for if their names or marks should be registered by unauthorised persons the firms lose the right to sell their manufactures under their own names and marks. The ordinary cost of registration, including the publication of a description of the mark as required by Paraguayan law, is about £5, but where it is necessary to publish very long descriptions of marks and printed labels the charges would be higher. The import trade in Paraguay is in the hands of a limited number of firms (chiefly foreign firms established at Asuncion) and of agents of foreign houses, who import direct from Europe, or who buy goods of European origin from large houses in Buenos Ayres and Monte Video. In some of the provincial towns also there are firms which import direct from Europe and from the neighbouring Republics. The usual terms given are six months' credit from the date of the invoice, but some European houses give eight or nine months' credit. In some cases it is customary to give a credit of eight months for one half of an order and six months for the other half. The credit is generally subject to interest at the rate of 6 per cent. per annum from the date of the invoice. As the local banks charge 12 per cent. interest on advances the importers are naturally disposed to avail themselves of the long credit offered.

**Philippines.**—The British Consul at Manila reports that the trade of the Philippines in the heavier class of machinery, steam engines, &c., is practically divided between the United States and the United Kingdom. The trade in petrol motors and electrical machinery is controlled by manufacturers in the United States, and there has been a considerable increase in business in these articles.

**Russian Far East.**—The British Consul at Vladivostok, in a recent report, states that it is difficult to find any ground for self congratulation when surveying the trade done in articles of British manufacture in his region. Our share in imports continues to be disappointingly small and, what is worse, there are no signs apparent of any determined intention on the part of our manufactures to improve their position. Yet this is a new country of enormous area on the immediate development of which vast sums of Government money are being spent, and through which a railway is now being driven, at a probable eventual cost of something like £30,000,000. At the time of writing, 10 steamers with general cargo from Antwerp and Hamburg had cleared from Vladivostok for Nikolaievsk, taking some 20,000 tons of cargo, nearly all of which consisted of salt, machinery and general contractors' stores. With the exception of large consignments of iron sheets—bought through commission agents on the Continent—the proportion of our manufactures in this amount is negligible. That this should be so is a proposition that few will be found to dispute. It gives rise to two obvious questions—why is it the case, and what can be done to remedy it? The answer to the first question is simple enough—we have no share, or next to no share, in Siberian trade, because we have never taken the trouble to organise business connections; because British firms, either from ignorance or from indifference, have not considered it worth while to establish themselves locally or to secure efficient representation in the country, contenting themselves with such few orders, as, without any effort on their part, happened to come their way. The results have been disastrous in more ways than one: trade has not developed, openings, from lack of knowledge of local conditions, have been wrongly handled, and an unduly large number of unsuccessful transactions have been made which have not only discouraged the firms directly concerned from further enterprise, but have induced a general mistrust of Siberian business as a whole. Nor is the answer to the second question far to seek. Our merchants and manufacturers will have their proper share in Siberian business when they have made up their minds to follow the excellent example shown to them by the Germans in past years—namely, to open up for themselves in the country and to organise, even at the risk of making a loss for the first year or two, a systematic scheme of commercial operations.

British manufacturers, if they hope to build up a trade of any consequence in this country, have to make up their minds to allow their customers more favourable conditions of credit than they countenance at present. It must be borne in mind that Eastern Siberia is very sparsely inhabited by a population of very modest means, and that the credit system is to them an absolute necessity. This applies to commodities of all kinds, and to peasants and retail and wholesale dealers. With the exception of one or two German firms who pay cash, all the local houses require credit for from three to nine months, extending sometimes to double that time. For the sale of machinery and mechanical outfits, &c., the instalment system is in current use, the period of payment ranging



over three years. The reason for the prevalence of the credit system is to be sought in the dearth of money and the fact that the capital in the country is generally insufficient for its needs. The rate of interest charged by banks on borrowed money has recently fallen, but even now it is from 9 to 12 per cent. Under these conditions buyers naturally prefer to obtain credit from their suppliers, even on equal terms; suppliers, on the other hand, profiting by European rates of interest, find an advantage in extending credit to their customers at the high local rates. It is evident that in order to be able to engage in this business at all, manufacturers must have a much closer personal acquaintance with the market than is at present the case, and that, for this purpose, they must be represented locally by competent agents in whose knowledge of the conditions and of Russian commercial law and practice they can rely. Travellers in British goods are very rare, and those who do visit these parts are generally handicapped by a complete ignorance of the Russian language. They are also, as a rule, poorly provided with samples and not prepared to spend sufficient time in the country. Broadly speaking, they do not appear to tackle their work in the thorough and systematic manner characteristic of the German traveller, who will have with him ample printed matter, will quote c.i.f. prices, accord such conditions of credit as local circumstances require, and supply, when necessary, the elaborate blue prints to which the Russians are so attached. It is a fallacy to suppose that Russian law does not protect creditors. On the contrary, they are probably better protected in Russia than in most other countries. Firms trading here with the essential local knowledge that German firms possess, experience surprisingly few losses, and, though the exaggerated terms of credit which are prevalent are hard to become accustomed to, yet it is certain that, unless the effort is made, this market must remain practically a closed one to British goods.

Later in his report the British Consul says that the question of an electric tramway for Vladivostok has been settled; two local contractors received a 10 years' concession to construct and run a double line of some 5 miles length from the railway station, and along the main street to the eastern extremity of the town. The rails are supplied by the town, power is to be purchased from a central station which is being built, and which will also provide light for the streets and for general use. The rolling stock, cables, machinery, and all other outfit for the tramways, as well as for the power station are to be supplied by German firms, the poles alone, it is believed, coming from America. British firms have no particular reason to be grateful to the municipality for the treatment accorded to them in this connection. Several of them have spent no little time and money in conducting negotiations with the Vladivostok Town Council with a view to obtaining the execution of the various improvements of which the city stands so much in need. Yet the call for tenders for building the central power station was announced so short a time before the adjudication that it was a matter of practical impossibility for any firm *not locally established* to compete.

Towards the end of 1910 wireless telegraphic communication was opened between Petropavlovsk in Kamchatka and Nikoleivsk—a distance of 800 miles. The station at Petropavlovsk was burnt down shortly after it commenced operations, and only temporary arrangements could be made for carrying on the service. Consequently the communication has been intermittent. As there is no postal service to Kamchatka during the winter months, the installation of wireless telegraphy will be of great value to the country, both administratively and from the point of view of the general public. The use of wireless telegraphy is being largely extended, and it has been decided to erect in due time the following stations: (1) On Behring Island; (2) at the mouth of the River Anadyr; (3) at Providence Bay and on Cape Dyejnev in the Tchukotsk Promontory; (4) at Markova, on the Anadyr River; (5) at Okhotsk, Yamsky, Ghidjiga and Tighil on the Sea of Okhotsk; (6) in Sakhalin, to ensure communication in case of the present cable being interrupted; (7) at Herbinski (on the Amgun). The stations in Ghidjiga, at the mouth of the Anadyr, and in Sakhalin should be working in 1912.

**British Columbia.**—In a recent issue of the *Electrical Record* (U.S.A.), it is stated that A. B. Kennedy, electrical contractor, of Merritt, British Columbia, reports an active and profitable electrical contracting business in that part of the country. At present he has in hand a contract for electrically equipping the new \$25,000 Nicola Valley General Hospital, also a cold storage plant for the Nicola Valley Meat Market, besides several other small contracts. The Nicola Valley Meat Market is having a 30-volt storage battery plant installed for lighting its premises, which consist of a coal storage plant, a large meat market, and an opera house. Mr. Kennedy also has a contract to install a 230-volt direct-current water turbine plant for the town of Lower Nicola. Mill Creek will furnish the motive power. This plant is being installed for D. Dodding, a prominent rancher and dairyman, who has also a branch of the provincial experimental farm on his ranch. In addition to supplying light for his dairy and home, Mr. Dodding will be able to provide the little town with light and power.

**Private Arrangement.**—C. SUCKLING (trading as G. Suckling & Co.), electrician, Brent Street and Golder's Green Road, Hendon.—A meeting of the creditors interested in the above matter was held on Monday last, when the representative of the Amorduct Co. was elected to the chair. The statement of affairs presented showed total unsecured liabilities of £853, of which £188 was due to the trade, while £365 was due to cash creditors. The cash creditors were the debtor's father and mother and a Mr. Carpenter. The assets were estimated to produce £258, and con-

sisted of stock £118 and book debts £140. The debtor attributed his present position to the failure of a local builder, who owed him an amount (£130), and also to pressure by several creditors. A writ had been issued last week for £163. It was stated that the debtor was formerly in business in partnership, trading under the style of Brock & Suckling. This partnership was dissolved about 18 months ago, the debtor paying the liabilities of about £400, and taking over the assets estimated at a like amount. He had received assistance from his father, and had been mainly engaged in electric wiring work for builders. There were no particulars available with regard to the turnover or gross profits, but the debtor's drawings had averaged about £2 per week. There was no life policy, but the debtor said there were two houses situated in Temple Grove, Golder's Green, which he had purchased from a Mr. Bernstein, through a building society, about two years ago, for £500 each, but debtor thought he had only paid the interest. Debtor made an offer of 3s. 4d. in the £ cash down, the cash creditors withdrawing their claims. This offer was discussed, but no conclusion was arrived at in the absence of the principal creditors, and the meeting was adjourned. The debtor's father, who is the largest cash creditor, is in a small way of business, and has evidently helped the debtor to the full extent of his power. The following are creditors:—

Amorduct Co., Ltd. . . . .	£141	Haymills, Ltd. . . . .	£27
Veritys, Ltd. . . . .	165	Bernstein, H. . . . .	49
Thomas, F., & Co. . . . .	42	Suckling . . . . .	810
General Electric Co., Ltd. . . . .	25	Suckling, Mrs. . . . .	30
B.T.-H. Co., Ltd. . . . .	41	Carpenter . . . . .	25

**Bankruptcy Proceedings.**—BERTRAM NEWMAN (trading as B. Newman & Co., described in the Receiving Order as Bert Newman, trading as B. Newman & Co.), electrician, 4, Cranbrook Road, Ilford, Essex.—The adjourned public examination of the above-named debtor was held at the Shire Hall, Chelmsford, on Wednesday last, when the statement of affairs showed liabilities amounting to £850 and a deficiency of £847. The debtor attributed his failure to bad debts. He estimated his losses on that account at over £630. After a short discussion, the examination was ordered to stand adjourned.

CHARLES OLDHAM McMILLAN, electrician and cycle dealer, Portmadoc.—Receiving order made on February 10th, on debtor's own petition.

**Dissolutions and Liquidations.**—C. G. REED & SONS, LTD., North Road, Brighton, ironmongers and merchants.—This company recently went into voluntary liquidation, and the following appear in the list of creditors:—

Bullers, Ltd. . . . .	£18	Moeller & Condorp, Ltd. . . . .	£52
The Electrical Co., Ltd. . . . .	23	W. Soutter & Sons . . . . .	48
Krupka & Jacoby, Ltd. . . . .	158	Stein (?) Electric Light Co. . . . .	27
J. Russell & Sons . . . . .	338	R. Hornsby & Sons . . . . .	27
Evered & Co. . . . .	383	Henley's Teleg. Co., Ltd. . . . .	32
Falk, Stadelmann & Co. . . . .	76	Simplex Conduits, Ltd. . . . .	58
Siemens Bros. Dynamo Works, Ltd. . . . .	93	Brimsdown Lamp Works . . . . .	25
R. A. Lister . . . . .	39	Sun Electrical Co., Ltd. . . . .	33

BOMBAY HYDRO-ELECTRIC SYNDICATE, LTD.—A meeting will be held at Gresham House, E.C., on March 11th, to hear an account of the winding up from the liquidator, Mr. F. J. Horne.

ROSE'S RECORDING TARGET CO., LTD.—This company is winding up voluntarily, with Mr. J. Leith, 85, Gracechurch Street, E.C., as liquidator. A meeting of creditors is called for February 22nd, at 13 and 14, Abchurch Lane, E.C.

**Catalogues and Lists.**—MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham.—Leaflet containing description, illustrations and prices of the firm's new totally enclosed drum type plain "star-delta" starters for squirrel-cage three-phase motors.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., Bank Buildings, 109-111, New Oxford Street, London, W.C.—New pamphlet of 16 pages, wherein are given particulars with illustrations (half-tone and diagrammatic) concerning their type "L" high lift centrifugal pumps, also notes on their starting up and operation. One of the views shows a 1,250-H.P. colliery pump driven by a three-phase 5,000-volt motor, a waterworks high lift pumping set driven by a three-phase 360-H.P. motor, underground mine pumps, sinking pumps for mines, water supply plants for industrial districts, &c. Other publications just issued by the same firm are as follows:—No. L 2, giving a list of prices of "Leanda" metal-filament lamps from 25 to 260 volts and from 9 to 900 British C.P.; and List No. P.M. 3, containing illustrated descriptions, with tabulated particulars including prices and weights, of electrical measuring instruments, moving coil and hot wire; wattmeters for D.C. or A.C., three-phase wattmeters, and other kindred manufactures.

MESSRS. SIEMENS BROTHERS DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., have just issued a "Wotan" lamps show-card of effective design lithographed in nine colours. It is mounted on a stiff board, and contractors who have not yet received one can have a copy on application. At the bottom it carries the words, "Drawn Tungsten lamps; save 15s. in the £; no lamps take less current."

MR. ROBERT R. STEEL, 794, Salisbury House, London Wall, E.C.—Pamphlet setting out the advantages of the "Alekin" improved automatic distilling apparatus for producing pure distilled water for a variety of purposes, especially for use in connection with storage batteries, and giving directions for connecting and working the apparatus.

THE DIESEL ENGINE CO., LTD., 179, Queen Victoria Street, London, E.C.—Thirty-two page brochure containing an imposing tabulated list of purchasers of Diesel engines in Great Britain and Ireland, India, Argentina, Brazil, Chile, Mexico, Japan, China, Australasia, Egypt, &c. Information is given as to the number of cylinders and the H.P. in the case of each order. Copies of this publication will be sent to any applicant.



THE WALSHALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall.—Twenty-page catalogue of meters for direct and alternating current including the following:—Moving coil ammeters and voltmeters (improved Weston type); sector cased and edgewise ditto; the B 6 moving iron type meter; handy meters for testing purposes; railroad meters; moving iron meters; the "Export" meter; leakage indicators for mines; master switches; series and potential transformers; watertight and motor car duplex meters. Illustrations appear and prices are very clearly tabulated.

MESSRS. HICK-DIESEL OIL ENGINES, LTD., 11, Queen Victoria Street, London, E.C.—Sixteen-page pamphlet describing the Hick-Diesel oil engine, giving an explanation and description of a typical installation, accompanied by half-tone and line diagrams. Dimensions are tabulated. The engines are made by Messrs. Hick, Hargreaves & Co., Ltd., of Bolton.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—Catalogue of 32 pages containing brief notes regarding, and illustrations of, Barwick motor starting and regulating gear, together with very fully tabulated lists of prices of upwards of 2,000 starters and regulators. The contents include prices of  $\frac{1}{2}$ -minute rating starters of open, semi-enclosed and totally-enclosed types, together with 1-minute rating starters of the same pattern, starting panels and automatic starters. The prices of shunt regulators cover a very wide range, and prices also appear of patent shunt regulators having all live parts mounted at the back of the slate, doing away with the necessity for a front covering. A view is given of the switch mounted on the back of the slate before the resistance is connected to it. Various resistances for cinematograph theatres, and liquid resistances for theatres, are also listed.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—New edition of the firm's "Osram" lamp price list of 28 pages. Conditions of sale, and instructions for handling and use, and tables for dimensions of pear shape, round bulb and candle-shape lamps, precede neat illustrations with brief particulars and prices of various types of lamps with wire-drawn filaments. Two entirely new lamps included are the 200 and 260-volt, 20-watt, 16-C.P. and the 100 to 135-volt, 11-watt, 10-C.P. The number and ranges of candle lamps have been increased, and these are now stocked in twisted, as well as plain, flame and other shapes. Osram striplite lamps suitable for all kinds of trough reflectors are also shown; these will shortly be made in 100 to 135-volt, 16-C.P. type. Another item in the pamphlet is lamps specially designed for use in motor-car headlights. We understand that considerably over five millions of Osram lamps with drawn-wire filaments are now in use in this and other countries.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Publication No. 184 (24 pages) deals with Sterling electric blasting machines. The ground covered may be indicated thus:—Electric fuses for high and low-tension systems; electric blasting machines generally; "Sterling" patent electric blasting machines and instructions for using them; how to fire shots by electricity. Illustrated notes and prices appear of magneto high and low-tension blasting machines; dynamo low-tension blasting machines; shot-firing cable and cable reels; galvanometers and spare parts.

**Book Notices.—Four-Place Tables.** Compiled by E. V. Huntington. London: E. & F. N. Spon. Price 3s. net.—This is a handy set of tables of logs and trigonometric functions, bound in flexible cloth, and with a thumb index leading directly to the sections desired. All the values of any one function are found at one opening. The functions always increase from left to right, to prevent errors in interpolation. Additional thumb indexes are provided at top and bottom to facilitate the use of the tables with the left hand only, but by some chance those in our copy have been wrongly cut, and fail in their object. Logs from 1 to 2 are given in a special table, direct reading; from 1 to 10 with differences for the fourth figure. Similarly, the logarithmic functions are given in special tables for the first or last 10°, as well as the ordinary tables from 0 to 90°, and various conversion tables are included, with a number of useful constants. The tables and notes have been carefully drawn up with a view to handiness and accuracy in use, and appear to be exceptionally convenient for quick working.

*The Magnet Magazine.* Vol. I, No. 1. Price 1s.—This is the first copy of the new magazine of the General Electric Co., Ltd., who are to be congratulated upon its excellent start. The fact that it is edited by Mr. M. Solomon (manager of the Witton carbon works of the G.E. Co.) is ample guarantee that a high literary and technical standard will be maintained, and the style and contents of the first issue are worthy of high commendation. The opening article is appropriately devoted to a biographical sketch of the late Mr. G. Byng, the founder of the company, whose portrait forms the frontispiece. The chairman, Mr. H. Hirst, contributes an extremely interesting foreword describing the recent expansion of the company, which now includes between 30 and 40 separate organisations at home and abroad, all controlled from one centre. Emphasis is laid upon the establishment of subsidiary companies in the principal external markets—Australia, India, China, Spain and South Africa, and, shortly, Argentina. This step was resolved upon some years ago, with the cordial support of the late chairman, and was due to the necessity of keeping the Witton factories fully employed, the home market being too limited in scope and unstable in character to afford alone a satisfactory field of enterprise. To this end the company entered into partnership with its foreign agents where practicable, while in other cases new companies were formed for the purpose. This policy has been fully justified by the results, which have already proved eminently satisfactory. An article on Paper-Mill Driving, an editorial explaining the scope and objects of the magazine, and a list of the Overseas companies and agencies of the G.E.C.,

complete the list of contents, which are of exceptional interest and quality.

*The Modern Locomotive.* By C. Edgar Allen. London: Cambridge University Press. Price 1s. net.—This is an addition to the admirable series of "Manuals of Science and Literature" in course of issue from the Cambridge University Press, and fully maintains the high standard of excellence set by its predecessors. It deals solely with the steam locomotive, the theory and practice of which are concisely but clearly outlined, with good illustrations.

"Macchine Dinamo-Elettriche e Trasformatori Statici." 1912. Milan: Biblioteca die Eletticità.

"Transactions of the Illuminating Engineering Society." Vol. VI, No. 9. December, 1911. Easton, Pa.: The Society. Price 75 cents.

"Proceedings of the Engineers' Club of Philadelphia." Vol. XXIX, No. 1. January, 1912. Philadelphia: The Club.

"Transactions of the University of Toronto Engineering Society." Vol. V, No. 3. Toronto: The University.

"Calcul et Construction des Alternateurs." By H. Birven. 1911. Paris: Gauthier-Villars. Price 6 fr.

"Review of the Coal Trade in 1911." London: The *Colliery Guardian*. Price 1s. net.

"L'Année Electrique Electrothérapique et Radiothérapique, 1911." By Dr. Foveau de Courmelles. Paris: Ch. Beranger. Price 3.50 fr.

"Science Abstracts." Sections A and B. Vol. XV, Part 1. January 31st, 1912. With Indexes to Vol. XIV. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Diesel Engines for Land and Marine Work." By A. P. Chalkley. 1912. London: Constable & Co. Price 8s. 6d. net.

"The Universal Electrical Directory (J. A. Berly's), 1912." London: H. Alabaster, Gatehouse & Co.

**New Osram Lamps.**—In issuing a new list of Osram lamps with drawn-wire filaments, the GENERAL ELECTRIC CO., LTD., claim that these filaments are not surpassed in strength by any other make of lamp; transit troubles are now eliminated. An interesting novelty is the low-candle-power lamp, which is now available in two types—200-260 volts, 20 watts, 14.5 C.P. and 100-135 volts, 11 watts, 9 C.P. We illustrate herewith one of the former, which it will be seen is pear shaped and shorter than the lamps of higher candle-power. The filament is wound on the supports in one continuous length. The introduction of these



OSRAM DRAWN-WIRE LAMP.

new types extends the range downwards almost to the lowest limit required in practice, and illustrates once more the extraordinary progress which has been made in the rapid evolution of the tungsten lamp. A test carried out at the National Physical Laboratory last year on nine 32-watt, 200-volt Osram lamps shows that they all burned for 2,000 hours and were unbroken at the finish, the average efficiency being 1.39 watts per horizontal candle during that period, and the falling-off in candle-power only 8 per cent. Such figures would have been regarded as hopelessly unattainable but a few years ago.

**Trade Announcement.**—MR. W. PAGDEN PERRY, of 6, Holborn Viaduct, E.C., has been appointed sole agent for London, the Home Counties and South-East Coast for the P. & G. electric heating and cooking apparatus. He is just introducing a new line in copper kettles with cast-brass scroll legs, especially to meet the views of the electric supply engineers. At the above address, we are informed, he is showing electric ovens on a new principle.

**Indicator Approved.**—The B. of T. has approved of Fricker's maximum demand indicator as deposited by MESSRS. FRICKER & MILLER, 82, Victoria Street, S.W.



## LIGHTING and POWER NOTES.

**Abingdon.**—At the quarterly meeting of the T.C., a report from the Electric Lighting Committee was received stating that an application for a provisional order had been sent to the B. of T., and that the Committee had since had an interview with a representative of a firm willing to form a company to be called the Abingdon Electrical Supply Co., Ltd., and to establish an installation. The Committee was still in negotiation. The Mayor said that, from what he knew of the opinions of individual members, the Committee was against an electrical undertaking as a municipal enterprise, but would prefer a company to carry it on, and he shared that opinion. The report was adopted.

**Atherton.**—The L.G.B. has sanctioned loans amounting to £3,500 for the purposes of electric lighting for the D.C., viz., a loan of £1,500 for mains, repayable in 25 years; a loan of £1,000 for services, repayable in 15 years; a loan of £200 for switchgear, repayable in 17 years; a loan of £700, for transformers and transformer pillars, repayable in 15 years; and one of £100 for meters, repayable in five years.

**Bath.**—The T.C. has received the sanction of the L.G.B. to a loan of £8,000 for the installation of a Diesel engine, motor-alternator and booster.

**Blackpool.**—The T.C. has decided to oppose a Bill for confirming certain agreements under the Electric Lighting Act, 1882, between the National Electrical Construction Co. and certain local authorities.

**Canterbury.**—Once again the merits of gas *versus* electricity have been troubling the minds of the Guardians of the Canterbury Workhouse. A few months ago it was decided that electricity should be substituted for gas in the workhouse. At the next meeting, however, the matter was again brought forward, and after a keen fight gas carried the day, and it was decided to stick to the old method. At the meeting on January 29th a resolution was passed that electricity should be laid on to the new home which the Guardians are building for the nurses employed in the infirmary, one the members remarking that the laying of the cable to the home would pave the way for the adoption of electricity in the house. Mr. S. S. Warren, however, gave notice that he would bring forward a motion to rescind the resolution. Accordingly at the meeting this week the matter was again discussed. Mr. Warren dwelt at some length on the merits of gas *versus* electricity, and contended that the former was much healthier and cheaper. Several members spoke in favour of electricity, and eventually on being put to the vote, the motion was lost by a large majority, only two voting for gas.

**Cheltenham.**—The R.D.C. has given consent to the T.C. to supply electricity to premises in the rural area, without prejudice to the R.D.C.'s right of action as regards all future applications.

**Cheshire.**—The Chester County Council has decided upon an electrical installation in the buildings of the Bache Hall Estate, the Hall itself to be utilised as a nurses' home in connection with the Upton Asylum.

The Council has decided to petition against the Altrincham and Bowden E.L. (Extension) Order.

**Clacton-on-Sea.**—After tests with gas and electric lamps the U.D.C. has decided to light the west front with 10 electric arc lamps.

Negotiations are proceeding with reference to a supply of electricity to the new home being erected in Holland Road, for the Reckitt's Home trustees. The latter have agreed to guarantee for at least two years an annual consumption equal to £50 a year. On a final decision being arrived at the necessary mains will be laid by the U.D.C.

**Colchester.**—The T.C. has decided to oppose by memorial the Bill that is being promoted to enable railway companies to supply electricity to private consumers.

**Congleton.**—The B.G. has decided next month to discuss the question of lighting the workhouse either by electricity or gas, dispensing with the present oil lamps. In the meantime expert advice is to be sought.

**Crewe.**—The Corporation proposes to borrow £1,925 for new electricity mains, £1,127 for additional plant at the generating station and £550 for other expenditure in connection with the electricity undertaking.

**Devonport.**—The T.C. has applied to the L.G.B. for a loan of £9,983 for additions to the electricity plant.

**Dover.**—The T.C. has decided to ask Mr. Wyndham, M.P., to block the Bill which seeks to give railway companies power to supply electricity to private consumers.

**Epsom.**—The U.D.C. has decided to install at the electricity works a 200-kw. Diesel engine, at an estimated cost of about £3,000.

**Farnworth.**—At the meeting of the D.C., held on February 7th, it was decided to petition against the Bill which the L. and N.W. Railway Co. are promoting, which would enable them to supply electricity to works near their railways. The chairman observed that the Bill would allow the company to compete unfairly with local authorities.

**Formby.**—Notice appears in the *London Gazette* of the revocation of the 1907 prov. order.

**Gloucester.**—Unless the city is exempted, together with the agreement of October 30th, 1899, the T.C. will petition against the Bill of the National Electric Construction Co., Ltd., which seeks to confirm free-wiring agreements.

**Halifax.**—At a meeting of the T.C. held on the 7th inst., the recommendation was adopted of the Tramways and Electricity Committee of a revised scale of charges for electrical energy for motive power purposes. The new scale will enable large consumers to obtain a supply of electric power at practically  $\frac{1}{2}$ d. per unit. An amendment referring the question to the Finance, Electricity and Gas Works Committee for consideration was defeated.

**Hazel Grove.**—The Stockport T.C. has decided to apply to the B. of T. for an order empowering it to supply electricity to the Woodlands Estate, which is in the area of the local U.D.C. The latter body recently declined to consent to the T.C.'s application.

**Kirkcaldy.**—The electrical engineer, in a report to the T.C., states that he has been considering the question of the best type and size of plant for extensions at the electricity works. Under present conditions, with six non-condensing high-speed steam engines, there was no doubt the proper type of plant to install was the mixed-pressure turbo-generator. The total capacity of the existing plant was 1,100 kw., and he advised that the turbine should be of 1,000 kw. They would require a condenser and cooling tower, and he estimated the cost at £9,000. Mr. Francis has been instructed to prepare plans and specifications and to advertise for tenders. The Corporation electricity works, it may be added, are progressing rapidly, and the large extension is absolutely necessary.

**Leith.**—The Dock Commission has accepted an estimate by Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne, for the erection of a 15-ton travelling crane at the new graving dock. The crane will weigh 150 tons, and is to lift 15 tons at 60 ft. radius. It is to be self-propelling and fitted with electric motors. The cost is £4,100, and the special track necessitated will probably cost £1,000.

**Lincoln.**—At a meeting of the City Council the other night, Mr. W. S. White moved that application be made to the L.G.B. for sanction to borrow £12,500 for the purpose of extending the plant at the electricity works. This was agreed to and the Committee's recommendation was confirmed.

**London.**—**WOOLWICH.**—The B.C. has sealed an agreement with a local firm in a district where mains are not yet laid for the supply of electric power on a three years' agreement. The capital expenditure involved is about £2,500.

**Luton.**—With reference to the Bill of the London and North-Western Railway Co., which runs through the town, seeking powers to supply electricity to any manufactory, works or premises adjoining or near to any part of the company's lines, the T.C., in Committee, has given the Parliamentary Committee powers to take what steps are called for in the matter to protect the interests of the Council's undertaking, and, if necessary, to lodge a petition against the Bill.

**Maidenhead.**—The T.C. has decided, with a view to a 200-kw. Diesel plant being installed at an estimated cost of £4,000, that the Chairman of the E.L. Committee and the engineer shall visit the works of Messrs. Carls Frères and examine the proposed plant. The L.G.B. is to be asked to sanction the use of £2,200 for the renewals reserve fund, and to raise the balance by loan.

**Malvern.**—The U.D.C. has decided to give power consumers a discount of 5 per cent. off the present price of 3d. per unit, on payment of account within 28 days.

**Newcastle-under-Lyme.**—The T.C. has decided to install at the electricity works two 150-kw. Diesel oil engines in preference to gas engines.

**Nottingham.**—A great deal of correspondence has been published in the Nottingham papers relative to the price paid for coal at the electricity works, one of the city auditors having called attention to it. A letter written by Mr. W. Bardill remarks upon the Corporation electricity plant as being a by no means modern one, and goes on to say:—"But the fact rests that the present plant is there, and until the Corporation can afford to put down a modern plant, situated where coal is at hand and where water is plentiful for condensing (say on the side of the Trent near to Clifton Colliery), and the plant specially adapted to use the cheapest form of fuel, there is no doubt that the Corporation officials, with the Committee, are doing all they possibly can in the interests of the ratepayers generally."

**Penmaenmawr.**—The U.D.C. has received the consent of the L.G.B. to a loan of £196 for extending the electric lighting of the promenade.

**Perth.**—The Corporation Electricity Committee is to apply for borrowing powers to the extent of £8,000. The department will in the near future require to meet the demand of two large new consumers—the new infirmary and the new premises of Messrs. John Dewar & Sons. The cost of the mains alone will be £3,500.



**Plymouth.**—The Hoe and Parks Committee of the T.C. proposes to illuminate electrically the Hoe, which is stated to be the finest promenade in Europe. The whole of the asphalt paths are to be lined with festoons of electric light—red, white and blue—which will have a charming effect. It is also suggested that there shall be three trellis archways over the entrance at the top of Lockyer Street. It is further proposed to illuminate the entrance by the lodge in Citadel Road, as well as at the entrance at the top of Windsor Lane. The bandstand, Smeaton tower, and the Armada memorial will also be electrically decorated.

**Radcliffe.**—In order to give a supply of energy in bulk to Radcliffe U.D.C., and to the new works of the Co-operative Wholesale Society, the Bury T.C. has applied to the B. of T. for permission to utilise overhead lines.

**Reddish.**—The Stockport electrical engineer is in communication with several large firms at Reddish with reference to their taking a supply of electricity from the Corporation. If the demand is satisfactory the mains will be extended to the township, and additional generating plant installed.

**St. Anne's.**—The Electricity Sub-Committee of the D.C. has under consideration proposals for reducing the price of energy for heating and cooking.

**Sheffield.**—The estimated amount of profit from the tramways undertaking for the year ending March 25th, 1913, which will be available for the relief of the district rate, has been put by the Tramways Committee at £19,238, as against £23,334 for 1912. With regard to the electric lighting department, the Committee put the estimated surplus for the years 1912 and 1913 at £4,142 and £2,902 respectively. The estimate of the tramways general manager and the surveyor of highways of £53,700, has been approved as the capital expenditure for rolling stock, plant, equipment of line, &c., for the 12 months ending March 25th, 1913. A Sub-Committee of the Watch Committee have had under consideration the proposals of the electric supply department regarding the substitution of electric lighting for gas lamps in the public streets. The claims put forward by the department in support of this proposition are (1) that the light is not concentrated at the base of the posts; (2) there is no partial failure of a lamp. The failure of a lamp would necessitate its immediate renewal assuring the maximum amount of light being constant; (3) the light is not effected by high winds; and (4) that improved lighting is obtained with no increase in the annual charges over and above that paid at the present time. It was further pointed out that the comparative capital costs for brackets, fittings, &c., including 10s. for labour, &c., but exclusive of posts were (a) lamps per post; four (b) gas, £7 1s. 10d.; (c) electricity, £5 17s. 6d.; (a) three (b) £6 16s. 10d.; (c) £5 11s.; (a) two (b) £5 6s. 4d.; (c) £4 18s. 2d.; (a) one (b) £2 6s. 10d.; (c) £2 6s. 10d. Taking these figures into consideration, the Sub-Committee state that whilst they show that the capital cost for the electrical equipment is less than for gas lanterns, fittings, &c., it should be borne in mind that the Watch Committee had already incurred a cost equivalent to the proposed capital cost for electrical equipment, and that the cost which had already been incurred was giving fairly satisfactory results. Further, the Sub-Committee stated the proposed conversion would involve the scrapping of the gas equipment, for which the cost had been incurred. Under these circumstances it did not appear that the proposed capital cost incurred by the substitution should fall upon the Watch Committee, but that the whole cost should be borne by the Electric Supply Department. A further proposal was also submitted by the Department, showing the lighting of nine districts in the city where mains were available, and which showed that the present gas lamps in the whole of the nine schemes cost £1,147, as against £1,038, the total amount for electric fittings. After full consideration of the facts the Sub-Committee resolved that it could not see its way to recommend the Watch Committee to adopt the suggestions of the Electric Supply Department unless that department was prepared to undertake the new capital cost involved in the proposal. This report was adopted by the Watch Committee. Application is to be made to the L.G.B. for sanction to borrow the following sums:—Mains, £57,000; services, £9,000; sub-stations and equipment, £15,000; transformers, £16,500; power-factor rectifiers, £9,000; cooling towers and foundations £11,200. Mains are to be extended in Meadow Lane at an estimated cost of £112, also in South Street Park and Edgedale Road at £231 and £117 respectively.

**Shrewsbury.**—The T.C. on Monday decided, if necessary, to oppose the Bill of the London and North-Western Railway Co. seeking powers to supply electricity to factories, &c.

**South Africa.**—CAPE TOWN SUBURBS.—A special correspondent at the Cape writes as follows:—"Tenders have recently been called by some of the suburban municipalities for the electric lighting of the streets, and the tender of the Cape Town Corporation has been accepted by the Woodstock, Mowbray, Rondebosch, and Claremont municipalities, and an agreement has also been arrived at between Cape Town Corporation and the Cape Peninsula Lighting Co., for the former to buy out the latter for the sum of £46,500, and current will be supplied on similar terms to Cape Town. The Wynberg municipality, however, accepted the tender of the neighbouring Council of Kalk Bay, which was briefly to supply the municipality of Wynberg with current at 6·6 per unit for street lighting, and 3d. per unit for private consumers. Kalk Bay would require to spend £4,500 on extension of mains, &c., and

Wynberg would have to either purchase the existing network from the Cape Peninsula Lighting Co., or erect new network, &c. The tender was approved and advised to be accepted by the Administrator, with the following proviso:—(a) That the municipality of Kalk Bay obtain the consent of their ratepayers to the raising of the necessary loan for the prosecution of the work; and (b) That the municipality of Wynberg obtain in due course the consent of their ratepayers to the raising of a loan to liquidate the amount to be paid for the purchase of the "overhead equipment" from the Cape Peninsula Electric Lighting Co., Ltd. A public meeting was held, and during discussion it was elicited that current is costing the Kalk Bay Council at present 13·36d. per unit; (This is not a printer's error—it is thirteen point three six.) The ratepayers' necessary consent was not forthcoming, and the scheme was rejected. Subsequently, the Wynberg municipality agreed to find the necessary capital if the Kalk Bay Council's tender still held good. This was confirmed at the last meeting of the Kalk Bay Council. It will be a great pity if the offer of Cape Town to take over the Kalk Bay generating station is not accepted, as with the exception of the Admiralty plant at Simonstown, and the Government railway workshops at Salt River, the whole of the electric lighting in the Cape Peninsula will be from one single generating station owned by Cape Town Corporation."

The services of Mr. A. C. Holtby, M.I.C.E., were requisitioned to verify the calculations of Mr. G. H. Swingler, the Kalk Bay municipal electrical engineer. These calculations Mr. Holtby confirmed in all respects and endorsed Mr. Swingler's report that it would be a profitable undertaking to secure the Wynberg contract on the prices set out in the tender.

The new School of Medicine at Cape Town will be lighted by electricity, the tender of Messrs. Simpson & Scott having been accepted.

**Stockport.**—The T.C. has instructed the electrical engineer to prepare plans and specifications for the installation of plant to give an A.C. supply for large power consumers. The cost is estimated at £20,000. The question of utilising overhead transmission lines is also to be considered, and the electrical engineer is to visit towns where such lines are used.

The local Tradesmen's Association has sent a protest to the T.C. against the action of the Electricity Committee in hiring out an electrically-driven vacuum cleaner. Such a provision, it was pointed out, was entirely within the realms of the private trade to supply. The Committee has replied that if the Association can assure it that there are three such cleaners in the town to be let on hire, the Committee will discontinue to let out the one purchased by it.

**Stretford.**—In reply to an application from the Stretford Gas Co. for a supply of energy approximating 25,000 units per annum intermittent load throughout 24 hours, it is to be stated that the supply will be offered at a price of 1½d. per unit, less 10 per cent., for a minimum period of five years, the Council to install the necessary cable at an estimated cost of £100.

**Swindon.**—The T.C. has agreed to supply electricity to the new ice factory and cold storage being erected in Catherine Street by the Bath Cold Storage and Ice Co., Ltd., at 4d. per unit for lighting and 2d. per unit for power, subject to a minimum annual payment of £20 for three years. The extension of the main will cost £59.

**Wakefield.**—The T.C. has approved of the City Electrical Engineer's scheme for supplying electricity to Sandal, partly by overhead and partly by underground mains, at an estimated cost of £1,850.

**Walsall.**—The annual report of the Electricity Committee of the Corporation just issued shows an adverse balance of £184. The Committee points out that this is attributable to exceptional circumstances, largely arising from the heavy expenditure which has had to be borne out of revenue in connection with the extensions and alterations in bringing up to date the existing plant and in installing an alternating-current plant. The Committee states that it is hopeful that as the plant, which is now nearly completed, comes into service, and with continued increased demand for current, a great improvement will be effected, and at the close of this year a substantial profit will be shown. In 1910 a profit of £1,231 was reported.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—The Doderio electric tramways, in the city of Corrientes, have now commenced running.

**Bingley.**—The Bingley D.C. has decided to oppose the Bill which the Keighley Corporation is promoting for the purpose, amongst other things, of providing and working a railless vehicle system through Bingley.

**Birmingham.**—It is reported that the Tramways Committee contemplates augmenting its rolling stock by nearly 100 cars of the latest pattern, at an estimated cost of £700 per car.



**Blackpool.**—The consideration of a suggested revision of terms under which Blackpool, St. Anne's and Lytham Tramways Co. has running powers over the Corporation's tramway system, has been deferred until March.

**Bournemouth.**—The Corporation is faced with a serious problem in connection with the tramway undertaking. The borough accountant and the tramway manager have presented reports showing that on the basis of experience in other places, £45,393 should be in hand at March 31st, 1912, as a renewals fund, while the amount actually standing to the credit of the reserve fund is only £7,000.

**Continental Notes.**—**RUSSIA.**—A company has lately been formed to construct an electric tramway in the town of Kalisch.

A new section—the Torgoraia-Malorosiskaia—of the new electric tramways in Odessa, has just been completed and put in operation. About 15 miles of the new lines are now open in the city.

**ITALY.**—The projected waterway from Milan to Venice, for the construction of which a Commission is now in session, has, as usual in such cases, important electrical bearings. The project, as outlined by the engineers, contemplates the construction of a canal from Venice to Chioggia through the lagoon: an existing canal, regulated, will then be utilised as far as the River Adige, whence a large new canal will be excavated to the River Po, which will be deepened up to the point where it is joined by the Adda. This river is also to be regulated and made navigable, by means of locks, as far as Pizzighettone, where a third canal is to be constructed. A waterway navigable by vessels of 600 tons will thus be provided. The various waterfalls along the course will be utilised for the generation of electricity for industrial purposes, and electric power to the extent of about 9,000 H.P. will be utilised on these canals.—*L'Ingegneria Ferroviaria*.

**Glasgow.**—The Sub-Committee on Finance of the T.C. has been asked to inquire and report upon a motion by Councillor Lyon on the whole question of instituting a half-hourly service of cars from 12 midnight to 3 a.m.

**Heywood.**—At the meeting of the T.C. a suggestion was made that the Council should consider the advisability of running cars to Middleton.

**Liverpool.**—The Corporation has decided to apply to the L.G.B. for sanction to the borrowing of £8,000 for additional tramway-cars.

**Marple.**—The U.D.C. has rejected the railless traction scheme submitted by Stockport T.C., owing to the inability of the local authorities to arrange satisfactory terms with each other.

**Newcastle-on-Tyne.**—The Tramways Committee recommends that free passes be granted to the members of the Council. Alderman Weidner asked the Town Clerk whether the granting of such passes did not come under Sub-sec. 3, Sec. 23, of the Municipal Corporation Act, 1882, which expressly debarred a member having any voice in a matter in which he had a pecuniary interest. Also whether the granting of such passes was likely to be held in the nature of remuneration, and whether it was legal or otherwise? The Town Clerk replied:—(a) All members of the Council who use the tramways have a pecuniary interest in the question of the grant of free passes not restricted to use whilst engaged on Council business, and are debarred from voting on the subject by virtue of the section referred to. (b) It is probable that the grant of free passes to the members of the City Council without such restriction would be considered by an auditor to be in the nature of remuneration, and illegal. After some discussion, the matter was referred to the Committee again.

**Ripponden (near Halifax).**—At a meeting of the U.D.C. it was unanimously resolved that the Halifax Corporation be again approached with a view to instituting a tramway service between the Triangle and Ripponden. Some time ago a deputation from the U.D.C. interviewed the Corporation Tramways Committee on the matter, when the chairman of the latter stated that it did not intend to extend the tramways any further into the outlying districts unless it received financial support from the districts concerned. Since then, however, railless cars have come to the front, and it is thought that as these cars can be run at about 6d. per mile and the initial outlay is only about one-seventh of that for the ordinary tramway system, the Corporation may now see its way to accede to the request.

**Salford.**—The Tramways Committee has decided to make daily return tickets available for the return journey at any time during the day of issue. Hitherto the holder of such a ticket could not make the return journey before 10 a.m.

**Uruguay.**—A company has been formed to carry out the electrification of the tramways in the city of Paysandu, Uruguay.—*Review of River Plate*.

**Walsall.**—The net profit of the Corporation tramway undertaking for the past year amounts to £1,575 (after the payment of £3,104, which might have been charged to capital expenditure), and this is to be carried to the reserve fund, which now totals £29,957. The Tramways Committee has informed the Finance Committee that this year it will be able to make a contribution from the profits of the undertaking for the relief of the rates to

the amount of £1,000, and that the sum will be paid in two instalments. Seven cars are to be fitted with covered tops, at an estimated cost of £65 for each car, the work to be done by the staff at the dépôt, under the superintendence of the manager. The tram workers recently applied for an increase of wages, and the Tramways Committee have now resolved that from March next the maximum rate of pay to drivers be increased to 6½d., and that of conductors to 5½d. per hour, and that the pay of the inspectors be advanced to 54s. per week, with a further increase of 1s. per week from March 1st, 1914. In all cases, it is pointed out, the increase will be subject to satisfactory services being given.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—On Friday last, Lord Denman, the Governor-General, opened the first Commonwealth wireless telegraph station at Melbourne. The Marconi Co. has since issued a writ against the Government for alleged infringement of its patents.

**New Cables.**—The new Channel telephone cable was laid last week by the c.s. *Cambria*, between Abbotscliffe and Cape Gris-nez. The cable, which provides two metallic circuits, was made by the Telegraph Construction and Maintenance Co., and is of the continuously-loaded type, the conductor being closely wound with fine iron wire.

A new cable is to be laid between Marseilles and Algiers, with aerial connections with Paris, and with Constantine and Oran in Africa.

**Reporting by Telephone.**—Special arrangements were made by the Post Office for reporting Mr. Churchill's speech at Belfast last week. The *Westminster Gazette* report was telephoned direct from Belfast to London, and was published the same evening, with the aid of the Exchange Telegraph Co. The *Liverpool Express* utilised the electrophone, 32 transmitters being fixed on the platform, so that Mr. Churchill's own words were heard by the reporters in Liverpool. There are only two telephone circuits in the cable from Stranraer to Belfast, but the Post Office engineers superposed upon them a "phantom" circuit, through which the *Yorkshire Evening Post* received its report in Leeds.

**South African Cable Rates.**—The Eastern Telegraph Co. will reduce the rate for Press telegrams between Great Britain and Cape Town and Durban from 9d. to 3½d. per word, on March 1st.

**Sweden.**—The first wireless station in Sweden will shortly be erected by the Marconi Co.; it will have a range of 1,250 miles, and will be situated near Stockholm.

**The Telephone Service.**—The P.M.G. has published a reply to the complaints to which we referred in our last issue. He points out that the storm in January brought down 3,000 overhead lines in London, and that about 8,000 subscribers have been transferred from the Westminster and Avenue exchanges to new exchanges; in the case of the transfers there were many private exchanges which had to be re-equipped, and the operators had to receive instruction in the new methods of working, and in spite of large additions to the operating staff at the exchanges it was impossible to maintain the services with the usual efficiency. The P.M.G. points out once more that many subscribers overwork their lines with outward calls, preventing inward ones from being received, and this causes a large proportion of the failures to get through. Four large new exchanges are in course of construction in Central London and the West-end. In the meantime there is still a succession of complaints appearing in the daily Press, failure to get through and interruption of line being the most common troubles.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" to-day.

**Australia.**—**VICTORIA.**—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common battery wall telephones, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

**MELBOURNE.**—March 26th. Deputy P.M.G. 1,200 dry cells (Schedule No. 623). **PERTH.**—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal*.

April 16th.—Deputy P.M.G., Melbourne. 536 magneto telephones and 400 common-battery telephones (Schedule No. 648). A copy of the specification, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal*.



**Bolton.**—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" February 9th.

**Bournemouth.**—February 26th. The Education Committee. Tenders for the wiring of the New Science, Art and Technical Schools and Public Library, Lansdowne. Specifications and forms of tender, £2 2s. (returnable), from the Borough Engineer.

**Bradford.**—February 29th. Emergency excitation battery, and oil-eliminating plant for feed-water purification, for the Corporation. See "Official Notices" to-day.

**Bristol.**—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" January 26th.

February 19th.—Two electric fire-alarms at Stapleton Workhouse, for the B. of G. Mr. J. J. Simpson, Clerk, St. Peter's Hospital.

February 20th.—Arc lamp carbons, joint and fuse boxes, A.C. meters and D.C. mercury-type ampere-hour meters, for a year, for the Corporation. See "Official Notices" February 9th.

**Canada.**—The city of Galt is calling for tenders for a synchronous motor, 250 K.V.A., 2,200 volts, 750 R.P.M., to be used on the waterworks.

**Cardiff.**—February 17th. The Union is inviting tenders for one 30 ft. by 8 ft. Galloway, Lancashire or Yorkshire type boiler and superheater. Specifications and forms of tender from Mr. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

**Coventry.**—February 22nd. Water-cooling plant of a capacity of 250,000 gallons per hour, for the City Electricity Department. See "Official Notices" February 9th.

**Croydon.**—February 19th. General stores and goods, for tramways department, for a year, for the T.C. Tramways Manager, Thornton Heath.

March 11th.—Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Devonport.**—March 7th. Switchboard extension and one 1,000-KW. D.C. turbo-generator, for the Corporation. See "Official Notices" to-day.

**Dublin.**—March 6th. 5,000-volt, 100-KW., three-phase transformer pillars, for the Corporation. See "Official Notices" to-day.

**Germany.**—The municipal authorities of Weilburg are about to invite tenders for the establishment of a plant to utilise the water-power of the River Lahn in the generation of electrical energy for lighting and power purposes.

The municipal authorities of Neustadt-am-Orle are about to invite tenders for the establishment of a central electric lighting station in the town.

The municipal authorities of Annaberg (Erzgebirge) are about to invite tenders for the supply of a new steam turbine for the central electric lighting station, at an estimated cost of £7,500.

**Gloucester.**—Stores for a year for the Corporation Light Railways Committee. Mr. L. Johnston, general manager and engineer, Bristol Road.

**Heston and Isleworth.**—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**H.M. Office of Works.**—February 21st. Fuse and switchboards, for a year. See "Official Notices" February 9th.

**Hornsey.**—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See "Official Notices" to-day.

**Hungary.**—March 6th. Tenders are being invited by the municipal authorities of Mor (Fejer) for the establishment of a central electric lighting station in the town.

**Ilford.**—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" February 9th.

**Italy.**—February 29th. H.M. Consul at Cagliari (Mr. R. H. Pernis) reports that tenders are invited by the municipal authorities at that place for the establishment of an electric generating station, the construction and working of electric tramways over a distance of 3,280 metres (about two miles), and the illumination of the principal squares and streets of the city by electricity. For further particulars, see this column for February 2nd.

**Kirkcaldy.**—February 29th. 1,000-KW. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" February 9th.

**Leeds.**—February 21st. 40,000 tons of steam coal, and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 9th.

March 9th.—6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" to-day.

**London.**—BERMONDSEY.—February 19th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 26th.

BATTERSEA.—February 20th. Materials and stores for a year, for the B.C. Electricity Department. See "Official Notices" February 9th.

March 5th.—One 1,500-KW. high-pressure steam turbine coupled to two 750-KW. D.C. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" to-day.

FULHAM.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 2nd.

HAMMERSMITH.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 9th.

POPLAR.—February 16th. Extensions to E.H.T. and D.C. switchboards, for the B.C. See "Official Notices" February 2nd.

March 4th.—Telpher coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" to-day.

ST. PANCRAS.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

STEPNEY.—The B.C. is shortly to invite tenders for electricity meters at an approximate cost of £2,500.

**Manchester.**—February 20th. (a) Tramcar type ampere-hour meters, and (b) general stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

February 27th.—Eight-ton overhead hand-power travelling crane over auxiliaries, operated from floor-level, for the Corporation Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street (returnable deposit £1 ls.).

**Newport (Mon.).**—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

**New Zealand.**—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

**Oldham.**—February 17th. Electric lighting and ventilating of Trinity Wesleyan Chapel, Waterloo Street. Mr. J. Winterbottom, 5, Norbury Street, Oldham.

Tenders are shortly to be invited for superheaters and mechanical stokers at an estimated cost of £1,500.

**Pontypridd.**—February 21st. Stores and materials for a year, for the U.D.C. Electric Light and Tramways Department. See "Official Notices" February 9th.

**Portsmouth.**—February 20th. Stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

**Siam.**—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

**Walthamstow.**—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

**Warrington.**—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Warlingham.**—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

**Wrexham.**—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" to-day.

## CLOSED.

**Australia.**—SOUTH AUSTRALIA.—The P.M.G. has accepted tenders of the B.I. and Helsby Cables, Ltd., for 12 tons of copper, at £70 per ton, and numerous tapes and binders, porous pots and zincs, &c.; also those of Messrs. G. Wills & Co., for 17 tons of bronze wire; the I.R., G.P. and Telegraph Works Co., for binders, leads, zincs, &c.; the Western Electric Co., for insulators.

**Bradford.**—Mr. H. Moss has received an order for one 60-H.P. back-gear motor for Messrs. Redfearn & Bedford's new wire-drawing works. Mr. Moss has also received the order for the electric lighting of warehouses and offices, and also for an intercommunication system of telephones for offices, warehouses and mills, at Nortonthorpe, for Messrs. Norton, Scholefield & Co.

**Bristol.**—The T.C. Docks Committee has accepted the tender of Messrs. Veritys, Ltd., for a main switchboard and connections, for the new Avonmouth Cold Stores.

**Burton-on-Trent.**—The following tenders have been accepted by the Council:—

British Westinghouse Manfg. Co.—Switchboards, motors, &c., £6,484.  
Babcock & Wilcox, Ltd.—Water-tube boiler, &c., £1,862.  
Alphons Custodis.—Chimney stack, £445.  
E. Green & Sons.—Economisers, £1,343.



**Colechester.**—The T.C. has accepted the following tenders for the electricity works :—

Crompton & Co., Ltd.—Generator, £264, and £6 for cost of erection.  
Lassen & Hjort.—Water-softening plant, £120.  
W. H. Allen & Son, Ltd.—Spare armatures for air-pump motors, £63.  
Stanford & Co.—Piping for condenser circulating pump and for the K engine exhaust, £50.

**Dewsbury.**—The Education Committee has accepted the tender of Mr. Foggo, at £125, for the supply and fixing of electric light fittings at Batley Carr Schools.

**Glasgow.**—The Tramway Committee recommends the following tenders for acceptance :—

Armature coils.—Manchester Armature Repair Co.  
Special track work.—Lorain Steel Co.; Edgar Allen & Co., Ltd.  
Travelling crane.—A. Jack & Co.

**Hereford.**—The T.C. has accepted the tenders of Messrs. Cory & Son, Ltd., for 1,000 tons of Cannop rough small coal to the electricity works, at 10s. 3d. per ton delivered.

**London.**—**BATTERSEA.**—The B.C. has decided to renew its contract for the supply of cables, &c., with Callender's Cable and Construction Co., Ltd., for a further period of one year.

**River Plate.**—The *Review of the River Plate* says that the Minister of War has contracted with Messrs. Siemens-Schuckert for the supply of five portable wireless telegraph outfits, at a cost of \$15,312 gold. These are to be supplied to the troops operating in the Chaco.

**Rochdale.**—The contract for wiring, &c., of the Art Gallery extension for electric lighting has been placed with the Rochdale Electric Co.

**Rotherham.**—The tender of the British Westinghouse Manufacturing Co., Ltd., at £1,405, has been accepted by the T.C. for a 500-KW. rotary converter, transformer and switchgear plant, for the electricity station; also the tender of the R.E.T. Construction Co., Ltd., for the supply of three railless cars, at £725 each. The following tenders have also been accepted for supplies of tramway and trolley vehicle materials up to March 31st next :—

J. Russell & Son.—Steel poles.  
Naylor Bros.—Bracket arms.  
British Insulated and Helsby Cables, Ltd.—Trolley wire.

**Sheffield.**—The following tenders have been accepted by the T.C. :—

Guest, Keen & Nettlefolds, Ltd.—40 tons of wrought-iron tramway tie-bars, £420.  
Cecil Walton.—Dismantling existing coal and ash conveyors at Kelham Island power station, and erecting in lieu thereof new coal and ash elevators and conveyors, £2,950.  
A. Reyrolle & Co., Ltd.—Extra-high-tension switchboard at Neepsend power station, £6,447.

**Stoke-on-Trent.**—The Corporation has placed an order for "Bennis" stokers and self-cleaning compressed-air furnaces, for the electricity station, Hanley, with Messrs. Ed. Bennis and Co., Ltd.

**Watford.**—The U.D.C. has accepted the tenders of the British Westinghouse Co. and Messrs. Ferranti, Ltd., for 12 months' supply of meters on their schedules of prices.

**Wimbledon.**—The T.C. Watch Committee has decided to accept the tender of the Gamewell Fire Alarm and Police Telegraph Co., at £1,098, to install their fire-alarm system in the borough; and instructions have been given the Town Clerk to ascertain from the Post Office London Telephone Department the terms upon which the Department would grant to the Council the use of cables (joint or separate) for the system and maintain it.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued :—

Monday, February 19th.—"A" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Tuesday, February 20th.—"B" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Thursday, February 22nd.—"C" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Friday, February 23rd.—"D" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

A special mobilization week-end run will take place at Fort Coalhouse in conjunction with the R.G.A. This run will be continuous until dawn on 25th. The party for this run will parade at Fenchurch Street Station (L.T. and S. Railway) at 3.10 p.m. for the 3.25 p.m. train, sharp. Dress: Service dress, putties, greatcoats, belts and haversacks; no arms will be taken.

Saturday, February 24th.—The second relief will parade at the same time and place for the run.

(Signed) P. H. CAMPBELL, Capt. and Adjt.,  
For Officer commanding L.E.E.

## FORTHCOMING EVENTS.

**Electrical Engineers' Ball.**—To-night, Hotel Cecil.

**Institution of Mechanical Engineers.**—Friday, February 16th. At 8 p.m. Annual general meeting.

**Institution of Electrical Engineers (Yorkshire Local Section).**—Friday, February 16th. Annual dinner.

**Institution of Electrical Engineers (Scottish Students' Section).**—Friday, February 16th. At 8 p.m. At the Technical College, Glasgow. Paper on "The Application of Electricity to Paper-Making," by Mr. N. M'Phee.

**Junior Institution of Engineers.**—Saturday, February 17th. At 6.30 for 7 p.m. At the Hotel Cecil, London, W.C. Annual dinner.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, February 19th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Automatic Isolation of Faults on High-Tension A.C. Systems," by Mr. J. G. Craven.

**Illuminating Engineering Society.**—Tuesday, February 20th. At the Royal Society of Arts, John Street, Adelphi, London. Discussion on "Shop Lighting," to be opened by Messrs. N. W. Pragnell and A. E. Broadberry.

**Institution of Electrical Engineers (London).**—Thursday, February 22nd. At 8 p.m. Paper on "The Supply and Transmission of Power in Self-contained Road Vehicles and Locomotives," by Messrs. J. C. Macfarlane and H. Burge.

**Institution of Electrical Engineers (Manchester Local Section).**—Friday, February 23rd. Annual dinner.

**Royal Institution.**—Friday, February 23rd. At 9 p.m. Discourse on "The Gyrostatic Compass and Practical Applications of Gyrostats," by Mr. G. K. B. Elphinstone.

Saturday, February 24th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture I.)

**Physical Society.**—Friday, February 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Accurate Comparison of Quantities of Radium," by Prof. E. Rutherford and Mr. Chadwick; "The Absorption of the  $\gamma$ -rays by Gases," by Mr. Chadwick; and "On Wave-form Sifters for Alternating Currents," by Mr. A. Campbell.

## NOTES.

**The General Electric Co.'s Annual Dinner.**—On Saturday last, the twenty-first annual dinner of the General Electric Co., Ltd., was held at the Trocadero; the chairman of the company (Mr. H. Hirst) presided, and covers were laid for over 500 guests and members of the staff, who foregathered from all parts of the country. Among the guests were many well-known public men, representatives of the Colonies, of law, science and industry, and many consulting engineers and central station engineers.

After the customary loyal toasts, the chairman proposed "Engineering Science and Industry." He expressed his sense of the responsibility imposed upon him by the loss of the late Mr. G. Byng, and eulogised the great business capacity of the founder of the company, who for 13 years had fought against disease until the end came last year. During that time it had devolved upon the speaker to carry on the business of the company, and to establish various new works and branches, both at home and abroad; if he had succeeded, his success was due to the support always received from Mr. Byng, who at all times, ill or well, kept in close touch with affairs. He regretted the absence, through illness, of Mr. Ferranti, who was to have responded to the toast, and recalled the days when the business was established, the only central station then existing being that run by Mr. Ferranti at Grosvenor Gallery. The development of that great company from small beginnings would not have been possible without the aid of a most loyal staff, most of the important positions on which, he was proud to say, were filled by men who had started with the company at 10s. a week, and were now receiving from £500 to £2,000. At times they had been hampered by the difficulty of finding men capable of filling high administrative posts, especially those abroad; the staff of necessity had to specialise, and thus lost the broadness of mind required in positions of this kind. Why could they not induce men of superior ability and education to enter business instead of the learned professions? They only tried business when all other resources failed. He was willing to pay premiums to University men who would allow themselves to be trained for high positions, which would be well remunerated. The predominant question in the minds of statesmen was the fight for the world's markets, which called for leaders of the highest ability. Such men were drawn from the Universities of Oxford and Cambridge, where they received exactly the training that was required in modern business. Trade was no longer a matter of huckstering: it had been transformed by modern methods, and "Captains of industry" must be men of many qualifications—readers of character, capable of leading men, equipped with knowledge of modern arts and sciences. The company had sent 50 men abroad during the last few years—men who had been trained by the company, but who would have been all the better for a broader education. If other nations attracted the best brains to commerce, so must we. To-day the greatness of the country depended upon the leaders of industry; the Universities ought to supply such men, and to imbue them with a sense of the dignity of their calling.

Prof. Perry, responding to the toast, referred to the wonderful progress that had been made by the company, and was glad to learn that so many had risen to eminence in the business with a humble start. But the poor office boy, he said, had the very worst kind of education for his calling; he was taught everything that was unessential, but the essential things were neglected. He ought to be able to write a letter in English, to do mensuration, and to know something about physical science. Above all, he ought to be



fond of reading—then he would educate himself as long as he lived. The fault lay with the primary schools, whose deficiencies had to be made good by the evening-class teachers, wasting years that should have been more profitably employed. He believed that the average man was just as clever as the man who was reputed clever, but that our methods of teaching were not adapted to the average man. Fortunately other countries were even worse than this; the safety of the English boy lay in going in for sports so that he did not become dulled, but remained an individual, not a machine. Reform in educational methods was urgently needed. Sir Edward H. Holden also responded, and warmly defended the boy from the Council school, who, if encouraged to study, could beat the University man. The company's staff consisted of Council school boys; he thought it would not have attained the same degree of success if it had depended upon University men. Mr. Walter, K.C., said the question raised by Mr. Hirst was one of paramount importance to the country. The fault lay in the fact that teachers were not properly trained for their profession, and were poorly paid, so that they could not be expected to be enthusiastic in their work. The scholarship system was another grave mistake. He agreed with the Chairman as to the necessity of keeping business methods abreast of modern scientific progress.

Mr. E. G. Byng, vice-chairman of the company, proposed "Parliaments of Empire"; now for the first time representing his father's name and family, he acknowledged the burden of responsibility which rested upon his shoulders, and asked the friends of his father and the G.E. Co. to be lenient to his faults. Mr. Hirst, as chairman, was the right man in the right place, and he assured him, on behalf of himself and his brothers, that it was their determination to work under him with loyalty. He hoped that the House of Lords, a house stabbed to the heart, would yet recover. The House of Commons had passed many excellent measures—the Insurance Act, Employers' Liability, Workmen's Compensation, &c.; in fact, it had protected everything except industry! Perhaps its turn would come soon. (It would be unfilial, he said, not to mention Protection once). Referring to the 42 Parliaments of Empire, he pointed out that Sir J. Taverner (Agent-General for Victoria) was present, who was the first man to provide a permanent home in London for an Overseas Dominion; that would soon be followed by the great Australian building in Aldwych. In responding, Sir W. Bull said he hoped Mr. Byng would eventually represent the G.E. Co. in Parliament, and that one day there would be a Pan-Britannic Parliament sitting in Westminster Hall to consider matters of Imperial interest. Sir J. Taverner agreed with Sir W. Bull, holding that the British Parliament was clogged with work, to the detriment of the welfare of the Empire. The time was ripe for the establishment of an Imperial Parliament with Empire representation.

Mr. M. J. Railing proposed "Success to Imperial Trade," remarking that modern methods of communication had made the world one great market; had they always risen to the opportunities offered to them? Increased output meant cheaper cost of production and better competition, and if they made use of their opportunities they had as great advantages as any country in the world. He looked forward to the establishment of one Imperial patent law, one company law, one system of weights and measures, and one code of standards throughout the Empire. Sir George H. Reid (High Commissioner of the Commonwealth Government) responded, and expressed his sympathy with the average boy, having been one himself. The children of England, he said, had never had half a chance; they would have to be more efficient than their ancestors, for modern industry was a kind of warfare. Every man could do something for the Empire now, without waiting for an Imperial Parliament; let everyone give a real preference to his own country—no Act of Parliament was needed for that. Let them set an Imperial brand on the manufactures of the Empire—"Made in the British Empire," not "Made in Germany." Lieut.-General Sir J. Bevan Edwards, also responding, said the Royal Colonial Institute had formed a special committee to deal with Imperial trade, and Mr. Ellis T. Powell said that the suggestion that a chair of Empire Trade should be founded at London University had been favourably received by the authorities.

Lastly, Mr. Faithfull Begg proposed the health of the chairman, to whom, he said, the success of the company was due in a pre-eminent degree; his energy ensured the success of everything he tackled. The toast was honoured with great enthusiasm, and the Chairman, after expressing his acknowledgments, toasted "The Staff." After the conclusion of the speeches, a concert took place, an excellent programme having been arranged, and the gathering did not break up until a late hour.

Every guest received a copy of the *Magnet Magazine*, the new journal of the General Electric Co., Ltd., to which we refer under "Book Notices."

### Dublin Electrical Contractors' Association Dinner.

—On Saturday the members of this Association entertained a numerous company at dinner in the Hibernian Hotel. The President, Mr. T. E. Brunker, occupied the chair. The loyal toast was accorded musical honours. The president proposed the "Institution of Electrical Engineers," and Messrs. Pilditch and Tatlow responded. Mr. Tatlow spoke of the close connection between electrical contractors and the Institution, and of the attention the Institution had given to wiring regulations, which varied with different insurance companies.

The president proposed "The Institution of Civil Engineers, the Royal Institute of Architects, and the Engineering and Scientific Association." Mr. G. M. Ross responded for the Institution of Civil Engineers, Messrs. Ashworth and Owen for the Royal Institute, of

Architects, and Messrs. Miller and Porte for the Engineering and Scientific Association.

Being constantly in touch with electrical contractors, Mr. Porte was able to speak of their high personal qualities. He proposed "The Health of the President" (Mr. Brunker). The president in returning thanks said that the object of the Association was to see that the best possible electrical work was done for the public. The members wished to do away with the "jerry contractor." They also wished the workmen employed to receive adequate wages. They were anxious for genuine, respectable electrical contractors to become members of their Association. In his opinion it was one worthy of the support of all central station engineers, and of all consulting engineers.

Mr. Richey proposed "The Health of the Honorary Secretary to the Association" (Mr. C. Howard Egan). Mr. Egan, in his reply, spoke of contractors who carried out work (often very well) at ridiculously low prices without any profit, and who consequently "died out" in a few years. He thought it should be impressed upon all present that the members of the Association were combined for the good of the public. He hoped that any outstanding contractors of note would join the Association.

The President proposed "Our Guests." Mr. Ruddle responded to the toast. He emphasised the importance of sound electrical work, and the danger arising from imperfection.

Capt. Purcell, Chief of the Dublin Fire Brigade, said he was directly interested in the operations of the Association. Speaking from experience—largely gained from visits to America—he said that very often disastrous fires were caused by electricity. He had seen methods for distributing electricity in America which would shock the members of the Association. There was certainly no regard for human life in America. Members of his own profession had on many occasions lost their lives at fires for the simple reason that in many cities in America high-tension wires were run overhead in bunches mingled with other wires. Moreover, when artisans were dealing with telephone or telegraph wires, they sometimes came in contact with these high-tension wires, and were killed in full view of the people in the street below. That was all due to the desire for "rush" and cheapness. He was glad to say that the Board of Trade and other people concerned in this country had laid down rules which had in a great measure prevented such accidents, the high-tension wires being laid underground. Dublin was singularly free from such accidents, and from fires due to electrical causes, and he had always attributed this to the careful supervision of the Corporation and to their not giving current to any establishment until the wiring and fittings had been thoroughly tested. He had also predicted that as the use of electricity became more common, people would grow foolhardy and careless, and as a consequence the proprietors of establishments would engage handy men to make extensions to their electrical systems and to put an additional load upon a circuit that it was not intended to bear. The result was that the fuses would possibly blow, and then the handy men would procure the nearest piece of ordinary wire and make a connection—and the fire brigade would come in last. He had always held that electric lighting was the safest of all means of lighting when properly installed, but that it was the most dangerous of all means of lighting when improperly installed. When speaking to proprietors of establishments upon the matter his advice to them had always been: "First get a proper specification for the work from a qualified consulting engineer; next get a reliable contractor, pay a proper price; don't take a cheap contractor. Take a man you can rely upon to do thoroughly honest work. If the work is done in a cheap fashion you have wires that are not capable of carrying the current, and you never know where you are. You have a terrible danger lurking within your house." He was sorry to say that his prediction as to carelessness in the use of electricity was to some extent coming true. During the past year in Dublin there had been eight fires which had been proved beyond all doubt to be due to electrical defects. In one case, a man admitted it was owing to the fact that some friends had pressed him to give the work to some poor fellow who would do it cheaply. Of course, the insurance company paid, but, all the same, the man's business suffered. It was for such reasons as these that he (Captain Purcell) wished genuine electrical contractors to get the work.

**Institution and Lecture Notes.**—INSTITUTION OF MECHANICAL ENGINEERS.—The annual report of the Council, to be submitted to the members to-day, states that the total membership at December 31st, 1911, was 5,828, an increase of 128. The revenue for the year was £15,922, and the expenditure £12,295, leaving a balance of £3,123 (with £504 carried to capital account). The total assets were £108,896, and after deducting debentures, the capital was £60,632. Extensions of the Institution building are in progress. A benevolent fund is being established under the Companies' Consolidation Act as a company limited by guarantee, with a nucleus of 1,000 £1 shares in Messrs. W. H. Allen, Son and Co., Ltd., presented for the purpose by Mr. W. H. Allen. The Council has had under consideration the question of holding entrance examinations for the younger applicants for admission, and has decided in favour of this course, subject to the approval of the members; the examinations of certain educational authorities being accepted as equivalent to, and exempting from, the Institution examination. The next summer meeting will be held in Belfast.

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON STUDENTS).—The annual dinner of the Students' Section will be held at the Trocadero on Saturday, March 16th.

INSTITUTION OF ELECTRICAL ENGINEERS.—Prior to the holding of the last ordinary meeting on February 8th, the President



announced that with a view to bringing the Provincial members into closer touch with headquarters, the Council had decided to hold summer meetings at the local centres, and that the first will be held this year at Glasgow, commencing on June 12th and terminating on June 14th. Arrangements are being made by which in addition to the reading of papers, visits will be paid to works, &c. It was also announced that Mr. Spagnoletti had been elected an honorary member of the Institution.

**NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.**—Mr. W. Gilbert read a paper on "Radiotelegraphic Detectors" before the above Society on February 9th, which was much appreciated.

At a meeting held in Edinburgh, on February 3rd, of the Scottish branches of the NATIONAL ASSOCIATION OF COLLIERY MANAGERS and the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, Mr. Robert Nelson, H.M. Electrical Inspector of Mines, replied at considerable length to the criticisms passed on his paper, "Electricity in Mines; the Avoidance of Accidents." He said that his idea in the paper had been to show that safety in electrical apparatus for use in mining was to be secured, first, by protectively surrounding all live parts with insulating material, and, secondly, by protecting that insulating material from mechanical damage by means of an earthed metallic outer covering. There was apparently universal agreement amongst the critics so far as the first contention was concerned, and the real difference of opinion seemed to be as regards his second argument. Earthing was only a safeguard when insulation had failed. Mr. G. L. Kerr, of Glasgow, had made a statement which was palpably wrong. He had asserted that there had been a big increase in the number of armoured cables, owing to the pressure of the Home Office, and that, in consequence of that pressure, a great many managers had substituted armoured for unarmoured cables. He would like to ask Mr. Kerr when, and in what way, the pressure was exercised, and whether any person had substituted armoured for unarmoured cables unconvinced of the superiority of the former. Mr. Kerr had also said that the result of these ill-considered regulations, if passed into law, would be to prohibit the use of electricity in a very large number of mines in Great Britain, and they would undoubtedly bear very hardly on many colliery undertakings; so far as he was aware, however, no person had ventured upon a detailed criticism of the regulations. Mr. G. L. Kerr, in a brief explanatory statement, said he adhered to his opinion that the Home Office had been forcing the use of armoured cables into collieries, and, personally, he knew of cases where armoured cables had been put in through the pressure of mines inspectors and much against the wishes of the management. He was glad to be able to congratulate Mr. Nelson and the Home Office on the regulations as now framed for adoption.

A paper was read by Mr. C. A. Carlow, Fife Coal Co., on "Lessons to be Learned from the Electrical Mining Accidents in Scotland in 1910." Mr. Carlow said that they had in Fife alone at least 1,000 motors running in connection with collieries. The Fife Coal Co. had 65 coal-cutting machines, cutting 660,000 tons in the year.

**INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE LOCAL SECTION).**—The meeting announced to be held at Leeds University, on the 14th inst., was unavoidably postponed.

**SOCIETY OF ENGINEERS.**—The Council may award in 1912 two premiums, to the value of £8 8s. and £4 4s., for approved essays on the subject of "How to Improve the Status of Engineers and Engineering, with special reference to Consulting Engineers." The competition is open to all, but application for detailed particulars should be made to the Secretary before entering. The last date for receiving essays is May 31st, 1912.

**JUNIOR INSTITUTION OF ENGINEERS.**—A handy little booklet has just been issued by this progressive Institution, dealing with "Its Origin and Aims," and makes interesting reading. It may be obtained free from the Secretary, 39, Victoria Street, Westminster, London, S.W.

**Metropolitan Association of Electric Tramways Managers.**—A meeting of this Association was held at the Municipal and County Club, Whitehall Court, S.W., on Friday, 9th inst., when the following were present: Messrs. A. H. Stanley, managing director, London Electric Railways and London United Tramways, chairman of the Association; H. E. Blain, West Ham; H. L. Howard, Barking; W. E. Hammond, Metropolitan Electric; A. V. Mason, South Metropolitan; Z. A. Knapp, London United; and T. B. Goodyer, Croydon, hon. secretary. Letters of regret at their inability to be present were received from Messrs. A. Coveney (Erith), W. Murray (Walthamstow), W. C. Ullmann (East Ham), F. Scofield (Leyton), and S. Dudman (Dartford).

**The Koss Water-Railway.**—Experiments have recently been made on the Dortmund-Ems Canal, in the presence of representatives of the German Government and Industry, with a new towing scheme which, it is claimed, is destined to revolutionise the service on inland waterways. Its inventor, Baurat Koss, a member of the Canal Administration, considers that he has succeeded not only in eliminating all the drawbacks of towing in its present form, but in greatly increasing its efficiency. The water-railway is a series of barges with wheels, compelled to move on a rail. But while the driving wheels of a railway train are intended to propel the train by the friction due to its weight and the resulting adhesion on the rails, the water-railway, in the absence of adhesive friction, requires artificial friction. This is produced by causing the wheels fixed to the bottom of the tug-boat to lift to about  $\frac{1}{2}$  to 1 m. height an iron rail lying at the bottom of the canal. The moorings of this rail are such as to allow of its being readily lifted beyond the surface of the water (*e.g.*, for the sake of inspection and repair) without loosening any joint. On the other hand, they prevent any objectionable displacement in a horizontal direction. On account of the stable equilibrium of the tug-boat, the water-railway,

unlike ordinary land railways, obviously requires only a single rail supporting the four wheels fixed below the bottom of the tug-boat. These wheels, actuated from the latter, may be said to draw the rail along between them, like the rolls of a rolling mill. In fact, the rail, as it were, is threaded into the wheels, and on the passage of the tug-boat, performs an undulating motion, its adhesion to the wheels setting the train of barges in motion, like an ordinary railway train propelled by its driving wheels. This propulsion along a substantial rail (in lieu of a screw propeller) is said to utilise three-quarters of the energy expended.

The water-railway thus is based on an entirely novel principle, viz., the lifting of a rail. Like so many other pioneers, the inventor had at first to contend against much prejudice. Nobody was inclined to believe that heavy iron rails could be lifted to a height of  $\frac{1}{2}$  to 1 metre by comparatively modest forces, and comprehensive preliminary tests were required to show the correctness of these views. A heavy iron rail of square cross-section, 80 metres in length, and 28 kg. in weight per metre, was found to be lifted by a quite moderate force (250-450 kg.) to heights variable between  $\frac{1}{2}$  and 2 metres. Further tests on rails of the smallest standard profile, weighing 6 kg. per metre, likewise gave encouraging results, bearing out in full Mr. Koss's theory.

The experimental tug-boat is arranged for electric propulsion, and derives its motive power provisionally through a cable, from the power boat of the canal equipped with a dynamo, which forms part of the train. However, the service eventually may be done by means of a trolley system, similar to that of an electric railway. In fact, part of the experimental section of the canal was fitted with a trolley wire stretched at a convenient height above its surface. The principle itself is of course quite independent of any special form of motive power; in fact, the tug-boat could as easily be driven by a Diesel motor or by any other means. Each of the barges is fitted with a brake, allowing the train to be quickly stopped by the aid of the rail, thus avoiding any collision between the barges.

The driving power is transmitted from the motor shaft, through pinions, to four vertical wheel axles, which, below the bottom of the tug-boat, are protected by an iron casing. The rail, as above stated, passes through the four wheels embracing it; the towing cable is likewise fixed to the iron casing. A hand-wheel allows the rail to be dropped clear of the tug-boat; after having then been detached from the train, the boat, fitted with a small screw propeller, may proceed without the aid of the rail, to any other canal section.

**For Sale.**—Messrs. Barker & Co. (Coachbuilders), Ltd., have for sale a complete generating plant suitable for works or country mansion. The Birmingham City Tramways Committee have for disposal the whole of the machinery and plant at the Bournbrook generating station. The goodwill and business of the Langdon-Davies Motor Co., Ltd., are being offered for sale as a going concern. The Oldham Co-operative Society, Ltd., have certain boilers, steam and gas engines and dynamos, &c., for sale. See our advertisement pages to-day.

**Appointments Vacant.**—The consulting engineers to the Bombay Hydro-Electric Power Transmission scheme (Messrs. A. Dickinson & Co., of Birmingham) are advertising for an engineer to superintend the construction and erection of a three-phase 100,000-volt transmission line 45 miles long; two divisional superintending engineers; one divisional superintending engineer with special experience in the erection of towers over navigable tidal creek and transmission towers 160 ft. high, creek 9,000 ft. wide; also three erectors.

A Professor of Electrical Engineering is wanted for the Manchester Municipal School of Technology (£600); electrical engineer for the Willesden U.D.C. (£300). See our advertisement pages to-day.

**The I.M.E.A. Convention, 1912.**—A preliminary programme of this Convention, which is to be held at Harrogate on June 18th, 19th, 20th and 21st next, has been issued.

Following the official proceedings and presidential address on the opening day (Tuesday), a discussion will be initiated by Mr. Frank Ayton (Ipswich) on "Means for securing reliability and maintaining continuity of electricity supply," and after luncheon Mr. F. M. Long (Norwich) will open a discussion on "A cooking load from the supply station point of view." In the evening a reception and concert will be held by the Mayor and Mayoress of Harrogate.

On the second day the party is to visit Leeds, where an official welcome will await it; and subsequently papers will be read by Mr. S. L. Pearce (Manchester) on "Limitations of Profit from Municipal Trading," and by Mr. R. A. Chattock (Birmingham) on "Organisation in Electric Supply Undertakings." The afternoon is to be devoted to visits to works, and in the evening the annual dinner will be held at headquarters—the Majestic Hotel, Harrogate.

The third day commences with a journey to Middlesbrough, where Mr. S. J. Watson (Bury) will open a discussion on "Automatic Pressure Regulation," and visits to local works are projected for the afternoon. An alternative visit to York is also being arranged on this day chiefly for the ladies.

The morning of the last day (Friday) is to be devoted to the annual general meeting, while the afternoon is given up to an excursion to Ripon, Studley Royal and Fountains Abbey.

This programme is subject to alteration except as to date; ladies, it may be noted, are now invited to the annual dinner.

It will be noticed by our readers that only a week end intervenes between the summer meeting of the Institution of Electrical Engineers to be held at Glasgow on June 12th-14th inclusive, and the M.E.A. Convention.



## ELECTRIC POWER IN SOUTH-EAST KENT.

It will be within the knowledge of the majority of our readers that south-eastern Kent has lately sprung into industrial prominence by reason of the vigorous development on a large scale of the extensive coal measures which have been proved to exist in that locality.



THE TILMANSTONE POWER HOUSE, WITH ADJACENT COLLIERY WINDING-ENGINE HOUSE.

The presence of coal beneath the Kentish chalk has, of course, been surmised for many years, but no particular importance was attached to this coalfield until after 1906. Since that year numerous syndicates have set to work to prove the coal area, and in the country lying, roughly, between Dover, Sandwich and Canterbury, it is on record that as a result of 12 borings, 96 seams of coal have been proved with an aggregate vertical thickness of 320 ft.; this corresponds to from 30 ft. to 60 ft. of coal per pit.



PLAN OF THE SOUTH-EAST KENT POWER CO.'S AREA, SHOWING THE POSITIONS OF THE VARIOUS COLLIERIES AND BORINGS AND THE TILMANSTONE POWER STATION.

The importance of this Kentish coal find, both as to quantity and quality, is not yet appreciated even in London, which at present pays so dearly for its fuel requirements. But it is not our purpose to refer at length to the question of the coal, except in so far as it has led to the introduction of electric power in south-east Kent.

In view of the great importance which attaches to electrical

methods of working in connection with modern mining operations, one of the first essentials in a new coalfield is a supply of electrical power available for preliminary operations.

This the East Kent Colliery Co. arranged to provide, and for this purpose erected an up-to-date power station at their Tilmanstone Colliery, where sinking operations have so far advanced that two shafts are down some 1,200 ft. and a third one 900 ft., while a very fine Markham winding engine has been installed.

On the transfer recently of the Kent Electric Power Co.'s electric supply powers for the area embraced between the River Stour on the north, as far as Canterbury, and due south from that city to Hythe on the coast, to the South-East Kent Electric Power Co.—a concern which is closely allied with the various colliery undertakings—the latter took over the Tilmanstone power station to form the nucleus of the much larger undertaking which will obviously be required to supply the electrical needs of the seven or eight collieries now projected in this area, and possibly of the coast towns of Folkestone, Dover, Walmer, Deal and Sandwich, which are also included. Mr. G. F. Metzger, whose connection with municipal electrical work, as chief engineer at Bath and later at Manchester, will be remembered by our readers, designed and supervised the whole of the work in connection with the power station and colliery at Tilmanstone, as consulting engineer to the East Kent Colliery Co., and is now engaged on the much larger project of the South-East Kent Electric Power Co., of which he has been appointed chief engineer.

Some idea of the ultimate scope of the S.E. Kent Co.'s operations may be gathered from the fact that designs are being prepared, under Mr. Metzger's supervision, for a larger power station, to be situated at either Sandwich or Snowdown (the site of one of the allied company's collieries), and to be

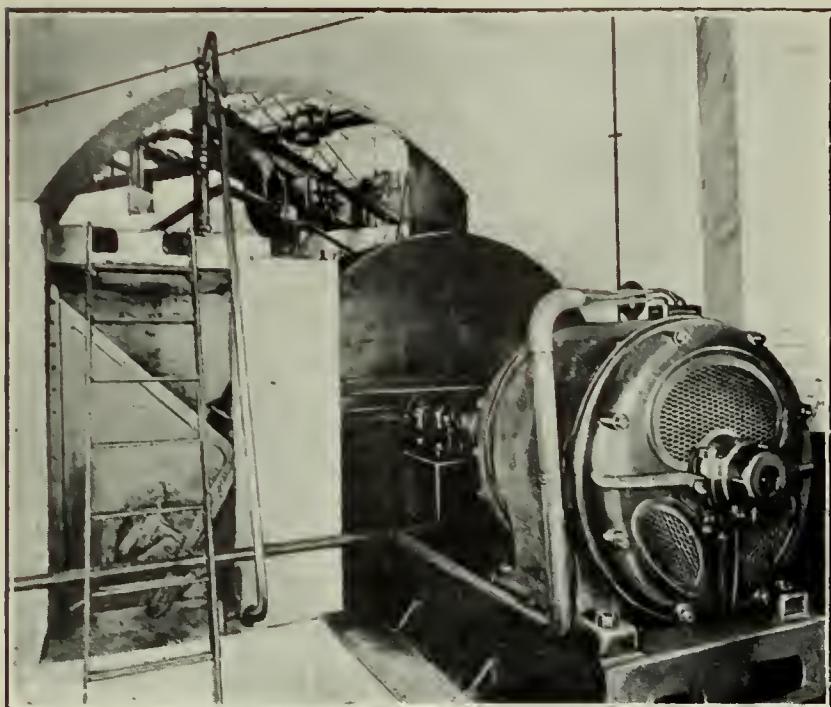


INTERIOR OF THE BOILER HOUSE.

capable of meeting demands estimated at upwards of 30,000 kw.

The power house has been substantially erected in red brick, and contains 1,400 kw. of modern turbine plant, boilers, &c., supplying three-phase current at 3,000 volts and 50 cycles, for sinking and pumping operations in one of the adjacent shafts.





ELECTRICALLY-DRIVEN INDUCED DRAUGHT PLANT.

It was constructed in record time, as the first sod was only cut on February 10th, 1911, and current was available five months afterwards.

Coal is brought direct to the powerhouse bunkers over the East Kent Light Railway, a line which will eventually connect to all the important collieries in the neighbourhood, and siding space has been arranged to accommodate ten trucks of coal.

The boiler house contains four Babcock & Wilcox land-type boilers in pairs: each boiler has 4,020 sq. ft. of heating surface, and is constructed for a working pressure of 200 lb. per sq. in., the steam being also superheated 150° by means of integral superheaters. The boilers are arranged for hand firing, and each is capable of evaporating 15,000 lb. of water per hour under normal conditions. The gases pass from the boilers through a Green economiser of 100 tubes arranged in two groups, with a small steam engine for actuating the scraper gear, and are drawn through one of two "Sirocco" induced-draught fans discharging through a 70 ft. x 5 ft. 6 in. diameter steel chimney.

The fans, which are used alternatively, are driven, the one by an Alley and McLellan engine, and the other by a 440-volt three-phase Westinghouse motor.

It may be well to mention here that Messrs. Babcock & Wilcox, in addition to supplying the boilers, &c., supplied the whole of the piping in both the boiler and turbine houses.

One of our views shows the steam pipe arrangement in the boiler house, which consists of 7-in. boiler branches

leading to a 10-in. header divided by valves into two sections, each of which supplies one turbine through a branch leading down to a steam separator beneath the turbine, the stop valve of which is supplied through a short rising pipe.

An auxiliary main supplies the fan and economiser engines and feed pumps, and the latter have an alternative connection to the main steam pipe.

Two Weir feed pumps, of a type used throughout the colliery for boiler feeding, are installed in the boiler house; each has a capacity of 5,100 gallons per hour, drawing water from the hot well and feeding alternatively through the economiser—the usual hot feed—or through a cold feed main direct, in case of repairs to the economiser or hot range.

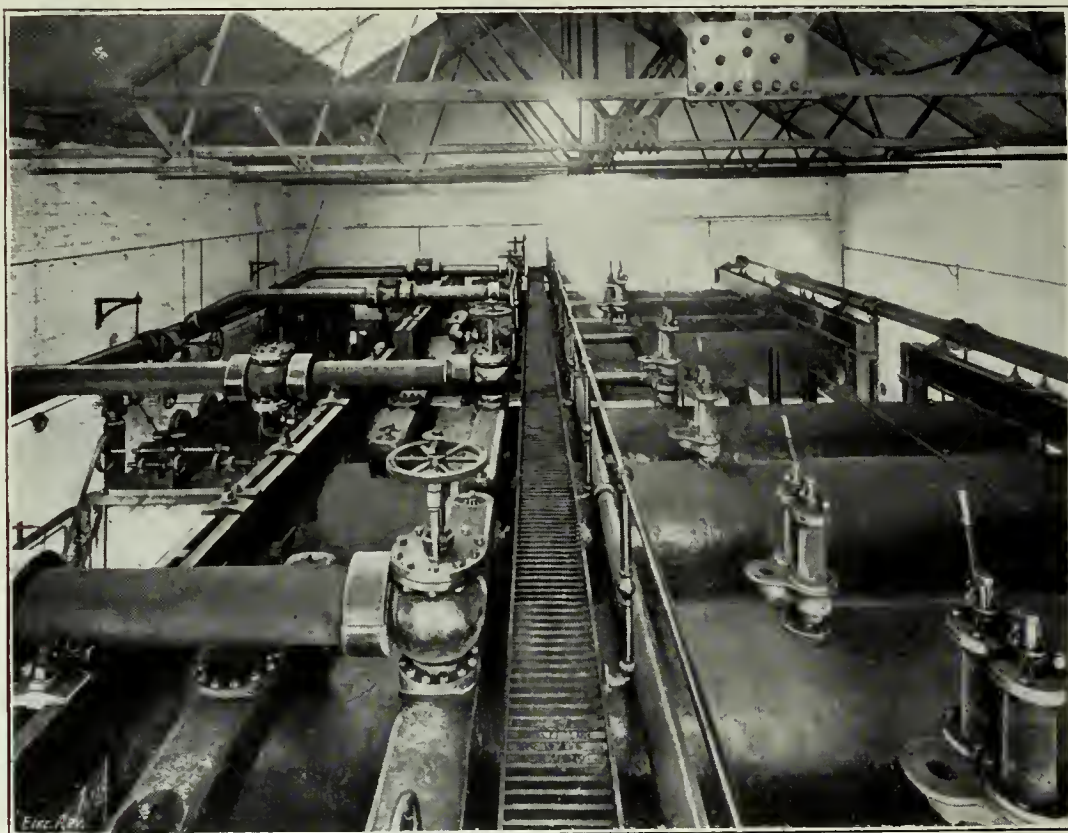
The steam and feed mains are of solid drawn piping with mild steel flanges riveted or screwed and expanded on. The firm's contract also included riveted steel atmospheric exhaust and cast-iron condensing water piping.

The whole of the water for condensing and boiler feeding comes from the adjoining pit, and as it is charged with salt and fine grit, it has been necessary to install a filtering plant for the water required for boiler feed

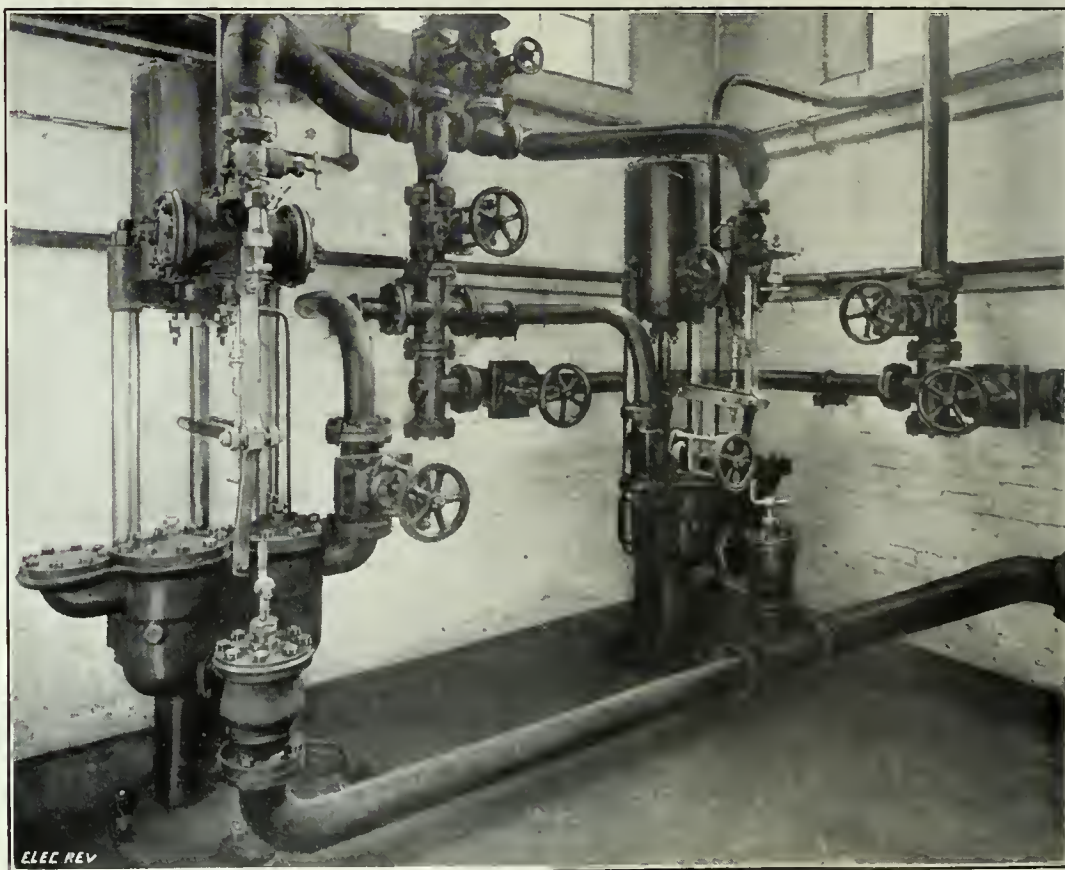
make-up, bearing circulation, &c.

The pit water gravitates from an adjoining reservoir through a Rake-type pressure filter, of Messrs. Mather and Platt's make, the filtered water being pumped up to an elevated storage tank situated 30 ft. above the filter base.

Alumino-ferric solution is added to the water entering the filter in order to coagulate the finely divided matter in suspension; the unfiltered water enters at the top of the filter—a riveted steel tank—and percolates through filtering material



VIEW OVER THE BOILERS, SHOWING STEAM PIPE ARRANGEMENT.



WEIR BOILER FEED PUMPS.



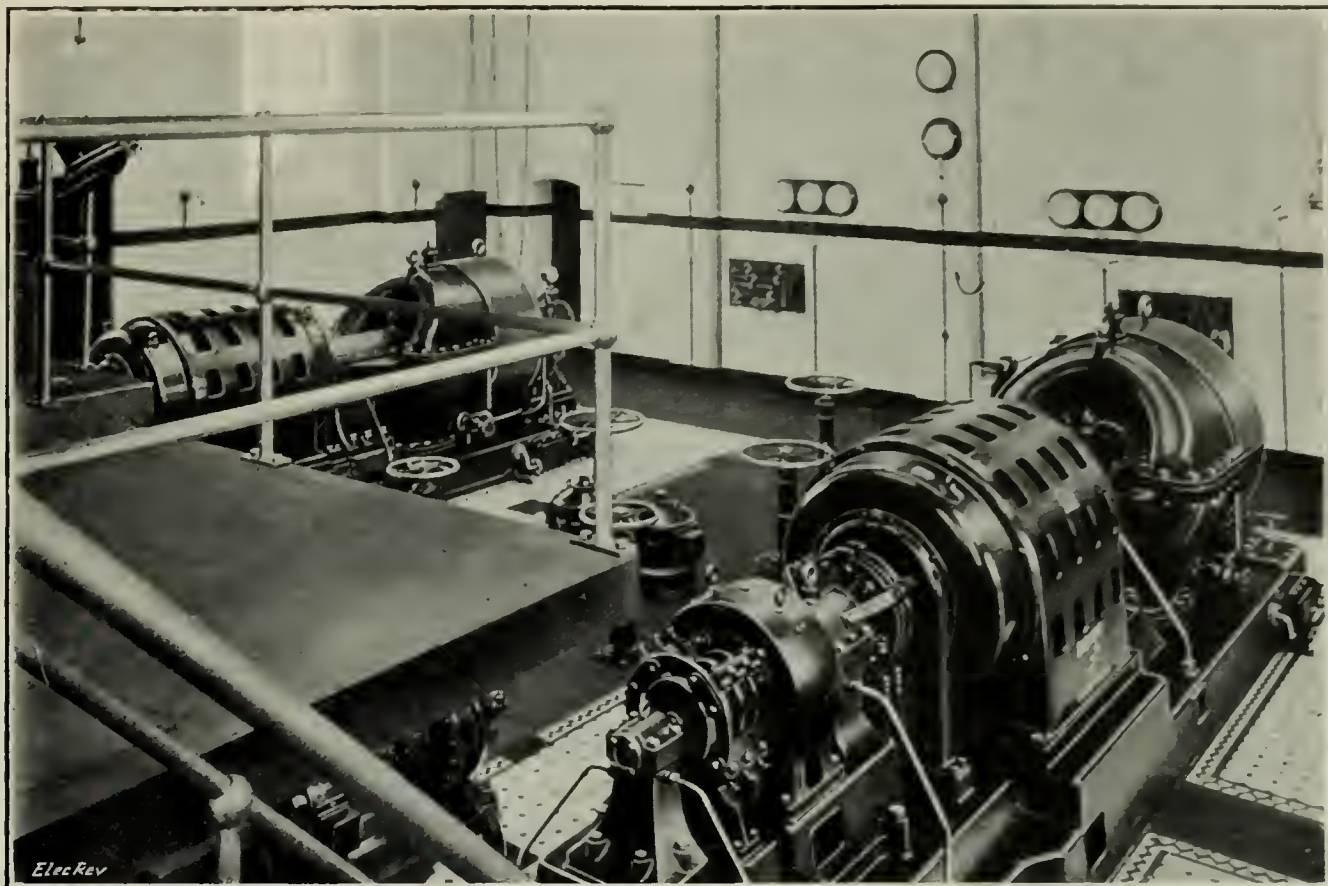
consisting of graded quartz crystals to a collecting chamber underneath, from which it passes to a 6-B.H.P. motor-driven turbine pump for delivery to the overhead tank. This filter, which has been found to be most effective in practice, is cleansed by simply passing filtered water through in the reverse direction.

Turning to the engine-room plant, the whole of which, we may note in passing, has been supplied by the British Westinghouse Co., there are installed two turbo-alternators, which were specified to give 1,000 kw. when running non-condensing and 1,200 kw. when working condensing.

The turbines are of the well-known Westinghouse impulse type, and are supplied with steam at 200 lb. per sq. in. pressure, and 150° superheat. The turbines normally operate condensing, but hand-operated nozzles are provided whereby, in case it should be necessary to shut down the condensing plant for any reason, extra steam may be admitted to the turbines to enable them to carry their full load non-condensing. These same nozzles can also be used to negotiate a 25 per cent. overload under normal condensing conditions. The alternators generate three-phase current at

The exciters are direct driven. A view on page 264 shows the steam end of a turbine, seen at the far end of the turbine room.

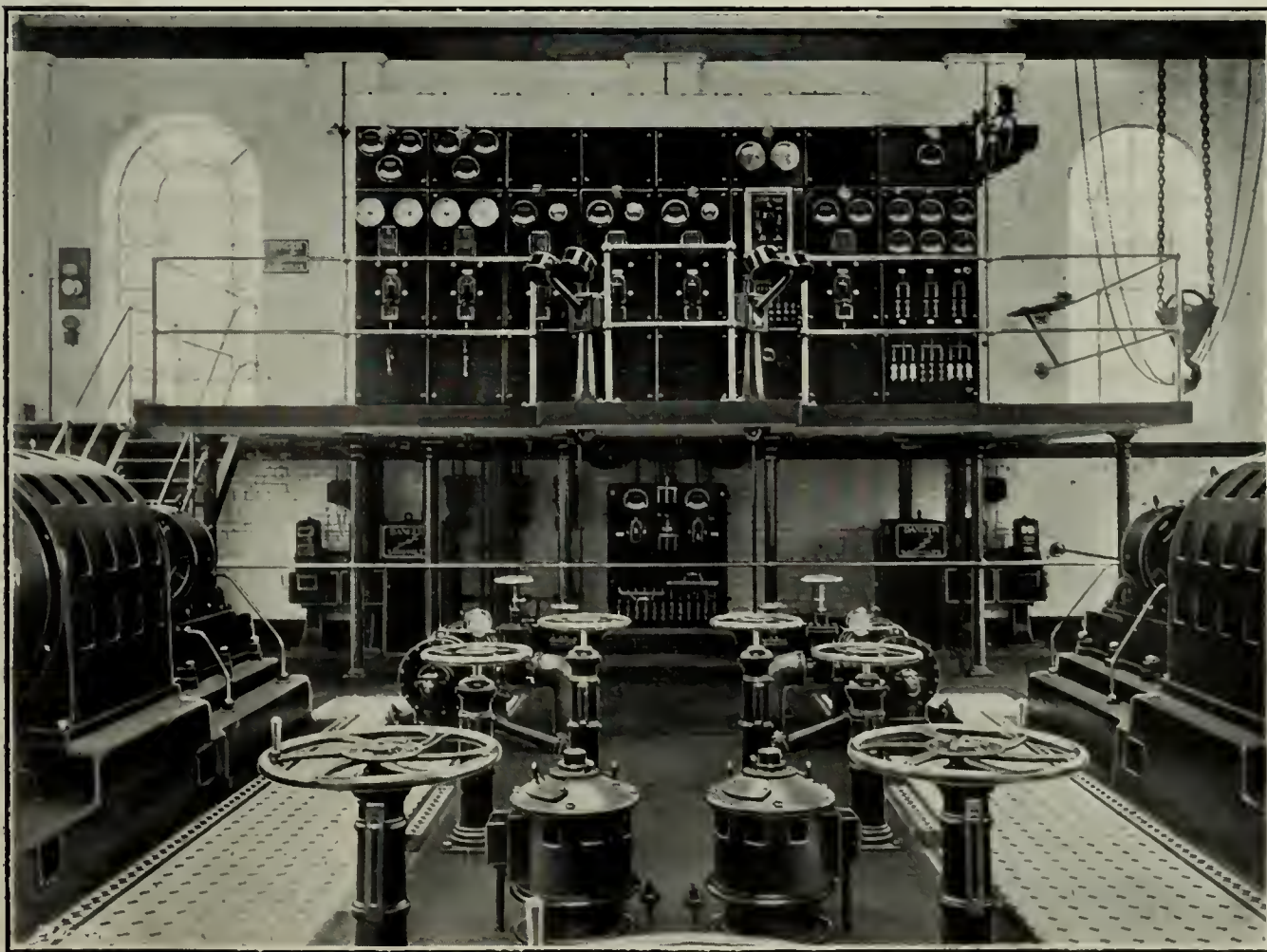
The two condensers are located directly under the turbines,



WESTINGHOUSE TURBINE PLANT IN THE ENGINE ROOM.

and are of the surface type, having a cooling surface of 3,440 sq. ft., which was specified to be larger than the standard practice, owing to the bad condition of the circulating water, and also the special conditions of working mentioned later. These condensers are guaranteed to main-

tain a minimum vacuum of  $27\frac{1}{2}$  in. with the whole of the steam due to the full load of the turbine—namely, 16,500 lb. per hour—passing through them. This result is obtained with 1,200 gallons of condensing water at from 65° to 75° F. The condensed steam is returned to the hot-well tank for boiler feed purposes. A prominent feature in connection with this condensing plant is that water-circulating pumps have been eliminated from the installation. The circulating water is received from the pit pumps into the two reservoirs adjoining the power house, which each contain a storage of 40,000 gallons. It then passes through the condensers by gravity, and finally to waste. The dry vacuum pumps and the hot-well pumps are of the Westinghouse-Le-



VIEW OF THE MAIN SWITCHBOARD, SHOWING THE VALVE HAND WHEELS, PUMP MOTORS, AND AUXILIARY SWITCHGEAR UNDER GALLERY.

3,300 volts and 50 cycles, the speed being 3,000 R.P.M. These machines are of the revolving field type, and are of massive construction. One of our views, taken from the switchboard gallery, shows the turbo-sets very clearly.

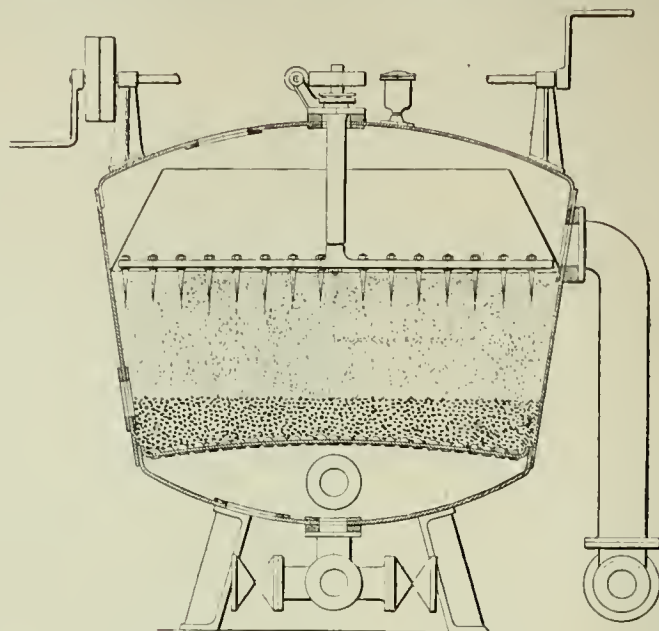
blanc type. The latter—one for each condenser—are located below the floor of the condenser pit, so that they may receive their water by gravity; whilst the dry air-pumps are motor driven and are located on the



engine-house floor level. The dry vacuum pumps are primed by gravity from the filtration tank, shown in the outside view, and are barely visible beyond the hand-wheels in the switchboard view. They are of the Leblanc rotary valveless type, and are designed to ensure the maintenance of the high vacuum specified. The water-extraction pumps are of the vertical-shaft centrifugal type, driven by two 6-B.H.P. Westinghouse enclosed vertical-shaft motors, visible in the foreground of our view, and driving the pumps 17 ft. below, through 2-in. hollow shafts supplied by the Weldless Steel Tube Co. A Hoffman thrust bearing is fitted beneath the motor, whilst the lateral stability of the shaft is ensured by three plummer blocks.

A Lea recorder is fitted between the water extraction pump

hinged condenser doors and handholes are provided at each end to facilitate rapid cleaning, whilst particular attention



SECTION OF PRESSURE FILTER.

has also been paid to making all valves readily accessible for grinding and adjustment.

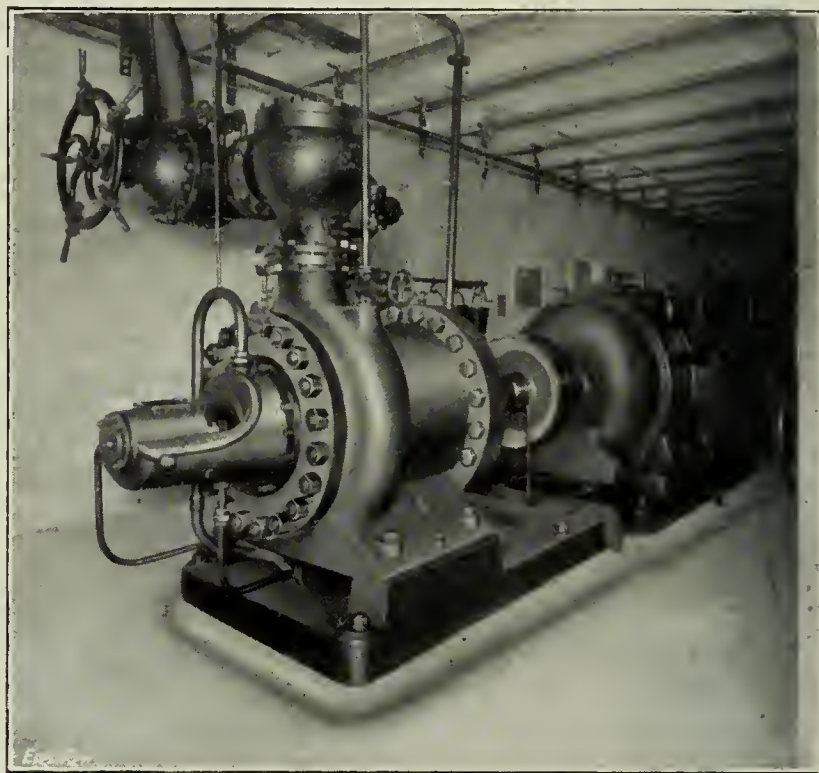


A.E.G. CELLULAR SWITCHBOARD IN PUMP ROOM.

discharges and the hotwell, the make-up being provided by the filtered water used for oil-cooling purposes.

The absence of piping above the turbine floor level was especially considered by the designer, and has been accomplished by bringing the connections from all the valves, bypasses, &c., to hand-wheels on the turbine floor, thus centralising the mechanical control of the plant at engine-house floor level.

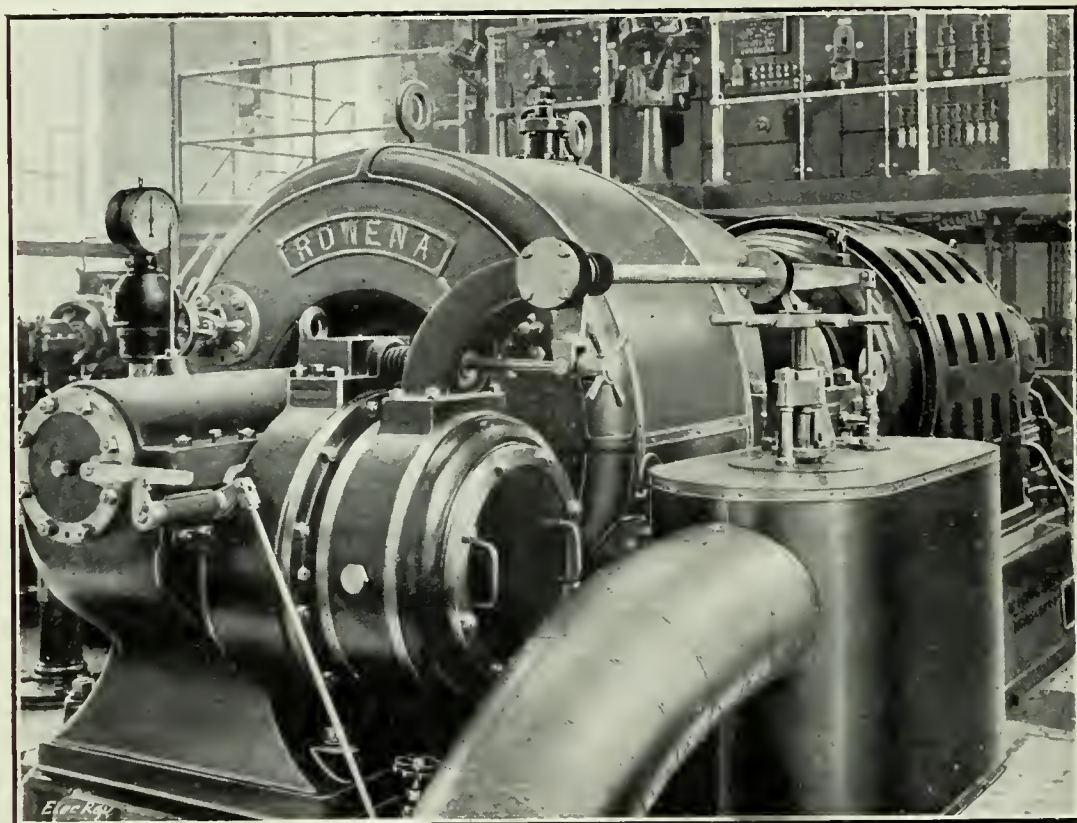
An exceedingly neat appearance is given to the engine house by this arrangement, without in any way congesting the hidden piping in the basement containing the condensers, which had to be fixed at a low level to secure the necessary head of water for allowing the water to flow through by gravity. The lay-out of the condenser pit is such that the condensers can be completely withdrawn from it for inspection and cleaning with a minimum of dismantling. Special



SULZER TURBINE PUMPS AT 660-FT. LEVEL.

There is a fully equipped 8-panel switchboard of black enamelled slate, controlling the turbo-alternators with their exciters, three out-going 3,300-volt feeders, two 50-kw. transformers, reducing the pressure from 3,300 to 440 volts for power purposes and to 220 volts for lighting, and six 50-ampere low-tension feeders, three for power and three for lighting. The generators account for two panels, the 3,300-volt feeders for three, and the transformers, low-tension feeders, and the Tirrill regulator for one each. The generators are protected by reverse-current relays and the high-tension feeders by overload time-limit relays. The switchboard panels are of cubical construction and are arranged so that each is self-contained and can be isolated for cleaning purposes and inspection without danger to the operator. The doors and main switches are interlocked in such a way that the former cannot be opened whilst current is passing through the panel connections. The switchboard is erected on a gallery and is shown on page 263.

The hand wheels controlling the generator rheostats are shown at each corner of the central cantilever extension of



VIEW OF THE STEAM END, WESTINGHOUSE TURBO-ALTERNATOR.



the switchboard gallery, and are positioned so that their operator has a clear view of the turbo sets. The two Westinghouse oil-cooled A.T.E. type transformers and the transformer switchboard will be seen under the main switchboard gallery, the switch pillars for controlling the hot-well and dry vacuum pumps being placed beside the transformers.

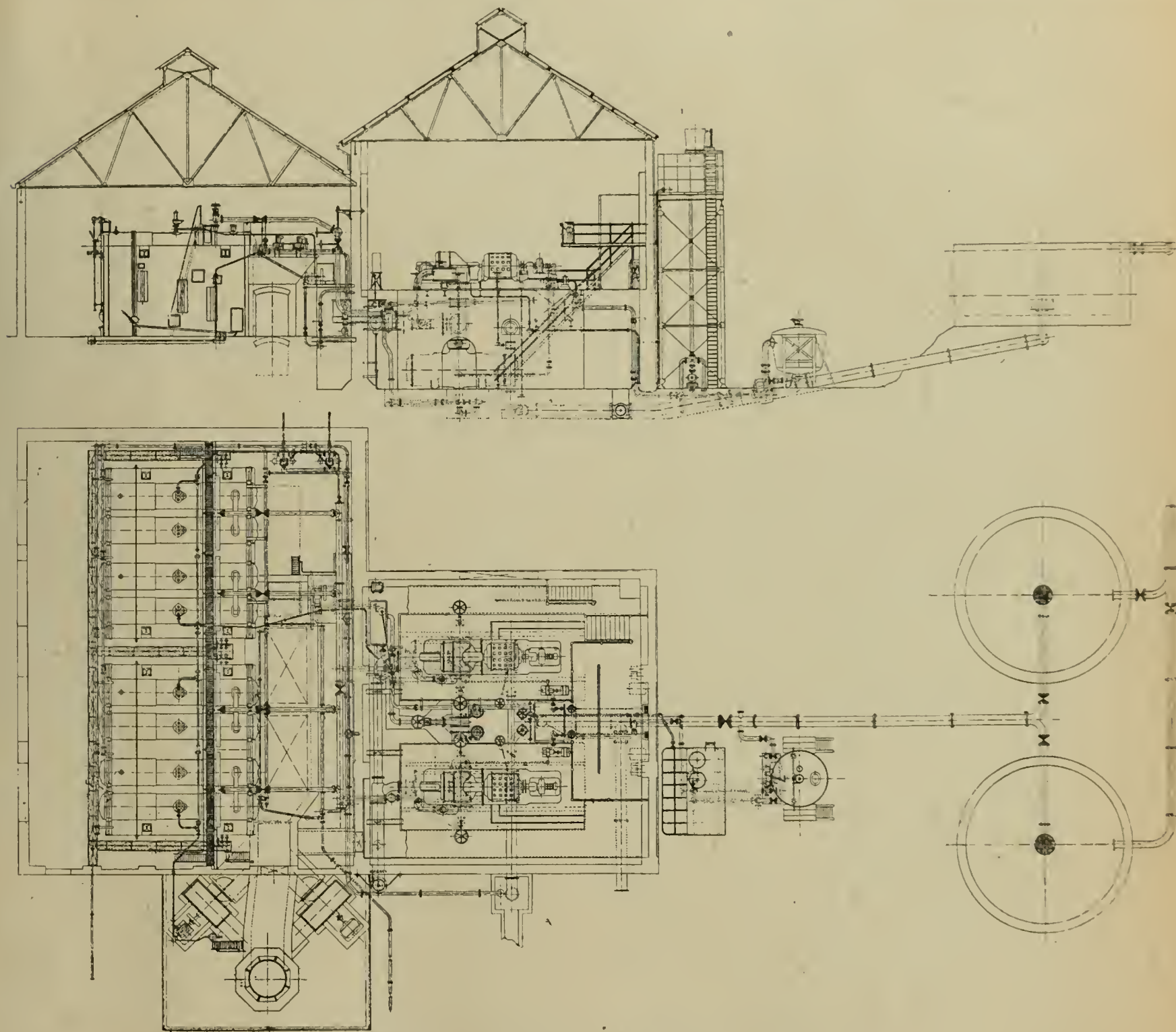
The high-tension cables and all the electrical connections to the switchboard are carried in troughs cut into the concrete floor of the turbine room, thus preserving a neat and workmanlike appearance for the whole equipment.

From the switchboard three feeders (by Messrs. Callender) are led to one of the shafts, where an extensive pumping installation is in use. Each feeder contains three 158 sq. in. cores, and is paper-insulated, vulcanised bitumen sheathed and single-wire armoured; it is laid solid to the pit brow,

They are driven by 3,000-volt A.E.G. water-cooled motors, having a continuous output of 500 B.H.P. at 1,500 R.P.M. The horizontal pumps are also of the Sulzer 6-stage type, designed to deliver 1,000 gallons per minute against a head of 1,300 ft. Although they are installed at the 660-ft. level (the numbers of impellers being reduced to suit this head), they will later be lowered to the 1,140-ft. level. These pumps are each direct-coupled to 3,000-volt A.E.G. enclosed ventilated induction motors, with a continuous rating of 680 B.H.P. at 1,500 R.P.M.

These motors are fitted with slip-ring rotor and brush raising and short-circuiting gear, and are started by means of liquid starters, provided with protective resistances.

The control of all the pumps is effected through a sheet-steel cellular switchboard by the A.E.G., installed in the 660-ft. inset pump room. There are three feeder panels for



SECTIONAL ELEVATION AND PLAN OF TILMANSTONE POWER STATION.

where it is coupled at a dividing box to a similar double wire armoured cable, which is carried down the shaft, supported by wooden cleats spaced 54 ft. apart, to an inset 660 ft. down.

A 10-pair telephone cable follows the same route, coupling up the power station and offices and the underground stations.

In the particular shaft to which we are referring, Sulzer four-stage vertical type sinking pumps were introduced to unwater the flooded portion of the shaft from the 660-ft. level to the 1,140-ft. level, the sinking pumps delivering water into a sump at the higher level, from which fixed horizontal pumps raise it to the pit bank.

The sinking pumps are each capable of delivering 1,200 gallons per minute against a maximum manometric head of 870 ft.

the shaft cables, one panel for each horizontal pump, and two panels for each sinking-pump motor.

The feeder panels are fitted with no-volt releases, pilot lamps and links for isolating the feeder oil switches.

The horizontal-pump motors are controlled by oil switches with overload and no-voltage release, the latter being interlocked with a liquid starter: this prevents the oil switch being closed unless the starter is in the starting position. One of the sinking-pump motor panels contains starting transformers, and the other the oil switch, isolating links, instrument transformers, &c. This oil switch is also provided with overload and no-volt release, the latter being interlocked with a starting transformer and emergency switch on the pump frame; owing to this interlocking, it is impossible to close the motor oil switch unless the starting transformer is in the starting position, and the motor can in



case of emergency be stopped simultaneously by the emergency switch, which trips the main oil switch.

Two panels are provided for motor "drying out;" one contains a 150-K.V.A. step-down transformer with L.T.appings, and the other the necessary switchgear. This arrangement enables a motor which has been idle for some time, or submerged, to be dried out, the isolating links in the motor switch panels being designed as change-over switches for this purpose.

It will be seen that this pumping plant embodies the most recent practice, and that the electrical installation, both down the shaft and in the Tilmanstone power station, is of a most substantial kind.

Our thanks are due to Mr. G. F. Metzger, who, as consulting engineer, has been responsible for, and has personally supervised the carrying-out of, the whole of the work, for enabling us to publish this article, and incidentally to inspect a very interesting plant.

## REVIEWS.

*The Elements of Electrical Transmission.* By O. J. FERGUSON. London: Macmillan & Co. Price 15s. net.

This book has been published with the idea of providing an introductory text-book for colleges and technical schools. The title is quite a misnomer, since certain portions of the book are the reverse of elementary, and, moreover, the book covers practically the whole field of electrical engineering.

The opening chapter deals with conductors and insulation. The usual tables are given, and also some very useful curves for skin effect. A decidedly good feature is the large amount of information regarding specifications for cables, &c.

Line insulators are treated in a detailed and satisfactory manner in Chapter II. Modern high-tension oil-filled bushings, suspension insulators, and so on, are critically considered, and again precise information is given as to the various tests that should be imposed upon this type of apparatus. More dimensioned drawings and fewer photographs would, however, have improved this chapter.

Chapter III is devoted to poles and towers for carrying transmission lines. The various kinds of timber suitable for poles, and the different methods of preserving the timber, are thoroughly gone into. Tables are given for pole dimensions, but no method is given for investigating the strength of such poles or of lattice towers. This is unsatisfactory from the point of view of a student. Some interesting photographs are given of the gigantic power transmission schemes now in operation in the United States.

Aerial line construction receives a thoroughly adequate treatment in Chapter IV, together with the several methods used for preventing disturbance in adjacent telephone circuits. Following this is a short chapter on underground line construction, which is good so far as it goes, although troubles due to electrolysis are somewhat too briefly described.

Chapters VI treats of switchboards and protective devices. The matter is good and up-to-date regarding modern oil switches, relays and lightning arresters. A good description of the Tirrill voltage regulator is given in this chapter.

The next two chapters deal with circuits and the constants of circuits. The usual ways of feeding various types of circuits, and their relative efficiencies, are gone into, together with proofs of formulæ for the inductance, capacity and other constants of electric circuits. We are glad to see formulæ derived from exponential expansions used for line calculations.

Chapter IX is an interesting and complete account of electric generating plant. Water power and its development are dealt with in a much more detailed and thorough manner than we are accustomed to find in books of this class, gauging the flow of water, pipe discharge formulæ, water-turbines and their governors, all being clearly discussed. Steam plant and internal-combustion engines also receive the consideration they merit. The various factors affecting the choice of electric generators are then entered into and some interesting oscillograms are used for driving home

points regarding armature connections. It is stated that the cost of large machines may be taken at \$15 per kilowatt. If this is so, then it may be safely stated that far better prices are obtained for electrical machinery in the United States than in this country.

Chapter X deals with the rights of way for a transmission line, sag in relation to span, wind pressure, and so on. Two examples of transmission lines are worked out.

The somewhat extensive subject of distribution is next treated of. The various types of modern high-voltage large power transformers and direct-current and alternating-current motors are well described. A considerable amount of practical information is given on air cooling for transformers, testing for water in transformer oil, the types of work suitable for different kinds of motors, and so on.

Electrical measurements are discussed in Chapter XII. Most of the ordinary types of ammeters and voltmeters are described in an unsatisfactory manner, without diagrams. Power and energy meters receive somewhat better treatment, but the same cannot be said of the description of curve tracers and oscillographs. Instruments of this character should be adequately described with the aid of diagrams, or omitted altogether. Some good reproductions of oscillograph records, and a few useful pages on harmonic analysis, are given in this chapter.

Line phenomena form the subject of the concluding chapter. The influence of inductance and capacity in causing oscillations and surges, standing and travelling waves, corona losses, and so on, are dealt with in a fashion strongly suggestive of the publications on this special branch of engineering by Dr. Steinmetz. An arithmetical slip occurs in the final formula for capacity in terms of inductance and length of line on page 437. A useful table of corona voltages is given, and also a very neat way of representing standing waves by means of co-ordinate geometry in three dimensions.

A good index is appended.

It must be remembered that while certain parts of this book are essentially of a practical character, on the other hand, a good knowledge of differential and integral calculus, complex quantities and infinite series is necessary for a complete understanding of other parts.

The book is well printed on good paper and bound in a serviceable fashion.—H.G.S.

*Die Selbstanschluss und Wählereinrichtungen im Fernsprechbetriebe.* By A. KRUCKOW. Brunswick: Fried. Vieweg und Sohn. Price 10 M. (Vol. X of Telegraphen und Fernsprech Technik in Einzeldarstellungen.)

At the present time, when the question of automatic telephony is rapidly increasing in importance, there is a distinct call for a book like this dealing critically and, more particularly, from the specialist's point of view, with the various automatic systems that have actually passed the test of practical experience.

In this country the Post Office authorities have only recently set up the first experimental lines for automatic working, but from the experience already gained in America, where numerous installations have been erected since 1895, and in Germany, where the first fully automatic system has been at work since 1908, there is little doubt that considerable extension in this direction is to be looked for in the near future.

The writer assumes a general knowledge of ordinary telephone working, and throughout points out the alterations introduced by the automatic systems into the older method of working, and he compares the two with regard to cost, speed of operation, &c. The systems dealt with more particularly include that of the Automatic Electric Co. (Strowger), the Siemens & Halske modification of it, the Rochester Co.'s system, the Austrian State system (Dietl), the Lorimer system, and that of Betulander.

The book is divided into 12 chapters.

Chapter I deals with the various automatic calling devices. In Chapter II the call-office connections and the various types of wall and table apparatus in use are considered. Chapters III and IV describe the construction and operation of the most important part of the apparatus, viz., the selector switch at the exchange, by means of which the subscriber is automatically connected to any desired number.



Chapter V deals with various auxiliary apparatus by means of which engaged lines are indicated, the duplicate use of engaged lines is prevented, calls are metered, &c. In Chapter VI the trunk line connections are discussed. Chapters VII and VIII deal with the actual internal arrangements of the exchanges, and with junction line working. Chapters IX and X deal with sub-stations, and with the use of automatic working for small country groups of subscribers. In Chapters XI and XII the question of semi-automatic installations, and the use of automatic selectors as labour-saving devices in hand-operated exchanges, are considered.

The descriptions and diagrams are admirably clear throughout, and the book as a whole will give a very fair idea of the present state of automatic working to any reader already familiar with existing telephone practice.

*Aitken's Manual of the Telephone.* By W. AITKEN, M.I.E.E. London: The Electrician Printing and Publishing Co., Ltd. Vol. I. Price 18s. net.

This is the first of two volumes intended to cover the whole field of commercial telephone engineering.

The present volume opens with a description of the principle of the telephone, and of the development of the telephone system of this country. The whole subject of subscribers' instruments and circuits, and of exchange working, is then dealt with, from the simple private telephone installation, through magneto and common-battery exchanges, to the modern developments in automatic exchange working. The various systems of junction and trunk line working are also included in this volume.

Each section is treated very fully, and the early methods which were used are described, as well as those in use to-day. A large amount of this matter, however, seems somewhat superfluous in a book intended for the modern telephone engineer, who usually has no great desire to learn how certain results were obtained in the past, more especially as to make a full study of the arrangements in use at present is a task of no mean magnitude.

The line of demarcation is not very clearly drawn between arrangements which are obsolete and those which, although old, are still in service. In a few cases, even, obsolete methods are described as if they were actually in use. For instance, in the section dealing with the Post Office trunk-line arrangements, a method of signalling is described as being present-day practice, although, as a matter of fact, the system in use nowadays is quite different.

A number of the illustrations seem scarcely necessary in a book intended to be read by professional telephone men. We also notice that, from fig. 219 to fig. 242, the illustrations are not numbered consecutively. This want of numerical order is very annoying when endeavouring to turn up a particular figure for reference. It would be a great improvement in subsequent editions if this were remedied and the numbers of the illustrations arranged to run consecutively throughout the volume.

The book, on the whole, is a very useful work of reference, but we feel that, at any rate, as far as the greater number of telephone men in this country are concerned, a considerable amount of the matter contained in it could be deleted with advantage. If the author had confined himself to present-day practice in this country, the book could have been produced for a less price, and would have been more generally useful to telephone men here. Of course, the lines on which the book is written render it useful, not only in Great Britain, but all over the world, but also, we are afraid, seriously restrict the number of people who can afford to obtain it.

**Glasgow Electrical Strike Ended.**—After a month's strike, a settlement was arrived at on Tuesday, 13th inst., between the members of the Electrical Workers' Union and their employers. A conference was held between representatives of both sides in the Electrical Contractors' Association offices, and after a lengthy sitting an agreement was come to on the wages question. It is understood that there were mutual concessions, and work was accordingly resumed.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Wrexham T.C. has increased the salary of the electrical engineer from £250 to £275 per annum.

We are informed that MR. A. NICHOLLS has resigned his position on the City sub-station staff of the Charing Cross, West End and City Electricity Supply Co., to take up an appointment in Canada. On behalf of the employes of the City section, Mr. Brazil—the head of the department—presented him with a case of drawing instruments, as a memento of over 10 years' association with the company.

The salary of MR. J. B. FELTHAM, chief assistant engineer at Gloucester Corporation electricity works, has been increased to £180 this year, with a further increase of £20 to £200 per annum in January, 1913.

MR. WARDROP, electrical engineer to the Elland U.D.C. has resigned.

MR. H. FOX has resigned the position of engineer and manager to the Roundhay Electric Light Co., and is going abroad on account of his health. The chairman and directors have presented him with a purse of money. MR. WARDROP, of Elland, has been appointed to succeed him, and all business communications should be addressed to him in future.

On Monday last MR. HAROLD A. SMITH, who has just been appointed to take charge of the test room under the Leith Corporation, was presented with a keyless chronograph watch from the staff and workmen of the Aberdeen Corporation Electricity Department. Mr. Smith was also entertained to supper in the Station Hotel, Aberdeen, on the previous Saturday evening.

**Tramway Officials.**—The Burnley Corporation Tramways Committee has decided to recommend the Council to increase the salary of the tramways manager from £400 to £450 per annum as from February 7th, and thereafter by two annual increments of £25, bringing the total to £500.

At a meeting of the Newcastle-on-Tyne City Council on the 8th inst., the Tramways Committee recommended that the tramways manager's salary be increased from £800 to £900, and that it be further increased to £1,000 a year hence. The report was adopted.

MR. HY. BENCH has been appointed general permanent way foreman in the Blackpool Corporation Tramways Department.

**General.**—Following our recent announcement that MR. H. B. RENWICK had been elected to a seat on the board of the County of London Electric Supply Co., Ltd., as managing director, we now understand that he has, in consequence of the additional duties involved, found it necessary to resign the chairmanship of the Electric Supply Publicity Committee.

MR. HUBERT JONES, late of the Installation Inspectors' staff of the Manchester Corporation Electricity Department, was on Saturday last the recipient of a set of carvers, presented to him by his colleagues. The presentation was made by Mr. Marlbor, Chief Installation Inspector. Mr. Jones, who has been with the Corporation for 10 years, has joined the firm of Messrs. E. M. Evans and Sons, electrical contractors, Manchester.

MR. ALFRED SCHWARTZ has resigned the Professorship of Electrical Engineering in the Manchester University and the School of Technology, on his appointment by the President of the Board of Education to a Staff Inspectorship in Engineering under the Board. The resignation dates from March 31st next.

We are asked to state that MR. SHERARD COWPER-COLES has entirely severed his connection with the Cowper-Coles Engineering Co., Ltd., and has removed to new offices and laboratories at 1 and 2, Old Pye Street, Westminster.

MR. ROBERT JAMES HATTON has been elected to a seat on the board of W. T. Henley's Telegraph Works Co., Ltd. Mr. Hatton has been the company's chief engineer and works manager for many years. Congratulations, Mr. Hatton!

The *Review of the River Plate* says that MR. PAKENHAM W. BEATTY, who has been appointed the South American representative and manager of the Edison & Swan Electric Light Co., arrived in Buenos Ayres in January, and will shortly open offices in Buenos Ayres and Rosario, and in several cities in Brazil and Chile.

The *Australian Mining and Engineering Review* of January 5th reported that MR. J. M. JOLLY, engineer and manager of the Australian Metal Co. (electrical department), was to leave on a six months' business trip to Europe and the United Kingdom.

MR. H. F. MARCHANT has been appointed secretary of the Armorduct Manufacturing Co., Ltd., in succession to Mr. J. S. B. Plummer.

Our congratulations to SIR WILLIAM PREECE, K.C.B., F.R.S., upon the celebration yesterday of his 78th birthday. "Many happy returns!"

**Obituary.**—The death occurred on Saturday of MR. DAVID ROSSER, electrical engineer on the Golden Grove Estate of Earl Cawdor.

On February 12th MR. ELLIS KERRY, one of the earliest railway telegraph clerks in the kingdom, died in his 87th year. His first appointment was on the Norfolk Railway, at a time when the charge for a 20-word telegram between Norwich and Yarmouth was 7s. 6d.

We regret to record the death of Sir Henry Oakley, a former chairman of the Central London Railway.



## NEW COMPANIES REGISTERED.

**British and Overseas Engineering Syndicate, Ltd.** (120,175).—This company was registered on February 10th, with a capital of £1,000 in £1 shares, to carry on the business of engineers, founders, manufacturers of machinery, tool makers, metal workers, suppliers of electricity, &c. The subscribers (with one share each) are:—S. G. F. Steadman, 4, Suffolk Street, Pall Mall East, S.W., solicitor; F. S. Gaylor, 4, Suffolk Street, Pall Mall East, S.W., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are S. G. F. Steadman and F. S. Gaylor; remuneration, £100 per annum, divisible. Registered office, 4, Suffolk Street, Pall Mall East, S.W.

**Naylorgraph, Ltd.** (120,069).—This company was registered on February 5th, with a capital of £3,000 in £1 shares, to take over certain patents, designs, &c., relating to electrical signs, and to adopt an agreement with J. P. Naylor. The subscribers (with one share each) are:—J. M. Hunt, Fairlawn, Southborough, gentleman; J. P. Naylor, 57, Croxted Road, Dulwich, S.E., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. M. Hunt (permanent chairman, subject to holding 1,000 shares), and J. P. Naylor; qualification, £200; remuneration as fixed by the company. Registered office, 57, Croxted Road, Dulwich, S.E.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Bullers, Ltd.** (62,020) (Formerly Buller's Telegraph Construction, Ltd.).—Return dated December 7th, filed December 14th, 1911. Capital, £400,000 in £10 shares (20,000 preference). 15,000 ordinary and 15,000 preference shares taken up, £10 per share called up on seven ordinary and 15,000 preference; £150,070 paid; £149,930 considered as paid on 14,993 ordinary. Mortgages and charges: Nil.

**City of Ely Electric Light and Power Co., Ltd.** (85,444).—Return dated January 12th, 1912. Capital, £5,000 in £1 shares; 3,003 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges: Nil.

**Chilian Construction Co., Ltd.** (111,448).—Return dated January 13th, 1912. Capital, £500,000 in £1 shares; two shares taken up; £2 paid. Mortgages and charges: Nil.

**H. Laughton & Co., Ltd.**—Particulars of £300 debentures, created January 19th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Engineering Instruments, Ltd.** (66,427).—Debenture dated January 19th, 1912, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. D. Forster, Darlington; and T. E. Hodgkin, Collingwood Street, Newcastle-on-Tyne.

## CITY NOTES.

## Dublin United Tramways Co., Ltd.

MR. W. M. MURPHY presided, on 5th inst., at this company's meeting held at the Imperial Hotel, Dublin. In moving the adoption of the report, he said that the large increase in passenger receipts (£12,022) for the half-year was mainly due to the visit of their Majesties to Dublin last July, and to the exceptionally fine weather. The total receipts were £169,249, against £157,254, an increase of £11,995, most of which they were able to retain as additional profit. The working and general expenses were £85,539, an increase of £2,222, and the working expenses of all kinds showed an increase of only £2,347. The total expenses were 51·6 per cent. of the gross receipts, or 5·383d. per mile run. The speaker said that he did not think there was any parallel in the kingdom of a tramway where the plant and track were nearly 14 years old, kept in the highest state of efficiency and run at a cost for all expenses, including rates and taxes, at less than 5½d. per mile. The net revenue available for distribution was £68,076, or £12,278 more than for the second half of 1910. After paying the usual dividends of 6 per cent. per annum on the preference and ordinary shares, they proposed a bonus equal to 1 per cent. on the ordinary shares. After that they set aside £14,000 to reserve for renewals of permanent way, £2,000 to accident insurance reserve, £3,000 to reserve for renewal of cars, carrying forward £10,374, £476 more than a year ago. Last year they set aside £12,000 toward permanent way renewals, but they had not drawn on any of that yet. The chairman went on to refer to track renewal work required this year and in later years, and he said that if they continued to build up a substantial reserve they would be able to secure the payment of steady dividends when the time came for renewal on a large scale. They would have to renew some of the oldest cars in the near future. The principal capital expenditure had been for a 1,500-kw. exhaust steam turbo-generator which had been in operation since November with most satisfactory results. They had reduced the consumption of coal per unit from 4½ lb. to 3½ lb., and the total saving expected through the use of this set was estimated to exceed 3,000 tons of coal per annum.

The report was adopted.

## London Electric Wire Co. and Smiths, Ltd.—

The directors have declared a dividend of 7½ per cent. (7s. 6d. per share), less income-tax, on the ordinary shares for the half-year to December 31st, making 10 per cent. for the year. £15,000 is placed to reserve making £30,000, £500 is reserved against fall in market price of investments, and £10,913 is to be carried forward.

## Smithfield Markets Electric Supply Co., Ltd.

SIR HERBERT S. LEON, Bart. (chairman), presided on Friday at Winchester House, E.C., over the fourteenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 226), said he had little to say because the past 12 months had been very uneventful. They would notice that the capital account had been reduced by £2,397 and now stood at £114,326. This reduction was entirely due to the scrapping of some of the plant in preparation for the installation of some new up-to-date machinery. The cost of this new plant, to which reference was made last year, did not yet appear in the balance-sheet, but a note had been made to the effect that the payment of the money to the contractor became a liability directly the new engines were at work. There were some physical difficulties to be surmounted, but he hoped they would excuse any explanation as to details. As a matter of fact, as he was not an engineer, he was not really competent to answer questions on such a technical matter. However, he was glad to say both the engineers and contractors were doing their best to overcome what they hoped would be only a temporary difficulty. The worst of it was that all these things seemed to move so slowly to the ordinary lay mind. If they turned to the revenue account it was satisfactory to note a decrease in most of the items on the debit side of the account. The cost of generation and distribution was slightly higher. It worked out at 2·7 per cent. more, but against that there had been an increase in revenue of 6·75 per cent., so that there was an increase in gross profit of not less than 25 per cent. They would see that the profit had been improved by £839, or 58 per cent., from which £500 had been placed to depreciation account and £400 to the debenture redemption fund. The available balance including the amount brought forward from last year was £1,829. The board had decided to recommend from this a dividend of 2 per cent., which would absorb £1,200, and to carry forward £629. He did not want to appear in any way pessimistic, but he desired to emphasise the fact that the cost of production could not be reduced below a certain figure which left the margin of profit very small, and therefore this dividend was not likely to be increased. Then there was always the possibility of a new lamp being introduced which would still further reduce the consumption of current, and when that came, the electric lighting companies would have to face the new circumstances. Satisfactory progress had been made in the markets during the year, inasmuch as the consumption of current had increased, and the yield per lamp installed was considerably higher.

MR. J. BROWNE MARTIN seconded the motion, which was carried.

The CHAIRMAN moved the formal resolution for the declaration of the dividend, and

MR. J. BROWNE MARTIN, in seconding, said he did not quite agree with the Chairman when he said he did not think they could pay more dividend. He believed they would.

The resolution was carried.

**Cambridge Electric Supply Co., Ltd.**—The directors' report states that during the year 1911 there have been connected 179 additional consumers, having the equivalent of 5,307 (30-watt) lamps, making a total of 76,294. Units supplied were 700,587, an increase of 68,320 units. The number of consumers continued to increase, and additional mains have been laid. The popularity of metal-filament lamps continues, and has led to large reductions in the cost of lighting. £4,515 has been transferred from the depreciation account for the purpose of writing off plant which has become obsolete. For the year there is a total profit of £8,885, which, added to £874 brought forward, makes £9,760. After deducting debenture and other interest £1,866, placing £2,750 to depreciation fund account, which will bring up the total placed to the credit of that account to £18,250, there remains a balance of £5,144. An interim dividend of 2 per cent., absorbing £1,696, has already been paid, and the directors recommend the payment of a further dividend of 3 per cent., making 5 per cent. for the year. This will absorb £2,544, leaving about £903 to carry forward.

**Bruce Peebles & Co., Ltd.**—The annual report for 1911 shows an improvement of £7,629. The profit, after deducting maintenance, general charges and debenture interest, is £354.

**Crossley Bros., Ltd.**—The directors report a decrease in profits due to serious labour troubles and consequent reduction in output. The dividend on the ordinary shares is to be 4 per cent. for the year, £10,000 being placed to reserve, and £30,020 carried forward.

**Llanelli and District Electric Light and Traction Co., Ltd.**—The directors' report (as abstracted in the *Financier*) states that the profit for the year to December 31st, including £56 brought forward, and after payment of loan and debenture interest charges, is £4,585, out of which the interim dividend of the 6 per cent. cumulative preference shares to June 30th, 1911, amounting to £1,761, has been paid, leaving an available balance of £2,824. The directors recommend the payment of the dividend on the 6 per cent. cumulative preference shares for the half-year to December 31st, 1911, £1,800, carrying forward £1,024. The progress made by the company in the tramway, lighting and power departments has been entirely satisfactory, necessitating extensions of the plant, some of which were completed during the year, and others are now in hand. The tramways were completed early in August, 1911, so that the full system was only in operation for about five months.



**Northampton Electric Light and Power Co., Ltd.**

THE directors report that the record of the past year's working shows continuous improvement. Lamps and motors added (all reckoned as 32-watt lamps) 17,810, making a total equal to 125,161 lamps. The horse-power of motors added is 419, making a total of 2,162 H.P., of which 1,815 are hired from the company. The mains added were 3 miles 782 yards in extent, making a total of 28 miles 977 yards, besides feeders added, 1,093 yards. The principal extensions are to Garden Suburb (Far Cotton), Weston Favell, and Harborough Road. The current sold for lighting and power has increased 26 per cent., the total units being 2,497,871, as against 1,978,974 in the previous year. The maximum load on plant was 1,566 kW. (22½ per cent. increase), the load factor 18.1, as compared with 17.7 in the previous year, and the working costs per unit sold show 5 per cent. decrease. The new plant referred to in the last report is now in working order; a considerable extension of the engine house has been effected, and many other additions and improvements have been made. Additional shares to the number of 13,346 were offered at a premium of 5 per cent., and were readily taken up by existing shareholders and their friends, and allotted in October last—namely, 11,525 as ordinary shares, and 1,821 as 5 per cent. preference shares. This brings up the total share capital to £100,000, the full amount at present authorised. The depreciation account has been increased by £5,200 (out of which £170 has been written off plant, £400 off accumulators, £250 off demolished buildings, and £725 off mains), also £350 has been written off motors, and £1,300 added to reserve. The sum of £704 will be required for the dividend on the 5 per cent. preference shares, and the directors propose that 7 per cent. per annum should be paid on the ordinary shares for the half-year (making 6 per cent. for the year), £2,047; also £102 interest on instalments on new shares, leaving £1,850 to be carried forward.

**Fife Tramway, Light and Power Co., Ltd.**

MR. WILLIAM LOW, of Blebo, Cupar-Fife, moving the adoption of the report at the annual meeting of this company, stated that the results achieved in 1911 were satisfactory. The revenue from the tramways amounted to £12,600, an increase on the previous year. Owing to the necessary capital expenditure in other directions, the extension of the tramways to Lochore had been left over to be dealt with this year, and it was proposed to undertake this extension in the course of the next few months. The directors are of opinion that this extension will materially add to the revenue the company will receive from the tramways undertaking. During the latter part of the year the Power Co.'s transmission lines were extended from Lochgelly to Wemyss, a distance of 12 miles, for the purpose of supplying the Wemyss and District Tramways Co. The supply was given to the tramway company at East Wemyss, which was 23½ miles from the Power Co.'s generating station, and the tramway was operated from the company's power station early in December last. The whole capital to build this extension to Wemyss had to be provided last year, but only one month's revenue was received. This year the Power Co. would have the benefit of a full year's revenue from this source. The directors proposed to continue to extend the transmission lines, and particularly with as little loss of time as possible to connect the coast towns from Leven to Inverkeithing, and to connect Kelty in order to give a power supply, and also a supply in accordance with electric lighting orders granted to the company. The revenue from the power and lighting department amounted to £4,400, compared with £2,265 for the previous year. The capital of the company had been increased to £300,000, and £34,445 additional ordinary shares had been placed at par without underwriting commission. This brought the total ordinary shares issued up to £93,250. After providing for preference dividend there was a surplus on the year's working of £3,658, to which had to be added £3,090 brought in from last account, making a total of £6,748, which the directors recommended should be carried forward.

**City of Buenos Aires Tramways Co., Ltd.**—The directors' report for the year 1911 states that the annuity payable by the Anglo-Argentine Tramways Co. has been received, and the net revenue for the year has amounted to £65,726. Interim dividends have been paid for the nine months ended September 30th, 1911, absorbing £46,500, leaving a balance of £19,226. The directors recommend that in addition to the interim dividends already distributed, a final dividend of 1s. 3d. per share (making 5s. per share, less income-tax) be paid for the year ended December 31st, 1911, absorbing £15,500; that £3,650 be transferred to general amortisation fund, and that £76 be carried forward.

**Farnham Gas and Electricity Co., Ltd.**—At the second ordinary general meeting, held at Farnham on Monday, Mr. A. J. Nash, C.C., the chairman, said that the electricity works were in a forward state, and a supply of electricity would be afforded this spring. They had entered into contracts for buildings, switch-board, engines, electrical machinery and cables, amounting to £11,013.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the five weeks ended December 29th, 1911, were 829,464, compared with 660,633 units in the corresponding five weeks of 1910.

**St. James' and Pall Mall Electric Light Co., Ltd.**

THE meeting was held on Tuesday at the offices, Carnaby Street, Golden Square, Mr. Walter Leaf presiding.

THE CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 227), said that it contained nothing of an exceptional or sensational character. What differences there were in the accounts were, without exception, on the right side. They hoped 12 months ago that the loss of revenue due to the metallic-filament lamp had been overcome, and he was glad to say that that hope had been fully justified. The units sold had increased by 808,973; connections to the amount of 976 kW. had been added, and the gross revenue had been advanced by £2,297. The costs had also increased by £1,058, so that the balance carried to net revenue account was larger than last year by £1,259. He trusted they would regard that as evidence of steady growth, the outcome of a very steady policy; and he saw no reason why, if trade conditions did not take a turn for the worse during the year, that growth should not be maintained. Rebuilding in the district was going on very satisfactorily, and they had just settled a contract with Messrs. Lyons to supply a new hotel they were erecting, which would be one of the largest in London. The important changes at Mason's Yard to which he referred last year had been carried out, and the entire cost of reconstruction had been provided by funds set aside for that purpose. The steam generating plant there had been removed, and the station was now equipped for the transmission of high-tension current supplied from Grove Road, with a large storage battery, which would be a most valuable stand-by in the case of any accident. The results had been so satisfactory that they had decided to carry out a similar improvement in part of the Carnaby Street plant. Two-thirds of the original boiler plant had been brought up to date, now consuming bituminous coal with a large saving of cost. Two-thirds of the steam plant, with an output of 13,220 kW., would remain fully efficient. The remaining plant of about 1,400 kW. was approaching a point where it would have to be regarded as obsolete, and their engineer advised them that they should make provision at once to substitute for it in the course of the next two years transformers designed to utilise a larger supply from Grove Road. The cost of scrapping the plant on which no further dependence could be placed was estimated at about £10,000. That sum they proposed to spread over three years. They had already made provision for £2,500 by the additional amount which they had this year taken under the head of depreciation: they had provided £4,500 which they had added to the contingency fund, and the balance they hoped to obtain without the least difficulty from the revenue of next year. To meet the load of the plant which they were now abolishing, the Central Co. had at their request placed an order for a new 3,000-kW. turbine generator of the newest design. There was room for that plant in the existing buildings at Grove Road. That new unit would, in the terms of the contract, be erected and running in time to take its share of next winter's load, and they looked forward with confidence, based on the experience of the past, to a further gain in economy and efficiency. Every year confirmed them in the belief that they did well to establish a bulk station in Grove Road, and they were constantly relying more upon it and looking to it for all future expansion. The Central Co. was now a vital part of their system. The day of scattered stations and small units was passing away, and although the process was a gradual one, they were looking forward to the time when all supply would be in bulk from large distributing centres, the older stations being used for distribution only. It was the constant policy of the board acting under the able technical advice of its managers to work steadily towards that end which was bound to come, and to facilitate by cautious foresight the steps which would enable them to attain it without waste and without hurry. In all respects but one, the outlook for the year was promising. They anticipated a growth in revenue, their relations with the London Co. whose alternating supply they had taken over had been most friendly. Their men were loyal and contented; even the turbulent times of last August left them unmoved. So long, however, as the danger of a great coal strike hung over the country, those who were responsible for a large industry must feel grave apprehension. They had made their preparations for the worst and there, again, the possession of the Grove Road station had been of invaluable assistance to them. They had also spare land there, and they had laid in a reserve stock of coal which would enable them at this time of the year to carry on their supply for 10 weeks, even if it should be impossible during that time to buy a single ton. But for the central station they could not have made that provision which, in his opinion, would serve them up to that point at which the cessation of output would mean a disaster which would have to be dealt with by other means than private foresight.

SIR JOHN H. MORRIS, K.C.S.I., seconded the motion, which was adopted without discussion.

**Lytham Electric Light and Power Co.**—The scheme for the formation of this concern is not being proceeded with, the main reason being lack of interest on the part of local residents. The issue to the public was 10,000 ordinary shares of £1 each. Only 21 applicants sent in for 1,357 shares.

**London Electric Supply Corporation, Ltd.**—The profit for 1911 was £61,412, against £53,225 for 1910. After paying 6 per cent. preference dividend, 2½ per cent. is to be paid on the ordinary, £5,000 is to be placed to reserve, £5,000 to contingencies, and £4,186 carried forward. The power supplied for traction purposes increased by 73 per cent., and that for industrial purposes by 87 per cent.



### Electrical Distribution of Yorkshire. Ltd.

THE directors' report for the year ending December 31st, 1911, again shows satisfactory progress. The gross profit for the three corresponding yearly periods ending December 31st, is as follows:—1911, £1,416; 1910, £751; 1909, £238. After deduction of interest paid and accrued the balance of the profit and loss account for the same period is:—1911, £1,347; 1910, £515; 1909, £184. The balance of the profit and loss account of £1,347, with £109 brought forward, makes a total disposable balance of £1,456, which the directors recommend should be dealt with as follows:—Dividend for the year 1911 at the rate of 4 per cent. per annum (free of income-tax) on the ordinary shares, £680; write off formation, preliminary and working expenses, £428; carrying forward, £348. During the year a considerable number applications for the supply of current have been received, and the company is now supplying in Calverley, Castleford, Farsley, Gomersal, Hipperholme, Horsforth, Liversedge, Ossett and Sowerby Bridge. Applications are being made to the Board of Trade during the Parliamentary session of 1912 for Electric Lighting Provisional Orders empowering the company to supply within other districts in the West Riding. The Urban District Council of Birstall has applied to the Board of Trade for consent to transfer its Electric Lighting Provisional Order to the company, and the Urban District Council of Greetland has applied for an Electric Lighting Order for the Urban District of Greetland, and has agreed, in the event of such Order being obtained, to transfer the same to the company. The company has now arrived at a profit-earning position, and the directors draw the attention of the shareholders to the fact that up to this time no payment has been made to them for expenses incurred or for services rendered. The directors suggest that this matter should be considered when the accounts for 1912 are dealt with a year hence. Mr. Henry Barran, of Leeds, has been appointed a director.

Since the approval of the report by the board, the chairman (Mr. John Nevin), who has filled that office from the formation of the company, has died (February 4th).

### Central London Railway Co.

MR. H. F. PARSHALL (chairman) presided, on February 8th, at the Holborn Restaurant, over the twenty-third ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 227), the CHAIRMAN said that, dealing first with the capital account, there had been a recent issue of £385,000 4½ per cent. preference stock, for which they had received £383,300, leaving £1,700 still to come in. During the past half-year they had spent £65,287 on capital account. Of this sum £60,239 had been spent on the new line to Liverpool Street. With regard to this extension, the progress of the work had been somewhat retarded owing to the national strike last year, and to various other causes, but he was pleased to say that, owing to the strenuous efforts of their engineers, there was every possibility of the line being open for traffic about the middle of the present year. They had also spent £1,211 in connection with the Ealing extension, for Parliamentary and engineering expenses. All the preliminary details in regard to this valuable extension had now been settled, and the necessary plans had been agreed between the Great Western Co. and this company, so that the constructional work would be commenced forthwith. The estimate of further expenditure on capital account was £123,500 during the ensuing half-year, and £246,500 in subsequent half-years. To meet this expenditure of £370,000 there were unissued preference and debenture stocks (including the small balance due on the former) amounting to £256,700, which, with the balance at credit of capital account of £141,383, made a total of £398,083. Coming to the revenue account, during the last half-year the railway had carried over 18 million passengers, which, compared with the same period last year, was a decrease of approximately 1,900,000 passengers, and a decrease in receipts of £18,312. This decrease in passengers could be attributed to the increased motor-bus competition, the unprecedented spell of fine weather which prevailed rendering the motor-bus more attractive than their tube as a mode of conveyance, to a most disappointing Exhibition traffic, due very largely to the number of counter-attractions which were running simultaneously, and also to the loss of traffic owing to the railway strike. Against this decrease in passenger traffic there was an increase in miscellaneous receipts of £590, so that the net decrease in revenue receipts was £17,037. This decrease was equal to 9·6 per cent. in passengers and 12·77 per cent. in receipts, and was at every station and included all classes of traffic. Looking at the favourable side of the half-year's working, they would see that there had been a very considerable decrease in the expenses amounting to £14,833, which result had been accomplished without in the slightest degree impairing the efficiency of the railway; in fact, more had been spent on the upkeep of the railway this half-year than in any corresponding period since the line had been open. The figures given in the report did not represent the results of all the economies which had been effected, since steady progress was being made in this direction. The decrease in expenses was accounted for as follows:—General working, £7,814; rates and taxes, £6,765; and sundry items, £254. The percentage of working expenses to traffic receipts for the half-year were 58·58 per cent., against 61·72 per cent. in the corresponding period of last year, being a decrease of 3·14 per cent. The cost per car-mile had decreased by '36d., which gave an increased net traffic receipt per car-mile of '23d. The cost per passenger had been '98d., against 1'06d., a decrease of '08d., giving a net increased receipt per passenger of '02d. The gross receipts amounted to £138,552, and after deducting working

expenses, there was a balance to net revenue of £64,856. After providing for debenture interest and other payments, the net revenue account showed that with the amount of £30,655 brought forward from last half-year, and the sum of £5,883 to meet the dividend on deferred stock, there was an available balance of £83,170. Interest on the 4½ per cent. preference stock would absorb £6,136, leaving a balance of £77,035. A dividend on the undivided ordinary stock at the same rate as last half-year, viz., 3 per cent., would absorb £27,351; 4 per cent. on the preferred ordinary stock would absorb £11,766; and 2 per cent. for the whole year on the deferred stock would absorb £11,766, making a total of £50,883, leaving a balance to carry forward of £26,552. In the revenue account there was an item of £1,756 under "strike expenses." In regard to the strike of August last they took every possible precaution beforehand to ensure a good train service being maintained, and he was pleased to say that in consequence the company suffered very little inconvenience. It was very satisfactory to note that with the exception of the motor drivers the majority of the employes remained loyal. They had among their staff a number of men who had been thoroughly trained to, and were capable of, driving the trains. When the regular drivers deserted their posts, these emergency drivers, as they termed them, stepped into their places, and thus a full train service was easily maintained. There were no delays, and the public experienced no inconvenience. In the final event the Board of Trade intervened. They represented to the company that this was not a local matter, but was a national matter, and that the company could not fairly stand out and say they could not take the men back, although there was no need for taking them back, and, in fact, they would have been better pleased not to have had them. But in order to meet the Board of Trade these men were taken back, and, to illustrate the state of affairs, he might say that the men made no representations that they wished anything more from the company either in wages or shorter hours or more privileges. They simply went out of sympathy. The sale of season tickets which was introduced last July had proved very satisfactory, and their passengers had expressed themselves as being greatly pleased with the facilities afforded. Every effort was being made to bring the various facilities afforded by the railway prominently before the public by means of advertising. A good deal had also been done in the matter of lighting and renovating their stations with a view to making them more attractive to the travelling public.

VISCOUNT ST. ALDWYN seconded the motion.

MR. WALFORD complimented the board and the staff on the decreased working expenses and also on the great push shown in order to get more travellers on the line.

MR. ROBERTS asked if the board could not compete with the buses between Tottenham Court Road and the Bank.

MR. FITCH considered that if the improved ventilation of the line could be impressed on the public it would do good. He considered it the healthiest and most satisfactory line to travel on in London.

SIR CHARLES CUFFE expressed the hope that the extension at Wood Lane would be pushed on rapidly.

MR. ANDERSON thought they must admit that the railway could not compete with the buses for short-distance traffic, and hence their hope lay in extensions. He would like the board to give them more particulars with regard to the policy of extensions, and whether they had considered the question of carrying the railway by means of a loop from Ealing through Brentford, Hanwell, Kew and Chiswick.

The CHAIRMAN said that with regard to competing for traffic between Tottenham Court Road and the Bank, at present they saw no new departure; when Liverpool Street Station was opened they would have more flexibility in meeting their competitors. The board recognised that they must extend, and the joining up at Wood Lane would be carried out as soon as possible, but the great bulk of the work had to be done by the Great Western Co. first, and pending that work being done, the board was not tying up the company's money. He did not know that he was entitled to make any specific statement regarding any extension, but he might say the board did not consider their programme was in any way a closed one; and, in fact, his own view was that they had only begun, and if the present extensions brought the results they anticipated, then the best policy of the railway would be to extend largely into the country and make themselves independent of local competition.

The report was then adopted.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid; and 200,000 cumulative 6 per cent. preference shares of £1 each, fully paid (special application).

And to allow the following to be quoted in the Official List:—

Mexican Light and Power Co., Ltd.—£1,000,000 5 per cent. second mortgage 50-year bonds, in lieu of the scrip.

**Chelsea Electricity Supply Co., Ltd.**—The directors recommend a dividend for the half-year to December 31st, 1911, at the rate of 6 per cent. per annum on the ordinary share capital of the company, making 5 per cent. for the year 1911, after paying debenture interest and placing £13,180 to depreciation fund, £704 to debenture premium redemption fund, and writing off £1,089 from the cost of extinction of founders' shares, and £1,000 from cost of purchase of Cadogan Electric Light Co., carrying forward £3,240 as against £2,290 in the previous year, subject to audit. The dividend is the same as last year, and will be payable on and after March 15th.



## Underground Electric Railways Co. of London, Ltd.

THE directors' report says that the result of the half-year ended at December 31st, 1911, continues to show a substantial improvement. The net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £104,045; amount receivable under guarantee on Metropolitan District Railway assented first preference stock £2,687, making £106,731. The net income from the operation of the power house was £45,918; the interest on £1,000,000 4 per cent. first power house debentures, and a proportion of commission, discount and expenses incurred in connection with the issue, absorbed £20,870, leaving a surplus from the power house of £25,048, making £131,779. The service of the £1,000,000 5 per cent. prior lien bonds, including the expenses of redemption, absorbed £10,415; the service of the £2,818,700 4½ per cent. bonds of 1933 absorbed £67,349, leaving a surplus over half-yearly charges of £54,015, which will be applied as follows:—Interest at the rate of 2 per cent. per annum on £4,928,050 6 per cent. income bonds of 1948, £49,280; income-tax, £3,053; to reserve applied in reduction of the accumulated revenue deficiencies, £1,682.

The traffic of the railway companies and of the London United Tramways, Ltd., in which the company is interested, continues to show satisfactory increases, notwithstanding the fact that the traffic on the railways was adversely affected by the extraordinarily fine weather during the summer months and by the general railway strike in August last. The London United Tramways not only shows an increase in gross receipts, but a very substantial decrease in working expenses. The Lot's Road power house undertaking became vested in the Lot's Road Power House Joint Committee as from January 1st, 1912, and was thereupon leased by the Joint Committee to the Metropolitan District and London Electric Railway Companies. The property has therefore become part of the undertakings of those companies.

The Metropolitan District Railway Co. has paid in respect of the last half-year a dividend at the rate of 2 per cent. per annum on its 5 per cent. second preference stock. The company owns the whole of this stock, and for the first time secures a return on this investment. The widening of the London and South-Western and the Metropolitan District Railways between Sudland Road and Acton Lane Junction was practically completed and opened for traffic on December 3rd last. The improvement gives to the District Railway Co. the exclusive use of a separate pair of rails between those points and relieves the company's working from interference by the London and South-Western trains, and also enables the company to work a more frequent and faster service of trains to the rapidly growing districts served by the Western Extensions. To provide for the additional service, the District Railway Co. has purchased 65 new carriages.

Contracts for the construction of the Paddington and Charing Cross extensions (London Electric Railway Co.) have been entered into, and the work is proceeding satisfactorily.

An escalator (or moving stairway) has been installed at the Earl's Court Station for the convenience of the interchange traffic between the Great Northern, Piccadilly & Brompton and the Metropolitan District Railways at that point. It was opened for public use on October 4th last, and has proved a very popular and convenient means of interchange between the two railways. Its success has justified the company in approving the installation of escalators instead of lifts at other stations.

The report proceeds to set forth the main provisions of its Parliamentary Bills, namely, Metropolitan District Railway Co.'s Bill, London Electric Railway Co.'s Bill, the Edgware and Hampstead Railway Co.'s Bill, and the London United Tramways, Ltd., Bill.

In regard to the London General Omnibus Co., the board of the Underground Co. has, with the concurrence of the board of the L.G.O. Co., formulated a scheme with a view to fusing the interests of the two companies.

A copy of the scheme was sent to all the shareholders on January 19th. It is proposed that if the holders of 75 per cent. (or such less proportion as the boards of the two companies may agree) of the ordinary stock of the London General Omnibus Co. accept the offer thereby made, the Underground Co. will create and issue to such stockholders in exchange for each £100 of their ordinary stock, and so on in proportion for larger or smaller amounts:—

(a) £105 of 6 per cent. first cumulative income debenture stock, carrying interest as from January 1st, 1912.

(b) £105 of 6 per cent. income bonds to rank *pari passu* with the present income bonds, and carrying interest as from January 1st, 1912.

(c) 100 "A" ordinary shares of 1s. each (part of a proposed issue of 1,200,696 like shares).

In addition, the ordinary stockholders of the L.G.O. Co. will receive from that company a cash bonus of £8 per cent. in respect of accumulated profits to December 31st, 1911.

The first cumulative income debenture stock will be secured as to capital by a first charge on such of the ordinary stock of the London General Omnibus Co. as is taken over by the company, and will rank for interest after the 4½ per cent. bonds of 1933, and before the 6 per cent. income bonds.

The 1,200,696 "A" ordinary shares will be entitled to divide between them one-third of the profits available for dividend.

In order to make the scheme effective, both companies have to amend their articles of association, and carry out certain other formalities, and all necessary steps are being taken for this purpose.

The item of stocks, shares and other property stands in the books at £10,988,686, and consists of stocks and shares in associated companies, consols and lands and buildings other than power-house property. The decrease of £1,003,232 in the figure shown in the balance sheet, as compared with the corresponding figure at June 30th, 1911 (£11,991,918), mainly results from the sale of £1,285,000 London Electric Railway preference stock.

## Imperial Tramways Co., Ltd.

THE directors' report to December 31st last has been issued together with the details of the revenue accounts of the subsidiary undertakings.

*Middlesbrough, Stockton and Thornaby Electric Tramways.*—The gross receipts from this undertaking amount to £56,686, as compared with £51,922 for the preceding year, an increase of £4,763. The total number of passengers carried was 11,221,628, against 10,276,749, an increase of 944,879. The net profit for the year is £13,305, as compared with £16,303 for the corresponding period. The net profit would have shown an increase compared with last year's amount, but for the fact that during the year a considerable portion of the track has been reconstructed and the outlay charged against the revenue for the year. The traffic receipts again show an improvement, having reached the highest amount in the history of the undertaking. The company's Bill of last session, as altered by Parliament, received the Royal Assent on August 18th.

*Corris Railway Co.*—The working of this undertaking shows an increase in net profit of £24. There has been an increase in receipts of £380, largely due to the running of motor coaches for the summer holiday traffic instead of horse coaches as hitherto. It is intended to develop this traffic to a larger extent in the ensuing season.

*London United Tramways, Ltd.*—The report and accounts of this undertaking show that the results for the past year again mark considerable improvement. The receipts have increased by £10,328, and the net revenue by £25,506, the available balance of net revenue after payment of fixed charges amounting to no less than £56,432. The directors of the L.U. Co. state that the revenue would have sufficed for a dividend distribution on the preference shares, but they considered that in the company's best interests it was advisable for this year to strengthen the reserves by appropriating the sum of £30,000 to a general reserve. Of the remaining balance £25,000 is added to the reserve for renewals and contingencies, this reserve fund now amounting to £76,033, and the general reserve to £30,000. The accumulated arrears of the Imperial Co.'s holding of 44,446 preference shares in the L.U. Co. now amount to 16½ per cent., and represent a total of £72,224.

The directors observe with pleasure that the position of the L.U. Co. has so substantially improved during the past year, and they are hopeful that the board of that company will see their way to resume payment of the preference dividend at an early date. In the meantime the non-receipt of dividend from that undertaking precludes the directors from recommending payment of any dividend on the preference and ordinary shares of this company. The revenue account for the year shows an available amount of £13,001, and after payment of the interest on debenture stock for the whole year, amounting to £12,712, there is a balance (including £7,390 brought forward from last account) of £7,678, which the directors recommend should be carried forward.

## Paisley District Tramways Co.

THE directors' report for the half-year ended December 31st, 1911, shows that the revenue was £28,933, the expenses being £15,828, leaving £13,105, less general interest £96, interest on debentures £1,600, debenture sinking fund £750, leaving £10,660, to which are added £1,441 brought forward and £375 "recovery on amount paid for electrical energy last year." There is thus a balance of £12,475, out of which £2,750 has been placed to general reserve account, and the balance is to be disposed of as follows: £3,750 to dividend at the rate of 5 per cent. per annum on £150,000 cumulative preference shares for the half-year; £1,000 to preference share sinking fund; £2,416 to dividend at the rate of 3 per cent. per annum on the ordinary shares for the half-year; £2,559 to be carried forward. The traffic receipts show an increase of £3,963 and the expenses an increase of £1,608. The increase in receipts is mainly due to the extension from Barrhead to Rouken Glen, which was not in operation during the corresponding half-year of 1910. The whole of the extensions having been completed, at the request and expense of the contractors, £150,000 5 per cent. cumulative preference shares and £80,000 4 per cent. debentures were offered on their behalf for public subscription in October last, and were duly allotted. £155,800 ordinary shares, credited as fully paid, were also allotted to the contractors in accordance with their contract for the construction work.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. o cars.
June, 1910 ..	14.69	5,439,550	£23,052	1.02	473,556	50
Dec., " ..	14.69	5,756,773	£24,773	1.03	511,731	50
June, 1911 ..	17.98	6,099,072	£26,121	1.04	559,021	56
Dec., " ..	17.98	6,487,033	£28,736	1.06	608,502	56

*Pennsylvania Water and Power Co.*—The directors' report states that the total revenue from all sources for the year 1911 amounts to \$516,285, and the interest charges, expense of operation and maintenance to \$450,084, leaving a surplus of \$66,200. While large contracts for the delivery of power to the United Railways and Electric Co. and the Consolidated Gas, Electric Light and Power Co., of Baltimore, were concluded early in the year, the company did not receive the full benefit of these contracts until July last. This, of course, had a marked influence on the total income for the year, and will be best realised by the statement that the income from power for the last six months of the year was double that between January 1st and July 1st. At the close of the fiscal year (says the *Financier*) the company was in receipt of income at a rate in excess of \$600,000 per year. The present income is derived from contracts of a nature which employ at times very nearly the present capacity of the plant. With a varying water supply, it is necessary for this company to make contracts which provide large capacity for limited periods of time. By reason of this fact, the directors propose to extend the capacity of the plant by installing during 1912 an additional unit to water-wheel and generator capacity. This will increase the present electrical capacity by 16,000 H.P., giving at the end of 1912 an installed electrical capacity of 72,667 H.P. This increased capacity will permit the making of further contracts for the delivery of power. During the year there has been issued \$350,000 of bonds on account of construction work. Of this amount \$100,000 have been taken down from the trustee and sold, the balance being held for the purpose of covering the cost of the proposed extension of plant during 1912.

*Harper Electric Piano (1910) Co., Ltd.*—The directors have declared a dividend for the half-year to December 1st at the rate of 2½ per cent. per annum.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	" Nitric .. .. per lb.	22/-	..
a	" Oxalic .. .. per lb.	23d.	..
a	" Sulphuric .. .. per cwt.	5/6	..
a	Ammoniac Sal .. ..	42/-	..
a	Ammonia, Murate (large crystal) per ton	£29 10	..
a	Bleaching powder .. ..	£5 10	..
a	Bisulphide of Carbon .. ..	£18	..
a	Borax .. ..	£16 10	..
a	Ferro-Silicon (50 %) (basis 45 %) ..	£12 12 6	..
a	Copper Sulphate .. ..	£22	£1 10 dec.
a	Lead, Nitrate .. ..	£25	..
a	" White Sugar .. ..	£22 15	..
a	" Peroxide .. ..	£32	..
c	Methylated Spirit .. .. per gal.	2/6	..
a	Potassium, Bichromate, in casks ..	33d.	..
a	Potash, Caustic (80/82 %) .. per ton	£20 5	..
a	" Chlorate .. .. per lb.	33d.	..
a	" Perchlorate .. ..	43d.	..
a	Potassium, Cyanide (98/100 %) ..	74d.	..
a	Shellac .. .. per cwt.	68/-	..
a	Sulphate of Magnesia .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. ..	£6 10	..
a	" Recovered .. ..	£5 10	..
a	" Lump .. ..	£5 5	..
a	Soda, Caustic (white 70/72 %) ..	£10 5	..
a	" Chlorate .. .. per lb.	33d.	..
a	" Crystals .. .. per ton	£3 5	..
a	Sodium Bichromate, casks .. per lb.	3d.	..
a	" Cyanide { (128/130 %) } ..	7d.	..
	(basis 100 %) }		
METALS, &c.			
b	Aluminium Ingots, in ton lots .. per ton	£65	..
b	" Wire, in ton lots .. ..	£102	..
b	" Sheet, in ton lots .. ..	£120	..
p	Babbitt's metal ingots .. ..	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis) per lb.	73d.	..
c	" Tube (brazed) .. ..	93d.	1d. dec.
c	" (solid drawn) .. ..	8d.	1d. dec.
c	" Wire, basis .. ..	73d.	..
c	Copper Tubes (brazed) .. ..	103d.	1d. dec.
c	" (solid drawn) .. ..	93d.	1d. dec.
g	" Bars (best selected) .. per ton	£79	£2 inc.
g	" Sheet .. ..	£79	£2 inc.
g	" Rod .. ..	£79	£2 inc.
d	" (Electrolytic) Bars .. ..	£66 5	15s. inc.
d	" Sheets .. ..	£83 5	15s. inc.
d	" Rods .. ..	£71 5	15s. inc.
d	" H.C. Wire .. per lb.	83d.	1d. inc.
f	Ebonite Rod .. ..	5/8	..
f	" Sheet .. ..	4/9	..
n	German Silver Wire .. ..	1/11	..
h	Gutta-percha, fine .. ..	4/7 1/2	1d. inc.
h	India-rubber, Para fine .. ..	48/10 1/2	3 1/2 d. dec.
i	Iron Pig (Cleveland warrants) .. per ton	£14	..
i	" Wire, galv. No. 8, P.O. qual.	£16 to £16 2 6	5/- inc.
g	Lead, English Pig .. ..	6/6	..
m	Manganin Wire No. 28 .. per lb.	£8 7 6	2/6 inc.
g	Mercury .. .. per bot.	6d. to 2s.	..
e	Mica (in original cases) small .. per lb.	2/6 to 4/-	..
e	" " medium .. ..	4/6 to 8/6	..
e	" " large .. ..	11d.	..
p	Phosphor Bronze, plain castings ..	1/0 1/2	..
p	" " rolled bars & rods ..	1/1	..
p	" " rolled strip & sheet ..	185/-	..
o	Platinum .. .. per oz.	93d.	..
d	Silicium Bronze Wire .. .. per lb.	£55	..
r	Steel Magnet, in bars .. .. per ton	£199 to £200	£3 inc.
g	Tin, Block (English) .. ..	2/4	..
n	" Wire, Nos. 1 to 16 .. per lb.	£45 to £150	..
p	White Anti-friction Metals .. per ton	£30 7 6	..
k	Zino, Sh't (Vieille Montagne bnd.) ..		..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	i Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakespeare.	p W. F. Dennis & Co.
h Edward Tilt & Co.	

## Telegraph Construction and Maintenance Co., Ltd.

—The directors have declared a dividend of 10 per cent. (£1 4s.) per share, together with a bonus of 2 1/2 per cent. (6s. per share), in addition to the 5 per cent. already paid, making 17 1/2 per cent. for the year 1911. For 1910 the total distribution was 20 per cent.

## STOCKS AND SHARES

Tuesday Evening.

It must be frankly acknowledged that there is nothing very interesting to say about the Stock Exchange markets this week. Noticeable features are advances in Reuter's shares, British Westing-

house Preference and Marconis; but, speaking generally, the electrical sections are quiet, with a good deal of firmness on the whole, and nothing very exciting either to read or to write about.

Anxiety dogs the Home Railway position with respect to the outlook in the coal trade, but the market received a sharp fillip from the substantial rise in Consols, due to political rumours. Tube issues are holding their recent improvements, with the exception of Districts, which have fallen 1/4, while Underground Electric Income bonds shed 2. These falls are said to have been caused by the fact that the absorption of the London General Omnibus Company by the Underground Electric may be regarded as an accomplished fact, and a slight reaction of sentiment has caused holders of Districts and Underground Incomes to inquire whether the fusion is, after all, going to benefit them to the extent supposed at first.

It may be of some interest to mention that London Electric Railway 4 per cent. Preference stock can now be bought at 83 1/2, this price carrying the dividend of 2 per cent. payable at once, so that a purchaser to-day will get all but 5 per cent. on his money from the investment.

London United Tramways 4 per cent. Debenture fell 2, and the market did not fail to observe the statements made at last week's meeting of London and South-Western Railway proprietors as to the proposals for electrifying part of the company's suburban system. Metropolitan Electric Tramways Deferred eased off to 3s. There is a certain amount of business doing in British Electric Traction, and the 6 per cent. cumulative Preferred rose 3 points. South Metropolitan Trams 4 per cent. Debenture at 74 1/2 is 2 higher.

Dividend announcements—some already made and others imminent—hold the market for Electricity Supply shares very firm. City "Lights" are 3/4 higher, and the other gains of last week have been retained. Edmundsons' Preference are 5s. better, following upon their previous gain of 7s. 6d., and Urban Preference also put on 5s., the two prices being 3 and 2 1/2 respectively, comparing with 2 3/4 and 2 1/4 a fortnight ago. It is fully expected that the Urban Company will now go ahead, and if so, of course, the parent will be substantially advantaged. South Metropolitan 4 1/2 per cent. Debenture stock, with a rise of a point, is the only one of its kind to show quotable alteration this week.

Securities connected with Mexican companies are all upset by the latest reports as to the revolution in that distressful country. The news at present is certainly not conducive to restful nights for those who have money invested in Mexico. But the authorities whom we have consulted do not seem to take a very gloomy view of the situation, arguing that the present trouble will blow over just the same as similar difficulties have done in the past. Meanwhile, however, Mexican Light and Power shares are down 2 1/2, the Preference 1 and Mexico Trams 1; while the bonds have suffered to a smaller extent. The whole department is somewhat affected by the cloud over Mexicans, and Sao Paulo Trams fell 2. La Plata Ordinary are 1 1/2 easier at 14s. Manaos Debenture rose 1/2 to 93. There are slight improvements in Para Electric Ordinary and Rio bonds. A jump of 2 1/2 in River Plate Preference raised the price to 112 1/2. Shawinigan Water shed 2 1/2, while Kaministiquia bonds are a point higher. Electrical Developments of Ontario have come into further demand, and are 1 1/2 up, while Calgary Power bonds are 1 lower on the week. Brisbane Trams Ordinary recovered part of their fall, and British Columbia Electric stocks are all firm, the 5 per cent. Preference being slightly higher. The recent rises in Kalgoorlie Electric Power have brought in sellers, with the result that both Ordinary and Preference are a trifle down.

Marconis are the most volatile share in the Stock Exchange at the present time. The price, on the whole, has been steadily good, touching 4 1/2 on Tuesday morning, in spite of the fact that the carry-over rate of 8 per cent. evidenced the continued existence of a big "bull" account. Men in the market talk with confidence of the shares going higher. Telegraph stocks are mostly steady and rather uninteresting. West India and Panama keep about 4 1/2, speculation having died out to a very large degree, and though hints are persistently circulated as to the probability of the company being bought out by one of the American syndicates at work in connection with Panama matters.

National Telephone Deferred has given way, and the market estimates of what the stock is likely to be repaid at, are being framed on lines a good deal more modest than those which prevailed a month or two ago. The latest guess which we have heard in the Stock Exchange is that holders will get some price nearer 130 than 120. Monte-Video Ordinary and Oriental Ordinary have both improved, while a few Telephone bonds are also better. A remarkable feature is a further rise of 27s. 6d. in the price of Reuters. Three rumours are afloat to account for this. One says that part of the reserve will be capitalised and shares distributed as a bonus. The second reports that such a distribution will take the shape of hard cash, and the third is to the effect that the dividend will be largely increased.

In the Manufacturing division there has been a tip round to buy British Westinghouse Preference, and the price mounted to 15s., easing off to 12s. 6d. afterwards. What the tip was on we have been unable to discover. Telegraph Constructions are better, and Babcock rose 1 1/4. Rubber shares, after experiencing dullness and depression, firmed up again on the results of the Mincing Lane sales this week.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 13th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations Feb. 13th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	8 — 9	..	6 2 3	Kensington & Knightsbridge, Ord	5	9 8½	62 — 7½	..	6 4 2
Do. 4½ % Pref. ....	10	4½ 4½	8½ — 9½	..	4 12 4	Do. 4 % Deb. ....	Stock	4 4	92 — 95 xd	..	4 4 3
Do. Second 6 % Pref. ....	10	6 6	10½ — 11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	78 — 82	..	5 9 9
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	10 — 102	..	4 8 8	London Electric, Ord. ....	3	2 ..	1½ — 1½	..	8 12 0
Brompton & Kensington, Ord. ..	5	10 9½	8 — 8½	..	5 17 8	Do. 6 % Pref. ....	5	6 6	4½ — 5	..	6 0 0
Do. 7 % Cum. Pref. ....	5	7 7	7½ — 8	..	4 7 6	Do. 4 % First Mort. Deb. ....	Stock	4 4	85 — 91	..	4 8 0
Central Electric Supply, 4 %	100	4 4	98 — 101	..	3 19 3	Metropolitan ..	5	5 4½	8½ — 4½	..	5 17 8
Guar. Deb. ....	5	5 5½	93 — 4½	..	5 17 8	Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½ — 4½	..	4 17 4
Charing Cross, West End & City	5	4½ 4½	4½ — 4½	..	4 14 9	Do. 4½ % First Mort. Deb. ....	Stock	4½ 4½	99 — 104	..	4 6 7
Do. 4½ % Cum. Pref. ....	5	4½ 4½	3½ — 4½	..	5 9 1	Do. 3½ % Mort. Deb. ....	Stock	3½ 3½	84 — 87	..	4 0 6
Do. "City Undertaking"	5	4½ 4½	93 — 96	..	4 3 4	Midland Electric Corporation	100	4½ 4½	95 — 97	..	4 12 9
Do. 4½ % Cum. Pref. ....	100	4 4	4½ — 4½	..	5 8 1	4½ % First Mort. Deb. ....	5	4 4½	8½ — 4	..	5 0 0
Do. Do. 4 % Deb. ....	5	5 4½	98 — 101	..	4 9 1	Newcastle-on-Tyne ..	5	5 5	4 — 4½	..	5 11 1
Chelsea, Ord. ....	Stock	4½ 4½	13½ — 14	..	5 0 0	Do. 5 % Pref., Non-Cum. ....	5	5 5	99 — 102	..	4 15 0
Do. 4½ % Deb. ....	10	7 6½	12 — 13	..	4 12 4	North Metropolitan Power Sup-	100	5 5	99 — 102	..	4 15 0
City of London, Ord. ....	10	6 6	117 — 121	..	4 2 8	ply, 5 % Mortgages (Red.)	10	..	9½ — 10½	..	..
Do. 6 % Cum. Pref. ....	Stock	5 5	100 — 103	..	5 12 4	Notting Hill, 6 % Non-Cum.	5	7½ 6½	8½ — 6½	..	5 9 5
Do. 5 % Deb. ....	100	4½ 4½	98 — 98	..	5 4 4	Do. 7 % Pref. ....	5	7 7	6½ — 7½	..	4 16 7
Do. 4½ % Second Deb. ....	Stock	5 5	11 — 11½	..	5 4 4	Do. 8½ % Deb. ....	100	8½ 8½	85 — 87	..	4 0 6
County of Durham, 5 % First	Stock	5 5	107 — 109	..	4 2 7	Smithfield Markets, Ord. ....	5	Nil 2	1½ — 1½	..	Nil
Mort. Deb. ....	10	5 4½	100 — 103	..	4 7 5	South London, Ord. ....	4	5 5	2½ — 3½	..	6 3 1
County of London, Ord. ....	10	6 6	87 — 90	..	5 0 0	Do. 5 % First Mort. Deb. ....	100	5 5	98 — 101	..	4 19 0
Do. 6 % Pref. ....	10	6 6	4½ — 5	..	6 0 0	South Metropolitan, 7 % Pref. ..	1	7 7	1 — 1½	..	6 4 5
Do. 4½ % Deb. ....	Stock	4½ 4½	4½ — 5½	..	4 17 7	Do. 4½ % First Deb. Stock ..	100	4½ 4½	97 — 100	..	4 19 0
Do. 4½ % Second Deb. ....	Stock	4½ 4½	93 — 96 xd	..	4 13 9	Urban, Ord. ....	5	5 ..	1 — 1½	..	..
Edmundson's, Ord. ....	5	Nil Nil	62 — 7½	..	6 4 2	Do. 5 % Cum. Pref. ....	5	5 ..	2½ — 3½	..	..
Do. 6 % Cum. Pref. ....	5	Nil Nil	..	..	..	Do. 4½ % First Mort. Deb. ....	100	4½ 4½	88 — 90	..	5 0 0
Do. 4½ % First Mort. Deb. ....	100	4½ 4½	..	..	..	Westminster, Ord. ....	5	10 10½	8½ — 8½	..	5 16 0
Folkestone ..	5	6 6½	..	..	..	Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½ — 5½	..	4 6 9
Do. 5 % Cum. Pref. ....	5	5 5	..	..	..						
Do. 4½ % First Deb. ....	100	4½ 4½	..	..	..						
Hove ..	5	9 8½	..	..	..						

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	6 6	5½ — 6	..	5 0 0	Monterey Rly. Light & Power, }	100	5 5	89½ — 91½	..	5 9 3
Calcutta, Ord. ....	5	8½ 7½	6½ — 6½	..	6 6 0	5 % 1st Mort. Deb. ....	100	5 5	193 — 198 xd	..	3 9 4
Do. 5 % Pref. ....	5	5 5	5 — 5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	39 — 41	..	12 2 10
Calgary Power, 1st Mort. Bds.	100	5 5	92½ — 94½	..	5 5 3	Northern, Lt., Power and Coal, }	\$500	5 ..	250 — 260	..	3 16 11
Canadian Gen. El. Com. ....	\$100	7 7½	11½ — 120	..	5 16 8	5 % 1st Mort. Bonds ....	100	5 5	110 — 115	..	5 4 4
Do. 7 % Pref. ....	\$100	7 7	117 — 121	..	5 15 8	Do. 5 % Deb. Stock ..	Do.	5 5	100½ — 102½	..	4 17 7
Cordoba Lt., Power and T., Ord.	1	3 3½	7 — 1	..	3 0 0	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	100 — 102	..	4 8 3
Do. 5 % Deb. ....	100	5 ..	95 — 98	..	5 2 0	1st Mort. Deb. ....	100	4½ 4½	125½ — 127½	..	3 18 5
Elec. Lt. and P. of Cochabamba,	100	6 6	91 — 93	..	6 9 0	Shawinigan Water, Capital ..	\$100	4 5½	107 — 109	..	4 11 9
6 % Bonds ..	100	5 5	83 — 86	..	5 16 3	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	103 — 105	..	4 5 9
Elec. Supply Victoria, 5 % 1st	100	5 5	94 — 96	..	5 4 2	Do. 4½ % Per. Deb. ....	Stock	4½ 4½	99½ — 101½	..	4 8 8
Mort. Deb. ....	\$500	5 5	108 — 105	..	4 15 3	Toronto Power, 4½ % Deb. ....	Do.	4½ 4½	92½ — 94½	..	5 5 1
Elec. Dev. Ontario, 5 % 1st	10/-	Nil ..	101 — 103	..	4 17 1	Vera Cruz Lt., P. and T., 5 %	100	5 5	107 — 109	..	5 10 1
Mort. Bonds ..	1	6 6	85½ — 87½	..	5 14 3	1st Mort. Deb. ....	100	5 5	107 — 109	..	5 10 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	85 — 87	..	4 12 0	Victoria Falls Power, Pref. ....	1	Nil 11½d.	1½ — 1½	..	..
Do. 6 % Pref. ....	1	6 6	106½ — 108½	..	6 9 0	West Kootenay Power and Lt., }	100	6 6	107 — 109	..	5 10 1
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	95 — 97 xd	..	5 3 1	1st Mort. 6 % Gold ..	100	6 6	107 — 109	..	5 10 1
Madras, Ord. ....	5	.. ..	..	..	..						
Melbourne, 5 % 1st Mort. Deb.	100	5 5	..	..	..						
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	..	..	..						
Mexican Lt. & Power, Common	\$100	4 4½	..	..	..						
Do. 7 % Cum. Pref. ....	\$100	7 7	..	..	..						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	..	..	..						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph .. ..	10	Nil	4†	7½ — 7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1 — 1½	+	1½	5 6 8
Do. 5 % Deb. Red. ....	Stock	5	5	97 — 99	..	5 1 0	Do. 5 % Pref. ....	1	5	5	1½ — 1½	..	..	5 6 8
American Telep. & Teleg., Cap.	\$100	8	8†	142½ — 144½	+1	5 10 9	National Telephone, Pref. ....	Stock	6	6†	99½ — 102½	..	..	5 17 1
Do. Collat. Trust .. ..	\$1000	4	4	93 — 95	..	4 4 3	Do. Def. ....	Do.	6	6†	120 — 122	-2½	..	4 18 4
Anglo-American Telegraph ..	Stock	3½	3	66 — 68 xd	+ ½	4 8 6	Do. 6 % Cum. 1st Pref. ....	10	6	6	9½ — 10	..	..	6 0 0
Do. 6 % Pref. ....	Do.	6	6	109½ — 110½ xd	..	5 8 4	Do. 6 % Cum. 2nd Pref. ....	10	6	6	9½ — 10	..	..	6 0 0
Do. Def. ....	Do.	30/-	30/-	25½ — 25½ xd	- ½	5 16 6	Do. 5 % Non-cum. 3rd Pref. ....	5	5	5	5½ — 5½	- ½	..	4 12 0
Anglo-Portuguese Tel., 5 % } Mort. Deb. }	100	5	5	102 — 104	+ ½	4 16 1	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 — 104	+ ½	..	4 6 6
Chilli Telephone .. ..	6	7	..	7½ — 7½	..	4 13 4	Oriental Telep. and Elec. ....	1	8	..	1½ — 1½	+ 1½	..	4 14 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 — 88	..	4 10 11	Do. 6 % Cum. Pref. ....	1	6	6	1½ — 1½	..	..	4 18 8
Cuba Telegraph .. ..	10	6	6†	10½ — 11½	..	5 6 8	Do. 4 % Red. Deb. ....	Stock	4	4	87½ — 89½	..	..	4 9 5
Do. 10 % Pref. ....	10	10	10	17 — 18	..	5 11 1	Pacific and European Tel., 4 % } Guar. Debs. }	Do.	4	4	98½ — 100½	..	..	3 19 7
Direct Spanish Telegraph, Ord.	5	4	4†	9½ — 9½	..	5 6 8	Reuter's .. ..	8	5	5†	10½ — 11	+ 1½	..	3 12 9
Do. 10 % Cum. Pref. ....	5	10	10	8 — 8½	..	5 17 8	Submarine Cables Trust .. ..	Cert.	6	6	130 — 133	..	..	4 10 8
Do. 4½ % Debs. ....	50	4½	4½	99 — 101	+ ½	4 9 1	Telephone Co. of Egypt, 4½ % } Deb. Red. }	Stock	4½	4½	99 — 101	+ ½	..	4 9 1
Direct United States Cable ..	10	4½	..	7½ — 8 xd	- ½	5 12 6	United River Plate Telephone	5	8	8	7½ — 7½	..	..	5 4 11
Direct W. India Cable, 4½ % } Reg. Deb. }	100	4½	4½	99 — 101	..	4 9 1	Do. 5 % Cum. Pref. ....	5	5	5	5½ — 5½	..	..	4 8 11
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 — 137	..	5 0 9	West Coast of America .. ..	2½	2½	2½	1½ — 1½	..	..	3 11 6
Do. 8½ % Pref. Stock .. ..	Do.	3½	3½	83 — 85	..	4 2 4	Do. 4 % Debs., 1 to 1,500 } guar. by Braz. Sub. Tel. }	100	4	4	98 — 100	- ½	..	4 0 0
Do. 4 % Mort. Deb. ....	Do.	4	4	100 — 102	..	3 18 5	West India and Panama Teleg.	10	1½	1½†	4½ — 4½	- 1	..	5 7 10
Eastern Extension .. ..	10	7	5†	13½ — 13½	..	5 1 10	Do. 6 % Cum. 1st Pref. ....	10	6	6	10 — 11	+	2½	5 6 8
Do. 4 % Deb. ....	Stock	4	4	99 — 101 xd	..	3 19 3	Do. 6 % Cum. 2nd Pref. ....	10	6	6	9½ — 10½	..	..	4 16 2
East and S. Africa Tel. 4 % } Mt. Db. Mauritius Sub. }	25	4	4	99 — 101	..	3 19 3	Do. 5 % Debs. ....	100	5	5	102 — 104	..	..	5 0 0
Globe Telegraph and Trust ..	10	5½	6†	11 — 11½	+ ½	5 2 2	Western Telegraph, Ltd. ....	10	7	6†	13½ — 14	..	..	3 19 3
Do. 6 % Pref. ....	10	6	6	13½ — 13½	+ ½	4 8 1	Do. 4 % Deb. ....	Stock	4	4	99 — 101	..	..	3 13 5
Great Northern Telegraph ..	10	18	5†	8½ — 88	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106 — 108	..	..	4 6 7
Indo-European Telegraph ..	25	13	5†	56½ — 58½	..	5 10 2	Do. 4½ % Fdg. Bonds .. ..	\$1000	4½	4½	101 — 104	..	..	..
Mackay Companies Common ..	\$100	5	5†	80 — 82	+ 2½	6 2 0								
Do. 4 % Cum. Pref. ....	\$100	4	4	70 — 72	..	5 11 1								
Marconi's Wireless Telegraph	1	5	..	3½ — 3½	+ ½	..								
Do. 7 % Cum. Partio. Pref.	1	16	..	3½ — 3½	+ 1½	..								

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 13th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 13th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil Nil	8 1/2 — 8 3/4	..	Nil	Metropolitan Railway Consol. ..	100	12 1/2 12 1/2	47 1/2 — 48 1/2	+ 1/2	3 17 9
Do. 5 % Pref. ..	1	5 5	7 1/2 — 7 3/4	..	7 5 6	Do. Surplus Lands ..	100	2 1/2 2 1/2	68 — 70	+ 1	3 18 7
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	80 — 85	..	5 5 11	Do. 8 1/2 % Deb. ..	100	3 1/2 3 1/2	90 — 92	..	3 16 1
Brit. Elec. Trac., 6 % Pref. ..	100	.. ..	14 — 18	..	..	Do. 3 1/2 % Pref. ..	100	3 1/2 3 1/2	86 — 88	..	3 19 7
Do. Do. Deferred ..	100	.. ..	6 — 9	..	..	Do. 3 1/2 % Con. Pref. ..	100	3 1/2 3 1/2	85 — 87	..	4 0 6
Do. Do. 6 % Cum. Pref. ..	100	.. ..	90 — 92	+ 3	..	Metropolitan District Ord. ..	100	Nil ..	34 — 34 1/2	— 3/4	Nil
Do. Do. 7 % Non-Cum. Pref. ..	100	.. ..	57 — 40	..	..	Do. 6 % Deb. ..	100	6 6	141 — 146	..	4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5 5	56 — 99	..	5 1 0	Do. 4 % Deb. ..	100	4 4	95 — 97	..	4 2 6
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2 4 1/2	79 — 83	..	5 8 5	Do. 4 % Prior Lien ..	100	4 4	100 — 102	..	3 18 5
Central London Railway, Ord.	100	3 3 1/2	72 — 74	..	4 1 1	Do. 4 1/2 % First Pref. ..	100	3 1/2 4 1/2	91 — 93	..	3 10 0
Do. Pref. ..	100	4 4	85 — 87	..	4 12 0	Do. 3 1/2 % Gtd. ..	100	3 1/2 3 1/2	75 — 77 xd	..	4 10 11
Do. Def. ..	100	2 2	62 — 64	..	3 2 6	Metropolitan Elec. Trams, Ord.	1	5 1/2 5 1/2	37 — 38 1/2	..	5 13 6
Do. 4 % Deb. ..	100	4 4	100 — 102	..	3 18 5	Do. Def. ..	1	Nil ..	2 — 2 1/2	— 1/2	Nil
City & South London, Ord.	100	1 1/2 1 1/2	28 — 29 xd	..	5 12 1	Do. 5 % Pref. ..	1	5 5	99 — 101	..	5 10 2
Do. 5 % Pref., 1891 ..	100	5 5	106 — 108 xd	..	4 12 7	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	100 — 102 1/2	..	4 9 1
Do. Do. 1896 ..	100	5 5	102 — 104 xd	..	4 16 2	Do. 5 % Deb. ..	100	5 5	100 1/2 — 102 1/2	..	4 17 7
Do. Do. 1901 ..	100	5 5	101 — 103 xd	..	4 17 1	Potteries, Ord. ..	1	2 ..	..	..	..
Do. Do. 1903 ..	100	5 5	101 — 103 xd	..	4 17 1	Do. 5 % Pref. ..	1	5 5	..	..	6 19 3
Do. 4 % Deb. ..	100	4 4	101 — 103	..	3 17 8	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	90 — 93	..	4 16 9
Dublin United Trams, 6 % Pref.	10	6 6	11 — 12	..	5 0 0	South Metro. Trams, 6 % Pref.	1	6 6	..	..	6 17 2
Great Northern & City, Pr. f. Ord	10	Nil ..	15 — 17	..	Nil	Do. 4 % Deb. ..	100	4 4	72 — 77	+ 2	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil 3 1/2	..	..	..	Underground Elec. Railways	10	.. ..	2 1/2 — 2 1/2	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	73 — 78	..	5 15 5	Do. 4 1/2 % Bonds ..	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	23 — 25	..	4 6 11	Do. 6 % Income ..	100	1 1 1/2	76 — 78	— 2	..
Do. 4 % Deb. ..	100	4 4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil ..	..	..	Nil
Lancashire United, 5 % Deb. ..	100	5 5	80 — 82	..	6 2 0	Do. 6 % Pref. ..	5	Nil ..	2 1/2 — 3 1/2	..	Nil
London Elec. Railwys, 4 % Deb.	100	4 4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	81 — 85	..	5 5 11
London United Trams, 5 % Pref.	10	Nil ..	8 1/2 — 8 1/2	..	..						
Do. 4 % Deb. ..	100	4 4	75 — 78	— 2	5 2 7						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	6	5	5 1/2	5 1/2 — 5 3/4	..	5 2 4	La Plata Elec. Trms, Ord. ..	1	..	..	2 1/2 — 2 1/2	— 1/2	..
Do. 2nd Pref. .. ..	5	5	5 1/2	4 1/2 — 5 1/2	..	5 3 6	Do. Pref. .. ..	1	6	6	..	..	6 0 0
Do. 4 % Deb. .. ..	100	4	4	94 — 95 1/2	..	4 3 9	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	1 — 1 1/2	..	4 8 0
Do. 4 1/2 % Deb. .. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5	Do. 6 % Pref. .. ..	1	6	6	1 — 1 1/2	..	4 16 0
Do. 5 % Deb. .. ..	100	5	5	102 — 104	..	4 16 7	Do. 5 % Deb. .. ..	100	5	5	93 1/2 — 97 1/2	..	5 2 7
Auckland Trams, 5 % Deb. ..	100	5	5	102 — 105	..	4 15 3	Madras Elec. Tr. (1904), Deb. ..	100	5	5	93 1/2 — 96 1/2	..	5 3 8
Bombay Elec. S. & Trams, Pref.	10	6	6	10 1/2 — 11 1/2 xd	..	5 7 10	Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 94	+ 1/2	5 6 5
Do. 4 1/2 % Deb. .. ..	100	4 1/2	4 1/2	96 — 98	..	4 11 10	Manila Elec. R. and Lt., Bonds	\$1000	5	5	101 — 103	..	4 17 1
Do. 5 % 2nd Deb. .. ..	100	5	5	98 — 100	..	5 0 0	Mexico Trams Com. ..	\$100	7	7 1/2	121 — 123	— 1	5 13 10
Brisbane Trams Invt., Ord. ..	5	8	8 1/2	8 1/2 — 9	+ 1/4	4 8 11	Do. Gen. Con. 5 % Bonds ..	..	5	5	101 — 103	..	4 17 1
Do. 5 % Pref. .. ..	5	5	5	4 1/2 — 5 1/2	..	4 15 3	Do. 6 % Bonds .. ..	100	6	6	101 — 103	..	5 16 6
Do. 4 1/2 % Deb. .. ..	100	4 1/2	4 1/2	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10 1/2	7 1/2 — 7 1/2	— 1/2	6 12 3
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	136 — 141	..	5 13 0	Do. 6 % Pref. .. ..	5	6	6	5 — 5 1/2	..	5 9 1
Do. Pref. Ord. .. ..	100	6	6	118 — 122 xd	..	4 18 4	Do. 5 % 1st Deb. .. ..	100	5	5	97 1/2 — 99 1/2	..	5 0 6
Do. 5 % Pref. .. ..	100	5	5	108 — 111	+ 1/2	4 10 1	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2	..	1 1/2 — 1 1/2	..	1 15 7
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	100 — 103	..	4 7 5	Do. 5 % 1st Deb. .. ..	100	5	5	99 — 101	..	4 19 0
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	102 — 104	..	4 6 7	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2 — 5 1/2	..	5 2 2
Do. 4 1/2 % Con. Deb. .. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5	Do. 4 1/2 % 1st Deb. .. ..	100	4 1/2	4 1/2	98 — 101	..	4 9 1
Calcutta Trams, Ord. .. ..	5	6	..	5 1/2 — 5 3/4	..	5 4 4	Rio de Janeiro Trams .. ..	\$100	4 1/2	5 1/2	115 — 116	..	4 6 2
Do. 5 % Pref. .. ..	5	5	5	5 — 5 1/2	..	4 15 3	Do. 1st Mort. 5 % Bonds ..	..	5	5	101 1/2 — 102 1/2	..	4 17 10
Do. 4 1/2 % Deb. .. ..	100	4 1/2	4 1/2	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds .. ..	100	5	5	96 1/2 — 99 1/2	+ 3/4	5 0 9
Cape Electric Trams .. ..	1	Nil	2 1/2	3 1/2 — 3 1/2	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	195 — 197	— 2	5 1 6
City Buenos Aires Trams (1904)	5	5	5	6 1/2 — 6 1/2	..	4 5 1	Do. 5 % 1st Deb. .. ..	\$500	5	5	162 — 164	..	4 16 2
Do. 4 % Deb. .. ..	100	5	5	95 — 98	..	5 2 0	Singapore Trams, 5 % Deb. ..	100	5	5	81 — 84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95 xd	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 103	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 — 5 1/2	..	5 9 1
Kalgoorlie Elec. Trams .. ..	1	Nil	..	1 1/2 — 1 1/2	..	Nil	Do. 6 % Pref. .. ..	5	6	6	5 1/2 — 5 1/2	..	5 11 7
Do. 5 % A Deb. .. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. .. ..	100	5	5	98 1/2 — 101 1/2	..	4 18 6
Do. 6 % B Deb. .. ..	100	5	6 1/2	58 — 62	..	8 1 4	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	104 — 106	..	4 4 11

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil 6	8 — 8 1/2	..	..	Dick, Kerr ..	1	5 ..	2 1/2 — 2 1/2	..	5 3 1
Do. 6 % Pref. ..	1	9 6	2 1/2 — 2 1/2	..	7 2 2	Do. Pref. ..	1	6 6	1 1/2 — 1 1/2	..	5 12 11
Babcock & Wilcox ..	1	26 24 1/2	6 1/2 — 6 1/2	+ 1/2	5 19 0	Do. Deb. ..	100	4 1/2 4 1/2	98 — 101	+ 5 1/2	4 9 1
Do. Pref. ..	1	6 6	1 1/2 — 1 1/2	..	3 13 10	Edison & Swan, A, £3 paid ..	5	Nil ..	1 1/2 — 1 1/2	— 1/2	Nil
B.I. & Helsby Cables ..	5	10 8 1/2	6 1/2 — 7 1/2	..	7 0 4	Do. fully paid ..	5	Nil ..	1 1/2 — 1 1/2	..	Nil
Do. Pref. ..	5	6 6	5 1/2 — 6 1/2 xd	..	4 16 0	Do. 4 % Deb. ..	100	4 4	71 — 75	..	5 6 8
Do. Deb. ..	100	4 1/2 4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb.	100	5 5	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2 4 1/2	94 — 97	..	4 12 9	Electric Construction ..	2	Nil 2 1/2	..	..	..
British Westinghouse, Pref.	3	Nil ..	1 1/2 — 1 1/2	+ 1/2	Nil	Do. Pref. ..	2	7 7	1 — 1 1/2 xd	..	7 9 4
Do. Deb. ..	100	4 4	57 — 60	+ 2	6 13 4	Greenwood & Batley, Pref.	10	7 7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien ..	100	6 6	102 — 105	+ 1	5 11 3	Do. Deb. ..	100	5 5	94 — 96	..	5 4 2
Browett, Lindley, Ord.	1	Nil ..	1/6 — 2/6	..	Nil	General Electric, Pref. ..	10	5 5	9 — 9 1/2	..	5 5 3
Do. Pref. ..	1	Nil ..	5/6 — 6/6	..	Nil	Do. Deb. ..	100	4 4	85 — 90	..	4 8 11
Brush, Ord. ..	2	Nil ..	0 — 1/4	..	Nil	Henley's, Ord. ..	5	15 10 1/2	11 1/2 — 12 1/2	..	6 2 5
Do. 7 % Pref. ..	2	Nil ..	0 — 1/4	..	Nil	Do. Pref. ..	5	4 1/2 4 1/2	4 1/2 — 5 1/2	..	4 5 11
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	56 — 61	..	7 7 7	Do. Deb. ..	100	4 1/2 4 1/2	104 — 106	..	4 4 11
Do. 4 1/2 % Second Deb.	100	4 1/2 4 1/2	37 — 42	..	10 14 4	India-Rubber, G. & T. ..	10	10 ..	10 — 12	..	..
Callender's Cable ..	5	15 10 1/2	9 — 9 1/2	..	7 13 10	Do. Pref. ..	10	5 5	9 1/2 — 10 1/2	..	4 17 7
Do. Pref. ..	5	5 5	5 — 5 1/2	..	4 15 3	Telegraph Construction ..	12	20 10 1/2	35 1/2 — 37 1/2	+ 1/2	6 7 0
Do. Deb. ..	100	4 1/2 4 1/2	98 1/2 — 100 1/2	+ 1/2	4 9 7	Do. Deb. ..	100	4 4	99 1/2 — 101 1/2	..	3 18 10
Castner-Kellner ..	1	17 20	3 1/2 — 3 1/2	..	4 11 10	Willans & Robinson ..	1	Nil ..	1 — 1 1/2	+ 1/2	Nil
Do. Deb. ..	100	4 1/2 4 1/2	106 — 110 xd	..	4 1 10	Do. Pref. ..	5	Nil ..	1 — 1 1/2	+ 1/2	Nil
Crompton & Co. ..	3	Nil Nil	1 1/2 — 1 1/2	..	Nil	Do. Deb. ..	100	4 4	53 — 58	+ 1	6 18 0
Do. Deb. ..	100	5 5	58 — 68	..	7 7 1						

\* Unless otherwise stated, all shares are fully paid. + Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/2 per cent., February 8th, 1912.



OPAL SHADES.

[COMMUNICATED.]

THE virtues of scientifically-designed shades with prism angles calculated in the laboratory have been dinned into the ears of the electrical world until we are apt to accept without question the claim that such expensive wares are essential to efficient lighting. We are in danger of forgetting the good qualities of the cheap, homely, old-fashioned opal, or, at the best, are unable to support our opinion of its excellence by convincing figures.

The following tables, therefore, may be of service in showing the actual state of affairs. The readings give the foot-candles of illumination on a standard surface at a distance of 5 ft., and each result represents the average of a number of readings.

The shades used were ordinary conical white-opal ones, and it will be noticed that the shallower one cuts off some of the horizontal rays in the case of the short carbon lamp only, whereas the deeper one practically obscures both lamps.

The introduction of long metallic filaments accentuated the difference between the vertical and horizontal candle-powers of incandescents: in the cases before us it will be seen the increase is from less than 2 to 1 to more than 4 to 1, so that, if light is required principally in a downward direction, the lamp must either be fixed on its side (to the detriment of the filament life) or a good reflecting shade must be employed. From the tables it is evident that, by using a suitable shade, the vertical illumination may be increased five times in the case of the carbon and nine times in the case of the metal-filament lamp. At the angle of 45°, the former is double, the latter half as much again.

16-C.P. 100-VOLT CARBON-FILAMENT LAMP.

	<i>Bare.</i>	<i>10 in. × 3 in. shade.</i>	<i>10½ in. × 5¼ in. shade.</i>
Vertical	... 0.35	1.44	1.92
30°	... 0.48	1.22	1.42
45°	... 0.58	1.04	1.13
60°	... 0.58	1.00	0.84
Horizontal	... 0.65	0.50	0.18

50-C.P. 100-VOLT METAL-FILAMENT LAMP.

	<i>Bare.</i>	<i>10 in. × 3 in. shade.</i>	<i>10½ in. × 5¼ in. shade.</i>
Vertical	... 0.47	2.71	4.15
30°	... 1.23	2.32	3.00
45°	... 1.62	2.32	2.83
60°	... 1.82	2.30	2.56
Horizontal	... 1.96	1.96	0.40

No doubt good results could be obtained by utilising the direct horizontal rays aided by a reflector of the shell type. Such a shade could not be produced cheaply in opal, and the silvered troughs usually supplied are likewise rather expensive. A metal trough painted white (but a by no means dazzling white) inside gave readings of 1.4 foot-candles with the 16-C.P. lamp and 3.2 with the 50-C.P. metal one.

On the whole, it seems the old conical opal shade serves its purpose well, and the contention of a recent writer, who advocated presenting the filament broadside on to the object to be lighted because "you can't shoot light out of a funnel like shot out of a gun" is scarcely accurate.

**Memorial to Prof. Ashcroft.**—On December 14th, 1911, the sudden death occurred of Prof. Ashcroft, assistant professor of civil and mechanical engineering at the Central Technical College. Prof. Ashcroft was so universally liked by all those who came in contact with him at the college, and he did so much to help his students both in and out of college hours, that there is a very strong feeling that his old students should unite to found a memorial to his name and work. After careful investigation by the Old Students' Association, it is considered that the most suitable plan to adopt is to place a tablet to his memory in the college, and to collect funds for the purpose of aiding his son, who is now about 14 years old, to follow and complete the course of training which the late Professor had planned for him. It is suggested that if each of his students would subscribe even a small sum, sufficient funds would be available to carry out the scheme. Donations should be addressed to Mr. E. F. Armstrong, 98, London Road, Reading, if possible before the end of February, so that immediate action may be taken.

THE FORMATION OF DEPOSIT BY TRANSFORMER OILS.

By P. N. HOOPER.

MR. SYMONS'S interesting contribution on the above subject\* must be welcomed and treated with the consideration it deserves, because so little has been done, and so much remains to be done, before any final decision can be arrived at as to the actual composition of this deposit, and the change which takes place in the oil during its formation.

Mr. Symons attributes the work that has been done on this subject to the fact that Mr. Peck called attention to it in the discussion on Messrs. Digby & Mellis's paper on the "Physical Properties of Switch and Transformer Oils," which was read before the Institution of Electrical Engineers at Manchester on March 22nd, 1910. I feel, however, that credit should be given to the staff of the Newcastle Electric Supply Co., who early in 1908 called the attention of the firm, Messrs. Alexander Duckham & Co., Ltd., to its presence, and asked them whether they could offer any explanation; since that date both these firms have been continuously carrying out research work in connection with it. I could wish that our Mr. A. Duckham could offer his views as a chemist on a subject in which he has been so keenly interested, and on which so much work has been done in his private laboratory, apart from the investigations carried out by my firm; but, unfortunately, his absence on a tour of inspection of oil fields will keep him abroad for some months, and therefore I am venturing, as far as may lie in my power, to put before your readers what I know of some of the results that he had obtained.

It was in December, 1908, that we informed the Newcastle Co. that the deposit was certainly not due to a deposition of wax, as had been suggested by them, for as a matter of fact, there was absolutely no trace of wax to be found, as would have been predicted by a chemist cognisant of the conditions, especially those of temperature, but we were able to say definitely that the deposit contained, as its most striking constituent, saponifiable matter, which was apparently combined to some extent with lead and manganese. At the same time, we were dissatisfied with the results of our tests, because there was no doubt that the compounds containing oxygen were far in excess of those which, according to the state of our knowledge, could be expected to be combined with the metals in question, if the compounds were to be regarded as the ordinary salts or soaps of fatty acids. The results were sent on to the Newcastle Co., and were submitted by them to the Wallsend Laboratories, who, at the end of 1909, reported that their investigations confirmed the results which we had set forth. However, before those results had been confirmed in this way, we had definitely discovered the source of the lead and manganese as coming from the compound mica sheet which had been used in the construction of the transformers, and, further, we had also had samples of transformer deposits which were practically free from lead and manganese, and consisted almost entirely of a hydrocarbon body combined with oxygen: in our opinion, it is that last-mentioned compound which is the essential constituent of all transformer deposits. Not only do we find it in transformers, but we have come across it as a deposit in lubricating systems, for instance, on turbines where the oil has been pumped round and round over a considerable period of time, at a warm temperature. Again, we have found it in Cutting oils where the oil has been circulated over long periods, and in the course of its use comes into intimate contact with the air.

Going to an entirely different sphere, for a last instance, I would refer to a totally different source in which this compound can be found, and that is bitumen or asphalt, which has been formed in nature by a process of evaporation and oxidation of mineral oils; in such bitumen compounds of this type exist.

Although for some considerable time we have been carefully considering and working on the exact constitution of this compound, in the hope of even giving it a definite

\* ELECTRICAL REVIEW, December 22nd and 29th, 1911.



chemical formula, we have so far made no perceptible progress, and as any chemist knows, research work of that kind may last a lifetime without being rewarded by achievement of the end in view.

With diffidence I venture to comment on some of the results which Mr. Symons has published, in the hope that my remarks may be of interest to your readers, and, perhaps, even of some use to those who, like ourselves, are investigating the subject.

The standards which he adopts for heating are of interest, and it is a pity that those users of transformer oils who issue specifications cannot agree to adopt some definite standard. As an instance of the variance in the specifications which come before us, I would mention that in one case we have to undertake a continuous heating test for 700 hours at a temperature of  $110^{\circ}\text{C}$ ., whilst at the other extreme we are requested to make our test at a temperature of  $200^{\circ}\text{C}$ . for the short period of eight hours. Then, in some instances, the oils are heated exposed to air, whilst in others it is specified that oxygen shall be bubbled through the oil. At first sight it would seem desirable to use the most rapid means—*i.e.*, to bubble oxygen through the oil at as high a temperature as might be safe, and for the shortest period of time that would give comparable results; for, like all oxidising actions, this formation proceeds more rapidly with the increase of temperature, and with the state of concentration of the reagents which enter into the combination. But there is quite a sound argument which has been put forward against such a drastic test—and that is, does such a rapid test truly represent what is going on in the transformer, and therefore is it not better to use a slower method, and more moderate treatment?

Personally, we are against such slow treatment, as we believe that all the information which is required can be obtained by the more rapid means; indeed, to satisfy ourselves as to the quality of the oil under consideration, we employ ozone as being the more active form of oxygen, and we keep our temperature as high as we dare, having in mind the danger of actual combustion.

Mr. Symons says that the discoloration of the oil can, to some extent, be taken to indicate the liability of oil to form deposit. Although this is to some extent true, when the oils to be compared are of the same chemical constitution, for example, if they come from the same type of crude, yet when one is comparing an oil which is chemically inclined to the aromatic series with one which is rather of the aliphatic series, colour cannot be taken as an indication, and as at the present moment transformer oils of these two divergent types of chemical composition are in common use, it would be quite unsafe for the user to rely on the discoloration test as an indication of the value of two such oils.

Mr. Duckham is absolutely at variance with Mr. Symons when the latter gentleman says that this chemical action is due to heat, and not essentially the result of oxidation, for I remember well that Mr. Duckham conducted experiments in which the same oil was placed in two different flasks, maintained at a high temperature. Through one of them he bubbled air, and through the other nitrogen, or rather air from which all the oxygen had been removed, and whereas the oil in contact with air (*i.e.*, oxygen) in due course gave a heavy deposit, there was not the least sign of any deposit forming in the vessel which was treated with nitrogen. Of course, in such a test as this, the oil through which the nitrogen bubbled became darker because evaporation and a certain amount of decomposition occurred, but, nevertheless, the darkening in colour was negligible, as compared with the deep black shade to which the original pale yellow oil was converted in the oxygen-treated flask. Another of his experiments shows, however, that the heat alone, at any rate at temperatures up to  $150^{\circ}\text{C}$ ., has little or no effect on the colour, for he heated tubes of the same oil in contact with air and various gases at this temperature, whilst from one tube the atmosphere was exhausted, and it was then sealed, and in that tube in which no distillation or oxidation could occur, the oil was the same colour at the end of the experiment as at the beginning, whilst all the other open tubes had darkened, and formed deposit to varying extents. Of course Mr. Symons is quite right in saying that oxidation produces no appreciable deterioration in any reasonable time if the oil be cold, for all chemical actions are greatly

accelerated by heat and retarded by cold. My point is that all the evidence which we have obtained goes to show that heat by itself does not cause this change, and that the oxygen, or a similar reagent, must be present. As an example of what I mean by a similar reagent, I would mention sulphur, which of all chemical elements is the one which in its reactions and combinations most closely resembles oxygen.

Mr. Duckham carried out preliminary tests with sulphur, and those tests showed that with sulphur, oxygen being entirely excluded, a similar action of darkening and of deposit occurred, and he hopes to be able to show before long that these combinations, whether with sulphur or oxygen, are of essentially the same structure.

Although it is, perhaps, rather out of place in these comments of mine to call attention to Mr. Symons's remark, "That the percentage loss in weight on heating will vary with the flash-point of the oil," yet I consider it necessary to do so, because it may be somewhat misleading, in view of the fact that many oil manufacturers do not supply what might be considered a "straight" distillate from the crude, but are in the habit of blending a somewhat heavy and perhaps an extremely light distillate to obtain certain results as to viscosity, &c.; in such a case the flash point could not be taken as a correct indication of the evaporating properties of the compound oil. To make my meaning clear, I would give a somewhat extreme case in which a heavy cylinder oil might be blended with a light boiling spirit in order to reduce its viscosity, and whereas the flash point of the cylinder oil might be some  $500^{\circ}\text{F}$ ., yet the presence of 10 per cent. spirit would reduce the flash even below ordinary atmospheric temperatures, *i.e.*, below  $60^{\circ}\text{F}$ ., and therefore in our opinion the actual evaporating tests ought to be carried out, or better still, a distillation test, the temperatures being noted at which, say, every 10 per cent. distils over.

It is somewhat difficult to follow what Mr. Symons means when he says that the physical changes are more moderate than the chemical changes when oils are submitted to a heating test (it being understood that oxygen or air has access), for we find that there is always under these circumstances a rapid regular and easily recognised chemical change, and we have found it quite inadvisable to take physical changes as a criterion of the liability of the oil to form deposit. In carrying out the tests, it is certainly, as emphasised by Mr. Symons, most advisable to keep a uniform temperature, but we have found it unreliable to do so by a method of stirring, and we adopt the precaution where possible of making the tests in a carefully jacketed hot-air oven, in which is fixed a cradle or "cruet," in which the samples are placed; this cruet is revolved round a vertical axis by clockwork during the whole of the test, and by adopting this precaution we find that by far the most uniform results have been obtained.

As to the formation of acids in the oil, Mr. Symons says that the most marked change is the increased acidity. We must say that we do not consider this to be so marked as the chemical change which takes place in the formation of the deposit, and, moreover, we have not so far felt confident in saying that the oxide which is formed is an acid in the true acceptance of that word, notwithstanding the fact that it certainly combines or reacts with alkalis; but the point which I specially wish to emphasise in connection with Mr. Symons's statement as to increased acidity, is that by this opinion he indirectly admits that oxygen is, after all, the most necessary agent in this reaction, for without oxygen he certainly could not generate an acid.

As to the colour of the deposits, we have obtained them of such pale colour, that when in suspension in the oil they appear to be absolutely white; but after filtration they have been found to be of a very pale lemon colour, and it has been our experience that the variation in colour of these deposits cannot be considered as being affected by the colour of the oil at the completion of the heating test. Mr. Symons appears to think that he has reached finality in the formation of deposit from a given volume of oil by continued heating, but with us, even with our 700 hours' test, we have never reached that point; yet there is no doubt that if an oil be submitted to a heating test, and then carefully filtered, on further heating the formation of more deposit is



less rapid. Our theory in connection with this matter is that oxygen combines with the unsaturated hydro-carbon molecules, and leaves practically unaffected those molecules which are fully saturated, and therefore better able to resist the action.

A point that we have noticed in the formation of these deposits is that some oils give well defined granular solid matter which rapidly sinks to the bottom, whereas oils of somewhat different chemical composition, under the same test, will form a quite impalpable flocculent body which will remain suspended for a long time in the oil, and if a mixture of such different oils be submitted to the test, you distinctly obtain both types of deposit, the granular form sinking at once to the bottom, and the flocculent, and paler formation, remaining in suspension.

In order to expedite the settling of the flocculent formation, it may interest some of your readers to know that we find that these deposits are insoluble in petroleum ether, and on the addition of a certain amount of that liquid to an oil after its heating test, the settlement is far more rapid. Indeed, an oil which has been heated for only a short time, and is quite bright, may begin to form a deposit as soon as petroleum ether is added. This insolubility in petroleum ether is a most valuable help in separating deposits for examination. Again, there are certain solvents in which these deposits are soluble, and from which they can be recovered on evaporation, which characteristic is again, of course, of the greatest use.

Another experience we have had with a heated oil is that after a certain amount of deposit is formed, and the oil allowed to become cold, if it be then filtered so that it is perfectly bright, on further standing it becomes gradually misty, and a further amount of deposit can be extracted. This characteristic we have not endeavoured to explain.

As Mr. Symons has stated, one would expect to find the so-called saponification value to be higher in the deposit than in the oil, because, after all, the deposit consists almost entirely of the oxide mixed with a little oil, whereas in the oil the proportions are reversed, as there will only be a very small proportion of the oxide in solution.

We cannot agree that "only a pure oil which will completely evaporate at a high temperature, leaving no residue," will give immunity from deposit, at least if air has access to the oil during the process of evaporation. To put my meaning more clearly, we have found that an oil which on distillation out of contact with the air, gives little or no solid residue in the flask, is quite as liable to form this special type of deposit as an oil which under the same circumstances leaves a heavy pitch-like residue, and in our opinion the actions cannot be considered in any way as related to one another, because, after all, the evaporation or distillation test, and the subsequent formation of pitch-like deposit, is simply a question of decomposition out of contact with oxygen, whereas the formation of transformer deposit is to be considered entirely one of oxidation without the question of decomposition coming into the action in any way, and the two solid bodies obtained from the different methods do not resemble each other physically or chemically.

The Newcastle Co. called our attention to a very important phenomenon which they had observed, viz., that in the presence of copper the formation of deposit was far more rapid; to check their statement we heated for 300 hours at 240° F. two samples of the same oil exposed to the air. They were in closed vessels, and in one of them copper foil was placed, so that 20 sq. in. of it were immersed in the oil. It was at once visibly evident that the sample containing the copper had deposited a greater amount than the other. The whole of the deposit of each sample was carefully extracted, washed, dried and weighed, and the copper heated sample gave .750 per cent., as against 0.059 per cent. in the other sample. On this it at once occurred to us that perhaps the copper had combined with certain oxides, or perhaps even in the suggested capacity of acids, to form a copper salt, but on testing the deposit it was found that the copper existing in it was only a very slight trace, and certainly not in a large enough proportion to satisfy our copper salt theory. And, indeed, this almost looks as though the action would have to be classified as catalytic, which expression after all is not really understood by anybody, but

forms a convenient word to hide our ignorance of the reaction and simply serves to convey the information that the copper is necessary to the reaction, but that its exact function is not understood. We are now making experiments with other metals in the hope that we may obtain interesting results.

Some of the German firms make another interesting test, which consists of heating the oil in which is immersed cotton tape; at the end of the experiment they test the tensile strength of the cotton and also what they term the acidity of the oil.

In concluding these remarks, I would say that, although we personally have not heard anything as to whether the Germans have been doing research work on this deposit question, we cannot help feeling from some of the results which they have obtained in practice, and from the type of oil which they recommend for transformer work, that they must have had for some time past a considerable knowledge of what are the desirable chemical qualities in the oil, even if they have not been aware of the actual *raison d'être*.

## TRADE STATISTICS OF CANADA.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1911, are taken from the recently issued trade statistics. Figures for the year 1909-10 are given for purposes of comparison and notes of any increases or decreases have been added:—

	1909-10.	1910-11.	Increase or decrease.
	Dollars.	Dollars.	Dollars.
<i>Brass wire, plain.—</i>			
From Great Britain ...	6,000	5,000	— 1,000
United States ...	36,000	37,000	+ 1,000
Total ...	42,000	42,000	
<i>Railway passenger cars.—</i>			
From United States ...	121,000	57,000	— 64,000
<i>Tram or horse cars.—</i>			
From United States ...	22,000	5,000	— 17,000
<i>Celluloid manufactures.—</i>			
From Great Britain ...	12,000	9,000	— 3,000
Germany ...	5,000	2,000	— 3,000
United States ...	73,000	42,000	— 31,000
Other countries ...	10,000	6,000	— 4,000
Total ...	100,000	59,000	— 41,000
<i>Coal, bituminous.—</i>			
From Great Britain ...	91,000	20,000	— 71,000
United States ...	12,979,000	14,576,000	+ 1,597,000
Total ...	13,070,000	14,596,000	+ 1,526,000
<i>Copper wire, plain, tinned or plated.—</i>			
From Great Britain ...	24,000	1,000	— 23,000
United States ...	61,000	64,000	+ 3,000
Total ...	85,000	65,000	— 20,000
<i>Electric light carbons and carbon points.—</i>			
From Great Britain ...	1,000	8,000	+ 7,000
Germany ...	14,000	14,000	
United States ...	28,000	37,000	+ 9,000
Other countries ...	2,000	2,000	
Total ...	45,000	61,000	+ 16,000
<i>Electric apparatus not mentioned—insulators, electric and galvanic batteries, telegraph and telephone instruments.—</i>			
From Great Britain ...	398,000	360,000	— 38,000
Austria ...	5,000	5,000	
France ...	3,000	7,000	+ 4,000
Germany ...	5,000	45,000	+ 40,000
Sweden ...	17,000	26,000	+ 9,000
United States ...	2,457,000	3,751,000	+ 1,294,000
Switzerland ...	—	22,000	+ 22,000
Other countries ...	1,000	2,000	+ 1,000
Total ...	2,916,000	4,218,000	+ 1,302,000



	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.		1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
<i>Incandescent lamp bulbs, &amp;c.—</i>				<i>Belting, leather.—</i>			
From Austria ...	19,000	15,000	— 4,000	From Great Britain ...	166,000	185,000	+ 19,000
„ United States ...	53,000	75,000	+ 22,000	„ United States ...	7,000	16,000	+ 9,000
„ Other countries ...	1,000	5,000	+ 4,000	Total ...	173,000	201,000	+ 28,000
Total ...	73,000	95,000	+ 22,000	<i>Lighting fixtures of metal, including electric light fixtures of metal.—</i>			
<i>Electric motors, generators, dynamos and sockets.—</i>				From Great Britain ...	19,000	24,000	+ 5,000
From Great Britain ...	35,000	24,000	— 11,000	„ Austria ...	2,000	2,000	—
„ France ...	2,000	2,000	—	„ United States ...	354,000	470,000	+ 116,000
„ Sweden ...	28,000	13,000	— 15,000	„ Other countries ...	10,000	11,000	+ 1,000
„ United States ...	428,000	518,000	+ 90,000	Total ...	385,000	507,000	+ 122,000
„ Other countries ...	—	1,000	+ 1,000	<i>Asbestos manufactures.—</i>			
Total ...	493,000	558,000	+ 65,000	From Great Britain ...	19,000	33,000	+ 14,000
<i>Lamp chimneys, glass shades and globes.—</i>				„ United States ...	174,000	212,000	+ 38,000
From Great Britain ...	7,000	3,000	— 4,000	„ Other countries ...	6,000	9,000	+ 3,000
„ Austria ...	14,000	13,000	— 1,000	Total ...	199,000	254,000	+ 55,000
„ Germany ...	13,000	19,000	+ 6,000	<i>Plumbago, ground and manufactured.—</i>			
„ United States ...	161,000	245,000	+ 84,000	From Great Britain ...	4,000	4,000	—
„ Other countries ...	1,000	2,000	+ 1,000	„ United States ...	36,000	39,000	+ 3,000
Total ...	196,000	282,000	+ 86,000	Total ...	40,000	43,000	+ 3,000
<i>Rubber belting.—</i>				<i>Mica.—</i>			
From Great Britain ...	13,000	29,000	+ 16,000	EXPORTS.			
„ United States ...	51,000	34,000	— 17,000	To Great Britain...	11,000	61,000	+ 50,000
Total ...	64,000	63,000	— 1,000	„ United States...	287,000	247,000	— 40,000
<i>Manufactures of india-rubber and gutta-percha, except clothing and similar goods.—</i>				„ Other countries ...	1,000	2,000	+ 1,000
From Great Britain ...	112,000	143,000	+ 31,000	Total ...	299,000	310,000	+ 11,000
„ Austria ...	6,000	3,000	— 3,000	<i>Electrical apparatus.—</i>			
„ France ...	3,000	5,000	+ 2,000	To Great Britain...	2,000	9,000	+ 7,000
„ Germany ...	39,000	44,000	+ 5,000	„ Newfoundland ...	3,000	3,000	—
„ United States ...	479,000	568,000	+ 89,000	„ United States...	21,000	110,000	+ 89,000
„ Other countries ...	2,000	4,000	+ 2,000	„ Other countries ...	2,000	10,000	+ 8,000
Total ...	641,000	767,000	+ 126,000	Total ...	28,000	132,000	+ 104,000
<i>Locomotives for railways.—</i>				<i>India-rubber manufactures.—</i>			
From Great Britain ...	33,000	2,000	— 31,000	To Great Britain...	9,000	31,000	+ 22,000
„ United States ...	314,000	295,000	— 19,000	„ Newfoundland ...	3,000	5,000	+ 2,000
Total ...	347,000	297,000	— 50,000	„ New Zealand ...	8,000	4,000	— 4,000
<i>Gasoline engines.—</i>				„ United States...	34,000	50,000	+ 16,000
From Great Britain ...	35,000	126,000	+ 91,000	„ Japan ...	2,000	—	— 2,000
„ United States ...	955,000	1,322,000	+ 367,000	„ Other countries ...	—	3,000	+ 3,000
„ Other countries ...	10,000	17,000	+ 7,000	Total ...	56,000	93,000	+ 37,000
Total ...	1,000,000	1,465,000	+ 465,000	<i>Machinery.—</i>			
<i>Steam engines.—</i>				To Great Britain...	30,000	78,000	+ 48,000
From Great Britain ...	30,000	43,000	+ 13,000	„ Newfoundland ...	22,000	19,000	— 3,000
„ United States ...	217,000	202,000	— 15,000	„ New Zealand ...	10,000	3,000	— 7,000
„ Other countries ...	6,000	—	— 6,000	„ Argentina ...	8,000	8,000	—
Total ...	253,000	245,000	— 8,000	„ France... ..	43,000	4,000	— 39,000
<i>Boilers.—</i>				„ United States...	238,000	570,000	+ 332,000
From Great Britain ...	116,000	52,000	— 64,000	„ Other countries ...	90,000	65,000	— 25,000
„ United States ...	124,000	128,000	+ 4,000	Total ...	441,000	747,000	+ 306,000
„ Other countries ...	3,000	1,000	— 2,000				
Total ...	243,000	181,000	— 62,000				
<i>All machinery not mentioned, except sewing machines, textile machinery, printing machinery, &amp;c.—</i>							
From Great Britain ...	592,000	1,241,000	+ 649,000				
„ France ...	13,000	27,000	+ 14,000				
„ Germany ...	56,000	220,000	+ 164,000				
„ United States ...	6,446,000	10,976,000	+ 4,530,000				
„ Other countries ...	30,000	93,000	+ 63,000				
Total ...	7,137,000	12,557,000	+ 5,420,000				
<i>Iron and steel wire, single or several, covered with cotton, linen, silk, rubber or other material, including cable so covered.—</i>							
From Great Britain ...	161,000	201,000	+ 40,000				
„ United States ...	159,000	286,000	+ 127,000				
„ Other countries ...	9,000	9,000	—				
Total ...	329,000	496,000	+ 167,000				
<i>Iron and steel wire not mentioned (except fencing wire).—</i>							
From Great Britain ...	46,000	52,000	+ 6,000				
„ Germany ...	23,000	18,000	— 5,000				
„ United States ...	141,000	197,000	+ 56,000				
„ Other countries ...	1,000	4,000	+ 3,000				
Total ...	211,000	271,000	+ 60,000				

**Electric Cabs in Hamburg.**—An article dealing with the working expenses of electric motor vehicles, particularly in the cab department, was published in the *Technische Rundschau*, of January 31st, the author being Herr Wendt, of Stettin. It is stated that the working results of the Hamburg Electric Cab Co. show that it is possible largely to reduce the reserve of cabs and the costs per cab-mile with electrical vehicles, as compared with the reserve and costs incidental to petrol cabs. The company possesses a fleet of 88 battery cabs having an average daily performance of 88'66 miles. On the average only four cabs are withdrawn from service for repairs and maintenance, and notwithstanding the long daily service the reserve only amounts to 5 per cent. The average life of the positive plates of the batteries is 10,230 miles, and that of the negatives 20,460 miles, whilst that of the pneumatic tires is 6,820 miles. The total costs are returned at 6½d. per cab-mile. This figure includes cost of energy at 1½d. per kw.-hour, maintenance of batteries, material and repairs, drivers' wages, general expenses of management, insurance, &c., 4 per cent. interest on capital and depreciation of cabs. The working receipts range from 7'68d. to 9'6d. per cab-mile, according to the extent to which the number of cabs is accommodated to the demand, and to the lesser or greater length of idle journeys without passengers. It is considered desirable that cabs of the same uniform type should be employed if the best results are to be obtained in order to restrict the cost of materials and replacements to a minimum, and to be able to teach the workmen how to undertake the repairs. As petrol cabs are not allowed in Hamburg for hygienic reasons and for increasing the safety of traffic, a direct comparison with such cabs in that city is out of the question. The author, however, does not state the definite financial results of the electric cab company, despite the four years of working.



## PROCEEDINGS OF INSTITUTIONS.

## The Evolution and Present Development of the Turbine Pump.

By DR. EDWARD HOPKINSON and MR. ALAN E. L. CHORLTON.

*(Abstract of paper read before the INSTITUTION OF MECHANICAL ENGINEERS, January 19th, 1912.)*

IN no domain, perhaps, has the turbine rotary principle achieved greater success in the last few years than that of high-lift pumping, though the realisation of its possibilities of such duties, by some, is perhaps as old as, or older than, the steam turbine itself.

In the year 1875 Prof. Osborne Reynolds invented a turbine pump of the series type, fitted with guide-vanes, and essential features of his original proposition have been adopted in subsequent practice

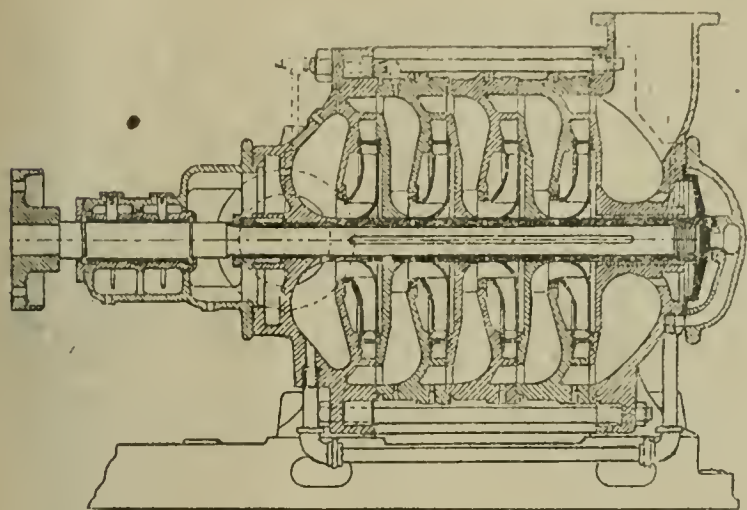


FIG. 1.—MODERN FOUR-CHAMBER PUMP. SECTION.

The first pump of which records and tests are available was constructed in the year 1887 by the firm of Mather & Platt for the Engineering Laboratory of the Owens College, Manchester. This pump had four impellers in series, and gave at 1,500 R.P.M. a total head of 148 ft., or 37 ft. per chamber. The average efficiency recorded in the tests made by Prof. Reynolds was 58.5 per cent.

The tests of Prof. Reynolds proved the capability of the pump to perform many duties, previously thought impossible by centrifugal pumps, and in 1893 the firm of Mather & Platt took up its commercial manufacture.

A modern four-chamber pump is shown in longitudinal section in fig. 1; its guide vanes and its impeller in fig. 2. Constructionally this pump differs principally from the earlier designs, in that the extended suction end is shortened, and is similar to the delivery end. This enables various classes of drives, motor, belt or steam turbines, to be better negotiated with a standard pattern. Successive chambers, instead of being secured to their neighbours by bolts and flanges, are held together by long bolts extending the entire length of the pump body and held only at the two ends (suction and delivery).

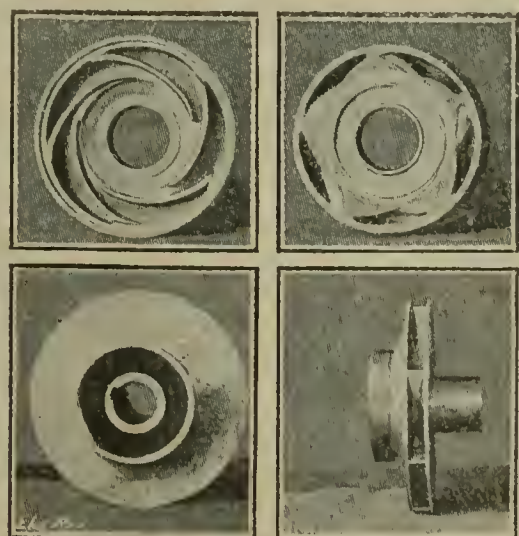


FIG. 2.—GUIDE VANES AND IMPELLER OF PUMP.

The impeller is of the shrouded type, having vanes bent well backwards, and the guide passages are longer and more correctly divergent, whilst the return way to the eye of the next impeller is of a curved form and more in line and continuous with the receptive ports, thus preventing the abrupt right angle turn through the casing obtaining in the Reynolds pump. The losses in the Reynolds impeller through side friction in its casing are obviated, and any leakage from the periphery back to the suction is prevented or greatly minimised by the outer circumference of the impeller

eye running in neck bushes with a very small radial clearance, amounting to less than 0.005 in. The importance of preventing

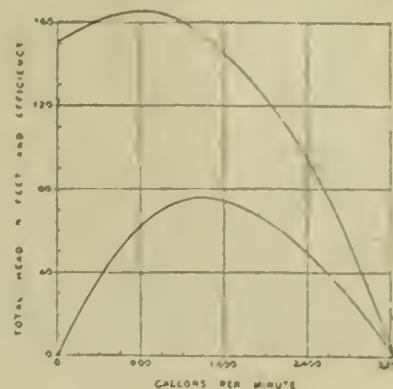


FIG. 3.—HEAD AND EFFICIENCY CURVES AT 600 R.P.M.

this leakage is very great if high efficiency is to be secured. The impeller is turned all over outside to reduce loss by skin friction,

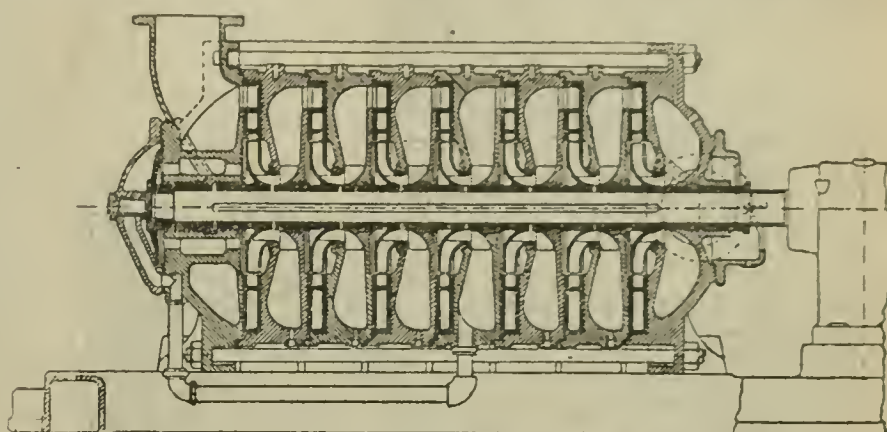


FIG. 4.—MATHER &amp; PLATT MINE DRAINAGE PUMP, 1911. SECTION.

and with the same object it is usual to use as many wheels as the circumstances will otherwise allow of.

The end or axial balance of the impellers is obtained by the automatic device shown, which acts well in practice, and compensates for wear and variable leakage taking place in the pump. In other respects the arrangement, direction of flow of water, and assemblage of the pump are the same as in the original Mather-Reynolds pump. Representative curves of head and efficiency of such a pump are shown in fig. 3.

A set constructed for the engineering laboratory of the University of Cambridge, in 1900, consisted of a pump at one end, a turbine at the other end, and an electric motor between them.

A similar combination was made use of later for actual installations, amongst others at the Newcastle electric power station, for circulating the condensing water. The pump raised and forced water from the river to the condenser in the electric generating station in the town, the return flow to the river passing through and driving the turbine, and the loss being made up by the electric motor in between.

Figs. 4 and 5 shows a series turbine pump lately constructed for mine drainage. It is probably the mine pump with the largest capacity yet constructed. This pump is capable of delivering 2,500 gallons per minute to a height of 2,000 ft. when running at a speed of 1,450 R.P.M., and absorbs over 1,900 H.P. at the spindle.



FIG. 5.—MINE-DRAINAGE PUMP, 1911.

It is operated by a three-phase motor at 2,500 volts, direct coupled through a flexible coupling of the pin and rubber-bush type.

The pump has seven impellers arranged in series, working in chambers, following each other, and not as is sometimes done for such high heads by arranging the impellers back to back, with the intention thus to balance the end-pressure. The series impellers are constructed of phosphor-bronze, and are mounted on a shaft of extra large diameter, to prevent sag in the middle and allow of fine clearance in the neck rings at the eyes of the impellers, thus reducing leakage. The guide-vanes into which the impellers discharge are large castings of special bronze, double-sided and cast in one piece, thus securing increased rigidity.

The intermediate chambers have the return passages from the periphery to the suction of the next impeller cast in. They are of cast-iron, and have feet cast on, which, resting on the planed



surface of the bedplate, support and keep the whole pump in true alignment, a precaution more necessary when the length of the pump is as great as in this case. The construction also facilitates the stripping and rebuilding of large pumps. There is only one exterior bearing, in the form of a separate pedestal standing on and bolted to the main bedplate at the suction end. The reason for this bearing being separate and of such a solid form and not overhung from the pump-casing, as in the more standard form of smaller pumps, is due to the large power transmitted through the pump shaft at a high speed. There is a water-logging passage to the shaft at the suction stuffing-box to prevent air leakage.

At the delivery end of the pump there is an internal automatically grease-lubricated bearing and a differential end balance-plate readily accessible for examination and adjustment, a great advantage with dirty waters. This construction obviates the disadvantages of a gland at the delivery end, subject to the full head

FIG. 6.—ELECTRICALLY-DRIVEN BOILER FEED PUMP, SHOWING IMPELLERS.

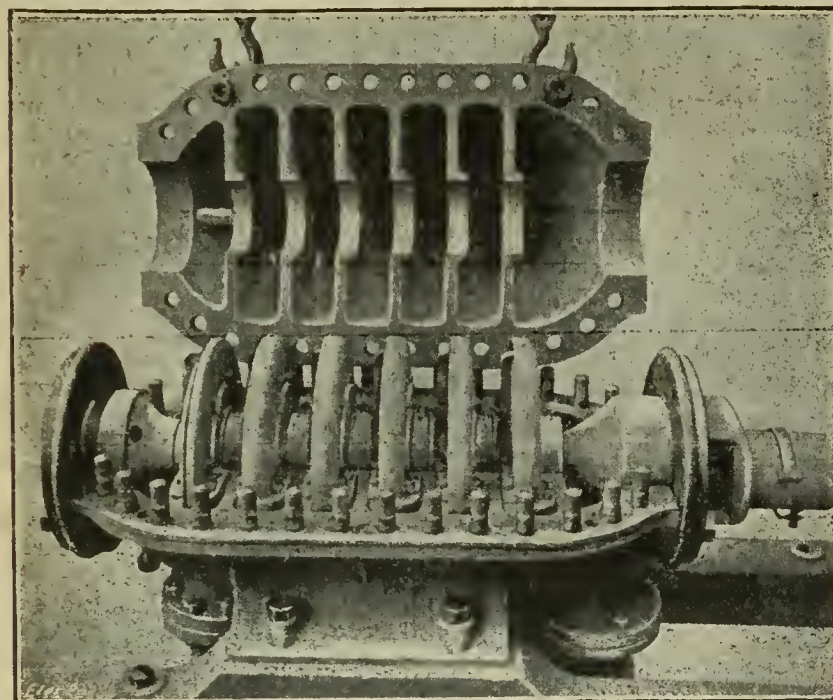
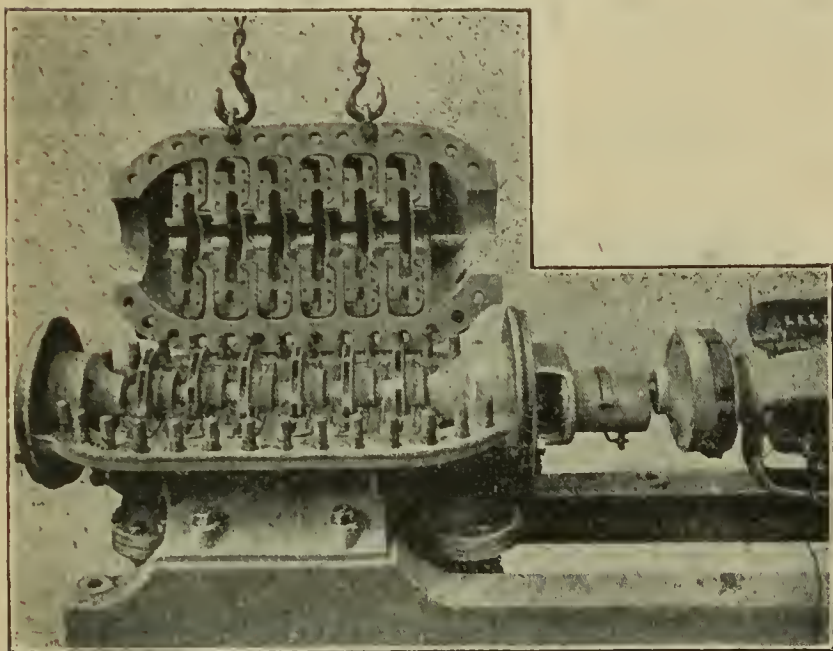


FIG. 7.—BOILER FEED PUMP, WITH GUIDE-PLATES IN POSITION.

pressure, with its attendant leakage and cutting of shaft. The lubrication of the internal bearings is effected by a piston worked by the head pressure pumped against.

Figs. 6 and 7 show an electrically-driven boiler feed-pump, consisting of two six-chamber pumps in series, of the split-body type, allowing of the whole of the inside impellers, shaft and guides being taken out together when the top half-cover is removed. This is a much simpler and quicker operation than taking adrift a standard type, but it is a more expensive form of construction.

The difficulty in such a design is to deal with the 260 lb. per sq. in. internal water pressure on the split joint. Reference to the illustration will show how this is accomplished. It will be seen that the impellers are surrounded by guide plates, put on in halves and bolted together, and the whole is then placed in a casing divided in the middle horizontal plane. The casing is provided with as many dividing ribs as there are impellers. Turned bosses on the guide disks rest in suitably machined seats in the dividing ribs. The top cover is bolted on to secure them in their places, and they are prevented from rotating by pins. The main joint against heavy pressures is thus a plain one and of great rigidity, and can easily be maintained tight. The capacity of the pumps shown is 140 gallons per minute, 260 lb. per sq. in. delivery pressure at 1,270 R.P.M.

### The Institute of Metals.

At the annual meeting of the Institute of Metals held recently in London the question of the utility of the Institute to practical men was again raised. Sir Gerard Muntz, in acknowledging a vote of thanks accorded to him on vacating the office of President after serving in it with distinction for two years, referred to criticism in the Press and elsewhere as to the utility of the Institute, and to the suggestion that it had drifted too much on the scientific side. Now that he was no longer President he could say, speaking as a manufacturer with many years' experience behind him, that far from being too scientific, the Institute had yet a long way to go in the scientific direction. The manufacturer would be the first to criticise such a tendency, and in his turn would give a practical answer to the papers of the scientist. His opinion was that the Institute had done an enormous amount of useful work for the practical man, and that it would become more and more valuable to the scientific and the practical men, who by working together could be of great mutual assistance to each other.

That may be regarded as Sir Gerard's *apologia*, and it is no easy matter to find fault with the manufacturers' or users' point of view upon such a matter when expressed by so distinguished a representative as Sir Gerard Muntz. Criticism has been directed against the Institute on several occasions because of the undue proportion of what, without offence, may fairly be called academic papers, but judging from the list of papers and authors at the London meeting this criticism has been without beneficial effect. Practically all the papers were academic rather than works papers. It is true that, more than in the past, science must come to the aid of industry, but it is also equally true that a study of the results obtained in practice is of as great importance as a theoretical discussion before practical trial. If the Institute continues to be mainly the mouthpiece of the research laboratories of our colleges it is doomed to comparative failure, and the Council will be well advised to make efforts to secure practical papers and practical discussions to supplement their present type. Further, it is to be hoped that the practical members will not hesitate to ask the readers of academic papers to state clearly in what direction the scientific principles and data described can be applied to works practice.

To the unusually interesting inaugural address prepared by Prof. William Gowland, the new President, with whom genuine sympathy was felt in his enforced absence from the meeting through illness, only a passing reference need be made here. Prof. Gowland maintained that till the rise of Greek and Roman civilisation, but little use was made of metals which must have been first known to the men inhabiting the localities in which they occurred. His main thesis, however, was to emphasise the idea that "the influence of copper, and particularly of bronze, is an element which has played a greater part in the civilisation of Europe than that of any other metal," and in the development of this he gave a mass of valuable information about the discovery, working and use of alloys.

The first paper taken was by Mr. Arnold Philip, the Admiralty chemist, and dealt with the corrosion of condenser tubes by contact with electro-negative substances, this constituting the first part of a series of contributions to the history of corrosion that the author has promised to present to the Institute of Metals. Mr. Philip's paper revealed a very satisfactory condition of affairs concerning the millions of tubes in use in the Royal Navy, which have been systematically preserved by the presence of electro-positive metals placed near and in metallic connection with them. Mr. Philip said that, though 10 per cent. of the failures referred to by him appeared mysterious, it was quite possible that the lack of any ostensible cause for the corrosion in these instances was due to the absence of fuller detail as to whether the tubes had been exposed to contact with electro-negative materials, such as coal, iron and the like. In the second place, when condensers were not in use, it was only sometimes that they were dried out by steam, whilst in others the water was merely drained off. He believed both causes had much to do with failures, but that the electrolytic action of particles resting in the tubes was more important in producing corrosion than the layer of salt water left on "draining off" the condenser. In his own experience, 90 per cent. of the tubes gave out along the bottom, but this experience was based solely on bad cases of corrosion, as minor ones were not referred to him, so that it was quite possible that the experience of others on this matter might be different.

MR. G. D. BENGOUGH, who opened the discussion, said that in his opinion the electrolytic theory of corrosion was sufficient to account for all the cases of corrosion within his experience. That is a very important point, because in certain quarters that theory has not received approval. Mr. Bengough pointed out that as far as Admiralty brass (copper 70 parts, tin 1 part and zinc 29 parts) was concerned there were very few cases of corrosion. All that seemed to be necessary was that they should evolve some sort of cheaper metal which would resist corrosion as well as Admiralty brass.

MR. A. E. SEATON called attention to the fact that there were no complaints of defective tubes in the Navy. The investigations which had taken place would help the work of the Corrosion Committee, and he had great hopes from the work which was now to be put in hand.

MR. ANDERSON said there was reason to believe that the means of preventing corrosion would be found in an electrical method. He was astonished that corrosion troubles were so rare in Admiralty practice, as in the last three months he had become acquainted with 60 to 70 cases, in many of which protective devices as mentioned by the author were in use. A great many of these had been in power stations and in the mercantile marine, but an appreciable proportion of the tubes had been of Admiralty mixture.



It might be taken from the information given that, although such cases were rare, the Admiralty mixture tubes were still liable to corrosion and pitting in the absence of an electro-positive mass. He agreed with the author's view that no matter how efficient the protective mass might be, its effect could not be attained unless good metallic contact existed between the tube to be protected, and the protective mass. He would like to know what means, if any, were used to ensure such contact. In his (the speaker's) system the plan adopted was to provide each tube with a soft metal washer, placed in the stuffing-box on the top of the ordinary packing, which when screwed up afforded ample contact between each separate tube and the tube-plate. It would also be of interest if the author could give any particulars of the current conveyed to the tubes by the protective blocks employed. He had recently been watching the behaviour of blocks fitted to a condenser in such a way that the electric current generated could be measured. The results showed that the current generated per block ranged from  $\frac{1}{2}$  to  $1\frac{1}{2}$  amperes, and that the average current in the condenser was about at the rate of 1 ampere per 1,000 sq. ft. of surface. Pits might occur in any position, and in his experience it was rather the exception to find them confined to any one latitude. This did not preclude the idea that even in other positions than the bottom, electro-negative particles might have attached themselves to the inside. It was found, however, that in many cases attacked tubes were completely and evenly lined with ferric oxide all over, with local perforations. His own view was that stray currents had a great influence on the corrosion of condenser-tubes, and might safely be assumed to account for a larger proportion of the mysterious cases. Generally, however, sea-going engineers were not provided with instruments which would detect them.

MR. E. L. RHEAD said that the possibility of electrolytic disturbances arising from the gases liberated from the water was as great as it was in the case of solid bodies. Solids deposited in a tube were centres from which gases were liberated. The question was not one concerning any gas in particular, but all gases liberated in contact with the tube would promote corrosion. In boiler practice, for instance, it was found that corrosion was especially prevalent when the feed was drawn from water contaminated by sewage. Corrosion did not usually extend to all parts of a tube, but was most prevalent where the water entered, which was just what would be expected if gases were liberated, and acted as the effective cause. In the case of corrosion of turbine-driven propellers, it had been found that this was specially prevalent in areas of reduced pressure. It was here that gases would be liberated, and he believed that the erosion was due to this, and not to the velocity or pressure of the water.

MR. PHILIP, in reply, expressed his agreement with the view that stray currents might be an effective cause of the damage in some cases of corrosion; but he did not think it was so frequently responsible, as was the contact of electro-negative substances with the tube. He had called attention in his paper to the ill effects attending the practice of merely draining off condensers when putting them out of use. The patches of corrosion, when at the bottom of the tubes, were always elongated. In view of the facts brought forward, he had proposed the use of vertical tubes, but the practical necessity of maintaining accessibility made these difficult to adopt at sea.

PROF. TURNER then read his paper on "The Behaviour of Certain Alloys when Heated in Vacuo," in which he showed that by heating brass in vacuo a separation of the zinc and copper could be effected in a very short time. Other alloys were also investigated. As the result of certain experiments, he suggested that the process described by him might prove industrially valuable in refining crude copper.

MR. VAUGHAN HUGHES, who took part in the discussion on the paper, referred to some work of his on incandescent lamps in the early eighties, when he found that in such vacua as were used even platinum would vaporise at comparatively low temperatures. This fact had made it necessary to reduce the area of the platinum exposed. Other metals, such as copper, nickel, and the like, were completely volatilised in the same conditions.

DR. WALTER ROSENHAIN next presented a paper in which he drew attention to the confusion which existed at the present time in the nomenclature of alloys; the name of an alloy, he said, conveyed no indication of the true nature of the material, and was in some cases quite misleading. These remarks did not apply so much to the well-known alloys, such as Muntz metal, naval brass, and similar alloys. When, however, an alloy consisting essentially of copper and zinc, and containing not more than 0.2 per cent. of manganese, was described as "manganese bronze," the need for some reform in the nomenclature became evident. There were also no clear demarcations between such terms as "brass" and "bronze." Much confusion existed as to the group of alloys of copper, zinc and nickel, some of which were known as "German silver." The alloys of aluminium with copper also presented difficulty. The object aimed at, concluded the author, would not be to introduce exact technical names into general commercial use, so much as to provide the engineer, in drawing up his specifications, and the analytical chemist in testing material under these specifications, with a clear set of names by which the general type of alloys could be distinguished.

Another paper to which brief reference should be made is that presented by Mr. R. H. Greaves, who explained the influence of oxygen on copper containing arsenic or antimony. The alloys were prepared synthetically from pure electrolytic copper. Oxygen was introduced as cupric oxide, and arsenic or antimony was added in the form of a rich alloy with copper. It was found that with constant arsenic, addition of oxygen causes no marked difference to the malleability until a certain limit (depending on the arsenic present) is reached; above this point the malleability falls off, and

with still more oxygen there is a rapid deterioration of the metal, which becomes cold-short. The addition of arsenic or antimony to pure copper hardens it; the effect of either on copper containing oxygen is first to diminish and then increase its hardness. The addition of oxygen to arsenical copper is without any marked influence on the hardness until it reaches a limit depending on the percentage of arsenic, when the hardness rapidly increases. Thus copper with 0.4 per cent. arsenic and 0.3 per cent. oxygen is quite as soft as, if not a little softer than, a similar metal free from oxygen. The limit of the percentage of oxygen which does not noticeably affect the hardness rises to about 0.35 per cent. as the arsenic increases to 0.5 per cent. Antimony first diminishes and afterwards increases the hardness of copper containing oxygen, while quite a low percentage of oxygen begins to harden copper containing antimony. Sir Gerard Muntz said that he had also called attention to the influence which oxygen had on copper, and Mr. Greaves's results to a large extent confirmed his own.

## Dynamos for Motor Road Vehicle Lighting.

By J. D. MORGAN, A.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Birmingham, January 10th, 1912.)

DURING the past few years serious attention has been directed to the development of electric lighting systems for motor road vehicles, as it is widely recognised that something superior to the ordinary methods of oil and acetylene lighting is urgently needed. By common consent, the use of a battery alone for providing current is unsuitable, and a dynamo is essential.

The principal conditions to be complied with are: (a) That the dynamo must be capable of maintaining a practically constant voltage over a wide range of speed variation and under different loads; and (b) if voltage variations are unavoidable, the amount of variation must not seriously affect the brightness of the lamps. Regarding the first condition, it is usual to arrange for the dynamo to supply current at the normal voltage when the vehicle is moving at the rate of from 10 to 15 miles per hour, and to maintain the voltage constant, or as nearly constant as possible, at all superior speeds, which may reach 50 to 60 miles per hour. When the vehicle is at rest or travelling below 10 miles per hour, the current is supplied entirely or for the greater part by a battery arranged in parallel with the dynamo circuit. Regarding the second condition, it is known that in metal-filament lamps a small increase above the normal voltage is attended by a relatively large increase of brightness. An experiment on a 4-volt lamp showed that an increase of the voltage from 4 to 5 caused the candle-power to increase from 3.6 to 8.

Several attempts have been made to construct machines in which a series compensating winding is used, the idea being to diminish the strength of the field progressively by the current in such winding after the normal voltage has been reached. Obviously a constant voltage cannot be obtained, but what is aimed at is to keep the voltage variation within practical limits over a given range of speed variation. A machine embodying this principle for road vehicle lighting is produced by Messrs. Bleriot, Ltd., and is illustrated diagrammatically in fig. 1. The shunt winding *a* is connected across the external circuit, and the current leaving the armature passes through the series winding *b* before reaching the shunt winding. A centrifugal switch at *c* closes the external circuit when a certain speed is attained. By the Bleriot method a much larger voltage variation can be produced at the brushes than is experienced in the external circuit, and the current through the shunt winding is subject to smaller fluctuations than it would be if connected across the brushes. Consequently a greater compensating effect can be obtained from the series winding than would otherwise be possible. Between the speeds of 1,600 and 4,000 revs. per minute the voltage rose from 10.5 to 13.75, and the current increased from 6 to 18 amperes. Over the same range of speed variation the voltage at the brushes rose from 11.5 to 16.75. The increasing difference between the two voltage curves illustrates clearly the usefulness of the arrangement of the windings in the Bleriot machine for regulation purposes.

As a result of the test it may be urged that the performance of the Bleriot machine was not satisfactory. The regulation of the machine is dependent on the condition of the battery. With the battery run down superior regulation was experienced, but when the battery approached the fully charged condition the voltage in the external circuit increased without increase of speed. The best results as regards steadiness of voltage are obtained when the maximum output does not exceed the consumption by more than about 2 or 3 amperes. With some batteries this figure may be increased, but in all cases a heavy charging current should be avoided.

All machines which are regulated automatically by an increase of current in some part of the system which is in communication with the external circuit appear to be useless without a battery.

An exceedingly good and interesting machine of the interbrush type is that of Messrs. Trier & Martin, which is illustrated diagrammatically in fig. 2. The machine is of two-pole shunt-wound construction, and is provided with a pair of intermediate brushes *a a'* placed midway between the ordinary main brushes *b b'*. The main and interbrushes are connected together through resistances *c*. The arrangement differs from the more familiar Leitner arrangement in that the interbrushes are connected to the main brushes instead of to the field windings. The makers describe the action of the machine in their patent specification as follows:—"As *b* is the negative and *b'* the positive brush, the current in the re-



sistance connecting the main brush  $b'$  with the auxiliary brush  $a'$  will, when the machine is running on open circuit, flow from  $b'$  to  $a'$  and, in the resistance connecting the other pair of brushes, will flow from  $a$  to  $b$ . The effect of these currents, which, of course, also flow in the armature coils between  $b'$  and  $a'$ , and  $a$  and  $b$ , is to

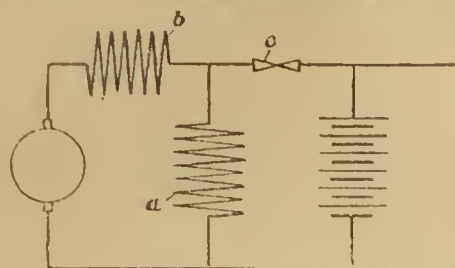


FIG. 1.

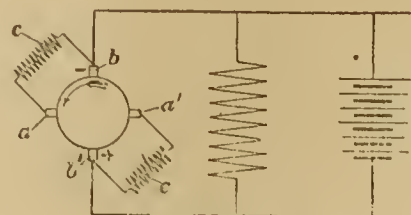


FIG. 2.

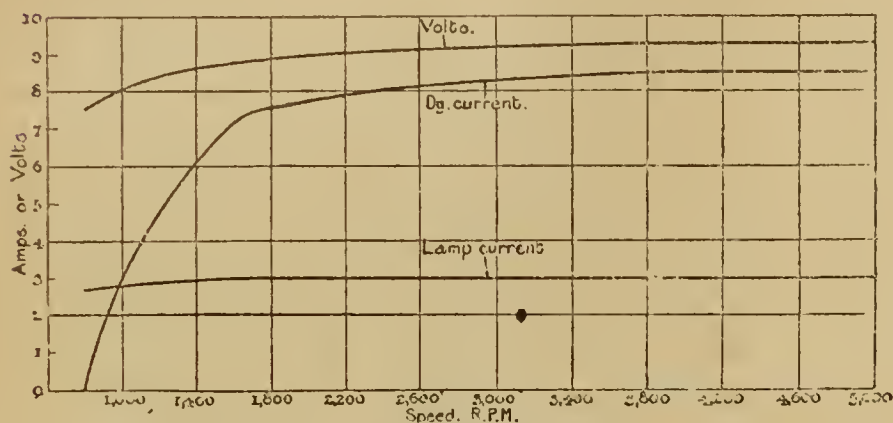


FIG. 3.

strengthen the main field. As the load increases, an armature reaction is set up which displaces the axis of the field forward, and by so doing reduces the current in the resistances  $c$ , and, consequently, the magnetic field is also reduced. When the axis of the magnetic field is displaced by  $45^\circ$ , there will be no current at all between the main and auxiliary brushes, as they will then be at equal potentials. A further displacement of the magnetic field due to increasing load and speed will cause a current to flow again between the main and auxiliary brushes, but such current will now be in the reverse direction, and its effect will be to weaken the main field instead of to strengthen it. Thus the output of the dynamo becomes self-regulating."

The performance of the machine is illustrated in fig. 3. In the tests an 8-volt battery was used. The output rapidly rises until a speed of about 1,600 R.P.M. is reached. Above this speed the output rises very slowly and keeps within a practical limit. As with other self-regulating machines, a battery is essential, and the maximum voltage and current obtained depend to some extent on the condition of the battery. The variations with changes in lamp load are insignificant. With lamps consuming  $4\frac{1}{2}$  amperes the maximum current given by the machine was 8 amperes.

Another interesting machine is the Midgley-Vandervell, or C.A.V. machine. This is of the type with which electrical engineers have been familiarised by the Rosenberg machine, depending for its self-regulating property upon the short-circuiting of certain armature windings. The principle of the C.A.V. machine is illustrated in fig. 4, where the upper view shows the connections and the lower one the magnetic system alone. Two opposite pairs of poles  $a$  and  $b$  are united by the body  $c$ . The poles  $a$  are provided with shunt windings, whilst the poles  $b$  are left unwound. Current is supplied to the external circuit by the armature windings under the poles  $b$  through brushes  $d$ , and the armature is wound in such a manner that the brushes also short-circuit armature coils lying in the neighbourhood of the leading edges of the poles  $a$ . The initial path of the magnetic flux is indicated diagrammatically by the thin dotted lines in the lower figure. When the current in the short-circuited coils reaches a certain value, the magnetism associated with them appears to break down the principal flux at the parts adjacent to those coils, and causes the flux to swing into opposite quadrants as indicated by the thick dotted lines in the figure. At this stage the machine becomes self-regulating, as the cross-magnetisation due to the armature coils under the poles  $b$  counteracts the principal flux, and so progressively weakens the field as the speed increases. This action proceeds to a limit beyond which, under a given load, the voltage and current are constant at all speeds.

The above explanation is based upon information contained in the inventors' patent specification, but whilst apparently satisfactory as a general guide to the action of the machine, it does not appear to be complete, for long before a marked change occurs in the disposition of the flux, current is supplied to the external circuit, which suggests that the two dispositions of flux shown in the figure exist concurrently at all speeds.

The behaviour of a machine in practice is shown by the diagram in fig. 5, which is representative of a large number of tests with the machine coupled to a battery and lamps as in service conditions. When the maximum voltage is reached it remains remarkably steady. A drop is shown in current at the higher speeds. This is probably due to defective brush contacts. It will be observed that the maximum current directed into the battery was 1.2 amperes. With such a small charging current a practically uniform condition is maintained in the battery, and the latter is, therefore, not so likely to interfere with the regulation of the machine as when a

machine is used the output of which is largely in excess of the demand. Using the head lights only, the maximum volts increased

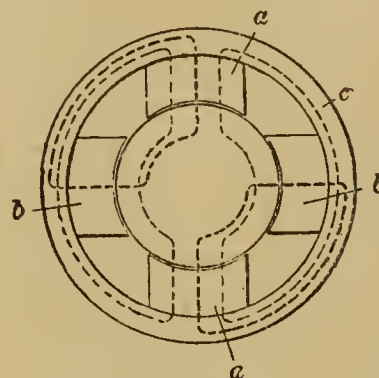
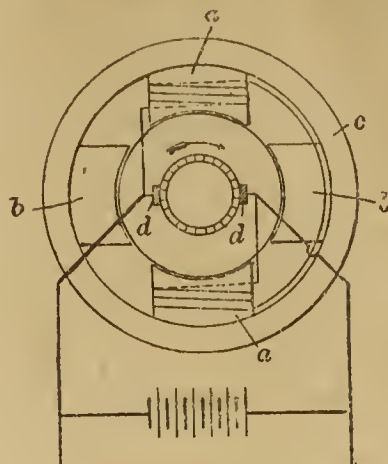


FIG. 4.

from 13 to 13.5, and using the side and tail lights only, the maximum volts rose to 14.

When a battery is used, an increase of voltage is attended by a proportionately larger increase of current passing through and from the machine, and in consequence self-regulation can be obtained. This fact is of great importance, inasmuch as it makes the battery an indispensable part of the equipment.

Another interesting self-regulating system is that of Grob, shown in fig. 6. The machine  $a$  is separately excited by a battery  $b$ , and the field windings  $c$  are connected between the positive poles of the battery and machine respectively. With increase of voltage across the brushes the difference of potential at the ends of the windings diminishes, and in consequence the strength of the field diminishes. This action rapidly proceeds to a limit above which the voltage and output of the machine under a given load remain fairly constant at all speeds. The system appears to be capable of giving good results, but it possesses the serious disadvantage that a battery of twice the normal size must be carried in order that one-half may be charged

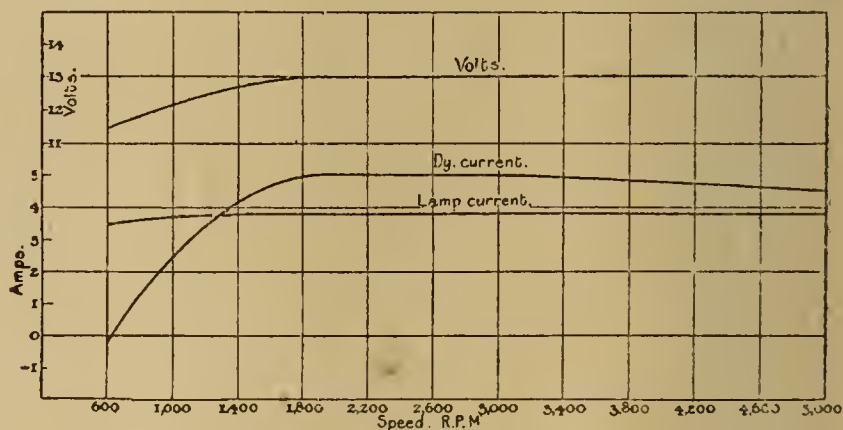


FIG. 5.

whilst the other half is in service. Further, the permanent or residual magnetism of the machine seems to prevent a perfectly steady voltage from being obtained.

Mechanically regulated dynamos depend for their action upon some moving part. In one machine the armature is moved axially by a governor, so that the number of lines cut by the armature winding varies practically inversely as the speed. In another machine the air-gap is widened or contracted, either by the use of

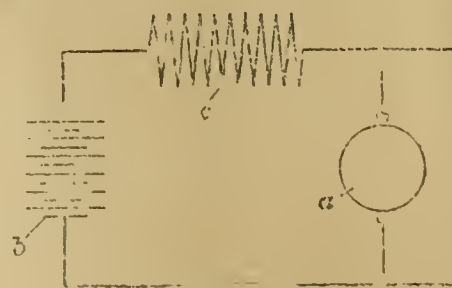


FIG. 6.

governor-controlled hinged pole-pieces, or by a conically-shaped armature which moves axially under the action of a governor between conically-shaped pole-pieces. Sliding masses of iron for varying the flux through the pole-pieces have also been proposed. The idea of shifting the brushes automatically seems to have been



popular with inventors. A very common method of regulation consists in the use of a field regulator actuated by a governor; this is undoubtedly a simple and practical procedure, but the difficulty appears to reside in the production of a sufficiently simple regulator capable of withstanding the conditions experienced on the roads.

The most important of mechanical devices hitherto produced for regulation purposes are those depending upon a slipping drive. These are divisible into two classes, which are characterised respectively by constant torque and constant speed. A constant torque device is wrong in principle for motor-car lighting. In motor-car practice it is common to arrange the side and tail lights in series under the control of one switch, and the head lights (if two are used) in parallel under the control of another switch. To cut out either set of lamps causes a big difference in the lamp load, and is, in consequence, attended by an increase of speed in the dynamo and of brightness in the remaining lamps.

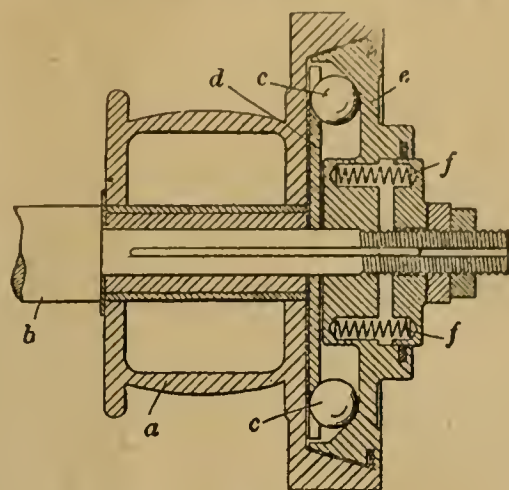


FIG. 7.

Constant speed devices usually consist of a governor-controlled clutch. An exceedingly good form is one constructed by Messrs. Joseph Lucas, Ltd. Fig. 7 shows a section of the clutch. A driving pulley *a* is arranged to run freely on the armature shaft *b* and is shaped at one end to contain a number of free governor balls *c*. The latter are supported in slots in a plate *d* keyed to the armature shaft, and are arranged to bear against the inner surface of a clutch element *e* which whilst secured to the shaft can slide thereon. The inner periphery of the pulley is shaped to correspond with the outer coned periphery of the part *e*, and between the two surfaces is inserted a thin ring of vulcanised fibre. Springs *f* serve to keep the clutch in action. At and below a certain speed the mechanism revolves as one piece, but above that speed the balls, by their centrifugal action, relieve the pressure due to the springs between the clutch surfaces and enable slipping to occur. There is no appreciable separation of the clutch surfaces when in action, but simply a variation of pressure. It will be observed that the balls are connected to the driven part and not the driving part of the mechanism.

As might be expected, a jerkiness of action is a common fault in slipping clutches at the critical speed owing to the difference between static and kinetic friction, and a drop in speed is often experienced at the instant when slipping begins; or, in other words, the clutch can continue to accelerate the speed of the

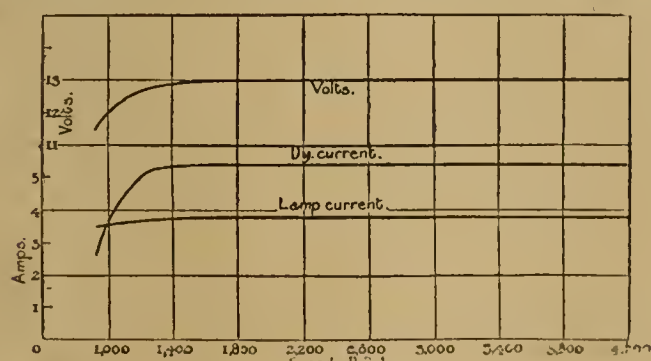


FIG. 8.

armature beyond the maximum speed for which the clutch is adjusted, but as soon as slipping sets in the speed drops and remains tolerably constant at all superior speeds of the driving pulley. Messrs. Lucas have avoided this defect by arranging for ample lubrication of the clutch surfaces so that they are always separated by a thin film of oil. By this provision the instant at which slipping occurs becomes practically imperceptible, and an extremely smooth action is obtained. Fig. 8 illustrates the results of a series of tests made on a Lucas dynamo fitted with a clutch of the type above described. It will be observed that the maximum output remained perfectly steady. With variation of load an increase of the maximum dynamo speed was obtained and a consequent increase of voltage. When supplying current (3.8 amperes) to two 12-volt head lights and three 4-volt side and tail lights the maximum voltage was 13. On cutting out the side and tail lights the voltage increased to 13.6, whilst on cutting out the head lights (leaving the others in service) the voltage rose to 14. The variation is not serious, but it serves to show that in some degree the governor-controlled clutch possesses the same characteristic as the constant-torque clutch. This difference must be observed however, namely, that by increasing the sensitiveness the speed varia-

tion under varying loads can be made much smaller in the governor-controlled clutch than in the constant-torque clutch. It is doubtful, however, whether anything is to be gained by developing the mechanism beyond a certain point, seeing that, even with a perfect mechanism, it is practically impossible completely to avoid variations of voltage with variations of load owing to conditions existing in the dynamo and battery. Such results as those obtained in the tests referred to are sufficiently good for practical purposes. As with other machines, the Lucas dynamo is arranged to work in conjunction with a battery, supplying into the latter about 2 amperes when the maximum output is reached. When the clutch is adjusted to suit the particular lamps and battery which it is required to supply, the cutting out of the battery involves a large (though restricted) increase of voltage in the lamp circuits. This is, however, not so serious as in the electrically regulated systems described, and would not render it impossible to use the lights in the event of a mishap to the battery. Much if not all the variation experienced in the working of the lighting systems above described, and not due to speed variation, is due to the battery.

#### DISCUSSION.

MR. L. MURPHY said that many of the devices discussed simply provided means for waste of the surplus energy when the engine was running at speeds just higher than necessary for the generation of the voltage required by the lamps. In one case this surplus energy was thrown in the battery, and in the other a clutch wasted energy in the form of heat. He did not care for the term "constant torque" and "constant speed" as applied by the author to the clutches; it would be more correct to call them "torque limiting" and "speed limiting" clutches. With a true constant speed device one would simply have an ordinary shunt-wound or magneto dynamo, and leave the constant speed device to do the rest. He took strong exception to the author's condemnation of the magneto machine; it was not necessary to design these machines in such a way that they demagnetised themselves at all in use. A strong point in favour of the magneto generator was its comparatively high efficiency for machines of small output.

DR. S. P. SMITH said that the trouble seemed to arise in the attempt to drive the lighting dynamo from the main engines, the speed of which could not be constant. Surely some attempts must have been made to avoid these complicated contrivances by installing a small auxiliary set for lighting quite independent of the main engines. The advantages of such an arrangement were obvious. The space taken up would be very small owing to the small output required, and since the battery would now be superfluous, the auxiliary engine might be accommodated in the space thus made free.

MR. R. V. C. BROOK, referring to the Bleriot system, said the constant action of the dynamo pumping surplus current into the battery was very detrimental to the latter, and in a case which had come under his notice the battery was found to be useless after a short time. He agreed that it should be possible to produce a magneto machine suitable for car lighting which would be more efficient than the self-excited type, and should have a fairly long life, judging from the performance of the modern ignition magneto. The slipping clutch seemed to him to be unmechanical, and unless it was looked after, would give trouble owing to the rapid wear.

MR. R. G. PORTE did not agree that the battery system was unsuitable, inasmuch as the dynamo had not been sufficiently tested on the heavier type of vehicle. Five years ago he tried a dynamo, and found that owing to the excessive vibration to which it was subjected, the result was not satisfactory. He, therefore, adopted the battery, and installed it in 100 of the London type 'buses, which in a period of five years travelled over 10 million miles. At present there were 150 'buses running in London with that system installed. The batteries were properly looked after, one set being charged while the other set was in use. They were of Tudor make, and were admirably suited to the work. The cost of the battery system was about quarter of the dynamo system.

MR. M. A. E. L. MOHARRAM did not think constant candle-power necessary, and considered that the varying speed of the car might be taken advantage of to supply illumination which varied as the speed.

MR. E. WILLIAMSON noticed that Mr. Morgan omitted all reference to the permanent-magnet machine without any regulating field winding, and said he would like to hear his views on the capabilities of such machines.

MR. J. D. MORGAN, in reply, said that a properly designed electrically-regulated machine did not spoil a battery, and a properly designed slipping clutch was not subject to serious heating. Regarding permanent-magnet machines, it was very hard to obtain any reliable information, and he had not succeeded in obtaining any machine for testing purposes. It appeared to be generally accepted that magnetos were subject to rapid weakening of the field, and consequently a machine which when new was constructed to give a certain output at a certain speed would be found to be unable to maintain the output after a short period of use on the road. It was admitted, however, that magnetos provided a very attractive alternative, and if it was found that they were not subject to deterioration they would be very useful for car lighting. The use of a small auxiliary set driven from an independent engine had already been considered by more than one well-known engineer, and eventually that system might be adopted. A little experience of motoring at night was sufficient to convince anyone that uniform brightness of the lamps was essential. The author had tried a machine excited from a battery and having an extra large accumulator arranged in parallel with the lighting circuit; it was found that some degree of regulation could be obtained in this way, but it was not sufficiently good for practical purposes.



**NEW PATENTS APPLIED FOR, 1912.**

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co.,  
Electrical Patent Agents, 285, High Holborn, London, W.C., and at  
Liverpool and Bradford, to whom all inquiries should be addressed.

- 2,253. "Registration and automatic time recording of trunk telephone calls." S. D. WILLIAMS. January 29th.
- 2,271. "Telephone switchboard connecting cords." P. P. CRAVEN. January 29th.
- 2,284. "Electric incandescent lamps." DEUTSCHE GASGLÜHLICHT AKT.-GES. (Auer. Ges.) (Convention date, November 4th, 1911, Germany.) January 29th. (Complete.)
- 2,310. "Automatic battery over-discharge preventer." H. LEITNER. January 29th.
- 2,319. "Means and apparatus for storing and transporting incandescent electric lamps." E. H. ARCHER. January 29th. (Complete.)
- 2,320. "Automatic and semi-automatic telephone circuits." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) January 29th. (Complete.)
- 2,325. "Electric railways having automatic traction systems." J. J. DESCHAMPS. (Convention date, January 30th, 1911, France.) January 29th. (Complete.)
- 2,336. "Sanitary protectors for telephone transmitters." C. ADAMS. January 29th. (Complete.)
- 2,343. "Methods of and machines for electric welding." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Elektrizitäts-Ges., Germany.) January 29th.
- 2,348. "Drying articles moulded from clay or other wet material more especially intended for use in connection with the drying of multiple channel conduits for electrical conductors." R. LAWTON. January 29th.
- 2,355. "Contact apparatus for electric indicators for indicating the direction of rotation of a shaft." P. MOLINARI. January 29th. (Complete.)
- 2,383. "Receiving apparatus for electric oscillation." GES. FÜR DRAHTLOSE TELEGRAPHIE G.M.B.H. (Convention date, March 14th, 1911, Germany.) January 30th. (Complete.)
- 2,413. "Magnetic blow-outs for electric switches or the like." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, January 31st, 1911, Germany.) January 30th. (Complete.)
- 2,423. "Process for the production of non-porous electro-deposited coatings upon metal sheets." B. LOWY and F. MÜLLER. January 30th. (Complete.)
- 2,442. "Electrostatic machines for the production of alternating current." W. PETERSEN. January 30th. (Complete.)
- 2,456. "Aerial conductors used in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and C. E. PRINCE. January 30th.
- 2,457. "Wireless telegraph receiving apparatus." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and C. E. PRINCE. January 30th.
- 2,467. "Spark plug for internal-combustion engines." C. H. STEVENS. January 30th.
- 2,468. "Electric incandescent lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) January 30th.
- 2,471. "Vapour alternating-current rectifiers and similar apparatus." HARTMANN & BRAUN AKT.-GES. (Convention date, February 3rd, 1911, Germany.) January 30th. (Complete.)
- 2,472. "Interrupters for magneto-ignition apparatus." H. DIEHL. (Convention date, February 3rd, 1911, Germany.) January 30th. (Complete.)
- 2,480. "Spark plug for a petrol combustion engine." H. J. FARRELL. January 30th.
- 2,497. "Insulated coupling for all classes of electric cables." H. COWEY. January 31st.
- 2,505. "Conductors and supports for use in incandescent electric lamps and the like." A. C. HYDE. January 31st.
- 2,517. "Electric alarm device for measuring instruments." S. WORLICZKA and M. SLUZAR. January 31st.
- 2,523. "Electrical water heaters." M. H. SHOENBERG. (Convention date, April 29th, 1911, U.S.) January 31st. (Complete.)
- 2,563. "Production of electrolier and analogous sheet-metal chains." H. B. BUTLER. January 31st.
- 2,566. "Illuminated signs adapted to be supported above the globe or like part of an electric or gas lamp." W. H. BEVILLE. (Addition to 229/1912.) January 31st.
- 2,573. "Pocket lamps." J. J. MULLANEY. (Convention date, February 9th, 1911, U.S.) January 31st. (Complete.)
- 2,575. "Construction of electrical accumulator." P. MARINO. January 31st. (Complete.)
- 2,594. "Electrodes for accumulators with alkaline electrolyte." W. K. L. DICKSON. February 1st.
- 2,598. "Dynamo-electric machinery." R. A. HOLBECH. February 1st. (Complete.)
- 2,630. "Means for and methods of charging and discharging electric accumulators or secondary batteries." A. M. TAYLOR. February 1st.
- 2,649. "Device for securing electric conductors and the like to walls or other supports." W. T. HENLEY'S TELEGRAPH WORKS Co., LTD., and A. J. HEDGECOCK. February 1st.
- 2,671. "Automatic and semi-automatic telephone circuits." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) February 1st. (Complete.)
- 2,672. "Automatic and semi-automatic telephone circuits." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) (Addition to 2,320/1912.) February 1st. (Complete.)
- 2,688. "Electrical storage batteries." R. J. CROWLEY and L. TURNER. February 2nd.
- 2,701. "Electrical condensers." BRITISH INSULATED AND HELSBY CABLES, LTD., and E. A. BAYLES. February 2nd.
- 2,702. "Electromagnets." D. E. BARNES and A. A. G. JENSEN. February 2nd. (Complete.)
- 2,711. "Couplings for electric wires." W. JOHNSON. February 2nd.
- 2,734. "Self-excited direct-current dynamo-electric machinery." AKT.-GES. BROWN, BOVERI & CIE. (Convention date, February 24th, 1911, Germany.) February 2nd. (Complete.)
- 2,738. "Electric clock systems." A. R. UPWARD. February 2nd.
- 2,743. "Automatic and semi-automatic telephone circuits." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) Addition to 2,320/1912.) February 2nd. (Complete.)
- 2,747. "Switches for opening and closing electric circuits." H. LEITNER. February 2nd.
- 2,757. "Spark plug for internal combustion engines." A. J. H. BURNETT. February 2nd.
- 2,760. "Electrodes for use in electric welding." A. P. STROHMENGER. February 2nd.
- 2,764. "Electrical heating and radiating apparatus." H. S. MARTIN. February 2nd.
- 2,768. "Spark plug for use in electric circuits adapted for rapid electric oscillations." W. P. THOMPSON. (Ges. für Drähtlose Telegraphie m.b.H., Germany.) February 2nd.
- 2,769. "Wireless telegraphy installations." W. P. THOMPSON. (Ges. für Drähtlose Telegraphie m.b.H., Germany.) February 2nd. (Complete.)

2,770. "Masts for use in wireless telegraphy installations." W. P. THOMPSON. (Ges. für Drähtlose Telegraphie m.b.H., Germany.) February 2nd. (Complete.)

2,817. "Electric power transmission apparatus." MACFARLANE ENGINEERING Co., LTD., and W. A. MACFARLANE. February 3rd.

2,823. "Integrating electricity meter." R. KENNEDY and D. R. KENNEDY. February 3rd.

2,872. "Electrical device for catching and destroying flies and other small insects." A. J. WRIGHT and W. W. NIBLOE. February 3rd.

**PUBLISHED SPECIFICATIONS.**

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

**1910.**

PRINTING TELEGRAPHS. B. Soldatencow. 14,659. June 17th. (January 17th 1911.)

**1911.**

ARC-LIGHT PROJECTOR FOR STAGE LIGHTING AND OTHER PURPOSES. Thompson. (Scwabe & Co.) 18,230. August 11th.

METHODS OF MOUNTING OVERHEAD WIRES FOR ELECTRIC RAILWAYS AND THE LIKE. Siemens-Schuckertwerke Ges. 20,031. September 8th. (September 8th, 1910.)

TELEPHONIC APPARATUS. E. A. Graham. 20,898. September 21st.

CONSTRUCTION OF JACK-STRIPS FOR TELEPHONE SWITCHBOARDS OR THE LIKE. Siemens Bros. & Co. and E. A. Petithory. 22,397. October 11th.

ELECTRO-COMB. G. Meyer. 23,183. October 20th.

COOLING DEVICES FOR RÖNTGEN TUBES. Firm of C. H. F. Müller. 23,325. December 23rd. (December 15th, 1910.)

ELECTRICAL WATER-HEATERS. L. Katz. 23,830. October 27th.

REGULATING DEVICE FOR POLYPHASE-CURRENT ARC LAMPS. A. Heilmann and W. Schaffer. 25,586. November 16th. (November 17th, 1910.)

ELECTRIC WIRING OF BUILDINGS. L. Milne. 348. January 5th. (Cognate application, No. 13,213 of 1911.)

BAYONET CAP AND SOCKET CONNECTIONS OF INCANDESCENT ELECTRIC LAMPS. C. G. M. Bennett. 585. January 9th.

APPLICATION OF ELECTRICITY TO SURGICAL, OPTICAL AND LIKE INSTRUMENTS. S. Richardson. 643. January 10th.

ELECTRIC METALLURGICAL FURNACES. V. Stobie. 674. January 10th.

ELECTRICAL APPARATUS ADAPTED FOR USE IN MINES AND THE LIKE. Sandycroft Foundry Co. and T. M. Dutton. 680. January 10th.

APPARATUS FOR COOKING OR FOR CARRYING OUT LIKE OPERATIONS BY MEANS OF ELECTRICITY. G. C. Bell. 634. January 15th.

MEANS OF CONTROL FOR PETROL-ELECTRIC VEHICLES. M. Stevens. 933. January 15th.

DRAWN WIRES, SUITABLE AS ILLUMINATING BODIES FOR ELECTRIC INCANDESCENT LAMPS, AND PROCESS FOR MANUFACTURING SAME. Deutsche Gasglühlicht Akt.-Ges. (Anerges.) 1,161. January 16th. (August 13th, 1910.)

ELECTRIC CONTROLLERS OR SWITCHES. F. Jackson and G. E. Pearson. 1,658. January 23rd.

SEARCHLIGHTS OR PROJECTORS. Siemens Bros. & Co. and R. Bradley. 3,322. February 9th.

COMBINED MAGNETO-IGNITION GEAR FOR INTERNAL-COMBUSTION ENGINES AND WIRELESS TELEGRAPHY APPARATUS, PARTICULARLY APPLICABLE TO AERIAL VESSELS. M. F. Sueter, F. L. M. Boothby and H. G. Paterson. 3,334. February 9th.

ELECTRIC LIGHT STANDARDS. E. G. Byng and J. H. Collings. 5,418. March 4th.

SPARKING-PLUGS FOR ELECTRICAL IGNITION PURPOSES. L. R. Jones. 5,790. March 8th.

SWITCHES AND INTERRUPTERS FOR ELECTRIC CIRCUITS. N. Schultz. 7,097. March 24th.

ELECTRIC MOTOR STARTING SWITCHES. J. Johnson. 8,515. April 3rd.

ELECTRICAL INDICATORS FOR RAILWAY SIGNAL LAMPS. W. H. I. Welch. 8,981. April 11th.

HIGH-FREQUENCY TRANSFORMER, ESPECIALLY SUITABLE FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. R. Goldschmidt. 11,162. May 9th. (May 9th, 1910.)

ALLOYS FOR USE IN MAKING DYNAMOS. W. Rubel. 12,483. May 23rd. (Convention date not granted.)

TELEPHONIC EXCHANGE SWITCHBOARDS AND ARRANGEMENTS. S. Graham. 13,887. June 5th.

POCKET LAMPS. R. Schwager. 15,818. July 8th. (July 8th, 1910.)

TELEPHONIC EXCHANGE SYSTEMS. Western Electric Co. (Western Electric Co.) 16,075. July 11th.

ELECTRICAL DRIVING DEVICES FOR SOUND-REPRODUCING MACHINES. M. Kaiser. 16,456. July 18th.

TIME-SWITCHES OR THE LIKE. A. G. Zenner. 17,718. August 3rd.

MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS AND APPARATUS THEREFOR. K. Schwab. 20,380. September 14th. (January 11th, 1911.)

PLUG AND SOCKET CONNECTIONS USED ON ELECTRIC LIGHTING OR POWER CIRCUITS. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 21,678. October 2nd.

PLUG AND SOCKET CONNECTIONS FOR ELECTRICAL APPARATUS. Naamlooze Vennootschap Fabriek van Instrumenten en Electricche Apparaten "Inventa." 23,622. October 25th. (November 4th, 1910.)

THREE-CONTACT PLUGS FOR TELEPHONE SWITCHBOARDS OR THE LIKE. Siemens Bros. & Co. and W. H. Grinstead. 23,910. October 28th.

ELECTROMAGNETS. A. Quastenberg. 24,146. October 31st. (November 14th, 1910.)

**Electrical Imports and Exports in January.—The**

foreign trade figures show that in the month of January there were advances of £4,309,000 in imports, of £2,685,000 in exports, and of £953,000 in re-exports. The following are some of the figures of particular interest to our readers:—

**EXPORTS.**

Electrical goods and apparatus...	£275,091	Inc.	£72,095
Machinery...	£2,666,642	Inc.	£180,559

**IMPORTS.**

Electrical goods and apparatus...	£139,961	Inc.	£14,191
Machinery...	£514,947	Inc.	£81,228



THE  
ELECTRICAL REVIEW.

VOL. LXX.

FEBRUARY 23, 1912.

No. 1,787.

ELECTRICAL REVIEW.

EMPLOYERS AND THE INSURANCE ACT.

Vol. LXX.]	CONTENTS: February 23, 1912.	[No. 1787.	Page
Employers and the Insurance Act	...	...	285
An Electrical Exhibition in the Midlands	...	...	286
Institutions Reforming	...	...	286
Copper	...	...	287
Electrical Engineer Wanted	...	...	287
Electrical Developments in Stratford-on-Avon ( <i>illus.</i> )	...	...	287
Electrical Law in the British Dominions ( <i>continued</i> )	...	...	289
Correspondence :—			
Professional Opening for Talent	...	...	291
The Electrical Profession as It Is	...	...	291
Parliamentary	...	...	292
Legal	...	...	292
Our Legal Query Column	...	...	296
Business Notes	...	...	296
Notes	...	...	305
City Notes	...	...	308
Stocks and Shares	...	...	311
Electric Tramway and Railway Traffic Returns	...	...	312
Share List of Electrical Companies	...	...	313
Notes on Rheostats ( <i>illus.</i> )	...	...	315
Index to Articles in the Technical Press	...	...	317
Proceedings of Institutions :—			
Recent Developments in Steam Turbine Practice ( <i>illus.</i> )	...	...	317
Association of Mining Electrical Engineers	...	...	321
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	...	322
Tests of a New A.C. Motor ( <i>illus.</i> )	...	...	323
New Patents Applied For, 1912	...	...	324
Abstracts of Published Specifications	...	...	324
Contractors' Column	...	Advertisement pages xxii and xxiv	

SEVERAL weeks ago we received from the Secretary to the Employers' Parliamentary Association a copy of a series of questions which that body had addressed to the Chancellor of the Exchequer anent the Insurance Act. We have hitherto refrained from publishing it, in the hope that we might be able to comment upon the answers at the same time, but, alas ! although a good opportunity was offered to the author of the Act to make reply, it appears that the questions which nearly affect the employers are among the 498 which remained unanswered at the close of the meeting held last week in the Opera House.

The Association above referred to undoubtedly draws attention to a number of grievances under which the employers will suffer when the Act comes into force. Moreover, as there appears to be a general scramble by various persons and groups of persons affected by the Act to secure amendments or alterations in their favour, the time is not inappropriate for the employer to make his voice heard.

Let us deal with one or two points in regard to which the position of the employer is not always accurately stated on the platform or in the Press. It is said that the employer pays 3d. a week for each man employed, and probably many people consider that this is the limit of his liability. But he has also to pay (through the taxes) his quota of the State contribution ; and he has also to defray, out of his own pocket, the cost of collecting the workers' contribution. It will thus be seen that his liability is very considerable.

What is well calculated to upset preconceived notions of fairness, is that the tax so imposed upon him is imposed merely because he is an employer—not because he is a man of substance. Nor does the question of his liability depend upon his success in business. His firm may be paying a dividend of 30 per cent., or it may be earning nothing. In either case, provided the same number of hands is employed, the State insurance premium is the same. Again, a professional man who is earning £5,000 a year may only have to pay insurance contribution for one typewriter, while your manufacturer, who is earning the same income and giving employment to 100 men, must pay £65 a year to the State in hard cash, and must incur other expenses which have been hinted at above.

In the light of these facts, is it to be wondered at that the employer deems himself hardly used and cries out for redress ?

But from whence will that redress come ? Seeing that the Act is now the law of the land, it is not likely to be modified or varied in the desired sense by the Commissioners. Their duty is to administer it as it stands. But the employer who is refused redress at the hands of the State, must needs take steps to help himself.

That he will take those steps either promptly or by slow

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly's).

1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.



degrees is sufficiently obvious to anyone who is familiar with the conditions of the labour market. Take, for instance, the case of an employer who, owing to lack of work, has had to reduce the amount of employment. At present, rather than dismiss old and well-trying servants, he probably reduces the working hours and keeps all his hands on. What will be the result of legislation which penalises employment? If there are two hands earning half wages, say, 15s., a week each, the employer must pay 6d. to the State; whereas, if he dismisses one outright and pays the other 30s., his liability to the State will be so much less.

It is *apropos* of this difficulty that Sir Charles Macara and his colleagues address to Mr. Lloyd George the pertinent question—"If this is done, will not many more workmen suffer unemployment, and probably require support from the unemployment insurance scheme, or to be maintained from the Poor Rates?"

The comfort extended to the employer who is to bear the brunt of these additional burdens upon industry, is that he will eventually benefit by a general raising of the standard of health throughout the country. It may well be that a rise in the standard of health will enure to the benefit of the employer; but the average man prefers to run his own business in his own way. Moreover, is it quite clear that all the benefits conferred by the Act will operate to the advantage of employers either directly or indirectly? Heaven forbid that we should complain because the Act does something to ease the burden of the unfortunate victim of consumption; but how does the erection of sanatoria help the employer?

In so far as the Act confers benefits of a general kind upon the community, it has much to commend it; but the employers, not unnaturally, protest that a benefit of a general kind should be paid for out of general taxes.

They are under the impression that "the business of employing other people" is being selected as an object of attack, and they bitterly resent it.

We have endeavoured to present this matter from the employers' point of view without any tinge of party bias. Perhaps the hardships we have tried to emphasise may be in some measure redressed by rules and regulations before the Act is actually put into force.

#### **An Electrical Exhibition in the Midlands.**

FIFTEEN municipal electricity committees, two tramway authorities, and one power company, operating in the Midland counties, have resolved upon a combined effort to "boost" electrical applications by means of an exhibition. Birmingham, as an industrial centre in which the variety of scope for electrical application is as great as it is anywhere in the kingdom, is leading the way in this matter, with Mr. Chattock as chairman and Mr. Howard Foulds as secretary of the Exhibition Executive, and Mr. W. E. Milns, also of the Birmingham electricity supply department, as Technical Adviser. The other members of the Executive are:—Messrs. C. E./C. Shawfield, of Wolverhampton; G. Tough, of Coventry; G. R. J. Parkinson, of the Midland Electric Corporation; and J. T. H. Legg, of the Birmingham and Midland Joint Committee. We note with interest, from the prospectus that has been issued, that some of the criticisms offered in respect of last year's electrical exhibition in London have been respected. For instance, "only exhibits likely to promote the employment of the supply of electrical energy by authorised undertakings will be accepted"; the Exhibition will remain open for only three weeks (October 7th to 26th); admission tickets will be issued to exhibitors at 3s. per dozen,

only those presented to be charged for; exhibitors may print their own tickets, after approval; first-rate bands will play twice daily; the Exhibition will be extensively advertised throughout the Midland counties; there will be arrangements entered into for railway excursions at reduced rates; and electricity will be obtainable under special contract rate of about 1d. per unit. Taking all these circumstances into account, and it being stated that definite promises of support have already been received from a number of the principal manufacturers, one can only congratulate the Midland counties authorities interested on the prospect of an almost certain success both for electricity suppliers and manufacturers. The Bingley Hall, with its 65,000 sq. ft. of space, is the largest permanent Exhibition Hall in the provinces and it is centrally placed. Particulars of space, charges, and so forth will shortly be available on application to Mr. George Stanley, Winchester House, Victoria Square, Birmingham, who has been appointed Exhibition director and secretary.

#### **Institutions Reforming.**

WE drew attention in our last issue to the announcement that in future the Institution will hold a summer meeting annually at one of the local centres, so as to bring the provincial members more closely into touch with the main body of their fellows; that this policy will meet with general approval cannot be doubted, and we shall hope to see a very large gathering of the members in June.

In this connection, though it seems a hopeless task, we would again urge the great desirability of providing the members—at least, those who intimate to the authorities that they will be present—with advance copies of the papers, so that the discussions may be the fruit of matured consideration, and not (as such discussions too often are) extempore opinions on surprise packets. In other walks of life—for instance, in the proceedings of Parliament—the members insist upon being afforded due facilities for the preliminary examination of new propositions before committing themselves to the expression of their views. Engineers are rarely practised orators, and are therefore in still greater need of time to prepare their remarks beforehand. The complaint is often made that the Institution discussions are largely monopolised by a certain set of speakers. Is this not in great part due to the fact that many members interested in the papers, and well qualified to discuss them, are deterred from speaking by their natural diffidence, doubting their ability to express their views in orderly fashion without some preparation? Thus the discussion is thrown into the hands of those who are accustomed to public speaking, and are confident of their powers of expression; their opinions may be well worth hearing, but those of the others should not be lost.

The American Society of Civil Engineers, whose procedure, like that of our own Institution of Mechanical Engineers, is in many respects well worthy of imitation, issues the papers for such meetings many months beforehand; our Institution, on the other hand, will not even permit a paper which *has been read* at a local centre to be published, if it is going to be read in London also, until the latter process has taken place. What good end is served by this obtuse policy—this "playing at secrets"? Is it feared that if members knew the contents of a paper in advance, they would absent themselves from the meeting?

Even the ultra-Conservative Civil Engineers are moving in the direction of earlier publicity—they will soon out-run the Electrical Engineers if the latter do not speed up. By a singular coincidence, as we write this a communication has come to hand from the "Civil Engineers' Appointments Board," formed at the instance of the Council of the Institution of Civil Engineers to assist engineers in getting into communication with employers in need of qualified engineering assistants, and *vice versa*. Apparently the operations of this board are not confined to members of the Institution of Civil Engineers. We give further particulars in our "Notes" of the new organisation, whose undertaking, it will be noticed, is intended to be self-supporting.



Copper.

THE statistics relating to copper during 1911 have been compiled so as to form the basis of an able and exhaustive article appearing in the number of the *Chicago Mining and Engineering World* for January 27th. The world's output for the year is given as 886,640 (English) tons, of which the United States produced over one-half, Mexico, Spain, Portugal and Japan about  $\frac{1}{6}$ th each, and Australasia nearly as much, followed by Chile, and Peru, Russia, Germany and Canada, the last four nearly equal, with 25,700 to 27,000 tons. The percentage output of the United States to the whole production for 30 years is given in another table, from which we note that this was at its lowest (so far as recorded) in 1880, when it was 16.2, and at its highest in 1906, when it was 58.1. For 1910 it was 54.2, and for 1911, 54.8. The curtailment agreement, says the writer, first entered into in 1910, was supposedly for only a period of a few months, but from developments during the past year it appears the agreement was subject to an extension.

The productions of the various States are lead by Arizona, followed closely by Montana and Michigan, and then by Utah, with about half the production of the first-named. The production by months shows a decided decrease only for August and September, occurring again in November and December, but apparently depending more on trade circumstances than concerted action. The total deliveries give an idea of the state of trade. These were highest in December, and lowest in January. Stocks were highest in June and lowest in December. The domestic consumption rises fairly well throughout the year, as also does export, while production, which averages 119,300,000 lb., is at its highest, at 130 million lb. in March, and lowest, at 109 million, in February. Imports of copper (including old copper) into United States are given at 108,000 tons, and would appear to fully equal (if not exceed) those for 1910. Prices have been flat, only showing a tendency to rise at the end of the year.

Among the opinions quoted on the position is that of Mr. James McLean, Vice-President of Phelps, Dodge & Co. According to his figures, the world's production has increased 73 per cent. since 1900, but consumption has increased 77 per cent. Together with other experts, he infers that the limit of production (until new fields are opened up) is in sight, but consumption may still go up.

The production for January given by the United States Copper Producers' Association is 58,270 tons, a decrease of 1,544 tons from December. The deliveries to domestic consumers have decreased by about the same amount. The deliveries for export have, however, largely increased. Naturally the stocks have borne the remainder of the consumption.

Electrical Engineer Wanted.

THE Trim Board of Guardians do not appear yet to have heard of the Rules of the Association of Consulting Engineers, if we may judge by an advertisement which appeared in the *Leinster Leader* of the 17th inst. In this advertisement tenders are called for from engineers who are prepared to undertake the duty of supervising "the work of providing and fitting up an electric lighting and motor installation at Trim Workhouse." With their tenders applicants must send certificates as to their fitness for carrying out the duties, and they must be in attendance at the meeting of Guardians at the hour of noon on March 2nd.

We do not suppose there will be a rush of professional gentlemen from Victoria Street to Trim in order to secure this competitive appointment, and we are really glad to think that no self-respecting consulting engineer will even consider applying for the post. At the same time, there is something to be thankful for in the fact that the Trim Guardians recognise that it is to their interests to employ an expert to advise them, and we cannot blame them for taking the only course known to them in order to secure the technical assistance they need.

ELECTRICAL DEVELOPMENTS IN STRATFORD-ON-AVON.

ELECTRICITY supply was commenced by the Stratford-on-Avon Electricity Co. in April, 1907. In the first place, it was hoped that water power could be utilised at the Alverston Mill site, but a closer examination of the circumstances of the case showed that the power available would not justify the capital outlay involved. The possibilities of a Diesel oil-engine installation, on the present site in Arden Street, were then considered, but the capital outlay required would have been heavy, and there was great uncertainty as to the future trend of the oil market.

Under these circumstances, Mr. C. D. Falcke (then, as now, chief engineer to the company), recommended the adoption of suction-gas plant, and the original installation comprised one 50-B.H.P., and one 81-B.H.P. Hornsby-Stockport suction-gas engine fed from Mersey producers and direct coupled to Johnson & Phillips interpole dynamos.

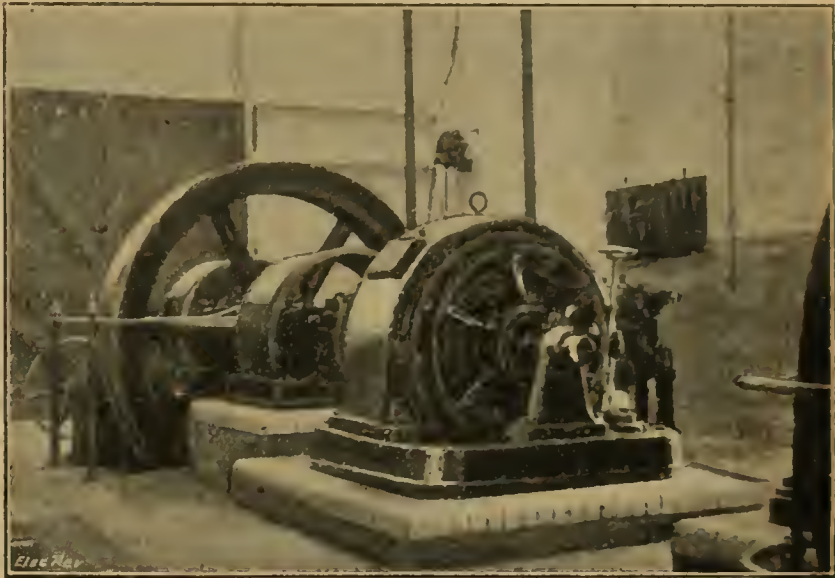


FIG. 1.—NEW GAS ENGINE AND GENERATOR, STRATFORD-ON-AVON.

The rapid extensions in the load supplied by the station (see Table I) soon called for additional plant, and in July, 1910, a third unit (see fig. 1), was installed, comprising a 170-B.H.P. National suction-gas producer, and a two-cylinder engine direct coupled to an 85-KW. Bruce Peebles dynamo. The accommodation of this engine and generator required but a slight elongation of the original power house,

TABLE I.  
STATEMENT OF ELECTRICITY GENERATED, SOLD, &C.

Year.	Units generated.	Units sold.	Per cent. sales.			Per cent. generated.		Max. load. KW.	Average d./B.T.U.
			Lighting.	Power.	Heat-ing.	Used in works	Un-acctd.		
1908	71,340	43,551	40.0	53.6	6.4	28.2	10.8	76	3.03
1909	102,845	77,055	43.4	51.5	5.1	18.8	6.4	75	3.04
1910	128,011	98,289	44.6	45.9	9.5	17.7	5.6	87	3.13

and there is still sufficient room on the building site to carry the end wall, shown in fig. 1, outwards to make room for two 100 or 150-KW. sets. That further extensions will soon be required cannot be doubted, there being already insufficient space capacity to allow for breakdown contingencies during the winter peak.

The original switchboard has been enlarged by two panels and now includes: three-generator panels, battery-booster motor and dynamo panels, balancer panel, feeder panel and end-cell panel.

The 300 ampere-hour "D.P." battery is still in use, and has not yet been extended. Its performance has given every satisfaction, and on the occasion of our visit, the cells were undergoing their first cleaning. About 1 1/4 in. of "sludge" had collected during the past four years, and this was being removed by hand (after siphoning out the acid), pumping being found an unsatisfactory means of removal. The maximum discharge current usually demanded from the cells is 50-60 amperes, and, in the light of recent experience, it would



have been preferable to have installed a larger battery in the first instance, so as to enable an earlier shut-down of the station (which is now run in two shifts, from 4.30 a.m. to 2 p.m., and from 2 p.m. to 11.30 p.m., or midnight), and heavier daily discharge of the cells. The battery booster has proved of insufficient capacity, hence end cells have lately been adopted for regulating purposes.

The railway coal rate from Swansea to Stratford being 7s. 2d. per ton, high grade anthracite cannot be obtained in the latter town at less than 26s. per ton, which rate was paid till July, 1910. On installing the new 170-H.P. set,

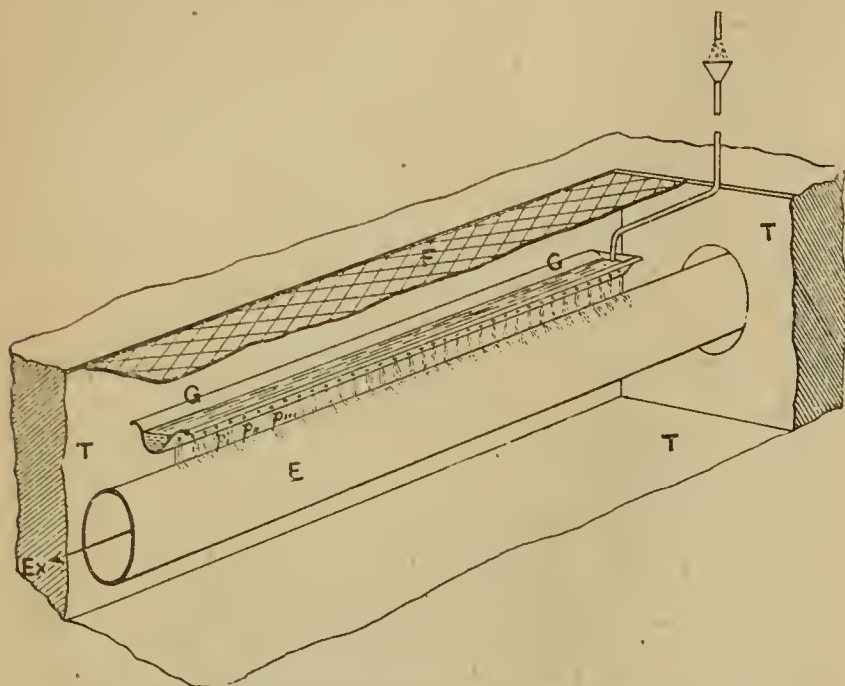


FIG. 2.—STEAM RAISING DEVICE FOR GAS PLANT.

trial was made of anthracite "slack" fuel (17s. per ton grade), in the producers. As had been feared, the poorer fuel taked badly and the standard steam raising attachments on the producers failed to supply sufficient steam to maintain a cool fire (particularly on heavy loads).

Before reverting to the dearer fuel and its consequent handicap on the profits of the station, Messrs. Falcke and Spiers devised a novel system of steam raising which has since given the utmost satisfaction and which, by reason of its simplicity and efficacy, deserves detailed notice.

As indicated in the diagrammatic sketch, fig. 2, water is run into a length of gutter troughing G, whence it trickles through side perforations\*  $p_1, p_{11}, p_{111}$  on to the exhaust pipe E, between the engine cylinder and the silencer. G and E are located in a trough T (covered by a floor plate F), whence steam is automatically drawn to the base of the gas generator P, fig. 3, by the suction of the engine admission stroke. To give an approximate idea of the amount of water vaporised, the 81-B.H.P. set, carrying 30-KW. load, required a stream of water about  $\frac{1}{8}$  in. diameter (about 20 ft. head) to be run into G (fig. 2).

No device could be simpler, and experience has shown that each engine can thus provide the full steam required by its own gas generator. By connecting tunnels and dampers, any engine can be supplied wholly or partially by any producer, and the latter can be fed with steam from any exhaust pipe.

Whereas fire bars burned out in from one to two weeks when using anthracite slack in conjunction with the standard vaporisers fitted to the producers, a life of from four to six months is obtained under the new system of working. Moreover, the steam supply is now strictly proportioned to the load, and a uniform quality of gas is maintained under all circumstances, together with a cool, clean-burning fire in the producers.

As the result of the adoption of the above system, the coal costs at Stratford, which averaged 0.40d. per unit sold in 1910, fell to 0.35d. per unit during the first six months of 1911, and were expected to reach 0.32 to 0.33d. per unit during the last half year. The total sales in 1910 were 98,289 units, and during 1911 it was hoped to exceed this

figure by at least 20,000 units, while incurring a lower total coal bill.

A 3-H.P. D.C. motor in the repair shop drives the lathe of the latter and drilling machine, and, in addition, a small fan blower, used to start up the first producer after a period of shut-down. The remaining producers are started as required by gradually opening their delivery valves. The delivery pipes being in parallel, the suction of the running engine rapidly brings the additional producers to working heat.

In the original installation, provision was made for starting up the engines by petrol, but the well-known liability to preignition on this system, and the dangerous mechanical shock thereby thrown on the cylinder and moving parts, have led to the installation of a compressed-air starting equipment driven by the electric motor shown on the wall bracket in fig. 1. The 170-H.P. set is now easily started and brought to full-load output in five minutes.

The old (smaller) engines are single-cylinder machines with "hit-and-miss" governing, but the new unit has two cylinders, four engine bearings, and is governed by graduated admission (controlled by a floating striking plate engaging at various points on a tapered block). The 81-H.P. engine has a 4-ton fly-wheel, whereas that on the 170-H.P. set weighs but 6 tons, yet vibration and cyclic speed variation are very slight.

It should be noted that in the new generating set 2 B.H.P. have been allowed per 1 KW. electrical output. This liberal allowance of engine capacity is necessary to ensure satisfactory peak performance with suction-gas plant. The 85-KW. dynamo specification included not more than 75° F. temperature rise during 8 hours' full-load run, followed immediately by 2 hours' run at 20 per cent. overload: actually, the temperature rise under these conditions does not exceed 70° F.

The gas cleaning towers on the various producers are very effective, and the engine valves need grinding once in from four to eight weeks, according to load. Until recently, the exhaust valve-rod guides were unlubricated, with the result that the valve stems wore badly during the first month of their life. Though subsequent deterioration was much slower, there was sufficient leakage round the worn stem to cause an unpleasant smell. This trouble has now been overcome by lubricating the guides with high-temperature grease (melting at 400° F.), fed from stuffing boxes with tell-tale plungers.

The valves are now turned up from forgings by the company's staff, a rather thicker stem being adopted than is

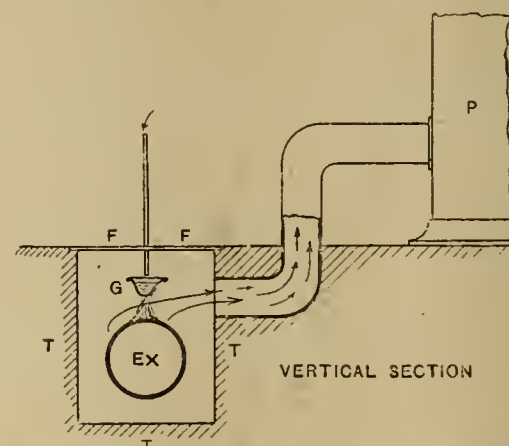


FIG. 3.—STEAM RAISING DEVICE AND PRODUCER CONNECTIONS.

provided by the engine makers, and a boss being left immediately below the valve head to allow for the local pitting which occurs at this point, and which first demands the renewal of the fitting.

Producer linings are found to last between two and three years, and are scraped about once per month. The fires are "sliced" as often as may be necessary, there being no risk of explosions within the generators when working under the new system of steam raising. Ashes from the producers are carefully sifted and the small pile of fuel refuse resulting from one year's working was, by its insignificant amount and worthless quality, a striking testimony to the economical working of the station.

Water for cylinder cooling and steam raising is pumped from a surface-water well by a  $\frac{1}{2}$ -H.P. motor driving a single-acting pump delivering 300 gallons per hour to an overhead tank, whence supply is by gravitation. The water supply,

\* The advantages of side perforations, as opposed to perforations along the bottom of the troughing, include steadier flow from the former and non-clogging of the perforations by solid matter, which is now deposited at the bottom of the trough.



which is exceptionally hard, and which rapidly furred up the original producer vaporisers, but which has no injurious effect with the new system of working, reaches 2,000 gallons per day in winter, and is then run to waste after use: in summer, however, the outflowing water is returned to the well, through a coke filter bed, for re-use.

So far, there has been no evidence of the abnormally high repair charges usually instinctively associated with gas-engine plant; nor is there any reason to expect any such extraordinary expense in future. The cleanliness of the station leaves nothing to be desired, and there is an entire absence of nuisance by vibration, noise or fumes.

For so small an undertaking, the Stratford-on-Avon Electricity Co. is already fortunate in possessing a well distributed load and several very valuable power consumers. The average load during the day is about 30 kw., while the winter peak reaches 90 kw. During the summer months, two essentially off-peak power consumers are a brewery taking 20 h.p. for a refrigerating plant from 5 a.m. to 6 or 7 p.m. daily from April to September, and a mill having a 60-h.p. motor, averaging 40 h.p. output between 6 a.m. and 8 p.m. daily from July to September.

The 25-kw. and 50-kw. generating sets are found very convenient for supplying the day load, and are therefore likely to be retained for some time to come. The new generator which will shortly be required, will be of 100—120 kw. output.

Stratford is essentially a conservative town (though considerable residential developments appear imminent), and in securing 200 consumers and an annual output of 100,000 units after four years' working, the Electricity Co. has attained no mean achievement—particularly when it is remembered that gas supply is in the hands of the town authorities, who therefore carry out the street lighting with incandescent gas. An excellent heating load has been secured, and the total motor load now exceeds 120 kw. An electricity showroom is soon to be opened in one of the main streets, and a vigorous system of circularising present and prospective consumers concerning the economy and merits of various electrical apparatus, is already in force.

Mr. Falcke has wisely advocated moderate prices throughout, and has actually been able materially to reduce the favourable tariffs inaugurated in 1907, in certain cases. Lighting supply is still at 5d. per unit, but heating and cooking demands are supplied at 1½d. per unit, while for power purposes the charges are from 2½d. to 1½d. On the testimony of numerous consumers, the lighting supply at 5d. per unit is, with a mixed metal and carbon-lamp equipment, equivalent to, or cheaper than, gas at 2s. 7d. per 1,000 cb. ft.

The Stratford undertaking, having grown up with the development of the metallic-filament lamp, has experienced no set-back from the latter. Among the more interesting consumers, other than the special power demands above noted, are:—

1. *The Stratford Hospital.*—Now lighted entirely by metallic-filament lamps, and which showed a material saving on its lighting bill during the first year after its conversion from incandescent gas lighting. This result had naturally great weight with residents in the locality.

2. *Holy Trinity Church.*—Employing a Kinetic organ blower driven by a 7-h.p. electric motor in place of the old hydraulic equipment. Electric fans are now being installed to circulate warm air through the church from a central slow combustion stove. A very elaborate metallic-filament lighting scheme was recently installed; unfortunately, the effect was considered too "theatrical" by certain church dignitaries, and the equipment was therefore replaced by a simple arrangement of half-frosted bracket lamps supplemented by short lengths of tubolite in the vestry and choir stalls.

3. *Shakespeare Theatre.*—During its spring and summer sessions (each lasting about one month), the theatre affords a very acceptable load. The demand is naturally irregular, but is worth about £60 per annum to the station.

The total length of house supply feeders approximates 10 miles, and armoured, lead-sheathed cables laid direct in the ground are now used in preference to the bitumen-filled wooden cable troughs originally employed; the cost of the former is considerably lower. To the best residential dis-

trict, duplicate feeders are laid to avoid the risk of cessation of supply due to cable breakdowns.

For shop lighting, a comparatively small number of Verity miniature arcs and a few of other makes are employed, but for this purpose and for ordinary domestic lighting, the use of metallic-filament lamps is rapidly extending.

In concluding this brief description of a very interesting undertaking, we wish to express our appreciation of the courteous assistance rendered by Mr. C. D. Falcke and his assistant, Mr. P. Spiers.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(Continued from page 245.)

2. *Queensland.*—The list of statutes in force in Queensland only contains a reference to one Act relating to the supply of electricity for light and power. We refer to an Act "to facilitate and regulate the supply of electricity for lighting and for other purposes" (1896), 60 V., No. 24. Prior to this date, it appears that the supply of electricity was only regulated, if at all, by one or two private Acts.

The Act of 1896, which appears to be modelled upon the English Electric Lighting Acts, is divided into parts as follows: (1) Preliminary; (2) Constitution of Electric Authorities; (3) Powers, Duties and Obligations of Electric Authorities; (4) Protection of Government Telegraph Lines; (5) Supply of Electricity and Recovery of Charges; (6) Purchase of Undertaking by Local Authorities; (7) Regulations and By-Laws; (8) Offences; (9) General Provisions.

The term "electric authority," as used in the Act, signifies any local authority, company or person, authorised by an order granted under the Act, to supply electricity within any prescribed area.

1. Preliminary: Sec. 4 embodies the principle that electricity must only be supplied by the State. It provides that, "From and after the passing of this Act, and subject only to the provisions in this part of this Act hereinafter contained, no local authority, company, or person shall construct or use any electric lines or works, or supply electricity, except under the authority of an order pursuant to this Act."

Provided that this Act shall not apply in any case in which an electric line is not constructed or used, or electricity is not transmitted or supplied beyond the limits of the buildings or premises in which the electricity is generated. This section has the effect of prohibiting the supply of a private company or person to a few neighbours. Sec. 6, however, makes an exception in the case of persons or companies which, at the passing of this Act, were supplying electricity.

2. Constitution of Electric Authorities.—Just as the Board of Trade has power to grant a provisional order for the supply of electricity in England, the Governor of Queensland in Council, may, by Sec. 8 of the Act under discussion, "From time to time by order in Council authorise any local authority, company, or person to supply electricity within any prescribed area for such purposes as may be specified in the order, and for such period subject to the provision of part 6 of this Act, as the Governor in Council may think proper."

Sec. 10 embodies the principle laid down by Sec. 4 of the Electric Lighting Act, 1882, and Sec. 1 of the Electric Lighting Act, 1888, by which the local authority is entitled to notice of the intention of a private company to apply for an order. It is to be observed that although such an order is not to be granted except with the consent of the local authority, the Governor in Council may, in a proper case, dispense with such consent. Sec. 2 provides that the electric authority shall be subject to such conditions, limitations, and liabilities as may be inserted in, or prescribed by, the



order affecting the undertaking with regard to a number of matters. To put it generally, the supply is subject to restrictions similar to those which are laid down in the Schedule to the Electric Lighting (Clauses) Act, 1899.

3. Powers, Duties, and Obligations of Electric Authorities; and 4. Protection of Government Telegraph Lines.—These are practically identical with the corresponding provisions of the English Acts.

5. Supply of Electricity and Recovery of Charges.—This part makes it incumbent upon an electric authority to supply electricity, and prohibits it from prescribing any special form of lamp, or making any undue preference to any consumer.

6. Compulsory Purchase.—The provisions of the Act relating to compulsory purchase are identical with those contained in the Electric Lighting Act, 1888, Sec. 2.

7. Regulations and By-Laws.—These are made by the Governor in Council.

Amongst the General Provisions (9), Sec. 58, provides that whereon matters in the Act are directed to be decided by arbitration, the arbitrator is to be nominated by the Governor in Council on the application of either party.

3. *Victoria*.—The supply of electricity in Victoria is regulated by the Electric Light and Power Act (No. 1,413), of 1896, as amended by the Electric Light and Power Act (No. 1,694), of 1900. These statutes bear a strong resemblance to those of Queensland, which have already been referred to. They are obviously founded upon the English Electric Lighting Acts.

Sec. 5 of the Act of 1895 provides that:—"No Council (*i.e.*, no Council of any municipal district), company, or person, shall use, lay, erect, construct, or put up, or place, any electric line, or supply electricity for public purposes, or private purposes, except under the authority of an Order made pursuant to this Act." This provision is subject to a proviso in favour of those who were supplying electricity at the time when the Act came into operation.

By Sec. 10 it is provided that subject to the Act the Governor in Council may, from time to time, by order authorise any Council to supply electricity for any public or private purpose within any area, and in the case of any company or person for such period not exceeding 30 years, as the Governor in Council may think proper.

The Act contains the usual provisions for notification to the local authority of any application to be made by a company or person. The consent of the local authority is generally required, but the Governor in Council has power to dispense with such consent in a proper case.

The provisions of the English Electric Lighting Acts with regard to the breaking up of, and interference with, highways and the interference with wires, &c., under the control of the Postmaster-General, seems to have been adopted *in toto* by the Victorian Legislature.

By Sec. 43 a right of compulsory purchase is conferred upon Municipal Councils.

The terms and conditions upon which this right may be exercised are practically identical with those which are to be found in Sec. 2 of the Electric Lighting Act, 1888. It is to be noticed, however, that the right may be exercised after 30 years, "or shorter period as is specified in that behalf in the order from the date of the order." The value of the lands, buildings, materials, plant, and works shall be deemed to be their fair market value at the time of the purchase, due regard being had to the nature and then condition of such buildings, materials, plant, and works, and the state of repair thereof, and to the suitability of the same to the purposes of the undertaking, but without any addition in respect of compulsory purchase or of goodwill or of any profits which may have been, or may be made, from the undertaking or of any similar considerations.

By Sec. 44 the Governor in Council has power to vary the terms upon which any Council may require the undertakers to sell.

Sec. 25 puts a limitation upon the profits which may be distributed. It provides: "The profits which may be divided amongst the shareholders of any company being an undertaker under this Act, so far only as such profits are derived from supplying electricity shall not in any year exceed £10 per cent. on so much of the paid-up capital of such company as has been apportioned for the works or

expenditure of such company as an undertaking under this Act. Provided that whenever throughout any half-year any company shall charge for electricity supplied a less price than the maximum charge fixed by order authorising the undertaking, such company may increase such rate of dividend for such half-year by  $\frac{1}{2}$  per cent. on the paid-up capital for each and every reduction of  $\frac{1}{4}$ d. per unit in the price of electricity."

A later Act (The Electric Light and Power Act, 1901, No. 1,775) provides that no Council of any municipal district shall transfer any legal powers given to them by the principal Act (*i.e.*, the Act above-mentioned) or give its consent to the grant of any order unless a poll of the ratepayers has been taken to ascertain their views. The Act also contains provision for the taking of such poll. This Act also provides (by Sec. 3) that no electricity undertakers or gas company may charge for the supply of electricity or gas used for power or heating purposes respectively or both a lower uniform charge than that charged for the supply of electricity or gas used for lighting purposes.

4. *South Australia*.—Legislation relating to the supply of electricity in South Australia seems to be confined to an Act which was passed in 1891 "to authorise municipal corporations and district councils to supply gas and electricity for lighting and other purposes." This statute is No. 531 of 1891. Part II is devoted to the supply of electricity, but many of the provisions of Part I which relate to the supply of gas, are made applicable to electricity by making the word "gas" include "electricity," and the word "pipe" include "electric line."

Sec. 49 provides that—"Any local authority may, subject to the provisions of this Act, supply electricity for any public or private purposes, within the limits of its district, or within such other limits as the Governor may from time to time by proclamation in the Government gazette, allow, provided that where such other limits comprise land within the district, of any other local authority, such proclamation shall not be made without the consent under seal of such other local authority."

In supplying electricity the local authority shall be subject to such regulations as may from time to time be presented by the Governor by Proclamation in the Government gazette with regard to the following matters:—

(a) The limits within which, and the conditions under which, a supply of electricity is to be compulsory or permissive.

(b) Securing a regular and efficient supply of electricity.

(c) Securing the safety of the public from personal injury, or from fire, or otherwise.

(d) The limitations of the price to be charged in respect of the supply of electricity.

(e) Authorising inspection and inquiry from time to time by the governor and any local authority which shall be concerned, other than the local authority supplying the electricity.

(f) The enforcement of the due performance of the duties of the local authority in relation to the supply of electricity by the imposition of penalties and otherwise; and

(g) Generally with regard to any other matters in connection with the supply of electricity.

Note.—The power here conferred upon the governor is very similar to the power to make rules which is vested in the English Board of Trade.

By Sec. 51 the local authority within any part of whose district the electricity is, under proclamation, authorised to be supplied by any other local authority may, in addition to any regulations which may be made under the provisions of the last preceding section, for securing the safety of the public, from time to time make, rescind, alter, or repeal by-laws for further securing such safety, and there may be annexed to any breach of such by-laws such penalties as the local authority think necessary, not exceeding £50 for each offence, provided that no such by-law shall have any force or effect unless and until they have been confirmed by the governor, and published in such manner as the governor may direct.

For the rest it may be taken that this Act follows the broad lines of the English Electric Lighting Acts.

5. *Western Australia*.—In 1892 an Act was passed in Western Australia entitled "An Act to authorise municipal



Corporations to supply or to grant licences or make contracts for the supply of electricity for lighting and other purposes." This Act was amended by the Electric Lighting Act Amendment Act, No. 7 of 1905, and as so amended it provides (by Sec. 1) that any local authority may, subject to the provisions of the Act, supply, or from time to time, licence or contract with, any company or person to supply electricity for all or any of the purposes mentioned in this Act within the limits of the municipality, or within such limits as the governor may, from time to time by proclamation, approve and allow. The term local authority as used in this section means the Council of a municipality or the board of a road district Council.

A licence or contract so granted may be for any period, or periods, not exceeding 21 years, and shall be subject to such regulations and conditions as to the performance by any such company or person of their duties in regard to such supply for the revocation or rescission of the licence or contract where the said company or person shall fail to perform such duties to the satisfaction of the local authority for authorising inspection and inquiry from time to time by any officer of the local authority, and generally with regard to any other matters in connection with any such licence or contract or supply of electricity.

In cases where the local authority exercise their right of entering into a contract under the Act, they have power to introduce terms of purchase, &c.

By Sec. 7 undertakers are also made subject to such regulations and conditions as may from time to time be prescribed by the Governor and published in the *Gazette* with regard to the following matters:—

(a) The limits within which, and the conditions under which, a supply of electricity is to be compulsory or permissive.

(b) Securing a regular and efficient supply of electricity.

(c) Securing the safety of the public from personal injury or from fire, or otherwise.

(d) The limitation of the prices to be charged in respect of the supply of electricity and the rent and sale of meters and fittings.

(e) Authorising inspection and inquiry from time to time by the Governor.

(f) The enforcement of the due performance of the duties of the undertakers in relation to the supply of electricity by the imposition of penalties or otherwise; and

(g) Generally with regard to any other matters in connection with the supply of electricity.

It will be seen that rules may be framed under this Order, which would take the place of our own Board of Trade Regulations.

(To be continued.)

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Professional Opening for Talent.

Unfortunately, at the time of writing I have not had an opportunity of reading a full report of Mr. Hugo Hirst's speech at the annual dinner of the G.E.C., briefly reported in the daily papers. It appears, however, that Mr. Hirst, whilst crying up his staff recruited from the office boys, is bewailing the fact that he is unable to obtain the services of public school men of social standing for some of the highly-paid positions his firm is able to offer.

The positions to which Mr. Hirst would appear to refer are those of commercial engineers, as he mentions that it is usual to ask a premium of £300 or more from such men for their training, whilst at the same time talking of the commercial side—I fail, however, to see how any office boy can fulfil the technical qualifications for such a post, however good a commercial man he may become.

Now, I would like to know how many appointments the G.E.C. have advertised in the *ELECTRICAL REVIEW* during, say, the past five years carrying salaries of from £500 to

£2,000, because I feel sure that there are plenty of available men with all the qualifications Mr. Hirst desires, if he will only make his requirements known, and give the salaries stated.

Personally, I can claim a public school and University training; I have paid the "£300 or more"; I hold a Certificate of Honour from University College, London; I am a member of two of our leading Institutions, and I hold an appointment as commercial engineer and manager of a well-known firm. Still, I should be pleased to offer my services to Mr. Hirst if he will give the salary he talks of.

I have not, however, "allowed myself to be thoroughly trained by the G.E.C.," and I think this must be what Mr. Hirst wants; but why will not the training and commercial experience gained with other firms do equally well? Mr. Hirst must not expect trained men to join his firm at 10s. to 25s. a week, or double the amount, in the hope of obtaining better things when they can command more elsewhere.

Let Mr. Hirst advertise in the *ELECTRICAL REVIEW*, stating his requirements and the salary he is prepared to give, openly and frankly, and he will get what he wants; and may I suggest to Mr. Hirst that one good commercial engineer, who can be commercial or technical as occasion requires, is worth three or more of the "late office boy" men.

Engineer.

### The Electrical Profession as It Is.

May I again seek the hospitality of your valuable periodical, seeing that your correspondent "Inquirer," quotes repeatedly from my previous letter, and concludes with a question of wide import.

What can be done to classify the individual in relation to the electrical industry? The answer to this is, I am afraid, beyond the scope of a letter, as it naturally extends into many fields, but it is a subject that has caused me much study, with results that may reach the ears of "Inquirer."

I would like to mention, however, that in many of the articles by Mr. Kilburn Scott in the *ELECTRICAL REVIEW* reference has been made to methods of certifying fully-qualified members of the industry which I think are applicable in this country.

The title "electrical engineer" should be as distinctive as "patent agent," "doctor," "solicitor," and the like, who have the protection of the court against impostors, seeing that it costs considerable amounts of money, combined with years of study before efficiency is reached, and their services to the community are nowadays almost indispensable.

Before much time passes I hope to see our most influential electrical engineers combine to draft a Bill to be laid before Parliament, a clause of which will insist that any person advertising himself as an electrical engineer must show proofs of efficiency and qualification, or must employ an engineer who is fully qualified before undertaking public contracts. Many other stipulations would, of course, be included.

W. Ellerd-Styles.

London, N.E., February 19th, 1912.

**Peat Fuel in Russia.**—It is announced from Berlin that a syndicate in which the St. Petersburg Electric Lighting Co., 1886, is interested, has acquired extensive peat fields near Moscow, where it is proposed to erect a large station for the supply of electric power to the district and the many works in the vicinity. It is also intended to transmit electrical energy to Moscow in order to render the St. Petersburg Co.'s station in Moscow independent, as far as possible, of the prices of naphtha and coal, which are subject to great fluctuations, and have at present reached an extraordinarily high level. It is said that the quantity of peat available is sufficient to cover the fuel requirements of the Moscow electricity works for a period of 100 years on the basis of the present production of power.

### Success of Croydon Corporation Tramways Band.

—The London and Home Counties' Amateur Band Association held their annual festival and contests on Saturday, 17th inst., at the Crystal Palace, when the Croydon Corporation Tramways Band was awarded second place in the Reed Band section. For this event a keen fight was made by all competitors, and we congratulate the Croydon contingent and their bandmaster, Mr. W. Ellis (late of the Fourth Devons and Second Queen's Regimental Bands), upon their well-earned success.



## PARLIAMENTARY.

*Standing Orders.*—The whole of the Private Bills have now been before the Examiner for proof of compliance with Standing Orders, and a few have been postponed for further consideration. Amongst the Bills which have been reported as having complied are the London United Tramways, London Electric Railway, Edgware and Hampstead Railway, Birmingham Corporation, Hull Corporation, Brighton Corporation, London and North-Western Railway, Bognor Gas Light Co. (Electricity), Brighton, Hove and District Railless Traction, Hove Corporation Railless Traction, Metropolitan Railway, North Ormesby, South Bank, Normanby and Grangetown Railless Traction, Metropolitan District Railway, Brighton District Tramways, Metropolitan Electric Tramways, and Preston, Chorley and Horwich Tramways.

*National Electric Construction Co.*—In the case of this Bill, which seeks power to confirm a number of agreements entered into with local authorities by the predecessors of the National Electric Construction Co., a mistake with regard to the newspaper notices has led to the decision that Standing Orders have not been complied with, and hence the matter will have to go before the Standing Orders Committee, who will decide whether the Bill shall be allowed to proceed. It appeared from the evidence given that the advertisement which should have been sent to the Tunbridge Wells paper went to the Crystal Palace paper and *vice versa*.

*Southall and Hounslow Railless Traction.*—Several allegations were made as to the non-compliance with standing orders in the case of the Southall, Hounslow and Twickenham Railless Traction Bill, and the Examiner found there had been a failure as regarded newspaper notices in respect of Clauses 21 and 46, inasmuch as the intention of the clauses with regard to the powers to be conferred on local authorities, and of the power to the company to erect waiting rooms, &c., were not properly stated. This Bill also will have to go before the Standing Orders Committee.

*Glasgow Tramways.*—Amongst the Scotch provisional orders, the Examiner has found that Standing Orders have not been complied with in regard to tramway No. 6 in the Glasgow Corporation Bill. This is a proposal to construct about  $\frac{1}{2}$  mile of tramway, to commence in Canniesburn Road and to terminate in the parish of New Kilpatrick, in the County of Dumbarton. The proposal will probably be struck out of the order.

*House of Lords' Bills.*—Amongst the Private Bills which it has been decided shall originate in the House of Lords are the following:—Brighton Corporation, Brighton District Tramways, Brighton, Hove and District Railless Traction, Hove Corporation Railless Traction, London and North-Western Railway, and North Ormesby, &c., Railless Traction.

*Petitions.*—A large number of petitions have been deposited in the Private Bills Office against Bills originating in the House of Commons, including the following:—

*London County Council Tramways.*—By the Bethnal Green, Hackney, Islington, Lambeth, Paddington, Hammersmith, Stepney, Greenwich, and St. Pancras Borough Councils, the City Corporation, Metropolitan Railway, Great Western Railway, Great Eastern Railway, London Omnibus Owners' Federation, &c.

*Metropolitan Electric Tramways.*—Stoke Newington Corporation, London County Council, and Middlesex County Council.

*National Electric Construction Co.*—Hackney B.C., Fleetwood U.D.C., Rathmines U.D.C., Pembroke U.D.C., Gloucester Corporation, Blackpool Corporation, Canterbury Corporation, Tunbridge Wells Corporation, Poplar B.C., Taunton Corporation, and a number of gas companies.

*Edgware and Hampstead Railway.*—Sir J. Maple's Trustees, Hendon U.D.C., Middlesex County Council, and four others.

*Metropolitan Railway Co.*—By 20 petitioners, including the London Electric Railway Co., Central London Railway Co. and the Metropolitan District Co.

*London Electric Railway.*—By the Metropolitan and Great Central Railways Co., Metropolitan Electric Supply Co., Twickenham and Teddington Electric Supply Co. and 12 others.

*Metropolitan District Railway.*—By the Metropolitan Railway Co., Twickenham and Teddington Electric Supply Co., Wimbledon and Sutton Railway Co., Metropolitan Electric Supply Co. and nine others.

*Southall, Hounslow and Twickenham Railless Traction.*—By 11 petitioners, including the Metropolitan District Railway, London United Tramways and Metropolitan Electric Supply Co.

*Keighley Corporation.*—Yorkshire Electric Power Co., and 10 others.

*London United Tramways.*—By Middlesex C.C. and the Richmond Corporation.

*Ramsbottom U.D. Railless Traction.*—By the Lancashire C.C. and the Lancashire and Yorkshire Railway Co.

**Electrical Smelting of Iron Ore.**—According to *Industritidningen Norden*, the Stora Kopparbergs Bergslags Aktiebolag has recently placed an order with the firm of Luth & Rosén, for the electrical equipment of the new electrical furnace which the firm is now building at its ironworks at Domnarfvet. The order comprises three controllable, air-cooled single-phase transformers, as well as the complete outfit of electrical instruments. The furnace in question is designed for a consumption of 12,000 electrical H.P., and is the largest electrical furnace in Sweden.

## LEGAL.

## ATTORNEY-GENERAL v. SHEFFIELD CORPORATION.

(Continued from page 250.)

ON Thursday, February 15th, MR. DRUCQUER, continuing the opening of the plaintiffs' case, called attention to the section of the Electric Lighting Acts affecting the question. He pointed out that the section in the Gas Works Clauses Act enabling persons to be supplied with pipes, burners, meters and lamps was in no way present in the Electric Lighting Acts. The company from whom the Corporation acquired their undertaking was registered on May 3rd, 1892. It was called the Sheffield Electric Light and Power Co., Ltd., and it had very wide powers in its memorandum of association to which he would call attention. Following on that on June 27th 1892, they obtained their provisional order, which contained a definition of consumers' terminals which had been universally adopted by the Board of Trade, and on which great reliance was placed by the plaintiffs. If the interpretation which the Corporation desired to place on the general Act was correct, they would, under one section, be compelled not only to wire up to the premises, but right up to the lamp itself. When they came to the regulations his Lordship would find that the undertakers must supply a constant pressure. That pressure was in fact tested by inspection at the consumers' terminals, and it was the only place where it could be tested, owing to the loss of pressure which took place between the terminals and the lamps. The Sheffield Electric Light and Power Co. carried on its business down to the year 1897. In April, 1897, the Corporation gave the necessary notice to treat for the purchase of the undertaking, but the company resisted that on the ground that the Corporation was unable to provide the necessary Corporation stock with which to purchase the undertaking. An action was instituted for compelling the transfer, but the Corporation lost the action, and after that they had to strike a bargain with the company in order to effect their purpose. In the meantime, it was somewhat important to notice that in May, 1897, the company purchased the business of the Universal Electric Fitting Co., Ltd., and by that means they practically created the department of which complaint was made in this action. They obtained that business by the usual means. The Universal Electric Fitting Co. was wound up, and the Electric Light and Power Co. increased its capital for the purpose of securing the assets of the Fitting Co.

HIS LORDSHIP: Then down to that time were the company not supplying fittings and things?

MR. DRUCQUER said, so far as they knew, none. Evidence would be given by the relator himself, an electrical contractor carrying on a large business in Sheffield, that throughout the whole of this period the company were practically doing no serious fitting work, but were only supplying energy. It might be that they were doing some fixing of wires, but they were certainly not carrying on this important trade, which they took over from the Universal Fitting Co. in the very year that the notice to treat had been unsuccessful.

MR. SARGANT: Does my learned friend say that the company were doing only wiring business and not doing fitting business?

MR. DRUCQUER said he was stating that for all practical purposes this department, of which plaintiffs complained, was commenced in 1897. The company had power to supply lamps, and he had no doubt they did so, but really the business of which plaintiffs complained was practically commenced in 1897. The agreement eventually entered into between the company and the Corporation was dated March 11th, 1898, and was set out in the Transfer Act, which he would read. That showed that there were a number of contracts which were not completed at the time the transfer was carried out.

HIS LORDSHIP: What became of the company after the transfer? Did it cease to exist, or does it exist as a trading company?

MR. DRUCQUER said the Act did not provide for the after existence of the company, and did not dissolve it.

MR. SARGANT said the contract provided for the sale of everything the company had got.

MR. DRUCQUER read the Transfer Act and the agreement scheduled to it. He agreed that the purchase included all the stock, including lamps and fittings, and that the Corporation took over certain contracts. Those contracts were set out in the defence, and were relied on there by the Corporation.

HIS LORDSHIP: Were there any continuing contracts, contracts for maintenance?

MR. DRUCQUER said not that he knew of. Particulars were ordered to be given, and none of the contracts disclosed in the pleadings came under the description of continuing contracts. Under the terms of the agreement, during the whole of the year 1898 the company were carrying on the business on behalf of the Corporation in consequence of the delay in procuring the Transfer Act.

HIS LORDSHIP: You say that a power to work out existing contracts does not necessarily imply a power to make fresh contracts.

MR. DRUCQUER assented. He said this was a pure bargain. The Corporation had to purchase the whole undertaking. They could not expect the company to leave out one department. In the case of a purchase by a Corporation they often had to purchase things they did not require, which they got rid of afterwards. That was often the case with the purchase of a tramway system by a Corporation for the purpose of electrifying it. The Corporation had to take over all the horses and stables, but as soon as they had taken over the whole undertaking they got rid of all that they did not want. That occurred particularly in the Manchester case, where the sum



involved was very large indeed, and all the horses and stables were useless to the Corporation.

HIS LORDSHIP: Was the company dissolved after this.

MR. DRUCQUER said he did not know that evidence would be given. The next Act he had to call attention to was the Sheffield Corporation Act, 1903. The Corporation relied on a certain section, but the facts that plaintiffs would establish were that the section was the result of a bargain that was made in committee. The powers sought by the Corporation in their original Bill were complete powers to carry on this very trade, now the subject of these proceedings, but notice of opposition was given on behalf of electrical contractors, and letters would be read.

MR. SARGANT: I shall submit that you cannot go into all this.

HIS LORDSHIP: I don't think you can. Most of these Acts contain a great deal that is the result of compromise.

MR. DRUCQUER said he would only state the fact. There was a compromise which was secured, instead of Sec. 26, of the original Bill, which contained the full powers that they wanted. Some importance turned on it, because of the powers given with reference to motors. Plaintiffs were complaining that motors were sold outside the defendants' boundaries, and they said that this section applied only to motors within the City boundaries.

Having thus occupied one hour and a-half in reading and commenting on the various statutes, MR. DRUCQUER said he now came to the facts of his case. Even supposing his Lordship accepted Mr. Justice Neville's decision in the Leicester case, having regard to the importance of the present case, they must go into the facts.

MR. JUSTICE EVE assented.

MR. DRUCQUER said he would first read the pleadings.

HIS LORDSHIP said he was fairly well acquainted with them by this time.

MR. DRUCQUER said there were some paragraphs he wished to call attention to. He was happy to be able to inform his Lordship that a print of the opening and of the evidence would be prepared and supplied to his Lordship.

MR. SARGANT: In view of what my friend has stated, it might be better to have it printed on House of Lords' paper at once.

MR. DRUCQUER quoted a decision of the House of Lords, in which Lord Macnaghten laid down that the test in these cases was whether the trading in question was reasonably incidental to their business as authorised by their Special Act. Proceeding, he remarked that the Corporation did not claim any powers to carry on the business outside their area, but the company whose undertaking they took over had no such limitation. What the plaintiffs complained of was that the Corporation were carrying on a business that was well known as that of an electrical contractor. There were thousands of persons in the country known as electrical contractors, and the evidence would be that all that the Corporation could do was the wiring for the purposes of supply up to the consumers' terminals as defined in the Confirmation Order and as defined in the Board of Trade Regulations. If his Lordship would look at the model which had been prepared, he would see that it showed the complete thing.

HIS LORDSHIP said he was fairly well acquainted with it, practically speaking.

MR. DRUCQUER having exhibited the model to his Lordship, and explained its working, referred to the Board of Trade regulations made in 1909, governing the supply of electric current. He said that the business of an electrical contractor started with the consumers' terminals and the whole of the fitting up was included in his business. His business was that of a general retail trade for the supply of every imaginable fitting in connection with electricity. It was a recognised trade, and it was what defendants were doing. Any passer-by might go into their shop and buy any article that was displayed. The Corporation kept a department where there were no restrictions whatever on the sale of these fittings. That they recognised there should be some limitation was disclosed by a minute of January 5th, 1906, in which the Corporation said that if work was executed by the department in question, it should only be for persons already consuming electrical current supplied by the Corporation or for persons about to become consumers. So far as this department was concerned, the Corporation had a proper shop and showrooms, and the only difference between them and that of an electrical contractor was that the Corporation had more money to expend. But it was open to everybody. There was no restriction whatever. A purchaser did not have to sign any undertaking that he was a consumer or ratepayer, or was about to become a consumer. He thought it would be well to read the whole of the matter relating to the minute of January, 1906. There was a resolution passed on December 5th, 1905, by the Council of the Sheffield Chamber of Commerce, stating that the Council had received a deputation from the Sheffield Electrical Contractors' Association on the subject of municipal trading as carried on in the electrical fittings and wiring department of the Sheffield Corporation. It went on, "The electrical traders are substantial ratepayers of the city, and by reason of the municipal competition to which they are subjected, they have convinced the Council of this Chamber that it is impossible to carry on their business. This Council hereby records its disapproval of the City Council carrying on this department with public funds, and recommends that a copy of this resolution be forwarded to the City Council in the name of the Chamber, and a copy of the same be given to the Electrical Contractors' Association for their use in the legal opposition they are pursuing." On January 5th, 1906, the Electric Light Committee of the Corporation considered this resolution, and passed the following minute:—"Resolved that this Committee regret that the Chamber of Commerce should lend itself to support the efforts of persons who desire to benefit themselves at the public expense, and that the Chamber

should have passed the above resolution without first communicating with the Corporation to ascertain the facts of the case. The Committee recommend the City Council to inform the Chamber of Commerce that the wiring and fittings department of the Electric Supply Department was necessarily purchased at great cost, under Parliamentary sanction, as part of the undertaking of the Sheffield Electric Light and Power Co. The work is executed by the Department only for persons already consuming electric current supplied by the Corporation or for persons about to become consumers. That, in the opinion of the Committee, it is necessary in the public interests and for the maintenance of a high standard of work that the Corporation should continue to execute work of the kind referred to. That all persons and firms in the city carrying on the electric wiring and fittings business have commenced to do so since the business now carried on by the Corporation was first established. That if it be as stated, that the wiring and fitting contractors cannot carry on their business profitably, it is due to undue competition among themselves. That the Committee has, on several occasions, received deputations of the wiring and fitting contractors, and fully investigated their complaints, and they have entirely failed to substantiate any grievance against the Electric Supply Department or to show why the wiring and fittings business, purchased at great cost of public moneys (the debt for which is still largely unpaid) should be discontinued for the benefit of private traders. The Committee have no desire to injure the wiring and fitting contractors in their business. The Committee simply carry on the wiring and fittings department as purchased by them with as little competition to the electrical contractors as possible." Having regard to that, one must assume (said counsel) that it was honestly meant and was not made merely for publication purposes. The important fact was that from that date the Corporation were found to be supplying a great number of people, which showed the great difficulty there would be in giving any partial relief in this case. The Committee put on record a minute which they found great difficulty in carrying out, and they might have the same difficulty in carrying out any limited undertaking or injunction. He thought that plaintiffs would be able to establish that, both as regarded motors and the other matters, the Corporation had not only before this action but after it, executed a great number of orders outside their boundaries, and it was absolutely essential that they should adopt some system which would obviate the difficulties of which plaintiffs complained.

Counsel having occupied 2½ hours, mostly in reading Acts of Parliament, and orders, pleadings and other documents, had not concluded his opening when the case was adjourned.

On Tuesday, MR. DRUCQUER continued the opening of plaintiffs' case, and, after putting in certain answers to interrogations, read certain particulars delivered by plaintiffs in support of their allegations as to trading by defendants outside their area, in the supply of electric motors and their accessories. These showed goods supplied to firms in Manchester, Blackpool, Mansfield, Cbelsford, &c. Many of these items, he said, were admitted, but it must not be taken that they were the only instances. They were taken out of the books on inspection; but there were another hundred cases which had not been investigated very closely showing business to a large extent. Then, with regard to the allegation that public moneys had been expended in connection with this trade.

HIS LORDSHIP: How does that become material? If it is *intra vires*, I suppose they can carry it on?

MR. DRUCQUER said there might be some question that they had common law powers as a municipality to carry on this department. If so, plaintiffs would prove that the Corporation could not use statutory funds to carry on the business.

HIS LORDSHIP: Have they raised such a case in the defence? Their case appears to be that they are authorised by the Provisional Order and the Electric Lighting Acts, and that this trade is incidental to the supply of electrical energy.

MR. DRUCQUER said that in Paragraph 23 of the defence, the defendants denied that they had ever expended the proceeds of any rate levied by them, or any money forming part of the Borough fund, upon any of the trades or businesses in question. The defendants said they had (as they were entitled to do) expended moneys borrowed under Sec. 7 of the Sheffield Electric Lighting Transfer Act, 1898, and used the plant, premises, property, and servants acquired and employed for the purposes of their electric undertakings, for the purpose of erecting and installing electric light fittings and wires, and electric bell fittings and wires, within their area. That admission, he thought, probably carried plaintiffs far enough, in so far as it was necessary to prove that they had expended public money. Plaintiffs were prepared, if necessary, to prove that not only had defendants expended money borrowed under their special powers, but they had expended rates. There had been deficiencies which they had had to make up out of the borough funds. Plaintiffs had delivered particulars of that. He thought, however, that paragraph 23 of the defence was sufficient for their purpose. The amount of capital used in the business at the time the Sheffield Power Co. was taken over by the Corporation was, as shown by the Board of Trade returns, £83,975. He now proposed to proceed to the evidence (after quoting the judgment of Mr. Justice Neville in the similar action against the Leicester Corporation).

HIS LORDSHIP asked, as a matter of history, why this action, which was commenced in 1906, was being tried in 1912, when the Leicester case, which was commenced in 1909, was tried in 1910.

MR. DRUCQUER said that, as he understood the position, it was this. Difficulties occurred in 1907 in connection with getting discovery. Defendants maintained that the admissions they had made carried them the whole way, and they refused discovery. Soon after that a Bill was introduced into the House of Commons, which, if it had been carried, would have made this case, and all similar cases, un-



necessary, as it sought to give full powers to Corporations to carry on this particular work.

MR. DANCKWERTS said he must enter his protest at once against the modern habit of quoting something that was intended to be done in Parliament. It was always done for purposes of prejudice. He submitted that his learned friend had no right to refer to anything that happened in Parliament.

HIS LORDSHIP: He is only explaining, in answer to my inquiry why this case has been something like six years in getting to trial.

MR. DANCKWERTS said it was no explanation at all, because this happened in 1907.

MR. DRUCQUER said he was giving an explanation of the delay. The Bill in question was contested until the obnoxious clause was deleted altogether, and during that period the Leicester action was commenced. They got discovery and proceeded at once with that action. If the action against the Leicester Corporation had failed, there would have been no object in proceeding with this complicated action.

MR. DANCKWERTS said he was instructed that for three whole years the action was allowed to sleep.

MR. DRUCQUER said he had given the explanation.

HIS LORDSHIP said plaintiffs were not prejudiced by it. It was only a matter of comment.

MR. DANCKWERTS said the judgment in the action against the Leicester Corporation had been read, and he presumed his Lordship was going to follow that.

HIS LORDSHIP said yes, so far as the facts were identical.

MR. DANCKWERTS said the only differences between the two cases, he thought, were in the fact that the Sheffield Corporation took over the enterprise of an electric company under certain terms, and the existence of the Sheffield Corporation Act, 1903. Apart from that, there was no difference. What he felt about it was this, that if his Lordship was going to follow the case of the Leicester Corporation, then, of course, defendants must submit to it, and he did not propose to waste time in rediscussing it. He did not know whether they could not clear up the issues sufficiently to shorten the matter.

HIS LORDSHIP said he was bound to follow the decision of Mr. Justice Neville.

MR. DANCKWERTS said he noticed the other side had said the case would go to the House of Lords.

HIS LORDSHIP said that was a threat that was often used in the early stages of an action.

MR. DANCKWERTS said he wanted to take advantage of that observation. He gathered that, subject to the two points he had mentioned, the case would really resolve itself into a question of taking evidence on certain points in order that the Courts above might have the facts judicially before them.

HIS LORDSHIP said it would be a good thing if any admission could be made which would clear the ground and avoid a great deal of expenditure of time in taking evidence.

MR. DANCKWERTS said he thought he could assist his Lordship to get to close grips. First, as regarded electric light fitting and wiring, defendants only claimed the right to do that for people who either took, or were about to take, electrical energy from the Corporation within the area of supply. That included the supply of fittings. They did not claim to do that with regard to lighting purposes for non-consumers. As regarded electric bells, a distinction must be observed. There were electric bells which were operated by the energy supplied by the Corporation. Those defendants claimed to supply on the same grounds as related to electric lighting. The second class of bells were those operated by local batteries, and which were not connected with the supply of energy. Defendants claimed the right to supply and install those, because they were mixed up with, and practically one operation, with the instalment of the electric fittings and wires for other purposes which defendants were entitled to perform. Defendants also claimed the right to do that under the Act of 1903. As regarded motors, they claimed the right of supply under the Act of 1903; first, whenever the motors were actuated by their energy; secondly, whether they were actuated by defendants' energy or not. They did not claim to supply energy outside the area at all.

HIS LORDSHIP: It has been alleged that an American, for instance, can go and buy fittings from your department and take them away.

MR. DANCKWERTS said that was an effort of imagination. They did not claim to supply electric light fittings to non-consumers.

HIS LORDSHIP: That is a question of fact. Whatever you claim, or do not claim, Mr. Drucquer says you are, in fact, doing it.

MR. DANCKWERTS: He will have to make that good. Continuing, he said their contention was that the Act of 1903 was not limited to the area, but they said they did not intend to carry on business outside the area. Of course, they were not allowed to supply energy outside the area. As regarded the transfer of the late company's business, the Corporation could not claim, and never had claimed, the power to carry on all the business which the company had power to carry on. Their claim was limited in the way shown in Sec. 3 of the Transfer Act, and they said they were not only entitled, but were bound to carry out the contracts and commitments of the company in force at the time of the transfer. They were entitled to deal with the stock-in-trade taken over from the company in a reasonable manner. They had never supplied any energy outside the area except temporarily to people who had it by orders of the Board of Trade. They had not done any wiring for electric lighting purposes for non-consumers since the action was brought, and had not done so since 1903.

HIS LORDSHIP said he was thinking how far they could shorten matters by prefacing any order made, with the admissions and claims made by Mr. Danckwerts. That would bring them within

one branch of the Leicester case. He understood Mr. Danckwerts also claimed the right to supply electric bells if the same were operated by energy supplied, or about to be supplied, by the Corporation, and also if they were operated by local batteries not connected with defendants' supply.

MR. DANCKWERTS said yes in connection with the fitting of a supply under the Act of 1903.

HIS LORDSHIP asked if counsel could agree on admissions which would satisfy both sides and shorten matters.

MR. DRUCQUER said the admissions which Mr. Danckwerts had made were not broad enough. They were really all contained in the pleadings. But for those admissions it might have been that he could have carried his evidence much further as to what had happened inside the area.

HIS LORDSHIP said he agreed that Mr. Drucquer was entitled to take up that attitude. It appeared to him that the only result of their discussion had been to lengthen the proceedings instead of shortening them. He thought that a great deal of what Mr. Danckwerts had said was admitted in the pleadings.

MR. DRUCQUER: And it does not help me.

HIS LORDSHIP: Then go on with your evidence.

MR. DRUCQUER then called MR. WM. H. PATCHELL, who explained to the Court the usual mode of supply of electrical energy to the consumer, and explained the exhibits which had been produced to illustrate the mode of supply.

Cross-examined by MR. DANCKWERTS: I gather that you are not familiar with the Sheffield Corporation undertaking?—I have not seen anything of it since it was bought by the Corporation. I only remember it in the days when Mr. Johnson was there running it: he was the engineer.

He was the manager of the old company?—Yes.

What did you see of it then?—Very little. Not much had been done in the way of street mains then. I do not claim any particular knowledge of the Sheffield undertaking.

MR. DANCKWERTS put further questions regarding the supply of energy, and explained that he was trying to frame his questions in popular language.

HIS LORDSHIP said he did not mind. Counsel was only reducing himself to the level of the tribunal.

MR. DANCKWERTS (to witness): The wires inside the house after the consumers' terminals are just as important as the wires before you reach the terminals, are they not?—You mean just as essential. Certainly. The consumer's terminal is the point upon which you can put your finger as the point at which energy is supplied by the undertaking and at which the statutory pressure can be tested.

MR. DRUCQUER said he had electrical contractors to give further evidence if his Lordship desired.

HIS LORDSHIP said it was for counsel to decide.

MR. DRUCQUER called MR. W. R. RAWLINGS, director of Rawlings Bros., Ltd. He said he was an electrical contractor and engineer and had had 25 years' experience. His business as an electrical contractor was to put in wires and fittings inside the consumers' premises. His work commenced at the consumer's terminals. The undertakers supplied all the fittings up to the terminals. He prepared the models.

Cross-examined by MR. SARGANT: You are not familiar with the practice at Sheffield?—No.

You prepared your models without reference to the system in operation at Sheffield?—Quite.

Do you know that at Sheffield they do not have transformers in the consumers' premises as a rule?—I believe they do not.

MR. ALBERT DAVIDSON, the relator in the case, said he was a M.I.M.E. and carried on business in Sheffield as a mechanical engineer. He was an electrical contractor prior to 1904, but ceased that business owing to the competition of the Corporation. He knew of the Sheffield Electric Light and Power Co., and knew that down to 1897 they were doing practically nothing in supplying electrical fittings. The Universal Fittings Co. did supply such fittings and was an auxiliary of the other company. Both companies had the same directors, but otherwise they were separate companies. The Fittings Co. was absorbed by the Power Co. The Power Co. did not, to his knowledge, issue a catalogue of fittings until they took over the Fittings Co. The defendants had a substantial showroom in Sheffield, and the fittings were clearly exhibited to the public. It was an ordinary commercial showroom. He had been in, but not to buy things. There was no notice of any kind exhibited to indicate that only consumers of energy would be supplied with fittings.

HIS LORDSHIP: Are the articles priced?—WITNESS: I could not say definitely.

Further examined: About two years ago there was an Electrical Exhibition at Sheffield, at which the Corporation exhibited very largely. There was no notice then that the Corporation only supplied consumers with fittings.

Cross-examined by MR. SARGANT: There were still seven or eight firms of electrical contractors in Sheffield carrying on business. He gave up his business owing to the competition of the Corporation, not because of competition with other firms. He stated that from his experience. He was a mechanical engineer, and perhaps had not quite the same knowledge and experience as his competitors, but he employed a competent manager who was skilled in electricity. He was doing the largest electrical jobs that were being done in Sheffield at the time, but it was subsidiary to his other business of a mechanical engineer.

Do you know that the Universal Fittings Co. did not do the wiring of houses at all?—Yes.

And that a considerable part of the business of the Sheffield Co. was the wiring of houses?—I don't know that as a fact. I know that they did it.



Further cross-examined, he reiterated that the two companies were practically working hand in hand. He had considerable local knowledge of the circumstances of their businesses.

You know the Corporation showroom is on the second floor?—Yes.

Does it not strike you as peculiar it should be on the second floor if they want to carry on a general business?—No, not having regard to the nature of the business.

Are there any fittings in the showroom which could be used except in connection with the 200 volts supply of the defendants?—I could not attempt to answer such a question. So far as my knowledge goes the showroom is a general showroom.

Are there any fittings shown which could be used in connection with any other supply of electricity except that given by the Sheffield Corporation?—I should prefer you to put that question to the manager of the department.

MR. SARGANT repeated the question, and WITNESS replied that he personally did not know.

Was there any attempt to advertise this showroom as a place where electric fittings could be purchased?—There is a general attempt in their current advertisements which they send out.

MR. DRUCQUER produced a specimen advertisement, and WITNESS, replying to MR. SARGANT, said these advertisements were sent out to the consumers, together with the bills for energy supplied.

Further cross-examined, he agreed that the chief object of the Electrical Exhibition was to demonstrate to the inhabitants the advantages of taking a supply of energy from the Corporation for many purposes of the household.

Re-examined by MR. DRUCQUER: Did you find the competition of the Corporation the same as the competition of other contractors?—No.

Why not?—Because the Corporation were on privileged ground.

In what sense?—I mean that where the Corporation had an inquiry for supply they could, and they had, supplied lengths of main which, when an ordinary contractor supplied them, were charged as an extra. We could never get a clear statement as to what belonged to the mains department and what belonged to the fittings department.

Further re-examined, he was a consumer of energy supplied by the Corporation, and as such received their advertisements. He identified various advertisements, and added that on principle he always refused to have anything to do with the Corporation, except for the supply of energy. He should have stated that the Corporation showroom was on the first floor above the ground floor.

His LORDSHIP: Are there any other makers of electricity besides the Corporation?—Yes.

And they can go to the Corporation for fittings?—Yes. One of the worst cases is where they had done so in regard to a private installation of Mr. Wild. I wrote to the Town Clerk about it. It is shown in their books. Mr. Wild's place is just within the city boundary, but there are no mains to it. There was no excuse for them doing that work, and it only shows what they will do if they are allowed.

MR. SARGANT: Did Mr. Wild ask for a supply?—I don't know.

MR. ERNEST GEORGE DENNEN, electrical contractor, carrying on business at Sheffield, produced models he had made, showing the mode of supply by the Corporation, and explained it to the Court. He said he knew of a case where the Corporation had repaired a dynamo used for electro-plating. The dynamo was driven by a gas engine.

MR. SARGANT said this was not in the particulars.

MR. DRUCQUER asked to be allowed to go into cases beyond the particulars.

His LORDSHIP said he thought at present they had better confine themselves to the particulars. If it was necessary he would give plaintiffs further discovery to enable them to add anything to their particulars.

WITNESS, cross-examined, said he was a consumer of energy supplied by the Corporation. He did not know of any invitation by the Corporation in the advertisements to do work for anybody but consumers.

MR. ROBERT TWEEDY SMITH, of the firm of Turner & Co., solicitors for the plaintiffs, gave evidence in regard to certain interlocutory proceedings in the action. He also detailed the proceedings in connection with the Bill in Parliament, and the action taken after the decision in the Leicester case, where the Corporation were restrained from wiring houses. There was communication between himself and the Sheffield Corporation on the subject of that decision, but beyond that there was no delay in proceeding with the action. On June 11th he went to Sheffield and inspected the books of the Corporation by an order of discovery, and took out particulars of the work carried on by the defendants. He selected certain particulars for the purposes of the present action, but he did not multiply instances unnecessarily. He had examined the accounts of the Corporation, and he had come to the conclusion that a portion of the rates was used for the purposes of the electrical business. In the year 1902 there was a sum of £164,164 17s. 2d., due to the treasurer from the electricity department, and there was a deficit on the borough fund of £4,865 3s. 7d. That was after giving credit for all the balances in the hands of the banks, and the various accounts and the deficits were carried to a combined account of income and expenditure of the district borough fund. That caused him to come to the conclusion that the borough fund had been used for the purposes of carrying on a portion of the electrical undertaking. It could not be said that the surplus resulting from trading could be utilised to make good any deficiency, because the accounts showed there had been a series of losses for some time.

Cross-examined by MR. SARGANT: He was not a chartered accountant, but he had a considerable knowledge of accounts, and

particularly of Corporation accounts. He admitted that he could only show there was a loss on the fitting and wiring department by inference, but the engineer in his report said there was a loss.

Can you contradict these figures? In 1902 there was a profit of £953 on wiring and fitting alone.—There is no such item in the account.

No, the accounts were kept together. Do you contradict the facts that the profits on wiring and fitting were as follows:—In 1903, £2,645; in 1904, £2,676; in 1905, £2,172; in 1906, £1,503; 1907, £1,663; 1908, £2,042; 1909, £3,211; 1910, £2,959; and 1911, £2,966. Are you prepared to say that the accounts you have got there enable you to contradict these figures in any way?—If you say the figures are hidden in some other portions of the accounts, I can't contradict it; but if that is so, they are not complying with the Board of Trade regulations.

That is our point. You said the published figures showed that there had been a loss. I only said by inference. I do not carry it beyond that.

This concluded plaintiffs' case.

For the defence, MR. DANCKWERTS said he would postpone his speech, and at once call

MR. JAS. SWINBURNE, F.R.S., M.I.C.E., who, by means of a model, explained to the Court the various means of storing and distributing electrical energy, and the improvements which had been made in the matter in recent years.

The hearing was adjourned.

On Wednesday further evidence for the defence was heard, the witnesses being Mr. Swinburne, Mr. S. E. Fedden, Mr. J. W. Wright, the City Treasurer of Sheffield and Mr. J. W. Barnes, commercial manager of the Sheffield electricity department.

(To be continued.)

#### MUSKER (1901), LTD. v. BESSEMER & CO.

IN the Nisi Prius Court of the Liverpool Assizes, on February 14th, 15th and 16th, before Mr. Justice Bray (without a jury), plaintiffs, a firm of hydraulic and electrical engineers, Liverpool, brought an action, for balance due for an electric crane, against defendants, a large steel and iron company, at Bolton.

Plaintiffs' case was that on May 19th, 1911, a crane supplied by them was, subject to certain complaints, ready for the contract test. Subsequently some faults developed, and plaintiffs' representative went to Bolton to see whether they needed his attention. Before he began to make any adjustments, the crane was being used by defendants to carry a number of steel billets, and got damaged to a serious extent. The question to be tried, said counsel, was whether plaintiffs or defendants were responsible for the broken crane. Plaintiffs contended that the crane was used for lifting and carrying a weight of 10 tons 6 cwt. at a radius of 25 to 29 ft. from the centre of the crane instead of 15 ft. The theory was that the crane, travelling along the lines in a position of unstable equilibrium, struck some obstruction on the line, which caused it to over-balance.

Evidence in support of plaintiffs' case was given on February 15th. Counsel for the defence reserved his remarks, and called evidence to prove that there was a defect in the crane.

Defendants gave evidence that there was no obstruction on the line, but that the accident was due to the slewing pinion catching across a projecting bolt on the carriage of the crane, causing the load to swing and bring the crane over.

The Judge came to the conclusion that plaintiffs' explanation was the correct one, and he therefore found for plaintiffs. It was agreed that the matter should be mentioned again in order to decide what form the judgment should take.

#### CUBEY v. OLYMPIA SKATING RINK CO., SEDDON AND HALL.

AT the South Shields County Court on 15th inst., before Judge Bonsey, Thomas H. Cubey, electrician, sued the Olympia Skating Rink Co., Henry Edward Seddon, Manchester, and William Hall, Bolton, to recover £59 16s. 8d., in respect of electrical goods supplied at the rink, and work done.

MR. H. S. MUNDAHL, who appeared for the plaintiff, said that the matter had been brought into Court in order that the liability for the debt might be fixed. It appeared that, in 1909, Seddon, Hall and others, built the Olympia Skating Rink at South Shields, and the building was afterwards taken over by the defendant company. Some of the goods included in the claim were ordered by Hall, others by Seddon, but when the plaintiff applied to them for payment, they each denied liability; the company also denied liability, and said they did not order the goods.

It was mentioned that the Olympia Co. had paid £1 3s. 4d. into Court in respect of one item for which they admitted liability.

After evidence had been given as to the ordering of the goods, and legal arguments as to the relative position of the parties, the JUDGE said there was no doubt that the plaintiff had supplied the goods and done the work, and consequently he was entitled to the amount of the claim. What he was deciding was not the pecuniary rights between the defendants in the case. He was merely deciding that the plaintiff was entitled to recover against those people who gave him the orders for the work or the goods. He, therefore, gave judgment against the Rink Co. for the £1 3s. 4d. paid into Court, against Hall for £5 8s., and against Seddon for £53 5s. 4d.

#### PATRICK TUCHY v. BELFAST CORPORATION.

AT the Four Courts, Dublin, last Saturday, before the Lord Chief Baron and a special jury, this case was concluded. The plaintiff, a member of the Royal Irish Constabulary, on August 16th last was riding a bicycle on the Shor Road towards Greencastle, Belfast



when he collided with a tramcar, the property of the Corporation. He sustained a fracture of the skull, and has since been under medical care. His case was that the servants of the Corporation were negligent in the driving of the tramcar.

For the defence, negligence was denied; and it was pleaded that the plaintiff had been guilty of contributory negligence. There was a suggestion that at, or just before, the moment of the accident the plaintiff, on his bicycle, was holding the back rail of the tramcar, and that this led to the accident, he having been negligent in not looking out for a car that was coming in the opposite direction, which was the colliding one. There was, however, evidence that the plaintiff had let go the tramcar some few minutes before the accident.

Counsel for the plaintiff—Messrs. A. M. Sullivan, K.C., James O'Connor, K.C., and S. A. Porter (instructed by Mr. Bernard Campbell). For the Corporation—Sergeant Moriarty, Messrs. Chambers, K.C., M.P., Wm. M'Grath, K.C., and T. Harrison (instructed by Mr. Frank Kerr).

COUNSEL having addressed the jury, the Lord Chief Baron summed up the evidence. He said the law was that if this man's injuries were caused by the negligence of the defendants' servants, without what the law called contributory negligence on his part, he was entitled to get compensation for his injuries. On the other hand, if the injuries were the result of two acts—one a negligent act on the part of the plaintiff, being one without which he would have never have sustained the injuries, then he could not recover damages. But there was a third proposition, namely, that if there was negligence on the part of the plaintiff, which, in fact, contributed to the accident, still, if the defendants' servants could by the exercise of due care and caution have avoided the consequences of the plaintiff's negligence, then the plaintiff was entitled to recover.

The jury, after an hour's deliberation, were unable to agree, and they were discharged.

#### STOKE NEWINGTON BOROUGH COUNCIL v. LANE & Co.

At the Shoreditch County Court on February 15th, plaintiffs sued defendants to recover £4 7s. 1d., the cost of laying an electric light service, and £1 4s. 6d. for current supplied and meter rent at a shop in High Street, Stoke Newington. According to a report in the *Daily Telegraph*, the shop was opened for the supply of Coronation electrical devices, and defendants only stayed a few months. The Council, therefore, charged for the installation, as, under their ordinary conditions, no application for a shorter period than one year was to be accepted, except under special circumstances, in which case the entire cost of connection of the mains must be paid by the applicant. Defendant claimed that he was not entitled to be charged, as other Councils supplied 20 ft. of cable free of cost. After considerable discussion, JUDGE CLUER said that, in this case, the Council's conditions wanted altering to suit certain arrangements. This was a genuine application for a permanent supply, but, by force of circumstances, they went out, though that did not make them liable for the mains under the present rules of the Council. Had the application not been genuine, it might have been different. The laying of the mains could not be charged for, and there would be judgment for the balance. Judgment was accordingly entered for the plaintiffs for £1 4s. 6d. and costs.

**Dinner in Honour of Prof. Unwin, F.R.S.**—On February 10th, Prof. W. Cawthorne Unwin, LL.D., F.R.S., was entertained by about 200 of his past students at the Criterion Restaurant, Piccadilly. The dinner was organised by the Old Students' Association of the City and Guilds Central Technical College, with the intention of celebrating their late professor's year of office as President of the Institution of Civil Engineers, a position which has never before been held by an engineer who has devoted practically all his life to the teaching side of the profession.

The chair was taken by the President of the Association, Mr. W. Duddell, F.R.S., who proposed the toast of the evening, and showed the phenomenal growth of the college under Prof. Unwin by stating that in 1885, when the college was opened, there were only 35 students, whereas in 1904, the year in which Prof. Unwin retired from actual teaching, the roll of students was 349. The chairman proceeded to speak about the professor's personal influence on his students, and evidently expressed the general feeling of the meeting when he said that all had regarded him as a second father, and that he was beloved accordingly. Mr. H. A. Humphrey, one of Prof. Unwin's original students, warmly seconded the chairman's proposal.

Prof. Unwin said that he was very much touched by the expression of his old students' respect for their professor, and having given a short but very interesting autobiography, he gave particulars as to the distinguished careers of several of his past students, now scattered all over the globe. Since the opening of the college 175 students had become Associate Members of the Institution of Civil Engineers, while 16 had been elected to full membership, and 157 had taken the new degree in engineering of the London University. Prof. Unwin hoped that soon his old college would have three distinct departments for Civil, Mechanical and Electrical Engineering respectively.

The meeting was a great success, and the Association presented Prof. Unwin with a cigar cabinet as a tangible souvenir of the evening.

#### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"C. W. G." writes:—"I have been for some eight years tenant of a house, which I have wired and fitted up for electric light at my own cost. I am now leaving, and wish to know what fittings I am legally entitled to remove. (a) Can I take down ceiling roses? (b) Can I take down branch and main switches? (c) Can I take down distributing fuseboard and main fuses?"

\* \* This query raises the question as to how far electric fittings are fixtures. The rule of law is that whatever is fixed to the soil becomes the property of the landlord; and as walls and ceilings are themselves fixed to the soil, whatsoever is fixed to them must be allowed to remain *in situ* at the end of the tenancy. In general, articles standing by their own weight upon the ground, or upon foundations prepared for them, are not fixtures—e.g., a wooden windmill resting upon a brick foundation (*R. v. Otley* (1830) 1 B. and Ad. 161). The question whether a particular article is a movable chattel or a fixture depends on the degree of annexation to the freehold and the object of annexation (*Cosly v. Shaw*, 19 L.R. Jn. 307); so it is conceived that if electric light is installed in a house, any fittings (apart from mere ornamental fittings) become the property of the landlord. Ceiling roses, branch and main switches, distributing fuseboard and main fuses would thus, it is submitted, become the property of the landlord.

#### BUSINESS NOTES.

**Lamp "Stickers."**—THE BRITISH THOMSON-HOUSTON CO., LTD., are now issuing a "sticker" for affixing to correspondence or stationery. It consists (as the accompanying illustration will show) of a reproduction of the "Sun's Only Rival" showcards, artistically printed in many colours on a circular adhesive label. Contractors who have not yet had any of these "stickers," or who have exhausted their stock, can obtain a supply on application to the publicity department of the company at Mazda House, 77, Upper Thames Street, E.C.



LAMP "STICKER."

**Company Liquidations.**—WAKELIN BROS., LTD., electrical engineers, 7, Tottenham Street, W.—The creditors and shareholders met on February 16th, at the Board of Trade offices, Carey Street, Lincoln's Inn, W.C., to select a liquidator and committee of inspection to act under the compulsory winding up order made against the company on December 12th, 1911, upon the petition of Mr. John Frederick Wakelin and other creditors, presented to the Court on November 23rd, 1911. Mr. W. J. Warley, Official Receiver, presided. The statement of affairs, lodged by Mr. J. F. Wakelin, managing director, showed liabilities £1,256, against assets valued at £601, and a deficiency of £1,955 with regard to the contributories. The assets comprised cash at bankers, £4; plant and machinery, £70; and good book debts, £527. The report of the Official Receiver states that according to the accounts which have been imperfectly kept, the company appears to have traded throughout at a small loss. In August, 1910, it obtained the exclusive agency for the South of England for the sale of a patent electric lighting set. The directors state that the first set supplied through the company proved to be defective and involved the company in considerable expense. The company claimed to be recouped by its principals and this led to litigation, which subsequently, on November 23rd, 1911, resulted in judgment against the company for £424 and costs. On November 24th, 1911, the Court appointed the Official Receiver to be provisional liquidator, and it being represented that it was desirable to carry on the business with a view to a suggested sale to a new company, the Court, on his application, appointed Mr. D. L. Honeyman, chartered accountant, of 18, St. Swithin's Lane, E.C., to act as special manager, he undertaking to indemnify the Official Receiver against loss. The business was carried on by the special manager until the date of the winding-up order, but trading in the meantime resulted in a small loss. Subsequently to the winding-up order an offer of £100 was made for the plant, machinery and stock, but the same was withdrawn. Steps were thereupon taken to remove the plant, &c., whereupon the superior landlord distrained for rent due. Upon the advice of the auctioneer employed by the Official Receiver, an offer of £70 was accepted for the plant, &c., out of which the rent, £34, and expenses of distraint, &c., were paid. The only other assets consist of cash in hand, £4, and book debts estimated to realise £527. The failure of the company is attributed by the directors to the litigation before referred to; also to the failure of a customer, and to lack of working capital. The chairman added that £66 had been received in respect of the book debts, and there was about



£100 in hand. A resolution was passed at both meetings for Mr. W. A. Henderson, chartered accountant, 3, Fenchurch Street, E.C., to act as liquidator, with the assistance of the following committee of inspection, viz.:—Mr. W. J. Rogers (Sun Electrical Co., Ltd.); Mr. Joseph Huskinson (D. Hulett & Co., Ltd.) and a representative of Fyfe, Wilson & Co., Glasgow. The following are the principal creditors:—

UNSECURED.			
Adnll Electric Co., Ltd. . . .	£35	Royer & Borghys . . . .	£25
Dixon, Edward . . . .	80	Russell & Co., J. . . .	18
Evered & Co. . . . .	47	Siemens Bros. . . . .	29
Bolding, John, & Sons, Ltd. . .	39	Simplex Conduits, Ltd. . .	26
Fyfe, Wilson & Co. . . .	424	Sun Electrical Co., Ltd. . .	37
Honeyman, D. L. . . . .	31	Tibbs, Percy . . . . .	83
Hulett, D., & Co., Ltd. . . .	17	Wakelin, H. R. . . . .	42
Pfoll, Stedall & Son . . . .	52		

NATIONAL LIGHTING CORPORATION, LTD., 35, Cock Lane, London.—First and final dividend of 4½d. in the £, payable at 33, Carey Street, W.C.

**Private Meetings.**—C. SUCKLING (trading as C. Suckling & Co.), Brent Street and Golder's Green Road, Hendon, N.W.—An adjourned meeting of creditors in the above matter took place of February 12th. It was reported that the offer previously made by the debtor of 3s. 4d. in the £ had now been increased to one of 7s. in the £. It was recommended that this offer should be accepted, on the understanding that all the creditors agreed and that the composition in question should be paid within a period of 10 days.

**Catalogues and Lists.**—THE SANDYCROFT FOUNDRY CO. LTD., Sandycroft, near Chester.—New catalogue (H.B.) of 46 pages relating to their patent "Cascade" induction motors (Hunt's patents). A specification is given accompanied with diagrams of connections and half-tone views of the motors and parts, also pictures showing their applications in the driving of pumps, haulage gear, air compressors, &c. Many of the pages are occupied with table matter respecting efficiencies, speeds, weights and prices, dimensions, &c. Particulars of liquid and metallic starters and of special outfits for Cascade motors are given.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Twelve-page publication containing various information respecting the use that is being made of aluminium for motor and carriage building. A table appears of the physical and mechanical properties of brass, steel and aluminium, also one of a number of sections; a third table sets out the weight per square foot of aluminium sheet.

MESSRS. W. A. WALKER & CO., 38, Victoria Street, Westminster, London, S.W.—Eight-page booklet giving a list of their regular stock, sizes of bright steel bars, strip, and sheets for deep stamping.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Twelve-page art-paper booklet (No. 180) giving full descriptive notes, with half-tone illustrations and diagrams of connections of their portable infantry, cavalry and artillery telephones.

MESSRS. STOCKER & CO., Leipzig.—One hundred and fifty-two-page catalogue (in German) containing particulars and prices of a great variety of electric bells, telegraph and telephone apparatus and material, electric clocks, fire alarm, electro-medical apparatus, and other manufactures for weak currents. A number of tools and sundries and diagrams of connections are given at the end of the book.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, Kent.—New catalogue, No. 512 (60 pages) in the firm's excellent standard style and form, containing full information regarding redesigned and improved Siemens water meters. In addition to a number of well executed half-tone pictures of the apparatus, there are many useful very clearly rendered explanatory sectional drawings. Dimensions, weights, and prices are given in tabular form. The contents of the catalogue may be indicated by the following names of sections:—Vane wheel meters (dry and wet running and larger types); water meter combinations; disk water meters; boiler feed disk water meters (for hot water), which should be of considerable interest to station engineers; full-bore water meters (for large quantities); and testing apparatus and tools.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, London, E.C.—A new price list of Mazda drawn-wire lamps covering standard and fancy miniature types has been issued. The list has a front cover in colours, illustrating the firm's "Strength" showcard, with the "Sun's Only Rival" design at the top. The list contains concisely arranged tables of the various lamps, and notes relating to the advantages of the Mazda drawn-wire lamp and its applications. A number of photographs show the illumination of offices, shops and factories with Mazda lamps. A full-page set of illustrations shows all the sizes of Mazda lamps made to scale, and facing this a table of sizes and voltages gives full data thereon. In addition to a complete range of standard types, the list contains a line of Mazda fancy lamps, candle and twisted flame, with drawn-wire filaments. Copies can be obtained on application.

THE ELECTRIC AND GENERAL STORES CO., 102 and 104, Albion Street, Leeds.—Illustrated and priced leaflets relating to the "Lodge" sparking plug, the Jones speedometer, the Claudel-Hobson carburettor, and the Dietz motor lamps.

THE WILSON-WOLF ENGINEERING CO., LTD., Thornton Road, Bradford.—Section III (eight pages) of their catalogue of type "C" motors and dynamos for direct current, from ½ to 6 H.P. A brief specification is followed by tabulated code-words, powers, speeds, and prices for open, protected or enclosed ventilated machines, motor-starters, spare parts, &c.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark London, E.C.—Advance copy of a 12-page booklet entitled "A Jewel of a Lamp," containing a non-technical description of the "Kohinoor" semi-enclosed D.C. arc lamp and its advantages, prepared for the purpose of appealing to consumers. Money tables are worked out showing the economy of this system of lighting as compared with grouped metal-filament lamps. Copies of the pamphlet will be sent to contractors on application.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Willesden, London, N.W.—Folder regarding their metal-filament lamps, and stating prices of same and results of tests made at the Westminster Electrical Testing Laboratory. An effective cartoon shows the disgust of a couple of prepayment gas-meter thieves, at the small sum found in the meter—the Pope lamp being to blame for the economy.

MESSRS. JULIUS SAX & CO., LTD., 24A, High Street, New Oxford Street, London, W.C.—Sixty-page catalogue of electric bells of various qualities and types, including continuous-ringing bells, indicating (mechanical replacement) bells, bracket, circular, water-tight outdoor, gas and water-tight and other bells. Relays, complete bell sets, indicators, fire alarm indicators, pushes of many kinds, batteries and wires, are all illustrated and priced. Special attention is directed to the firm's rubbing-contact bell.

**Books Received.**—"Bulletin of the Association des Ingenieurs Electriciens." October-November, 1911. Liège: The Association. Price 11 fr.

"Journal of the American Society of Mechanical Engineers." Vol. 34, No. 2. February, 1912. New York: The Society. Price 35 cents.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 1. January, 1912. Brussels: E. Bruylant. Price 1 fr. 75.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland." 1911-12. Glasgow: The Institution.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 2. February, 1912. Philadelphia, Pa.: The Institute. Price 50 cents.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXI, No. 2. February, 1912. New York: The Institute. Price \$1.00.

"Fire Tests with Textiles," and "Fire Tests with 'Pyrene' Fire Extinguishers." 1912. London: The British Fire Prevention Committee. Price 2s. 6d. each.

"Resistance Coils for Alternating Current Work," and "The Measurement of the Inductances of Resistance Coils." By H. L. Curtis and F. W. Grover. September, 1911. Washington: Government Printing Office.

Boletín de la Sociedad de Fomento Fabril. Vol. XXIX, No. 1. January 1st, 1912. Santiago, Chile: The Society.

"The Steam Turbine." By Robert M. Neilson. 1912. London: Longmans, Green & Co. Price 18s. net.

**Applications of Aluminium.**—The windows of the BRITISH ALUMINIUM CO.'s premises at 109, Queen Victoria Street, E.C., just now afford an interesting object lesson in the versatility of aluminium. Mounted in an artistic framework of polished aluminium are 12 panels which bear samples demonstrating the various forms of the raw material and the processes involved in its manufacture. The first two panels under the headings "Ingots" and "Slabs" show specimens of notched bar and slices cut from the company's standard forms of rolling slab. Wire bars and rods, round, square and of rectangular section, are represented in great variety under their respective headings. The panel devoted to sheets gives a selection of the different forms of finish to which aluminium lends itself, whilst the exhibit of sections shows angles, channels, lap-plates and mouldings of the many forms which the company regularly supplies. Tubes are displayed in a number of forms and sizes, and the panel devoted to alloys is equipped with examples of castings for motor and other work. The last two panels, devoted respectively to "wire" and "cable" give some idea of the fields in which aluminium is so extensively replacing copper.

**An Everlasting "Sunbeam."**—THE SUNBEAM LAMP CO., LTD., have received from a well-known supply engineer the following letter:—

"We are forwarding to you to-day a lamp of your manufacture, that has not yet given out, and it may be of interest to you to know that it has been burning in my own house on an average of six hours every evening, since October, 1908, which means a life of over 7,600 hours."

This is certainly a remarkably good record.

**Diesel Oil Engines.**—We learn that in the fortnight between January 28th and February 10th, orders were received by the MASCHINENFABRIK AUGSBURG-NÜRNBERG A.G. for 20 M.A.N. Diesel oil engines of altogether 10,570 B.H.P. Amongst these are two horizontal single-acting two-cycle engines, each of 2,000 B.H.P., ordered by L. Mannstädt & Co., of Kalk, near Cologne, and two horizontal double-acting four-cycle engines, each of 1,600 B.H.P., ordered by the Municipal Electricity Works, at Halle, where one engine of this size has been running for some time.

**Social Events.**—The seventh annual dinner of the employes of MESSRS. A. REYROLLE & Co. was held on February 17th at the Collingwood Restaurant, Newcastle-on-Tyne, a company of over 150 being present, under the chairmanship of Mr. Reyrolle. After the loyal toast, the toast of "The Firm" was proposed by Mr. F. Coates, who expressed the opinion that the success of the



firm was, to a large extent, due to the mutual regard which existed between the employers and the employes, and which in turn was due to Mr. Reyrolle, who was accessible to all. The firm had shown an example of progressiveness in the past, and he ventured to prophesy that the rate of progress would be fully maintained in future. At the present moment they had in hand a couple of orders for 6,000 and 20,000-volt switchgear for a large supply company in the United States, and he thought that to send switchgear to that country was no mean achievement.—Mr. Reyrolle, in reply, thanked Mr. Coates for his words of appreciation, and said that it was his ambition to do more, if possible, to make all the employes feel that they had a personal interest in the firm. They had certainly made wonderful progress during the past 10 years, and he was confident that by keeping together and working in harmony they would make still greater progress. As had been said, their manufactures would shortly be represented in the States by several high-tension ironclad panels, and the firm's exhibit at the Turin Exhibition had been very favourably commented upon. Several of the employes contributed to a varied programme which followed, and the evening was very successful.

To-night, at 8 p.m., at the Pillar Hall, Victoria Station (S.E. and C.R.), the staff smoking concert of the Charing Cross, West-End and City Electricity Supply Co., Ltd., is being held.

On Friday, 16th inst., the fifth annual dinner and smoking concert of the workmen of the Sunbeam Lamp Co., Ltd., Gateshead, was held in the Collingwood Hotel, Newcastle, a large number being present, under the chairmanship of Mr. T. J. Grainger, the general manager of the company. There were also present Mr. H. W. Edmundson, works manager, Mr. J. Gledson, the Northern District superintendent, and Mr. R. M. Beresford, secretary. After the loyal toast was given, the success of the company was proposed by Mr. G. Barras, the manager of the glass works, and responded to by Mr. Grainger, who spoke optimistically of the future of the company. A successful musical programme was given by Messrs. E. Batey, T. A. Golightly, A. H. Rushton, R. M. Beresford, T. Onions and A. Bell, with Mr. G. W. Danskin as accompanist. A hearty vote of thanks to Mr. A. H. Rushton, who made the arrangements for the evening, terminated the proceedings.

The annual dinner of the staff of the "Robertson" and "Osram" Electric Lamp Works was held on Friday, 16th inst., at the Clarendon Hotel, Hammersmith. Close upon 100 sat down under the chairmanship of Mr. C. Wilson, the popular manager. An excellent programme was provided by members of the staff, the principal item being an amusing playlet called "House Full," which was briskly played by members of the Dramatic Society, who deserve great credit for the excellent way in which it was done. Miss D. Dallender and Miss E. Drasd ably filled their respective parts, while Mr. H. Damerell, the producer, and Mr. J. Minson kept the audience amused throughout. The toast list included "The King and Royal Family"; "The Allied Firms," briefly and pithily proposed by Mr. J. T. Fletcher; and "The Visitors," proposed by Mr. F. P. Driver, and responded to by Mr. White and Mr. Sydney Rentell. Mr. P. Pring proposed "The Chairman," and in response, Mr. Wilson reciprocated the kindly expressions of the proposer, and referred to the general growth of factories in Hammersmith, theirs being the second largest; he pointed out that far from factories being conducive to empty houses, as had been prophesied, the reverse was the actual fact.

**Advance in Prices.**—MESSRS. A. SEAGE & CO., of Hammersmith, announce that, in consequence of the continual advance in material and wages, they have had to advance prices by 5 per cent. from Wednesday, February 21st.

**Mexico.**—The British Vice-Consul at Guadalajara (Mr. P. G. Holms) reports that a firm of importers of that place desires to get into touch with British manufacturers of agricultural machinery, producer gas engines, centrifugal pumps and material for electrical installations. Any further communications regarding the inquiry should be addressed to the British Vice-Consulate, Guadalajara.—*Board of Trade Journal*.

**Aberdeen Destructors.**—The Corporation Cleansing Committee, in the selection of contractors for the installation of a dust destructor, is to confine its attention to Heenan & Froude, Manlove, Alliott & Co., and Hughes & Stirling. A deputation is to satisfy itself as to the comparative merits of the destructors of these firms before accepting tenders.

**Trade Announcements.**—MESSRS. GILLESPIE AND BEALES, of Amberley House, Norfolk Street, Strand, W.C., have recently been appointed by the Limmer Asphalte Paving Co., Ltd., as their sole selling representatives in the United Kingdom for their joint-box compounds and insulating bitumens.

THE GENERAL ELECTRIC CO., of New York, have acquired from the Sandycroft Foundry Co., Ltd., the sole right to manufacture and sell in the United States of America and its colonies and dependencies, cascade motors of the "Sandycroft-Hunt" patent type. We are informed that the application of these cascade motors is becoming more and more general for all purposes where slow and variable speeds are required. The possibility of obtaining such speeds has now made alternating current as useful for industrial purposes as direct current.

THE CRYPTO ELECTRICAL CO., of Bermondsey Street, S.E., have now a new telephone line (No. "2807 Hop") in addition to 12830 and 12831 "Central."

MR. H. CRESSALL informs us that he is making an extended stay at Mr. Schniewindt's works at Neuenrade, in Germany—prior to making arrangements for manufacturing resistance nets in England. All communications relating to resistance nets, previously addressed

to him at 13, Summer Row, Birmingham, should be sent to him at Neuenrade, Westphalia, Germany, until further notice.

IMESON, FINCH & CO., LTD., electrical and tramway engineers, Stockton-on-Tees.—The receiver and liquidator of this company announces that he has sold the business and trading effects of the company to Messrs. Imeson, Finch & Co. (1912), Ltd. The latter company has issued notice to the same effect, intimating that it is carrying out all contracts and trading engagements commencing from January 31st, 1912.

**For Sale.**—The Trafford Power and Light Supply Co. (1902), Ltd., have for disposal a quantity of electrical plant. The Greenock Corporation has for disposal one 100-kw. Belliss-Silvertown balancer set, and two 150-kw. Belliss-Silvertown shunt or compound sets. The Rotherham Corporation has for disposal a 165-kw. D.C. steam set. The Polytechnic Estate, Ltd. (Wimbledon), have for sale a quantity of gas and electric plant, batteries, &c. See our advertisement pages to-day.

**Bankruptcy Proceedings.**—Under a receiving order made against the BRITISH ACCESSORIES CO., 119, Pentonville Road, London, N., the first meeting of creditors was held on Tuesday, last week, at Bankruptcy Buildings, Carey Street, W.C., Mr. E. Leadam Hough, Senior Official Receiver, presiding. The chairman reported that Ernest Dunstan Hawker and Arthur Sydney Finch had attended under the proceedings, and the former had stated that he entered into partnership with Finch in November, 1910, for the purpose of carrying on business under the style of the British Accessories Co. It was only a verbal partnership, and each of them provided a sum of £50 by way of capital. In February of the following year they bought from the Standard Plating Co. a wind tin-sign business which had been carried on as the Bright Sign Co. The purchase price was £190, of which they paid £20 down in cash, whilst the balance was to be paid by monthly instalments, but they had only paid three of these, and now alleged that the business had been misrepresented to them. As a matter of fact, the debtors began proceedings against the Standard Plating Co.; they, however, discontinued them owing the want of ready money. They carried on their ordinary business until the beginning of October last, when the petitioning creditors pressed them for payment, and they were then compelled to close down. No statement of affairs had yet been lodged, but the debtors had estimated their liabilities at £320, whilst their only available assets were some book debts of the face value of £55, which they thought would realise £40. The stock-in-trade and machinery, together valued at £21, was required to meet the claim of the landlord. The serious feature of the case was that, shortly before they committed the act of bankruptcy upon which the proceedings were instituted, the debtors executed a bill of sale over their household furniture in favour of Mrs. Hawker. No money passed at the time, and the bill was said to have been given in order to secure payment of money then owing to her in respect of loans. The failure was attributed to want of capital. There was no offer of composition before the meeting, and the case was left in the hands of the Official Receiver to be wound up in bankruptcy in the usual manner. Proofs of debts were lodged by:—

Standard Plating and Kupron Works, Ltd.	..	£136
Tempered Spring Co., Ltd.	..	12
Gaskell & Grocott	..	59

C. O. McMILLAN, electrician and cycle dealer, High Street, Portmadoc.—First meeting, February 29th, at Chester; public examination, March 25th, at Portmadoc.

## LIGHTING and POWER NOTES.

**Accrington.**—A L.G.B. inquiry into the application of the Accrington Council to borrow £33,750 for the local gas generating scheme and electrical extensions at Altham and Clayton-le-Moors, will be held on February 27th.

**Barnes.**—At the last meeting of the Council, the Lighting Committee reported that, after considering a lengthy report by the engineer on differential tariffs, it had decided to approve the Norwich system of charging, and had referred the whole question back to the engineer for further report.

**Belturbet.**—At the monthly meeting of the Urban Council, the agreement between Mr. Cave and the Council for the lighting of the town by electricity for the next three years was submitted by the clerk, and approved of.

**Birmingham.**—The Corporation is stated to be going to reduce electricity charges all round. At present, the charges at Aston—which was recently absorbed by the city—are much lower than elsewhere in the area, varying for lighting from 3d. to 2½d., the latter figure for all in excess of 1,500 units per quarter, while in Birmingham the charges vary from 4d. to 2d. (for over 20,000 units per quarter).

**Brighton.**—The T.C. has decided to devote £3,000 from the present year's electricity profits (estimated at from £6,000 to £8,000) in relief of the rates.

**Cardiff.**—The City Council, with a view to improving the electric lighting in the principal thoroughfares and effecting an immediate reduction in the cost, has ordered the electrical engineer to proceed forthwith to convert the old electric lamps to flame arc and high candle-power metal-filament lamps.

**Carlisle.**—The T.C. has informed the R.D.C. that it intends extending the supply of electricity to Stanwix as soon as the work can be undertaken.



**Canada.**—The New Brunswick Hydro-Electric Co., with \$1,500,000 capital, which proposes to supply St. John with cheaper heat, light and power, developed from water powers on the Lepreaux River and neighbouring streams, will apply to the Legislature in March for incorporation.

The Cedar Rapids Power Syndicate, of Montreal, headed by D. Lorne McGibbon, has now assumed the name of the Cedar Rapids Manufacturing and Power Co. Detailed plans of the company's operations on the north side of the St. Lawrence are so far advanced that tenders will be called for the dyke and power house without further delay; it is the company's desire to begin active operations at the plant in the early spring. The capital of the company has been placed at \$10,000,000.

**Chesterfield.**—The T.C. has applied to the L.G.B. for a loan of £7,000, for extensions to the electricity works.

**Dundee.**—The Electricity Committee has under consideration the question of encouraging extra business by granting a reduction in the charges. The scheme before the Committee was as follows:—For power purposes the charge would be 1½d. per unit for the first 10,000 units, the next 40,000 units to be charged at ¾d. instead of the average price of 1½d. All units over 50,000 would be charged at ¾d., but this concession would only be granted to reasonably steady and constant loads, and not to intermittent users. The present rate for 10,000 units is from 2½d. to 1½d. per unit. The rates for small power users were to be reduced from 2½d. to 1½d. per unit, and the larger power users were to have a 10 per cent. reduction. The tramway rate would be reduced from 1½d. to 1d. per unit. A proposed reduction in the case of shopkeepers and domestic users was also considered, this being on the basis that if they guaranteed the present consumption they could have all the extra supply required at the rate of 1½d. for the first 100 units per quarter, and over that at the rate of ¾d. Current to be supplied at these rates, no matter for what purpose it is used. The present lighting rate is from 3½d. to 2½d., according to the amount used, and the heating and cooking rate from 1½d. to ¾d. These proposed changes involved a reduction in revenue of about £2,400 per annum. After full consideration, the Committee decided to consent to the reductions in the case of the large power users, but to defer consideration of the other cases meantime.

The question of the new sub-station was again considered. Mr. Richardson, the engineer, said the load had greatly increased in the south of the city and also at the harbour. He had had complaints regarding the pressure, and because of the growing load he was of opinion that a new sub-station was required. To install new machinery at the Dudhope station and lay an extra cable would cost between £9,000 and £10,000, while the erection of a new sub-station would only amount to about £7,000. It was agreed that the engineer prepare a report on the subject.

**Dunoon.**—At a meeting of the T.C. a letter was read from the B. of T., stating that it proposed to revoke the Dunoon Electric Lighting Order (1906) within three weeks from January 26th, but that it was prepared to consider any further representation the Council might have to make. The Council agreed at a later meeting to send a deputation to see the B. of T. officials.

**Falkirk.**—At a conference between representatives of the Eastern District Committee of Stirling County Council, and a Committee of Falkirk T.C., it was stated that the meeting was held on the initiative of the T.C. to consider the electric lighting order being promoted by Mr. George Balfour, of London. On behalf of the County Council, however, it was pointed out that it had practically arranged terms with the promoter of the order, which would come before the B. of T. this week. No finding was arrived at as a result of the conference.

**Germany.**—The electricity station at Heinitz which supplied power and lighting for the industrial district of the Upper Saar Valley and the Palatinate was recently burnt out, depriving numerous towns and villages of their supply and throwing out of work 20,000 men.

**Goole.**—The D.C. recently discussed the three electric lighting proposals for some hours, and decided to obtain a copy of the Yorkshire Power Co.'s draft agreement.

**Great Yarmouth.**—The electrical engineer (Mr. Gordon Bryant), in reporting a breakdown at the generating station caused by the fracturing of a 6-in. diameter bye-pass steam pipe, said that the steam, filling the engine room, thoroughly saturated the electrical machinery with water, and rendered the main dynamos useless for the time being. The supply, however, was partially restored after a period of three hours, while two hours afterwards the whole of the private and a greater part of the public lighting was running as usual. Seventeen tramway trolley standards on the Marine Parade are to be fitted with electric light by means of up-to-date flame arc lamps of 2,500 c.p. each for a period of 16 weeks from June 7th, at an approximate cost of £80 per season.

**Hastings.**—Whilst opening the important thoroughfare at the corner of Robertson Street recently, to lay a high-pressure gas main, the employés of the Gas Co. drove their wedges through six pipes containing electric cables, thereby extinguishing the lights in the central district of the town for an hour.

The Corporation decided at its meeting at the end of last week to extend the electric light mains in London Road, St. Leonards, so as to embrace St. Matthew's Gardens and the upper part of the thoroughfare at a cost of £326. By carrying out the work, 20 gas

lamps will be transformed to electric lighting, showing a saving of 30s. a year per lamp.

**Hornsey.**—At the last meeting of the B.C., Councillor Double moved: "That the Council allow to consumers of electric current for lighting purposes when charged for at a flat rate, a discount of 5 per cent. on the first 100 units consumed off the quarterly accounts, if payment is made within one calendar month from quarter-day." He said that the Electricity Supply Committee had been considering the matter for some time. In the meantime the woes of the small consumers, who were the backbone of the undertaking, continued, and they had no redress. Upon the chairman of the Committee stating that the whole question of charges would be thoroughly discussed by the Committee, Councillor Double withdrew his motion.

**Huddersfield.**—The borough treasurer's financial statement relating to the Corporation electricity works shows that the income for the year ended December 31st, 1911, was £39,592, compared with £35,209 for 1910. The various items were:—Single-phase lighting, £22,842; single-phase power, £1,032; three-phase power, £8,449; street lighting, £812; hire of motors, meters, &c., £3,250; and fittings service, £207. The expenditure amounted to £23,978, compared with £21,516, leaving a balance surplus of £15,613, against £13,693 for 1910. Interest on loans absorbed £6,763; contribution towards redemption of debt, £1,776; and public works board (amount repaid), £1,607; leaving a net surplus of £2,466, compared with £656 last year. The surplus has been transferred to the depreciation and contingencies account, which now stands at £4,988, compared with £6,123 for the previous year. The Committee has also decided that an amount equal to 2 per cent. on the capital outlay be in future transferred each year to the depreciation and contingencies account.

**Lancashire.**—The Lancashire Electric Power Co. has notified various local authorities that in the event of a coal strike it will be able to supply the maximum demand of the whole of the consumers for six weeks, and to supply sufficient current to enable power consumers to run their works for a period of eight or ten weeks.

**London.**—**MARYLEBONE.**—At a recent meeting of the Council a report from Mr. Carson Roberts, the L.G.B. auditor, on his audit of the accounts of the electricity department for the year ending March 31st, 1911, came under consideration. He stated that several members of the Council had attended the audit and had raised objection to transactions of the sales department and to items of account relating thereto. As these objections related to questions of policy it was not his duty to refer to them with the exception of two. The first was as to whether the Council observed the limitation placed upon them by Sec. 20 (2) of their Act of 1904, or whether in fact they "themselves execute the wiring of private property" in contravention of that section. The other question was as to whether the separate statements of the receipts and expenditure of the sales and publicity department as shown in the general ledger, and the profit and loss account of the sales department shown in the minute book, were in all respects correct statements. The following question had also been raised, which the auditor stated may concern his next audit, viz.: Sec. 20 of the Act, 1904, clearly empowers the Council to trade in fittings and electric materials of any kind and to enter into contracts for installing the same, but it provides that "they shall not themselves execute the wiring of private property except between the main of the Council and the consumer's meter." The practice which had prevailed under the new sales department during the year has been that of obtaining the actual labour for this wiring work through a contractor, who receives a commission on the labour cost. There is no putting out of the wiring to contract, for work is arranged and directed by the officers of the Council, the allotment of the workmen's time is controlled by them, the supply of all material, and some of the tools, is arranged by them, and, in some instances, even the engagement of extra men. No other contractor has the opportunity of tendering for the work which is executed on this plan. In some cases the work is offered to contractors in the ordinary way, and the question as to compliance with the statutory provision only arises when the plan above mentioned is followed. In the auditor's opinion, considerable alteration would be necessary to bring this plan within the terms of the Sub-section, which appeared to contemplate an actual contract or sub-contract for the wiring. A proposal for revising the arrangement had been formulated by the general manager in September last, and this proposal, if generally applied, would involve a veritable execution of the wiring through contractors. Under these circumstances, he did not think it was necessary for him to make any further report, or to take any action in the matter on this occasion. In dealing at some length with the attempt of the Council to separate "the sales" from the "publicity" transactions in the ledger account, Mr. Roberts said that it had been abandoned because its completion involved a large number of estimated figures which could not be, or profess to be, by any means, accurate or reliable. It was argued, he states, that (1) experimental work in testing apparatus; (2) the cost of providing and setting up apparatus for the approval of prospective users; and (3) the losses arising on the stocking of new inventions which may prove to be unsaleable, are to be charged as part of the cost of developing and advertising the general undertaking, and not as sales department expenditure, even when a municipal authority has statutory power to engage in the trade of selling these appliances, some of these items of expenditure might be of questionable legality, particularly in the case of No. 2 mentioned above, and it is only on the strength of the very wide powers conferred upon the Council by their local Act of 1904, which gives unusual freedom



in these matters, that they have been passed at audit. In his opinion, as it is by the sales section of the Act that they are legalised, they should be charged to the sales department accounts. Observations on this report of the district auditor from the secretary and accountant of the electricity supply department and the borough accountant were received and approved of by the Finance Committee, who submitted same for the approval of the Council. After a long discussion, the motion by Councillor Lewis to refer the matter back for reconsideration was lost, and the report was adopted.

**POPLAR.**—The Electricity Committee has decided to renew the tenancy of the Council's electric showrooms and offices at 121, East India Dock Road, as it is satisfied that the showrooms have been profitable, and are of advantage in extending the business of the undertaking. A pump house is to be constructed in connection with the installation of pumps for pumping water for condensing purposes at the generating station, at an estimated cost of £750.

**STEPNEY.**—A loan of £2,500 is to be taken up from the L.C.C., for the purchase of meters. The Electricity Supply Committee reports that in connection with the agreement between Stepney and Poplar under which each authority, if required, takes or gives each other a stand-by, bulk, or reciprocal supply of current, that it had under consideration the question of the Council further availing itself of the provisions of this enactment in relation to the question of the provision by the Council and the Poplar Council of machinery and its utilisation to the best and most economical advantage of each Council. After exchanging views with regard to the question it was proposed: (a) That the existing agreement should be incorporated in the new agreement; and (b) That such new agreement should make provision under which, broadly speaking, the Poplar Borough Council will remove the necessity of the Stepney Borough Council providing certain additional machinery until such time as the maximum demand of Stepney reaches 7,270 kw., by affording the Stepney B.C. a supply of electricity and by the Stepney B.C. themselves, after this period of supply, affording to the Poplar B.C. a supply. Subject to details being satisfactorily settled and to the approval of the B. of T. and the L.C.C., the Committee has decided to enter into the proposed agreement, and to fix the seal of the Council thereto when ready. Closely associated with this agreement, the Committee states, is the question of the Council's own position at the present moment as electricity supply undertakers, and the question was particularly accentuated by the remarkable increase in the growth and development of the undertaking, which necessitated the immediate consideration of the provision of further machinery. In this connection it had considered a report by the electrical engineer and manager to the effect that the two double-current turbine-driven sets at the Limehouse station should be converted into alternators, and that two 1,000-kw. converters should be provided therefor. With this object in view, he had obtained the following quotations for carrying out the work:—Conversion of double-current generators to two 1,500-kw. alternators, B. Peebles & Co., £3,784; Siemens Bros. Dynamo Works, £3,787; Dick, Kerr & Co., £3,936; C. A. Parsons & Co., £4,473; two converters required in connection therewith, B. Peebles & Co., £4,600. The above offers do not include the cost of alterations to, and the preparation of, concrete foundations and sundry adjustments necessary to the two turbines. Having considered the foregoing proposals, the Committee have decided to accept both the offers of Bruce Peebles & Co. at £3,784 and £4,600 respectively.

**HAMMERSMITH.**—Subject to a satisfactory agreement being entered into with the Kensington and Notting Hill Electric Lighting Companies for the supply to the Council of additional three-phase current, it has been decided to agree to supply three-phase current to the Shepherd's Bush Exhibition at the rates of 1d. per unit from sunrise to sunset, and 2d. per unit from sunset to sunrise, plus an additional 1d. per unit for the first 50,000 units per month, and for all the three-phase current supplied after October 15th and otherwise, upon the terms and conditions of the existing agreement for the supply of current from the Council. A supply of current is also to be given the Brilliant Sign Co. for a period of 7 years subject to an agreement being entered into that the whole of the firm's machinery should be driven by electric power, and to the payment of the minimum sum of £300 during the first three years. Subject to the payment of a royalty of 10s. 6d. per stand and without prejudice to the rights of the Council under their contract for the supply of electricity to Olympia, certain exhibitors at the International Machinery Exhibition to be held there in October next are to be granted permission to install small motor plant for generating current for the purposes of demonstration on their respective stalls.

**L.C.C.**—It is proposed that a Special Committee on London Electricity Supply be appointed, constituted as follows:—Sir John Benn, Messrs. H. E. A. Cotton, H. H. Gordon, Frederick Hall, Percy A. Harris, Bernard Holland, G. H. Hume, Isidore Salmon, Stuart Sankey, A. J. Shephard, W. J. Squires and W. Whitaker Thompson. The terms of reference to the Committee include the power to confer with such Government departments as it thinks necessary, and with the local authorities and companies generating or supplying electric current in London. It may also obtain such expert advice as may be necessary; but prior to becoming committed to any proposal affecting the Council's position as a loan sanctioning authority, the Finance Committee must be consulted.

The St. James's and Pall Mall Electric Light Co. has decided to discard some of its old plant at the Carnaby Street works, and re-equip it as a transformer sub-station with a reserve battery.

**Pelton.**—The P.C. has decided to ask the Electric Lighting Co. to submit a tender for the lighting of the district.

**Pontefract.**—Objections to the application of the T.C. for a prov. order for E.L. have been made by the Locomotive Manufacturers' Association and Railway Carriage and Waggon Builders' Association, the Yorkshire Electric Power Co., the Electrical Distribution of Yorkshire, Ltd., and the Electrical Contractors' Association (Incorporated). The opposition threatened by the West Riding C.C. has been withdrawn.

**Radcliffe.**—An inquiry was held on February 14th and 15th by Mr. T. C. Elkin, on behalf of the L.G.B., respecting the U.D.C.'s application for sanction to borrow £17,000 on behalf of the electricity undertaking. The scheme provides for the extension of its own electricity works by the addition of new plant, and the transmission of a bulk supply from the new municipal generating works erected by the Bury Corporation at Chamber Hall. Two-thirds of the proposed expenditure will be incurred by the apparatus for taking and distributing the supply from Bury. The inquiry was invested with interest by reason of the opposition to the Council's scheme by the Lancashire Electric Power Co., who desire to break down the municipal monopoly in the town. The Power Co.'s works are on the borders of the township, and its case is that the town ought to avail itself of the facilities afforded by the near existence of the generating station, while counsel for the company also pointed out there were rate-payers who objected to the Council's expenditure as being needless, because there was an adequate supply there already. The Power Co. is applying to Parliament for a provisional order to enter Radcliffe (as it did without success two years ago), and counsel for the Council contended that if the B. of T. decided to grant the company's application, all municipal Lancashire would be up in arms and would call upon Parliament to reject it. Mr. S. J. Watson, the Bury Corporation's electrical engineer, giving evidence, pointed out that the Bury works had not to pay an expensive board of directors and maintain London and Manchester offices like a private company had. Mr. E. M. Lacy, consulting engineer to the Radcliffe U.D.C., said that, taking everything into consideration, the terms offered to Radcliffe by Bury were better than those quoted by the Power Co. The Inspector refused an application by the Power Co. for the production of the agreement between Bury and Radcliffe. Counsel for the company hoped that the L.G.B. would insist on the agreement being sent for its perusal.

**Rawtenstall.**—The T.C. has adopted plans for extensions to the electricity works, at an estimated cost of £1,500.

**Richmond (Surrey).**—The T.C. has agreed to a proposal which permits of the Electric Lighting Co. taking a supply in bulk from the Lot's Road or other big generating plant. Various reductions in price are to be made in connection with this arrangement, which will also result in the removal of all steam generating plant from the local station eventually. The period of compulsory purchase by the T.C. will be extended to 1921, and provision is made for revision of prices at five-year intervals.

**Rochdale.**—On Tuesday Mr. T. C. Elkin held a L.G.B. inquiry into the application of the T.C. for sanction to a loan of £8,700 for extensions to buildings and plant at the Dane Street electricity works; the amounts set down were £1,200 for a chimney stack, £1,300 for engine-house extensions and switchboard galleries; £1,200 for economiser house, &c.; £650 for economiser, £2,650 for Lancashire boilers, £1,000 for a motor-alternator, and £700 for switchgear. There was no opposition to the loan.

The electrical engineer has intimated to the Electricity Committee that the responsibilities undertaken by that department would necessitate a further loan of £4,000 in addition to the £8,700 mentioned above. The latest additions to plant, &c., now proposed are due to the Whitworth and Milnrow tramway extensions and to the decision of the Council to widen the area in which it is proposed to supply in bulk. The extensions are expected to be required by the end of the present year.

**Salford.**—A number of the employees in the Corporation electricity department, along with workers in the lighting, gas and sanitary departments, came out on strike on Monday morning. The men ask for improved working conditions, including an increased wage minimum. On Monday night hundreds of strikers collected outside the electricity works with a view to persuading the men who had not joined their ranks to do so, and in many cases they were successful. Fears are entertained that the trouble may spread to the tramcar drivers and conductors. At a meeting at midnight, tramcar drivers and conductors were urged to join the strikers, but they declined to give a decision till they had consulted their secretary, Alderman Jackson. The greatest number of malcontents belong to the gas department. Half the streets of Salford were in complete darkness on Monday night.

**Scarborough.**—The Electric Supply Co. has just built a large coal store, and made provision by that means for five or six weeks' supply, over and above the ordinary supply, under contract. There will be two months' supply of coal to fall back upon in the event of a strike, and the supply of electricity can be maintained certainly for that length of time. Anxiety amongst Scarborough people in regard to the threatened coal strike is rather amusingly indicated in the fact that several nervous consumers called at the



electric supply office and inquired whether it would be advisable to purchase oil lamps. They were assured that the electric supply would be maintained over any probable period of the threatened strike.

**Stockport.**—The Corporation is seeking the consent of Heaton Norris U.D.C. to supply the area which adjoins Stockport with electricity, and the Heaton Norris Ratepayers' Association has written urging the Council to resist any attempt of Stockport in this direction.

**Stourport.**—The B. of T. has informed the U.D.C. that it intends to revoke the electric light order, as the Kidderminster and District Electric Light Co., which is the undertaker, has found it commercially impossible to tender for the public lighting. Consequently the company did not propose to supply electricity to Stourport, but did not intend to surrender the powers conferred in respect to the Kidderminster foreign district. The U.D.C. has decided to acquiesce in the revocation of the order.

**Sunderland.**—At a meeting of the T.C. on the 14th inst., Alderman Bruce moved the adoption of the Electricity and Lighting Committee's report, which recommended that additional plant be obtained for the Hylton Road power station, at an estimated cost of £22,207, and that alternating and continuous-current mains be provided, at an estimated cost of £15,000. He said they were asking for a new turbine, and with its assistance would be able to supply new customers, and the resulting revenue, amounting to £1,275, would more than meet the additional interest and sinking fund on the new plant. By means of the new plant they would be able to produce more power at a cheaper rate, while at the same time the present plant would provide them with a means of safety in case of a breakdown. The profits on the electricity works last year were about £5,000, against £1,100 for the year previous. The engineer was strongly in favour of the proposal, and the Committee, with one exception, was in favour of it. Mr. Frank Nicholson said that from 1905 to 1911, inclusive, the capital expenditure had increased by £127,000, or 42 per cent., but the annual amount set aside for sinking fund had increased in the same period from £9,900 to £16,000, or 63 per cent. Alderman Bruce said the critics of the undertaking forgot to deduct from the total of the money borrowed the money that had been paid back. Already, of the £431,000 that had been borrowed, over £117,000 had been paid off. They had not taken a penny out of the rates, so that this sum must have come out of the profits. After further discussion, the report was carried.

**Swinton and Pendlebury.**—Before entering into a fresh agreement with the Lancashire Electric Power Co. for the supply of electricity in bulk, the Swinton and Pendlebury D.C. has called in, as consulting electrical engineer, Mr. R. B. Leach.

**Taunton.**—The T.C. has lodged a petition against the Bill of the National Electric Construction Co., Ltd., which seeks to confirm free wiring agreements with the Corporation and other Councils, the agreements entered into having been proved to be *ultra vires*. Not wishing to entirely repudiate the agreement, the Council unsuccessfully tried to compromise with the company.

**Torquay.**—The T.C. has instructed the engineer to submit a scheme for supplying electricity to St. Marychurch.

**Walkden.**—A proposal of the Worsley D.C. to electrically light that portion of Walkden known as the Barracks has been defeated, 9 voting against and 4 in favour of the scheme, which had been sanctioned by the Highways Committee, which had also accepted the tender of the Lancashire Electric Power Co. for poles and electric lighting.

**West Bromwich.**—The T.C. has applied to the L.G.B. for a loan of £7,700 for electricity extensions. A travelling crane, two boilers, an economiser, feed pump and induced-draught plant are to be installed.

**Whitehaven.**—The following terms have been adopted by the T.C. for a stand-by supply of current: A fixed yearly charge of £2 per kW., based on the maximum number of kilowatts required, in addition to the ordinary supply rates and usual meter or other rents, with six months' notice on either side to terminate agreements.

**Wigan.**—The extensions and new equipment just completed in connection with the Municipal Electricity Works, were formally opened on Wednesday afternoon last week, when a new 1,000-KW. mixed-pressure turbine set and a 400-KW. reciprocating set were started up.

**Worcester.**—The T.C. has petitioned against the Bill of the London and North-Western Railway Co. seeking powers for railway companies to supply current to works, &c., adjoining their lines.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—A prolonged chapter in the municipal history of Belfast was closed on 14th inst., when the Corporation sanctioned the payment of £56,155 (the amount of the arbitrator's second award), to the Cavehill and Whitewell Tramways, as the value of the undertaking as a going concern, that is to say, as a rent or profit producing undertaking. The decision was

arrived at at a special meeting of the Corporation, summoned to receive and adopt so much of the minutes of the proceedings of the Law Committee of the 10th inst., as referred to the arbitrator's award in the matter of the tramway. To the price fixed by the arbitrator, some £10,000 additional expenses have been incurred, thanks to the mischievous work of the people, who, in conjunction with the Nationalists and Trade Unionists, made the sale of the system a political one. For this uncalled-for intervention, the taxpayers of Belfast will have to pay £10,000, or one-sixth of the original award for the purchase of the system as a going concern.

A memorial from certain residents of the Botanic Avenue district objecting to the proposed line of tramway on Botanic Avenue has been considered. Mr. Nance reported that the avenue was perfectly safe for a tramway, and that since the memorial had been published in the Press, he had received a large number of letters from residents in the district, asking that the line should be proceeded with. The Committee decided, having regard to the fact that the tramway had been approved of by the Council and sanctioned by Parliament, to go on with the construction of the line on the avenue in question. The proposed extensions will measure about 7 miles.

**Colwyn Bay.**—It was reported at the meeting of the Council last week that the Llandudno and Colwyn Bay Electric Railway Co. had written declining to comply with the request of the Council for a further payment towards road widening expenses, with a view to the construction of the tramway to Old Colwyn. The Clerk to the Council was instructed to reply expressing the Council's disappointment, and to say that it would not be in a position to make further progress with the negotiations for the purchase of land until the expenses in that respect were met by the company. It was also decided to suspend these negotiations for the time being. Mr. Purdy, replying to statements made at the annual meeting of the Electric Railway Co., denied that the Council was in any way obstructing the scheme for the extension of the tramway to Old Colwyn. The Council was unanimously in favour of the company going on, and was pressing it, in fact, to do so. The one drawback, as far as the Council was concerned, was that the company was trying to get out of its contract to pay the Council £3,000 for the work done to take the line up to Groes. If the Electric Railway Co. allowed its powers to lapse, the Council would in all probability take them up, and make the line itself.

**Continental Notes.**—**ITALY.**—The Italian Government has just granted a concession to the Société Franco-Italienne du Chemin de Fer Métropolitain de Naples, which is a company formed in Paris chiefly with French capital, for the construction and working of an underground railway network in Naples, the term being for 70 years. The undertaking will comprise a city network and a suburban network which will be connected together in the new city part of Vomero. The former, which will traverse the city from west to east and be nearly five miles in length, will begin near Piedigrotta, and will end at the station of the Vesuvius Railway. In the case of the suburban line, which will partly be worked on the rack-rail system, a commencement will be made at Vomero, and the terminus will be at Agnano, the total length being 6.2 miles. The city line will be provided with 15 stations, which will be equipped with lifts and staircases for reaching the surface, and it is to be completed within five years. It is estimated that the total cost of construction will amount to £1,200,000, and the company will not receive any subsidy either from the Government or the city authorities. The establishment of the railway will permit of the migration to the healthy suburbs of a portion of the population now living in the overcrowded interior of the city.

La Società Trazione e Imprese Elettriche is the name of a new company which has lately been formed in Milan to acquire and carry on the Milan-Gallarate tramway, and to convert the same to electric traction.

The Consiglio dei Ministri have authorised a concession to a private syndicate at Belluno for the construction and working of an electric railway from Belluno to Agordo, with a branch to Roe Basse Bibano. The line is estimated to cost, including rolling stock and working material, 5,685,496 lire. The State accords an annual subsidy of 6,800 lire for 50 years.

The Consiglio have also under consideration two other electric railway concessions, the one for a line to run from Formignie to Mocogno through Lama and the other from Lucca to Pietrasanta via Camnionne.—*L'Ingegneria Ferroviaria*.

**FRANCE.**—La Société Nantaise de Tramways et d'Electricité is the name of a new company which has just been formed in Brussels with a capital of £600,000, to acquire and carry on the tramways and electric lighting undertaking in the town of Nantes.

**TURKEY.**—La Société des Tramways de Salonique has just secured a concession for a new line of electric tramways in the town of Salonica.

**Hove.**—The T.C. has, by 22 votes to 9, confirmed the propriety of promoting a Bill empowering the Council to run vehicles by means of railless traction.

**Hull.**—On Monday the Corporation Tramways Committee decided to allocate £12,000 out of the tramway profits towards the relief of the rates.

**London.**—L.C.C.—It has been decided to allow certain tests to be carried out with the railless trolley system on the route between Woolwich and Eltham.

**HAMMERSMITH.**—Mr. W. Worby Beaumont, the Referee appointed by the B. of T., will open an inquiry at the Law Courts to settle the difference between the London United Tramways Co. and the B.C. The company's solicitors have served on the Council's



solicitors a writ asking for the appointment to be declared null and void.

**Madagascar.**—The Consultative Chamber of Fianarantsoa has taken in hand the question of installing a local electric railway between that city, the actual capital of the South, and the port of Mananjary on the East coast. The country offers the greatest facilities for an undertaking of this kind, and it appears possible to form a private company and carry out the scheme, without a subsidy from the colony, the goods traffic in sight being such as to make the venture sufficiently profitable.

**Mexico.**—The Imperial Trade Correspondent at Toronto reports that a Canadian company has been incorporated, with a capital stock of about £1,027,000, to construct and work an electric railway, 90 miles in length, from Mexico City to Puebla, for which a concession has been obtained from the Mexican Government. In connection with the foregoing, it may be noted that H.M. Consul-General at Mexico City reports that work on the electric lines to connect Mexico City with Puebla and Toluca will probably be begun this year. Extensive surveys have been made, but it has not yet been decided whether the Puebla line shall pass through Xochimilco or a little to the north and east. A quantity of T rails and trolley wire has been ordered for suburban use, and a large stock of material is in hand. The mule tramway to Santa Fé is to be converted to electric traction as the first link on the road to Toluca.—*Board of Trade Journal*.

**Nottingham.**—A curious "hold-up" on the tramways occurred on Sunday night. In what is known as the King Street section, and which includes the whole of the lines in the Market Place, Market Street, King Street and Parliament Street, the cars came suddenly to a standstill and the lights were extinguished. After a few minutes' delay the current came on, the cars, again illuminated, responded to the drivers' efforts, and moved forward about a dozen yards, only to come to an abrupt stop with simultaneous extinction of the lights. This alternate coming-on and going-off of the current continued for three-quarters of an hour, and in the meantime the Market Place became congested with between 50 and 60 cars. Every now and then the great six-acre Market Place would be brilliantly illuminated by the electric lights on this great assemblage of cars suddenly glowing, the cars would move forward, and then darkness and stagnation would return. Passengers quitted the cars in scared promptitude and large crowds of people watched the novel scene with wonder and not a little amusement. The first indication of anything wrong occurred at 10 o'clock, and it was not until a quarter to 11 that the current became continuous and the system was working normally.

**Oxford.**—It is rumoured that the National Electric Construction Co. has proposed that the Corporation should purchase the local tramways and electrically equip them, afterwards leasing them to the company, who will pay the financial charges incurred. The Council will shortly consider the proposal, which it is hoped will extricate the Corporation and company from a difficult position.

**Plymouth.**—The traffic return for the four weeks ended February 10th showed receipts amounting to £2,383, an increase of £70 compared with the corresponding period of last year. There was an increase on all the sections. There was a considerable decrease in the consumption of energy, which averaged 1.37 units per car-mile, as against 1.53 last year.

**Stalybridge.**—Colonel von Donop, reporting on the tramway accident at Mossley on October 20th, says the driver lost control of his car, either owing to mismanagement, or to a defect in the controller. The evidence was limited, but he favours the latter cause. The Joint Board has arranged to fit all cars used on hilly routes with the Huddersfield form of mechanical brake. The inspector urges that the magnetic brake should be used habitually, and not treated as an emergency brake, in order to make its use familiar.

**Tasmania.**—According to the *Australian Mining and Engineering Review*, it is the intention of the Government to approach Mr. C. H. Merz on the question of furnishing a report upon the electrification of the Tasmanian railways, and the utilisation of hydro electric power for the purpose.

**Victoria.**—Mr. P. J. Pringle, manager of the Electric Supply Co. of Victoria, has forwarded to the directors in England a proposition in connection with the extension of the Ballarat Tramways to Sebastopol.—*Australian Mining and Engineering Review*.

## TELEGRAPH and TELEPHONE NOTES.

**Canada.**—The Bell telephone franchise with the city of Ottawa will terminate in June next, and the city, before renewing the franchise, is taking steps to investigate the working of a municipally-owned telephone system. The citizens claim that the prices of telephones are too high—\$25 for residential and \$45 for business purposes. At present the bonus paid the city is but \$5,000, and

there are nearly 9,000 telephones in use, the number having trebled since 1904, when the contract with the Bell Telephone Co. was made.

The people of Manitoba have not made a success of the Government-owned telephone system in that province. The former low rates, given at first by the Government, had to be raised to a paying basis, and now the people are kicking to such an extent at the high telephone rates, that the question has become quite a thorn in the side of the Manitoba Government.

**Mexico.**—An American Consular report states that a concession has been granted to a number of merchants in Monterey for the operation of a telephone system in that city on a co-operative basis. The plan of the originators of the idea is that each subscriber should own his telephone, and there will be not fewer than 4,000 subscribers who will also be stockholders in the new company.

**New Zealand.**—Before long Wellington will have a long-distance wireless station of very high power. The station is being erected on the top of Otari Peak, the highest point of the Tinakori range, nearly 1,000 ft. above sea level. The masts, two in number, will be 150 ft. high; they are to be of the ladder type, of wood. When this station is completed it will be possible to "wireless" to Sydney and Fiji, and other distant parts. In the meantime the smaller wireless plant at the G.P.O. is in constant use.

**Paris Telephone Service.**—The telephone service in Paris has always been a source of great discontent on the part of the subscribers, being a State undertaking, and very slow in operation. But recently a curious state of affairs was reported by the Paris correspondent of the *Standard*, in which the fault lay on the part of the subscribers. It appears that a number of the latter, desirous to prevent disturbance of their slumbers, have been in the habit of taking the receiver off the hook on retiring to rest. But having occasion to use the telephone at night themselves, they find their lines cut off. As the result of the commotion and indignation consequent upon this discovery, the explanation has been afforded that so large a number had adopted the plan described above—which had the effect of keeping their signal lamps in the central-battery exchange alight all night—that the current consumed enormously increased, and to prevent endangering the working of the whole system, it was found necessary to cut off the subscribers in question for the night. They cannot have it both ways—either they must forfeit the use of the telephone at night, to secure freedom from interruption, or they must submit to the risk of being called up, in order to retain their privileges.

**Russia.**—The Russian Budget Bill for 1912 includes, for the construction and repair of telegraph and telephone lines, a sum of 9,800,000 roubles.—*Board of Trade Journal*.

**Telegraphic Addresses.**—The Post Office authorities are considering the possibility of hastening the delivery of telegrams to registered addresses in London by including in the address a second short word indicating at once the office from which the telegram will be delivered, and thus saving time. In future telegraphic addresses this object might, we think, be achieved by a special ending to the actual word itself.

**The Telephone Factory.**—The Town Clerk of Nottingham has received formal acknowledgment of the letter conveying the request of the City Council and other public bodies to the Postmaster-General, that he should receive a deputation on the subject of the proposed removal of the telephone factory from Nottingham to Birmingham. At present it is uncertain whether Mr. Samuel will receive a deputation, inasmuch as he has already intimated to the City Council that his decision involving the change is irrevocable.

**The Telephone Service.**—In reply to a question in Parliament, the P.M.G. stated recently that the rural telephone party line scheme had failed for want of subscribers, and new conditions would be announced shortly. He stated also that the Government had decided to pay contributions in lieu of rates on premises taken over from the National Telephone Co., on the same basis as in the case of other Government buildings, and on lines acquired from the company in accordance with the assessments as they stood on June 30th last. These assessments would not be increased or decreased as wires were added or removed.

The attack upon the management of the telephone service by the Post Office is being developed, on the one hand by the Telephone Users' Association, and on the other by two committees of members of Parliament, with a view to bringing about improvements in the efficiency of the service.

**Telewriter Progress.**—It is stated in the Press that a greatly improved pattern of the instrument of the National Telewriter Co. is in use in connection with the Press Gallery of the House of Commons, for the transmission of late messages direct to the composing rooms of three of the leading London daily papers. It is also being tested by the Admiralty with a view to installing it on warships.

**Wireless Telegraphy.**—The range of the military station on the Eiffel Tower is to be doubled, and plant of six times the present output installed.



**CONTRACTS OPEN and CLOSED.****OPEN.**

**Aberdare.**—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" February 16th.  
 March 11th.—Electrical goods, for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (Form 26). Stores Manager, Aberaman Offices, near Aberdare.

**Australia.**—VICTORIA.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

April 2nd.—250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common battery wall telephones, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

WESTERN AUSTRALIA.—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal*.

Paper-insulated, lead-covered cable and loading devices (Schedules 184 and 185), for the P.M.G.'s Department, Perth. See "Official Notices" to-day.

**Belfast.**—February 28th. Seven miles of double track permanent way for the Corporation. - Mr. H. A. Cutler, city surveyor, (deposit two guineas).

**Birmingham.**—March 12th. Electrical stores, for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

**Bolton.**—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" February 9th.

**Bournemouth.**—February 26th. The Education Committee. Tenders for the wiring of the New Science, Art and Technical Schools and Public Library, Lansdowne. Specifications and forms of tender, £2 2s. (returnable), from the Borough Engineer.

**Bradford.**—February 29th. Emergency excitation battery, and oil-eliminating plant for feed-water purification, for the Corporation. See "Official Notices" February 16th.

**Canada.**—March 1st. The Commercial Intelligence Branch of the Board of Trade is in receipt of copies of the plans and specifications and form of tender in connection with a call for tenders for the supply and erection of turbine pumping machinery for the main pumping station at Winnipeg. The pump must be of the best type of horizontal turbine pump driven by an induction motor, directly connected. Tenders to the Mayor and Board of Control, Winnipeg, Manitoba. A deposit of \$1,200 (about £247) is required with each tender. The documents referred to may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

CALGARY.—March 20th. City Commissioners. One 2,500-KW. turbo-generator set, one 1,000-KW. synchronous motor-generator, 50-KW. motor-generator and 25-KW. exciter set. Deposit £500. Particulars can be seen at Board of Trade Commercial Intelligence Department in London.

**Coventry.**—March 11th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**Devonport.**—March 7th. Switchboard extension and one 1,000-KW. D.C. turbo-generator, for the Corporation. See "Official Notices" February 16th.

**Dover.**—March 5th. Electrical sundries, cables, &c., for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street, Schedules 2s. 6d. each.

**Dublin.**—March 6th. 5,000-volt, 100-KW., three-phase transformer pillars, for the Corporation. See "Official Notices" February 16th.

March 6th.—1,500-KW. polyphase alternator and dismantling and alteration of plant at the Pigeon House generating station, for the Corporation. See "Official Notices" to-day.

**Dundee.**—The Corporation Tramways Committee invites tenders for stores. Mr. Peter Fisher, manager.

**Great Central Railway.**—March 5th. Stores and materials for a year. See "Official Notices" to-day.

**Heston and Isleworth.**—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" February 16th.

**Hornsey.**—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See "Official Notices" February 16th.

**Hoylake and West Kirby.**—March 7th. Two centrifugal pumps and A.C. electric motors, frequency 50, with automatic switchgear, for U.D.C. sewage pumping works. Engineer and surveyor, Town Hall, Hoylake.

**Hungary.**—March 6th. Tenders are being invited by the municipal authorities of Mor (Fejer) for the establishment of a central electric lighting station in the town.

**Ilford.**—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" February 9th.

**Kirkcaldy.**—February 29th. 1,000-KW. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" February 9th.

**Leeds.**—March 9th. 6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" February 16th.

**London.**—BATTERSEA.—March 5th. One 1,500-KW. high-pressure steam turbine coupled to two 750-KW. D.C. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" February 16th.

POPLAR.—March 4th. Telfer coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" February 16th.

ST. PANCRAS.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

L.C.C.—March 8th. Electrical installation at the Victoria Embankment Gardens conveniences, Charing Cross. See "Official Notices" to-day.

MARYLEBONE.—March 13th. Materials for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**Manchester.**—February 27th. Eight-ton overhead hand-power travelling crane over auxiliaries, operated from floor-level, for the Corporation Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street (returnable deposit £1 1s.).

**Margate.**—Two small electrically-driven rotary pumps, with automatic starting and stopping apparatus, for the T.C. Mr. E. A. Borg, surveyor, Grosvenor Place.

**Newport (Mon.).**—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

**New Zealand.**—March 27th. Public Works Department. Supply to Lytellton, under the Lake Coleridge electric power scheme, of water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London.

**Norway.**—March 1st and 4th. Christiania Corporation Electric Works. (1) Transformers; (2) low-current cables. Sealed tenders to "Elektricitetsverkets Expeditionskontor, Raadhusgaten 19," Christiania. Local representation is desirable. Copies of the specifications (in Norwegian) and of the form of tender for (2) may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal*.

March 5th.—Overhead conducting material and hollow steel posts, for the Trondhjem tramway extension. Specification at the Com. Int. Dept. of the Board of Trade in London.

**Nottingham.**—March 2nd. 350 tons of steel tramway rails and seven tons of tie bars for the Tramways Committee. Mr. A. Brown, city engineer.

**Rochdale.**—March 6th. Corporation Paving and Sewage Committee. Electrically-driven centrifugal pumping plant, at the Roch Mills Sewage Disposal Works. Specifications and forms of tender (£5, returnable) from Mr. S. S. Platt, borough surveyor, Rochdale. Tenders only considered from firms who have had experience with similar work.

**Salford.**—March 11th. Stores, &c., for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Southampton.**—Tenders are to be invited for reconstructing the tramway track from Grove Road to the Shirley terminus at an estimated cost of £4,250, also for the supply of rails in connection with the reconstruction works on the Shirley route. Tenders are also to be invited in July next for the reconstruction of the tramway track between the Clock Tower and Bargate at an estimated cost of £3,500.

**Siam.**—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

**Sunderland.**—March 5th. Steam turbine, 5,000-KW. alternator and condensing plant, for the Corporation. See "Official Notices" to-day.

**Swansea.**—March 6th. Turbo-alternators and condensing plant, for the Corporation. See "Official Notices" to-day.

**Swindon.**—March 9th. Materials for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" to-day.

**Taunton.**—Single-phase transformers, for the T.C. See "Official Notices" to-day.



**Walthamstow.**—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

**Warrington.**—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**Warlingham.**—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

**West Ham.**—March 9th. 5,000-KW. two-phase turbo-alternator, with condensing plant and two-phase E.H.T. switchgear, for the Corporation. See "Official Notices" to-day.

**Wrexham.**—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" February 16th.

### CLOSED.

**Altrincham.**—The Education Committee has accepted the tender of Messrs. Swainson & Co., at £98, for electric fittings for the County High School for Boys.

**Ashton-under-Lyne.**—The Electricity Committee has accepted the tender of Messrs. Tetlow Bros. for the supply of three boilers.

**Bacup.**—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., for cables for the supply of current to Stacksteads.

**Belgium.**—The Belgian Post and Telegraph authorities in Brussels have opened tenders for the supply of a quantity of telephone cable with 20 pairs of conductors. Ten concerns—one Austrian, five German, two Belgian, one French and one British (the British Insulated and Helsby Cables, Ltd.)—competed for the contract, the lowest offer being that of the Kabelfabrik und Draht Industrie Gesellschaft, of Vienna.

**Broadstairs.**—The U.D.C. has accepted the tender of Messrs. J. Keith & Blackman Co., Ltd., for two motor-driven ventilating fans for lavatories, at £30 10s.

**Dundalk.**—At the meeting of the Proposals Committee of the Louth County Council, the following tenders were received for the installation of electric light in Dundalk Court House:—

J. Gowdy, Belfast	..	..	..	..	..	£77
Dundalk Motor Works (Mr. P. J. Watters)	..	..	..	..	..	180
James C. Meldon, Dublin	..	..	..	..	..	89
E. Gallagher	..	..	..	..	..	91
Gaskin Bros.	..	..	..	..	..	(accepted) 90

**Frankton (N.Z.).**—The Frankton Junction Town Board has accepted the tender of the Brush Electrical Engineering Co. for the equipment of an electric power house. Suction gas plant will be used, with D.C. dynamos and balancer booster sets.

**Gibraltar.**—The Admiralty has accepted the tender of the Brush Electrical Engineering Co. for an important extension to the power station at H.M. Dockyard, Gibraltar, consisting of D.C. turbo-generating plant, boilers, condensing plant, mechanical stokers, switchboards, crane, &c.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

#### WAR OFFICE.

Electric cable and wire.—British Insulated and Helsby Cables, Ltd.; Hooper's Telegraph and India-Rubber Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Midland Electric Wire Co.

#### INDIA OFFICE: STORE DEPARTMENT.

Cable, &c.—C. Macintosh & Co.  
Cells, &c.—J. Stone & Co.

#### CROWN AGENTS FOR THE COLONIES.

Telephones.—New Phonopore Telephone Co.

#### OFFICE OF WORKS.

Generating sets in connection with British Museum extension.—Browett, Lindley & Co.  
Ventilating fans for ditto.—Matthews & Yates, Ltd.

#### GENERAL POST OFFICE.

Silence cabinets.—Siemens Bros. & Co., Ltd.  
I.R.V. cable.—Johnson & Phillips, Ltd.  
Paper-core cable.—Johnson & Phillips, Ltd.; Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; British Insulated and Helsby Cables, Ltd.  
Dry cells.—Siemens Bros. & Co., Ltd.  
Loading coils.—Western Electric Co., Ltd.  
Stoneware conduits.—Albion Clay Co., Ltd.  
Cable distribution plugs.—Siemens Bros. & Co., Ltd.  
Switchboards.—British L. M. Ericsson Manufacturing Co., Ltd.  
Telegraph ironwork, cupholders.—F. W. Cotterill, Ltd.  
Telephone exchange equipment at Western Exchange, London.—Automatic Telephone Manfg. Co., Ltd.  
Ditto at Morley, Leeds.—British Insulated and Helsby Cables, Ltd.

**Hornsey.**—For the supply of certain electrical plant, the tender of Messrs. Belliss & Morcom, Ltd., at £3,000, has been accepted by the B.C.

**Norwich.**—The Electricity Committee of the T.C. has accepted the tender of Messrs. Jas. Howden & Co., Glasgow, for a 2,000-KW. turbo-generator with condensing plant, at £7,798.

**London.**—L.C.C.—The Education Committee received the following tenders for electric lighting at the School of Photo-Engraving and Lithography:—

Tredegar & Co.	..	..	..	..	..	(accepted) £612
Pinching & Walton	..	..	..	..	..	684
A. Hawkins & Sons	..	..	..	..	..	819
E. Newbald	..	..	..	..	..	834
Tilley Bros.	..	..	..	..	..	948
G. E. Taylor & Co.	..	..	..	..	..	949
W. J. Fryer & Co.	..	..	..	..	..	1,135
G. Weston & Sons, Ltd.	..	..	..	..	..	1,221
W. H. Gaze & Sons, Ltd.	..	..	..	..	..	1,269
E. Lawrance & Sons, Ltd.	..	..	..	..	..	1,320

Chief Engineer's estimate, £712.

The Highways Committee has placed an order for 130 tons of side slot rails for Kingsland Road conduit lines with the Frodingham Iron and Steel Co., Ltd., at £11 15s. per ton.

For the supply of pneumatic tools for the third section of the central car-repair depot the following tenders were received:—

Globe Pneumatic Engineering Co., Ltd.	..	..	..	..	..	(recommended) £411
Howard Pneumatic Engineering Co., Ltd.	..	..	..	..	..	£448 and £361
Consolidated Pneumatic Tool Co., Ltd.	..	..	..	..	..	498

**BERMONDSEY.**—The tender of the North-Western Electrical Appliances Co. has been accepted by the B.C. for a supply of lowering gear, at £73.

**FULHAM.**—The Electricity and Lighting Committee has recommended the Council to give its approval to the placing of an order for 300 electricity meters with Messrs. Siemens Bros., the hurried acceptance being due to a low price being quoted provided the order was placed by February 13th.

**SHOREDITCH.**—The Electricity Committee received tenders from five manufacturers for paper and rubber-insulated, lead-covered, armoured cable. That of Messrs. Siemens Bros. & Co., Ltd., for 9 miles of '035 in. × '035 in. × '022 in. sectional conductors, at £298 per mile; 5 miles of '0125 in. × '0125 in. × '0125 in. circular conductors, at £192 per mile; 1½ miles of '0125 in. × '0125 in. twin circular, at £164 per mile; and rubber-insulated '0125 in. × '0125 in. twin, at £233 per mile.

The B.C. has accepted the tender of Messrs. Le Grand & Sutcliffe, at £375 10s., for converting the existing steam action of the Deepwell pump at the Hoxton Baths into an electric motor drive.

**STEPNEY.**—The following tenders were received for the conversion of double-current generators at Limehouse to two 1,500-KW. alternators:—

Bruce Peebles & Co., Ltd. (recommended)	£3,784	(To complete by end of August.)
Siemens Bros. Dynamo Works	..	.. 3,787 (28 weeks + 3 weeks for erection.)
Dick, Kerr & Co., Ltd.	..	.. 3,936 (7 months + erection.)
C. A. Parsons & Co., Ltd.	..	.. 4,473 (Running by end of August.)

Two 1,000-KW. converters required in connection therewith:—

Bruce Peebles & Co., Ltd. (recommended)	£4,600	(To be running by end of August.)
-----------------------------------------	--------	-----------------------------------

**Plymouth.**—The Tramways Committee received two quotations for the supply of 100 tons of tramway rails with fish and anchor plates, and has accepted the tender of the Lorain Steel Co., of America, which was the lowest.

**Rawtenstall.**—The T.C. has accepted the tender of Messrs. Whipp & Bourne for alterations to the electric call bells, &c., throughout the Municipal Offices.

**Sunderland.**—The T.C. has accepted the following tenders:—

British Insulated and Helsby Cables, Ltd.—440 yards of 7/20, 7/16, 19/17 and 19/15 cable.  
Reason Manufacturing Co.—25 10-ampere electrolytic meters.  
Dey Time Register, Ltd.—Dey time recorder.  
British Westinghouse Electric Manufacturing Co., Ltd.—Three three-phase integrating wattmeters.

**Swinton and Pendlebury.**—The tender of Messrs. H. E. Buck & Co. for electric wiring in the Town's Yard has been accepted by the D.C.

**West Bromwich.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a 1,000-KW. turbo-alternator and rotary condenser.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 26th.—"A" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.  
Tuesday, February 27th.—"B" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.  
Thursday, February 29th.—"C" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.  
Friday, March 1st.—"D" Company. Technical work, 7 to 8 p.m.  
Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.  
Saturday, March 2nd.—Mobilization week-end run at Fort Coalhouse. The party will parade at Fenchurch Street Station (L.T. and S. Railway) at 9.10 p.m. Dress: Service dress, putties, greatcoats, belts and haversacks; no arms will be taken.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adj.,  
For Officer commanding L.E.E.



FORTHCOMING EVENTS.

**Institution of Electrical Engineers (Manchester Local Section).**—Friday, February 23rd. Annual dinner.  
Tuesday, February 27th.—At 7.30 p.m. At the University, Manchester. Paper on "High-Tension Porcelain Insulators," by Mr. J. Lustgarten.  
**Royal Institution.**—Friday, February 23rd. At 9 p.m. Discourse on "The Gyrostatic Compass and Practical Applications of Gyrostatics," by Mr. G. K. B. Elphinstone.  
Saturday, February 24th.—At 8 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture I.)  
Tuesday, February 27th.—At 8 p.m. Lecture on "Optical Determination of Stress and some Applications to Engineering Problems," by Prof. E. G. Coker (Lecture I).  
Saturday, March 2nd.—Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson (Lecture II).  
**Physical Society.**—Friday, February 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Accurate Comparison of Quantities of Radium," by Prof. E. Rutherford and Mr. Chadwick; "The Absorption of the  $\gamma$ -rays by Gases," by Mr. Chadwick; and "On Wave-form Filters for Alternating Currents," by Mr. A. Campbell.  
**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, February 23rd. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Further discussion on Dr. F. B. Jevons's paper on "Motion and Change," and paper on "Some Considerations on the Choice of Auxiliary Plant for Power Stations," by Mr. A. H. Finch.  
**Institution of Post Office Electrical Engineers (Metropolitan Centre).**—Monday, February 26th. At 6 p.m. At the I.E.E. Paper on "Machine Switching in Telephony," by Mr. B. O. Anson.  
**Institution of Electrical Engineers (Newcastle Local Section).**—Monday, February 26th. At 7 p.m. At the Technical College, Darlington. Paper on "The Electric Driving of Rolling Mills," by Mr. C. A. Ablett.  
**Electro-Harmonic Society.**—Tuesday, February 27th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' Night. See "Notes" pages.  
**Institution of Civil Engineers.**—Tuesday, February 27th. At 8 p.m. Papers on "Roller and Ball Bearings," and "The Testing of Antifriction Bearing Metals," by Prof. J. Goddard.  
**Institution of Electrical Engineers (London Students).**—Wednesday, February 28th. At 7.45 p.m. Discussion on "Methods of Illumination."  
**Borough Polytechnic Institute.**—Wednesday, February 28th. At 8 p.m. Distribution of prizes and certificates.  
**Royal Society of Arts.**—Wednesday, February 28th. At 8 p.m. Paper on "Education in Science as a Preparation for Industrial Work," by Mr. H. A. Roberts.  
**Leeds Association of Engineers.**—Thursday, February 29th. At 7.30 p.m. At 5, Park Lane, Leeds. Paper on "The Manufacture of Steel Tram Rails," by Mr. A. S. Keith.  
**Northampton Institute Engineering Society.**—Friday, March 1st. Paper on "Some Recent Developments in Electrochemistry," by Mr. E. L. Emtage.

NOTES.

**International Electrotechnical Commission.**—At the meeting of the I.E.C. held at Turin, in September last, three Special Committees were nominated to continue the study of Nomenclature, Symbols, and the Rating of Electrical Machinery, and to draw up preliminary propositions which will be laid before the various Local Committees with a view to subsequent international agreement. These Special Committees consist of one delegate each from the following countries:—

Nomenclature. (3)

France, Germany, Great Britain.

N.B.—Prof. Larsen is specially invited to attend the Meeting on Nomenclature.

In view of the growing importance of the Spanish language, the Spanish Committee is invited to send a delegate to follow the work on Nomenclature.

Symbols. (9)

Belgium, France, Germany, Great Britain, Holland, Italy, Spain, Switzerland, U.S.A.

Rating of Electrical Machinery. (8)

Belgium, France, Germany, Great Britain, Italy, Sweden, Switzerland, U.S.A.

Arrangements are being made for a meeting of these three Special Committees to be held towards the end of March, and, at the invitation of the French Committee (President M. R. V. Picou), they will take place in Paris. The following is a list of the delegates who will attend:—

Country.	Nomenclature.	Symbols.	Rating.
Belgium ...	—	Prof. E. Gerard	Prof. E. Gerard
France ...	M. E. Brunswick	M. Paul Janet	M. P. Boucherot
Germany...	Dr. E. Budde	Dr. K. Strecker	Herr L. Schüler
Gt. Britain	Dr. Thompson	Mr. L. A. Le Gros	Mr. A. Siemens
Holland ...	—	Dr. M. de Haas	—
Italy ...	—	To be appointed	To be appointed
Spain ...	—	Señor de la Pena	—
Sweden ...	—	—	To be appointed
Switzerland	—	To be appointed	Dr. Wyssling
Utd. States	—	Prof. C. A. Adams and Mr. C. O. Mailloux.	—

**London Motor - Cars.**—For the quarter ended December 31st, the L.C.C. registered 1,619 motor-cars, 312 heavy motor-cars, and 498 motor-cycles. Altogether, the municipality has registered 48,701 motor-cars, 3,379 heavy motor-cars, and 16,874 motor-cycles.—*The Motor.*

**Applications for Appointments.**—The following letter reached us too late for inclusion in our "Correspondence" columns, but as it would be too late next week, we print it here:—

"I should like to draw attention through the medium of your paper, to the needless trouble and expense which candidates are often put to by the thoughtlessness of some Corporations, when inviting applications for appointments. My case in point is Willesden, the advertisement of which appears in your issue of February 16th. I duly sent for an application form, and after reading it through, I find a footnote as follows:—The applicant may, if he so desires, forward 33 copies of his application and testimonials to the clerk, for distribution amongst the members.

"Now, the trouble and expense of preparing 33 copies of a fairly lengthy application and three testimonials is no small matter, and although an applicant, who is really in earnest does not mind devoting some hours of his spare time to the task, to do the work decently means a fairly heavy printers' bill. Certainly the sending of these copies is optional, but what chance does the applicant have who neglects to avail himself of this kind permission? Absolutely none.

"Again, members of the Council, if they seriously considered the matter, would, I think, prefer to do without these extra copies.

"Assuming that there are 100 candidates, which is not by any means unusual, what busy man has time to read through 100 applications and testimonials, and give the matter the attention it deserves? It usually means to him so much waste paper. I contend that sending extra copies is an absolute waste of time both to the candidate and the councillor, and unfortunately it is becoming all too common.

"Let one form only be sent by each applicant. These can be gone carefully through by the chairman of the committee and the clerk, and the qualifications and particulars of the candidates tabulated. To eliminate the unsuitable candidates and prepare a short list of those whose qualifications are most suitable is then comparatively simple, and is the only fair way of dealing with the matter.

"I shall submit my application and testimonials for Willesden without sending any copies, and stand or fall by that, and I trust that all applicants will, by following my example, do their share to put down this growing tendency to put candidates to unnecessary trouble and expense.—ANTI-CANVASSER."

**Examinations for Electrical Engineers.**—In further reference to our leader of last week, "The Engineer in the Mine," it is evident that the Transvaal Government regulations insisting on all machinery in mines being in responsible charge of properly-certificated engineers, have tended materially to improve the status of engineers in that country. The certificates are only issued after a written examination following on a period of practical experience in mines.

Some four years ago a strike of coal miners in New South Wales, and an agitation amongst some of the men to have electrical apparatus removed from a colliery, caused the Government to institute examinations. These have been carried out successfully, and now every one in charge of electrical plant in New South Wales collieries is certificated. The men have regained confidence in electrical gear, and the agitation against it has practically disappeared.

A year ago the Association of Mining Electrical Engineers started examinations for their own members, and about 60 first and second-class certificates were awarded, there being about 75 candidates. For those who had been in charge of electrical plant in mines for many years special service certificates were granted, on the lines of those given to colliery managers when examinations for colliery managership were first instituted.

The Association will again hold examinations on March 16th and 23rd, and with a strong examination board consisting of Messrs. W. Maurice, W. C. Mountain, Prof. W. Robinson, S. C. Wardell, Alex. Anderson, H. J. Fisher, and Prof. W. Thornton as chief examiner, the candidates may be assured that if they are successful, their certificates will carry weight when appointments are being made by mine managers.

We have had an opportunity of looking through the examination papers set last year, and certainly think that they are a fair test of candidates' practical fitness for taking charge of electrical machinery in mines. Before the certificates are actually handed over, however, the successful candidates must show that they have had actual experience in mines, and this ensures that the certificates shall not be made cheap by being won by the candidate who merely crams for the examination, or who may be well up in theory, but lacking in practice.

Many arguments have been advanced for and against examinations, but we think that examinations which are run on the lines adopted by the Association of Mining Electrical Engineers are free from most of the objections urged against them.

The Transvaal Government will not allow any engineer to be employed in a responsible position in a mine until he has obtained a certificate of competency by examination, and in the case of electrical machinery the certificate must be specially endorsed to the effect that the holder is competent as regards electric power applications.

(1).—At Chorley Police Court on February 15th, Henry Chidlow, of Coppull, was fined 10s. and costs for a breach of the Coal Mines Act. He was found lying on the electric motor in the pump house, asleep, with his arms around the cable. His hand was only a few inches from a belt travelling at the rate of 2,500 ft. a minute. He was supposed to be looking after the motor.



**The Civil Engineers' Appointments Board.**—At the request of the Council of the Institution of Civil Engineers—Sir Alexander Binnie, Sir Alexander Kennedy, F.R.S., Lord Cowdray and Dr. J. H. T. Tudsbery—have undertaken to form an organisation to assist engineers, especially those of junior rank, to enter into communication with employers who are in need of the services of qualified engineering assistants. The board formed with this object will be prepared to receive applications for engineering employment, and also applications from employers for engineering assistants, and will endeavour to further the interests of both parties by placing them in communication in circumstances which may seem likely to lead to satisfactory results.

It appears to be impracticable for this business to be dealt with otherwise than by letter. Those who seek employment will be furnished with forms in which to state particulars necessary to enable a judgment to be formed as to suitable quarters in which they may be advised to make inquiry. It is not intended to deal with testimonials, which should not be sent to the board unless asked for, but to leave such details of special qualifications to be stated by the applicants individually to those with whom they may be put into communication.

As the undertaking must be self-supporting, it will be necessary to charge some small fees to those who make use of it, and these will be indicated on the forms. Members of the Institution of Civil Engineers especially are invited by the board to assist their endeavour by communicating with them at 3, Little George Street, Westminster, S.W., when they are in need of assistants.

**The Electrical Trades Benevolent Institution : Annual Dinner.**—Mr. F. B. O. Hawes, the secretary, announces that the Annual Festival Dinner of this Institution, will be held on Friday, April 26th, at the Whitehall Rooms, Hotel Metropole. It is expected that a very distinguished member of the electrical profession will preside. In every way last year's festival dinner was a very great success, and it is to be hoped that, by giving somewhat longer notice of this year's function, still better results may be achieved. The necessity of building up a large invested fund, out of the dividends on which pensions may be paid, is of vital importance.

**Fatalities.**—A verdict of "Accidental Death" was returned at an inquest at Leigh, Lancs., on the 14th inst., on Wm. Aldred (44), who had been employed at Leigh Gasworks. Deceased was lifting a lid off a purifier by an electric overhead crane, when a spark ignited some escaped gas and set fire to his clothes. He received fatal burns. John Hardman, yard foreman, said some gas always escaped from the purifiers when the lid was lifted. Jas. Gibson, the gasworks manager, said the gas generally got away with the current of air. The reason for the purifier being enclosed was to prevent the fumes going into the neighbouring houses. Arthur Smith, electrical engineer, said a break in the circuit might account for the spark. It was rather dangerous to have such an installation in an inflammable atmosphere.

On Wednesday, last week, an inquest was held on the body of Edward Batchelor (33), lately of Tysoe Street, Clerkenwell, who had wandered on the line at the Cannon Street Underground Station. A doctor said there was a mark of singeing, about 5 in. long, on the neck, a mark on the chin, and the hair had also been burned. Death was due to asphyxia from electric shock. Witness thought deceased might have trodden on the "live rail." Had Batchelor been wearing woollen socks he might have had a better chance, as dry clothing was a non-conductor.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE LOCAL SECTION).—The annual dinner of this section was held at the Hotel Metropole, Leeds, on Friday evening last, with Mr. T. Harding Churton in the chair. It commenced at a somewhat early hour, which was fortunate, in view of the very extensive toast list which followed later. As to the latter, we pass over the loyal toasts which, of course, were duly honoured, also that of the "City and Corporation of Leeds," proposed by Mr. J. F. C. Snell, and responded to by the Lord Mayor.

"The Institution of Electrical Engineers" was proposed by Mr. Robert Armitage, M.P., chairman of the Leeds Electricity Committee, who eulogised the work of the Institution, remarking on the extraordinary progress made in electrical matters in a short time, and the great importance of central station supply. Mr. Robert Hammond, in responding, remarked that the I.E.E. was founded almost exactly 40 years ago, and to-day no science was so fraught with influence on mankind as electricity. It had conquered space and time, and provided a system of locomotion, both luxurious and cheap, which its forbears could hardly have dreamt of. The Institution had started on a career of work greater than any in the past—the prolongation of the industrial life of the nation, which depended on the economy of our fuel resources, and an understanding of the great fuel waste involved under present conditions.

The toast of the "Yorkshire Local Section," which followed, was proposed by Ald. Smithson, in the unavoidable absence of Mr. William Cramp; he attributed the growth of the Institution to the success of the local sections, which appealed to the country member, and congratulated Mr. Dickinson (the hon. secretary of Yorkshire Local Section) on his election to the Council of the Institution. Mr. T. Harding Churton, chairman of the Section, in responding, said its progress was largely due to Mr. Dickinson's efforts. It was hoped that the new rules would widen the scope of the Institution, and lead to many allied engineers joining it. A sign of the times was that Leeds was proposing to install a 6,000-8,000-kw. turbine set, which would be one of the largest in the country. He urged strongly that the cost of electricity in Leeds

should be reduced to such a level as would induce local manufacturers to give it the preference, rather than that profits should be earned to subsidise the rates.

To Mr. John McLaren fell the task of proposing "The Electrical Industry," which he said had so much vitality that it did not stand in need of boosting up. It had had great obstacles to overcome, thanks to the opposing influence of the Government in the beginning, and unwise speculation. Only the force of necessity gave it its chance, and we were still bound to admit that it did not give an adequate return for the capital and energy expended on its behalf. He agreed with the previous speaker as to the necessity of cheap local power, and urged that a limit should be set to rate appropriations, which were the outcome of a short-sighted policy. A glance at the toast list led him to fear that he would be there till 6 o'clock in the morning, but thanks to the restraint which had been exercised, "we were getting on very well." Mr. Walter Emmott, who briefly responded, deplored the increasing importation of electrical material, which could be produced in Britain.

Mr. George Wilkinson, President, I.M.E.A., proposed the "Kindred Associations," referring to the untimely end of the Consulting Engineers' Association at the hands of its big brother, and Mr. E. Kitson Clarke, who replied, suggested that one would like to hear more of mutual aid amongst engineers as well as the promotion of common interests, to which engineering societies devoted their energies.

The final toast of "Our Guests" was proposed by Mr. Wilson Hartnell, who declared that the engineering prosperity of the country was due to the courage and ability of its commercial men and operating engineers, and deplored the lack of sympathy with engineering developments, especially if they were not immediately successful. Mr. J. S. R. Phillips (of the *Yorkshire Post*) who responded, suggested that had the newspaper press been in existence in early times, engineering and other matters would have progressed much more quickly. In connection with a recent political speech in Ireland, of which everybody knew, he had tested the utility of the electrophone, and it might be news to them that after the first ten minutes or so during which it was possible to hear satisfactorily, that speech was transmitted over the telephone and written out as received.

Musical and vocal selections were rendered during the evening, which, it is unnecessary to add, was fully occupied.

**JUNIOR INSTITUTION OF ENGINEERS.**—The annual dinner of this Institution took place at the Hotel Cecil on Saturday last, and was well attended. Commendatore G. Marconi occupied the chair, and amongst those present were Vice-Admiral Sir Henry Jackson, Engineer Vice-Admiral Sir Henry Oram, Sir George Greenhill, and Count Albiz (managing director of the Spanish Marconi Telegraph Co.).

The loyal toasts included that of "The King of Italy," in honour of the President, and were followed by that of "Electrical Inter-communication," proposed by Prof. Perry. He spoke of the rapid progress made in the development of wireless working and of the improvements which had recently been made in cable telegraphy also, and instanced, in regard to the latter, a cable now working between the Azores and America, on which it was possible to transmit 220 letters per minute in each direction. In telephony, too, recent progress seemed to indicate that the possible distance of transmission would be increased by 75 per cent., and he foresaw that in a few years the inhabitants of Teheran, Persia, would be able to listen to opera performed in London.

In reply, the president said that since his first paper was read before the Institution of Electrical Engineers (13 years ago) wireless communication had made great progress. The problem of high-speed apparatus was principally a mechanical one, and in regard to distance of transmission, there need be no limit to its extent in the future. Troubles due to atmospherics were being gradually overcome, receivers were being improved, and the transmitting apparatus was becoming more efficient. In the tropics communication was often effected over 1,000 miles overland. The question of interference was of importance, and the extension of wireless working was largely dependent on the ease with which stations could be operated without mutual disturbance. Vessels only 8 miles from the trans-Atlantic stations at Clifden and Glace Bay were not affected by these larger installations, and the efficiency of stations close together was being greatly improved. With regard to ship working, which was at present limited to the use of two wave-lengths only, he thought a third and longer wave-length should be authorised. Although the number of vessels equipped with wireless apparatus was rapidly increasing, the difficulties due to interference did not increase to a corresponding extent. Much was being done in solving the problem by the introduction of wave-group tuning systems in transmission and also by the development of directive systems. In the latter case, although some spreading of the waves took place, it was relatively small. They did not go all round, and become a nuisance to those who did not want them.

The toast of "The Junior Institution of Engineers" was submitted by Mr. G. C. Horsley, and responded to by the chairman of the Institution, Mr. Walter T. Dunn; and later that of "The President," given by Mr. S. Bylander, was enthusiastically received.

During the evening the late secretary of the Institution, Mr. Walter T. Dunn, was presented with an illuminated address and a cheque in recognition of his 27 years' service in that capacity. In making the presentation, Mr. B. E. Dunbar Kilburn referred to the unfailing tact and courtesy shown by Mr. Dunn and to the efficient way in which his work had been carried out.

The musical arrangements for the evening were under the direction of Mr. Richard Cooper, A.R.C.O., and were of a very enjoyable character.



**PHYSICAL SOCIETY.**—At the annual general meeting on February 9th, Prof. H. L. Callendar, F.R.S., President, in the chair, the reports of the Council and the treasurer were adopted by the meeting. Prof. H. Nagaoka was elected as an honorary fellow.

The officers elected for the ensuing year were as follows:—President, Prof. A. Schuster. Vice-Presidents: those who have filled the office of president, together with Mr. A. Campbell, Prof. C. H. Lees, Prof. T. Mather, Dr. A. Russell. Secretaries: Messrs. W. R. Cooper, 82, Victoria Street, S.W.; and S. W. J. Smith, Imperial College of Science and Technology, South Kensington. Foreign secretary: Prof. S. P. Thompson. Treasurer: Mr. W. Duddell.

Prof. A. Schuster then delivered the presidential address on "A Critical Examination of the Possible Causes of Terrestrial Magnetism." He said that scientific opinion had always favoured the view that there was a definite reason for the close approach of the magnetic to the geographical pole. The view that iron was responsible for the observed magnetic field had generally been put aside, because iron lost its magnetisation at temperatures lower than those which must hold at moderate depths below the surface. But the objection raised on this ground disregarded the possibility that the critical temperature of iron might be raised by pressure. For the present they must keep their minds open to the possibility that the iron contained in the earth was magnetisable. The difficulties which stood in the way of basing terrestrial magnetism on electric currents inside the earth were insurmountable. The question whether the rotation of the earth might be responsible for its magnetic field was examined, and the possibility was considered that rotation determined magnetic force which might or might not cause magnetisation according to the nature of the body. This view deserved attention, because there was some theoretical foundation for it. Inasmuch as molecules might be considered to behave in a manner analogous to that of a gyrostatic compass. The theory would also explain in a natural manner the secular variation by a precessional motion of a magnetic molecule. On the other hand, the theory would have to explain why the iron inside the earth became—by rotation—more strongly magnetised than the iron in laboratories. There was always the possibility of some substance being subject to the effects of rotation in a much higher degree than iron. Such questions could only be settled by experiments which were in progress. In conclusion, the question was raised whether the negative electron was subject to gravitation.

**S.A. INSTITUTE OF ELECTRICAL ENGINEERS.**—At the annual meeting on January 18th, at which Mr. J. H. Rider presided, it was stated that there had been a net increase of 65 members, making a total of 270. A students' section had been inaugurated. Mr. W. H. Perrow was awarded the gold medal of the Institute, for the best paper read in 1910. Mr. J. H. Rider was re-elected President, and gave an illustrated lecture on the electrical system of the L.C.C. tramways.

**THE POLYTECHNIC, REGENT STREET, W.**—A special course of 12 lectures on "Electric Lighting" is being delivered on Thursdays, at 8.30 p.m. The first of the lectures was delivered on January 18th, and the course has been specially prepared for architects, builders, &c. The ground being covered is as follows:—Definitions of circuits; lamps and fittings; wiring and installation work; motors—direct and alternating; generation and miscellaneous.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (NEWCASTLE BRANCH).**—On Wednesday the following papers were to be discussed at the meeting of this Section held at Armstrong College:—"Earthing, Earth-Plates and Leakage Detectors," by Chris. Jones (South Wales Branch); "Electricity Applied to the Scottish Shale Oil Industry," by Jas. R. Laird (West Scotland Branch); "Motor Starters for Mining Work," by A. P. Drake, B.Sc. (Yorkshire Branch).

**ILLUMINATING ENGINEERING SOCIETY.**—The annual dinner took place on February 15th. Prof. S. P. Thompson presided, and in responding to the toast of the Society, said it had stimulated invention on the part of some of the members. The Society had been successful in directing attention to such important matters as the proper lighting of schools, streets, shops and picture galleries.

The Imperial Mission is holding a public meeting at the Caxton Hall on Wednesday, February 28th, at 8.30 p.m., at which Mr. Charles Bright, F.R.S.E., will give an address on "Inter-Imperial Cable Communications: a Non-Party Question."

**Tungsten Lamp Tests.**—The German Gasglühlicht A.-G. (Auergesellschaft) has had tests made in the Physikalisch-Technische Reichsanstalt, of the duration of life of eight 16-hefner 220-volt metal-filament lamps, with alternating current. The working pressure was 217 volts; the consumption of current at the beginning of the measurements between 0.0944 and 0.0971 amp.; the mean luminosity, measured vertically on the lamp axis, between 16.2 and 17.2 hefners. The specific consumption worked out at from 1.22 to 1.28 watt-hefner. Of the eight lamps tested, seven burned for over 1,500 hours and gave the following measurements:—Current consumption, 0.0941 to 0.0958 amp.; mean luminosity, 15.1 to 16.6 hefners; specific consumption, 1.33 to 1.35 watt-hefner. As a result of the tests it appeared that the falling off in the light in the 1,500 working hours was on the average only 7 per cent.—*E.T.Z.*

**Appointments Vacant.**—Junior assistant engineers, for the Newcastle-on-Tyne Electric Supply Co., Ltd. (10s.); electrical fitters for H.M. Dockyard, Devonport (36s.); fitter, for the Blackpool Tower Co., Ltd.; charge engineer, for the Corporation Electricity Works, Crewe (£80); charge engineer, for the Greenock Corporation Electricity Department (42s. 6d.); shift engineer, for the Electric Light Department, Southern Nigeria (£300); charge engineer (35s.) and junior (15s.) for the Willesden U.D.C. Electricity Department. See our advertisement columns to-day.

**The Electro-Harmonic Society.**—The next Concert (Ladies' Night) will be held at the Holborn Restaurant (King's Hall) on Tuesday evening, February 27th, at 8 o'clock. Mr. S. Z. de Ferranti will be in the chair. The artistes are as follows:—Vocalists—Miss Florence Holderness (Soprano), Miss Mabel Braine (Contralto), Mr. Henry Turnpenney (Tenor), Mr. Ivor Foster (Bass-Baritone). Harp, Miss Gwendolen Mason; Raconteuse, Miss Lillian Lyn; Violin, Mr. T. E. Gatehouse; Prestidigitateur, Mr. Bradley Alexander; Sketch at piano, Mr. Ernest Hastings; Humorous sketch, Mr. Fred Curtis; Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—At a meeting of the Dundee Electricity Committee held last week, Convener Nairn moved that the salary of the engineer be increased from £600 to £650. The convener stated that it had been his intention to move an increase of £100, but Mr. Richardson said he would rather have an increase of £50 granted unanimously, than £100 granted only by some of the members. The convener said that their engineer was the lowest paid engineer of any city or town of the size of Dundee. The increase was agreed to.

There was an interesting ceremony at Blackpool electricity works on February 15th, when Mr. C. Furness, the borough tramway manager and electrical engineer, on behalf of the staff, presented to MR. GEO. OLLIER a silver-mounted salad bowl and fruit jar. Mr. Ollier, one of the assistant engineers, is leaving to take up the position of assistant engineer at the newly erected generating station of Bispham-with-Norbreck U.D.C.

MR. GOULBURN, engineer in charge with the Charing Cross, West End and City Electricity Supply Co., Ltd., was presented on Friday last with a slide rule by the members of the engine-room staff, as a token of respect and appreciation. Mr. Goulburn is leaving the company to take up a post in South America.

MR. H. COLLINGS BISHOP, borough electrical engineer and tramways manager at Newport (Mon.), who is relinquishing the position at the end of February, was on Saturday presented by the engineering and clerical staff with a pair of candelabra, a box of cigars and a box of cigarettes.

The Buxton U.D.C. has agreed to allow MR. LEEMING to act as electrical consulting engineer for the County Education Committee, to superintend the E.L. installation at the Cavendish High School for Girls.

On leaving to take up an appointment at Dover, MR. W. G. DAVIES, of the Wrexham Corporation electricity staff, has been presented with a dressing case, umbrella, and a case of pipes.

By 15 votes to 5, the Plymouth T.C. has rejected the recommendation of the Electricity and Street Lighting Committee to increase the salary of MR. F. HAYES, assistant electrical engineer, from £225 to £250 per annum.

The West Bromwich T.C. has decided to increase the salary of MR. W. A. JACKSON, electrical engineer, from £350 to £400 per annum.

MR. C. HARCOURT STEPHENS has resigned his position as electrical and mechanical engineer to the Cornwall Tailings Co., Ltd., in order to take up the position of engineer at the electrical power station, Raub, Pahang, Federated Malay States.

MR. R. BROOKS, chief consumers' clerk at Marylebone, is leaving to take up an appointment with the Victoria Falls and Transvaal Power Co., Ltd., in South Africa, and his colleagues on the staff were to entertain him at dinner at the Boulogne Restaurant last night. Mr. E. J. Jennings, secretary and accountant of the department, was to preside, and Mr. Brooks was to be presented with a gold watch and an illuminated address. A musical programme, under the direction of Mr. C. G. Adams, was to follow.

**Tramway Officials.**—The L.C.C. Highways Committee, finding it necessary, owing to the expansion of work in the tramway department, to employ five additional third-class assistants, recommends the promotion of the following from the fourth to the third class (commencing at £160 per annum):—MESSRS. G. BROOKS, A. E. PLANNER, H. T. HIDER, E. H. BUDD and J. BETHUNE. The following alterations in salaries of staff in the tramway department are recommended:—

MR. H. D. SMITH, advertising assistant, to advance from £525 to £550 per annum.

MR. H. R. SEXTY, building superintendent, to advance from £325 to £350 per annum.

MR. G. T. DICKINS, stores superintendent, to advance from £325 to £350 per annum.

MR. J. R. WALKER, senior charge engineer at the Greenwich generating station, to advance from £300, by increments of £15, to £345.

MR. J. P. DUDIN, charge engineer at the Greenwich generating station, to advance from £270, by annual increments of £10, to £300.



The Secretary for India, in a letter to the Lord Mayor of Liverpool, has asked that the services of MR. J. A. BRODIE (city engineer) may be lent to the Government of India, to advise it as to the laying out of the new capital at Delhi, and a special Council meeting has been called to approve the Health Committee's recommendation that this request be acceded to. Mr. J. A. Brodie has been the city engineer since 1898, and has taken entire control of the construction of the permanent way and equipment of the electric tramways, comprising a length of more than 100 miles; also the erection of five car-sheds: the electrical overhead equipment and cars being constructed under the associated supervision of himself and the city electrical engineer (Mr. A. Bromley Holmes) as joint engineers.

**General.**—The L.C.C. Education Committee reports that the head of the Physics and Electrical Engineering Department at the Hackney Institute has resigned his appointment, and pending the filling of the vacancy, it recommends the employment temporarily of Lieut. R. F. PITCAIRN, R.N. (retired) as lecturer on electrical engineering for four weeks at the rate of £20 per month.

The following notice appears in the *London Gazette* for February 20th: "The King has been pleased to give and grant unto Francis Blewett Shaw, Esq., Electrical Engineer to the Ministry of Local Government in Bangkok, His Majesty's Royal licence and authority to accept and wear the Insignia of the Fourth Class of the Order of the White Elephant, which decoration has been conferred upon him by His Majesty the King of Siam, in recognition of valuable services rendered by him."

MR. FRANK RISCH is vacating the position of sales representative for Messrs. Ferranti, Ltd., in London and southern area, in order to take up the post of London sales manager to the Edison & Swan United Electric Light Co., Ltd. Mr. Risch formerly held positions as London manager to Messrs. Kelvin & James White, Ltd., and manager of the sales department of Messrs. Dick, Kerr & Co., Ltd. Trained at the Woolwich works of Messrs. Siemens Bros. & Co., Ltd., he for eight years held a position on the staff of that firm prior to the removal to Stafford, and he was associated with the erection of plants in some of the earliest central stations in London and in the provinces.

**Obituary.**—The death occurred recently of M. LOUIS DELAUNAY-BELLEVILLE, of Belleville boiler fame.

We much regret to have to record the death of MR. ISAAC PROBERT, late superintending engineer of the Postal Telegraph Department. Mr. Probert, who was born in June, 1850, entered the service of the Electric Telegraph Co. in 1864, and was appointed clerk at the Shrewsbury Office in 1869. In 1872 he became assistant instructor at the Telegraph School, then located at Cannon Street, London. In 1889 he was appointed to the important position of electric lighting superintendent, and in 1908 he became superintending engineer in charge of the Postal Electric Light and Power Station at Southwark. Mr. Probert (who retired in June, 1910) during his long career, rendered valuable service to the department, and his loss will be deeply regretted by his numerous friends and old colleagues.

## NEW COMPANIES REGISTERED.

**Wilkeson Fuel, Light and Power Co., Ltd.** (120,329).—Registered February 17th, by Ashurst, Morris, Crip & Co., 17, Throgmorton Avenue, E.C. Capital, £100,000 in £1 shares. Objects: To carry on in the United States of America or elsewhere the business of colliery proprietors, iron and coal masters, iron and steel manufacturers, miners, smelters, chemical manufacturers, engineers, founders, tinplate manufacturers, dealers in metals and petroleum and other mineral oils, dealers in machinery and apparatus for manufacturing, increasing and improving the illuminating or heating power of gas, spirit, oil, petroleum and heat-producing agents, suppliers of electricity for light, heat, motive power or otherwise, &c., and to adopt an agreement with the London and Vancouver Syndicate. The signatories (with one share each) are:—R. Macmecken, Moorgate Station Chambers, E.C., accountant; R. H. Frisley, Moorgate Station Chambers, E.C., and Chicago and Vancouver, British Columbia, broker; C. Sofrano, 25, St. Mary Axe, E.C., gentleman; J. M. Fulton, Moorgate Station Chambers, E.C., chartered accountant; A. A. Amos, 285, Lea Bridge Road, Leyton, clerk; A. J. Swan, 4, Sutherland Road, Chiswick, clerk; S. H. Penwarden, 36, Peterborough Road, Leyton, clerk. Minimum cash subscription seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories; qualification, £100; remuneration, £250 each per annum (chairman, £350). Registered office, Moorgate Station Chambers, Moorfields, E.C.

**Stoffels Electric Switch Co., Ltd.** (120,285).—This company was registered on February 15th, with a capital of £25,000 in £1 shares, to acquire and turn to account any invention relating to electric tramways and railways and the working thereof, in particular to acquire from K. W. G. J. Stoffels the benefit in respect of certain countries of an invention relating to self-acting tramway points and certain patents relating thereto. The subscribers (with 250 shares each) are:—W. O. Burt, 41, Eastcheap, E.C., merchant; J. L. Burt, 41, Eastcheap, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are:—K. W. G. J. Stoffels, J. L. Burt, W. O. Burt, J. B. van der Sprekel and one other to be appointed before annual general meeting in 1913; qualification, £250 shares. Registered by Ballantyne, McNair & Clifford, 150, Leadenhall Street, E.C.

**Cantie Switch Co., Ltd.** (120,197).—This company was registered on February 12th, with a capital of £500, in £1 shares, to take over the business of the Cantie Switch Co., carried on by H. W. Cox at Mount Street, Nottingham, and to carry on the business of electrical engineers, electricians and contractors, suppliers of electricity, manufacturers of electric apparatus, &c. The subscribers (with one share each) are:—W. F. Cox, Tavistock Chambers, the Market Place, Nottingham, solicitor; H. W. Cox, 67, Mount Street, Nottingham, electrical engineer. Private company. H. W. Cox is the first director. Registered office: 67, Mount Street, Nottingham.

**Honiton and District Electric Supply Co., Ltd.** (120,319).—This company was registered on February 17th, with a capital of £7,000 in £1 shares, to carry on at Honiton and elsewhere in Devonshire the business of an electric supply company in all its branches, and to take a transfer of all the

rights, privileges, liabilities and obligations conferred or imposed upon J. A. Purves and W. T. Purves, of Exeter, by the Corporation of Honiton, under an agreement dated October 4th, 1911. The subscribers are:—C. Harding, Burwood, Honiton, draper, 200 shares; S. Cox, The Gables, Honiton, gentleman, 50 shares; J. A. Purves, 6, Pennsylvania Park, Exeter, C.E., 50 shares; C. P. Slade, High Street, Honiton, engineer, 25 shares; C. N. Tweed, Kingslea, Honiton, solicitor, 25 shares; H. L. Rundle, Holyshute, Honiton, solicitor, 20 shares; J. A. S. Altham, The Central Garage, Honiton, motor engineer, 5 shares. Minimum cash subscription, 3,500 shares. The number of directors is not to be less than three or more than seven; the first are C. Harding (chairman), S. Cox, J. A. Purves, C. P. Slade and C. N. Tweed; qualification, 250 shares; remuneration as fixed by the company. Registered office, High Street, Honiton.

**Spanish and General Wireless Trust, Ltd.** (120,299).—Registered February 16th, by Coward & Hawksley, Sons & Chance, 30, Mincing Lane, E.C. Capital, £350,000 in £1 shares. Objects: To acquire, hold, sell and turn to account shares, stocks and securities of any wireless or other telegraph company carrying on business in Spain or elsewhere, &c. The signatories (with one share each) are:—H. W. Allen, 51, Braxted Park, Streatham, S.W., company secretary; A. S. Birch, 24, Goldsmith Road, Leyton, private secretary; G. E. Turnbull, Charing Cross Hotel, S.W., electrical engineer; H. W. Cornby, 84, Cecile Park, Crouch Hill, N., assistant secretary; G. Pells, 29, King's Road, Leytonstone, private secretary; C. J. Ketteridge, 514c, Wandsworth Road, Clapham, S.W., transfer clerk; R. H. Hill, 141, Winchester Road, Highams Park, Essex, transfer clerk. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories. Qualification, £100; remuneration, £400 each per annum, and a percentage of the profits. Registered office, Watergate House, York Buildings, Adelphi, W.C.

**G. M. Boddy & Co., Ltd.** (120,246).—This company was registered on February 14th, with a capital of £1,000 in 950 preference shares of £1 each, and 1,000 ordinary shares of 1s. each, to take over the business of an electrical engineer, factor and agent for the sale of electric lamps and other electrical appliances and apparatus carried on at 8, Leadenhall Street, E.C., by G. M. Boddy & Co. The subscribers (with one preference share each) are:—G. M. Boddy, 8, Leadenhall Street, E.C., electrical engineer; H. G. H. Wilkinson, 166, Melrose Avenue, Cricklewood, N.W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are G. M. Boddy and H. G. H. Wilkinson (both permanent); qualification, one share. Registered by Adkin & Son, 15, Dowgate Hill, E.C.

**A. Richmond Turner & Co., Ltd.** (8,153).—This company was registered in Edinburgh on February 15th, with a capital of £1,000 in £1 shares, to acquire and carry on the business of Albert R. Turner & Co., electrical engineers, 676, Eglinton Street, Glasgow. The subscribers (with one share each) are: A. A. R. Turner, 676, Eglinton Street, Glasgow, electrical engineer; F. Evans, 100, Bothwell Street, Glasgow, commission agent. Private company. A. R. Turner is the first director. Registered by John Oswald & Sons, Edinburgh.

## CITY NOTES.

### Westminster Electric Supply Corporation, Ltd.

THE directors' report for 1911, announces that Lord Suffield, while still retaining a seat at the board, has resigned the chairmanship, and Mr. J. Browne Martin has been appointed in his place. The directors report the death of Mr. Edmund Boulnois, who had served as a director for 23 years. Mr. Montagu Gluckstein has been elected to the vacancy. The supply of current has increased from the equivalent of about 33,800 kw. to the equivalent of about 35,460 kw. The length of roadway in which continuous-current mains have been laid now exceeds 90 miles, making about 361 miles of ways, into which upwards of 273 miles of copper (strip and cable) has been drawn. In addition, six miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. An interim dividend, at the rate of 10 per cent. per annum on the ordinary shares, and the dividend on the 4½ per cent. preference shares for the half-year ending June 30th, 1911, have been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £47,290, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £10,788, leaving a balance of £36,502. Out of this the board recommend the payment of a dividend at the rate of 10 per cent. per annum, less income-tax, for the past half-year, carrying forward £10,607.

Units sold .. .. .	18,049,133	Total 18,509,068
.. used on works, &c. .. .	459,935	
kw. on circuit, December, 1911 ..	35,337	

The meeting is called for February 28th.

### British L. M. Ericsson Manufacturing Co., Ltd.

The annual meeting was held yesterday in London. The report, which was adopted, showed that the result of last year's working was a net profit of £27,144, or 27 per cent. on the capital, after heavy depreciation of the capital assets. We shall refer to the matter more fully next week.

**Tyneside Electrical Development Co., Ltd.**—A further dividend of 10 per cent. is recommended, making the usual distribution of 15 per cent. for the year.

**Para Electric Railways and Lighting Co., Ltd.**—A final dividend is to be paid of £5 per cent. on the ordinary shares, making 10 per cent. for the year, the same as for 1910.

**Scarborough Electric Supply Co., Ltd.**—The directors' report states that after placing £1,000 to depreciation, there is a balance on revenue account of £3,242, and the directors recommend a dividend, free of income-tax, at the rate of 3 per cent. for the year, leaving £242 to be carried forward. During the year 2,849 30-watt lamps (equiv.) were added, making 114,187. The units supplied, including 300,000 for the tramways, were 859,853, an increase of 26,974. Metallic-filament lamps, which at first tended to reduce receipts, are now attracting a sufficient number of new consumers to counteract this adverse effect.



### South Metropolitan Electric Light and Power Co., Ltd.

IN the directors' report for the year ended December 31st, 1911, the revenue account shows a credit balance of £31,072, which, with £1,243 brought forward, makes a total of £32,315. After deducting £11,740 for interest on debenture stock paid and accrued, and for other interest, £5,004 for interim dividend paid on the 7 per cent. cumulative first preference shares, and £1,500 for interim dividend paid on the 6 per cent. cumulative second preference shares, there remains a balance of £14,071. The directors recommend payment of a final dividend to December 31st, upon the 7 per cent. cumulative first preference shares, requiring £5,004; final dividend to December 31st, upon the 6 per cent. cumulative second preference shares, £1,500; placing to credit of depreciation account, £3,000; to credit of preliminary expenses, £1,500; the balance of £3,067 to be carried forward. The following comparative figures show the progress of the company's business:—

Year.	Lamps (35-watt). Connected.	Inc.	No. of consumers.	Gross revenue.	Expendi- ture.	Net revenue.
1907	160,380	15,668	3,383	£43,302	£16,234	£27,068
1908	177,628	17,248	3,649	42,954	15,978	26,976
1909	191,302	13,674	3,916	41,847	16,465	25,382
1910	208,046	16,744	4,305	44,687	17,678	27,009
1911	230,191	22,145	4,697	51,614	20,541	31,072

The company's showroom has been much appreciated by consumers, and has assisted the development of the business generally. The West Kent Electric Co.'s business is steadily developing. A further £10,000  $\frac{1}{2}$  per cent. first mortgage debenture stock has been issued during the year. The dividend warrants will be posted on Tuesday, 27th inst.

**National Electric Supply Co., Ltd., Preston.**—A general meeting of shareholders was held on February 15th, Mr. J. Booth presiding. Dividends of 4 per cent. on preference shares and 4s. on each ordinary share (the latter making 7s. for the year) were declared. The Chairman moved the adoption of the report, and said that £3,000 had been spent, chiefly on mains for new custom and on additions to the high-tension plant, to enable the company to deal economically with the growing demand for alternating motors. They had paid £2,881 for local rates, and had lodged an appeal against their assessment. Unless a settlement was arrived at, they must seriously consider making future additions to their plant outside the borough boundary. Owing to the use of metallic lamps, the revenue from lighting had been reduced, consumers saving from 50 per cent. to 70 per cent. in their bills by these lamps. The report was adopted.

**Bruce Peebles & Co., Ltd.**—The directors' report, to which we made brief allusion last week, and which comes before the annual meeting at Edinburgh to-day (Friday), says that further unsecured debentures amounting to £10,841, and shares amounting to £18,403, have been issued in accordance with the scheme of reconstruction. The liquidation of the old company is completed, and a petition is being presented to the court for the discharge of the liquidators. The results for the year show an improvement of £7,629, as compared with the previous year. The profit, after deducting maintenance, general charges, expenses of administration, and the interest paid on the mortgage debentures and accrued on the unsecured debentures, is £354 for the year. No material improvement has been shown in trade conditions during the year, but continuous attention having been given to the extension of the business both at home and abroad, the gradual progress of the business is reflected in the present accounts.

**Crossley Bros., Ltd.**—The directors' report for 1911 shows that the amount to the credit of revenue account is £83,002. After paying 5 per cent. on the preference and 4 per cent. on the ordinary shares for the year, £10,000 is placed to the reserve fund, and the balance of £30,020 is carried forward. The decrease in profits is due to the serious labour troubles experienced during the year and the consequent reduction in the output. The directors regret the death of their late chairman, Sir William Crossley, Bart. Three members of the staff, Mr. Joseph James Carter, Mr. James O'Hanlon and Mr. Wilfred L. Webb, were appointed directors in July last.

**Mather & Platt, Ltd.**—The directors have declared a dividend on the ordinary shares at the rate of 10 per cent. per annum, with a bonus of 2 per cent., free of income-tax, less the interim dividend of 5 per cent. already paid.

**British Engine, Boiler and Electrical Insurance Co., Ltd.**—The report, as published in the *Financier*, states that the accounts for the year to December 31st show a disposable balance of £22,125, including £1,497 brought forward. A dividend of 5s. per share (£3 paid up) was paid in July, absorbing £5,100. The directors now recommend a final dividend of 5s. per share and a bonus of 3s. per share, less tax, absorbing £7,664, placing £7,000 to the reserve (making the same £83,000), leaving to carry forward £2,091.

**Bournemouth and Poole Electricity Supply Co., Ltd.**—The directors announce a further dividend of 3 per cent., making  $5\frac{1}{2}$  per cent. for the year 1911.

### London Electric Supply Corporation, Ltd.

THE directors' report for the year ended December 31st, 1911, states that the profit for the year is £61,412, against £53,225 last year. To this is added £3,660 brought forward, less interest on temporary loan, viz., £115, making a total of £64,958. Out of this the interest on debenture stock to December 31st, viz., £15,191, has been paid, leaving a balance of £49,767 to be appropriated. The board recommend a dividend of 6 per cent. on the preference shares (of which an interim dividend of 3 per cent. was paid on September 1st, 1911) viz., £26,952; a dividend of  $2\frac{1}{2}$  per cent. on the ordinary shares, £8,325; to reserve account (making £77,500), £5,000; to contingencies account (making £10,000), £5,000; carrying forward, £4,186. The supply has been efficiently maintained during the year. The units sold were 20,476,982, as against 13,538,124 last year; the total costs per unit sold being '82d., as against 1'03d. last year—a reduction of 21 per cent. The power supplied for traction purposes shows 73 per cent. increase, while the power supplied for industrial purposes shows 87 per cent. increase over last year. The capital expenditure for the year was £73,022, and was principally for new plant and mains in connection with the contract for the supply of power to the London, Brighton and South Coast Railway Co., and to deal with the extension of the electrification of their suburban system now proceeding. The plant and machinery have been maintained out of revenue, and are in efficient condition. The meeting is to be held to-day (Friday).

**Kensington and Knightsbridge Electric Lighting Co., Ltd.**—The directors' report for the year 1911 states that the renewal and reserve fund account now stands at £106,615, being an increase of £10,531 over the amount of the account at the end of the previous year. After providing for the amount placed to renewal and reserve fund account, and after paying the dividends on the 6 per cent. first preference shares to June 30th, 1911, on the 5 per cent. second preference shares to September 30th, 1911, and an interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the first half of the year, the balance standing to the credit of the net revenue account for 1911 is £9,055. Of this sum £1,500 has been appropriated to the payment of the first preference dividend to the end of the year, and £625 has to be set aside to meet the portion of the dividend on the second preference shares accrued to the same date. It is proposed to pay out of the balance of £6,930 a further dividend on the ordinary shares at the rate of 10 per cent. per annum, for the past half-year, making, with the interim dividend paid on August 11th, 9 per cent. for the year. This will leave £1,680 to be carried forward. The meeting will be held on February 29th at Brompton Road.

**Bristol Tramways and Carriage Co., Ltd.**—Sir Geo. White presided at the annual meeting held on February 14th. In moving the adoption of the report (see ELECTRICAL REVIEW, page 223), he said that the receipts of the tramways department showed an increase of  $3\frac{1}{2}$  per cent., and those of the carriage department advanced by 20 per cent. The traffic expenses increased by £9,200, and the general expenses decreased by £2,068. Rates and taxes were £13,465, and the total dividend for the ordinary shareholders amounted to £18,833. There would, however, be a considerable diminution in their future charges for city rates, owing to the recent decision of the Court of Appeal that tramways paid in the same proportion as the railways. The report was adopted.

**Brompton and Kensington Electricity Supply Co., Ltd.**—It is announced that after crediting depreciation account with £6,063, and carrying to reserve fund £6,000 (raising the fund to £30,000), a final dividend on the ordinary shares at the rate of 11 per cent. per annum, making 10 per cent. for the year, tax free is recommended, carrying forward £7,858.

**City of London Electric Lighting Co., Ltd.**—The directors last week decided, subject to the completion of the audit, to place £50,000 to reserve, and to recommend a dividend of 12s. per share, being at the full rate of 6 per cent. per annum on the preference shares, and a dividend of 16s. per share, being at the rate of 8 per cent. per annum on the ordinary shares. On account of these dividends, 6s. per preference share and 6s. per ordinary share was paid in September, 1911, and the balance remains to be paid. After payment of these dividends and other appropriations there will remain about £26,000 to be carried forward. The total dividend on the ordinary shares for 1910 was 7 per cent.

**Lancashire United Tramways Co., Ltd.**—The directors report that the receipts amounted to £24,191, leaving a net profit of £12,783 for 1911. After paying the interest on prior lien debenture stock, £12,500, the balance, £283, is carried to depreciation.

**Chatham and District Light Railways Co.**—Mr. A. R. Monks presided on February 13th at 83, Cannon Street, E.C., over the twenty-first ordinary general meeting of the above company. On the motion of the chairman, seconded by Mr. H. C. Lewis, the report (see ELECTRICAL REVIEW, page 186), was adopted without discussion.

**Northwich Electric Supply Co., Ltd.**—The directors have declared a dividend of 5 per cent. on the cumulative preference shares, and 3 per cent. on the ordinary shares.

**Vulcan Boiler and General Insurance Co., Ltd.**—The directors have declared a dividend of 6s. per share and 2s. per share bonus.



### Liverpool Overhead Railway Co.

THE half-yearly meeting of this company was held on February 13th, at Liverpool, Mr. H. C. Woodward presiding, in the absence of Sir Wm. Forwood, who was unwell.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 222), deplored the rather sudden death of their colleague on the board, Mr. George H. Robertson. Mr. Robertson was one of the promoters of the company, and during the 24 years he always took the keenest interest in its welfare. As one of the promoters of the line he could claim to be one of the pioneers of electric traction in this country, for theirs was the first electric railway. The adoption of electric traction required no ordinary courage, and also knowledge of the science then very much in its infancy; but Mr. Robertson had already thrown himself enthusiastically into the promotion of the telephone system, and electric traction therefore strongly appealed to him. The telephone service, which had now been taken over by the Government, would remain a monument of his industry, courage, and foresight, for to him more than to any other man, the success of the great enterprise was due. They ventured to think that the accounts would be regarded as satisfactory and encouraging. The gross traffic (rail and tram) for the half-year showed an increase of 347,206 passengers, representing £2,451. This increase was general in all classes of travel, and was due to the improved trade of the port, and the long spell of fine weather last summer; and the large increase was carried at an extra cost of only £119. Within the past few weeks they had carried the record number of workmen since the line was opened, their earnings per workman carried being 1'23d., compared with 1'24d. last year. The average value of all their passengers was 1'71d. In the good old times, before they were worried by tramways, their average earnings were 1'93d. If they could have maintained that rate, their earnings last half-year would have been £4,127 more than they were. There were some small increases, and some small decreases in expenditure, but the result of the whole showed that they had carried that large number of passengers at a net cost of '082d. per passenger, or, roughly, one-twelfth of a penny per passenger. He thought that reflected great credit upon the management. They had placed, as usual, £1,500 to the credit of their renewal fund, which now amounted to £43,866, and to the credit of the contingent fund £1,300, with £858 to the credit of the insurance fund. The total revenue for the half-year amounted to £40,791. Deducting from that the working expenses, £27,687, they had a balance of £13,103. Out of that they had paid interest on their mortgage debentures, £4,329, leaving £8,773 to be added to the amount brought forward, £4,665, which left available for dividend £13,439. They recommended a 5 per cent. dividend on the preference shares, and at the rate of 2 per cent. per annum on the ordinary shares of the company, carrying forward £4,763. They had always endeavoured to cultivate good relationships with those in their employ, and they had encouraged them to go direct to the board if they had any grievance. That, however, did not save them from trouble during the general strike in August last, but they were glad to say that one-sixth of their staff remained loyal, and they were able to conduct a modified service. This dislocation of traffic entailed some loss upon them, and the increases they had granted in pay, and alterations in the conditions of their service, involved an increase in their expenditure. The board were in the habit of meeting the shareholders every six months, and he did not think the prophets of old were called upon to prophesy every six months; and if they did, it was in cryptic terms. He did not wish to prophesy. They all knew Liverpool as well as he did. As long as trade was good in the port, their railway would do well. The new Atlantic dock was making rapid headway, and the construction of a further new dock at the north-end must be very advantageous to them in bringing more traffic to the railway. Since the close of the year their traffics had continued to expand in a satisfactory manner, the weekly increase averaging nearly £100.

MR. J. E. ANDERSON seconded the motion for the adoption of the report, which was carried unanimously without comment.

Subsequently an extraordinary general meeting of the company was held to consider a new issue of debenture stock.

MR. H. C. WOODWARD, who again presided, moved a resolution authorising the directors to raise £226,500 by the creation and issue of 4 per cent. debenture stock for that amount, subject to an agreement with the Mersey Dock Board. He explained that this was no new burden on the company. Their present debentures expired at the end of the current year, and the Dock Board undertook to guarantee the interest on the new debentures if from any reason the railway should be unable to meet the interest. The new debentures would practically rank as security. They would be permanent stock instead of terminable debentures.

MR. J. E. ANDERSON seconded, and the resolution was carried unanimously.

### Mersey Railway Co.

MR. J. FALCONER, M.P., presided at Worcester House, E.C., on Friday, over the half-yearly meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 227), the CHAIRMAN said the outstanding feature of the accounts was one which must be gratifying to everybody, inasmuch as for the first time in the history of the company they had been able to pay the interest due upon certain class of their original debenture stocks. With the exception of the new debenture stock raised for electrifying the railway under the Act of 1900, this was the first time in the history of the company when any return had been made upon the original capital provided for the purpose of constructing the railway. This was a thing on which the debenture-holders were to be congratulated, and it was a step forward

which must be satisfactory also to shareholders, although their time for receiving a dividend had not yet come. In order that the shareholders might see what the progress had been since the electrification of the line, he might give a few figures. In 1900 they had redeemable debenture stock bearing 4 per cent. interest, but the period for the redemption of which had gone by. They also had arrears of interest upon other debenture stocks amounting to £450,844, and the company was in the hands of a Receiver. The Act of 1900 was introduced for the purpose of dealing with the financial situation and providing the capital for enabling the line to be worked electrically. They found the capital to replace the redeemable 4 per cent. stock, and also the money to electrify the line, and the results of the electrical working had been very striking in every respect. They completely got rid of the steam and smoke which made the tunnel almost offensive as a means of travelling, and they had now a perfect atmosphere both in summer and winter. Their train service was now practically one of three minutes, and as a matter of fact they ran twice the number of trains they did under steam working. Their lifts had been accelerated, and the result was that in the half-year they were dealing with they had carried 7,383,000 passengers, as against 3,357,000 in the last year of steam working—an increase of 4,000,000, or 120 per cent. Their gross revenue had increased from £29,470 in the last half-year of steam working to £54,150, an increase equal to 83'75 per cent. The expenditure for working in the last half-year of steam working was £28,282, whilst in the half-year under review it was £30,190, or only 6'5 per cent. more. So that whilst the train service and the traffic had doubled, the working expenses had remained practically the same as they were under the old conditions. The net revenue during the last half-year of steam working was £1,188, whilst during this half-year it was £23,960. At the same time they had built up a renewal fund amounting to £16,000. The results showed that the system of working and the policy they had pursued, were for the interests of the public and of the shareholders. Since electrical working had been adopted there had been a continuous progress in the development of the traffic, but it was right to point out that in the half-year under review there had been a slight drop; this took place during July, August and September, when they had to contend against abnormal heat and the railway strike, which, as everyone knew, was more acute in Liverpool than anywhere else. In September, when the railway strike passed away, they resumed their normal condition, and the succeeding months showed an increase in the traffic. This showed that the districts served by the railway were being steadily developed; and whilst he did not care to prophesy, still he was bound to say that, having now for eight years had continuous development, they saw no reason why there should be a different state of things in the future. So long as they continued to give the excellent service they did, they had reason to believe that the growth of their traffic would continue. As regarded the accounts, the only item he would refer to was the proposed expenditure of £6,631 on plant during the current half-year and succeeding half-years. The plant in question was a turbo-generator of 800-kw. capacity. At the present time they were working with three engines of 1,200 kw. each, and after careful consideration by the engineer and the board they were satisfied that it would be a substantial advantage to have the new generator, as it would effect a considerable economy in running expenses. He hoped that when the plant was fixed they would find that the working expenses were even lower than in the old steam days. It would be seen that the board had paid the full interest on the 1866 debenture stock and the 1871 stock, and had paid £1 13s. 2½d. on the 1882, 1883 and 1885 stock, the total sum utilised being £13,643. He thought the shareholders of the company were greatly indebted to the debenture-holders for the consideration they had shown in the past, and he hoped before long the shareholders also would receive a dividend.

MR. R. COOPER seconded the motion.

Replying to questions raised by MR. SHERRETT and MR. SYKES, the CHAIRMAN said the board were large ordinary shareholders. Personally, his own interest was larger in the ordinary shares than in the debentures. It would require the earning of £13,287 more, for the company to pay the full dividends on the whole of the debenture stocks before the preference stock received anything. He saw no reason why they should not go on increasing their earnings, for the company was perfectly capable of dealing with a large increase in traffic. That was one of the advantages of electrical working.

The report was adopted.

**Dublin and Lucan Electric Railway Co.**—The half-yearly meeting was held at Dublin on February 15th, Mr. J. W. Hill presiding. The directors' report showed that the gross receipts were £3,960, or £47 less than in the corresponding half of 1910. The expenditure had increased by £217. After providing for debenture interest, there was an available balance of £1,124, out of which the dividend on the 5 per cent. preference shares was to be paid, £102 being allocated to provision of mechanical stokers, £21 to an alternative feed water supply at the power station, £526 being carried forward, as compared with £531 in 1910. In the course of his remarks, the chairman said that through the mechanical stokers which were put in a few months ago, they consumed about 80 tons of coal less.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to, Marconi's Wireless Telegraph Co., Ltd.—Further issue of 22,989 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 727,012 to 750,000.



### Lanarkshire Tramways Co.

MR. A. R. MONKS (chairman) presided on February 13th at the offices, 83, Cannon Street, E.C., over the twenty-first ordinary general meeting of the above company.

THE CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 226), said the extension to New Stevenston was completed and opened for traffic on July 31st. This extension cost £10,680 and also involved a payment of £3,500 to the Burgh of Motherwell towards the cost of building a new bridge over the Calder. Four additional cars were also purchased for the extension, at a cost of £2,760. To meet part of this capital expenditure, £14,650 debentures were issued at £95 per cent., the discount and expenses of the issue, aggregating £762, being written off. The traffic receipts showed an increase for the first half of the year of £320 and for the second half an increase of £2,250—a total of £2,570. The increase in the second half was, of course, mainly due to the opening of the New Stevenston extension. Advertising and other sundry revenue items were also in excess of the previous year, which made a net gain in the gross revenue of £2,640. Taking the expenses, their power costs showed an increase of £230, the increased charges being due to the additional mileage run, but the other expense accounts were all lower. Traction expenses were £600 less, maintenance charges for permanent way and overhead line not being so heavy as in the previous year. There was a small saving in parcels expenses, and a substantial reduction of £530 in general expenses. The increase in their takings and the reduction in the expenses gave them an improvement of £3,570 in the gross profit, and he thought they would agree that the results for the year were highly satisfactory. The board had added £9,000 for the past year to reserve for depreciation, and interest amounting to £1,555 had also been credited to the reserve, making £51,815 at credit as at December 31st. £15,632 had been invested in first-class securities, and the balance was in their own undertaking. After writing £849 off cost of orders, loose tools, &c., £762 in connection with the debenture issue, and making the necessary reserves for local authorities and for additional remuneration to the directors, the balance allowed for payment of a dividend for the half-year at the rate of  $6\frac{1}{2}$  per cent. per annum (making 6 per cent. dividend for the full year), and left £1,385 to carry forward. In addition to their wayleave for the year of £2,890, they paid £3,230 for local rates, a total payment to the local authorities for the year of £6,120. As mentioned in the report, the Lanark County Council was promoting a Bill to construct tramways from Uddingston to Bellshill and Mossend, and to connect up with their lines, and, further, to acquire this company's undertaking forthwith. It was their intention to oppose the Bill, and they were satisfied that Parliament would not grant the powers asked for.

MR. J. F. NAUHEIM seconded the motion, which was carried without discussion.

On the motion of MR. WATSON, it was agreed:—

That the remuneration of the board of directors be at the rate of 1,000 guineas per annum, to be divided as may be determined by them, and that they shall also be entitled to receive in each year, as heretofore, 10 per cent. of the net profits of the company remaining in that year after payment of a dividend of 5 per cent. on the amounts paid on the share capital, such additional remuneration to be divisible among the board equally. The board shall be entitled to charge and be paid all travelling and other out-of-pocket expenses incurred in the discharge of their duties.

### Tyneside Tramways and Tramroads Co.

THE half-yearly meeting was held in Newcastle-on-Tyne on February 13th, Dr. J. T. Merz presiding.

The report of the directors showed that the surplus of receipts over expenses was £4,587, plus £620 brought forward from last half-year, making a total to the credit of profit and loss account of £5,207, and after deducting interest on debentures, loans, &c., amounting to £962, there remained an available balance of £4,244. The directors recommended a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; a dividend on the ordinary shares at the rate of  $2\frac{1}{2}$  per cent. per annum (less income-tax), as compared with  $1\frac{1}{4}$  per cent. for the corresponding half-year of 1910, £1,674; placing to the credit of reserve for renewals, depreciation and other contingencies (thus increasing it to £10,700), £600; setting aside for the reduction of registration and formation expenses, &c., £180; writing down the Consols owned by the company to present market value, £817; leaving to be carried forward £373. The dividend paid on the ordinary shares for the whole year was an increase of  $\frac{1}{4}$  per cent. over that for 1910. The traffic receipts show an increase of £2,150 for the half-year, making an increase for the whole year of £2,983. The whole of the track, overhead line and rolling stock has been kept in thorough repair during the past year out of revenue.

THE CHAIRMAN stated that the increased traffic was made up of £130 on holiday traffic, £475 on workmen's traffic, and £2,378 on the ordinary traffic. They had passed the record of 1907, when the year's receipts were just above £24,000. Their receipts per car-mile had been 8'87d. against 7'95d., and as their minimum was 7'24d., it showed that they had made considerable progress. Their costs stood at 5'99d., as compared with 5'81d. Out of their increased profits they had paid £1,004 more for dividends, the rate being 2 per cent., as against  $1\frac{1}{4}$  per cent. for the previous year. They had placed £1,600 to the reserve, as against £1,500. They had written off £381 expenses in opposing the Corporation Bill. They had also written down Consols even below their present market value—to 77½. In the course of the current year and in coming years they hoped to have sums to invest, and they would be invested where they would be get-at-able, because they would have to anticipate expensive repairs in the lines and cars, which would mean calling upon the reserve fund. So far, for the present year,

the increase in traffic receipts was £130, against an increase in the corresponding period last year of £117. How that would go on it was impossible to foretell. They did not view the future without some apprehension that their regular and profitable working might be disturbed. But it was impossible to make any forecast. If such disturbance did not take place, they looked forward to the future with hope that they would have better returns still.

MR. G. E. HENDERSON seconded the report and accounts, which were adopted.

On the motion of the CHAIRMAN, seconded by LORD ARMSTRONG, the dividends were carried in accordance with the report. The retiring directors and auditor were reappointed.

### City of Buenos Ayres Tramways Co. (1904), Ltd.

THIS company's meeting was held on Thursday last week at Winchester House, E.C., Mr. John Heaton presiding.

THE CHAIRMAN, in moving the adoption of the report, said they followed those of previous years so closely that he did not think they would have any hesitation about adopting them. The two important matters which they had now to consider in connection with the company were, first, whether the annuity receivable from the Anglo-Argentine Co. had been regularly paid, and secondly, as to whether the amortisation funds had been sufficiently maintained. As regarded the first, it was always a satisfaction to him to be able to refer to the increased security that they got for their annuity. When they first proposed the fusion scheme, the security was considered quite ample. It was then £70,000 a year, and the revenue of the Anglo-Argentine Co. was £250,000. The revenue of the latter company had increased very largely, and for last year it had amounted to no less than £900,000, against which their annuity of £70,000 a year was a first charge. As an instance of the enormous resources of the Anglo-Argentine Co., he might mention that the general manager was over here a short time ago, and in the course of conversation he told him (the chairman) that he believed that next year they would be able to pay the annuity out of the advertisements on the cars. As regarded the amortisation funds, they had the written assurance of the auditors that they had been fully maintained. The amount they placed to the general amortisation fund was a little less than last year, but the explanation was quite satisfactory. During the year two leases upon their properties fell in, and they had to make new contracts, and in one case a new tenant had to be found. That was done, and it would be a satisfaction to them to know that the new rents they would obtain, would be considerably in excess of those they received before. That improvement would, of course, be for the benefit of the amortisation funds. They had already paid three quarterly dividends, and they proposed now to pay the balance of 1s. 3d. per share.

MR. E. H. WOODS seconded the motion, which was carried unanimously.

### Bath Electric Tramways, Ltd.

In their report the directors state that the traffic receipts show an increase of £1,462, compared with those of the previous year. The earnings for the past five years are:—1907, £41,452; 1908, £38,395; 1909, £40,136; 1910, £42,372; 1911, £43,334. The efficiency of the company's system, including the permanent way, rolling stock and plant, has been fully maintained. The acquisition of the site adjoining the power station, with the foundry erected thereon, which was referred to in last year's report, has been fully justified by results, the orders in hand at the present time keeping the plant fully occupied. After charging the expenses of operation and administration for the year ended December 31st, 1911, there remains a balance of £15,392, plus £6,697 brought forward, a total of £22,088. From this has to be deducted £6,037, interest on  $4\frac{1}{2}$  per cent. first mortgage debenture stock, paid and accrued to date; £1,000, fourth instalment of sinking fund for first mortgage debentures; £1,163, interest on loans; £3,750, dividend on the preference shares for the year to December 31st, 1911, paid July 1st, 1911, and January 1st, 1912, a total of £11,950, leaving a balance of £10,138, which the directors recommend should be carried forward pending the repayment of the loan, now reduced to £22,650. The year has been a record one in the history of the company, and the marked increase in the carry forward, which was £10,138 this year, as compared with £6,697 last year, an increase of no less than £3,441. The figure in 1909 was £3,964. In both the matter of the balances carried forward and the annual earnings there had been a steady and satisfactory progress. Expenses at Bath in 1911 show an increase of about £900 upon 1910, the total being £26,974. Power expenses accounted for £3,699, as compared with £3,536. Operating, including petrol, wages, &c., amounted to £12,662, as compared with £12,636. Repairs and renewals were about the same—£5,534, as against £5,333. Management expenses advanced from £2,257 to £2,522. Rents, rates and taxes and insurance accounted for £1,568, against £1,394, and parcels cost £989, as against £908.

### STOCKS AND SHARES.

Tuesday Evening.

OVER the whole of the markets has been hanging the cloud of the possibility of a coal strike. The fear of what might happen, were a national stoppage to take place, held business in a close grip.



Everybody was afraid to launch out into fresh commitments. When the rumour got round that the Government was about to move, possibly through the channel of the Eight Hours' Bill, a better sentiment supervened; but until something more definite is known than is available as we write, timidity and caution are the characteristic features in most of the markets.

Home Railway stocks are distinguished by a material rise in City and South London Ordinary, where the price has put on 4 to 32½ middle. It is pointed out that the stock has been overlooked in the rush to buy Tube issues; and, moreover, with the extension of the Underground system, the City and South London should benefit with the rest of the companies. Moreover, there is an idea that the line may go further South. Apart from this, the tendency has been moving in sympathy with that prevailing in the market for steam stocks. Metropolitan Consolidated fell 1½, and Districts slumped 1½, while Underground Electric Income bonds went back 2. For these last two movements the reason generally assigned was that the stale bulls were hastening to get out while they were able to do so at decent prices, but Districts and Metropolitans shared in the recovery, and the losses on balance are small. The Central London trio is marked as dividend: allowing for this, the Deferred stock is 2 down, and the Ordinary 1½. Great Northern and City Preferred Ordinary went back ½, and a similar fraction was lost by London United Tramways Preference, where the recent buyers are a little uneasy at the failure of the shares to go ahead. British Electric Traction are being put up by speculative purchases, the 7 per cent. Preferred being most favoured, and showing a rise of 3½; but the Deferred, with an improvement of 1½, attracts a certain amount of attention from those who like a low-priced gamble. Metropolitan Electric Trams are hardly so good, while Potteries Ordinary are 1½ up.

A number of the English Electricity Supply Companies have declared their dividends, and most of the results are distinctly satisfactory. City of London rose ½ further upon the announcement of a dividend of 16s. per share. Counties are no less than ¾ higher, the Preference rose ½, and the Second Debenture is 1 higher. There are improvements in Bournemouth and Poole Ordinary, Chelsea Ordinary, Charing Cross Ordinary, Brompton Preference, and Westminster Ordinary, while London Electric Ordinary are also harder. It would appear that those who are interested in the industry are backing their faith by fresh purchases and by persuading their friends to follow the same course; and although the aspirations of some of the bolder spirits may seem at the present time to lean to the side of optimism, the practical fact that so many of the shares return high rates of dividend at the present prices is sufficiently attractive to induce buying.

Shawinigan Water, after going back a little, was strongly supported, and the net gain of 5½ is more than double the fall which occurred last week. Mexican issues are still rather doubtful, and quotations tend to decline, the progress of the "Revolution" being a restraining factor. Sao Paulo Trams have recovered their fall, and Rio Trams are a good market, the two classes of bonds being in considerable demand. Anglo-Argentine Trams First Preference lost ½, although the railway strike in the Republic is declared to be at an end. City of Buenos Ayres 4 per cent. Debenture has been marked up 5½.

British Columbia Electric Railway stocks are steady. Business in the various issues in this section continues to be active.

Manufacturing shares have another big rise in Babcock & Wilcox Ordinary as one outstanding feature. The price touched 7, but reverted to 6¾, this showing a gain of 1½, and dividend anticipations are very optimistic. Willans & Robinson Debenture rose 4 points further, while both classes of shares held their improvements. Last week's gain, too, in British Westinghouse Preference has been well maintained: the tip to buy them declares that the rise is by no means over. The demand for the shares led to speculative purchases of the 4 per cent. Debenture stock, the quotation for which has put on 4. Even now the 6 per cent. Prior Lien Debenture yields 5¾ per cent. on the money, and the 4 per cent. Debenture at 64 pays 6¼ per cent. Castner-Kellners are 1½ lower, and Dick, Kerr Preference 1½ higher.

Marconi shares are as lively a market as ever, and after touching 4½ bid, the price eased off to 4½ upon the arrangement of the Special Settlement this week in the new shares. A huge speculative position for the rise was disclosed, and the bulls in some cases had to pay 10 per cent. for continuing their shares, the official making-up price of which was 2½ premium.

There has been a further setback in West India and Panama Telegraph Ordinary shares, and the market professes perplexity as to what the next movement is likely to be. Many people who got out at £5 and over are standing by with the intention of repurchasing when it seems desirable, for there is a widespread opinion that the group which engineered the recent boomlet is going to take the shares in hand again. So far as we can see, there need be no violent hurry to buy back the shares just yet, but it is all very much of a gamble, and the price might be run up to 5 before one could say Canal.

There is nothing very exciting on foot amongst other telegraph issues. American Telephone and Telegraph capital stock is 1½ higher, which made Anglo-American deferred brace up, and the two Mackay Companies' stocks are a little better upon the issue of a good report. Eastern Extensions are ½ up. Eastern Ordinary gained 1. The Reuter rumours, to which reference was made here last week, have brought about another advance in the shares, which now stand at 11. National Telephone Deferred begins to rally after its drop, the price being 1 higher.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen .. ..	Feb. 14	2,504	+ 110	87	55,562	+ 3,255	14.4	..
Ayr .. ..	" 17	362	+ 2	40	12,340	+ 189	8	..
Bath .. ..	" 14	1,237	— 1	7	4,602	+ 127	14.75	..
Birkenhead .. ..	" 18	2,088	+ 93	46	52,790	+ 1,979	13.64	..
Birmingham Corp.	" 10	19,654	+ 6,132	45	400,316	+ 87,910	56.4	..
Blackburn .. ..	" 14	1,864	— 7	46½	56,306	+ 4,170	14.62	..
Blackpool Corp. ..	" 15	683	— 68	..	61,470	+ 7,824	11.87	..
Blackpool-Fleetw'd	" 17	481	+ 33	6	1,733	+ 72	8	..
Bournemouth .. ..	" 14	2,733	+ 251	46	81,676	+ 846	21.95	..
Bradford .. ..	" 10	9,499	— 29	45	246,013	+ 14,766	56	1.2
Brighton .. ..	" 18	1,531	+ 129	46½	47,405	+ 2,630	9.5	..
Bristol .. ..	" 16	11,750	+ 1,175	..	41,822	..	30.5	..
Brit. Elec. Trac. Co.								
Airdrie .. ..	" 9	512	+ 105	6	1,565	+ 337	3.65	..
Barnsley .. ..	" 9	453	+ 16	..	1,023	+ 90	..	..
Barrow .. ..	" 9	£99	+ 373	..	1,682	+ 441	5.37	..
Devonport .. ..	" 9	592	+ 74	..	2,772	+ 38	8.85	..
Gateshead .. ..	" 9	1,933	— 45	..	5,698	+ 74	11.25	..
Gravesend .. ..	" 9	365	+ 29	..	1,163	+ 121	6.5	..
Greenock .. ..	" 9	1,827	+ 185	..	3,770	+ 470	7.25	..
Hartlepool .. ..	" 9	404	— 1	..	1,284	+ 117	6.72	..
Kidderminster .. ..	" 9	168	— 1	..	488	+ 50	..	..
Leamington .. ..	" 9	244	+ 12	..	764	+ 46	..	..
Merthyr .. ..	" 9	365	+ 12	..	1,075	+ 68	2.9	..
Metropolitan .. ..	" 9	15,232	+ 822	..	45,683	+ 8,850	22	..
Middleton .. ..	" 9	495	— 52	..	1,487	— 70	8.5	..
Mid. Joint Com'tee	" 9	5,520	— 19	..	15,962	+ 92	..	..
Oldham—Ashton ..	" 9	1,017	+ 12	..	3,020	+ 136	9.13	..
Peterborough .. ..	" 9	220	+ 29	..	627	+ 85	5.31	..
Potteries .. ..	" 9	3,765	+ 128	..	10,947	+ 468	29	..
Rothsay .. ..	" 9	76	+ 2	..	291	+ 37	2.75	..
Southport .. ..	" 9	410	— 8	..	1,272	+ 5	8.17	..
S. Metropolitan ..	" 9	1,234	— 4	..	3,830	+ 51	..	..
Swansea .. ..	" 9	2,100	+ 242	..	6,218	+ 334	12.5	..
Tynemouth .. ..	" 9	242	— 32	..	747	— 71	3.75	..
Weston-s-Mare .. ..	" 9	47	+ 2	..	145	+ 51	3	..
Worcester .. ..	" 9	415	+ 1	..	1,303	+ 25	5.75	..
Wrexham .. ..	" 9	177	+ 13	..	617	+ 30	..	..
Yorks. Wool. Dist.	" 9	18.3	— 16	..	5,752	+ 74	17	..
Miscellaneous .. ..	" 9	370	— 11	..	1,123	+ 26	..	..
Burnley .. ..	" 17	2,600	+ 2.8	..	13,168	+ 721	11.73	..
Burton-on-Trent ..	" 18	525	+ 50	46	58,744	+ 4,488	22.5	..
Bury .. ..	" 12	2,255	+ 82	46½	112,649	+ 8,255	17.35	..
Cardiff .. ..	" 17	4,461	+ 381	46	4,941	— 75	14.9	..
Chatham and Dist.	" 15	1,445	+ 96	7	2,781	+ 22	9.89	..
Cork .. ..	" 15	8.8	+ 9	7	80,354	+ 5,205	11.6	75
Croydon .. ..	" 9	2,7.8	— 78	45	10,575	+ 974	4.87	..
Darlington .. ..	" 17	421	+ 48	47	12,251	+ 799	1.76	..
Darwen .. ..	" 16	449	— 5	46	11,415	+ 1,499	1.36	..
Dover .. ..	" 10	348	+ 31	45	35,1.9	+ 1,661	54.2	..
Dublin .. ..	" 15	10,117	+ 241	..	50,858	+ 3,220	7.87	..
East Ham .. ..	" 17	2,146	+ 182	46	15,578	+ 991	5.5	..
Exeter .. ..	" 16	516	+ 24	46	706,148	+ 37,4.0	98	25
Glasgow .. ..	" 17	34,801	— 59	..	183	— 183	19.3	..
Hastings .. ..	" 15	1,327	— 4	..	88,219	+ 7,709	2.1	1
Huddersfield .. ..	" 17	3,5.8	+ 116	46	135,860	+ 7,628	14.1	..
Hull .. ..	" 17	5.848	+ 396	46	6,0.8	+ 145	3.8	..
Ilkeston .. ..	" 15	234	+ 10	46	19,860	+ 1,25	10.6	..
Ipswich .. ..	" 10	320	+ 14	45	6,399	+ 451	4.2	..
Kilmarnock .. ..	" 10	273	+ 5	49	7,779	+ 14	39	..
Lancashire United	" 7	2,386	+ 28	7	347,103	+ 23,036	57.5	..
Leeds .. ..	" 17	14,260	+ 785	46	..	..	20	..
Leicester .. ..	" 17	5,123	+ 588	..	25,771	+ 2,003	3.72	..
Leith .. ..	" 17	1,136	+ 108	89½	67,445	+ 4,404	116	..
Liverpool .. ..	" 10	21,834	+ 1,231	59	1,967,176	+ 97,053	139.5	7
L.C.C. .. ..	" 7	77,727	+ 654	45½	36,106	+ 710	..	..
London United ..	" 17	10,476	+ 105	..	3,297	+ 42	8.5	..
Lowestoft .. ..	" 17	280	+ 17	20	747,910	+ 87,242	105	..
Manchester .. ..	" 17	80,652	+ 1,335	46	193,132	+ 15,010	31.3	..
Newcastle .. ..	" 17	8,262	+ 632	..	32,524	+ 1,058	7.25	..
Newport .. ..	" 17	1,247	— 2	46	90,567	+ 3,876	23	..
Oldham .. ..	" 18	3,607	+ 138	47	19,163	+ 40	5.5	..
Pontypridd .. ..	" 17	809	+ 81	46	98,784	+ 6,971	15.25	..
Portsmouth .. ..	" 10	8,020	+ 11	45	95,601	+ 2,4.2	10	..
Preston .. ..	" 14	1,311	+ 43	46	31,780	+ 2,493	12	..
Rotherham .. ..	" 15	1,902	+ 48	45	220,990	+ 8,394	41	..
Salford .. ..	" 12	8,644	— 389	45½	305,589	+ 19,381	40	..
Sheffield .. ..	" 20	12,841	+ 783	47½	56,690	+ 6,602	11	..
Southampton .. ..	" 14	2,109	+ 243	46	31,649	+ 4,747	7	..
Southend-on-Sea ..	" 14	847	+ 137	46	18,801	+ 3,18	10.25	..
South Shields .. ..	" 17	1,114	+ 19	46	7,261	+ 815	3.7	..
Swindon .. ..	" 7	110	+ 12	45½	2,633	+ 153	11	..
Tyneside .. ..	" 14	797	+ 21	7	50,580	+ 6,323	8.72	..
Wallasey .. ..	" 17	1,846	+ 45	46	34,232	+ 2,075	9	..
Walthamstow .. ..	" 17	1,253	+ 62	46	122,462	+ 10,719	15.25	..
West Ham .. ..	" 8	4,880	+ 257	45	45,274	+ 2,133	25	..
Wolverhampton ..	" 14	1,820	+ 107	46	..	..	..	..
Gen. London Rly.								
City & S. Lon. Rly.	" 17	10,078	— 422	7	35,899	— 2,169	6.32	..
Dublin-Lucan Rly.	" 18	6,787	+ 12	7	24,021	— 549	7.26	..
G.N. and City Rly.	" 16	199	— 14	7	712	+ 1	7	..
L'pool Overh'd Rly.	" 17	8,424	+ 249	7	12,018	+ 793	7	..
Llandudno-Col. Bay	" 18	2,943	+ 221	7	10,392	+ 7.9	6.6	..
Lon. Elec. Ry. Co.	" 16	241	+ 8	11½	1,481	+ 151	6.5	..
Mersey Railway ..	" 17	29,620	+ 1,803	7	105,195	+ 5,415	21.25	..
Metropolitan Rly.	" 17	4,063	+ 123	7	14,614	+ 586	4.5	..
Met. District Rly.	" 18	88,945	+ 432	7	120,925	+ 1,28	25.75	..
Anglo-Argentine ..	" 17	25,850	+ 1,351	7	88,642	+ 4,689	26	..
£Anokland .. ..	" 18	103,298	+ 4,853	7	851,516	+ 13,211	..	..
Bombay (B.E.T.) ..	Jan. 12	19,820	+ 1,761	6½	119,299	+ 9,814	28.3	..
£Brisbane .. ..	" 19	6,266	+ 671	3	8,012	+ 589	..	..
Brit. Columbia Rly.	Jan.	17,084	+ 2,126	..	..	..	..	..
Calcutta .. ..	Feb. 17	8,085	+ 752	..	..	+ 4,704	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
£Kalgoorlie, W.A. ..	Jan.	2,884	..	..	..	..	20.5	..
£Lisbon .. ..	..	..	..	..	..	..	..	..
Madras .. ..	Feb. 15	1,518	+ 67	6	4,727	+ 71	..	..
£Montevideo .. ..	Jan.	55,651	+ 3,106	3	90,768	+ 8,053	..	..
Perth (W.A.) .. ..	Feb. 16	3,759	+ 467	7	13,166	+ 1,819	29	..

\* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 20th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 20th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. . .	10	5½	5½	8½—9½	+ ¼	5 18 11	Kensington & Knightsbridge, Ord	5	9	8½	6½—7½	..	6 4 2
Do. 4½ % Pref. . . . .	10	4½	4½	8½—9½ xd	..	4 14 9	Do. 4 % Deb. . . . .	Stock	4	4	92—95	..	4 4 8
Do. Second 6 % Pref. . . .	10	6	6	10½—11½ xd	+ ½	5 6 8	Kent Elec. Power, 4½ % Deb. . .	Stock	4½	4½	75—82	..	5 9 9
Do. 4½ % Deb. Stock . . .	Stock	4½	4½	10½—102	..	4 8 3	London Electric, Ord. . . . .	3	2	1½—2	+ ½	2 19 11	
Brompton & Kensington, Ord. .	5	10	9½	8—8½	..	5 17 8	Do. 6 % Pref. . . . .	5	6	6	4½—5	..	5 0 0
Do. 7 % Cum. Pref. . . . .	5	7	7	7½—8½	+ ½	4 4 10	Do. 4 % First Mort. Deb. . . .	Stock	4	4	85—91	..	4 8 0
Central Electric Supply, 4 % } Guar. Deb. }	100	4	4	98—101	..	3 19 3	Metropolitan . . . . .	5	5	4½	8½—4½	..	5 17 8
Charing Cross, West End & City	5	5	5½	8½—4½	+ ½	5 14 3	Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—4½	..	4 17 4
Do. ½ % Cum. Pref. . . . .	5	4½	4½	4½—4½ xd	..	4 17 4	Do. 4½ % First Mort. Deb. . .	Stock	4½	4½	99—104	..	4 6 7
Do. " City Undertaking " }	5	4½	4½	8½—4½	..	5 9 1	Do. 8½ % Mort. Deb. . . . .	Stock	8½	8½	84—87	..	4 0 6
Do. Do. 4 % Deb. . . . .	100	4	4	93—96	..	4 3 4	Midland Electric Corporation }	100	4½	4½	95—97	..	4 12 9
Chelsea, Ord. . . . .	5	5	4½	4½—4½	+ ½	5 5 3	4½ % First Mort. Deb. }						
Do. 4½ % Deb. . . . .	Stock	4½	4½	98—101	..	4 9 1	Newcastle-on-Tyne . . . . .	5	4	4½	8½—4	..	5 0 0
City of London, Ord. . . . .	10	7	6½	13½—14½	+ ½	4 19 1	Do. 5 % Pref., Non-Cum. . . .	5	5	5	4—4½	..	5 11 1
Do. 6 % Cum. Pref. . . . .	10	6	6	12—13	..	4 12 4	North Metropolitan Power Sup- }	100	5	5	99—102	..	4 18 0
Do. 5 % Deb. . . . .	Stock	5	5	117—121	..	4 2 8	ply, 5 % Mortgages (Red. ) }						
Do. 4½ % Second Deb. . . .	100	4½	4½	100—103	..	4 7 5	Notting Hill, 6 % Non-Cum. }	10	..	..	9½—10½	..	..
County of Durham, 5 % First }	Stock	5	5	87—89	..	5 12 4	Pref. }						
County of London, Ord. . . .	10	5	4½	9½—10	+ ½	5 0 0	Oxford . . . . .	5	7½	6½	6½—6½	..	5 9 5
Do. 6 % Pref. . . . .	10	6	6	11½—11½	+ ½	5 3 3	St. James' and Pall Mall, Ord.	5	10	10	7½—8½ xd	..	5 19 5
Do. 4½ % Deb. . . . .	Stock	4½	4½	107—109	..	4 2 7	Do. 7 % Pref. . . . .	5	7	7	6½—7½ xd	+ ½	4 16 7
Do. 4½ % Second Deb. . . .	Stock	4½	4½	101—104	+1	4 6 7	Do. 3½ % Deb. . . . .	100	8½	3½	85—87	..	4 0 6
Edmundson's, Ord. . . . .	5	Nil	Nil	8½—8½	..	Nil	Smithfield Markets, Ord. . . .	5	Nil	2	1½—1½ xd	..	6 3 1
Do. 6 % Cum. Pref. . . . .	5	Nil	Nil	2½—3½	..	Nil	South London, Ord. . . . .	4	5	5	2½—3½	..	6 3 1
Do. 4½ % First Mort. Deb. . .	100	4½	4½	87—90	..	5 0 0	Do. 5 % First Mort. Deb. . . .	100	5	5	98—101	..	4 19 0
Folkestone . . . . .	5	6	6½	4½—5	..	6 0 0	South Metropolitan, 7 % Pref. .	1	7	7	1—1½	..	6 4 5
Do. 5 % Cum. Pref. . . . .	5	5	5	4½—5½	..	4 17 7	Do. 4½ % First Deb. Stock . .	100	4½	4½	97—100	..	4 10 0
Do. 4½ % First Deb. . . . .	100	4½	4½	93—96	..	4 13 9	Urban, Ord. . . . .	5	5	..	2½—3½	..	..
Hove . . . . .	5	9	8½	6½—7½	..	6 4 2	Do. 5 % Cum. Pref. . . . .	5	5	..	2½—3½	..	..
							Do. 4½ % First Mort. Deb. . .	100	4½	4½	88—90	..	5 0 0
							Westminster, Ord. . . . .	5	10	10½	8½—8½	+ ½	5 14 8
							Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—5½	..	4 6 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6	6	6½—6	..	5 0 0	Monterey Rly. Light & Power, } 5 % 1st Mort. Deb. }	100	5	5	89—91	— ½	5 9 11
Calcutta, Ord. ..	5	8½	7½	6½—7	+ ¼	6 1 5	Montreal, Lt., H. and Power ..	\$100	7	8	193—198	..	3 9 4
Do. 5 % Pref. ..	5	5	5	5—5½	..	4 15 3	Northern, Lt., Power and Coal, } 5 % 1st Mort. Bonds }	\$500	5	..	39—41	..	12 2 10
Calgary Power, 1st Mort. Bds.	100	5	5	92½—94½	..	5 16 8	River Plate, Ord. ..	Stock	10	..	250—260	..	3 16 11
Canadian Gen. El. Com. ..	\$100	7	7½	116—120	..	5 15 8	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110—115	..	5 4 4
Do. 7 % Pref. ..	\$100	7	7	117—121	..	5 15 8	Do. 5 % Deb. Stock ..	Do.	5	5	100½—102½	..	4 17 7
Cordoba Lt., Power and T., Ord.	1	3	3½	7—1	..	3 0 0	Roy. Elec. Co., Montreal, 4½ % } 1st Mort. Deb. }	100	4½	4½	100—102	..	4 8 8
Do. 5 % Deb. ..	100	5	..	95—98	..	5 2 0	Shawinigan Water, Capital ..	\$100	4	5½	131—133	+5½	3 15 2
Eleo. Lt. and P. of Cochabamba, } 6 % Bonds }	100	6	6	91—93	..	6 9 0	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	107—109	..	4 11 9
Eleo. Supply Victoria, 5 % 1st } Mort. Deb. }	100	5	5	83—86	..	5 16 3	Do. 4½ % Per. Deb. ..	Stock	4½	4½	103—105	..	4 5 9
Eleo. Dev. Ontario, 5 % 1st } Mort. Bonds }	\$500	5	5	95—97	+1	5 3 1	Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Kalgoorlie Eleo. P. and L., Ord.	10½	Nil	..	8½—8½	..	Nil	Vera Cruz Lt., P. and T., 5 % } 1st Mort. Deb. }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6	6	8—8	..	8 0 0	Victoria Falls Power, Pref. ..	1	Nil	11½d.	1½—1½	..	..
Kaminitiquia Power, 5 % G. Bs.	\$500	5	5	103—105	..	4 15 3	West Kootenay Power and Lt., } 1st Mort. 6 % Gold }	100	6	6	107—109	..	5 10 1
Madras, Ord. ..	5	..	..	2½—3½	..	..							
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101—103	..	4 17 1							
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	85—87	—1½	5 14 11							
Mexican Lt. & Power, Common	\$100	4	4½	85—87	..	4 12 0							
Do. 7 % Cum. Pref. ..	\$100	7	7	106½—108½	..	6 9 0							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½—96½	— ½	5 3 8							

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1—1½	..	5 6 8
Do. 5 % Deb. Red. ..	Stock	5	5	97—99	..	5 1 0	Do. 5 % Pref. ..	1	5	5	1½—1½	..	5 6 8
American Telep. & Teleg., Cap.	\$100	8	8½	144—146	+1½	5 9 7	National Telephone, Pref. ..	Stock	6	6½	99½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4	4	93½—95½	+ ½	4 3 9	Do. Def. ..	Do.	6	6½	121—123	+1	4 17 7
Anglo-American Telegraph ..	Stock	3½	3	66—68	..	4 8 6	Do. 6 % Cum. 1st Pref. ..	10	6	6	9½—10	..	6 0 0
Do. 6 % Pref. ..	Do.	6	6	109½—110½	..	5 8 4	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10	..	6 0 0
Do. Def. ..	Do.	30½	30½	25½—25½	+ ½	5 16 0	Do. 5 % Non-cum. 3rd Pref.	5	5	5	6½—5½	..	4 12 0
Anglo-Portuguese Tel., 5 % } Mort. Deb. }	100	5	5	102—104	..	4 16 1	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103—104	..	4 6 6
Chili Telephone ..	5	7	..	7½—7½	..	4 19 4	Oriental Telep. and Eleo. ..	1	8	..	1½—1½	+ ½	4 11 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86—88	..	4 10 11	Do. 6 % Cum. Pref. ..	1	6	6	1½—1½	— ½	4 16 10
Cuba Telegraph ..	10	6	6½	10½—11½	..	5 6 8	Do. 4 % Red. Deb. ..	Stock	4	4	87½—89½	..	4 9 5
Do. 10 % Pref. ..	10	10	10	17—18	..	5 11 1	Pacific and European Tel., 4 % } Guar. Debs. }	Do.	4	4	98½—100½	..	3 19 7
Direct Spanish Telegraph, Ord.	5	4	4½	8½—9½	..	5 6 8	Reuter's ..	8	5	5½	10½—11½	+ ½	3 9 7
Do. 10 % Cum. Pref. ..	5	10	10	8—8½	..	5 17 8	Submarine Cables Trust ..	Cert.	6	6	130—133	..	4 10 8
Do. 4½ % Debs. ..	50	4½	4½	99—101	..	4 9 1	Telephone Co. of Egypt, 4½ % } Deb. Red. }	Stock	4½	4½	99—101	..	4 9 1
Direct United States Cable ..	10	4½	..	7½—8	..	5 12 6	United River Plate Telephone	5	8	8	7½—7½	..	5 4 11
Direct W. India Cable, 4½ % } Reg. Deb. }	100	4½	4½	99—101	..	4 9 1	Do. 5 % Cum. Pref. ..	5	5	5	5½—5½	..	4 8 11
Eastern Telegraph, Ord. Stock	Stock	7	5½	137—140	+1	5 0 0	West Coast of America ..	2½	2½	2½	1½—1½	..	3 11 5
Do. 8½ % Pref. Stock ..	Do.	8½	8½	83—85	..	4 2 4	Do. 4 % Debs., 1 to 1,500 } guar. by Braz. Sub. Tel. }	100	4	4	98—100	..	4 0 0
Do. 4 % Mort. Deb. ..	Do.	4	4	100—102	..	5 18 5	West India and Panama Telep.	10	1½	1½	4½—4½	— ½	..
Eastern Extension ..	10	7	5½	13½—13½	+ ½	5 0 11	Do. 6 % Cum. 1st Pref. ..	10	6	6	10½—11½	..	5 7 10
Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10½	..	5 6 8
East and S. Africa Tel. 4 % } Mt. Db. Mauritius Sub. }	25	4	4	99—101	..	3 19 3	Do. 5 % Debs. ..	100	5	5	102—104	..	4 16 2
Globe Telegraph and Trust ..	10	5½	6½	11—11½	..	5 2 2	Western Telegraph, Ltd. ..	10	7	6½	13½—14½	..	5 0 0
Do. 6 % Pref. ..	10	6	6	13½—13½	..	4 8 1	Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3
Great Northern Telegraph ..	10	18	5½	82—83	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106—109	..	3 13 5
Indo-European Telegraph ..	25	13	5½	66½—68½	..	5 10 2	Do. 4½ % Fdg. Bonds ..	\$1000	4½	4½	101—104	..	4 6 7
Mackay Companies Common ..	\$100	5	5½	81—83	+ 1	6 0 6							
Do. 4 % Cum. Pref. ..	\$100	4	4	70—73	..	5 9 7							
Marconi's Wireless Telegraph	1	5	..	4½—4½	+ ½	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	3½—4½	+ ½	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 20th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 20th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. . .	1	Nil Nil	1 1/2 — 1 5/8	..	Nil	Metropolitan Railway Consol. . .	100	12 1/2 17 1/2	46 1/2 — 47 xd	— 1/2	3 19 9
Do. 5 % Pref. . .	1	5 5	7 1/4 — 7 1/2	..	7 5 6	Do. Surplus Lands . .	100	2 1/2 2 1/2	68 — 70 xd	+ 1 1/2	3 18 7
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	80 — 85	..	5 5 11	Do. 3 1/2 % Deb. . .	100	3 1/2 3 1/2	90 — 92	..	3 16 1
Brit. Elec. Trac., 6 % Pref. . .	100	.. ..	14 — 16	+ 1 1/2	..	Do. 3 1/2 % Pref. . .	100	3 1/2 3 1/2	85 — 87 xd	+ 1/2	4 0 6
Do. Do. Deferred . .	100	.. ..	8 — 10	..	..	Do. 3 1/2 % Con. Pref. . .	100	3 1/2 3 1/2	84 — 86 xd	+ 1/2	4 1 5
Do. Do. 6 % Cum. Pr'f. . .	100	.. ..	92 — 94	+ 2	..	Metropolitan District Ord. . .	100	Nil ..	33 1/2 — 34	— 1/2	Nil
Do. 7 % Non-Cum. Pr'f. . .	100	.. ..	41 — 43	+ 3 1/2	..	Do. 6 % Deb. . .	100	6 6	144 — 146	..	4 2 2
Do. 5 % Perp. Deb. . .	100	5 5	96 — 99	..	5 1 0	Do. 4 % Deb. . .	100	4 4	96 — 98	+ 1	4 1 8
Do. 4 1/2 % 2nd Deb. . .	100	4 1/2 4 1/2	79 — 83	..	5 8 5	Do. 4 % Prior Lien . .	100	4 4	100 — 102	..	3 18 5
Central London Railway, Ord.	100	8 8	69 — 71 xd	— 1 1/2	4 4 6	Do. 4 1/2 % First Pref. . .	100	8 1/2 4 1/2	89 — 91 xd	..	4 18 11
Do. Pref. . .	100	4 4	83 — 85 xd	..	4 14 2	Do. 3 1/2 % Gtd. . .	100	3 1/2 3 1/2	76 — 78	+ 1	4 9 9
Do. Def. . .	100	2 2	58 — 60 xd	— 2	3 6 8	Metropolitan Elec. Trams, Ord.	1	5 1/2 5 1/2	27 1/2 — 31 1/2	..	6 13 6
Do. 4 % Deb. . .	100	4 4	100 — 102	..	3 18 5	Do. Def. . .	1	Nil ..	23 1/2 — 25 1/2	— 1/2	Nil
City & South London, Ord.	100	1 1/2 1 1/2	32 — 33	+ 4	4 10 11	Do. 5 % Pref. . .	1	5 5	99 — 101	..	5 10 2
Do. 5 % Pref., 1891 . .	100	5 5	106 — 108	..	4 12 7	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Do. Do. 1896 . .	100	5 5	102 — 104	..	4 16 2	Do. 5 % Deb. . .	100	5 5	100 1/2 — 102 1/2	..	4 17 7
Do. Do. 1901 . .	100	5 5	101 — 103	..	4 17 1	Potteries, Ord. . .	1	2 ..	100 — 102	+ 1/2	..
Do. Do. 1903 . .	100	5 5	101 — 103	..	4 17 1	Do. 5 % Pref. . .	1	5 5	100 — 102	..	6 19 3
Do. 4 % Deb. . .	100	4 4	101 — 103	..	3 17 8	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	89 — 92	— 1	4 17 10
Dublin United Trams, 6 % Pref.	10	6 6	103 1/2 — 113 1/2 xd	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6 ..	89 — 92	..	6 17 2
Great Northern & City, Pr'f. Ord	10	Nil ..	12 1/2 — 13 1/2	— 1/2	Nil	Do. 4 % Deb. . .	100	4 4	72 — 77	..	5 4 0
Hastings Trams, 6 % Pref. . .	5	Nil 3 1/2	73 — 78	..	5 15 5	Underground Elec. Railways	10	.. ..	23 1/2 — 25 1/2	— 1/2	..
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	73 — 78	..	5 15 5	Do. 4 1/2 % Bonds . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	23 1/2 — 27 1/2	..	4 6 11	Do. 6 % Income . .	100	1 1 1/2	74 — 76	— 2	..
Do. 4 % Deb. . .	100	4 4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil ..	1 — 3 1/2	..	Nil
Lancashire United, 5 % Deb. . .	100	5 5	81 — 83	+ 1	6 0 6	Do. 6 % Pref. . .	5	Nil ..	2 1/2 — 3 1/2	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4 4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	81 — 85	..	5 5 11
London United Trams, 5 % Pref.	10	Nil ..	3 1/2 — 4 1/2	— 1/2	..						
Do. 4 % Deb. . .	100	4 4	75 — 78	..	5 2 7						

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . .	5	5	5 1/2 — 5 1/2	— 1/2	5 4 9	La Plata Elec. Trms, Ord. . .	1	.. ..	21 1/2 — 23 1/2	..	..
Do. 2nd Pref. . .	5	5	4 1/2 — 5 1/8	..	5 3 6	Do. Pref. . .	1	6 6	32 — 1	..	6 0 0
Do. 4 % Deb. . .	100	4 4	93 1/2 — 95	— 1/2	4 4 3	Lisbon Elec. Trams, Ord. . .	1	5 1/2 6 1/2	1 — 1 1/2	..	4 8 0
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	101 — 103	..	4 7 5	Do. 5 % Pref. . .	1	6 6	1 — 1 1/2	..	4 16 0
Do. 5 % Deb. . .	100	5 5	103 1/2 — 105 1/2	+ 1 1/2	4 14 9	Do. 5 % Deb. . .	100	5 5	93 1/2 — 97 1/2	..	5 2 7
Auckland Trams, 5 % Deb. . .	100	5 5	102 — 105	..	4 15 3	Madras Elec. Tr. (1904), Deb. . .	100	5 5	93 1/2 — 96 1/2	..	5 3 8
Bombay Elec. S. & Trams, Pref.	10	6 6	108 — 113	..	5 7 10	Manaos Trams & Lt., 1st Deb. . .	100	5 5	92 — 95	+ 1/2	5 5 3
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	98 — 100	+ 2	4 10 0	Manila Elec. R. and Ltg., Bonds	\$1000	5 5	98 1/2 — 100 1/2 xd	..	4 19 6
Do. 5 % 2nd Deb. . .	100	5 5	98 — 100	..	5 0 0	Mexico Trams Com. . .	\$100	7 7 1/2	120 — 122	— 1	5 14 9
Brisbane Trams Invt., Ord. . .	5	8 8 1/2	8 1/2 — 9	..	4 8 11	Do. Gen. Con. 5 % Bonds . .	..	5 5	100 1/2 — 102 1/2	— 1/2	4 17 7
Do. 5 % Pref. . .	5	5 5	4 1/2 — 5 1/2	..	4 15 3	Do. 6 % Bonds . .	100	6 6	101 — 103	..	5 16 6
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. . .	5	10 10 1/2	7 1/2 — 7 1/2	— 1/2	6 13 4
B. Columbia Elec. Rly., Def. . .	100	8 8 1/2	136 — 141	..	5 13 0	Do. 6 % Pref. . .	5	6 6	6 — 6 1/2	..	5 9 1
Do. Pref. Ord. . .	100	6 6	117 — 121	+ 1	4 19 2	Do. 5 % 1st Deb. . .	100	5 5	97 1/2 — 99 1/2	..	5 0 6
Do. 5 % Pref. . .	100	5 5	103 1/2 — 111 1/2	+ 1/2	4 9 8	Perth (W.A.) Elec. Tr., Ord. . .	1	2 1/2 ..	1 1/2 — 1 1/2	..	1 15 7
Do. 4 1/2 % 1st Mort. Deb. . .	40	4 1/2 4 1/2	100 — 103	..	4 7 5	Do. 5 % 1st Deb. . .	100	5 5	100 — 102	+ 1	4 18 0
Do. 4 1/2 % Vancouver Deb. . .	100	4 1/2 4 1/2	102 — 104	..	4 6 7	Rangoon El. Tr. & Sup., Pref. . .	5	6 6	5 1/2 — 5 1/2	..	5 2 2
Do. 4 1/2 % Con. Deb. . .	100	4 1/2 4 1/2	103 — 105	+ 2	4 5 9	Do. 4 1/2 % 1st Deb. . .	100	4 1/2 4 1/2	98 — 101	..	4 9 1
Calcutta Trams, Ord. . .	5	6 6	5 1/2 — 5 3/4	..	5 4 4	Rio de Janeiro Trams . .	\$100	4 1/2 5 1/2	116 1/2 — 117 1/2	+ 1 1/2	4 5 3
Do. 5 % Pref. . .	5	5 5	5 — 5 1/2	..	4 15 3	Do. 1st Mort. 5 % Bonds . .	..	5 5	101 1/2 — 102 1/2	+ 1/2	4 17 0
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds . .	100	5 5	98 1/2 — 99 1/2	+ 1/2	5 0 3
Cape Electric Trams . .	1	Nil 2 1/2	5 — 5 1/2	..	..	Sao Paulo Tram, Lt. and P. . .	\$100	10 10 1/2	197 — 199	+ 2	5 0 6
City Buenos Aires Trams (1904)	5	5 5	5 1/2 — 5 1/2	..	4 5 1	Do. 5 % 1st Deb. . .	\$500	5 5	102 — 104	..	4 16 2
Do. 4 % Deb. . .	100	5 5	101 — 103	+ 5 1/2	4 17 3	Singapore Trams, 5 % Deb. . .	100	5 5	81 — 84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5 5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5 5	93 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5 5	100 — 103	..	4 17 1	Un. Elec. Trams Monte Video . .	5	6 7	5 1/2 — 5 1/2	+ 1/2	5 6 8
Kalgoorlie Elec. Trams . .	1	Nil ..	5 — 5 1/2	..	Nil	Do. 6 % Pref. . .	5	6 6	5 1/2 — 5 1/2	..	5 11 7
Do. 5 % A Deb. . .	100	5 5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. . .	100	5 5	98 1/2 — 101 1/2	..	4 18 6
Do. 6 % B Deb. . .	100	5 5	58 — 62	..	8 1 4	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2 4 1/2	104 — 106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord. . .	1	Nil	6 — 6 1/2	..	..	Dick, Kerr . .	1	5 ..	2 1/2 — 3 1/2	..	5 3 1
Do. 6 % Pref. . .	1	9 6	2 1/2 — 2 1/2	..	7 2 2	Do. Pref. . .	1	6 6	2 1/2 — 1 1/2	+ 1/2	5 9 9
Babcock & Wilcox . .	1	26 24 1/2	6 1/2 — 6 1/2	+ 1/2	3 14 11	Do. Deb. . .	100	4 1/2 4 1/2	98 — 101	..	4 9 1
Do. Pref. . .	1	6 6	1 1/2 — 1 1/2	..	3 13 10	Edison & Swan, A, £3 paid . .	5	Nil ..	1 1/2 — 1 1/2	..	Nil
B.I. & Helsby Cables . .	5	10 8 1/2	6 1/2 — 7 1/2	+ 1/2	6 17 11	Do. fully paid . .	5	Nil ..	1 1/2 — 2 1/2	..	Nil
Do. Pref. . .	5	6 6	5 1/2 — 6 1/2	..	4 16 0	Do. 4 % Deb. . .	100	4 4	71 — 75	..	5 6 8
Do. Deb. . .	100	4 1/2 4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb. . .	100	5 5	77 — 80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2 4 1/2	94 — 97	..	4 12 9	Electric Construction . .	2	Nil 2 1/2	1 — 1	..	..
British Westinghouse, Pref. . .	3	Nil ..	3 — 3 1/2	..	Nil	Do. Pref. . .	2	7 7	1 1/2 — 1 1/2	..	7 9 4
Do. Deb. . .	100	4 4	61 — 64	+ 4	6 5 0	Greenwood & Batley, Pref. . .	10	7 7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien . .	100	6 6	102 — 105	..	5 14 3	Do. Deb. . .	100	5 5	94 — 96	..	5 4 2
Browett, Lindley, Ord. . .	1	Nil ..	1/6 — 2/6	..	Nil	General Electric, Pref. . .	10	5 5	9 — 9 1/2	..	5 5 3
Do. Pref. . .	1	Nil ..	5/6 — 6/6	..	Nil	Do. Deb. . .	100	4 4	85 — 90	..	4 8 11
Brush, Ord. . .	2	Nil ..	0 — 1 1/2	..	Nil	Henley's, Ord. . .	5	15 10 1/2	11 1/2 — 12 1/2	..	6 2 5
Do. 7 % Pref. . .	2	Nil ..	0 — 1 1/2	..	Nil	Do. Pref. . .	5	4 1/2 4 1/2	4 1/2 — 5 1/2	..	4 5 11
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	56 — 61	..	7 7 7	Do. Deb. . .	100	4 1/2 4 1/2	104 — 106	..	4 4 11
Do. 4 1/2 % Second Deb. . .	100	4 1/2 4 1/2	87 — 92	..	10 14 4	India-Rubber, G. & T. . .	10	10 ..	10 — 12	..	..
Callender's Cable . .	5	15 10 1/2	9 — 9 1/2	..	7 13 10	Do. Pref. . .	10	5 5	9 1/2 — 10 1/2	..	4 17 7
Do. Pref. . .	5	5 5	5 — 5 1/2	..	4 15 3	Telegraph Construction . .	13	20 10 1/2	35 1/2 — 37 1/2	..	6 7 0
Do. Deb. . .	100	4 1/2 4 1/2	98 1/2 — 100 1/2	..	4 9 7	Do. Deb. . .	100	4 4	99 1/2 — 101 1/2	..	3 18 10
Castner-Kellner . .	1	17 1/2 20	2 1/2 — 3 1/2	— 1/2	5 10 4	Willans & Robinson . .	1	Nil ..	1 — 1 1/2	..	Nil
Do. Deb. . .	100	4 1/2 4 1/2	106 — 110 xd	..	4 1 10	Do. Pref. . .	5	Nil ..	1 — 1 1/2	..	Nil
Crompton & Co. . .	8	Nil Nil	1 — 1 1/2	..	Nil	Do. Deb. . .	100	4 4	59 — 62	+ 5	6 9 1
Do. Deb. . .	100	5 5	58 — 68	..	7 7 1						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/4 per cent., February 8th, 1912.



NOTES ON RHEOSTATS.

By "B. K."

THE following notes are based on the results of considerable practical experience in the design, testing and operation of almost every type of rheostat, and, it is hoped, may be of some interest, both to those engaged in their manufacture and also to the far larger number who are either buying or using rheostats of one form or another.

At the outset it may be said that in spite of the subject having of late received considerably more attention, there are still many cases where, through insufficient care having been given to the selection of rheostats *suitable for their work*, much loss of time and money has been involved. Indeed, it is not too much to say that the successful working of many industrial plants depends largely on the type of rheostats and control gear adopted.

In view, therefore, of its importance in the above connection, it is proposed first to consider the question of :—

*Rating.*—On looking through makers' catalogues we may see that certain rheostats are guaranteed to start against 50 per cent. overload—which at first sight appears quite sufficient for ordinary service. It will be noticed, however, that the temperature rise, and in many cases the time of

and what constitutes a safe limit depends largely on the nature of the resistance, this subject being discussed later.

It may here be worth while mentioning that where a manufacturer speaks of a two-minute, five-minute, &c., rating it is generally understood to mean that it is permissible to take a period of two or five minutes in moving from the "off" to the "full on" position, and *not* as is sometimes inferred—that one may remain two or five minutes on the first step.

In certain types of rheostats—namely, liquid and some embedded types—the system of horse-power minute rating should be used, and this also serves to check roughly at sight the suitability of a given starter for its work. The horse-power-minute capacity may be defined as the product of rated H.P. of motor × starting time in minutes × ratio of starting to full-load torque, this figure generally being taken for some definite period—thus, H.P.-minutes per half-hour—the latter quantity being the time allowed for cooling. If starting is performed infrequently, obviously the above figure may be increased; for instance, in liquid starters the H.P.-minutes per half-hour value may be doubled where the interval between starts is of the order of three to nine hours, depending on the size.

The next point to be considered is the question of current increments, and the following table, which it is believed has

Values of constant "c" = Ratio  $\frac{\text{Momentary rush}}{\text{Full-load current}}$  when starting under full load.  
No. of sections of resistance.

% C <sup>2</sup> R in arm.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Approx. H.P.
1.75	15.01	7.59	3.9	2.75	2.24	1.97	1.79	1.66	1.57	1.50	1.45	1.40	1.37	1.34	1.31	100
2.0	14.8	7.14	3.71	2.67	2.19	1.92	1.76	1.63	1.55	1.48	1.43	1.38	1.35	1.32	1.29	50
2.5	14.5	6.4	3.44	2.52	2.10	1.85	1.69	1.59	1.51	1.45	1.40	1.36	1.33	1.30	1.28	15
3.0	14.2	5.86	3.27	2.42	2.03	1.8	1.66	1.55	1.48	1.42	1.37	1.34	1.31	1.288	1.265	7½
3.5	14.03	5.45	3.09	2.34	1.98	1.76	1.63	1.53	1.46	1.40	1.35	1.33	1.29	1.27	1.25	5
4.0	13.8	5.13	2.95	2.26	1.92	1.72	1.59	1.50	1.43	1.38	1.34	1.31	1.28	1.26	1.24	3
4.5	13.7	4.8	2.84	2.19	1.87	1.69	1.56	1.48	1.42	1.37	1.33	1.29	1.27	1.25	1.23	2
5.0	13.6	4.57	2.75	2.13	1.84	1.66	1.54	1.46	1.40	1.355	1.318	1.29	1.27	1.24	1.22	1
6.0	13.3	4.21	2.6	2.05	1.78	1.61	1.50	1.43	1.37	1.33	1.30	1.27	1.25	1.23	1.21	½

NOTE.—The values given above for a single section of resistance would never be approached in practice, and in no case would the current rush quite attain the above values.

starting, is carefully omitted. It will be obvious that almost *any* rheostat would start a motor against 50 per cent. overload if the time of starting were sufficiently short—but it would be found that under normal conditions (and, unfortunately, sometimes abnormal) such a rheostat, having a very short time rating, would very soon break down. It is therefore important that the time rating should be ample and the temperature rise reasonable, while the permissible time between successive starts should be clearly stated. In

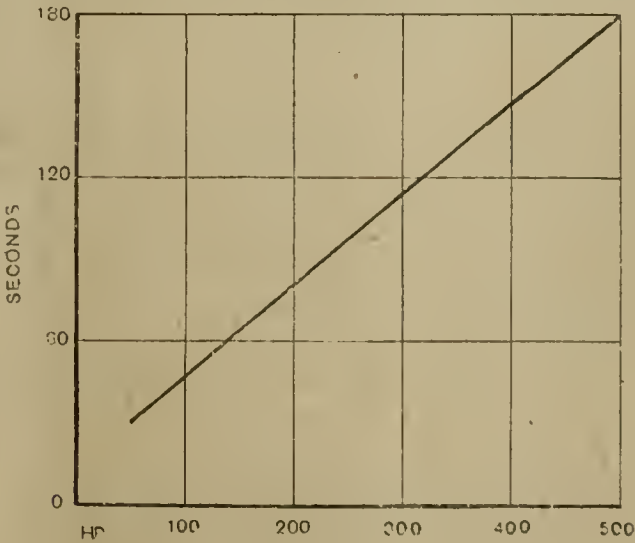


FIG. 1.

general, no starter should have less than a 30-second rating, while the one-minute type is in many cases desirable even for small motors.

The curve in fig. 1 gives suitable approximate values to assume for the starting period, to serve as a basis for calculation, special cases, of course, being treated individually.

The temperature rise may vary from 200° F. to 500° F.,

not been published hitherto, will be found useful. Incidentally it illustrates the absurdity of certain specifications which demand increments of 10 per cent., and even 5 per cent. per step.

The fallacy of allowing, say, 10 per cent. of normal on the first step of a 13-contact starter is apparent, as by the time full-load current is reached, the number of steps available for starting proper will be so small that current rushes of 200 to 300 per cent. will take place. The table also will be found useful in considering starters of the multiple solenoid or lever type for large motors, where usually the number of sections employed is small. Owing to self-induction, the actual current rushes will always be rather less than the table shows, and this point should be borne in mind.

Intimately connected with the above is the question of voltage drop between contacts, this being in many rheostats at present on the market much too high. Theoretically, the voltage-drop should be below that at which arcing is set up, but as this would mean a large number of contacts, a higher value has to be employed. This should on a sliding-contact starter not exceed from 60 to 70 volts even on the higher voltages, and lower values are desirable, in order to avoid too rapid wear of the main or auxiliary contacts.

To comply with the above it will be found necessary to depart from the geometric rating, and somewhat increase the value of the resistance sections on the later steps, and this in practice is found to cause no trouble, although, of course, the larger the number of active contacts the more perfect the possible grading.

The next point we will consider is the construction of D.C. starting rheostats—first as regards their switch portion, and later the resistance. The faceplate or sliding-contact type is in general use for horse-powers up to 50; it is also used



to some extent between 50 and 100 H.P., but is not to be recommended for such powers except in special cases. Slate or marble is frequently used; although it is cheap, the former is low in insulation, and would probably not be used if a more robust form of construction could be cheaply produced.

Where slate is used it should always be treated: this "special treatment," so described by the makers, generally merely consists of boiling in paraffin wax. The metal and mica construction, as specified by the British Admiralty for ship use, is excellent when properly carried out, but in general is too expensive for ordinary service.

The contacts should always be easily renewable from the front, and auxiliary roller contacts of carbon are very desirable on starters which are subject to frequent and arduous service. The gap between adjacent segments should be as wide as possible, consistent with not allowing the contact brush to become wedged in it. It is desirable that both a main and a shunt sector be fitted, thus preventing any necessity to depend on the hub for current carrying and ensuring a constant full field during starting. The practice of barring the first contact to the spool cheek is to be deprecated, and the provision of a field-full-on button, or better still, a shunt sector as above, is much to be preferred. The advisability of providing an overload device on the starter is questionable. The average overload soon either gets tied down, or if left alone fails to make sufficiently good contact to short-circuit the no-volt coil properly, and hence in time of emergency fails to act, and the motor if unprotected by suitable fuses may burn out.

The very best practice is to interlock the hand-operated starter with a separate circuit-breaker—the overload device being arranged to *open* the circuit of the operating coil, thus giving a much greater certainty of action than by relying on a possibly bad contact by partially *short-circuiting*.

Where a spiral hub spring is fitted, care should be taken to see that the angle of twist is not too great, and some provision for adjustment of tension is essential, as after a certain amount of use the springs become weaker, and fail to retract the starting arm.

Terminals should be of ample size. Some manufacturers apparently assume that their customers will be using cables at about 5,000 amps. per sq. in., instead of 1,000, even the latter figure being, of course, too high for large cables.

The question of protection and covers is now receiving considerable attention, and one point may well be mentioned in this connection. In many semi and totally enclosed starters, it is impossible for the operator to see whether he is squarely on a contact segment, or merely touching, perhaps, on a line, the next segment in addition.

In the latter case, since the greater part of the current naturally goes through the later contact, severe local burning is set up, and in a very short time the contacts require cleaning or replacing. This clearly points to putting this possibility beyond the control of the operator, which may be ensured by the fitting of an auxiliary operating gear giving a step-by-step motion quickly and squarely on to each contact. In at least one type of this gear it is possible for the correct movement to be given at the beginning of the travel, while later on the contact arm may have advanced or slipped, thus giving rise to the very trouble this gear was designed to avoid. This point should therefore have attention.

The resistance next claims consideration, and upon its suitability the utility, or otherwise, of the complete starter largely depends.

Of the materials used, iron should be unhesitatingly rejected, its only virtue being its cheapness. Various coatings have been tried, but though they are more or less effective at first, it is usually only a matter of time for corrosion to set in.

The various alloys such as Eureka, Ferry, &c., are excellent, and are accepted by the Admiralty when wound in a specified manner. Open spirals, though giving good ventilation, are liable to short, while the practice of using asbestos tubes cannot be considered good. Asbestos is by its very nature weak mechanically, a poor insulator and very hygroscopic—three qualities which do not render it particularly suitable for this work. There is little doubt that the ideal form of resistance, where wire must be used, is the unit form, and one type in particular has been developed to a great degree

of perfection, and is now specified by the British Admiralty. Resistance units should be interchangeable and readily renewable in case of replacement being necessary.

Much has been said in praise of carbon type resistances, but the fact remains that they are, in general, used to a very small extent compared with the ordinary type of resistance, and after spending a considerable amount of money in experiments, several important firms have found good reason to decide against their manufacture.

Where possible, there is no doubt the grid resistance is the most satisfactory form; but even in this case there are several important points which require attention.

Cast-iron as generally employed should either be coppered or coated with a special heat-resisting graphite or aluminium paint, and the surfaces where contact is made at the lugs should be coppered or tinned, the latter being specified by the Admiralty.

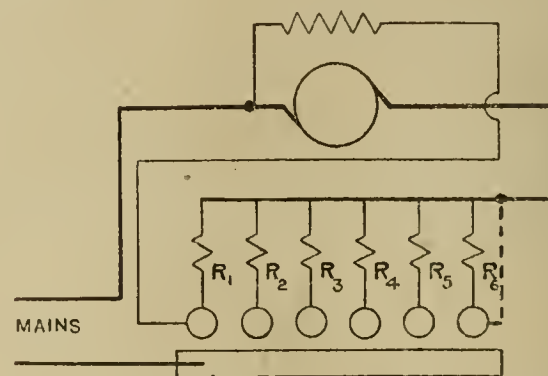
Cast-iron also suffers from the disadvantage of increasing its resistance with temperature. This increase depends on the temperature rise and composition of the iron. A usual figure is from 12 to 25 per cent. for average temperature rises.

Where frames of resistance grids are mounted one above the other, it is necessary to reduce the rating to allow for the air impinging on the upper grids being already heated from the lower banks; the following figures show the necessary reduction in the rating for various numbers of frames:—

Number of frames.					Rating.
1	...	...	...	...	1
2	...	...	...	...	'8
3	...	...	...	...	'67
4	...	...	...	...	'6
5	...	...	...	...	'54

Where heavy currents are to be carried continuously, the type of terminal used should be of ample size and substantial construction.

Mention may here be made of a method of connection for heavy currents to limit the current to be carried by the individual sections of resistance, and their switches, to reasonable figures. This is termed the parallel method, and is shown in fig. 2 as applied to a multiple-lever regulating rheostat.



$R_6$  is omitted and dotted connection inserted when used for starting.

FIG. 2.

It will be seen that the method consists of successively putting sections of resistance *in parallel* with each other instead of the more usual method of cutting *out of series*. This will be found to effect a considerable saving on large multiple-switch type starters, and, it is believed, is not generally appreciated at its true value.

In conclusion, it is proposed to indicate briefly one or two of the faults and troubles which are common to most rheostats—often, be it said, not due to any inherent defect in the design of the starter.

*Troubles on Starting Gear.*—The lot of the particular individual at a large works whose duty it is to clear up the inevitable complaints which must arise from time to time is not a happy one. This is largely due to two classes of user—(1) The man who cannot appreciate that there ever should be any reason for, say, a burn-out, and (2) the man who, while knowing full well that the cause of a breakdown is his own improper usage, yet tries to fix all the blame on the makers of the rheostat.

The most common trouble is, perhaps, burning-out or failure of the resistance portion, and as there is always a



reason for everything, it is of the first importance to find out the actual starting conditions. Although this is often difficult, it is generally worth while, and prevents a repetition of the same trouble. For instance, it may be found that a starter designed for light infrequent starting is being used for the motor driving a printing press, requiring constant "inching," and necessitating the use of the very highest class of starting gear, and a heavily rated resistance. Many instances similar to the above might be quoted, and only serve to emphasise the importance of the remarks under "Rating" above.

A second prolific cause of complaint is the harmless necessary no-volt coil, and here again if the simple precaution of ascertaining the actual maximum and minimum shunt current of the motor with which the starter is to be used, is taken at the time of ordering, there is very little chance of trouble. Where the variation in shunt current is large, the auto-spool is frequently fitted across the lines in series with a high-resistance unit, thus rendering the hold-on unaffected by the varying shunt current. This high-resistance unit is frequently the cause of trouble, and where, for instance, on 500 volts, the use of very fine wire on the unit is necessary to obtain the requisite resistance (2,000 to 3,000 ohms) it is perhaps preferable to use three 8 or 16-c.p. 220-volt lamps in series instead of a unit. The lamps have the decided advantage that they are easily replaced, and give a visible indication when current is on the motor and switchgear.

In connection with troubles with the no-volt coil, it sometimes happens that the starter arm refuses to release when pressure is removed. This is due to residual magnetism (assuming the arm is not mechanically caught) and may be cured by the fitting of a small brass pin in the spool cheek. Of course with really soft iron spool cheeks and armature, this trouble will not occur, but unfortunately *cast-iron* is often used for the cheeks on account of cheapness.

A rather interesting case was that in which a small series regulator was actually found to increase the speed of the motor (a shunt-wound machine) when all resistance was in circuit, although it was required to reduce speed by 30 per cent. The customer was naturally indignant, and, of course, quite failed to understand the true explanation. First, the actual running current was so small that the volts dropped by the regulating resistance were only about a quarter of what was required; and secondly, owing to an abnormally high shunt current, the resistance of the standard no-volt coil fitted (suitable for normal shunt-current), was sufficient to weaken the field to such an extent as to give a net increase in speed.

In addition to the above there are, of course, many little troubles, which must be dealt with individually, but it is hoped the above brief notes may serve to indicate the points to be looked for, and possibly cause one or two people to spend a little longer in the selection of a rheostat than the individual who calmly sends a wire to the nearest maker: "Send one motor-starter passenger train to-day certain," and then grumbles because he is mildly asked for at least the horse-power and voltage.

INDEX TO ARTICLES IN THE TECHNICAL PRESS.

By "INTERESTED."

THERE is nothing which causes more irritation than looking through piles of technical journals in an endeavour to trace some particular article published a few weeks earlier, which is required for reference. Invariably the issue containing the information sought is missing—some one has borrowed it, or the paper is mislaid; and, after spending perhaps half an hour looking for that which cannot be found off-hand, the telephone is requisitioned for the purpose of worrying different publishers by asking whether a certain article ever appeared in their publications, and, if so, in which number. By the time telephoning is finished the missing paper is found, or a clerk has been round to the local library or to a

business friend, and thus obtained what is wanted. This kind of thing is annoying and a waste of time, and the language used on occasions like these is often none too edifying.

A very good idea was recently brought to my notice for overcoming this kind of trouble, and I now put it forward in the hope that other readers will benefit thereby, and perhaps save publishers being worried in order to look up information, instead of receiving an order by telephone to forward a certain copy of a paper by return post straight-away.

The arrangement is simply this: an ordinary loose-leaf book—or any other form of book, for that matter—is ruled over several pages after the following pattern:—

INDEX TO PUBLISHED ARTICLES.					
Subject.	Author.	Date.	Name of journal.	Volume and No.	Tel. No. of publisher.
Left-hand page.			Right-hand page.		

At any time when one is reading, and an article appeals to the reader as likely to be handy for future reference, a note is made in the book under the headings set out. It has been suggested that a note made in the customary manner in the pocket-book would answer the same purpose, but that is a fallacy. Notes often get misplaced, especially in loose-leaf books, or destroyed or obliterated when made in a hurry with pencil, and you cannot remember how long ago the note was made. On the other hand, when you have taken the trouble to rule-up a few pages after the fashion described above, ostensibly for a single purpose, then the desired particulars can be entered at the time of reading in a spot which is always handy, and where they can always be found for reference later on without delay. It is not forgotten, and a note is not made in some out-of-the-way place in the note-book which afterwards takes a lot of finding. I have given the idea a trial, and feel quite satisfied that it is well worth the little trouble involved in ruling a page or two.

Those firms who kindly send along little pocket-books and diaries about Christmas time, might do worse than have a leaf or two at the end of their books ruled on similar lines to the pattern here illustrated.

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in Steam Turbine Practice.

By K. BAUMANN.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, January 16th, 1912.)

WHEN the British Westinghouse Co. commenced the building of Rateau turbines in 1908, it had the benefit of experience gained in the building of Parsons turbines, which already had resulted in 1903 in the use of velocity stages in the high-pressure end. The type of Rateau turbines built since 1909 is shown in fig. 1 (p. 318). The steam is admitted to the velocity wheel through nozzles fixed to nozzle boxes of cast steel, which, with the steam chest, are the only parts of the turbine subject to high pressures and high temperatures. The design of the casing and the diaphragms, in halves with only horizontal joints, allows of a very easy inspection and accessibility to the rotor, and to the interior of the turbine by lifting the top half. Due to the use of a velocity wheel, an ordinary labyrinth gland has proved to be quite satisfactory with regard to the leakage of steam, and has the advantage of greatest simplicity and reliability. The high-pressure gland is connected to the exhaust of the turbine, and is sealed against air by the well-known water gland used on the Westinghouse-Parsons turbines, which is also adopted as a low-pressure gland.

The recent development of the various steam turbines shows very clearly the tendency towards the use of the two types known as the disk and drum or Curtis-Parsons type and the Curtis-Rateau type. These must be considered the most important types at present in use, as is best shown by the fact that practically all turbine builders in this country are adopting one or the other. It is not possible to give a definite statement, that in general one is better than the other; this depends on the conditions under which the



turbine is required to work in any particular case. The reliability of the turbine will depend much more on the design of the details than on the principle on which it is constructed.

Dividing turbines into three categories:—

1. Turbines with small outputs—less than 750 KW. at 3,000 R.P.M., or 2,250 KW. at 1,500 R.P.M.
2. Turbines with moderate outputs—750-1,500 KW. at 3,000 R.P.M., or 2,250-4,500 KW. at 1,800 R.P.M.
3. Turbines with large outputs—above 1,500 KW. at 3,000 R.P.M., or 4,500 KW. at 1,500 R.P.M. :—

we can state the relative position to be as follows :—

For turbines with small outputs the disk and drum type is certainly cheaper, i.e., the disk and drum type can be made at a lower

for 3,000 R.P.M. the mean diameter would be 42 in., or for 1,500 R.P.M. 84 in.

The maximum steam quantity is proportional to the blade height. As the ratio blade height : mean diameter of last row of blades is generally less than one-fifth, the stress at the root of the blades (for drum turbines) is only half of the stress of the drum. In drum turbines, therefore, the blade height is only dependent upon the reliability of the method employed for fixing the blades to the drum.

There are methods of fixing the blading existing with which no stress is produced in any part larger than that at the root, and since this stress is of no importance, the maximum height of the blades in drum turbines is limited by other considerations ; in order to

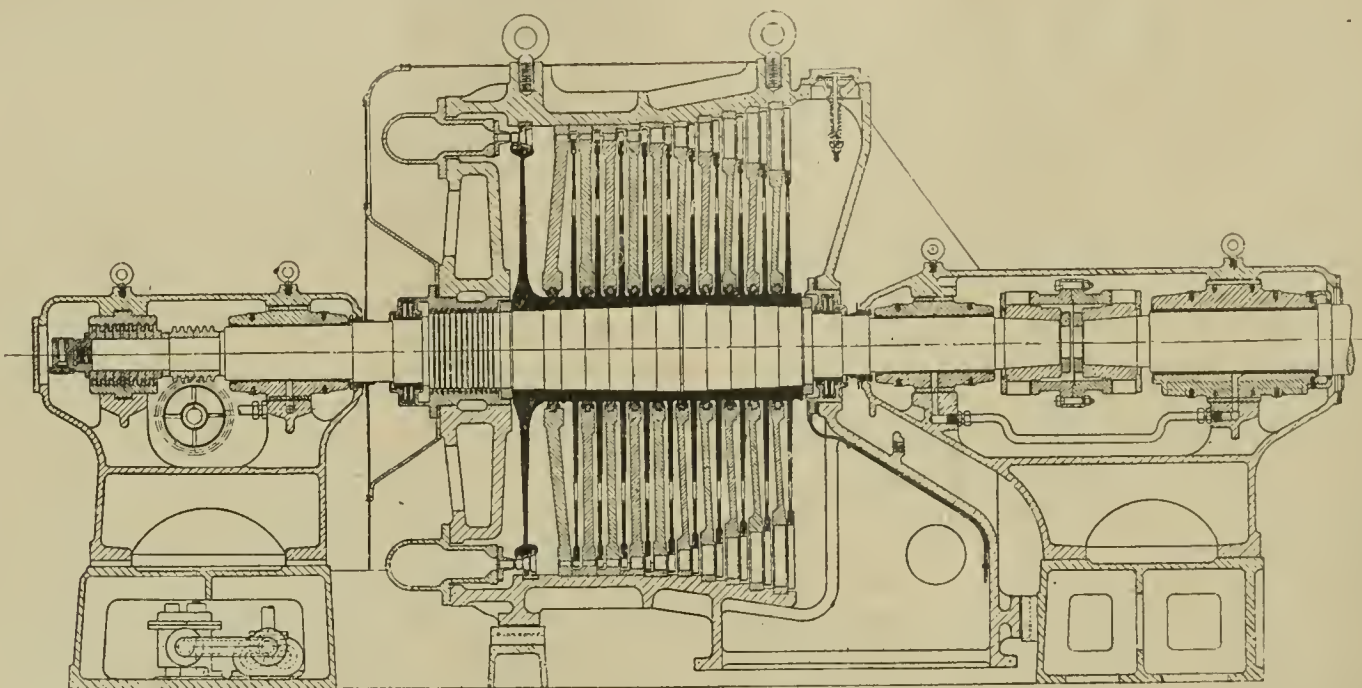


FIG. 1.—MODERN WESTINGHOUSE RATEAU STEAM TURBINE, 1910.

price for the same steam consumption, or allowing the same price for both types, the disk and drum turbine can be made with the better efficiency.

For moderate outputs the two systems are about equal with regard to economy and first cost.

For large outputs, the Curtis-Rateau turbine is the better because the disk and drum type would have to be made as a double-flow turbine, in the low-pressure part, which would increase the cost of the turbine considerably without a corresponding increase in efficiency.

In short, the drum turbine is the design for small outputs ; the disk turbine for large outputs.

The maximum output which can be obtained with a disk turbine, under the same conditions with regard to working stresses, leaving losses and vacuum, is about twice as large as the maximum output which can be obtained with a drum turbine.

The maximum output for which steam turbines can be designed depends on the maximum weight of the steam which can be passed through the low-pressure part with reasonable efficiency. The greater the steam quantity, the greater the output of the turbine.

The specific volume of the steam, and therefore the maximum output which a turbine can be designed to give, depends mainly on the vacuum, and the output is, other conditions remaining the same, about 2.83 times larger at 27 in. than at 29-in. vacuum. In order, therefore, to compare the drum with the disk turbine, as regards maximum output, we must assume the same vacuum for both.

In order to reduce the leaving loss to a minimum, the blading should be so arranged that the absolute outlet velocity from the last wheel is in an axial direction. The maximum output is proportional to the sq. root of the leaving losses. The maximum mean diameter of a turbine depends on the peripheral velocity, which itself is limited by the maximum stresses allowable.

The maximum stress in drums should not exceed one-third of the elastic limit, or about one-fifth of the tensile strength of the material, and hence the mean blade velocity should not exceed 400 ft./sec. for forged steel drums, or 465 ft./sec. for 3 per cent. Ni-steel drums.

The maximum stresses in the case of a plain rotating disk are only 41.25 per cent. of those of a drum rotating at the same peripheral speed ; or, in other words, to obtain the same stresses a plain rotating disk must be run with a peripheral speed 55.5 per cent. higher than that of a rotating ring or drum. Unfortunately disks used for steam turbines must be provided with a hole at the centre for the purpose of fixing them on to the shaft, and the tangential stress near the periphery of the hole is increased to double the stress in a solid disk without a hole. This means that a disk with a very small hole is only very little stronger than a ring rotating with the same peripheral velocity.

A plain disk with a hole in the centre, is not, however, strong enough for turbine work, and it is therefore necessary to increase its strength, by strengthening the disk near the periphery of the hole by a boss, and increasing the thickness of the disk towards the centre in order to obtain as nearly as possible a disk of uniform strength.

Mild steel disks equal in strength to plain disks, as used in practice, can be run at a peripheral velocity of 555 ft./sec., so that

keep the difference of the peripheral speeds at the root and at the top of the blades within practical limits it is not advisable to increase the blade height above one-fifth of the mean diameter, as already pointed out.

The blade height which can be used in disk turbines is dependent upon the stress at the root of the blade, and taking the maximum blade height of Rateau turbines to be one-fifth of the mean diameter, the maximum output is proportional to the square of the diameter.

For a given number of revolutions of the turbine, the diameter is proportional to the peripheral speed and the output, and for the same stress in disks and drums, other conditions remaining the same, a disk turbine can be built having twice the maximum output of a drum turbine.

The fact that some makers have recently begun to use solid drums, which would theoretically be stressed only to the same figure as disk turbines, does not alter the above statement with regard to relative capacity, because it is unsafe to run solid drums at a higher peripheral speed than ordinary drums. This is due to small faults in their interior which it is quite impossible to detect, and which it has been shown increase the calculated stresses to more than double. Both the disk and the ordinary drum construction have the advantage of allowing inspection to be made of each part, thus ensuring that the material is homogeneous throughout.

The maximum output of a disk turbine, being proportional to the square of the diameter is—for a given permissible stress—inversely proportional to the square of the revolutions per minute.

In practice, however, it is not advisable or necessary to stress the material in large turbines to the same extent as in small turbines, so that the relation between speed and output may be taken as follows :—

Maximum output for 1,500 R.P.M., three times larger than for 3,000 R.P.M. ; for 1,000 R.P.M., five times larger, and for 750 R.P.M., eight times larger than for 3,000 R.P.M.

As the stresses are proportional to the square of the diameter for a given speed, it follows that, other conditions remaining the same, the maximum output is proportional to the tensile strength of the material.

The maximum output is effected in the same way by the decrease of stress obtained by improving the disk and blade shape.

For a given turbine of, say, 42 in. mean diameter, running at 3,000 R.P.M., the maximum output only depends on the vacuum and the leaving losses. The relations between these quantities have been plotted in fig 2 in the calculation of which the following figures were assumed :—

Initial pressure	...	...	= 180 lb./sq. in. gauge.
Superheat	...	...	= 150° F.
Turbine efficiency	...	...	= 70 per cent.
Generator efficiency	...	...	= 94 per cent.

The question of the maximum outputs which can be obtained with the different types of turbines becomes very important in view of the great increase in the maximum capacities of turbo-alternators during the last three years. This is mainly due to the rapid development of the impulse turbine, the high costs of which for



small outputs and great economy for large outputs have caused the manufacturers of these turbines to introduce designs of turbo-generators suitable of giving very large outputs at relatively high speeds. Whereas four years ago 1,000 kw. was considered a very large output for 3,000 R.P.M., manufacturers are at present prepared to go up to 3,000 kw., and even higher, for this speed. The increase of the output of turbo-alternators has been more rapid in the United States and on the Continent than in this country. For

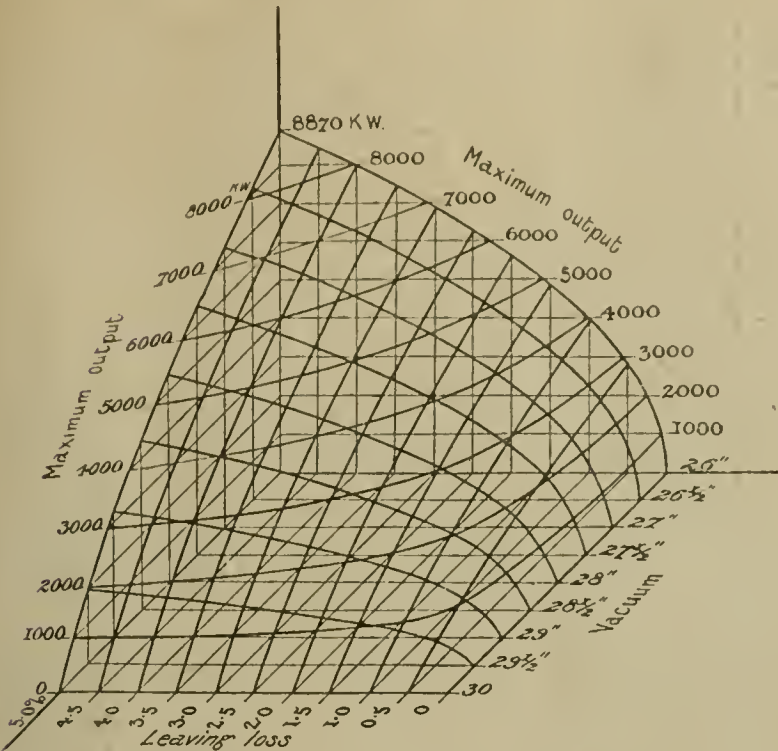


FIG. 2.—MAXIMUM OUTPUT OBTAINABLE FROM DISK TURBINES.

example, the American Westinghouse Co. recently built 5,000 K.V.A. running at 3,600 R.P.M., and 15,000 kw. maximum rating at 1,800 R.P.M. The A.E.G. Co. is reported to have in work 15,000 K.V.A. at 1,000 R.P.M., and Siemens-Schuckert works 4,000 K.V.A. at 3,000 R.P.M.

In the design of steam turbines a most important factor is the critical speed of the shaft. In this matter the disk type of turbine has a very considerable advantage over the drum, in that its critical speed can be calculated with ease and certainty.

The first turbines of the Rateau and Zoelly type were made with a flexible shaft, i.e., the normal speed was above the first critical speed. At one time there was even a tendency to neglect the critical speed altogether, as it was found that turbines, if properly balanced, could, under normal conditions, be run very satisfactorily even at the critical speed. Unfortunately, it was soon found in commercial running, when abnormal conditions are bound occasionally to occur, that if the shaft were deflected—as, for instance, when water is carried over with the steam—it remained deflected, because it was running at the critical speed.

The question of the critical speed is of the first importance when using the three-bearing design, which is becoming more generally adopted for small turbines.

The critical speed of a shaft is usually defined as that speed at which a very small eccentric mass will cause the shaft to deflect to a very great extent. It can be demonstrated that this speed coincides with the natural frequency of vibration of the shaft, and also that it is that speed at which any accidental deflection of the shaft results in a centrifugal force due to its rotation about its position at rest, sufficiently large to maintain this deflection.

If only one weight be used there is but one critical speed, and as the speed is raised above this the running becomes steadier. Extensive use of this fact has been made by De Laval in his single-wheel turbine, in which, in order to reduce vibration, the running speed is seven times greater than the critical speed.

If more than one weight be used the shaft will have critical speeds of higher frequency, and in the case of shafts with uniformly distributed loads there are theoretically an infinite number of critical speeds, of which, however, only the first, second, and, in exceptional cases, the third and fourth, are of practical importance.

It is very important to know the second critical speed of shafts running above the first, because it is essential that the running speed be sufficiently removed from both the first and the second, in order to reduce the vibration to a small amount. Also, it is very often impossible to calculate the critical speed with absolute accuracy, and, consequently, it should be made a standard practice to have the running speed at least 30 per cent. above or below any critical speed.

Steam turbines are generally governed by a throttle valve, which is connected to a mechanical governor either directly or indirectly by means of a steam or oil relay.

Direct governing, which has been adopted from steam engine practice, is very satisfactory for small turbines, provided the valves are absolutely balanced; for larger turbines, steam relays with pulsating motion have been used, but now nearly all manufacturers of steam turbines use oil relays, and this is undoubtedly the most satisfactory arrangement. In the case of combined turbines, governing by cutting out nozzles improves the economy at partial loads.

It has been stated that a disadvantage of the combined turbine is that it must be provided with nozzle cut-out governing at partial

loads, in order to obtain satisfactory consumption at these loads. This, however, is not so, as there is, of course, no reason why ordinary throttle governing should give less satisfactory results at partial loads with combined turbines than with "pure" types of turbines. Automatic nozzle control complicates the governing mechanism to such an extent that it should only be adopted in exceptional cases, where turbines are run for a considerable length of time at low loads and where the loads may change rapidly. In most cases ordinary throttle governing is preferable, as the small improvements obtainable with nozzle cut-out governing (2 per cent. at  $\frac{3}{4}$  load, 4 to 5 per cent. at  $\frac{1}{2}$  load) do not justify the additional complication in the governing apparatus. The practical difficulties of automatic nozzle control are due not to the necessity of arranging valves in front of the nozzles, but to the complicated gear required to operate the valves, which latter must be reasonably tight when closed. These difficulties do not exist when hand-operated valves are used, and in most cases these meet the requirements.

The steam turbine is the machine for large outputs, and it has during the first half of the last decade superseded the steam engine for outputs above 1,000 kw. The recent improvements in steam turbines, which resulted in the adoption of the combined types, have still further reduced the minimum output at which a steam engine is more advantageous than a steam turbine. Units of 500-kw. capacity are now usually ordered as turbines, and even 250-kw. turbines are able to compete successfully with the best modern steam engines. In countries, as, for instance, the United States, where the cost of coal is of secondary importance, there is a tendency to adopt turbines for even the smallest outputs. For small units, generally the pure Curtis types with only a single wheel are used. These are also used very successfully for special purposes, as, for instance, the driving of condenser and high-lift pumps.

The developments which have taken place during the last five years show an improvement not only in high-pressure condensing turbines as used for power stations, but also a tremendous increase in the application of turbines to all possible industrial purposes. This has involved the manufacture of new kinds of machines known as low-pressure, mixed-pressure, back-pressure and reducing turbines.

The great importance of low-pressure turbines was first pointed out by Prof. Rateau, who invented the Rateau steam accumulator, which is really a necessary accessory for low-pressure installations.

The Rateau accumulator allows low-pressure steam at a constant or approximately constant rate to be taken from a machine which is working intermittently. If the available low-pressure steam quantity is always sufficient for the output required, the installation of a low-pressure turbine is quite satisfactory; if for short periods no low-pressure steam is available, high-pressure steam must be reduced and passed into the low-pressure steam main. If, however, this occurs for long periods, or if the low-pressure steam quantity is not sufficient to produce the power required from the turbine, the losses due to throttling high-pressure steam to below atmospheric pressure are too large. In such cases, which represent the normal condition, the installation of a mixed-pressure turbine is necessary.

The main application of low-pressure turbines is at present in connection with steam engines in existing power stations. Engines previously run condensing are changed to run non-condensing, and allowed to exhaust into a low-pressure turbine, the alternator of which is coupled electrically to that on the steam engine, so that engine and turbine form one set.

This arrangement is very economical, providing the normal output of the combined set is increased at least 50 per cent. above that of the engine alone. Usually the combined set is arranged so that the normal full load of the engine alone when exhausting against a back pressure of about 16 lb. per square inch absolute is kept the same as before, the low-pressure turbine utilising the exhaust steam coming from the engine. It is advisable to pass the exhaust steam from the engine through an oil separator, which acts also as a water separator. The additional output which can be obtained from the low-pressure turbine depends mainly on the vacuum. The improvement in economy is much larger in cases where river or sea water is available for cooling water than in cases where cooling towers are necessary. At partial loads the back pressure on the steam engine drops below atmospheric pressure; it is therefore essential to steam-seal the glands on the low-pressure cylinders of the steam engine in order to reduce air leakage to an absolute minimum and to secure the highest possible vacuum.

The following figures are based on the average conditions which usually occur in these combined plants in the case of compound engines.

The steam consumption of the engine running non-condensing will be about 35 per cent. (30 per cent. to 40 per cent.) greater than when running condensing. The exhaust steam from the engines will give an additional output in a low-pressure turbine of:—

61	per cent. of the output of the engine at 27-in. vacuum,
70	" " " " 28 " "
81	" " " " 29 " "

and the steam or coal consumption would be:—

For 27-in. vacuum:	$1.35/1.61 =$	84	per cent. of the original steam consumption
" 28 " "	$1.35/1.70 =$	80	" " "
" 29 " "	$1.35/1.81 =$	75	" " "

As the turbine is electrically coupled to the engine, no special governing of the turbine is required. For starting and paralleling generally, high-pressure steam is required, which is either regulated by hand or by a mechanical governor. It is not necessary to provide a reducing valve, as the steam pressure in the low-pressure turbine will not be higher than atmospheric pressure, due to the very large areas through the blading of the turbine.



A low-pressure turbine is simply a high-pressure turbine with the first wheels taken off.

Mixed-pressure turbines are high-pressure turbines with an additional inlet for low-pressure steam, or low-pressure turbines with additional high-pressure stages to utilise high-pressure steam in case the available low-pressure steam quantity is not sufficient for the load required. They are generally used in collieries and rolling mills, utilising low-pressure steam coming from different kinds of engines, which are exhausting against a back pressure of about 16 lb. per sq. in. absolute, through steam accumulators.

A section through a mixed-pressure turbine consisting of one velocity wheel and one Rateau wheel in the high-pressure part and five Rateau wheels in the low-pressure part is shown in fig. 3.

Mixed-pressure turbines are not generally connected electrically with the steam engines from which the supply of low-pressure steam is obtained, and must therefore be separately governed by a speed governor. In order to obtain satisfactory running in parallel with other engines, it is essential that the load of the turbo-set be independent of the steam conditions, which means that the speed of the turbine must be only dependent upon the load of the alternator, and independent of the low-pressure steam quantity available. The change in speed, when changing from high-pressure steam to low-pressure steam or *vice versa*, must therefore be as small as possible. These conditions were first realised by Prof. Rateau, who invented a governor fulfilling these conditions, which is now applied by nearly all the manufacturers of mixed-pressure turbines.

The present importance of the mixed-pressure turbine for this country is best illustrated by the fact that nearly 40 per cent. of the turbines ordered are of the mixed-pressure type.

In the case of low-pressure turbines the maximum outputs obtainable depend more on the turbine than the alternator, which is the reverse of the conditions obtaining in the case of high-pressure turbines.

Back-pressure turbines exhaust against a pressure above atmospheric pressure. Turbines which run non-condensing exhausting into free atmosphere are also included in this class.

The exhaust steam is generally used for heating purposes, as, for instance, in ships for heating the feed water or in mills for heating water in open pans, or in salt works for evaporating brine.

surplus steam is by-passed to low-pressure wheels, which are fixed on the same shaft and placed in the same cylinder.

The full-load consumptions and total efficiencies of the most important turbines are given in the following list:—

No.	Manufacturer.	Year of test.	kW.	Revs. per min.	Lb. per kW.-hour.	Total efficiency.
1	A.E.G. ... ..	1906	3,000	1,500	12.75	63.8
2	C. A. Parsons ... ..	1907	3,500	1,200	13.35	62.7
3	{ Westinghouse Machine Co. }	1907	7,500	750	15.00	66.3
4	Brown-Boveri & Co. ...	1907	3,500	1,360	13.70	64.8
5	Escher, Wyss & Co. ...	1908	5,000	1,000	15.17	63.1
11	A.E.G. ... ..	1909	4,000	1,500	11.92	63.8
12	El. Maschinenfabrik ...	1910	3,500	1,500	14.07	64.8
14	{ Maschinenfabrik Augsburg-Nürnberg }	1910	2,500	1,500	15.50	64.5
18	B.T.H. ... ..	1911	3,000	1,500	15.96	64.7
21	Escher, Wyss ... ..	1910	4,000	1,000	13.30	64.4
22	Escher, Wyss ... ..	1910	2,000	3,000	13.03	66.0
25	Oerlikon ... ..	1911	3,000	1,500	11.62	64.1
26	British Westinghouse...	1911	3,000	1,500	13.72	63.9
27	British Westinghouse...	1911	5,000	1,500	13.00	67.9
28	Richardsons, Westgarth	1910	6,250	1,200	11.90	68.4

From this list it will be seen that the steam consumption has been improved from 12.75 lb. per kW.-hour in 1906 to 11.6 lb. per kW.-hour in 1911; and the total efficiency—

Actual output of generator

Mechanical equivalent of heat drop according to adiabatic expansion from 63.8 per cent. in 1906 to 66.3 per cent. in 1907, and 68.4 per cent. in 1910. This figure has not been improved upon in 1911.

The best efficiency on mixed-pressure turbines running on low-pressure steam has been obtained on a 1,000-kW. turbine running at

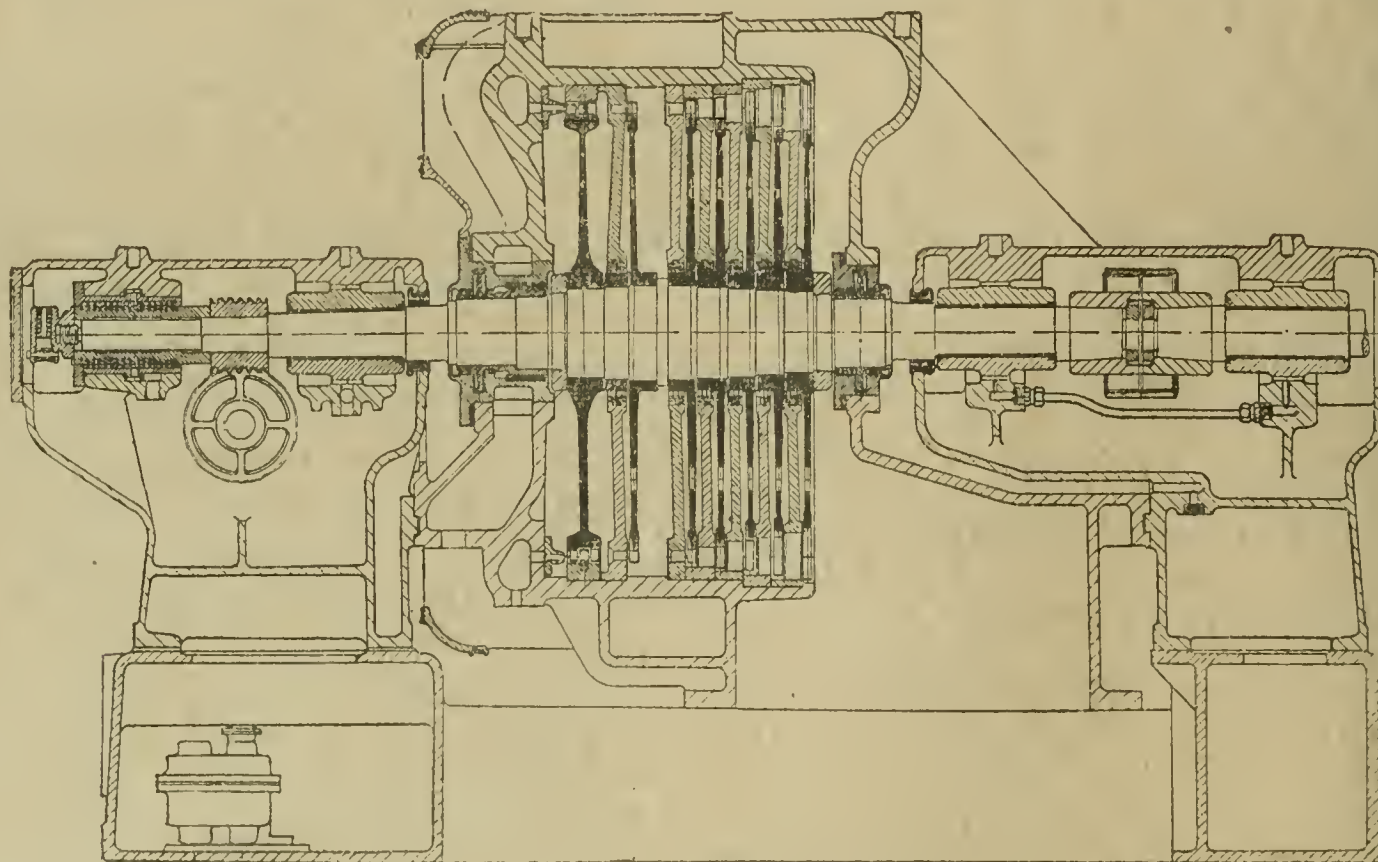


FIG. 3.—MIXED-PRESSURE TURBINE. THE BRITISH WESTINGHOUSE CO., 1910.

The governing of these turbines may differ according to the conditions prevailing. When all the steam is required for heating purposes, independent of the load, an ordinary speed governor is used, opening or closing a high-pressure throttle valve according to the load required. When, on the other hand, the turbine is required to work in parallel with other engines, and is intended to utilise only that amount of steam required for heating purposes, it need not be provided with a speed governor at all, the steam being controlled by the pressure in the heating steam pipe. If more heating steam is required, the pressure in the heating steam main decreases, and this change of pressure can be used to open the governor valve in a similar manner to that used for reducing valves.

Neither of the two methods is quite satisfactory in all cases. If, in the first case, more load is required than that obtainable from the heating steam available, steam must be passed through the turbine and blown into atmosphere. This represents a great loss, as this steam could be utilised in a low-pressure turbine. The second method is absolutely satisfactory in this respect, but it is necessary that the machine be run in parallel with other engines, the load of which is changed according to the heating steam quantity required.

An absolutely satisfactory arrangement can be obtained by the use of reducing turbines. In case the load of the turbine is more than that obtainable from the heating steam quantity required, the

3,000 R.P.M., made by the British Westinghouse Co. The efficiency realised in this case was 69.8 per cent.

The efficiency of a steam turbine is the ratio:—

Actual work done on turbine shaft

Mechanical equivalent of heat drop according to adiabatic expansion

This ratio is referred to wherever efficiency is mentioned in the following discussion. In order to compare the merits of different steam turbines, the efficiencies as obtained above are usually calculated and compared. This, however, does not provide a rational basis of comparison, as the efficiency of a turbine is itself dependent upon the steam conditions. The author has adopted standard steam conditions to which the performances of all turbines can be reduced by applying proper corrections. These standard conditions are:—

For high-pressure turbines, 180 lb. per sq. in. pressure, 150° F. superheat, 28 in. vacuum (30 in. bar.).

For low-pressure turbines, 16 lb. per sq. in. absolute pressure, 0° F. superheat, 27½ in. vacuum (30 in. bar.).

According to our present knowledge the corrections to be made for superheat are independent of steam pressure and vacuum, and are therefore the same for high, low, and approximately for back-pressure turbines.

The corrections are as follows:—1 per cent. improvement of steam consumption of every 10° F. superheat. Between 0° and



100° F. superheat; for every 12° F. superheat between 100° and 200° F. superheat; and for every 14° F. superheat between 200 and 300° F. superheat.

The efficiency increases with the superheat, and consequently the actual is larger than the theoretical correction, which is calculated from the variations of the available heat drop in adiabatic expansion.

The improvements in efficiency may be taken as 4.25 per cent. better efficiency at 100° F. superheat, 6.75 per cent. at 200° F. superheat, and 7.5 per cent. at 300° F. superheat, than for dry saturated steam.

The corrections given have been deduced from a large number of tests made on impulse turbines; they are probably too large for pure Parsons turbines, which are unable to utilise high superheat to the same extent as impulse or impulse reaction turbines.

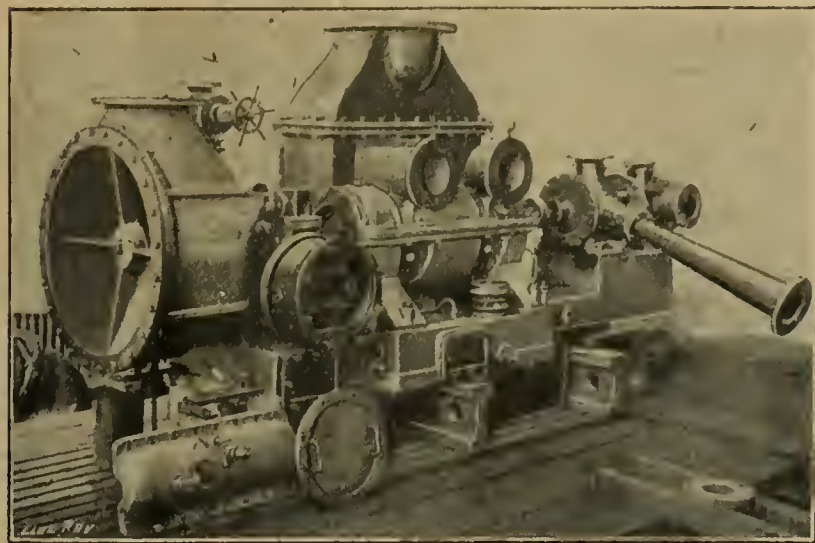


FIG. 4.—WESTINGHOUSE TURBINE-DRIVEN AUXILIARY PUMPS.

Tests have shown that when the steam is wet the efficiency is reduced. Assuming that the efficiency follows a continuous curve for superheated and wet steam when plotted with entropy as a basis, the efficiency will change by 1 per cent. for each 1 per cent. variation in wetness. It follows, therefore, that the steam consumption measured as condensed water will be 2 per cent. higher for each 1 per cent. increase in moisture.

The efficiency of a turbine using and designed to use a very high vacuum will not be so good as that of a turbine of quite similar type, having the same number of stages, but designed to utilise a lower vacuum. The difference will be slightly larger for drum than for disk turbines, as the latter can be designed to use a higher vacuum to greater advantage than the former.

The average theoretical corrections obtained by considering the adiabatic heat drop available may be taken as 5 per cent. improvement of steam consumption for 1 in. between 26 and 27 in. vacuum; 6 per cent. between 27 and 28 in.; 7.75 per cent. between 28 and 28½ in.; and 11.5 per cent. between 28½ and 29 in. vacuum.

The actual improvement which can be obtained with the present design of impulse turbine is 4 per cent. between 26 and 27 in., 5 per cent. between 27 and 28 in. and 6 per cent. between 28 and 29 in. vacuum.

According to these figures the efficiencies of equivalent turbines with the same number of stages using and designed to utilise different vacua would be:—

1 per cent. better efficiency at 26 in. than at 27 in.	
1       "       "       27       "       28       "	
1       "       "       28       "       28½       "	
2.5     "       "       28½     "       29       "	

These figures represent a very fair average for any steam conditions between the limits of steam pressure, 100 lb. to 200 lb. per sq. in. gauge and superheat 0° F. to 300° F.

Whereas the superheat correction is nearly independent of the other steam conditions, the vacuum correction depends to a great extent upon the steam pressure, and is very much larger for low-pressure turbines. The average theoretical corrections for these are:—

12 per cent. improvement of steam consumption for 1 in. between 26 and 27 in.; 13.75 per cent. between 27 and 28 in.; 17 per cent. between 28 and 28½ in.; and 22.5 per cent. between 28½ and 29 in.

The actual improvements which can be obtained with the present design of low-pressure impulse turbine of similar construction, but increased number of stages for higher vacuum, are:—

11.5 per cent. improvement of steam consumption for 1 in. between 26 and 27-in. vacuum; 13 per cent. between 27 and 28 in.; and 14.5 per cent. between 28½ and 29-in. vacuum.

According to these figures, turbines using and designed to utilise different vacua give efficiencies as follows:—

0.5 per cent. better efficiency at 26 in. than at 27 in. vacuum	
0.7     "       "       27     "       28     "	
1.0     "       "       28     "       28½     "	
3.5     "       "       28½     "       29     "	

The corrections given represent a very fair average for any steam conditions between the limits: 14 lb. per sq. in. absolute, 0° F., and 18 lb., 100° F.

The efficiency which can be obtained with turbines having the same number of stages depends also, but in a lesser degree, upon the

steam pressure. When the steam pressure is low not only are the leakage, ventilation and friction losses in the turbine smaller, but the blading efficiency increases as the total heat drop decreases.

The average theoretical corrections are as follows:—

2 per cent. improvement in steam consumption for 10 per cent. increase of pressure between 100 and 140 lb. per sq. in. gauge; 1.95 per cent. between 140 and 180 lb.; and 1.90 per cent. between 180 and 200 lb. per sq. in. gauge.

The actual improvement in steam consumption which can be obtained with the present design of impulse turbine is 1.5 per cent. for 10 per cent. increase of pressure between 100-200 lb. per sq. in. gauge.

According to these figures equivalent turbines having the same number of stages, using and designed to utilise different pressures, would give improved efficiencies as follows:—

0.4 per cent. better at 180 lb. per sq. in. than at 200 lb. per sq. in. gauge; 0.6 per cent. better at 140 lb. than at 180 lb.; and 1.9 per cent. better at 100 lb. than at 140 lb. per sq. in. gauge.

These corrections are a very fair average for any steam conditions between 0° F. superheat, 26-in. vacuum, and 300° F. and 29-in. vacuum.

The range of pressure met with in low-pressure turbines is so small that the pressure correction for thermo-dynamic efficiency is negligible. The average consumption correction is 4 per cent. improvement for 10 per cent. increase of pressure between 14 and 18 lb.

These figures may be taken as a fair average between the limiting steam conditions, 0° F. superheat, 26-in. vacuum, and 100° F. superheat, 29-in. vacuum.

The corrections we have already considered refer to the steam consumptions of turbines utilising steam conditions for which they have been specially designed, and are of the greatest importance to the purchaser when fixing the steam conditions under which turbines have to work.

The most economical speed for small low-lift pumps and high-lift pumps is too high for reciprocating engines, and it was therefore necessary to drive these either by belt, gearing, or by means of electric motors. The advent of the steam turbine, however, made direct coupling possible, but it necessitated the further development in these pumps so that the speed might be sufficiently high to enable a reasonably efficient turbine to be built at a competitive price.

The advantages of steam-driven pumps are often of great importance in the case of pumps used for condensing plants. A view of such a group for a surface condenser is given in fig. 4, which shows a turbine on a overhung shaft driving a centrifugal

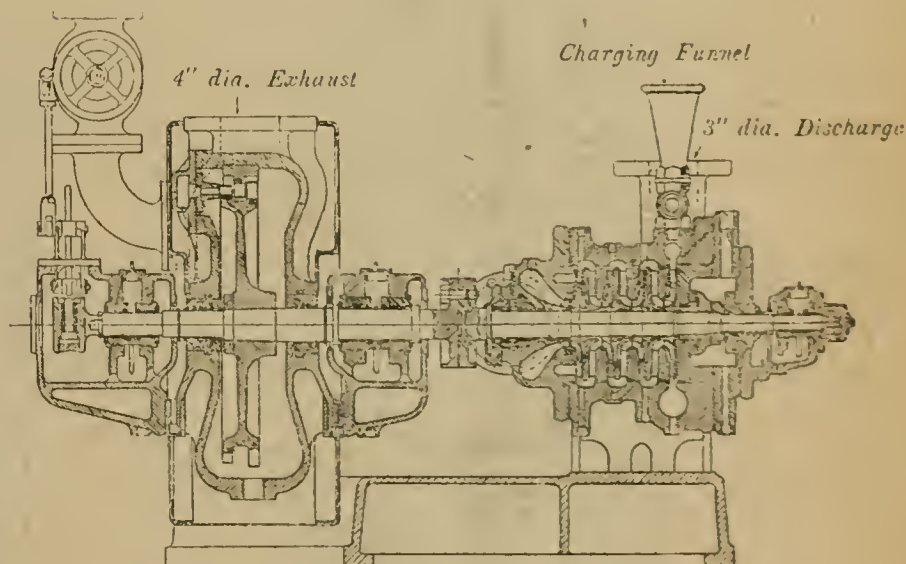


FIG. 5.—TURBINE-DRIVEN BOILER FEED PUMPS.

pump with two double-flow impellers of the helico-centrifugal type, a rotary air pump of the Le Blanc type, and an extraction pump consisting of one double-flow impeller.

This set, which is running at 2,500 R.P.M., is used in conjunction with a 3,000-KW. mixed-pressure turbine for a full-load steam quantity of 80,000 lb. per hour.

A section of a horizontal turbine driving a boiler feed pump running at 4,000 R.P.M. is shown in fig. 5.

#### Association of Mining Electrical Engineers.

A MEETING of the East of Scotland Branch was held at Edinburgh on Saturday last, when an interesting paper was read by MR. R. H. WILLIS, British Electrical Plant Co., Alloa, on "The Mechanical Design of Electrical Plant usually found in Collieries." He said that all electrical plant which was to be used in collieries should be characterised by extreme robustness. Undoubtedly it would pay in the long run to install a machine with the heaviest shaft, longest bearings and stiffest brush gear. This was particularly the case with regard to three-phase machines where, of necessity, clearances between the rotor and the stator were small, and consequently no undue deflection could be allowed on the shaft. In such a case, also, the length of the bearings was of importance. Two methods were adopted to get over the trouble in fairly large machines. The first was to mount the rotor in bearings inde-



pendent of the end frame, and these bearings could then be packed to compensate for any wear that might take place. The second arrangement was to have adjusting screws in the end frames so that the latter could be raised and lowered in relation to the stator as might be required. Oil flinging was one of the most most fruitful sources of trouble in connection with electrical machinery. It was difficult to account for this, as frequently he had seen two machines identically alike, made from similar stock parts, and running at the same speed, the one throwing oil badly and the other perfectly dry. All the same, the general lines to be adopted to prevent this trouble comprised a large oil flinger of either one or two ridges, with a capacious bell mouth coming well down to the shaft, and with large overthrow drains to permit the oil to run back into the oil well. In cases where machines were provided with fans it would be often found, in spite of the above precautions, that the oil was sucked out of the bearing by the fan. In this case it became necessary to provide an additional cap over the bell mouth, absolutely closing it.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Mazda Traction Lamps.

The strength of the Mazda drawn-wire lamp has greatly extended its field of use; it has been demonstrated that it can be operated satisfactorily even under the severe service conditions on battleships under target fire, and the fact that these lamps are suitable for use on electric tramways instead of the ordinary carbon lamps has been verified by tests on the part of a number of leading tramway companies, who have found them give satisfactory results. The BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, E.C., have therefore standardised a line of Mazda traction lamps, which are supplied in a nominal rating of 30-C.P. 35-watt, and 30-C.P. 40-watt, all rated at an efficiency to give a length of life that is economical for the conditions of tramway power costs. These lamps



FIG. 1.—MAZDA TRACTION LAMP.

are supplied for series burning, so as to operate in the standard arrangement of five lamps in series for railway voltages of 500-volt, 550-volt or 600-volt. The marked improvements in energy consumption amounting to about 70 per cent., render these traction lamps an economical substitute for the old type of lamp.

### Bosch Force Feed Lubricator.

This is a new form of mechanically driven oil pump for force feed lubrication, and is adaptable to all kinds of high and low-speed engines, machine tools, &c. The action of the lubricator is positive, and the oil which is forced into the tube by the pump must, under all circumstances, reach the point where the lubrication is required. A separate set of pumps is provided for each oil supply. Each arrangement consists of a pump body, valve and pumping piston, the suction and pressure actions for each section being permanently connected with the pump body. It works equally well in either direction of rotation, and can be arranged for rotary drive or oscillatory drive as desired. The pumps are driven by a worm drive, which is transmitted direct without any other gearing; all the pumps are mounted to a common centre, and are brought successively into operation by

means of two small inclined disks mounted on a vertical shaft, one disk operating the valves and the other the pump plungers. The various feeds can easily be adjusted, and the whole pump body can be removed completely from the tank for inspection or replacement by removing a few screws.

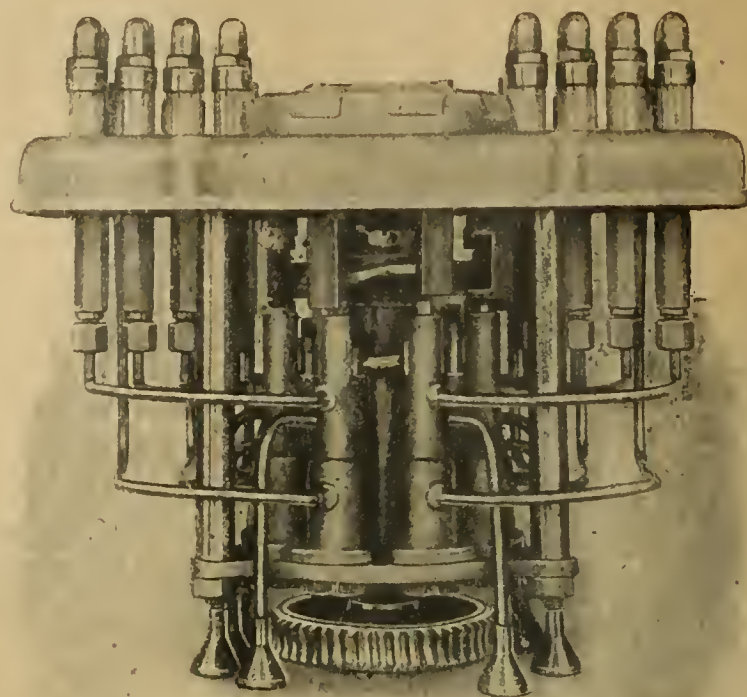


FIG. 2.—BOSCH FORCE FEED LUBRICATOR.

There are no springs and no intricate mechanism in this type of lubricator, which is substantially made, so that there is no likelihood of its getting out of order. All adjustments are made from the outside of the tank. The oil feed is absolutely positive, and the lubrication is, of course, in proportion to the speed with which the lubricator is driven.

The accompanying illustration shows the pump body removed from the tank; the separate strainers, pumps, disks, sight feeds, &c., can readily be seen. The pump is made by the BOSCH MAGNETO CO., LTD., 40, Newman Street, W.

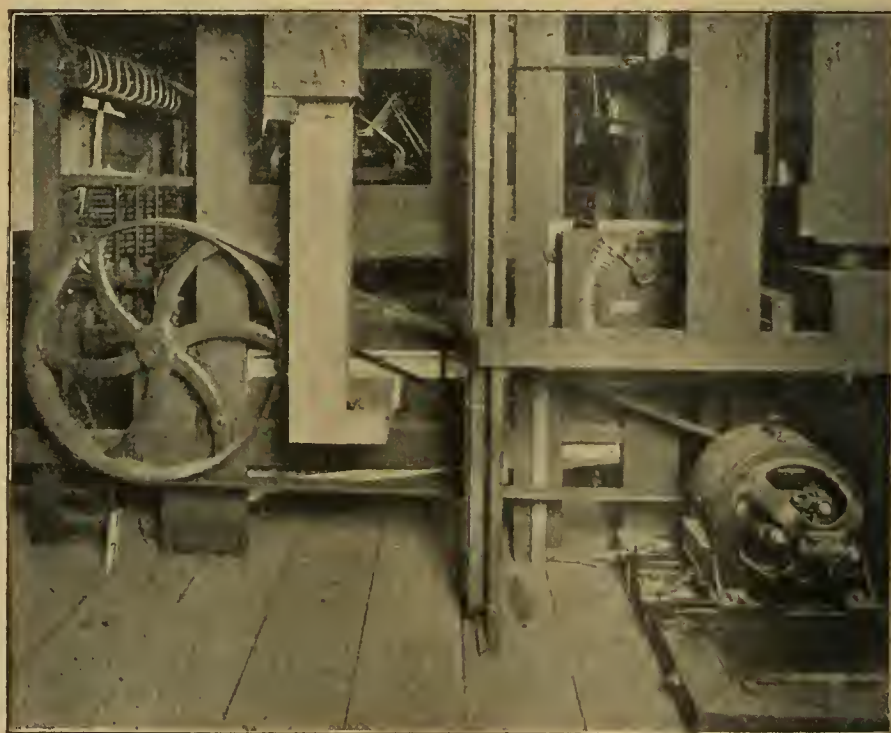


FIG. 3.—MARPLES ELECTRIC ORGAN-BLOWING EQUIPMENT.

### An Electric Organ-Blowing Equipment.

Visitors to Reinhardt's production of the "Miracle," at Olympia, will have been impressed by the effective organ, which has been erected by the well-known organ builders, Messrs. Brindley and Foster, of Sheffield and London, and it is interesting to note that the instrument is provided with an electric organ-blowing equipment, controlled by the Marples patent regulator. As will be seen in fig 3, this consists of a low-speed D.C. motor, running at approximately 200 R.P.M., connected by means of a belt to a 36-in. diameter pulley on a three-throw crankshaft, which, in turn, drives three wedge-shaped feeders.

The motor is mounted practically within the organ case, and is absolutely silent in working. The speed of the motor is regulated by means of the radial multiple-contact starting and regulating device shown in the illustration. The arm is connected by means of a chain to the top of the main reservoir, and is so arranged that when the reservoir is full the motor automatically stops. As the wind is used the motor will increase its speed or slow-up automatically, always keeping the bellows full.

The Marples patent regulator provides not only the regulating



stops, but also a sufficient number of starting stops, so that an additional motor-starter is not required. The only apparatus which the organist has to operate is a single-pole switch placed in a convenient position at the keyboard. This type of controller has been fitted already in over one hundred churches, public halls, &c., and is supplied by the ADNIL ELECTRIC CO., LTD., Artillery Lane, London, E.C.

#### Simplex Hand Lamp.

In addition to the question of a substantial hand lamp which complies with the various requirements laid down by the Home Office for use in factories, there is a large demand for a type which prevents unauthorised removal of the electric lamp itself from the handle carrying it. As is well known, the Home Office Regulations have been laid down with a view to preventing the user of the lamp from receiving a shock which might prove dangerous, and which has been known to be fatal. Both these objects are effected in a new form of hand lamp now being put upon the market by SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, and illustrated in section in fig. 4. It is of substantial construction, with a handle made of insulating material. The lamp-locking device is arrived at by means of a screwed bush *b*, into which the

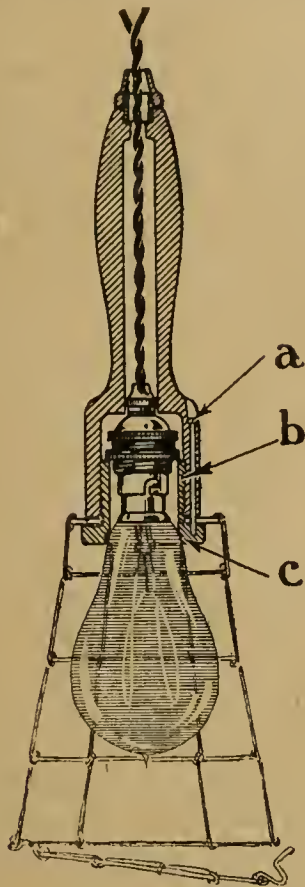


FIG. 4.—SECTION OF SIMPLEX HAND LAMP.

lamp and an ordinary shade carrier and cord grip-holder are fitted in the manner shown. When the shade ring is screwed down tightly on to the upper end of the bush, obviously the lamp will be locked; the whole is then screwed into the handle of the lamp. To take up any uneven expansion and contraction due to heating, an asbestos washer is fitted round the screwed bush at *c*; the bush and the handle of the lamp are locked by means of a pin inserted in a slot at *a*, so arranged that the pin itself can be sealed when once in position, and therefore rendered safe from interference on the part of any unauthorised person. The whole arrangement is simple and effective, and is well calculated to prevent thieving.

#### The "Glareguard."

For very many purposes a strong local illumination is necessary, and is best obtained by lowering a pendant or bracket electric lamp to a distance of a couple of feet above the work in hand; but this



FIG. 5.—THE "GLAREGUARD."



FIG. 6.—"GLAREGUARD" IN USE.

has the very objectionable result that the user's eyes are then subjected to the glare of the lamp, and it is a very common thing for a strip of paper to be stuck on the edge of the shade to shield the eyes, giving a very untidy effect. To remedy this drawback, the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have introduced a neat little device called the "Glareguard" (fig. 5), which can be used with any existing shade or fitting; it consists simply of a cardboard shield, green outside and white inside, attached by a jointed brass frame

to a collar which is fixed on the lampholder with the aid of the shade-carrier, as shown in fig. 6. It is readily adjustable to the most comfortable position, and should prove a most popular and beneficial device.

#### "Slipon" Shade Carrier.

An extremely neat solution of the problem of fixing shades on lampholders has been arrived at by MESSRS. JACKSON BROTHERS, of 37A, Woodgrange Road, Forest Gate, London, E. It consists simply of a brass ring with spring claws, which is pushed on the barrel of the holder after the shade has been put in place. The ring and its application are illustrated in figs. 7 and 8. It might be thought at first sight that the fastening would be insecure; this, however, is quite a mistake. When the barrel is screwed for the nut usually employed (which is, of course, dispensed with in this case), the claws grip the thread so firmly that quite a vigorous pull is required to remove the ring, a fact which we have personally verified: and even where the barrel is not threaded, the frictional grip is said to be ample to sustain the shade. But, in addition to this, another safeguard is provided, for when a lamp is in the holder, the pins of the bayonet socket project through the slots sufficiently far to render it impossible for the ring to be removed. Thus the device is suitable for use even where there is considerable vibration, as, for



FIG. 7.—"SLIPON" SHADE CARRIER.

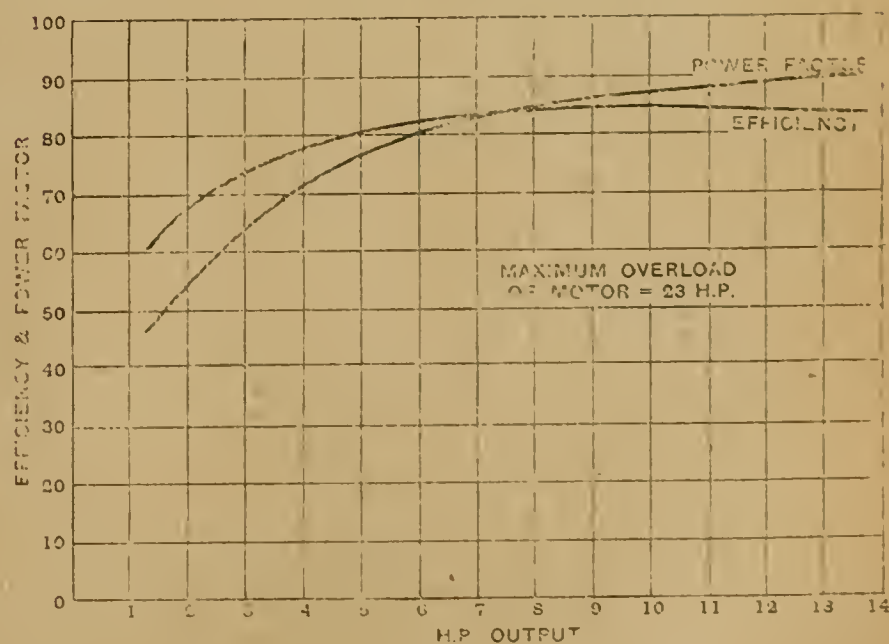


FIG. 8.—MODE OF USING THE "SLIPON" CARRIER.

instance, on tramcars. The difficulty of removing the ordinary screwed ring is familiar to all users, and has been intensified in the case of the deep shades used with metallic-filament lamps; with the "Slipon" carrier it suffices to pull the shade off, without putting the hand or a special tool inside it at all. The claws can readily be adjusted to suit slight variations in the diameter of the barrel. The cleaning of shades and reflectors is often neglected on account of the bother of unscrewing the nut and replacing it; but this invention, which can be applied to holders already installed, renders it an easy matter to carry out this operation, the importance of which ought to be more generally realised.

#### TESTS OF A NEW A.C. MOTOR.

It will be generally agreed that while the strenuous competition in electrical machinery has caused designers to go most carefully into the various factors of design, with the result that a far more effective use is now made of material than was the case ten



years ago, there is at the same time an uneasy feeling that electrical machinery is occasionally over-rated.

Moreover, in A.C. motors, which are frequently sold to people who have no means of testing them, or even any appreciation of the results of tests, there are great possibilities of reducing the qualities of the machine without any risk of detection.



We do not think for a moment that this course is followed by manufacturers of repute, but at the same time it rather suggests that the small power user should exercise some caution when putting in alternating-current motors. And he should realise that he must pay a reasonable price in order to obtain a machine which will give him satisfaction.

We are not referring so much to the risk of mechanical breakdown, because that in these days is quite rare. What we have in mind is the small losses, which, while in a small motor almost negligible, are likely to mount up to a very considerable sum in the case of a number of motors in operation for some hours per day.

It is satisfactory to know that there are quite excellent designs of small A.C. motors on the market, which are not only mechanically sound, but also give very excellent results from an efficiency point of view.

We give herewith the results of an independent test made on one of the A.C. motors which have been put on the market by Messrs. Scholey & Co., Ltd.; the figures, both from the point of view of temperature and efficiency, are remarkably good.

The curves attached also show quite a good power factor and efficiency, demonstrating that the motor has been very carefully designed.

The following are tests on a Scholey-Ingleby 10-H.P. induction motor, squirrel-cage, 1,500 revolutions, 400 volts, 50 cycles, three-phase:—

	Revs.	Volts.	Current per phase.
No load ...	1,500	400	4.3 amperes.
Full load ...	1,415	400	14.5 "
25 % overload ...	1,400	400	18 "

Temperature rise after six hours' run:—

Stator windings ...	40.5° F.
Stator core ...	32.5° F.
Rotor core ...	30.6° F.

Pull-out load, 23 H.P. at normal volts.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 2,896. "Electrical switches." A. CRAWFORD. February 5th.  
 2,902. "Hygienic attachment or cover for telephone mouthpieces." F. M. STANTON. February 5th.  
 2,910. "Electrically-operated boat hoists." J. FIELDING. February 5th.  
 2,914. "Receiver hook-lock for telephones." P. LE BRETON. February 5th.  
 2,936. "Insulator for supporting the current rails of electric railways." A. WATKINS. February 5th.  
 2,964. "Accumulators or secondary batteries." W. K.-L. DICKSON. February 5th. (Complete.)  
 2,957. "Electric railway systems." K. E. STUART. February 5th.  
 2,979. "Electric boat hoisting apparatus." J. FIELDING. February 6th. (Complete.)  
 3,007. "Means for governing the speed of alternating-current commutator machines." H. C. E. JACOBY. February 6th. Addition to 20,495/1907.)  
 3,011. "Electric hand-lamps." H. LUCAS and W. H. EDWARDS. February 6th.  
 3,023. "Manufacture of metal-filaments for electric lamps." T. TERRELL and W. L. PAKENHAM. February 6th.  
 3,026. "Water-tight binding post for electric cables." Firm of R. BOSCH. (Convention date February 20th, 1911, Germany.) February 6th. (Complete.)  
 3,046. "Construction of appliance for disinfecting telephone mouthpieces." A. WEINTRAUD. February 6th.  
 3,054. "Magnifying and detecting weak alternating currents." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and H. J. ROUND. February 6th.  
 3,055. "Wireless telegraph receiving apparatus." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and J. H. ROUND. February 6th.  
 3,061. "Means for attaching dynamo electric machines adapted to be driven by velocipede wheels and the like." C. SCHLICK. February 6th. (Complete.)  
 3,065. "Electric arc lamps of the type in which carbons impregnated with chemicals are consumed in a chamber substantially air-tight." B. A. QUINT. February 7th.  
 3,082. "Self-indicating fuse cut-out for electrical distribution fuseboards." E. WALTERS. February 7th.  
 3,097. "Telephone systems." E. R. CORWIN. February 7th. (Complete.)  
 3,098. "Telephone systems." E. R. CORWIN. February 7th. (Complete.)  
 3,099. "Incandescence electric lamps." A. W. BEUTTELL and J. A. MANNERS-SMITH. February 7th.  
 3,105. "Automatic dynamo-electric machines." H. F. FOSTER and A. W. S. POCLINGTON. February 7th.  
 3,106. "Cooling arrangements for dynamo-electric machinery." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) February 7th. (Complete.)  
 3,107. "Method of connections for eliminating the influence of the temperature on the current strength of a resistance, the magnitude of which increases with the temperature." FRIED. KRUPP AKT.-GES. (Convention date, March 4th, 1911, Germany.) January 7th. (Complete.)  
 3,114. "Electric warp stop-motions for looms." D. SCHATZ. February 7th. (Complete.)  
 3,117. "Method of multiple-control for electric motors." R. RICHTER and MAFFEI-SCHWARTZ-KOPFF WERKE G.m.b.H. (Convention date, April 21st, 1911, Germany.) February 7th. (Complete.)  
 3,121. "Safety fuses for electrical installations." APPAREILLAGE GARDY (S.A.) (Convention date, February 23rd, 1911, Switzerland.) February 7th. (Complete.)  
 3,123. "Electrical railways having automatic traction systems." J. J. DESCHAMPS. (Addition to 2,325/1912. Convention date, June 30th, 1911, United States.) February 7th. (Complete.)  
 3,144. "Electric lifts of the alternating-current type and the like." H. J. MOYSEY. February 7th.  
 3,146. "Trolley head for overhead electric traction cars." W. WOOD. February 7th.  
 3,166. "Means of increasing the E.M.F. of rotary converters for battery charging and the like." A. M. TAYLOR. February 8th.

- 3,235. "Automatic telephone toll-recording systems." H. W. FITCHETT. February 8th.  
 3,236. "Electrically-driven clocks." P. A. BENTLEY. February 8th. (Complete.)  
 3,244. "Process for the manufacture, isolation and enrichment of radium and other radio-active substances." E. EBLER. (Addition to 2,155, 1912. Convention date, November 21st, 1911, Germany.) February 8th. (Complete.)  
 3,249. "Arrangement for electric machines to reduce the circulating currents in the coils under commutation." P. L. R. FRASER. February 9th.  
 3,253. "Electric heating element." H. J. DOWSING and D. HUNTLEY. February 9th.  
 3,263. "Electric cable conductors for the conveyance of variable currents applicable to telephonic or other purposes." W. E. HITCH. February 9th.  
 3,264. "Metal-filament lamp preserver." W. W. GARRY. February 9th.  
 3,269. "Arc lamp." KORTING & MATHIESEN AKT.-GES. (Convention date, December 2nd, 1911, Germany.) February 9th. (Complete.)  
 3,281. "Driving vehicles by means of internal combustion engines combined for recuperating purposes with dynamos, accumulator batteries and motors." H. PIEPER. (Convention date, February 20th, 1911, Germany.) February 9th. (Complete.)  
 3,322. "Electric heating elements particularly applicable to electric cooking apparatus." H. H. HOLMES and W. A. STREET. February 9th.  
 3,325. "Electrical resistance bodies and the manufacture thereof." G. COOPER. February 9th.  
 3,334. "Transmitters and receivers for wireless telegraphic and telephonic apparatus." E. BELLINI. (Addition to 11,339; 1911.) February 9th. (Complete.)  
 3,335. "Means for holding electrical insulators." BULLERS, LTD., and G. V. TWISS. February 9th. (Complete.)  
 3,338. "Electric fused switches and switchboards." H. H. BERRY and W. J. MARKHAM. February 9th.  
 3,341. "Electrodes for electric arcs." A. J. BOULT. (Dynamit Akt.-Ges. vorm. Alfred Nobel & Co., Germany.) February 9th. (Complete.)  
 3,342. "Process and apparatus for carrying out gas reactions in the electric arc." A. J. BOULT. (Dynamit Akt.-Ges. vorm. Alfred Nobel & Co., Germany.) February 9th.  
 3,348. "Incandescent electric lamps." R. H. SINGLEY. February 9th. (Complete.)  
 3,366. "Process for electro-plating non-conducting articles." A. FREI. February 10th. (Complete.)  
 3,397. "Electric arc lamps." CROMPTON & Co., LTD., and C. CROMPTON. February 10th.  
 3,381. "Electric means or apparatus for setting of one or more alarms from one clock for use in one or more sleeping or other apartments." J. F. X. MILLER. February 10th.  
 3,412. "Electricity meters." S. Z. DE FERRANTI. February 10th. (Complete.)  
 3,419. "Electric automatic alarm for notifying the approach of a train." T. H. HARVEY. February 10th.  
 3,431. "Stands, wall brackets and the like for electric lamp and other electric fittings." CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., A. R. KIMBLEWHITE and H. HILL. February 10th. (Complete.)  
 3,432. "Supports for electric arc lamps." JANDUS ARC LAMP AND ELECTRIC CO., LTD., and A. D. JONES. February 10th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

- TELEPHONIC APPARATUS. E. A. Graham. 23,742. October 13th.  
 ELECTRICAL CONDENSERS. British Insulated and Helsby Cables, Ltd., and A. E. Bayles. 24,084. October 18th.  
 ELECTRIC WIRES OR CABLES. British Insulated and Helsby Cables, Ltd., and E. A. Bayles. 26,591. November 16th.  
 FUSIBLE CUT-OUTS FOR CONTROLLING ELECTRIC CIRCUITS. V. Hope. 29,122. December 15th.

### 1911.

- MOULDS SUITABLE FOR USE IN THE MANUFACTURE OF ELECTRIC ACCUMULATOR ELECTRODES. R. Pape. 905. January 12th. (Cognate application, No. 12,019 of 1911.)  
 TRANSMISSION OF SOUND BY ELECTRICAL MEANS. S. G. Brown. 956. January 12th.  
 PROCESS FOR OBTAINING RAPIDLY THE ESTABLISHMENT OR THE VARIATION OF THE ELECTROMOTIVE FORCE OF A DYNAMO-ELECTRIC MACHINE. Soc. Alsacienne de Construction Mecaniques. 1,252. January 17th. (January 17th, 1910.)  
 CONTROLLING APPARATUS FOR ELECTRICAL LIFTS. A. W. Penrose & Co. and F. Barlow. 1,395. January 18th.  
 ELECTRIC WELDING. F. B. Koopman and Pontelec Welding Patents, Ltd. 1,563. January 20th.  
 ELECTRIC SIGNALLING ON RAILWAYS. H. Brown. 1,566. January 20th.  
 ELECTRICALLY-HEATED COOKING APPARATUS. W. P. Perry. 1,833. January 25th.  
 ELECTRICALLY-HEATED OVENS. W. P. Perry. 1,885. January 25th.  
 RHEOSTAT ADAPTED TO BE REGULATED FROM A DISTANCE. L. C. Eilersten. 8,156. March 1st. (March 31st, 1910.)  
 ELECTRIC SWITCHES, CIRCUITING BREAKERS AND THE LIKE. P. K. Morris and G. A. Lister. 8,205. April 1st.  
 ELECTRIC MOTOR-GENERATORS. Electric and Ordnance Accessories Co. and H. V. Bowen. 9,856. April 24th.  
 AUTOMATIC DISINFECTING DEVICE FOR TELEPHONES. P. Z. Andronikoff. 10,116. April 26th.  
 ELECTRIC METERS OF THE ELECTROLYTIC TYPES. C. F. Mounsdon. 10,689. May 3rd.  
 MAGNETO-ELECTRIC MACHINES. H. C. H. Smith. 12,011. May 18th.  
 PRIMARY GALVANIC BATTERIES. R. Darby. 14,769. June 24th.  
 PLATE-CARRIERS FOR STEREOSCOPIC X-RAY PHOTOGRAPHY. S. Kelly. 17,122. July 26th. (August 1st, 1910.)  
 TREATING SUBSTANCES BY ELECTRO-OSMOSIS. Felten & Guillaume Carlswerk Akt.-Ges. 17,597. August 2nd. (August 2nd, 1910.)  
 INDICATING TAIL-LAMP. M. S. Rosenfeld. 18,447. August 15th. (August 26th, 1910.)  
 ELECTRIC CONTACT-BREAKERS. F. Beljitt. 18,479. August 16th.  
 ELECTRIC SIGNAL APPARATUS. W. S. Reynolds. 18,693. August 19th. (March 17th, 1911.)  
 DRIVING GEAR OF ELECTRICALLY-OPERATED WINCHES. D. Wilson. 18,911. August 23rd.  
 CIRCUIT ARRANGEMENTS FOR AUTOMATIC TELEPHONE SYSTEMS. Siemens and Halske Akt.-Ges. 19,186 and 19,231. August 27th. (August 27th, 1910.)



# THE ELECTRICAL REVIEW.

Vol. LXX.

MARCH 1, 1912.

No. 1,788.

## ELECTRICAL REVIEW.

## LOCAL AUTHORITIES AND THE SUPPLY OF ELECTRICAL FITTINGS.

Vol. LXX.]	CONTENTS: March 1, 1912.	[No. 1788.	Page
Local Authorities and the Supply of Electrical Fittings	...	...	325
The Contractor and the Municipality	...	...	326
Tramcar Meters	...	...	327
The Monopoly Question in Germany	...	...	327
Fair Play for Contractors	...	...	327
The Use of Condensers on Alternating-Current Lighting Circuits ( <i>illus.</i> )	...	...	328
The Fetish of "Boiler Insurance"	...	...	329
Electrical Law in the British Dominions ( <i>continued</i> )	...	...	330
Correspondence:—			
Opal Shades	...	...	331
Our Progressive Manufacturing Firms	...	...	332
The Electrical Profession as It Is	...	...	332
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	...	333
Our Legal Query Column	...	...	334
Parliamentary	...	...	335
Business Notes	...	...	335
Notes	...	...	342
The Sydvaranger Iron Mines in Norway ( <i>illus.</i> )	...	...	345
The Lighting of Machine Shops ( <i>illus.</i> )	...	...	348
New Electrical Laboratories of Manchester University ( <i>illus.</i> )	...	...	349
Notes from Canada	...	...	349
City Notes	...	...	350
Market Quotations	...	...	356
Stocks and Shares	...	...	356
Share List of Electrical Companies	...	...	357
Proceedings of Institutions:—			
Recent Developments in Steam Turbine Practice	...	...	359
The Degradation of Accumulative Energy ( <i>illus.</i> )	...	...	361
Notes on Central-Station Practice	...	...	362
Legal	...	...	363
New Patents Applied For, 1912	...	...	368
Abstracts of Published Specifications	...	...	368
Contractors' Column	Advertisement pages xxvi, xxviii and xxx		

A CASE of signal importance to the electrical world was decided last week by Mr. Justice Eve. We refer, of course, to that of the Attorney-General *v.* the Mayor, &c., of Sheffield. It involved the vital question—Can Corporations or other local authorities who are exercising powers conferred upon them by the Electric Lighting Acts, 1882 and 1888, enter the commercial arena as dealers in electric fittings? Having regard to the bold claim made by the Corporation concerned in the case under review, it is satisfactory, from the point of view of the private wiring contractor, to find that the Court was in a position to grant an injunction.

In the action, which was commenced in 1906, the plaintiff sought to restrain the Corporation, which has power to supply electricity, from carrying on the following, amongst other industries: (a) erecting and installing electric light and bell fittings, indoor telephones and lightning conductors; (b) keeping a dépôt for the display of lamps, fittings, switches, telephones, cigar lighters, &c.; (c) effecting repairs to installations, and the repair, &c., of arc lamps; (d) the sale, outside their area, of motors, lamps and fittings; (e) the supply of electric light fittings, wires and bell fittings and wires in premises not supplied or intended to be supplied by them with electricity; (f) repairs for persons to whom they had supplied motors and fittings. Altogether, taking it "by and large," this up-to-date Corporation ran a very tidy little business of a varied character in which capital to the extent of £20,000 to £30,000 was sunk, and from which, as no charge was made against the department in respect of such trifles as interest on capital, rent of premises, or depreciation and obsolete stock, it was able to show a profit rising from £2,645 in 1903 to £2,966 in 1911.

Had it not been for the enterprise of the Sheffield citizen who set the law in motion, this flourishing concern might have continued to prosper, but Mr. Justice Eve has pronounced anathema upon it. As to the branches of industry enumerated in paragraphs (a) and (c) (*supra*), he pointed out that such enterprise on the part of a municipal electricity authority had already been declared illegal by Mr. Justice Neville in the Leicester case.

The rights of a supply authority, working under a provisional order, are founded on Sec. 10 of the Electric Lighting Act, 1882, which provides that "for the purposes of supplying electricity," the company may acquire such licences, &c., "and generally do all such acts and things as may be necessary and incidental to such supply."

In the case of Attorney-General *v.* Leicester Corporation (1910) 2 Ch. 359, it was held that "supply" within the meaning of the section is completed at the consumer's terminals. The installation and provision of lamps, bells, motors and fittings are not part of a "supply" within the meaning of the word as used in Sec. 10 of the Electric

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION  
of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly's).

1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.



Lighting Act, 1882, but are a separate business, incidental, not to the supply of electricity, but only to its use. For a local authority to carry on such business without express powers, and in reliance on the general words of the section, is accordingly to act *ultra vires*. Mr. Justice Eve, in the case under review, came to the conclusion that all the other items—the private telephones and the lightning rods (which latter, in justice to the Corporation, we should mention were only supplied through a sub-contractor)—were equally illegal. The defendants relied on the Municipal Corporations Act, 1882, and the Sheffield Corporation Act, 1903, in order to establish that their powers were somewhat more ample than those of an ordinary local authority. But this plea failed them.

It is said that the litigation which has culminated as above, after preserving the even tenor of its way for six years, will be taken to the House of Lords. If it should turn out that the two learned judges who have decided this case, and that of the Leicester Corporation, have decided otherwise than in accordance with the law, it is strange that local authorities in various parts of the country should have gone to the trouble and expense of obtaining special powers to indulge in these forms of trading.

## THE CONTRACTOR AND THE MUNICIPALITY.

A PAPER read before the Society of Municipal Engineers of New York, by Mr. C. A. Crane, secretary of the General Contractors' Association of New York, which appeared in a recent issue of the *Sanitary Record*, is deserving of wide publicity. It is directed specially against the grossly unfair clauses which appear in most municipal conditions of contract all the world over. We commented on an instance from Australia only the other day.

These clauses seem to be known in the States as "Club Clauses." The idea seems to be that they are put in to be used as clubs to knock down the contractor if he fails to give satisfaction to the officials in any particular, whether connected with the clause itself or not.

Mr. Crane quotes the following from a paper by a Mr. Rollins :—

"Every unnecessary or unfair clause in a specification has its part in limiting competition and in lowering the standard of honesty among contractors.

"A clause that may be used as a club may be avoided in one of two ways, either by not bidding on work governed by the clause or by using graft to ensure that it shall be a dead letter."

The usual iniquitous clause making the contractor responsible for the mistakes of the employer or his engineer is once more condemned. It appears that this clause has actually been set aside in the Courts of Connecticut on the ground that the contractor has a right to rely on the information furnished to him by the engineer. The "Engineer Sole Arbitrator Clause" appears also to be rampant in the States.

During the present week the Court of Appeal in this country has decided against the Bristol Corporation in the action which it took against Messrs. John Aird & Co., Ltd., to enforce an arbitration by its own engineer. The Court laid it down that the Engineer could not be judge of his own action; and, inasmuch as actions by him were in question, he has been set aside. We hope that this important decision sounds the knell of this unfair clause.

It is interesting to note that the Institution of Municipal and County Engineers have this week decided to retain it in their conditions, but we fancy they will find that this decision destroys the clause and weakens any set of conditions which contains it.

Suspension or delay of works, so often the cause of loss to contractors everywhere, is touched upon, and it is argued that inasmuch as the contractor is to be fined if he cause delay, so also should the employer compensate the contractor if he orders suspension of works or delays the contractor in any way. On the face of it, this seems to be pure common-sense and justice.

Another gross anomaly is the clause permitting the engineer to vary the design after the contract is signed, and still to hold the contractor responsible for the result.

The effect of a delay caused by the employer (or by another contractor on the same job) in postponing the period of maintenance, and in causing loss of interest on capital, is also discussed.

It might be said by some ardent friend of the principle of municipalising everything: "What does it matter how the contractor is robbed, provided the city gets its work done within the estimate?" This is a very short-sighted view, and grossly immoral as well.

It matters very much every time anyone is robbed, even when it is done with the utmost legality. Not every official—certainly not officials receiving salaries on the scale which prevails in this country—can safely be trusted with a club in his hand. The next thing is that he may be found demanding, "Your money or your life!" and brandishing his club.

What is the result in the long run? Honest, able and trustworthy contractors refuse to tender for municipal work at all.

Even in times like the present, when the building trade is very hungry, some municipal bodies are finding that they cannot get the best contractors in their own town to make them an offer. They have to rely on the riff-raff, or at best on contractors from a distance, who do not yet know their "little ways."

Contractors have a way of telling one another when they have assured themselves that any given official will not let them take their profit, and a bad reputation re-acts on the town and puts up the cost of its works, and eventually its rates.

No subject of the present day calls more urgently for treatment than that of local public works and finance. Chaos is the only word that describes the state of things. Nothing is standardised. Every different city has its own designs (or more likely vague and difficult suggestions) for everything from a road roller to a paving stone. If the Local Government Board has any ideals or standards on any municipal works at all, it is obviously unable or unwilling to enforce their adoption.

Every variety of design or specification means expense. And as if the direct excess of cost were not enough, we find every town sending expensive deputations to every other town to find out and inspect as many more variations from standard practice as possible. Municipal "White elephants" cumber the ground, and we find new loans incurred for new works before the old, which they are intended to replace, have been paid for. Thousands of local authorities employ



thousands of small-salaried engineers to produce tens of thousands of varieties in design and specification of roads, sewers, outfall works, sanitary carts, snow shovels, and what not. Fortunately for the ratepayer, electric lighting stations have been mostly designed to accommodate standard plant of one kind or another. But even in electrical work there is great room for improvement.

In one matter, and one only, with rare exceptions, do they all follow the same practice, and that is in the conditions of contract, and the use of "club clauses."

#### Tramcar Meters.

FROM Mr. T. B. Goodyer, of Croydon, whose interest in the subject of tramcar meters has on previous occasions been noted in our columns, we have received a summary of replies by twenty-eight municipal tramway managers on the influence of meters on their services, which find employment for over 1,700 cars.

There appears to be a unanimous opinion as to the more even running, better time-keeping, and improvement in the equipment, resulting from the use of the meter. Indeed, only a sceptic would nowadays doubt that considerable economy in working does result from the intelligent use of car meters.

There is, however, another side to this question of the use of meters; economical running by meter may be pushed to an extreme which means dawdling, from the passengers' point of view, and we believe that Mr. Goodyer's own system, among others, is not entirely blameless on this score.

We would emphasise this point strongly; economy in working is purchased dearly when the potential short-distance passenger begins to consider whether he cannot reach his destination almost as quickly on foot.

The existence of tramways depends on their power to attract passengers; and while economising devices are admirable when used with discretion, they must not be allowed to interfere with the convenience of the passenger.

#### The Monopoly Question in Germany.

As mentioned in this journal on former occasions, the Prussian Government in August, 1910, adopted measures for the protection of installation contractors, and the special electrical makers, against the monopolistic efforts of the large firms in connection with installations to be supplied from overland central stations established by the latter firms. The example thus set has, in the meantime, been followed by other Federal Governments, although the degree of success which has attended State action in the matter has apparently not yet been ascertained. Now the Prussian Government has issued a fresh order, explaining and amplifying the principles of the previous order. The new order is not only directed against a direct monopoly as consisting in the exclusive right of carrying out installations to be connected with supply mains, but it also requires that an examination shall be made of the arrangements to see whether they could bring about indirectly a monopoly for individual firms or otherwise make competition unjustifiably difficult. The order then deals with the question as to how far it is admissible to make the right for the execution of connecting works in the supply area of an overland station dependent upon permission being granted to individual contractors. This demand is recognised as justified in so far as it only follows the purpose of affording protection to the central station and consumers against the inefficient execution of works. The only conditions which are to bind

the grant of permission for this purpose, and the method of examining the conditions, are fully set forth in the order, which also expressly disallows any limitations in the obtaining of installation materials, lamps, motors, &c.

#### Fair Play for Contractors.

AN important question regarding municipal contracts has been raised by a recent decision of the West Ham Municipal Council. The progress of the undertaking makes it necessary that more generating plant should be provided at once. The Council had under consideration an offer for a large set from two of the best-known British contractors, and after all technical details had been arranged, it was finally rejected because the firms in question insisted on inserting what is termed a "lock-out clause" in a contract. The matter is now being re-advertised in the hope that other firms may accept the restriction imposed by the Council.

A "lock-out" clause is practically universally inserted in conjunction with a "strike" clause. These clauses free the contractor from the liabilities incurred by late deliveries, if these deliveries are retarded by cessation of work due to a strike ordered by a Trade Union on the one part, or a lock-out decreed by an Association of Employers on the other. In either event the individual contractor is not the sole controller of the course of events, and if a clause recognising the right of a worker to strike is allowed, then the corresponding right of associated action should be permitted to the employer.

It is through a majority on the Council who are trade unionists that the present difficulty has been raised. They are anxious to strengthen their position, and will not hear of any restriction being placed upon the right of the worker to strike. They state as justification for their attitude that the effect of cessation of work presses harder on the workers, whom it may bring to starvation point, than on the employer, whom it may only ruin, and that on this ground they retain the strike but resist the lock-out clauses.

While an argument of this character might have had some weight in the days of individual action, at the present time when labour disputes take place between collective bodies representing Labour on the one hand, and Capital on the other, it has not the same force. Fair play demands that if the strike is allowed to the worker as the last resource for attack, the lock-out must equally be permitted to the employer as the last resource for defence. We do not anticipate that the present invitation to tender will result in any high-class British firm accepting the position, and, meantime, the undertaking will be placed in great difficulties.

**Electric Cooking.**—"Health, Comfort and Cleanliness in the Home" is the title of an excellent booklet, which, while it is priced 1s., is being circulated free of charge by the Westminster Electric Supply Corporation, Ltd., to all householders taking supply from its circuits, who make application for a copy. It is attractively produced and sets forth in an interesting manner the advantages of cooking by electricity, the matter being accompanied here and there by appropriate sketches, which should appeal to the popular fancy. Mrs. W. T. A. Cross, first-class Diplôme of the National Training School of Cookery, the writer, shows why she prefers electric cooking to any other kind, a few pages being devoted to an elaboration of each of the following claims:—It is easy; it is clean; it is safe; it is hygienic; it is economical; and lastly, it is up-to-date. A list of makers of electric cooking stoves, and advertisements by these firms giving descriptions of their apparatus, appear at the end and they should be of service to the householder after being favourably impressed by the general reading matter in the book.

**Weighty Transactions.**—We recently commented upon an improvement in the arrangement of the printed volumes issued by the American Society of Civil Engineers. The same society now announces that in future in place of the present four annual volumes there are to be two volumes only, each containing as much material as two quarterly tomes, but being only half the bulk of one of them; that is to say, the material bulk of the year's volumes will be only a fourth of what it now is, though the literary contents will be the same. This change is to be brought about by the use of India paper. It would be a welcome change could all publications be equally reduced in mass and volume, more especially such as have more than an ephemeral life. Our bookshelves would shrink to a fourth, and we could afford to retain many volumes which we now part with.



## THE USE OF CONDENSERS ON ALTERNATING-CURRENT LIGHTING CIRCUITS.

BY A. W. ASHTON, M.Sc.

*Introduction.*—The recent development of a cheap and reliable form of condenser capable of working continuously on 250-volt A.C. circuits has made it possible to run low-voltage incandescent lamps on circuits of higher voltage at a very small first cost, and with an efficiency much greater than is possible with any other type of voltage-reducing apparatus. With this method the lowest voltage lamps can be run on the highest voltage circuits, and it is quite possible and comparatively cheap to run a two-volt lamp on an 11,000-volt circuit.

The idea of using condensers in this way was first developed because of the impossibility of making low-candle-

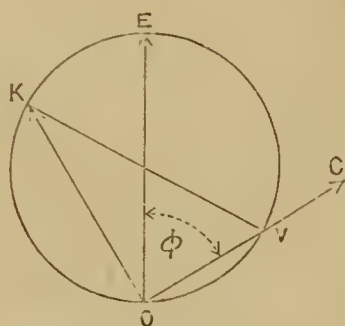


FIG. 1.

power lamps suitable for 250-volt circuits. Recent progress in the manufacture of metal-filament lamps has to some extent limited the application of the condenser for this purpose, although there are plenty of positions in which lamps of less than 14.5 C.P. (the lowest C.P. manufactured for 200-volt circuits) are sufficient.

It has been found, however, that, owing to certain valuable properties possessed by the condenser, it becomes economical even in the case of high-candle-power lamps, to use 25 or 50-volt lamps in series with condensers. Briefly, the reasons for this are:—

1. The condenser prevents damage to the filament due to "overshoot" and the failures which occur due to the initial rush of current when switching on.
2. The low-voltage lamp having a comparatively short thick drawn-wire filament, can be handled without fear of breakage.
3. The blackening due to deposit of the metal on the bulb, caused by electric discharge between the legs of the

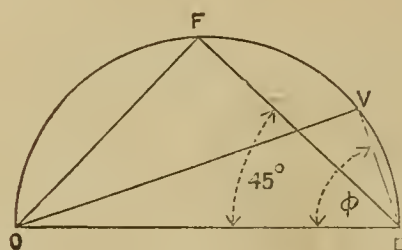


FIG. 2.

filament, is much less with a low-voltage than with a high-voltage lamp.

4. Except in the case of candle-powers of 50 and upwards, the low-voltage lamps are less in first cost and have a higher efficiency.

One outstanding point in connection with the application of condensers is that a variable number of lamps cannot be switched on in parallel, with a single condenser in series with the lot; therefore, where the ordinary methods of wiring are retained, a separate condenser is used on each lamp or group of lamps controlled by a separate switch. As far as new installations are concerned, the use of a separate condenser for each point has been obviated by the invention of the series condenser system, in which groups of from 10 to 20 lamps are run in series with one condenser.

This system is considerably cheaper in wiring costs than

the systems at present used, and it entirely prevents short circuits. It will further be of advantage to the supply engineer, in that the condenser effectively acts as a current limiter, and that the leading currents taken will generally improve the power factor of the whole system.

The above advantages, combined with the use of 10 to 16-watt lamps, costing 1s. 3d. to 1s. 6d. (list), should enable electricity to make great headway in the smaller houses, which at present are almost exclusively lit by gas, and in which the cost of wiring and lamp renewals, rather than the cost of energy, has kept electricity out of the market.

*Theory of the Method.*—The theory of the application of condensers to lighting circuits has several novel features, which may be discussed conveniently with the aid of vector diagrams.

When a condenser is connected in series with a lamp to an alternating-current circuit, the supply voltage  $OE$  is split into two components differing  $90^\circ$  in phase. These are  $OK$  ( $V_1$ ), the volts across the condenser and  $OV$  ( $V_2$ ), the volts on the lamp. The current  $OC$  is in phase with  $V_2$  and  $90^\circ$  in advance of  $V_1$ ; it is determined mainly by the capacity of the condenser and the frequency and voltage of supply, and is in any given case  $= 2\pi f KV_1/10^6$ , where  $K$  is the capacity of the condenser in microfarads. If  $c$  = rated current of the lamp, then in order that the lamp should receive its correct current we must make—

$$K = c \times 10^6 / 2\pi f V_1, \text{ that is—}$$

$$K = \frac{c \times 10^6}{2\pi f \sqrt{E^2 - V_2^2}}, \quad (1)$$

since  $E$ ,  $V_1$  and  $V_2$  form the sides of the right angled triangle  $KOV$ . From equation (1) the capacity can be calculated for any given case, provided the curve of E.M.F. is approximately a sine curve.

The current taken by the circuit is the normal current of the lamp at the full voltage of supply, but practically no power is wasted in the condenser, the power factor being—

$$= \cos \phi$$

$$= \cos KOV = OV/KV = V_2/E.$$

Thus the ratio of the lamp voltage to the supply voltage gives the power factor of the circuit, the current, however, being always leading.

By taking an example it can be shown that the current is mainly determined by the condenser; and that, even if the lamp is short-circuited, the current only increases very slightly. A 50-volt 17-watt lamp requires 5.5 microfarads in series to run properly on a 200-volt 50-period circuit. When the lamp is short-circuited the current becomes—

$$= 2\pi f KE/10^6 = 314 \times 5.5 \times 200/10^6 = .346 \text{ ampere,}$$

as against .34 ampere when the lamp is in circuit.

This obviously prevents any considerable rise of current above normal when the lamp is cold, *i.e.*, when switching on.

*The Series System.*—The peculiar current-limiting action of the condenser enables a variable number of lamps to be run in series with the same condenser. The switches are put in parallel with the lamps, and when closed the lamps are short-circuited; the switches being opened in order to light the lamps.

Provided the sum of the voltages of the lamps alight at once does not exceed 40 per cent. of the supply voltage, they will receive their rated current whatever number is switched on, assuming that the rated current is the same for all the lamps.

The voltages of the lamps may be different, and, in fact, to vary the candle-power the voltages must be proportionally varied. Suppose it is intended to use one-ampere lamps on 220 volts, 50 cycles, then for 10, 16 and 25-watt lamps the voltages must be 10, 16 and 25 volts respectively. Any arrangement of lamps can be used simultaneously provided the aggregate of lamp voltages does not exceed 40 per cent. of 220—*i.e.*, about 90 volts. Therefore five 16-watt lamps could be used at once on this condenser, but seven or eight could be connected, as not all the lamps connected would be required simultaneously. One such condenser would be suitable for running all the lights required for a small five or six-roomed house or flat.



The principle of this method depends on the fact that the current in any given case is determined by the voltage ( $V_1$ ) on the condenser, which  $= \sqrt{E^2 - V_2^2}$ . When  $V_2$  is 10 per cent. of  $E$ , it will be found that  $V_1$  is about 7 per cent. less than  $E$ ; this, however, does not mean that the lamps are 7 per cent. below normal current, as, owing to the decrease of lamp resistance with decrease of temperature, the reduction in current would only amount to 4 per cent. By adjusting the capacity of the condenser so that the lamp current is correct for 50 volts on the lamps, the current will be  $1\frac{1}{2}$  per cent. above normal with one lamp on and 3 per cent. below normal with five lamps on. These variations are negligible compared with those due to inequalities in the lamps themselves, which, moreover, have less effect on the life of the lamps when a condenser is used.

An important feature of the series system is the way in which, after the 40 per cent. is exceeded, the current gets less and less as more lamps are switched on, so that the maximum power is limited to 0.5 times the apparent power taken by the condenser when across the mains.

This can be best seen from fig. 2, in which  $O E$  = supply volts =  $E$ ,  $V E$  = volts on lamps =  $V_2$ ,  $O V$  = volts on condenser =  $V_1$ ,  $\phi$  = lead of current in advance of supply volts.

Then power taken by circuit  $= E C \cos \phi$ , where  $C$  = current  $= V_1/R$ ;  $R$  = reactance of condenser: power  $= E \cdot V_1/R \cdot \cos \phi = V_1 V_2/R$ , since  $V_2/E = \cos \phi$ . The product  $V_1 V_2$  is a maximum when  $V_1 = V_2$ , i.e., when  $V$  is at  $E$  and  $\phi = 45^\circ$ . The maximum power is therefore  $= E^2/2R$  = half the apparent power taken by the condenser when no lamps are in circuit.

In the example above, for a condenser taking one ampere on a 220-volt circuit, the maximum power is 110 watts. This property of the condenser makes it unnecessary to fix maximum-demand indicators or current limiters where the contract-demand or maximum-demand systems of charging are adopted.

Where the number of lamps alight at once is not varied, their aggregate of voltages may be about 75 per cent. of the supply voltage, but it is not desirable to have the lamp voltages greater than this figure, as this would considerably increase the cost of the condenser. For instance, three 50-volt lamps or four 40-volt lamps may be run in series on a 220-volt circuit, but not four 50-volt lamps.

*Applications of Condenser Systems.*—The parallel system may be conveniently applied to houses already wired, and can be adopted for a single lamp or any number of lamps as may be convenient, the remaining lamps being left to run at their original voltage. The system can be applied to those points where the greatest saving can be effected, i.e., where low-candle-power lamps are sufficient or where the number of breakages is abnormal. The following example shows the saving that can be obtained with this system. A 100-volt lamp of 22.5 C.P. consumes 25 watts, whilst a 200-volt lamp of the same candle-power consumes 32 watts. Assuming a life of 2,000 hours, in each case the saving in energy alone is 14 units, i.e., 7s. at 6d. per unit, which is about the cost of the condenser for 220 volts, 50 periods. Where, however, the frequency is higher, the cost of the condenser is correspondingly reduced.

The condenser may be fixed under the floor above the ceiling rose, or on the wall near the switch. In the smaller sizes, a cylindrical type is made with an adapter for inserting in the existing lampholder. For single lamps the condensers have dimensions about 2 in.  $\times$  2 in.  $\times$  6 in., are made with all live parts efficiently covered, and are all capable of withstanding continuously 250 volts alternating without fear of breakdown.

For lighting private houses the cost per point of the series system with switch lampholders is not more than half that of the ordinary "loop-in" system of wiring. This saving is effected owing largely to (a) simplicity in wiring, there being only one wire run from lamp to lamp; (b) the distribution board being replaced by one pair of double-pole fuses; (c) the difference in cost between low-voltage and high-voltage lamps, viz., about 1s. 6d. per lamp. With regard to (a) it can be shown that the length of wire is reduced from about 20 yards per point to 8 yards per point, with a corresponding saving in labour and conduit.

For street lighting, high-candle-power incandescent lamps

can be used to replace arc lamps in series without altering the wiring, the condensers simply replacing the arc lamp resistances. The same method can be adopted for outside shop-lighting, where the trouble of recarboning arc lamps is operating to the advantage of high-pressure gas. In both cases the prevention of damage from overshoot and the more robust filament of the low-voltage lamp amply compensate for the small initial outlay on the condenser.

## THE FETISH OF "BOILER INSURANCE."

By S. LEES.

It is pretty safe to say that at the present day there is hardly a steam-power plant of any importance that is not "insured" in the usual way. And he would be a bold spirit indeed who would dare to suggest that the insurance of steam-raising plant was an unnecessary superfluity. There is an almost sacred atmosphere about the engineering insurance business, and the preacher of no-insurance would instantly stand charged with the wickedest form of engineering heresy breatheable.

Looking at the question of boiler insurance broadly from an economic standpoint, what advantages or benefits does the insured owner get in return for the premiums paid? Periodical inspections are made, and reports thereon are furnished for the edification of the owner, but such information is at least as much in the insurance company's interest as in that of the insured party. And such inspections cannot really be said to be of any especial value to an owner, as in any steam-power plant worthy of the name the very engineering staff forms the class of men from which the average engineer inspector or surveyor is drawn.

Reference to annual engineering-insurance reports for the past year or so, reveals a falling off in this class of business. And in its 1911 report recently issued by one of the leading companies, mention is made of the diminishing rate of increase in the insurance of steam-raising plant and auxiliaries: the reason therefor being partly ascribed to the supersession of steam by gas, electric, and other non-steam plant. Such a statement emanating from a reliable authority is not without significance. Is it not more than possible that owners of steam plant are beginning to look more deeply into details, which hitherto more favourable industrial conditions had not rendered of such pressing consequence as regards their bearing on the more important matters, especially production costs? At this day it can be truly said that it is the little things which count.

Power plant manufacturers, and owners and operating engineers, are ever striving after increased efficiency and economy, and to these ends are constantly introducing and trying innovations in the way of improvements and finenesses of working for which a keenly competitive age has created a demand. Of the many new things and methods which are being daily evolved, but few survive the only true criterion—the time test, some are indifferent, and the majority distinctly bad, and as such doomed to inevitable failure under the rigorous conditions of present everyday working life.

There are hundreds of steam plants of considerable size and importance, say, in the neighbourhood of 30 boilers, and the bulk of these will have been insured from the day of installation, and a goodly proportion of this number will probably be from 15 to 20, and in some cases more, years of age.

Now, with many owners it is as likely as not that during the whole of this time nothing untoward in the way of accident will have happened to their boilers. But supposing that some defect or other having developed—other than actual explosion, using the word explosion in its generally accepted meaning—it becomes necessary to repair a plate or tube or stay, eventualities by no means unheard of. The matter is, of course, duly discussed with the insurance company, and the owner not unnaturally feels that the responsibility of "making good" will be borne by the insurers. His optimistic view, however, is soon dispelled when the company



convey to him the unexpected news that they repudiate financial responsibility for such contingencies, their legal liability, as clearly shown on the insurance policy, being limited to explosion. The owner indignantly criticises the (to him) unreasonable attitude adopted by the company, but it is pointed out that during the whole of the time the premiums have been paid the owner has had the benefits of thorough inspection and the valuable resources of the company in the way of advice, &c., placed at his disposal. The unhappy owner, reflecting over the matter, argues to himself that his engineering staff is, or, at any rate, should be, equally as competent to deal with any engineering problem which may arise on his plant as the insurance company's staff, and from a commercial standpoint he may come to the conclusion that in future he will take the "risk" of explosion upon his own shoulders, and have his own engineering department make all necessary inspections, examinations, &c. Perhaps as an inducement to increasing the efficiency of his engineering staff, the owner may hold out as encouragement in this direction the prospect of increase of pay. He may also have an idea that a fund to draw on for such a purpose might well be started with, as a nucleus, the amount of the premiums hitherto set aside for payment to the insurance company.

That engineering insurance occupies such an unquestionably important position in the commercial world is hardly to be wondered at, considering that the legal liability on the insurer's part is so limited and narrowly defined, and the apparently low premium charges would seem to indicate that engineering insurance generally, and, in particular, the boiler class, is a "good risk," to use an insurance phrase.

The whole subject of insurance is wrapped up in legal technique, and the engineering side is no exception; but it seems curiously inconsistent that such a striking difference of practice should obtain in two otherwise closely related departments, as the boiler and engine branches. As already mentioned, with the former the risk is limited to "explosion" (what potential material for the forensic mind of the legal fraternity the legal definition, according to the particular circumstances, this otherwise simple word affords). But in the case of engines and auxiliaries, and one might well include electrical plant, the risks accepted are broader, and, in fact, extend to practically all possible contingencies which may arise. Not that insurance companies always liquidate claims smilingly; such arrangements as compromises with the owners or makers of insured plant are not unheard of. Even so, does it not seem strange that such an inconsistent practice should obtain in different branches, considering how closely allied these are in their respective working? Furthermore, the imagination need not be drawn upon unduly for one to realise how an unexpected happening on either the engine or the boiler side may render one or the other susceptible to its influence, and be the cause indirectly, possibly, of further undesirable developments.

The writer does not wish to belittle the undoubted good and useful work carried on through the medium of engineering insurance, but is this form of insurance such a necessity, at any rate, in the case of the larger plants, as its advocates would have owners and users believe? For, be it said, the more important the plant, and the more certainly will it be insured. But, strangely, the very class of plant which it would seem at least desirable to subject to strict and more frequent periodical inspection is the one in which anything approaching to general insurance does not by any means obtain. Statistics have shown only too often how the penny-wise policy of unskilled or inadequate attention has come to grief, and a timely report has been the means of bringing the fact plainly to the mind of many an owner how near his own plant has been to disaster what time he has reluctantly, it is true, become a convert to the policy of insurance. With this class of plant, and there are many of such examples working without anything approaching to skilled supervision—indeed, it has been shown that steam boilers working at considerably above atmospheric pressure have been in regular charge of juvenile and female labour—insurance, in some form or other, is almost imperative, as the statutory obligations imposed on owners of steam plant, if not appreciated or interpreted in their proper light, may be of no value whatever as affecting the condition of the plant, and, after all, this is the point which is of primary

importance and really antecedent to the legally necessary and formal annual inspection.

The time-honoured code of stereotyped rules and instructions usually framed by the engineering insurance people for users has always appealed to the writer, more on account of its curious inconsistencies than as a guide and help. In scarlet italics the legend, "Telegraph for the Inspector," boldly appeals, so that he who runs may read. But offices are offices the whole business world over, and Insurance establishments run a close second to the banking houses in the matter of business hours, so that a wire after conventional office times would, in all probability, mean redelivery, and mishaps, cursed-like, would seem in the very nature of things invariably to happen at most awkward and unexpected times.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(Continued from page 291.)

6. *British Columbia*.—It is provided by an "Act to consolidate and amend the law relating to the incorporation of municipalities" (1897), Sec. 50, that in every municipality the Council may, from time to time, make, alter and repeal by-laws for any of the following purposes or in relation to matters coming within the classes of subjects next hereinafter mentioned, that is to say, "(inter alia) (11) for purchasing, constructing, operating and maintaining works for supplying the inhabitants of the municipality with water, electricity or gas, and regulating the conditions and terms under which the same may be supplied and used. (12) For acquiring, by purchase or otherwise, any tramway, street railway, ferry, gas works or electric lighting plant already constructed or established wholly or partly within the limits of the municipality, and to lease or maintain, operate and extend, as may seem expedient, the same in the discretion of the Council by resolution passed from time to time in that behalf."

The statute above referred to appeared to meet all the requirements of the Legislature until 1910, when the "Electrical Energy Inspection Act," of that year was passed. It recited that "many fatal accidents had recently occurred through defects in the construction or operation of premises, works, wires, and appliances for generating, transmitting and supplying electrical energy." It provided for the appointment by the Lieutenant-Governor in Council of an inspector who has authority at all reasonable times to enter upon premises and inspect machinery, &c. The inspector has power, by virtue of Sec. 9 of the Act, to give notice to the owner of any place to remedy any defect within a specified time, and penalties are imposed for disobedience to any such order. The method of providing for the salary of the inspector, and the expenses of working the Act is somewhat novel: "At the end of each calendar year the Attorney-General shall ascertain the total sum expended during the year in the enforcement of this Act, including the salary of the inspector. The sum so found to have been expended shall be apportioned by the said minister amongst the persons whose premises, works, wires or appliances have been inspected under the provisions of this Act during the year."

7. *British Guiana*.—In 1890 an Ordinance was passed in British Guiana to facilitate and regulate the supply of electricity for lighting and other purposes. It is provided by Sec. 4 that the Governor and Court of Policy may, from time to time, license any local authority, or any company, or person, to supply electricity for any public or private purposes within any area, subject to the following provisions—Here follow a number of provisions which are practically identical with those of the Electric Lighting Act, 1882. Sec. 4 (1) provides that:—"The consent of every local authority having jurisdiction within the area or any part of the area within which a supply is licensed to be furnished shall be required to the application for a licence, which con-



sent such local authority is hereby authorised to give, with such conditions, if any, as subject to the approval of the Governor and Court of Policy the local authority may, if they are of opinion that having regard to all the circumstances of the case such consent ought to be dispensed with, make in a special order dispensing with such consent; but the grant of authority to any undertakers to supply electricity within any area shall not in any way hinder or restrict the granting of a licence to the local authority, or to any other company or person within the same area." As will have been noticed, this provision as to withholding consent follows very closely upon the lines suggested by Sec. 1 of the Electric Lighting Act, 1888. Sec. 27 of the ordinance makes provision for compulsory purchase of undertakings by local authorities on terms which are almost identical with those laid down in Sec. 2 of the Electric Lighting Act, 1888. It is important to notice that the statutory period within which the right of purchase may be exercised is 42 years.

In a case which was heard in the colony in 1902 the appellant alleged that he contracted with the respondents for the supply of electrical energy, that they duly supplied him with such up to a certain date; that he duly paid them, and that they wrongfully cut off the supply. It was held that the section which makes the undertakers liable to a penalty for making default in the supply of energy was not *ultra vires*, and that the fact of the imposition of such penalty did not prevent the appellant suing for breach of his agreement (*Gomes v. Demerara Electric Co.*, J. June 21st, 1902).

Two Acts incorporating electrical companies are in force in the colony—namely, the British Guiana Electric Lighting Co. Act (No. 15 of 1903), and Demerara Electric Co.'s Act (No. 13 of 1899).

8. *Canada*.—The law of Canada as applied to electric lighting appears to be founded on the assumption that there are contractors supplying electricity. It merely seeks to regulate these persons. Thus by the Electric Light Inspection Act, 1906, c. 88, contractors before granting a supply must declare to the purchaser the constant pressure at which they propose to supply energy. This pressure must not vary by more than 3 per cent. The contractors are to be responsible for all electric lines, fittings, apparatus belonging to them, or under their control, upon the purchaser's premises, being maintained in a proper condition, but are not to be responsible for any damage arising from the use of the electric current in lines, fittings and apparatus not belonging to them or under their control. Before supplying electricity to any purchaser the contractors must obtain from a Government Department or from an office appointed for the purpose a certificate of registration, and must pay the officer issuing such certificate the fees prescribed by the Governor in Council. Elaborate provision is made for inspection of meters, which must be duly certified. No meter can be fixed for use unless it plainly indicates by means of suitable dials the amount of current or energy passing to the purchaser's wires. If a dispute arises between the contractor and the purchaser (*i.e.*, consumer), or between the contractor and inspector, respecting the correctness of a meter, the inspector must, if so required, by any person dissatisfied, refer that dispute to the Department for final decision.

9. *New Brunswick*.—There does not appear to be any Act of the legislative Assembly of New Brunswick relating to the general supply of electricity. Nevertheless, Acts seem to be passed from time to time, under which the power to supply electricity is conferred upon companies. Thus, in 1902, an Act was passed to incorporate the Aberdeen Electric Co. By that Act the company were empowered to generate and sell electricity, and in carrying out the supply to erect and place poles in streets, &c., such works to be carried out under the supervision of the municipal councils of the various cities in which the works were laid. Sec. 12 of the Act contained a provision to the effect that "No poles or wires shall be placed in such a way as to interfere with the poles or wires of any telephone or electric light company now existing, or as to injure or impair the efficient working of any telephone or electric light system in operation in this province, in places where any such system may be in operation before the company hereby incorporated establishes its system; it being understood, however, that nothing

herein shall be construed to prevent the company hereby incorporated from erecting its poles and stringing wires, or laying the same underground, on the opposite side of any highway or street to that occupied by the poles or wires of any existing telephone or electric light system."

(To be continued.)

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Opal Shades.

I am interested in the article on page 275 of your February 16th issue on "Opal Shades."

I should like to point out that the writer of the article apparently misses the point in respect of the virtues of scientifically-designed shades, in his endeavour to state the claims for ordinary opal shades.

It is very well known that a certain concentration of light can be obtained from opal shades, just as it can be obtained from any reflecting surface—a piece of tin, glass mirror, or any white surface.

The point is, however, not that these surfaces can reflect, but that there is no definite control of the reflection by which the light can be distributed in a definite, desired form. This is the real advantage for efficient lighting given by scientifically-designed reflectors, such as the Holophane.

The opal shades give a "diffuse" or irregular reflection, and the form of light distribution cannot be definitely controlled; whereas, with Holophane reflectors, by the use of right-angle glass prisms, we secure definite and regular reflection, which admits, shaping the reflector so as to give any desired form of light distribution. This difference marks a distinct advantage for the prismatic glass reflector, as, when properly designed, such reflectors ensure that the light is distributed in accordance with the required conditions for uniform lighting in any installation.

With the definite and efficient reflecting results, therefore, that Holophane reflectors give, it is possible to employ lamps in a much more certain and effective manner for illuminating work than with opal shades.

It is no longer necessary to hang lamps directly in the line of vision, as is so prevalently the case with opal shades, but lamps can be placed well above the line of vision or close to the ceiling, with marked improvement in illuminating results.

Along the line of reasoning given for opal shades, one might argue that it is not necessary to employ a nozzle for a hose, as by pinching the hose at the end one could get the necessary stream or spray of water without purchasing expensive nozzles.

It is important for contractors, engineers and users to have a proper understanding of the value of a scientific and efficient reflector. Illuminating work admits of definite engineering, requiring the use of scientific designs of reflectors, just as, in other kinds of engineering, scientific designs of apparatus are required and are displacing those of a more or less approximate and non-scientific design.

No doubt at the time clocks were invented many people contended that sundials and previous other crude methods of keeping time were sufficiently satisfactory, and it was not necessary to purchase expensive clocks and watches. At the present time clocks and watches have become accepted instruments, giving definite and accurate results, and, in the same way, the prismatic glass and other scientific designs of reflectors should supersede the previous crude designs, such as the opal shade.

It is a fortunate thing for the electric lighting industry that they have available such an excellent, convenient and effective device as the Holophane reflector for securing good illumination. These reflectors are made in three convenient forms to cover the general conditions of lighting. They are made to suit each size of metal-filament lamps. A correctly designed supporting gallery holds them in the



exact focusing position over the lamp, and a complete "lighting unit" or "set" is therefore available in ready form which ensures a definite lighting result, far superior to anything obtained with other types of reflectors, such as the ordinary opal shades. Furthermore, these Holophane reflectors are of proper size and length to enclose the lamp, thus eliminating glare—a material improvement over the results in practice with opal shades, where, in many cases, the lamps protrude their bare brilliancy in a most glaring and unpleasant way.

Nor must Holophane reflectors be considered expensive. While their first cost is naturally somewhat higher than that of the simple pieces of opal glass and such types of reflectors, this first cost is more than returned in the better lighting results these Holophane reflectors ensure.

Good illumination is so much dependent upon effective and efficient reflection, that it is false economy to economise by buying cheap reflectors.

F. W. Willcox.

London, E.C., February 24th, 1912.

### Our Progressing Manufacturing Firms.

At the annual dinner of the General Electric Co., and in the *Magnet Magazine*, Mr. Hirst has quite unintentionally furnished a reply to "N. D. G.'s" letter in your last issue. I do not for one moment suggest that "N. D. G." refers to the General Electric Co., though I am sure that 9 out of 12 central-station engineers could speak of similar experiences with several supply firms; nor are "N. D. G.'s" troubles entirely over yet. By March 31st he will receive a statement on which each consignment, sent him in error, will be charged.

Mr. Hirst states that "it was found necessary to form subsidiary companies in order to keep the Witton factories fully employed." Cases have been brought to my notice by colleagues in which two of the largest supply houses, which are specially equipped for the work, were asked to tender for an 8-H.P. three-phase motor and a small switchboard, capable of dealing with a private plant of about 10 kw. In each instance the time required for delivery was about three months; smaller firms offered to supply in 7 to 14 days, and secured the order. Again, a new tungsten lamp was shown at Olympia Exhibition, and the various agents were energetically canvassing for orders shortly afterwards. One engineer ordered 500; I am not quite sure whether he has received the whole of the 500 at present—if he has, he is more lucky than the contractors.

I have the opportunity of watching the methods of our friends, the gas and general engineering supply houses, and I must admit that they have solved the difficulty, as I experience practically no trouble in that direction.

Your readers will ask what is the cause of this difficulty.

In my opinion, it is branch offices and their organisation. Whilst several firms are notable exceptions, the following is a typical case: A's traveller calls to inquire whether I am requiring anything. On a recent occasion I was ordering a three-phase meter, with demand indicator, and also a motor and circuit-breaker. Upon my asking a few questions regarding the speed, power factor, &c., the representative admitted that he knew nothing about it, but would arrange for a meter expert to call. A visit to the local office only produced the same result. A few days later B's traveller called, and upon my asking for the same particulars, he produced his pocket-book of "Technical Data," promptly replied to all my queries, and secured the order. The order was executed in the time stated, and the apparatus proved satisfactory in every way. This firm is an exception, being apparently perfectly organised in works, head office and branches.

If supply houses find it necessary to have so many branch offices, each of these offices should be in charge of a manager who thoroughly understands the whole of the goods he is selling. He should also possess the necessary organising ability, and either train or obtain representatives with a general knowledge of every inquiry they are likely to handle. The head office or works should supply the staff with full general and technical particulars of everything they manufacture (which is the exception rather than the rule). Particular attention should be given to deliveries, and no

standard article should be offered for sale until they are in a position to deliver.

Mr. Hirst need only look up the value of electrical goods imported from the Continent to realise that more than enough orders to keep his factories going can be obtained.

Central Station.

### The Electrical Profession As It Is.

With reference to my recent letter on this question, I regret that pressure of other matters has prevented me from replying sooner to the comments and letters which my letter produced. First, I must correct an impression which appears to exist as to my aims and myself. In your editorial comment on my letter you refer to me as someone who is having difficulty in finding a situation: let me make it clear that such is not the case. In the past I *have* held positions of responsibility, neither am I at present seeking a situation, so that your comment is entirely wrong in that respect; my sole object in writing was to put matters as I have seen them, and it is only too true that numbers of men could say exactly the same, were it not that most of them are disgusted and tired of discussing the subject.

Considering matters about hopeless, these men do not rush into the Press with their grievances, and in this, perhaps, they are right, as it appears more evident every day that most of the journals have no sympathy for the unfortunates of the profession, those who have gone under in the struggle for just recognition. I quite realise that the profession contains many would-be engineers, such as plumbers, iron-mongers, bellhangers, &c., and of these gentry and the havoc they cause I could say a lot; but in dealing with such a phase of the question we must not forget those who, by training and experience, can legitimately call themselves electrical engineers, but are not getting an honest chance, owing to evils which surround them.

The "premium pupil" and the "improver" evil alone are responsible to a large extent for the present condition of things. It is in the spirit of improvement for all deserving that I write these lines, and in the same spirit I trust they will be read.

Diogenes.

[That we deeply sympathise with those who have "gone under" through no fault of their own must be evident to all readers who are familiar with the views we have expressed in our pages. There are also undoubtedly cases of men who have not had a fair chance to prove their worth. But both these classes, as a rule, are silent as to their misfortunes; the noisiest and most self-assertive person is of the kind that knocks off work at the first stroke of the hour: that talks of a "fair day's work for a fair day's pay" and appoints himself the judge as to both items; and that takes no interest in work, though he may be enthusiastic on modes of recreation. We do not wish to class the worker with the shirker, by any means, but the complaint of unrequited merit is usually *prima-facie* evidence, at any rate, that the latter is the complainant. We do not wish by these remarks to cast any reflection on "Diogenes," of whose sincerity we have no doubt.—EDS. E.R.]

**Motor-Cabs in Berlin.**—The most recent statistics regarding the Berlin cab business show the striking influence which the introduction of auto-traction has exercised, and give also some idea of the position of electric cabs. The total number of "droschkas" in the Berlin Police Circuit reached its highest in the year 1907, when it amounted to over 9,000. Since then the numbers have steadily fallen, until at the beginning of 1911 the figures were 7,900, reduced a further 600 by the middle of July the same year. Motor-droschkas up to 1904 continued few in number, but since then they have steadily increased, and of the 7,000 droschkas there are already nearly 2,000 (= 28½ per cent.) motor-droschkas. Of these 2,000, electric motor-cabs form only 14 per cent. A further increase of motor-droschkas and a rapid retrogression of the horse-drawn vehicle is to be expected. The statistics show only a small increase in electric motor-cabs. On July 1st last, a decline of 21 was recorded, as in consequence of the liquidation of the Bedag Co., 36 electric cabs were disposed of. The notice of the President of Police in favour of motor-cabs gives ground for the supposition that a recovery from this decline would be made by the end of year (1911). It is prescribed that electric cabs shall in future be painted ivory white to distinguish them from petrol motor-cabs, for which a brown livery is ordered.—E.T.Z.



## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Hydraulic Sluicing Plant.

We illustrate below an interesting plant which has recently been supplied by MESSRS. JENS ORTEN-BOVING & Co., of Union Court, Old Broad Street, E.C., for sluicing purposes to a Colonial mine.

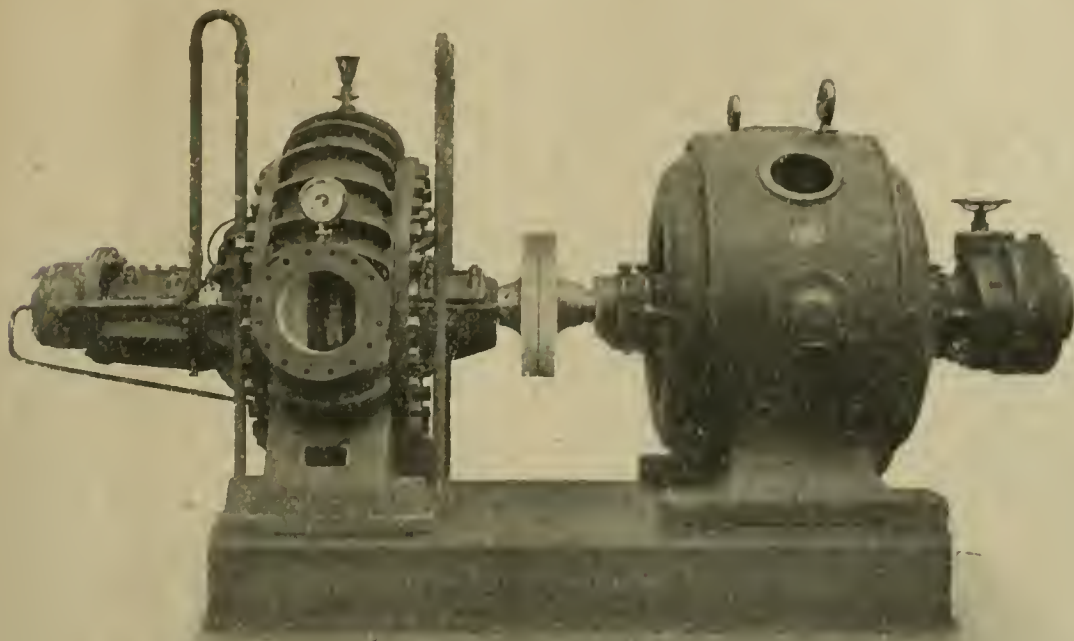


FIG. 1.—ELECTRICALLY-DRIVEN SLUICING PUMP.

It consists of a high-pressure multi-stage type Victoria pump, fitted with an impeller and guide wheel of special phosphor bronze, the inner surfaces being carefully finished to reduce friction, &c.

Dismantling and reassembly of the wheels and diaphragms, which fit cylindrically in the casing, are extremely simple matters, and it is impossible for these parts to get out of alignment when the pump is re-erected. The pump is direct driven, through a flexible coupling, by a 710-B.H.P. three-phase motor operating on 2,200-volt 60-cycle current, and connected to a nozzle fitted on a swivel stand, through a steel pipe 2,000 ft. long.

The pump is designed for a total manometric head of 415 ft.; this results in a pressure of between 130 and 150 lb. per sq. in. at the nozzle, according to the position of the latter, and the jet at this pressure is used for forcing off the gravel, stones and boulders from the solid rock of the hill-side where the mining operations are in progress. Careful trials under full load have shown a pump efficiency as high as 83 per cent.

### High-Lift Centrifugal Pumps.

The accompanying illustration shows a double-ended mine pump driven by an electric motor, and designed for delivering 670 gallons a minute against a head of 1,500 ft. when running at a speed of 1,485 R.P.M. This is one of a series of centrifugal pumps for working under high lifts which are being introduced by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109-11, New Oxford

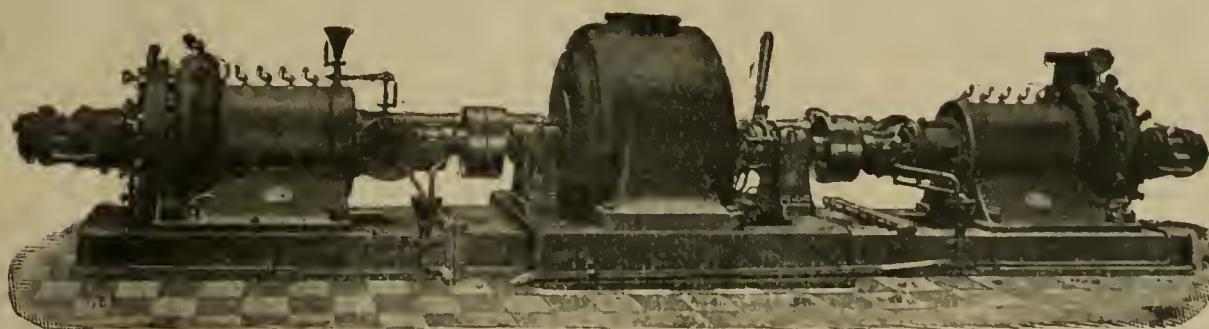


FIG. 3.—DOUBLE-ENDED HIGH-LIFT MINE PUMP.

Street, W.C. In these pumps the runners and guide channels are of special bronze, the suction gland is water-sealed, and the bearings are lined with white metal and provided with ring lubrication. Balancing is effected by the maker's patent hydraulic device, which automatically adjusts itself for variation of head, output and wear; this arrangement is fitted at the pressure end of the pump, and only one bush needs renewal when wear takes place.

Sinking pumps with vertical shafts, boiler feed pumps, &c., are included in the series.

### Rubbing-Contact Electric Bell.

There are few devices so simple, satisfactory and reliable as the common trembling bell; yet this has one weak point—the contact breaker—and many a failure to respond to the "push" has been

due to dirty contacts. The ordinary pattern, with the contact spring mounted on the armature, might have been designed expressly to avoid rubbing of the contacts, so effectually does it attain this end: in the type here illustrated, however, the bell is fitted with the Julius Sax rubbing-contact, which, as will be seen at once, by an extremely simple device, ensures that whenever contact is made the fixed and moving contacts shall rub over one another and thus clean the surfaces. These contacts are fitted to the highest quality bells made by MESSRS. JULIUS SAX & Co., LTD., of 24A, High Street, New Oxford Street, London, W.C.

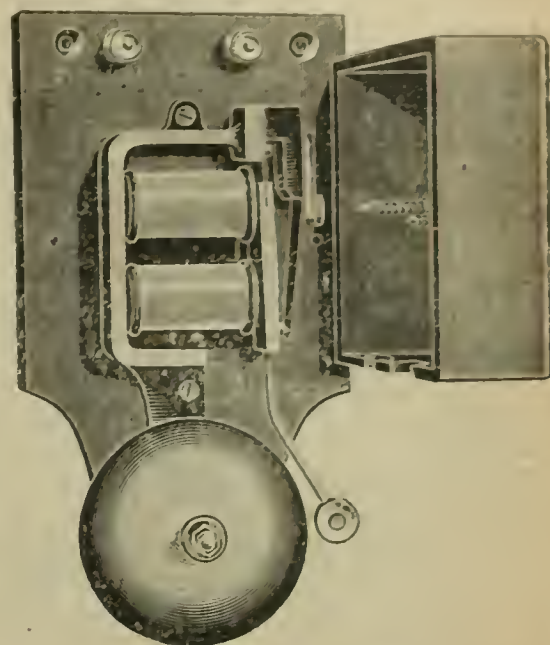


FIG. 2.—BELL FITTED WITH RUBBING CONTACT.

### New Simplex Radiator.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have recently introduced a combination electric radiator and humidifier.

This is intended to get over the uncomfortable drying of the air liable to be experienced with every form of heating unless a high rate of ventilation is arranged for. Our illustration shows the

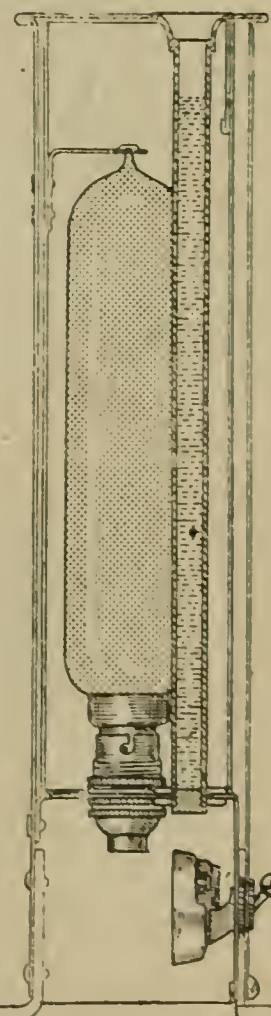


FIG. 4.—SECTIONAL VIEW OF SIMPLEX COMBINED RADIATOR AND HUMIDIFIER.

water tank in section, at the back of the radiator lamps, by means of which sufficient moisture is imparted to the air without resorting to such an amount of ventilation as would impair the efficiency of the heater.

The electric radiator takes no oxygen from the air, and with this form of heater the ventilation may be adjusted to the amount required by the occupants of the room.

### Boiler-Feed Disk Water Meters.

An interesting type of meter for hot water has been introduced by MESSRS. SIEMENS BROS. & Co., LTD., of Caxton House, S.W.,



which, it is claimed, ensures reliable operation, even in the case of very high feed-water temperatures, and is noteworthy in that owing to the use of graphite for the rubbing and sliding parts, lubrication of the moving parts is unnecessary. The construction of the meter is shown in the accompanying illustration (fig. 5). A hollow metal disk, resting on a ball and socket joint, is enclosed in a chamber, the form of which is determined by the peculiar movement of the disk. The disk, which divides the measuring chamber into two equal parts, takes its bearings on the lower and upper ball surfaces. The inlet and outer ports are arranged close together

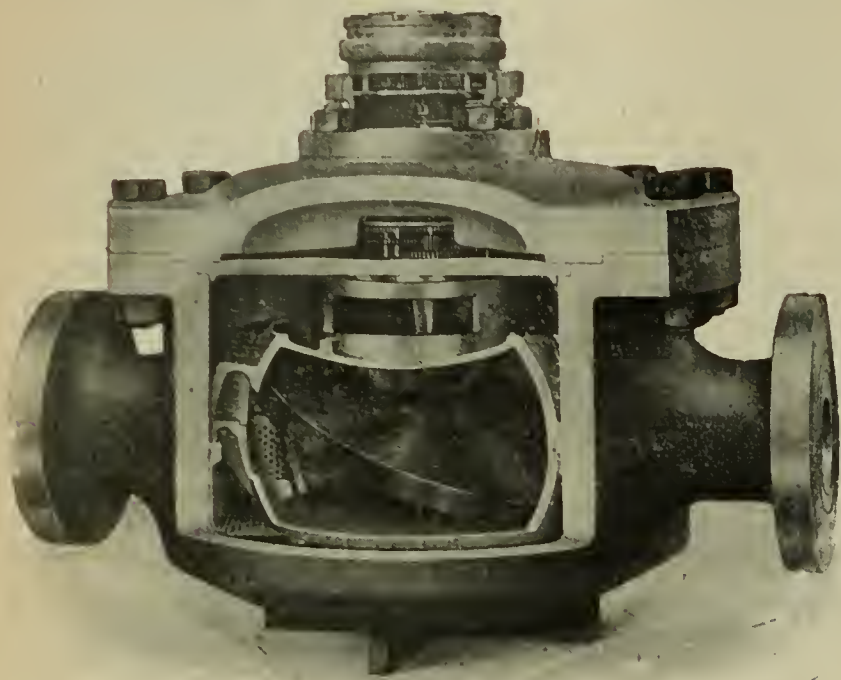


FIG. 5.—BOILER-FEED DISK WATER METER.

and are separated from one another by a vertical wall, running from the circumference to the centre of the chamber. This wall engages a corresponding slit in the measuring disk and prevents the disk from revolving around its vertical axis, and the water from passing through the measuring space without acting upon the disk.

In passing through the measuring chamber the water takes a certain definite course, setting the disk in motion, and with every rotation of the disk, a definite quantity of water—dependent upon the size of the chamber—leaves the meter, as in a piston pump, in which one complete charge leaves the cylinder during one movement of the piston. The quantity of water passed through the meter is read off the dial, which is similar to that of a gas meter.

#### A New Tube-Bending Machine.

THE WARDLE ENGINEERING CO., of 196, Deansgate, Manchester, are supplying the "Skolz" patent pipe-bending machine for the cold bending of gas, steam, and hydraulic piping or solid round bar—such as is used in reinforced concrete work.

This machine is shown in fig. 6; it consists merely of a framework carrying a bending block moved by a screw, and a couple of

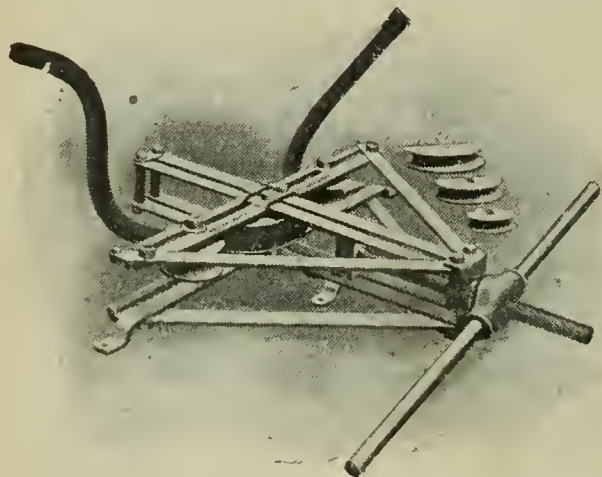


FIG. 6.—THE "SKOLZ" TUBE BENDER.

guide pulleys, and it can be laid on a plank or bench and worked by a man or youth.

The machine is made in three sizes, covering tubes of from  $\frac{1}{2}$  in. to 2 in. bore.

The Wardle Co. also supplies "Skolz" iron cement—a metallic-iron powder—which, when mixed with water to the consistency of putty, can be used for filling defective castings, making joints, &c., in heaters, tanks, pipes, and electric tramway standards, and sets with metal-like hardness.

#### Mazda Traction Lamps.

In our notice of these lamps last week the sizes in which they are made were incorrectly stated. They should have been:—20 C.P. 25 watts, and 30 C.P. 40 watts.

### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"REMUNERATION" writes:—"We received in 1909 and 1910 instructions to draw up specifications and obtain estimates for putting a certain installation into order (there having been complaints for several years), and instructing us to use up old materials. We obtained estimates, using old materials, but stated that it would be rather a patched-up job, and thereafter were told to get estimates for complete renewal, which we did.

"The question of building a new boiler house then cropped up, and of renewing the whole work on a basis hitherto not feasible, and we drew fresh specifications, plans, &c., for this, and got tenders. The works did not go on.

"We charge 3 per cent. on lowest of estimates in each of the three cases—plus expenses, plus reports, and plus other things.

"Our clients state that we are not at liberty to charge on 3 per cent. basis—nor to receive remuneration on basis of any percentage on estimated costs, and quote 'Farthing v. Tompkins, 1893, 9 T.L.R. 566.' They say our fees should be settled on principle of *quantum meruit* in view of works not being carried out. How is that to be arrived at? We know of no custom or rule. Our clients referred to constitute three eminent lawyers. We should like to know whether there are cases where the Courts have passed the 3 per cent. basis.

"The question seems to be of interest to the profession, and while we are not on unfriendly terms with our clients, we should like to know what is customary and what is correct."

\* \* The statement that clients are not bound by the 3 per cent. scale is probably correct. It was decided in *Farthing v. Tompkins (supra)* that an architect was not entitled to recover commission (claimed on the amount of the lowest tender) on the estimated expense of a building never, in fact, erected, as that would include payment for supervision of the works, but he was allowed remuneration for plans, specifications and working drawings, and quantities taken out by him. A claim for a definite fee, like 3 per cent., must be founded either on agreement or on universal well-recognised custom; and it is anticipated that "Remuneration" would hardly assert that there was any such custom in his profession. What is known as "Ryde's scale" for the payment of architects in relation to building contracts has often been discussed in the Courts, and although in particular cases it may be held to be applicable, it is not always so. Each case must depend on its own peculiar facts. (See *Stenning v. Mitchell*, "Emden's Building Contracts," fourth edition, page 661). In the circumstances, it is probable that the view of the "three eminent lawyers" is correct.

"ESCO" asks:—"Where a gas company and an electricity company are supplying in the same town, if the electricity company obtains the contract for the whole of the public lighting, can it compel the gas company to supply gas (on reasonable terms) to certain street lamp-posts which it would not be profitable to supply with electricity, or which are not in the neighbourhood of the electricity supply mains?"

\* \* It would be interesting to see the form of contract under which the electricity company above referred to has obtained powers. Indeed, it is not easy to answer the query without access to that document. Sec. 24 of the Gas Works Clauses Act, 1871, provides that gas undertakers must supply gas to any public lamps within the distance of 50 yards from any of the mains of the undertakers in such quantities as any road authority within the limits of the special Act may require to be supplied. It is not clear that the road authority has any power to delegate the right to make this requirement. Moreover, by Sec. 29 of the Electric Lighting Act, 1882, it is provided that in cases where a supply of electricity is authorised in any area, and within such area gas undertakers are under any limited or general obligation to supply gas on demand, the Board of Trade may, upon the application of the gas undertakers, make inquiry, and if they are satisfied that the supply of gas in that part has ceased to be remunerative, and that they should be relieved from the obligation to supply gas on demand, may make an order granting relief, either wholly or in part, and upon such terms and conditions as they may think proper, and from and after the date of such order, the gas undertakers are relieved. Whether this power would be exercised by the Board of Trade in the case suggested it is difficult to say.

**New Brazing Flux.**—Messrs. Southern Automobiles, Ltd., of Westcombe Hill, Blackheath, S.E., have brought out a new flux for brazing cast-iron under the title of "SA Brazing Flux." One of the features claimed is that this flux will carry the spelter into the minutest cracks; also it is not vital that the surfaces of the fracture should be perfectly clean, although it is advisable where possible. The flux leaves very little scale behind it, and what there is will be found quite soft and easily removed. The makers offer to send a small sample of repair work to any of our readers who are interested, and also to advise on any class of cast-iron repair, if the parts are sent to them carriage paid. It is stated that the cost of a repair using this material will be very much less than the present rates charged for this class of work.



## PARLIAMENTARY.

## Government Department Contracts.

A RETURN has been prepared of all contracts made in the United Kingdom for manufactured articles by the several Government Departments in the years ending March 31st, 1910, and March 31st, 1911, respectively, either with contractors outside the United Kingdom or with contractors or agents who obtain the articles from abroad. The following are amongst the contracts so made:—

	1909-10.	1910-11.
<b>THE ADMIRALTY.</b>		
Apparatus, wireless telegraphy ...	£1,236	£5
Carbons ...	184	220
Cells, dry ...	438	2,806
Drills, electric ...	—	67
Fuses ...	108	5
Lamps, arc ...	—	280
Plugs, ignition ...	53	72
<b>WAR OFFICE.</b>		
Aluminium ...	£683	£1,061
Wireless telegraphy apparatus ...	104	—
Carbons, electric lighting ...	1,490	209
Coils, porcelain ...	141	—
Copper ingot ...	108,200	120,276
Electric fans ...	40	—
Motors, dynamos & boosters ...	—	7,019
Plant, electrolytic ...	—	2,278
Telephones ...	67	60
<b>POST OFFICE.</b>		
Telephone Exchange installations & telephonic apparatus ...	£6,871	£21,744
Telegraphic apparatus of various sorts ...	531	244
Fire alarm apparatus ...	—	300
Electric light apparatus and fittings ...	1,595	483
Carbons—Electric light ...	587	682
Ebonite goods ...	2,237	1,081
Binellac wire ...	213	—
Tin ...	2,365	1,597
Spelter and zinc ...	142	—
Motors—Electric and parts ...	—	102
Tools ...	234	402
Cells, dry ...	12	24
Eburiu insulators ...	84	50
Ambroin insulators ...	—	79
Lightning projectors ...	—	562
Measuring and testing apparatus ...	135	104
Cable terminals ...	—	503
Steel ...	—	179
Wax heaters, electric ...	21	167

**Petitions.**—The following are amongst the petitions which have been deposited against Bills originating in the House of Lords:—

Brighton Corporation.—Hove Corporation; British Electric Traction and others; Portslade, Shoreham and Southwick Urban District Councils.

Brighton District Tramways.—Hove Corporation and the Portslade U.D.C.

Brighton, Hove and District Railless Traction.—Hove and Worthing Corporation; British Electric Traction Co.; Shoreham and Southwick U.D.C.'s; and Steyning R.D.C.

Hove Corporation Railless Traction.—British Electric Traction Co.; and the Portslade, Shoreham and Southwick U.D.C.

London and North-Western Railway.—The North Metropolitan Electric Power Supply Co.; Midland Electric Corporation; St. James' and Pall Mall Electric Light Co.; Kensington and Knightsbridge Electric Lighting Co.; Lancashire Electric Power Co.; companies supplying electrical energy in, and in the neighbourhood of, the Administrative County of London; Yorkshire Electric Power Co.; and 52 other petitions, including a large number of local bodies and gas companies.

North Ormesby, South Bank, Normanby and Grangetown Railless Traction.—North-Eastern Railway; North Riding County Council; and Cleveland and Durham County Electric Power Co.

**Trackless Trolley Systems.**—Mr. Pirie asked the President of the Board of Trade if the attention of the Government had been drawn to the growing necessities, especially in country districts, for an increase of facilities for the promotion of trackless tramways; if he could state the number of Bills and Provisional Orders respectively that had had to be promoted through the House of Commons for this purpose; what was the total cost of such promotion; and if, in view of the fact that such tramways required no more erection than the establishment of telegraph or telephone lines along the road, which connection the telephone authorities were permitted to put up without having to come to this House, the Government would consider the desirability of leaving this matter within the hands of the local authorities by authorising direct communication with the Board of Trade in order to obtain the necessary sanction. Mr. Buxton, in reply, said that during the

last three Sessions 24 Bills or Orders were promoted for the purpose of authorising the running of cars on the trackless trolley system, and 12 Bills or Orders for the like purpose were being promoted this Session. Of the 24 schemes, 8 only had been sanctioned by Parliament. He had no information as to the total cost of promotion which had been incurred. The question of facilitating trackless trolley schemes had been under the consideration of the Board of Trade, and he hoped to be able to introduce legislation on the subject.

**Second Reading.**—In the House of Commons on February 21st the Ramsbottom Urban District Railless Traction Bill was read a second time.

In the House of Lords on Tuesday the following Bills were read a second time:—Hove Corporation Railless Traction Bill; North Ormesby, South Bank, Normanby, and Grangetown Railless Traction Bill.

In the House of Commons on Tuesday the following Bills were read a second time:—Bognor Gas Light and Coke Co. (Electricity) Bill; London Electric Railway Bill.

## BUSINESS NOTES.

**Bennis Contracts.**—We have received a lengthy list of contracts for stokers and coal and ash handling plant recently received by Messrs. Ed. Bennis & Co., Ltd., of Little Hulton and London. They include the following:—

Balfour, Williamson & Co., London, E.C. (for Chili).—Six stokers and self-cleaning compressed air furnaces; gravity bucket conveyor for feeding four boilers.

The North-Eastern Steel Co., Ltd., Middlesbrough.—Two stokers and self-cleaning furnaces. Repeat order.

Steel, Peck & Tozer, Ltd., Rotherham.—Six stokers and self-cleaning furnaces. Repeat order.

Admiralty Dockyard, Chatham (Electric Light and Power Station).—Four chain grate stokers. Repeat order.

Corporation of Stoke-on-Trent, Electricity Station, Hanley.—Two stokers and self-cleaning furnaces. Repeat order.

Technisch Bureau Voor Economische Stoomproductie, Rotterdam (for De Suikerraffinaderij, Amsterdam).—Two high-duty coking stokers on chassis for Stirling boilers.

The Bradford Colliery Co., Ltd., Manchester.—Two colliery furnaces for hand-firing. Repeat order.

The Tinsley Park Colliery Co., Ltd., Tinsley Park, Sheffield.—Two hand-firing furnaces (self-cleaning).

Tetlow Bros., Hollinwood (for the Ashton-under-Lyne Corporation Electricity Works).—Three bucket elevators for feeding three boilers.

T. Docwra & Son, London (for the Alexandria, Newport and South Wales Docks Power Station).—Coal bunker for four boilers.

S. Cutler & Sons, Ltd., London (for Amsterdam Municipality).—Two rotary truck tipplers suitable for dealing with Continental railway trucks, varying in capacity from 10 to 20 tons each.

**Catalogues and Lists.**—MESSRS. WARD & GOLDSTONE, Springfield Lane, Salford, Manchester.—36-page catalogue containing information relating to a great variety of electrical accessories for the motor-car and garage. This is a profitable department of business which it is felt the electrical contractor has not cultivated so zealously as he might have done, otherwise it would not have got so largely into the hands of general automobile firms. Messrs. Ward & Goldstone have specialised for the last eight years in the application of electrical appliances to the car, particularly the electric lighting of the car and charging appliances for the garage; therefore, their catalogue, with its various supplements, one of which is devoted exclusively to a system of electric car lighting, and lamps, batteries and accessories used in connection therewith, should be of considerable service. The contents of the catalogue include accumulator charging equipments, the "Hydranamo" system of accumulator charging from the cellar water-tap, the "Primax" battery, circuit-breakers, ignition coils and batteries, meters, inspection and test lamps, "Sampson" car lighting sets, switchboards, motor-car switches, interior lamps, side and head lamps, wires, spark plugs, &c.; also the "Sherbourne" petrol engine and dynamo, the "Sampson" electric lighting and charging set, the "Colonial" combined plant, and so forth. One of the supplements enters into the "Sherbourne" engine more fully, and the other contains a description of the "Facile" electric car lighting set, the Radiant electric lamps, car lighting accumulators, electric side lights, &c. Loose accompanying lists relate to "Metallum" lamps (prices); "Multex" pocket and portable hand-lamps; "Auto-Metal" accumulator and battery lamps; and the "W. & G." electric vulcanizer. The small lighting plants listed are with two-cycle type engine, which the firm early introduced for electric lighting purposes. During the last five years they have sold many hundreds of these sets in the Colonies for bungalow, farmhouse and similar purposes, and many for use in England. Copies of the catalogue will be sent to interested firms on application.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., Cheston Road, Aston.—16-page catalogue, No. M275, in which are given brief descriptions, together with illustrations and tabulated particulars including prices, of the following:—"Vickers" motor starters, open, semi-enclosed and water-tight types; Vickers combined motor starters and shunt regulators, single and double automatic types; motor control panels of open, semi-enclosed and water-tight types. Dimensions are tabulated at the end. All sizes of open and semi-enclosed starters are held in stock.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—A batch of small mailing cards used by the firm for enclosure with correspondence has been received. Each of them



gives an illustration, brief notes, and prices of one or other of the following:—D.C. motor-generators; cell-testing voltmeters; a combined ohmmeter and generator; knife switches; water-tight rotary switch; mining switchgear; and searchlights.

**THE INDESTRUCTIBLE CABLE CO.,** 20, High Holborn, London, W.C.—16-page catalogue containing illustrated particulars of their several classes of copper wires and cables with "indestructible" insulation, a number of pages being devoted to tables of code-words, diameters, weights per mile and prices. The last few pages are devoted to particulars of bronze wires for telegraph and telephone wires, soft copper wires for bells, copper and iron binding wires. Copies of the list will be sent on application.

**THE ARMORDUCT MANUFACTURING CO., LTD.,** Farringdon Avenue, London, E.C.—A new folder has been issued, giving particulars of the "Gral" metal-filament lamps and a table of prices for lamps, ranging from 25 to 260 volts and 7.2 to 90 C.P. Quantities of these folders are being supplied to the trade, over-printed, for distribution among consumers.

**THE ELECTRICAL POWER ENGINEERING CO.,** Stechford, near Birmingham.—Circular containing tabulated particulars and prices of their standard D.C. dynamos and motors, enclosed ventilated and totally enclosed, for from  $\frac{1}{8}$  to 10 H.P., also starting switches, &c., for same.

**MESSRS. COX-WALKERS, LTD.,** Darlington.—Leaflet giving particulars and prices of the "C.W." new pattern electric lamps for motor-cycles and cars.

**THE WESTERN ELECTRIC CO., LTD.,** North Woolwich.—Small pamphlet (No. 107) of 16 pages, containing full instructions for installing their Westophones, Interphones, and single-line telephones, with about a dozen useful diagrams.

**Hydro-Electric Contracts.**—A large number of orders have recently been booked by **MESSRS. JENS ORTEN-BOVING & CO.,** London, including the following:—

#### WATER TURBINES.

Trenton, Canada.—Four twin vertical turbines, 1,200 H.P., 18-in. head, 122 R.P.M. each, with governors.  
 Drawin & Milner, Sheffield.—One turbine, 100 H.P., 15 ft. head, 200 R.P.M.  
 City of Worcester, England.—One vertical double Francis turbine.—9 $\frac{3}{4}$  in./14 in. H., 285/450 B.H.P., 125 R.P.M.  
 Shibaura Engineering Works, Hachiman Hydro-Electric Co.—One Francis turbine, 200/220 H.P., 17-ft. head, 230 R.P.M.  
 Hydro-Electric Power and Metallurgical Co., Ltd., Tasmania.—Two impulse wheels, 5,000 H.P., 1,000 ft. head; two exciter wheels, 180 H.P., 1,000 ft. head.  
 Indian Government, hydro-electric plant.—Three high-pressure turbines, H = 510 ft., 450 H.P.

#### PIPE LINES.

Hydro-Electric Power and Metallurgical Co., Ltd., Tasmania.—Two H.P. pipe-lines, 950, 850 and 750 m/m internal diameter, with H.P. muff joint, about 4,350 ft. long, maximum static head 1,120 ft.  
 Indian Government, hydro-electric plant.—Three welded pipe-lines, 16-in. diameter, 1,350 ft. long, &c.

#### PUMPS.

Willans & Robinsen, Ltd., Queensland Railway.—One circulating pump, 1,700 G.P.M., 114/124 ft. head, 1,740 R.P.M., with spares.  
 The Tata Iron Works Co., India.—One electrically-driven Victoria turbo-pump, 750 G.P.M., 573 ft. head, 1,450 R.P.M., 184 B.H.P.  
 Yates & Thom, Ltd., Blackburn.—One centrifugal pump, 600 G.P.M., 635 R.P.M., 28 ft. head.  
 Körting Bros., Ltd.—One Victoria low-pressure turbo-pump, 3,000 G.P.M., 50 ft. head, 730 R.P.M.

**Belgium.**—A new company has just been formed in Brussels, with a capital of £58,000, and the title *Le Lift Compagnie Générale de Construction Mecanique et Electrique*.

**Mordey-Fricker Electricity Meters.**—We understand that the British Insulated and Helsby Cables, Ltd., who have hitherto manufactured these meters for the Mordey-Fricker Electricity Meter Co., Ltd., have also made arrangements to take over the sales business in these instruments.

**Annual Dinner.**—On the evening of February 23rd the staff of the Anchor Cable Co., Ltd., held their eight annual dinner at the White Horse Hotel, Leigh, when about 32 members and friends sat down. After dinner a smoking concert was held, presided over by Mr. James Callender. Mr. J. Bowyer, the works manager, proposed the toast of the evening, "The Anchor Cable Co., Ltd.," to which Mr. Callender replied. In the course of his remarks, Mr. Callender said that the past year had been the most successful in the annals of the company. He complimented the whole of the staff on the way in which the work of the year had been carried through, and on behalf of the company thanked them all heartily for their efforts. Mr. Arthur Croke proposed the toast of the guests, to which Mr. Lang suitably responded. The concert was provided by Mr. Walter Darlington's party, consisting of Messrs. Sumner, Allred and Reason, who rendered songs, duets, and humorous sketches.

**Trade Announcements.**—**MR. A. H. FINCH** and **MR. A. IMESON**, late managing directors of Imeson, Finch & Co., Ltd., have ceased their association with this firm, and have commenced business as a private firm (Imeson & Finch, tramway contractors and manufacturing electrical engineers, Alma Chambers, Bridge Road, Stockton-on-Tees), manufacturing and supplying as before.

The business of **MESSRS. NASH & SMITH**, electricians, of 14, Corn-wall Road, Walmer, Kent, has been taken over by Mr. Edward W. Smith.

**MR. GEO. NEWBY**, electrical engineer, of Harrogate, has removed to new premises at 10, Prospect Crescent.

**THE HART MANUFACTURING CO.** announce that owing to increased business and the necessity for holding adequate stocks in London, they have taken over the adjoining building, thereby doubling the capacity of their premises. Their address is 76 and 77, Rochester Row, Westminster.

**Book Notices.**—*The Motor Manual*, 1912. London: Temple Press. Price 1s. 6d.—This is the fourteenth edition and the 200th thousand of an invaluable handbook, whose popularity speaks for itself. It is kept well up to date and rewritten when and where necessary, and contains an inexhaustible store of information on the subject of motor-cars. No owner should be without it.

*Motors and Motoring.* By Prof. H. J. Spooner. 5th edition. London: T. C. & E. C. Jack. Price 2s. net.—This is a very clearly-written account of the construction and characteristics of the petrol engine as applied to motor-cars and the management of the car in use. It is primarily intended for students, but is quite well adapted for the use of any person interested in the subject. It is very well produced, but the author has perhaps too freely availed himself of the system of emphasising words by printing them in bold-faced type. On page 227, for example, there are only eight lines in which this does not occur. Electric vehicles are only mentioned in passing; but there is a good section on electrical ignition.

**Bankruptcy Proceedings.**—**THOMAS TOPPING**, electrical and mechanical engineer, 361, Lord Street, Southport, Lancaster.—The adjourned public examination of the above-named debtor was held at the Court House, Government Buildings, Victoria Street, Liverpool, on Monday last, before Mr. Registrar Howarth. An opportunity is to be given the debtor to amend his statement. The Registrar said if he was informed by the Official Receiver that the amendment of the statement was in order he would close the examination, if not it would be adjourned.

**JOSEPH PLATT**, electrical engineer, Bolton.—An order was made on January 17th suspending discharge for one year.

**For Sale.**—Messrs. Toplis & Harding will, on Tuesday, March 5th, sell by auction as a going concern the goodwill and business of the Langdon-Davies Motor Co., Ltd. Messrs. P. Huddleston & Co. will, on Friday, March 8th, sell by auction, at 298 and 300, Goswell Road, the entire stock and plant of Vaughan Engineering Installations, Ltd., (in liquidation). See our advertisement pages to-day.

**Dissolutions and Liquidations.**—**FRIEND, WINTLE AND CO.**, electrical and general engineers, Quay Street, Cardiff.—Messrs. H. G. P. Friend and H. Wintle have dissolved partnership. Mr. Wintle will attend to debts, &c.

**AFRICAN TRANS-CONTINENTAL TELEGRAPH CO., LTD.**—Creditors must send particulars of their debts or claims to the liquidator, Mr. P. J. Baird, 2, London Wall Buildings, E.C., by April 15th.

## LIGHTING and POWER NOTES.

**Accrington.**—On Tuesday a L.G.B. inquiry was held here by Mr. T. C. Elkin into the application of the Corporation for sanction to the borrowing of £33,750 for purposes in connection with the electrical undertaking of the Corporation, including the carrying out of work at Altham and Clayton-le-Moors. Mr. Gray, electrical engineer for the Corporation, gave a detailed estimate of the cost of the engines and generating plant necessary for the Corporation's requirements, and said the tenders had not yet been let. The Town Clerk said that, making reasonable allowances, the whole of the plant would be in use next winter. It was required for the supply of electricity to Clayton-le-Moors and for Altham, and for general extensions. Figures were given showing that the cost of gas plant would be £8,000, gas engines and generators £13,500, main switchboard £550, foundations, &c., £2,480. There was no opposition to the application.

**Acton.**—It was reported at the last meeting of the Council that certain matters were still in dispute in connection with the transfer of the electricity undertaking to the Metropolitan Electric Supply Co., whose solicitors' letter, making an offer of settlement, the chairman (Councillor Crane, J.P.) moved be referred back to the Committee, with an instruction that, unless the matter was settled forthwith, the Committee take the strongest possible action, either by applying to chambers for the naming of an arbitrator or the naming of an arbitrator between the two parties. It was suggested that the Committee conducting the negotiations was hurried and hustled by members of the Council, who were anxious that the undertaking should leave the Council's hands.—Councillor Page said the matter was hurried in order to help the rates for the current year.—The chairman said he was obliged to add that at the outset a letter was written by him, as chairman of the Council, to the late electrical engineer, warning him against allowing the company to have access to the papers or books of the undertaking without the consent of the Council, but that instruction was entirely disregarded.—The motion to refer back was agreed to.

**Australia.**—The Melbourne City Council is negotiating with the Brunswick and Port Melbourne Councils for supplying them with energy at £6 10s. per kW. of maximum demand and 7d. per unit.

The Sydney City Council has had under consideration the question of coal storage for the Council's power house. The engineer's estimate is based on 20,000 tons being required to meet



three months' consumption in five years' time, and this would necessitate obtaining 2½ acres of ground on which to store 12,500 tons of coal which could not be accommodated at the power house.

Tenders have been called for the erection of a 600-kw. generating plant on the banks of the Molongo River, N.S.W., adjoining the Federal capital site. High-speed engines and three-phase alternators with water-tube boilers are proposed, the cost being about £20,000. This plant will supply power and light for the contractors engaged on the work of building the City.

We hear from Mr. P. J. Pringle, that, in the case of the Ballarat and Bendigo undertakings of the Electric Supply Co., of Victoria, it has been decided to increase the price of electricity owing to the growing cost of working due to all-round increases of wages, &c. During the past 12 months the Ballarat private lighting revenue has increased some 50 per cent. and the consumers by 59 per cent.; the horse-power of motors installed and in hand has increased by 84 per cent. This represents 253 new consumers and 286 H.P. in motors. Mr. Pringle also refers to the withdrawal of free passes on the Ballarat and Bendigo tramways for the same reason as mentioned above. Nearly 200 passes are in circulation, 110 in connection with the police and the remainder divided amongst the members and officials of five municipalities.

**Argentina.**—The Rosario Municipality has resolved to throw out the two tenders received for public lighting. The Rosario Electricity Co. has presented a draft contract for approval, offering to supply current on very reasonable terms for a period of 25 years. This project will be taken into consideration by the Council as soon as it meets.—*Review of the River Plate.*

Work will shortly be commenced on the electric light station at Curuzu-Cuatia. Mr. L. Bubbio, a local merchant, is the concessionaire.

**Aylesbury.**—The U.D.C. has passed the following resolution:—"That the Council, in the event of a prov. order for electric lighting being granted, and confirmed by Parliament, intend to carry out the powers conferred by such an order."

**Balderton.**—At a meeting of the P.C., a report was submitted by Mr. Dilley stating that negotiations with the gas company for a public supply having come to nothing, the Lighting Committee had considered the feasibility of obtaining an electricity supply from Messrs. Simpson & Co.'s engineering works. The scheme proposed was an overhead system of cables with 75 lamps, 50 of 50 C.P. and 25 of 100 C.P., the estimated cost being £115 a year, equivalent to a rate of 2½d. in the £. A resolution was passed to submit the scheme for the approval of the annual parish meeting on March 25th.

**Bispham.**—The new electric light station is expected to be in full working order within the next fortnight. Already a large number of customers have been secured.

**Braunton.**—After a long period of waiting and uncertainty, Braunton, a large North Devon village, has been successful in providing an electric supply, which was formally opened a few days ago. The contractors were Messrs. Crompton and Co., and the engineer in charge was Mr. H. Trefusis. The original scheme for lighting the village is now complete, but there are still several extensions to be carried out. The public lamps will number 60, and are of 50-C.P. each. The lamps used are Osram metal-filament lamps, with pear-shaped globes. The cost of lighting by meter is 5d. per unit, and by contract, 8s. per annum, for each 32-C.P. lamp. Current for motors, &c., or heating will cost 2½d. per unit. The plant consists of a horizontal oil engine of 38 B.H.P. at 225 R.P.M. The dynamo gives an output of 25 kw. at 220-250 volts. The battery consists of 130 cells, having a capacity of 360 ampere-hours.

**Burnham (Somerset).**—The U.D.C. has signed an agreement by which the prov. order for electric lighting is to be transferred to a local company to be formed by Dr. Purves, of Exeter. The company is to pay the cost of obtaining the order, and the Council is to pay not less than £200 a year for street lighting.

**Burnley.**—The Accrington Corporation has promised that the charge for electricity for lighting purposes in Altham should be the same as in Accrington. The Burnley R.D.C., in whose district Altham is, decided to be represented at the L.G.B. inquiry at Accrington, so as to get that condition inserted in the Order.

**Canada.**—A report from the office of H.M. Trade Commissioner for Canada states that another company is maturing plans for operations on the north side of the St. Lawrence opposite the lower end of Grande Island. It is said that the company intends at first to generate 50,000 H.P. The company's capital is stated to be over £2,000,000.—*Board of Trade Journal.*

**Continental Notes.**—**SWEDEN.**—The Swedish Waterfall Authorities have recently placed an order with the Karlsbad Mechanical Works at Kristinehamn for the turbine plant of the Government's power station, which is under erection at Olfkarleby. The order comprises three turbines of 13,000 H.P. each, and designed for a fall of 16 metres and 150 R.P.M. The buyers have reserved the right of ordering two additional turbines of the same type and size, and at the same price per unit, before the end of 1913. The turbines are going to be installed in open chambers, and in regard to dimensions they are among the largest in the world. The consumption of water is estimated at 80 cu. metres per second, which is about 100 per cent. more than that of the turbines at Trollhätten. The order, which also comprises the oil pump and air-compressing plant, amounts to about £22,225.

**AUSTRIA.**—The municipal authorities of Kufstein are interested in a scheme for the establishment of a plant to utilise the water power of the river Weissacherache, in the Tyrol, in the generation of electrical energy for lighting and power purposes.

**Dewsbury.**—A petition has been lodged by the Corporation against the L. & N.W. Railway Bill seeking power to supply electricity to works and other premises adjacent to its lines. The petition protests that the proposals in the Bill constitute an innovation in legislation, and submits that there is no justification for enabling the Railway Company to enter into competition with the Corporation.

**Dunoon.**—Following upon the receipt of the B. of T.'s intimation to revoke the Dunoon Electric Lighting Order (1906), a deputation from the T.C. visited London last week with the object of inducing the Board to reconsider its decision. It is learned that the deputation has been successful in its mission, and that the board has agreed to an extension for another year.

**Edinburgh.**—From a report by Mr. G. A. D. Mackay, inspector of cleansing and lighting under the Corporation, it appears there are 1,248 electric arc lamps in use for street lighting, and that the annual cost per lamp is £10. The stairs in the high tenements in the central parts of the city are now lit with electricity at a cost of 21s. each per annum.

**Falkirk.**—The burgh chamberlain and electrical engineer are to report on the necessity of further borrowing in connection with the extension of the electric light station.

**Keighley.**—The Borough Education Committee has decided to have the new Highfield School lighted by electricity.

**Liverpool.**—An interesting discussion took place at the Corporation meeting on February 21st, when the report came up for approval of the Electricity Committee's recommended reduction of electrical charges, particulars of which have already been published. Councillor Gates moved an amendment that the charges should be further reduced by 5 per cent., pointing out that by the £25,000 voted out of the profits of the electricity department in relief of rates, they were paying 10 per cent. of the prices received from the consumers. 10 per cent. profit on a Corporation undertaking was, he thought, excessive, and the first duty of an electricity Committee was not to make a profit, but to supply the public at a popular price. The only chance of the electricity undertaking getting on a sound footing was by renewing their plant without incurring fresh capital charges, instead of making profits. Councillor Max Muspratt said if the electricity concern was a public company money would be borrowed, no doubt, on debentures, which would not pay under 5 per cent. This undertaking, with the security of the ratepayers behind it, was able to borrow money at 3½ per cent., and the ratepayers had a perfect right to 1½ per cent., or something over £25,000 on their capital. It was a perfectly right and just charge, and the consumers had not the remotest claim to any of it. The amendment was lost, and the Committee's recommendations were agreed to.

The annual report of the Corporation superintendent of street lighting for 1911 shows that 6½ miles of street in the city were lighted by electricity.

**London.**—**HACKNEY.**—A report has been received from Messrs. Preece, Cardew & Snell on the recommendations of Mr. Robinson, the borough electrical engineer, as to a scheme for extending the Council's electrical undertaking by means of three-phase H.T. plant. The report summarises the present position of the Hackney undertaking, showing that the present cost of energy at the station amounts to not more than £3'41 per L.T. KW. demanded, plus 0'355d. per L.T. unit generated. Offers of bulk supply from the neighbouring authorities of Stepney and Poplar are considered, both at £3 per KW. demanded, plus '33d. per unit (H.T.) at their switchboards. These work out at £4'35 per KW. demanded, plus 0'379d. per L.T. unit and £4'2 per KW., plus 0'379d. per L.T. unit, respectively, delivered, for 1,500 KW., or more than the present cost to the Council. Mr. Robinson's scheme, with which Mr. Preece agrees, provides for three three-phase 3,000-kw. turbo-alternators, with boilers, &c., and a ring main supplying three sub-stations, each capable of dealing with 200-kw. maximum demand. The estimated cost is: Generating station, £116,000; H.T. mains, £25,000; three sub-stations, £32,250; L.T. sub-feeders, £22,944; total, £196,194. The station estimates summarised are as follows:—

	£	per KW.
Buildings, coal bunkers and handling plant ...	34,000	3'77
Boilers ...	31,200	3'47
Pipe work ...	11,020	1'22
Turbo-alternators and switchgear	30,500	3'38
Motor-generator, sundries ...	9,280	1'03
	£116,000	12'87 per KW.

These figures, Mr. Preece says, are in agreement with others which his firm has obtained in the case of actual plants carried out. He suggests, regarding the duplicate ring main proposed by Mr. Robinson, that a single ring main with a duplicate diagonal main would prove sufficient for the purpose and cheaper. It is proposed to deal with the scheme in three stages, each one involving the installation of a 3,000-kw. turbine, and the first including a 1,500-kw. motor-generator to link up the H.T. and L.T. plant. The costs are:—Stage I: £64,700; Stage II: £30,300; Stage III: £21,000. A comparison of the estimated cost per KW. demanded in the case of extension of the Council's plant and of purchased supply is given for the years 1912-1919, and greatly favours the extension



of the local plant. Mr. Preece agrees with Mr. Robinson that there are disadvantages incidental to the purchase of a stand-by supply, but sees no reason why the three authorities—Hackney, Stepney and Poplar—should not at a later date link up for mutual help.

**BATTERSEA.**—The General Purposes Committee has decided to retain counsel to appear in support of the Council's petition against the L. & N.W. Railway Bill in the event of the negotiations proceeding, with a view to an undertaking being given to meet the points raised on behalf of the Council, proving unsuccessful. In order to cope with the anticipated increased load, the Electricity Committee has compared terms obtained from the County of London Electric Supply Co. for the supply of electricity in bulk, with a scheme submitted by the electrical engineer, and has come to the conclusion that it would be more economical and satisfactory for the Council to install additional plant. Application is, therefore, to be made to the L.C.C. to sanction the borrowing of £8,768, the estimated cost of an additional turbo-generator set, with the necessary surface condensing plant, pipework, switchgear, and cables in connection therewith. In order to increase the efficiency of six boilers at the central station, five are to be fitted with superheaters and a mechanical stoker is to be fitted to the remaining one.

**L. & N.W. Railway Bill.**—We notice that decisions to oppose this Bill have been come to by West Bromwich, Doncaster, Workson and Cardiff, in addition to others previously referred to.

**Lexden and Winstree.**—The B. of G. has decided to have the electric light installed in the workhouse, and to take current from the Colchester T.C., whose officials are to superintend the work. The installation will cost £139, and the annual cost will be £40 a year. The estimates for gas and petrol gas were both considerably higher for the installation, and, the annual cost of gas was £152, and of petrol gas, £30.

**Lytham.**—A petition is being extensively signed in Ansdell and Fairhaven districts for electric light to be supplied by St. Anne's Council. Before the request can be granted, however, permission will have to be obtained from Lytham Council, and St. Anne's Council will have to obtain the necessary powers.

**Newport (Mon.).**—On February 27th a L.G.B. inquiry was held relative to the application of the T.C. for a loan of £5,000 for electricity purposes.

**New Zealand.**—Tenders have been invited for the machinery, &c., in connection with the Lake Coleridge hydro-electric scheme. This includes a 7,000-ft. tunnel and 2,700-ft. of pipe lines leading to the turbines. Three 2,150-B.H.P. Francis turbines at 500 R.P.M., and a 225-B.H.P. Pelton wheel are to be installed, the latter for driving the exciter. This represents a first installation of 6,000 H.P., but the plant can be extended to 12,000 H.P.

**Peterborough.**—The Corporation has received a request for a supply of electricity for lighting All Saints' Church (Peterborough) and vicarage, as well as a number of residences in the same district. The Council at its next meeting will be asked to extend the mains to supply these, at an estimated cost of £492. The income is put at £58 from consumers, or, including street lighting £97.

**Port Glasgow.**—The T.C. has unanimously decided to abandon the proposed scheme for the installation of plant for electric lighting and power purposes. The question of further procedure has been remitted to the Electricity Committee for report to another meeting.

**Portrush.**—The Plebiscite Committee reported that the majority of ratepayers in favour of electric light was 38; 139 persons had promised to become consumers, 132 had refused to do so, and 157 had not answered that question. The report was adopted.

**St. Anne's-on-Sea.**—The net profits of the local electricity undertaking last year were £1,500. The petition of Ansdell householders to St. Anne's Council for a supply of current in the Lytham Urban District was considered by the Council on Monday; it was decided to institute certain necessary inquiries before proceeding further.

**Salford.**—The B. of G. has approved of a scheme for substituting electric lighting for gas lighting at the Hope Hospital at an estimated cost of £2,000.

**Slough.**—The U.D.C. has accepted the tender of the Slough and Datchet Electric Supply Co. for lighting the pumping station for a year at 6d. per unit for the first 80 units per quarter, and 3d. per unit beyond.

**South Africa.**—Messrs. E. H. Gellander & Co. have secured the contract for the lighting of Volksrust (Transvaal) under agreement with the municipality, and it is hoped to have the installation complete by September, 1912. The system is to be a three-wire D.C. one, with 460 volts across the outers. The municipality will take current at 6d. per unit for street lighting with carbon lamps, or 6½d. if metal lamps are used of not less than 50 c.p. each. The municipality guarantees to use 700 units per month for street lighting, based on 150 nights of six hours and 150 nights of five hours. The contractors will be allowed to charge private consumers at a rate not to exceed 1s. per unit, with a minimum of 5s. per month, and the municipality for its buildings at not exceeding 9d. per unit. The supply will be from sunset to sunrise. Meter rent will be 1s. per month. The agreement is for six years, on the expiry of which the municipality has the option of renewing the agreement or taking over the concern.

**Stockport.**—In consequence of the gasworkers employed by the Corporation striking work on Saturday, the town was threatened with a gas famine. In the evening the gas lighted thoroughfares were mostly in darkness, the electrically lighted streets, however, being illuminated. The gasworkers endeavoured to prevent the electric tramways from running. The strike was settled on Tuesday.

**West Ham.**—In order to provide for the more economical working of the No. 12 turbo-generator, it has been decided to provide a new condenser at a cost of £1,850, and application is to be made to the L.G.B. for sanction to borrow that amount.

**Willesden.**—The Lighting Committee reports having considered the question of the general lighting of the district. This lighting is at present effected by electricity and gas, 10 miles of streets being lighted by the former and 70 miles by the latter; the total cost of lighting per annum by the two systems being:—electric £3,038 and gas £7,294. The Committee has instructed the engineer to prepare a detailed statement of the lighting of every thoroughfare in the district together with the illuminating power of the lamps now fixed. In the meantime, he has been authorised to make arrangements for the lighting of Teignmouth Road and St. Gabriel's Road by electricity and gas respectively, and to obtain estimates from the Electricity Committee and the Gas Company to enable the comparative merits of the costs of the two systems to be ascertained.

**Workson.**—The Council has approved of plans and estimates by the engineer, and decided to seek sanction from the L.G.B. to raise a loan of £7,280 for the following purposes:—Storage battery, &c., £1,750; condensing plant, &c., £1,050; mains and services, £3,740; mechanical stokers, addition to switchboard, &c., £391; contingences, £349—a total of £7,280. It will also make application to the B. of T. for sanction to the erection of overhead wires for the purpose of taking over all existing street lamps that remain lighted by gas, 54 in number.

## TRAMWAY and RAILWAY NOTES.

**Algeria.**—Plans are being prepared in respect of a projected electric tramway in the town of Constantine.

**Australia.**—Mr. Stone, the electrical engineer to the Railway Department, is coming to London to confer with Mr. C. H. Merz on the electrification of the Melbourne suburban lines, the traffic on which has materially increased since the original report was made in June, 1908.

Mr. H. R. Harper, as one result of his recent visit to Europe and America, has succeeded in inducing the Melbourne City Council to obtain a couple of electric-battery lorries for its own use.

Further reports on the Perth, W.A., tramways situation show that a discussion has taken place on the introduction of the motor-bus, and that the purchase of 30 or 40 chassis, possibly from the London General Omnibus Co., is being considered. A speaker denied that these would be the discarded vehicles of the company, which, we have been informed, are in some demand in the Colonies.

The Executive of the Australian Tramway Employés Union recently officially announced that if the men's case were not called on for hearing in the Federal Arbitration Court in February, all the employés of private companies in Australia would go on strike. The men, it was stated, had informed the officers of the Union in the different States that they would take this action on their own account if the case were not heard at once.

**Baildon.**—At a meeting of the D.C. held on Tuesday, February 20th, it was reported that the proposals of the Bradford Corporation in relation to the tramway project met with the approval of the Baildon authority. The Council, it was stated, had expressed a desire for the Corporation to obtain the necessary powers, and it was willing to pay an annual rental for a period of 10 years. Fuller details of the project were considered in committee.

**Blackburn.**—At a meeting of the Corporation Tramways Committee on Monday, it was decided to recommend the T.C. to advance the wages of all drivers, conductors, and shedmen, ½d. per hour, as from the end of the tramway year, March 25th next. No application for an increase had been made.

**Brighouse.**—The Corporation has, by deputation, approached the Halifax Tramways Committee with a request that railless cars should be run by Halifax from the present terminus to the Sun Inn, Rastrick. The Halifax committee was of opinion that the proposal was impracticable, and the deputation then suggested that the Brighouse Corporation should extend its present system and lease the new line to Halifax. After it had been pointed out that such a scheme would have to obtain Parliamentary sanction, the matter was left for consideration by a small sub-committee.

**Coventry.**—By an award under arbitration, the price fixed for the purchase of the tramway company's undertaking by the T.C. is £202,132, this being the value as a going concern. The T.C. is ordered to pay the company the arbitration costs. The sum originally asked by the company was £315,760, and the three valuations made for the Council were £128,180, £133,063, and £130,678. A loan for the purchase money and costs (estimated at £5,000) has been applied for by the Council.



**Greenock.**—A proposal is under consideration for an extension of the tramways to the upper parts of the town. The railless system has been suggested.

**Huddersfield.**—At a meeting of the T.C. held on February 21st, it was reported that revised rates of pay and conditions of service proposed by the Electricity Committee had been accepted by the men employed at the Electricity Works. The proposals set forth that the hours worked should not exceed an average of 54 per week; that overtime be paid at the rate of time and a quarter, and that one week's holiday with pay be granted to all men employed in the department after 12 months' service. The wages varied from 5d. to 8½d. per hour.

**London.**—According to the *Times*, the London United Tramways Co. has agreed to sell its Chiswick power station to the L.C.C. for £220,000. A part of the company's system has for some time been supplied from the Lots Road power station, and presumably the forthcoming acquisition of the company's tramways in London by the L.C.C. has determined it to this course. The Chiswick station formed part of the original tramways scheme carried out by the late Sir Clifton Robinson, and is quite out of date judged by present day requirements.

**Newcastle-on-Tyne.**—At a meeting of the Corporation Tramways Committee on February 22nd, the estimates for the ensuing 12 months were presented by Mr. J. H. Rodgers. He said that last year the estimated income from all sources was £212,350, and he thought that before the end of March this would be increased by £20,000, making a total of £232,350. They estimated that for next year there would be an income of £223,900, which was actually £8,000 less than they would get this year. They estimated £20,000 for general expenses, an increase of £1,500 over last year, the principal reason being the larger amount paid in rates and income-tax. He pointed out that while in 1907 they paid the city £6,783 in rates, they now paid nearly £12,000. On general repairs and maintenance they estimated for next year an outlay of £25,000; on the power station an expenditure of £9,600. The public lighting expenses showed an increase of £4,200, with an expenditure of £123,800. Their gross surplus, if their estimates were correct, would be £100,000, but out of that amount for interest, redemption, and income-tax, £74,000 was needed, less £3,500 interest on money invested. After meeting other liabilities, the net profit was put down at £26,800. Mr. Rodgers submitted a list of streets where renewals would have to take place; these had been inspected by the City Engineer and tramways manager, and the cost amounted to £7,650. There were other places that should be renewed during the year, but the Committee hoped that they would be able to manage the work in the following year. If they were compelled to renew them, they would have to ask for money out of the reserve fund. It was decided to spend £17,836 on extra plant at the power station, thus making £25,486, which would have to be drawn out of the reserve fund. The chairman said that the last-named amount would have to be paid out of this and next year's profits to make the reserve fund what it was. The estimates were adopted.

**Preston.**—The borough engineer and tramways engineer have been instructed to prepare a scheme for the electric lighting of the tramway routes and the Corporation property. The question of improving the lighting of the various streets in the borough has been postponed pending further information.

**Radcliffe.**—During 1911, the number of car-miles run on the U.D.C.'s tramways was 290,054, and the receipts amounted to £10,556, or 8'41d. per car-mile, as compared with 284,990 car-miles, £9,832 receipts, or 8'28 per car-mile for 1910. These figures do not include the extension tramways (Ainsworth and Bury and Bolton Roads), on which there was a loss of £688 (as against £856 in 1910), which will, by agreement, be borne in equal shares by the Bury and Radcliffe Councils.

**Stalybridge.**—The Joint Tramways and Electricity Board has decided to obtain 30 Spencer mechanical brakes for use on the tramways.

**Turkey.**—A new water-power generating station is to be established by the Société des Tramways et Eclairage Electrique de Damas.

**York.**—The Light Railway Commissioners have acceded to the application of the Corporation for a provisional order authorising the extension of the tramways from a junction with the Dringhouses line in Blossom Street to a terminus near the back of the Grand Stand. The extension, which will be about a mile in length, 7 furlongs being double track, is estimated to cost £18,800.

## TELEGRAPH and TELEPHONE NOTES.

**Cheaper Cables.**—The P.M.G. recently stated that the Eastern Telegraph Co. had agreed to reduce the rate for Press telegrams of a non-urgent character to Cape Town and Durban from 9d. to 3½d. a word, as from to-day. He hoped that a reduction in the rate to India would also be effected shortly.

**Congo.**—The Budget of the Congo State for the current year contemplates the expenditure of 40,000 fr. for the installation of a telephone line, and 1,700,000 fr. for the establishment of a wireless telegraphic service.—*Elek. u. Mach.*

**East Africa.**—In his annual report on the development of the East Africa Protectorate for the year ending March 31st last, the Governor says that the total length of telegraph lines amounts to 1,016 miles of pole lines, of which 859 miles are erected on iron poles, and 157 on wooden poles. The mileage of wire amounts to 2,261. The length of telephone pole line is 60 miles, carrying 301 miles of wire. There are 300 telephones in use.

**Portugal.**—The Government has signed a contract with the Marconi Co. for the erection of stations at Lisbon and Oporto, in the Azores, at Madeira, and at St. Vincent. All the installations are to be completed this year.

**South America.**—The *Review of the River Plate* reports that a German syndicate has been buying up the shares of the Cia. Telegrafica-Telefonica, and will shortly obtain a controlling influence. The company will be formally turned over to the syndicate for about £100,000, which works out at about \$230 per share. The syndicate represents the German Cable Co. touching at Fernando Noronha, and with the acquisition of the Argentine Co. it will extend its lines to Monte Video. We referred to this matter in our issue of February 2nd.

**Telegraphists' Hours.**—At a meeting of the London branch of the Postal Telegraph Clerks' Association on Monday last, a resolution was unanimously adopted protesting against the great increase in the late duties at the Central Telegraph Office, and the alleged disregard of the operators' comfort and convenience by the controlling officers.

**The Telephone Service.**—In reply to questions in Parliament, the P.M.G. recently explained that difficulties were experienced in connection with the transfer to new exchanges of the 5,150 subscribers and 1,950 junction circuits connected with the old Westminster and Avenue Exchanges of the company. These exchanges had to be vacated because their equipment was not of a modern type, and the leases of the premises were about to expire. He regretted the resulting inconvenience to subscribers, but believed that during the past three weeks great improvement had been made.

**Uruguay.**—Commenting on the decree of the Government that all ships conveying passengers to or from Uruguay shall be equipped with wireless installations from May 1st, the Monte Video correspondent of the *Times* suggests that as it is an unimportant and unattractive port of call, it is quite doubtful whether the result will not be that Monte Video will be omitted from the itinerary of ships not so equipped, instead of adopting the wireless system.

**Wireless Telegraphy.**—It is proposed that the French Government shall grant a sum of £10,000 to encourage the installation of wireless plant in fishing smacks.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" February 16th.

March 11th.—Electrical goods, for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (Form 26). Stores Manager, Aberaman Offices, near Aberdare.

**Aldershot.**—March 5th. Additions to main switchboard at the electricity works, for the U.D.C. Mr. F. Garside, electrical engineer, Laburnum Road.

**Australia.**—VICTORIA.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

April 2nd.—250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 23rd.—2000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" to-day.

WESTERN AUSTRALIA.—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal*.

Paper-insulated, lead-covered cable and loading devices (Schedules 184 and 185), for the P.M.G.'s Department, Perth. See "Official Notices" February 23rd.

**Barrow-in-Furness.**—March 4th. Electrical and other stores, for the Electricity Department of the T.C. Borough Electrical Engineer.



**Birmingham.**—March 12th. Electrical stores, for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

**Brazil.**—April 18th. The General Direction of Public Works at Pernambuco is inviting tenders for the concession for the construction and working of a system of electric tramways in the town.

**Bulgaria.**—GABRAVO.—Concession for the electric lighting of the city. Particulars from the Municipality.

**SOFIA.**—March 15th. Telegraph and telephone materials for the Bulgarian Directorate General of Posts, Telegraphs and Telephones. Local representation.—*Board of Trade Journal*.

**Canada.**—CALGARY.—March 20th. City Commissioners. One 2,500-KW. turbo-generator set, one 1,000-KW. synchronous motor-generator, 50-KW. motor-generator and 25-KW. exciter set. Deposit £500. Particulars can be seen at Board of Trade Commercial Intelligence Department in London.

**Croydon.**—March 11th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**Devonport.**—March 7th. Switchboard extension and one 1,000-KW. D.C. turbo-generator, for the Corporation. See "Official Notices" February 16th.

**Dover.**—March 5th. Electrical sundries, cables, &c., for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street. Schedules 2s. 6d. each.

**Dublin.**—March 6th. 5,000-volt, 100-KW., three-phase transformer pillars, for the Corporation. See "Official Notices" February 16th.

March 6th.—1,500-KW. polyphase alternator and dismantling and alteration of plant at the Pigeon House generating station, for the Corporation. See "Official Notices" February 23rd.

**Dundee.**—The T.C. Electricity Department invites tenders for the supply of general and electrical stores. City Electrical and Tramways Engineer.

**Edmonton.**—March 13th. Electrical supplies and lamps, for the B. of G. Mr. F. Shelton, Clerk, White Hart Lane, Tottenham.

**Egypt.**—March 18th. Supply of 340,000 sleepers to the Egyptian Railway and Telegraph Department.

**France.**—March 6th. The General Direction of the French Posts and Telegraphs (103, Rue de Grenelle, Paris) is inviting tenders for eight lots of telephone cable with 14 and 24 pairs of conductors.

**Glasgow.**—March 8th. Rotary converters and accessories, for the Corporation Electricity Department. See "Official Notices" to-day.

**Great Central Railway.**—March 5th. Stores and materials for a year. See "Official Notices" February 23rd.

**Heston and Isleworth.**—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" February 16th.

**Hornsey.**—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See "Official Notices" February 16th.

March 16th.—Extension of dynamo and feeder switchboard, for the T.C. See "Official Notices" to-day.

**Hoyle and West Kirby.**—March 7th. Two centrifugal pumps and A.C. electric motors, frequency 50, with automatic switchgear, for U.D.C. sewage pumping works. Engineer and surveyor, Town Hall, Hoyle.

The U.D.C. is also inviting tenders for an additional boiler and pump at the electricity station.

**Hungary.**—RAJEC.—Installation of electric lighting. Particulars from the Municipality.

**Leeds.**—March 9th. 6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" February 16th.

**London.**—BATTERSEA.—March 5th. One 1,500-KW. high-pressure steam turbine coupled to two 750-KW. D.C. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" February 16th.

**POPLAR.**—March 4th. Telfer coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" February 16th.

**ST. PANCRAS.**—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

**L.C.C.**—March 8th. Electrical installation at the Victoria Embankment Gardens conveniences, Charing Cross. See "Official Notices" February 23rd.

**MARYLEBONE.**—March 13th. Materials for a year, for the B.C. Electricity Department. See "Official Notices" February 23rd.

**SOUTHWARK.**—March 13th. Cable, for the B.C. Electricity Department. See "Official Notices" to-day.

**Manchester.**—March 13th. Two 650-800-KW. and one 750-KW. motor converters or rotary converters and static transformers, for the Corporation. See "Official Notices" to-day.

**Merthyr Tydfil.**—March 6th. Electrical accessories for a year, for the B. of G. Workhouse Master.

**Newport (Mon.).**—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

**New Zealand.**—March 27th. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London.

**Nottingham.**—March 2nd. 350 tons of steel tramway rails and seven tons of tie bars for the Tramways Committee. Mr. A. Brown, city engineer.

**Rhodesia.**—March 4th. Electrical plant, for the Municipality of Salisbury. See "Official Notices" to-day.

**Rochdale.**—March 6th. Corporation Paving and Sewage Committee. Electrically-driven centrifugal pumping plant, at the Roch Mills Sewage Disposal Works. Specifications and forms of tender (£5, returnable) from Mr. S. S. Platt, borough surveyor, Rochdale. Tenders only considered from firms who have had experience with similar work.

March 7th.—(a) Two Lancashire boilers, with mechanical stokers and coal elevators; also economisers and extensions to pipework; (b) one three-phase motor alternator, for the Corporation. See "Official Notices" to-day.

**Roumania.**—March 11th. The municipal authorities of Constantza are inviting tenders for the concession for the establishment of a central electric lighting station and for the construction and working of a system of electric tramways in the town.

**Salford.**—March 11th. Stores, &c., for a year, for the Corporation Electricity Department. See "Official Notices" February 23rd.

**Siam.**—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

**South Shields.**—March 6th. Supply of engine-room stores, hardware tools, carbons, lamps, &c., to the electricity works for a year. Mr. H. S. Ellis, borough electrical engineer, Mill Dam, South Shields.

**Spain.**—The municipal authorities of Monforte (province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years.

**Sunderland.**—March 5th. Steam turbine, 5,000-KW. alternator and condensing plant, for the Corporation. See "Official Notices" February 23rd.

**Swansea.**—March 6th. Turbo-alternators and condensing plant, for the Corporation. See "Official Notices" February 23rd.

**Sweden.**—March 31st. The Electro-technical Department of the Stockholm Municipality are inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). Tenders to "Föreståndaren för Kungl. Vattenfallsstyrelsens Elektrotekniska Byrå," Stockholm, whence also copies of the specifications may be obtained on deposit of 25 kronor (about 27s. 10d.), returnable on receipt of a *bona fide* tender.—*Board of Trade Journal*.

**Swindon.**—March 9th. Materials for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" February 23rd.

**Taunton.**—Single-phase transformers for the T.C. See "Official Notices" February 23rd.

**Warrington.**—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**West Ham.**—March 9th. 5,000-KW. two-phase turbo-alternator, with condensing plant and two-phase E.H.T. switchgear, for the Corporation. See "Official Notices" February 23rd.

**Wolverhampton.**—March 6th. Stores, electrical, &c., for the Corporation Tramway Department, for a year. Mr. W. A. Luntley, general manager, Cleveland Road.

**Wrexham.**—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" February 16th.

## CLOSED.

**Ashton-under-Lyne.**—The tender of Triumph Stoker, Ltd., Leeds, has been accepted for "Triumph" mechanical stokers for three new Lancashire boilers, 9 ft. diameter, for the Corporation electricity works.

**Belgium.**—The municipal authorities of Antwerp last week opened tenders for the supply of a quantity of submarine electric cables. Thirteen concerns tendered—eight German, two Belgian, and one each Austrian, French and English (the last-named being the British Insulated and Helsby Cables, Ltd.). The lowest offer was that of the Rheydts Kabelwerk Gesellschaft, of Rheydts, Germany.



**Bristol.**—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. G. E. Taylor & Co., of London, for cables, switchboard, and lighting in connection with the new shed and cold stores at the Royal Edward Dock.

**British Columbia.**—The *Liverpool Journal of Commerce* says that the British Columbia Electric Railway Co. is to construct, at a cost of a quarter of a million sterling, an additional tunnel to Lake Buntzen, and provide a separate generating station on the shore of the inlet, having a normal output exceeding 100,000 H.P. In this connection negotiations have just been concluded with the Caledonian Ironworks Co., Ltd., for three large water-wheels of the "double" pattern, each developing 14,000 H.P.; whilst to Messrs. Dick, Kerr & Co., Ltd., has been awarded the contract for electrical generators, each of 9,000-kw. capacity. "This equipment is to be ready for commercial service early next year. The competition for the work partook of an international character, tenders and designs being submitted by practically all the leading electrical manufacturers throughout Europe and America."

**London.**—The Metropolitan Water Board has accepted the tender of Messrs. Belliss & Morcom, Ltd., at £342, for the provision of engine and dynamo, &c., in connection with the extension of the electric lighting system at the Hampton Station.

**ISLINGTON.**—The B.C. has accepted the following tenders for the annual supplies to the Lighting Department:—

Engine-room stores.—James Gibb & Co., Ltd.  
Arc lamp carbons.—Wm. Giepel & Co.; Sloan Electrical Co., Ltd.  
Arc lamp globes.—Carl Quiltman.  
Oils and lubricants.—Stern Sonneborn Oil Co., Ltd.  
Transformers and accessories.—British Electric Transformer Co., Ltd.; Ferranti, Ltd.; Johnson & Phillips, Ltd.  
Electricity supply meters.—Siemens Bros.; British Thomson-Houston Co., Ltd.  
Cables.—British Insulated and Helsby Cables, Ltd. (for high and low-tension insulated cables on the sliding basis, and rubber-insulated cables on a fixed basis).  
Electrical sundries, lamps, brushes, arc lamp parts, &c.—London Commercial Electrical Stores.  
Metal-filament lamps.—Brimsdown Lamp Works, Ltd.  
Electrical sundries.—General Electric Co., Ltd.  
Brushes.—British Electrical Manfg. Co., Ltd.  
Arc lamp parts.—A. Round.  
Cable terminal, service and network boxes, tapes and iron castings.—Callender's Cable and Construction Co., Ltd.; W. Lucy & Co., Ltd.; British Insulated and Helsby Cables, Ltd.; Sykes & Sugden, Ltd.; J. Gibb & Co., Ltd.; Dussek Bitumen Co.; General Electric Co., Ltd.

**Newport (Mon.).**—The B. of G. on Saturday accepted the amended tender of the Neville Engineering Co. for an electric lift, at £280.

**Ocker Hill Power Station.**—The Midland Electric Corporation for Power Distribution have accepted the tender of the Brush Electrical Engineering Co. for a 3,000-kw. turbo-alternating set, with condensing plant and pipework complete.

**Norway.**—The Stavanger Electrical Works have recently, according to *Technisk Ugeblad*, placed an order with the Swedish Metal Works, of Vesterås, for a new copper cable, at about £4,444, which is going to be laid between the electrical power station at Oltesvik and the electrical works at the town.

**Raasay Iron Mines.**—Messrs. Mirrlees, Bickerton and Day's tender, at £4,733, has been accepted for the supply of two four-cylinder Diesel oil engines coupled to British Electric Plant Co.'s alternators. Messrs. Brash & Russell's quotation of £450 has been accepted for supplying a high and low-tension switchboard.

**Rugby.**—The U.D.C. has accepted the tender of Messrs. Willans & Robinson, Ltd., for a Willans-Diesel oil engine and Victoria turbine pumps.

**Southend-on-Sea.**—The T.C. has accepted the following tenders:—

Brush Electrical Engineering Co., Ltd.—Four open-type trailer cars and accessories, for the pier tramway, £669.  
Electrical Construction Co., Ltd.—Re-winding dynamo armature, £81.

**Stalybridge.**—The Stalybridge, Hyde, &c., Tramways and Electricity Board has accepted the tender of Messrs. Beoley and Sons for superheater and pipework.

**West Ham.**—The T.C. has accepted a quotation from the British Thomson-Houston Co., at £627 for the supply of switchgear required in connection with the supply of current to the Port of London Authority.

Messrs. Chamberlain & Hookham's tender for 50, 75, 100, 150 and 200-ampere A.C. meters for the T.C. has been accepted.

**Worcester.**—The City Education Committee has accepted the tender of Messrs. R. F. Morris & Co. for installing the electric light in Hounds Lane Schools, at £50.

**Diesel Engine Manufacture.**—The *Pall Mall Gazette* says:—"Report has it that the Diesel Engine Co. is about to enter into an interesting and important scheme. . . . We understand that the project contemplated is an amalgamation of the interests of the Diesel Engine Co., Carls Bros., of Ghent, and a British firm, said to be Davey, Paxman & Co., of Colchester, the latter being well placed apparently for developing this particular class of business. Report has it that the capital of the combined undertaking will be £750,000, of which between £400,000 and £500,000 may be issued to the public, and about £100,000 or more will be held in reserve. . . . We understand that the system of licensing the manufacture to other firms, which has proved successful, and useful from the point of view of users, will be continued freely as before."

## FORTHCOMING EVENTS.

**Northampton Institute Engineering Society.**—Friday, March 1st. Paper on "Some Recent Developments in Electrochemistry," by Mr. E. L. Emtage.  
Saturday, March 9th.—Annual dinner.

**Royal Institution.**—Saturday, March 2nd. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture II.)  
Tuesday, March 5th.—At 3 p.m. Lecture on "The Optical Determination of Stress, and some Applications to Engineering Problems," by Prof. E. G. Coker. (Lecture II.)  
Saturday, March 9th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture III.)

**London Association of Foreman Engineers and Draughtsmen.**—Saturday, March 2nd. At 8 p.m. At Cannon Street Hotel, E.C. Paper on "The Past, the Present and the Future Possibilities of the Internal-Combustion Engine," by Mr. W. P. Durnall.

**Society of Engineers.**—Monday, March 4th. At 7.30 p.m. At the I.E.E. Paper on "The Trolley Vehicle System of Railless Traction," by Mr. H. C. Adams.

**Leeds University Engineering Society.**—Monday, March 4th. Paper on "Safety Devices applied to Apparatus used in Mines," by Mr. W. E. French.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, March 4th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Static Sub-station Equipment," by Mr. W. A. A. Burgess.

**Röntgen Society.**—Tuesday, March 5th. At 8.15 p.m. At the Finchley Technical College. Demonstration of the Physiological Action of an Alternating Magnetic Field, by Dr. S. P. Thompson; and Demonstration of a Radiometer, by Mr. W. Hampton.

**Institution of Civil Engineers.**—Tuesday, March 5th. At 8 p.m. Papers on "Roller and Ball Bearings," and "The Testing of Anti-Friction Bearing Metals," by Prof. J. Goodman.

Wednesday, March 6th.—Students' visit to the Associated Portland Cement Manufacturers' Works, Swanscombe, Kent.

**Royal Society of Arts.**—Wednesday, March 6th. At 8 p.m. Paper on "Some Modern Problems of Illumination: The Measurement and Comparison of Light Sources," by Mr. T. Thorne Baker.

**Institution of Electrical Engineers (London).**—Thursday, March 7th. At 8 p.m. Paper on "Tariffs for Electrical Energy, with particular reference to Domestic Tariffs," by Mr. W. W. Lackie.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 4th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Tuesday, March 5th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Thursday, March 7th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Friday, March 8th.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Saturday, March 9th.—Mobilization week-end run at Fort Coalhouse, Tilbury. The party will parade at Fenchurch Street Station (L.T. and S. Railway) at 3.10 p.m. Dress: Service dress, greatcoats, belts and haversacks; no arms will be taken.

Recruits' instruction.—Tuesday and Friday nights, 7 to 8 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adj.,  
For Officer commanding L.E.E.

**The British Electrical and Allied Manufacturers' Association.**—We have received the following report of a meeting of the Council of this Association, which was held at the offices, 36, Kingsway, London, W.C., on the 15th inst. There were present Messrs. A. B. Anderson, W. W. Blunt, F. R. Davenport, F. C. Gibbons, C. Koettgen, H. C. Levis, B. Longbottom, R. K. Morcom, F. H. Nalder, E. S. New, M. J. Railing, W. Rutherford, W. O. Smith, A. D. Williamson, and A. P. Wood. Mr. A. Bruce Anderson was elected chairman for the year, and he took the chair. The firm of James Howden & Co., Ltd., was elected a "Member" of the Association. The secretary reported the completion of the work of the Committee appointed to suggest amendments of the "Model General Conditions," and was directed to present same, after printing, to the Institution of Electrical Engineers. The secretary further reported that the Committee appointed to revise the Standards for Electrical Machinery (Report No. 36) has made considerable progress with this work. Representatives of the Association were appointed to the Engineering Standards Sub-Committee on Generators and Transformers, and also on the International Electrical Standardisation Committee. A Committee was also appointed to investigate and report to the Council the relations between the Electrical Trades' Benevolent Institution and the Association. Further consideration was given to the Electric Lighting Bill, 1911, and the secretary was instructed to communicate with the Electrical Contractors' Association in regard to the same. The secretary reported satisfactory progress of the following Sections: Dynamo and Motor, Engine, Meter, Telephone, Transformer, Heating and Cooking, Incandescent Lamp, and Switchgear Sections.

**Colliery Explosion.**—An explosion took place at the Powell Duffryn Collieries on Thursday last week; nearly 2,000 men were in the mine, but only three men were injured, and it is believed that the effects were thus limited by the efficient system of laying the dust in vogue in these pits.



## NOTES.

**Correspondence.**—RE WAKELIN BROS.—We have pleasure in publishing the following letter, which has come to hand just as we go to press:—

"Our attention has been called to your report of the meeting of creditors and shareholders of Messrs. Wakelin Bros., Ltd., electrical engineers, 7, Tottenham Street, W., held on 16th inst., for the purpose of selecting a liquidator, &c. We act for Messrs. Fyfe, Wilson and Co., electrical engineers, 145, Bath Street, Glasgow, who are the sole agents for the sale of the Kelvin petrol sets, and it was through them that Messrs. Wakelin Bros., Ltd., secured the exclusive agency for the South of England, referred to in the report, in which it is said that 'the directors stated that the first set supplied through the company (our clients) proved to be defective, and involved the company in considerable expense.'

"This statement is quite untrue. Our clients delivered to the bankrupt company four generating sets in all. The first set delivered was for demonstration purposes only, and was stipulated to remain in the bankrupts' premises. They, however, without our clients' knowledge or consent, sold it, and obtained a price for it in excess of the invoiced price to themselves. As to the second and third sets, no question whatever arose. As regards the fourth set delivered, it was alleged by the bankrupt company to be defective in construction, but this was denied by the plaintiffs, and it was clearly proved that the defective condition of the set was due not to the set itself, which was properly tested before leaving the works, but to improper and faulty assembling in the fitting up, and for this Messrs. Wakelin Bros. were entirely responsible.

"This was the judgment of Mr. Justice Coleridge, who tried the case, and whose opinion is before us. It is true the bankrupt company pleaded a counterclaim in respect of expenses, &c., which they said they had incurred on account of the alleged defects. They failed to substantiate this counterclaim, and the judge entirely rejected it without even calling on our clients' counsel. Although the bankrupt company received full payment of the price of the whole four sets, amounting to over £400, our clients did not receive a single penny from Wakelin Bros., who retained the price of the sets as against their grossly inflated claim. The bankrupt company were found liable in the full costs of the action, but these, like the price of the sets, were not paid.

"It is clear, therefore, the cause of the bankruptcy must be sought elsewhere. You will appreciate that it is very misleading and calculated to be hurtful to our clients' interests that the report in this respect should be allowed to go uncontradicted, and we trust you will publish this letter in your next issue.

"PINKERTON & SNEDDON, Solicitors, Perth.

"Agents for Fyfe, Wilson & Co.

"February 28th, 1912."

**The Coal Strike.**—As we go to Press the strike is already in progress in various parts of the Kingdom. The negotiations conducted by the Government have broken down, and by the time these lines appear in print, close upon a million miners will be idle. Electric light and power stations have, as far as practicable, laid in stocks of fuel which will enable them to continue service for some weeks ahead. Large numbers of workers in many departments of industry have already been thrown out of work or are under notice. Electrical manufacturers in the neighbourhood of London have coal supplies in some cases which will permit them to continue running their works for a month or two, but some will be obliged to shut down in a fortnight. Although at the time of writing there remain a few hours before all the miners' notices expire, the omens are most unfavourable, and a stoppage seems to be inevitable. In the interests of the entire nation let us hope that it will be of brief duration. We shall return to the subject next week.

**Fatalities.**—An inquest was held on Saturday last, at Dublin, into the cause of death of Henry Andrews, aged 36 years, who met his death on the previous day at the Corporation electricity works, Pigeon House Fort. According to the evidence of Mr. L. J. Kettle, deputy city electrical engineer, who was present at the time of the accident, the deceased was an engineer, or erector, in the employ of Ferranti, Ltd., and was engaged by them on the switchboard and cable work, carrying out a contract. He had been discussing certain switchboard work with witness. Witness had suggested that certain covers, part of the contract work, would be better on, and the deceased said he could put them on at any time. Witness warned him that all the switchgear was alive, being in use. Deceased did not proceed to do any work, not having even changed into his working clothes. He was standing in front of the switchgear, and touched part of the gear with his right hand. This gear was not alive, but suddenly he apparently reached out his left hand and touched a gear which was alive. Witness saw that he had received an electric shock, and immediately switched the current off. Artificial respiration was resorted to. A doctor was telephoned for, but the ambulance arrived first, and took the deceased to hospital. Deceased was a man of great experience, who knew as much about the work, if not more, than witness did. The warning would not have less effect on him than anyone else. The only work the deceased did that day was to put on covers, and there was no danger in doing that work. The jury returned a verdict of "Accidental death," and expressed their sympathy with the relatives of the deceased. Mr. T. H. Morris, secretary of Messrs. Ferranti, Ltd., also expressed the sympathy of the company with the relatives.

On Saturday last about 2,000 tons of coal, which had been stored by the City of London Electric Lighting Co., at Bankside, in anticipation of a coal strike, suddenly shifted, carrying before it a 10-ft. high retaining wall inside the works, which in turn fell on an outer wall 15 ft. high. Brickwork and coal crashed on to some houses in White Hind Alley, where a number of small children were playing. Some of them were overwhelmed, and two, four years of age, were dead when their bodies were recovered. The accident is attributed to the saturation of the coal in the heavy rainfall of Friday night last.

**Tungsten Lamps on Alternating Current.**—Extended tests have shown that there is no difference in the life of tungsten lamps on either alternating or direct-current circuits, the peculiar phenomenon of "off-setting" which occurs in tantalum filaments on A.C. circuits being absent. The effect of frequency on the performance of carbon and tungsten lamps is a matter of considerable interest, as carbon lamps cannot be satisfactorily employed on frequencies below about 40 cycles, unless the filaments are exceptionally thick. With filaments of the same size, the tungsten lamp is less liable to flicker than the carbon lamp on low frequencies, but this is not a practical condition, as the tungsten filament is always much smaller than a carbon filament of the same candle-power. We are informed, however, that tests made on Mazda lamps with drawn-wire filaments show that they will operate satisfactorily on frequencies of 50 and upwards, with filaments as small as that of the 15-watt 100-volt lamp, and on frequencies down to 25 cycles, in sizes not less than the 25-watt 100-volt lamp: the 40-watt 100-volt size, and larger sizes, it is claimed, are quite satisfactory on a 25-cycle circuit.

**Concerts.**—The staff of Messrs. Babcock & Wilcox, Ltd., held their fifteenth annual smoking concert on the 23rd ult., in the King's Hall, Holborn Restaurant. Mr. H. W. Kelle was in the chair, and in proposing the health of "The Firm," he welcomed the presence of all the directors of the company in England—with the exception of Mr. Knight, whose illness was greatly deplored—as well as some of the best known names in the engineering world. In replying to the toast, both Mr. Dewrance and Mr. Rosenthal referred to the threatened coal strike, and urged greater loyalty between workers and employers. The efforts of the numerous artistes engaged were greatly appreciated by the audience, which numbered about 700. Space does not permit us to give a detailed account of the programme, but special mention should be made of the delightful singing of Miss Annie Bartle, the beautiful flute solos rendered by Miss Edith Penville, the quaint humour of Mr. Walter Montagu, and Mr. Ernest Hastings's sketches at the piano. Votes of thanks to the chairman and to the committee brought a most successful evening to a close.

The fourth grand concert of the Metropolitan Electric Tramways Athletic and Social Club is to take place at the Alexander Palace on Thursday, March 28th. The band of the Metropolitan Electric Tramways always largely contributes to the programme for this annual event, and the evening is most enjoyable.

**Electrical Exhibition in Cornwall.**—It has been decided to hold an electrical exhibition in Cornwall in August next under the auspices of the Royal Cornwall Polytechnic Society, and the Society's diplomas of honour and diplomas of merit will be offered for trade exhibits and medals for inventions in electrical machinery and appliances. It is thought that, in view of the fact that several of the most important mines in the district are going in largely for electrical machinery, it should prove of mutual benefit to the mining industry and the electrical manufacturers if a successful exhibition could be organised. The exhibition will be held at Falmouth from August 26th to 31st. Mr. E. W. Newton is secretary.

**Canada.**—According to *Commercial Intelligence*, a new company with the title of Roper, Clarke & Co., Ltd., has been formed in Montreal to act as manufacturers' agents for the sale of electrical apparatus, machine tools, &c. The offices are at 141, St. Peter Street, Montreal. Mr. Roper was formerly manager of the Canadian General Electric Co.'s branch in Ottawa. The same journal states that "Mr. A. G. Chisnall, of the engineering staff of the Shawinigan Power Co., Montreal, has taken up an appointment with Messrs. Irving Smith, importers of electrical apparatus and machinery. Mr. Chisnall has been employed by several of the leading manufacturers of electrical plant in this country."

**Appointments Vacant.**—Shift engineer, for the Neath R.D.C.; works superintendent for the Oldham Corporation Tramways; sub-station charge engineer, for the Bristol Electricity Department (35s.). See our advertisement pages to-day.

**Electrical Trades Benevolent Institution.**—We are asked to announce that, another dinner having been fixed to take place on April 26th, it has been found necessary for this Institution to change the date of its annual festival dinner, which will now take place at the Hotel Cecil on Wednesday, April 24th. Mr. Ferranti has kindly consented to preside.

**To Prevent Smoke Nuisance in Australia.**—The Sydney City Council recently passed the following resolution:—"That with regard to a reference from Council of November 21st, 1911, as to whether Council should object to the establishment of any factory in the city boundary unless the motor power is electricity, representations be made to the Government with the object of obtaining an amendment of the Factories Act, so that no factory or industry to be hereafter established within a limited area of the city, to be hereafter fixed, shall be allowed to use power requiring combustion causing smoke."—*Australian Mining Standard*.



**Institution and Lecture Notes.**—**INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).**—The annual dinner of the section was held on Friday last; the chairman, Mr. W. Cramp, presided, and there were about 130 members and visitors present.

After the loyal toasts had been duly honoured, Mr. W. Fox (past president of the Manchester Association of Engineers) proposed the toast of the "Institution of Electrical Engineers," and said that he had to offer its president, Mr. Ferranti, his congratulations upon the distinguished honour that had lately been offered him by the Vice-Chancellor of the Manchester University, viz.:—"The honorary degree of Doctor of Science." It appeared to him to be a crown of a very brilliant career, and whilst Mr. Ferranti might in future have great social honours conferred upon him, none could be greater than that now offered by the University, as it was the direct appreciation of his great work which had given him a world-wide reputation. He was informed that it was the aim of the president to induce the Institution to welcome commercial engineers as members, and that the Institution should take its place amongst the bodies influencing trade conditions in this country and in the Colonies, worthy objects of a worthy mind, and he heartily wished the president might bring them to a successful issue.

Mr. S. Z. de Ferranti, in reply, said they would be pleased to hear that the applications for new membership had very considerably increased; the transfers had also increased to such an extent that in the last quarter they had between two and three times the number that wanted to be transferred about a year previously. If the Institution was to be useful, it had to be strong and well off. Such an Institution could do good work by removing the obstructions and handicaps which, in many cases, had been placed in the way of our industry. Not long ago he tried to institute a campaign to further the idea of cheap electricity—1d. for domestic purposes other than lighting; but the Council thought it was rather a tall order to take up, and decided not to start such a campaign. But it was thought that good might be done by ventilating the subject, and with that view he asked Mr. Lackie to give a paper on the question of how they had introduced electricity so largely for domestic purposes in Glasgow, which would be read before the Manchester Section next week. It would be a most happy thing if the various engineering and scientific societies could keep more together and come more closely in contact. There was a great deal of overlapping. There was no branch of engineering that electricity did not enter into in some way, and what was wanted for the benefit and advancement of our branch was a perfect understanding with all other branches.

Mr. W. Cramp also replied, and said that, with regard to future policy, it seemed to him a mistake to ask the Institution of Electrical Engineers to follow what they might call the example of its older sisters—the Civil and the Mechanical Engineers. The I.E.E. had entirely different ground to cover. The I.E.E. had done what no other Institution had done, and that was to create throughout the country "Local Sections" which read their own papers, carried on their own discussions, &c. Both those Institutions would probably have to follow the I.E.E. He was sure the President and representatives of the Council present that night would not object when he said that in Manchester they sometimes spoke of the "London Section." They were not in Manchester disloyal, nor did they intend to be, but they were alive and sometimes were kicking. This kicking was a sign of good health, which he believed the President himself would not object to.

Mr. Alderman Walker proposed the toast of "Our Guests," and said it was useless for the designer and manufacturer to incorporate ideas unless there was a market to take them. Within a very few miles of that building he had that week seen groups of mills with 200,000 spindles, each with its own boiler plant, its own chimney stack and reciprocating engines; coal contracts had to be made, and arrangements for clinker to be removed. He ventured to submit that when the next mill-building boom came along such a crime as that would not be repeated. To-day there was a vast field for the electrical industry in Lancashire.

The Mayor of Salford replied, also Mr. H. N. Dunlop, secretary of the British Electrical and Allied Manufacturers' Association, who said his Association now comprised all the large electrical firms and a large number of the smaller firms, so that to-day it stood as an Institution representing the electrical industry of this country. There had been a considerable amount of discussion in various Institutions about the advantages of standards for electrical machinery. That was a problem which interested particularly the manufacturer, who was now trying to set his house in order.

During the evening musical items were given by Mr. Wilfrid Ludlow, which were highly appreciated by the company present.

**INSTITUTION OF MARINE ENGINEERS.**—The adjourned discussion on the paper on "Auxiliary Machinery for Internal Combustion-Engined Vessels," by Mr. W. R. Cummins, took place on the 5th ult. In reply to the first part of the discussion, the author stated that British manufacturers of auxiliary machinery for the engine-room were as far advanced as their foreign competitors. After the discussion of the previous meeting, there did not seem much doubt that compressed air as a power transmission system was inferior to electricity in efficiency. Mr. W. P. Durnall said the electric motor for auxiliaries when first introduced on board ship was not a mechanical engineering appliance, but to-day machines could be obtained, in the form of polyphase induction motors, that could stand comparison with any class of machinery. Mr. William Walker considered that it would be impracticable to have an oil engine for each unit of auxiliary plant, and thought that electricity was best, provided that suitable plant could be obtained for the deck machinery, and Mr. E. H. Evans cited instances where electrical machinery had been in use for many years in the Navy.

**ILLUMINATING ENGINEERING SOCIETY.**—On February 15th the annual dinner of the Society was held, Prof. S. P. Thompson, the president, being in the chair. Prof. R. S. Clay proposed "The Illuminating Engineering Society," which he said now numbered 330 members, including 120 corresponding members abroad, and was doing valuable work. Prof. Thompson, in responding, referred to the success of the Society in stimulating interest in the measurement of illumination, and in the efficient lighting of schools, workshops, &c., and said that much remained to be done. Mr. F. W. Goodenough proposed "Kindred Societies," remarking on the friendly relations which had been established by the formation of the Society between members of a number of Societies with apparently divergent interests. Mr. R. G. Shadbolt (president of the Institution of Gas Engineers) replied, and said that if the Society continued to progress as it had done in the past, gas engineers would be compelled to join it in much larger numbers. Mr. W. M. Mordey (past-president I.E.E.) also responded, pointing out that the Society covered a ground of its own, which could not be covered by any previously existing Society. Mr. R. J. Wallis-Jones proposed "Our Guests," and Dr. W. Garnett and Dr. F. G. Kenyon replied. Finally the toast of "The Chairman," proposed by Mr. L. Gaster (hon. secretary) was enthusiastically honoured and duly acknowledged.

Mr. Louis Rottenburg, one of the engineers of the New Transport Co., Ltd., was to deliver a lecture, on February 29th, to the Cambridge University Engineering Society, on "The Proposed London Goods Clearing House," with regard to its economic side, but more especially on the engineering details.

**INSTITUTE OF METALS.**—The annual autumn meeting of the Institute of Metals will this year, for the first time, take place in London, in the last week of September. The next meeting will be the occasion of the third May lecture, which will be delivered on May 10th by Sir J. A. Ewing, on the subject of "The Inner Structure of Simple Metals." The corrosion investigation recently taken up by the Institute is now being actively pushed forward. The Corrosion Committee recognises the desirability of learning fully as to the experience of others on the subject of the corrosion of brass condenser tubes, and has had prepared a Corrosion Inquiry Form, which will be sent by the secretary to anyone interested.

At the annual general meeting of the ASSOCIATION OF TECHNICAL INSTITUTIONS last week, Sir G. H. Kenrick was elected President for the ensuing year. In his presidential address on the subject, "Shall we teach Trades?" he said it was useless to expect discoveries in science to be applied to industries unless they had teachers who would make it their business to master these discoveries and explain them to the young people who were learning the trade. For the purpose of giving the training best suited to the trade, every trade should form its own Education Committee and give it plenty of money and plenty of discretion. Mr. W. M. Gardner, Principal of the Technical College, Bradford, maintained that it was impossible in these days for a lad to learn his trade properly in works. If the young man did not learn his trade at a technical school he never learned it at all; he became a mere machine, knowing only a portion of the work.—*The Times*.

**Annual Dinners.**—**THE WEST HAM ELECTRICITY DEPARTMENT.**—The sixth annual dinner of the West Ham Electricity Department was held in the Connaught Rooms, Great Queen Street, on Thursday evening, the 22nd ult. About 150 members of the staff with their friends were present, and a very pleasant evening was passed. The borough electrical engineer, Mr. H. H. Couzens, was in the chair, and amongst others the Mayor (Alderman J. R. Hurry), and the chairman of the Electric Lighting Committee (Mr. Croot), were present.

After the usual loyal toasts, the health of the Mayor and Corporation was proposed in a felicitous speech by Mr. Gilbert, the mains engineer. In the double capacity of ratepayer and employee, Mr. Gilbert eulogised the manner in which the municipal work of the borough was carried on. The Mayor, in reply, pointed to the progress made by the electricity department, and mentioned that power was sold at a lower rate in West Ham than anywhere else. This had a great deal to do with the growing appreciation of the borough as an industrial centre. They were very near neighbours to London, and the supply of cheap power was an important factor for many industries. He then referred to the heavy burden thrown on the ratepayers in educational matters by the fact that they were one of London's largest dormitories, and showed that in this department, too, the Corporation was leading the country. The speech was received with musical honours.

The next toast, that of the welfare of the electricity department, was proposed by Mr. Croot. After referring to the pleasant relations which existed between the workers, staff and committee, which had so much to do with the prosperity of the undertaking, he spoke of the difficulty the engineer was placed in by the insistence of the Council that no lock-out clause should be inserted in a pending contract for new generating plant. Mr. Croot pointed out his own personal view as to the difference between a lock-out and a strike, but showed how in the negotiations which had been carried on he had placed the interests of the undertaking above his own views, and endeavoured to get the lock-out clause accepted. Mr. Couzens, in reply, recognised that Mr. Croot had loyally done his best to get the generating plant contract settled, and then proceeded to mention the continued progress made by the undertaking. Ten years ago the output for all uses was under a million units: last year it was over 25,000,000, and this year, despite the loss of some large users, it would be higher still. They used every endeavour to attract new factories to the locality, and he was glad to say that several very large users were carefully considering the question of establishing works in their area. In this way the department was an indirect benefit to the borough as a whole.



Mr. Couzens then referred to the loss the undertaking had sustained during the year by the removal of Mr. Maekenzie, the mechanical superintendent at the generating station, who had accepted a position at Bow with the Charing Cross Co., and welcomed Mr. Allan, his successor. He thanked all members of the staff for their loyalty and interest, and urged them always to place the welfare of the undertaking above their own private interests. The speech was received with many expressions of goodwill, which evidenced the good feeling existing in the undertaking. A good musical programme enhanced the success of the gathering.

**EAST LONDON COLLEGE ENGINEERS.**—This annual function took place on Saturday last at the Great Eastern Hotel, and proved a most enjoyable function. Dr. J. T. Hewitt, F.R.S. (President of the Engineering Society), was in the chair, and was supported by Principal Hatton and other members of the staff. In proposing the toast of the evening, the Principal remarked that the Imperial College had gained the largest number of first-class honours degrees (internal) in engineering in the London University since the first examination in 1903, and the East London College came second on the list containing all the other Colleges in London.

**Inquiries.**—A correspondent wants names of actual makers of caps for small incandescent lamps. Another correspondent asks for the names of English and foreign makers of coil-winding machines, for winding cotton-covered copper wire on spool, bobbin, or directly on core, to be used for transformers, dynamos, generators, &c.; and to be complete with indicator.

**Electricity in Mines.**—The *Times* reports that Mr. McKenna has considered the objections received by him to the proposals made last May of special rules relating to the installation and use of electricity in mines. "He is advised by the Departmental Committee which framed the rules that certain modifications to meet the objections may properly be made, and he understands that these modifications, which are embodied in an amended print, are accepted by all the owners' associations throughout the kingdom from whose members objections were received. The rules will, therefore, be re-proposed in the new shape in pursuance of Sec. 54, Sub-sec. (2), of the Coal Mines Regulation Act, 1887. They will become established at the mine of any coal-owner who does not object to them within 20 days after their receipt by him."

**Firemen's Congress in St. Petersburg.**—On May 25th-28th next there will be an International Congress of Firemen at St. Petersburg, together with an exhibition of fire prevention and salvage service apparatus. Particulars can be obtained from the Committee of Organisation, St. Petersburg, Mokhowaja 5.

**The Dundee B.A. Meeting.**—This year's meeting of the British Association takes place at Dundee from September 4th to 11th, with Prof. W. E. Schäfer, F.R.S., as president. Section A will have as its chairman Prof. H. L. Callendar, while Prof. A. Barr will preside over the proceedings in Section G (Engineering).

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The St. Anne's Council has decided to grant an increase in salary to Mr. J. H. CLOTHIER, electrical engineer, by £25 per annum, making £325.

The Bradford Electricity Committee at a special meeting held on Thursday last week interviewed three candidates for the post of commercial assistant in the electricity department, and, as a result, Mr. JOHN E. SCHOFIELD, sales engineer to the Yorkshire Electric Power Co., has been appointed to the position. Mr. Schofield has been engaged with that company for the past three years, during which time he has been responsible for inducing a large number of power-users, such as owners of textile mills, engineering works, and collieries, in the company's area, to adopt electric driving. He had previously held appointments under the Huddersfield Corporation and the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, and was also for some time principal engineer to Messrs. Gibbings & Chauntler, consulting engineers. In his new position he will have charge of the business development branch of the department's operations, while Mr. J. H. SCHNAUBER (late assistant engineer in the department) has been promoted to the position of deputy city electrical engineer, vacated by Mr. H. S. ELLIS on his leaving to take up the position of borough electrical engineer at South Shields.

Our Durban correspondent states that on January 27th Mr. J. H. GYLES, electrical superintendent at the Durban Corporation power station, was the recipient on the eve of his marriage to Miss Cobbledick, also of Durban, of a canteen of cutlery and a cake basket from his colleagues in the electrical department with whom he has been associated for the past 10 years. The presentation was made by Mr. John Roberts, borough electrical engineer.

The Willesden Electricity Committee reports having received the resignation of Mr. J. G. BRUCE, the electrical engineer. It has also received the resignation of Mr. L. F. BICKELL, chief distributing engineer, and to fill this position, Mr. F. D. BALSHAW has

been appointed at a salary of £120, with apartments at the sub-station.

The Liverpool Corporation has appointed Mr. JOHN HAMILTON, of the Glasgow Corporation electricity department, as an assistant engineer in the electric supply department.

**Tramway Officials.**—The Light Railways Committee of the Southend-on-Sea T.C. has increased the salary of Mr. A. C. JOHNSON from £200 to £220 per annum, with subsequent annual increments of £20 to £300 at the discretion of the Committee.

Mr. W. WILSON, who has been in the employ of the Camps Bay Tramways Co., has been appointed chief traffic superintendent to the Port Elizabeth Tramways, and prior to leaving he was presented by Mr. Farquhar, secretary to the company, with a gold watch.

When the recommendation of the Tramway Committee of the West Ham T.C. to increase the salary of Mr. F. EGGINGTON, chief assistant, from £250 per annum to £275, rising to £300 a year hence, was considered, the voting was equal, 20 members voting for the increase and 20 against. Thus the matter for the present remains in abeyance.

**General.**—A Cape correspondent writes: Mr. JOHN DENHAM, M.I.E.E., who acted as Government electrician to the late Government of the Cape Colony for many years, is being transferred to the Mines Department at Johannesburg under the new Union Government. Mr. Denham also acted as local representative of the Institution of Electrical Engineers. Owing to so many changes and transferences in the Government Post Office and Railway Electrical Departments, the local section of the Institution of Electrical Engineers has been completely disorganised, and it is feared that it will become disbanded.

Mr. C. H. WORDINGHAM, M.I.C.E., superintending electrical engineer to the Admiralty, has been elected a Fellow of King's College, London.

*Indian Engineering* states that Mr. A. N. DIXEY, assistant telegraph superintendent, Great Indian Peninsular Railway, is the superintendent of the G.I.P.R. new electrical department, under the locomotive superintendent, Parel, Bombay, and Mr. J. P. Rees is the electrician.

The Southport Corporation Tramways and Electricity Employés' Social and Athletic Society has presented a gold watch and chain to Mr. JOHN GRIFFITHS in recognition of his services as secretary.

The Ossett T.C. has appointed Mr. MOTTRAM, gas manager, as electrical adviser to the Corporation for a year.

According to the *Times* the King has sent a scarf-pin to Mr. L. J. STEEL, electrical engineer, of Portsmouth Dockyard, in recognition of his services in connection with the preparation of the *Medina* for their Majesties' voyage to India.

**Obituary.**—MR. G. E. PRITCHETT.—We regret to record the death of Mr. George Edward Pritchett, F.R.I.B.A., which occurred at his residence at Bishops Stortford, on Saturday last, after a short illness. The deceased gentleman, who had reached the advanced age of 88 years, had made many friends in the electrical world, in which, though an architect by profession, he played an interesting part in the early pioneering days of electric lighting in London. Between 20 and 30 years ago, with one of his sons, Mr. G. E. B. Pritchett (now one of the managing directors of Pritchetts & Gold), he started, as G. E. Pritchett & Co., an electric light station at Black Horse Yard, Rathbone Place. This was equipped with Brush series arc machines giving supply, on the series arc lamp system, to a large number of shops and business premises in Oxford and Regent Streets and neighbourhood, by means of overhead wires. The station was also equipped with the first two Mordey alternators ever made, supplying A.C. at 2,000 volts. The undertaking was the second electrical distribution scheme carried out in London, the Grosvenor Gallery installation having preceded it by a couple of years. The Black Horse Yard station was sold to the Metropolitan Electric Supply Co. a few years later, when the Electric Lighting Act of 1888 was introduced, and it was run by that company for some time. It now forms a distributing station in connection with the Marylebone municipal electric supply system. Some 14 or 15 years ago the deceased gentleman retired from his architectural profession, and since then he has been taking a special interest in electrical matters, particularly in X-ray work. He was an original member of the Röntgen Society, an Associate Member of the I.E.E., and a Fellow of the Society of Antiquaries. This journal has lost in Mr. Pritchett one of its oldest and most constant readers, for he had been a subscriber to the ELECTRICAL REVIEW from the beginning (40 years ago this year) up to the time of his death, and a complete set of our volumes from No. 1 to No. 69 are in his library at Bishop's Stortford.

COL. G. E. GOURAUD.—The *Times* contains a notice of the death, which occurred on February 17th, at Vevey, Switzerland, of George Edward Gouraud, C.M.H., Colonel, late of the U.S. Army, at the age of 70 years. The name of Col. Gouraud will be familiar to many of our readers as that of Edison's representative on this side of the Atlantic some years ago.

DR. OSBORNE REYNOLDS, F.R.S.—We regret to record the death of Dr. Osborne Reynolds, Emeritus Professor of Engineering at Manchester University, which occurred at Watchett, Somerset, where he had resided since he retired from the acting professorship six years ago. Dr. Reynolds was born in 1842. Among other important work carried out by him was the organisation and arrangement of the Whitworth Laboratories at Owens College.

MR. J. HOLDRON.—The death occurred on February 23rd, of Mr. John Holdron, who had for many years been in business as an electrical engineer in Market Place, Ashby-de-la-Zouch. He was 65 years of age.



## THE SYDVARANGER IRON MINES IN NORWAY.

THE most northern province of Norway is Finmarken, which extends from Tromsø to the Russian frontier to the north of Finland, and covers an area corresponding to about one-seventh of that of the whole country (124,495 sq. m.). Finmarken is very thinly peopled, and its population



FIG. 1.—CONCENTRATING PLANT AND POWER STATION BUILDINGS, KIRKENÄS.

represents only one-seventieth of the whole population, which is only natural on account of its northern latitude, the latter reaching to  $71^{\circ} 11' N$ .

The Sydvaranger Iron Mines are situated at the bottom of the Varanger fiord, which is the most easterly of the immense number of fiords in Finmarken, and if the map be consulted it will be found that the exact latitude of the mines is  $69^{\circ} 40' N$ . They were discovered in 1902 by a party who were prospecting for copper, but struck iron instead. A Norwegian merchant, Mr. Anker, was the leading spirit, and he at once started trial works with the view of ascertaining the extent of the deposits, with the result that the Aktieselskabet Sydvaranger was formed in 1904 with a capital of £666,667.

The magnitude of the capital is sufficient to show that the deposits in question were not going to be dealt with in a small way, and, in fact, according to the original estimate, the annual output was calculated at 600,000 tons of concentrates and briquettes. Owing to various unforeseen difficulties these anticipations have not been fully realised, for which reason the company have been obliged to secure additional capital in order to carry out the original plans to their full extent.

The results of the company's activity up to the present are, however, the completion of a concentrating and briquetting plant with a capacity of about 300,000 tons per year, which started operations in the autumn of 1910, and as a further and not less satisfactory result, it may be mentioned that a small town with a population of 2,000 has grown up at the shipping port, Kirkenäs, with a truly American speed.

In spite of the high latitude the climatic conditions are by no means intolerable, although the average temperature during seven months of the year is below zero, and may occasionally drop as low as  $30^{\circ}$ - $40^{\circ} F$ . below zero. In July and August it is more than  $50^{\circ} F$ ., and rises occasionally even to  $70^{\circ}$ - $80^{\circ} F$ . The most extraordinary feature is, however, this: that Kirkenäs is practically an ice-free port, while Christiania, for instance, which is situated about 9 degrees further to the south, is only kept open by means of ice-breakers.

The deposits cover an area of about 3,500 acres, and the ore occurs in lodes, which are up to 600 ft. wide, the length varying from 1 mile downwards.

The geological formation of the territory is of volcanic origin, and the iron ore occurs in granite gneiss. The total quantity of ore has been estimated to amount to 1,000 million tons to a depth of 100 metres, of which 400 millions are accounted for in the Björnevands Mines, which are the

most important of the various deposits, and are situated at the centre of the territory, about 5 miles from Kirkenäs. These are the first to be exploited, and there are about 50 million tons which can be extracted by quarrying. The ore is chiefly a low-grade ore, holding from 34 to 37 per cent. of iron, although there are also some 4 million tons of ore at the lake of Oernevand of a content of 52-53 per cent. of iron.

These mines are connected with the port of Kirkenäs by means of a railway, which is almost the only part of the whole plant not worked by means of electricity.

The locomotives employed are of the so-called fireless type, which are operated by means of steam of 200 lb. pressure, the charging being effected from a stationary boiler plant. The ore on the surface at Björnevand represents a whole mountain, which has been laid out in five benches at a height of about 65 ft. The drills used are the Ingersoll rock drills, which are worked by means of electricity, and are capable of boring vertical holes to a depth of 11 yards.

One may get an idea of the scale on which the work is carried out, when it is mentioned that 65,000 tons of ore, or a trifle more than the gross tonnage of both the *Lusitania* and the *Mauretania*, have been blasted in a single operation.

For loading the broken ore on the railway trucks, Marion steam shovels of a capacity of 90 tons an hour are used.

From the quarry the ore is carried on flat cars with loose 10-ton buckets to the preliminary crushing plant in the vicinity, where the ore is crushed by means of an Allis-Chalmers gyratory crusher to a size of 10 in. or less. This crusher is driven by a motor of 250 H.P., for which the energy is supplied from the central power station at Kirkenäs. The consumption of power at full load varies from 160 to

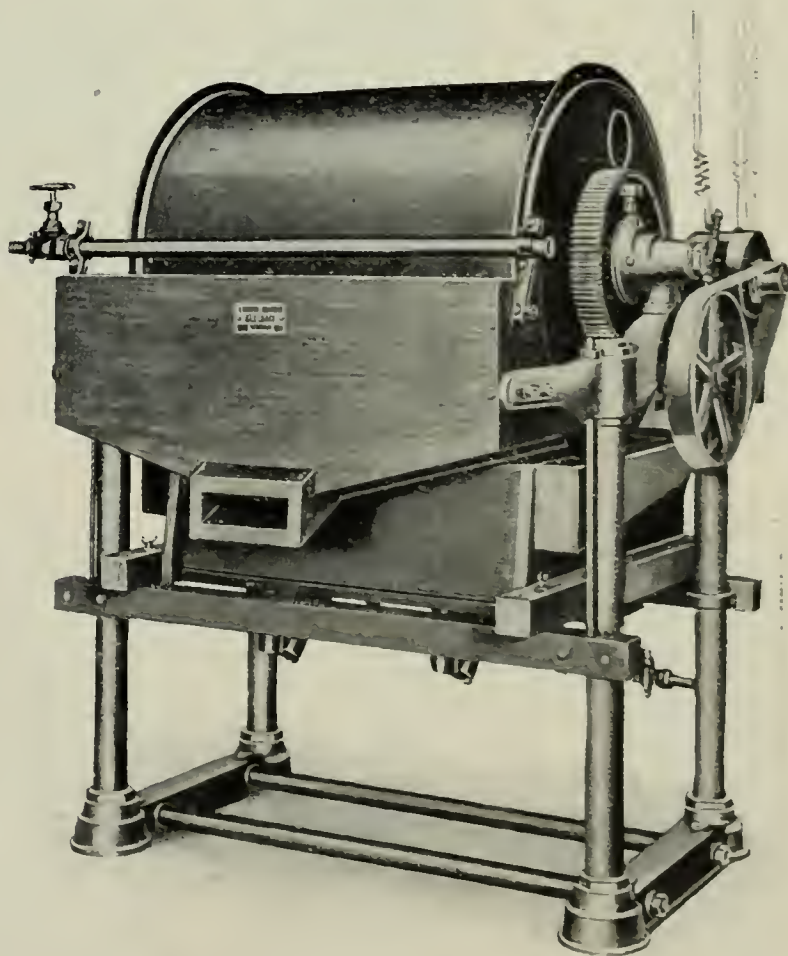


FIG. 2.—GRÖNDAHL MAGNETIC SEPARATOR.

170 H.P. After having been crushed, the ore is conveyed by means of a 36-in. belt through a tunnel to a number of bins on the side of the hill, which are capable of holding 4,000 tons of ore.

These bins are built on the solid rock, and from them six railway trucks of a capacity of 45 tons each can be filled



at a time, by means of which the ore is carried to the plant for concentration and briquetting at Kirkenäs.

The buildings of this plant are very large, and cover at the present time an area of 17,000 sq. m.: when they are completed this will be increased by 5,000 sq. m., making in all 22,000 m.<sup>2</sup>

A view of the buildings is shown in fig. 1, and as will be seen, they have been built on an incline so as to allow of the ore being subjected to the various processes in succession by gravitation. The whole plant has been built according to the Gröndahl wet system, and it has been divided into 20 separate working units, of which 12 are in operation at present. According to the estimate the capacity of each unit is 300 tons per 24 hours, and the whole plant, when completed, will thus be able to treat 3,600 tons per diem.

Each of the aforesaid units consists of an ore bin at the top, from which the ore passes to a Hadfield jaw crusher. By means of a conveying belt, it is carried to a distributing bin, and further through two ball mills, fed automatically, and through two sets of Gröndahl separators, two tube mills, and finally through two sets of finishing tandem separators, after which the concentrates are collected in settling tanks.

The various parts of the plant are arranged in a series of terraces, one for each class of machinery, and the whole treatment of the ore being carried out on the gravitation principle, it follows that the ore passes quite mechanically from one part of the machinery to the other, assisted by the flow of water.

Passing from the ore bins at the top, the crude ore is reduced by means of the Hadfield crusher to a size of about 2 in., after which it is carried to the distributing bins, which are placed above the ball mills (fig. 3).

lined with chilled cast-iron bars, which form a corrugated surface. The mills are charged with 4 tons of steel or cast-

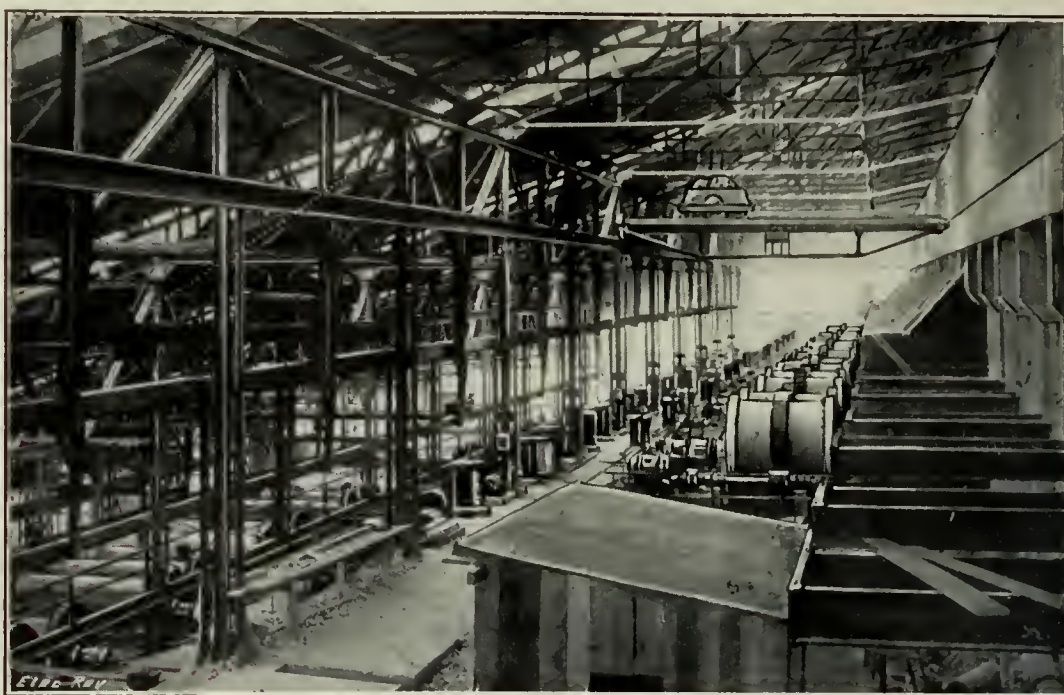


FIG. 3.—DISTRIBUTING BINS AND BALL MILLS.

iron balls, by means of which the ore, with the assistance of water, is ground to a size of about 20 mesh, and they are each driven by a separate electric motor. The mills have a

working capacity of 150 to 200 tons of ore per 24 hours, and the power required varies between 50 and 100 H.P.

Having passed the ball mills, the concentrates, which now represent a mass resembling pulp, proceed to the Gröndahl patent magnetic separators, of which fig. 2 gives an illustration, while the whole set of separators is shown in fig. 4. The separators are arranged in tandem, and the brass drums

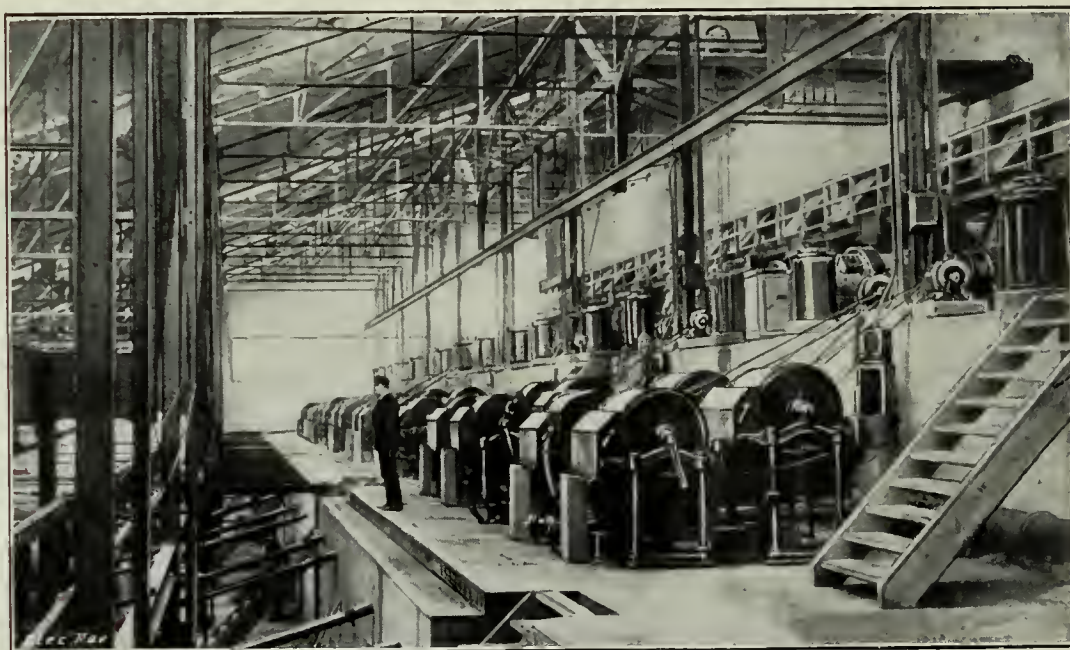


FIG. 4.—GRÖNDAHL MAGNETIC SEPARATORS.

are 34 in. long, their diameter being 28 in. The drums rotate around a fixed system of electromagnets of alternating polarity, the lowest point of the same being about  $\frac{1}{2}$  in. above the water level in the weir box.

In order to get rid of the bulk of the non-magnetic slimes, the ore may be passed through a slime box before being charged into the separator.

The pulp passes under the rotating drum, which encloses a magnet with specially-designed pole-pieces, and it is thus not fed directly on the drum, but is brought under the magnetic influence by the flow of water from the ball mills into the weir box. During its passage the pure magnetite of the ore is drawn by the magnets out from the water, adheres to the drum and is carried round to the limit of the magnetic field, where it is swept off by a spray of water, the tailings being carried off to the dumps.

Having passed the first of the tandem separators, it is quite possible that the concentrates may have carried with

them some of the non-magnetic particles, and for this reason the process is repeated in the second separator, so as to get



FIG. 5.—TUBE MILLS.

The latter are of the Gröndahl type, and are supplied with automatic feeders. They are made from cast-iron cylinders



rid of all unnecessary matters, and thus increase the iron content. Both separators are capable of dealing with more than 150 tons of concentrates per 24 hours.

They are belt-driven by a motor, and the power which is required for magnetising purposes amounts to 8 amperes at 220 volts for each separator.

From the separators the pulp passes to the tube mills (fig. 5), which are not an essential part of the machinery for this process, but are necessary for the Sydvaranger ore on account of its fine granulation, which necessitates a regrinding of the ore. After having passed the first set of separators, the concentrates hold up to 55 per cent. of iron. But having been ground in the tube mills and treated by a finishing set of separators exactly like those described above, the content of the final products is brought up to 69 per cent. of iron. The concentrates are finally carried to settling tanks, the number of which is six. Each of these is capable of holding 3,000 tons. When the water has been drained off, the tanks are emptied by means of grab buckets, and the concentrates are either passed to the briquetting works and pressed into briquettes of a size of  $6 \times 6 \times 2\frac{1}{2}$  in., or they are subjected to a drying process and shipped as fine ore or "slig," which this particular brand of ore has been called.

The only available waterfalls in the neighbourhood of the mines were those of the Pasvik River, which forms the boundary line between Norway and Russia. But owing to various difficulties with the Russian Government, the company had to abandon the idea of employing water-power, and had to resort to steam instead. The central power plant is erected at Kirkenäs, and the whole plant, when completed, will consist of the following parts:—Three steam turbo-generators designed for three-phase alternating current at a pressure of 800-850 volts, the maximum output of each being 3,750 H.P.; one steam turbo-generator for three-phase alternating current, 800-850 volts, of 300 H.P.; one steam

Co., of Stockholm. Each boiler has a heating surface of 5,375 sq. ft., and the pressure is 180 lb. per sq. in.

The turbines are directly connected by means of spring couplings with the 2,100-kw. generators, which are provided with direct-coupled exciters, and run at a speed of 1,500 R.P.M. The results of the tests of the electric plant were as follows:—

Output of generator, kw.	...	...	2,135	2,140
Steam per kw.-hour, lb.	...	...	16	16.61
Auxiliary machines, kw.	...	...	56	52
Net kw.	...	...	2,079	2,088
Lb. coal per net kw.-hour	...	...	1.95	1.91

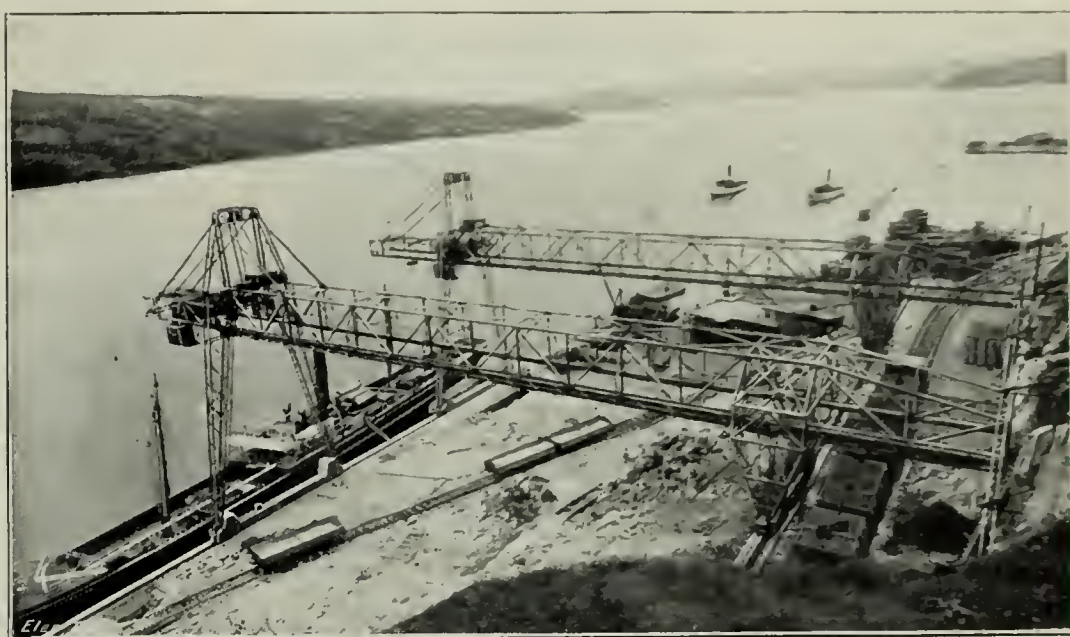


FIG. 6.—ELECTRICALLY-DRIVEN WHARF CRANES.

The necessary coal for the plant is carried by means of an aerial ropeway either from the ships directly or from the stores at the quays, and delivered to a stock-pile in front of the power plant. From the central station the energy is transmitted to the concentrating plant, to the mines, and to all other places where it may be required, as, for instance, for lighting purposes at Kirkenäs, &c.

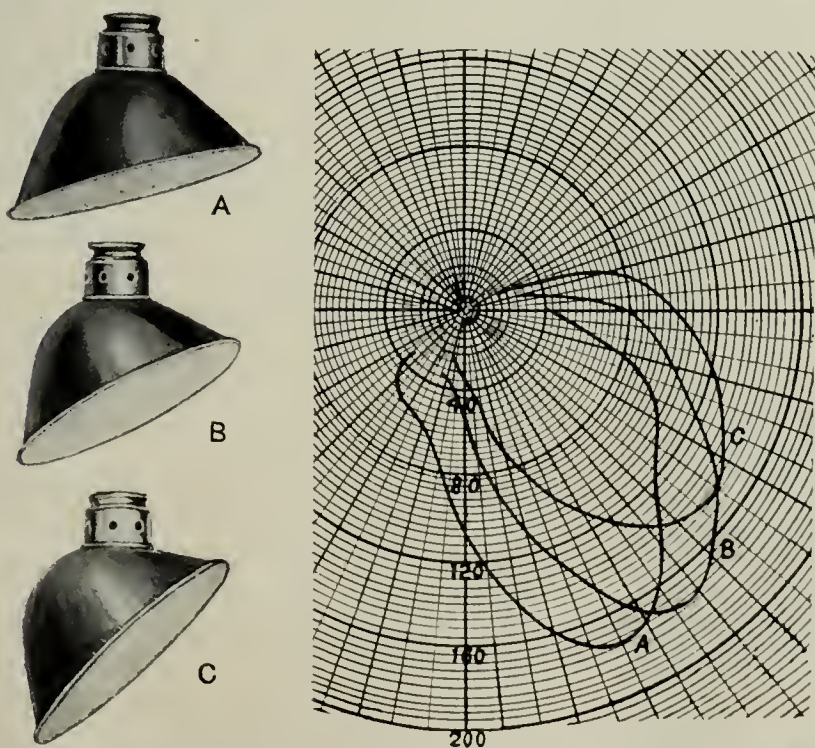
The tracks to the quay are laid at a height of nearly 50 ft. above the level of the quay, and here are placed two electrically-driven cranes with a lifting capacity of 12 tons each (fig. 6). The bridge has been built at such a height so as to enable 12,000-ton steamers to be loaded. It requires a time of about five minutes for each crane to lift a loaded bucket, to carry it forward above the ship, to lower and to empty it into the hold and place it back on the car.

Being worked day and night, both cranes can manage to load a quantity of from 4,000 to 4,800 tons of ore daily.

For the discharging of coal there is a separate quay, 165 ft. long, equipped with rails and a crane, also electrically driven, capable of dealing with 800 tons per 24 hours. The aerial ways, by means of which the coal is distributed to the various places, are capable of carrying 40 tons each per hour.

In conclusion, it may be stated that no mines have ever been started with such a complete equipment from the very beginning as the Sydvaranger Mines, and the extensive use which has been made of electric power for nearly all purposes shows that electricity has gained such a firm footing in the mining industry that it has become altogether indispensable. Even for lighting purposes it holds its own at Sydvaranger, and that in the face of two such formidable competitors as the midnight sun in summer and the aurora borealis in the winter.

**Electric Smelting in Sweden.**—The Stora Kopparbergs Bergslags Co., of Falun, which, a few years ago, introduced a 700-H.P. electric furnace of the Elektrometall type, is now reported to have acquired a licence for the use of the type of furnace devised by Dr. Helfenstein, of Vienna. It is proposed to erect furnaces of 12,000 H.P. for the extraction of iron from ore, the plant to be brought into operation in the autumn.



THE LIGHTING OF MACHINE SHOPS (see page 348).  
FIG. 1.—EFFECT OF SHADES AT DIFFERENT ANGLES.

turbo-generator for continuous current, 220 volts, 275 H.P.; and four centrifugal pumps, directly-driven by motors with three-phase alternating current, each pump possessing a capacity of 1,660 gallons per minute with 230 ft. head. The boiler plant will consist of seven Babcock & Wilcox boilers with superheaters, mechanical stokers and three 240-tube economisers. Five of the boilers have been installed, and two of the above-mentioned large generators, for the working of which two boilers are designed for each generator, while one boiler is kept in reserve. The whole plant has been delivered by the De Laval Steam Turbine



## THE LIGHTING OF MACHINE SHOPS.

ATTENTION has been frequently directed to the important influence which adequate lighting has upon the efficiency when large machine-shop operations are carried out, and this has been, and is, one of the arguments in favour of the adoption of an electric system of power driving in the shop.

considerable number of points, spaced at greater or less distances apart, according to the light intensity which is required at the point of minimum illumination, and the variation between the maximum and minimum limits which is permissible. In this connection the candle-power of the lamp itself is not the only consideration. Due account has to be taken of the way in which the light has to be distributed, and the area over which the light is incident. Speaking



FIG. 2.—BAD LIGHTING.

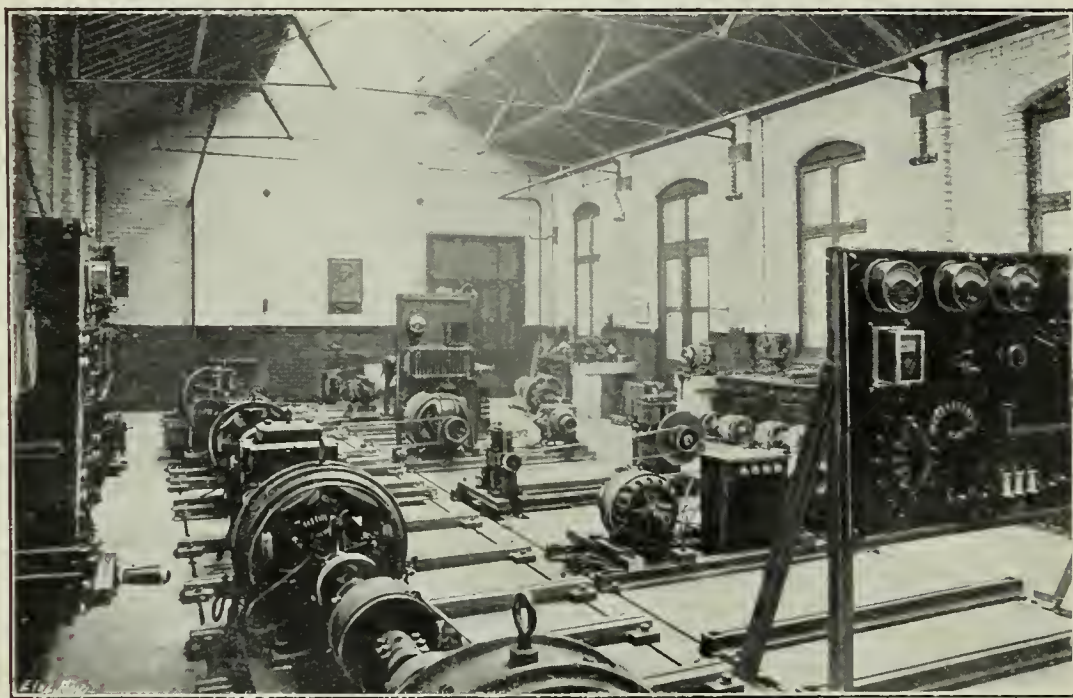


FIG. 3.—CORRECT LIGHTING.

Quite apart from the advantages which electric motive power offers in connection with the convenient arrangement of the tools and scientific splitting-up of the power demand into appropriate groups, it has become recognised that efficiency has been very largely increased by the clearing away of overhead shafting and belting, which formed obstructions to the good and uniform lighting of machine shops, both during daylight hours and during hours of artificial lighting. It should be pointed out, by the way, that such clearing

in general terms, it may be said that the foot-candle intensity for an ordinary machine shop should be about unity, this, however, being increased if the operations require minute attention, or where special conditions exist. For example, in the drawing office a light intensity of eight is not too much, the pattern shop should have an intensity of about three, and for fine work, such as engraving, the intensity should be about 10 ft.-candles. For general illumination in a factory where additional special illumination for each machine or bench is provided, the intensity may be one-and-a-half, while the local bench illumination should be about four. If no local illumination is provided, it should be the aim of the electrical engineer to provide a uniform illumination of the order of 4 ft.-candles intensity.

The subject, however, does not end with the question of general or local intensity of illumination, but the question of direction has also to be considered. Light may be provided of the proper intensity, and spread in a satisfactory manner, but owing to the exigencies of the work which is being done and the position of the operator, it may be found that the actual effect upon the operating efficiency is not so good as was anticipated. For this reason the question of shading becomes of very great importance. Perhaps a concrete instance will do more to explain this point than a good deal of theoretical argument, and this is supplied in the



MANCHESTER UNIVERSITY: JOHN HOPKINSON DYNAMO ROOM (see page 349).

away of overhead obstructions materially increases the hours during which natural daylight could be used.

When artificial lighting becomes necessary, the question of the best arrangement of lighting units becomes a very important one, and it is nowadays usual to pay attention in a greater or less degree to the question of good illumination. In considering this problem, it is the custom within economical limits to divide the lighting units into a

illustrations annexed. Fig. 1, p. 347, shows a photometric sheet of some steel reflectors made by the Holophane Co., of Newark, Ohio, U.S.A., the curve A representing the distribution of light given by the top shade figured; B that of the middle shade; and C of the lowest one, as tested with a 60-watt, 110-volt clear metal-filament lamp taking 1.18 watts per c.p. It will be seen that even with the slight divergences of the axis of the shade from the vertical, a totally different



distribution curve is given in each of the three cases, and this opens up considerable possibilities in the directing of light in connection with machine-shop operations. The importance of this point will be understood when it is realised that the influence of reflector equipment and the need of carefully selected suitable types of reflectors for industrial requirements such as mills, factories, foundries, machine-shops, &c., is fully as vital as in every other class of lighting service, and perhaps more so. The need for the proper shading of the lighting sources is often as important as the attainment of correct foot-candle intensity on the work, and figs. 2 and 3 illustrate very forcibly the glare effect from bare lamps and the improved illumination from good reflectors. In the former case, the lamp, although correctly placed, threw the light directly into the eyes of the operator and made his work on the slotting machine extremely difficult and fatiguing. The application of the shade, however, had the effect both of shading the operator's eyes and of throwing the light with increased intensity upon the work. The reflector used was an angular-type Holophane d'Olier steel reflector, like those shown in fig. 1, but of suitable size to suit the standard carbon lamp.

In many respects factory and machine-shop lighting has not yet reached finality in this country, and it would almost seem as if factory designers had not realised that a careful study of illumination problems was a directly useful piece of work, and not simply a fad. When this fact eventually is appreciated—a process which, unfortunately, may take some time—many of the anachronisms which at present exist in our industrial establishments will be done away with. At the present time electric lighting has been widely adopted for factory uses, and is highly appreciated; but it is not too much to say that its advantages are, in many cases, being thrown away owing to the lack of knowledge or interest of those responsible for the equipment.

### NEW ELECTRICAL LABORATORIES OF MANCHESTER UNIVERSITY.

TO-DAY the new Physical and Electrotechnical Laboratories of the University will be opened by Prof. Arthur Schuster, who held the chair of Physics from 1888 to 1907, and designed the original equipment of the Physical Institute. On his retirement Prof. Rutherford was appointed to the chair of Physics, and Dr. Beattie, who had been in charge of the Electrical Engineering Department, continues in that position. The extensions have been necessitated by the steady increase in the numbers of research students and by the use of large quantities of radio-active substances, the radiation from which disturbs electrical measurements in adjoining rooms, and the Council decided to provide new premises entirely for the Department of Electrical Engineering.

The new Electrical Engineering Laboratories are not actually larger than those formerly occupied, but are more conveniently subdivided and arranged; a separate workshop, battery room, lecture room, and research rooms have also been provided, and the department as a whole has been considerably enlarged. The laboratories are also advantageously situated for easy intercourse with a number of related departments. The new building includes on the first floor a number of small rooms for physical research, and a glass-blower's workshop, the latter, with the tinsmith's workshop below, serving the needs of the University in general. The electrotechnical laboratories occupy the ground floor, where they are conveniently grouped round the dynamo room. They comprise direct-current and alternating-current rooms, drawing room, workshop, research room, switch-board room, magnetic testing laboratory, battery room, private research room, &c., with a lecture room on the first floor specially equipped for the teaching of electrotechnics. Bare wires on insulators have been adopted for the experimental circuits. A 600-A.H. battery has been installed, in addition to the smaller battery already available in the main physics department.

The equipment of the dynamo house and the laboratories,

both old and new, has been carried out by Dr. R. Beattie, the head of the department. The number of students in attendance at the lectures has averaged over 50 in recent years, and the increase in their numbers has necessitated the creation of a demonstratorship, to which Mr. H. Gerrard has been appointed. Much valuable research work has been carried out by Dr. Beattie, in connection with applied magnetism and A.C. measurements.

We give on the opposite page a view of the interior of the John Hopkinson dynamo house, which forms the nucleus round which the new laboratories have been built.

### NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE British Columbia Electric Railway Co. intends to make some very large extensions to its plant this year. One of the existing generating stations has a plant of about 50,000 H.P., and it is proposed to increase this to 85,500 H.P. The company has also an auxiliary steam plant, the capacity of which it intends to increase from 12,000 H.P. to 20,000 H.P. Messrs. Dick, Kerr & Co., Ltd., it is understood, are to make three generators which will be driven by three water turbines of 14,000 H.P. each. By the end of 1912 the company's available power will thus be 105,000 H.P.; about £200,000 will be spent on these extensions. Proposed future work indicates that the total power will approach 200,000 H.P.

The Western Canada Power Co., whose generating station is at Stone Falls, B.C., have put into operation one of the largest units so far installed in Canada, with the exception of those at Niagara Falls. Two units are to be erected of 13,000 H.P. each; the head of water for the turbines is 110 ft.

The question of enlarging the Welland Canal which runs from Lake Erie to Lake Ontario, practically parallel to the Niagara River, is under consideration by the Dominion Government. The idea is to make it possible for ocean-going vessels to pass through the canal.

If the scheme goes through, the canal will almost certainly be in such a manner as to provide the maximum amount of water power consistent with satisfying the requirements of navigation.

It is more than probable that the next few years will see a great opening up of the immense territory known as New, or Northern, Ontario. Great mineral wealth, fertile soil, timber lands and water powers of some magnitude, are among the attractions of this region.

In the past, the Dominion Government has only tried to people the West, with the result that the older Provinces, such as Ontario and Nova Scotia, have been left out in the cold. Now, however, Federal assistance will be given in the matter of immigration, and in other ways, to every Province, and, as an outcome of this encouragement, the Government of Ontario proposes to spend £1,000,000 on the development of the northern parts of the Province which have hitherto been practically unheard of. This money will be expended on the making of good roads, development of water powers, and other public works.

**Letters Stolen.**—MESSRS. BI-METALS, LTD., the proprietors of Tinol, and MESSRS. NEVILLE WILLIAMS & CO., of 80A, Southwark Street, S.E., inform us that their premises were broken into on the evening of February 22nd, and all the letters were stolen from the letter box. They will be extremely obliged if anyone writing to them on or about that date, and not having received an answer, will kindly furnish a copy of his letter.

**Petrol-Electric Buses.**—MESSRS. W. A. STEVENS, LTD., inform us that they secured orders for 20 Tilling-Stevens petrol-electric buses for the Birmingham and Midland Motor-Omnibus Co., Ltd., and for six similar vehicles for the Greenock and Port Glasgow Tramways Co.



## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Evershed & Vignoles, Ltd.** (43,206).—A memorandum of satisfaction to the extent of £14,000 (being amount issued) on February 1st, 1912, of trust deeds, dated February 11th, 1902, and January 18th, 1904, securing £15,000, has been filed. Issue on February 8th, 1912, of £300 debentures, part of a series of which particulars have already been filed.

**Holsworthy Gas and Electric Supply Co., Ltd.**—Debenture, and as collateral security thereto, a mortgage, both dated January 27th, 1912, to secure £500, charged on the company's undertaking and property, present and future, including any uncalled capital and certain land and premises in Holsworthy, Devon. Holder: W. Harris, Ratherton, Holsworthy.

**Concordia Electric Wire Co., Ltd.** (74,416).—Return dated November 9th, filed November 14th, 1911. Capital £2,000 in £1 shares. All shares taken up. £1 per share called up on 7 and 10s. per share on 1,993. £1,003 10s. paid. Mortgages and charges: Nil.

**Cape Electric Tramways, Ltd.** (54,636).—Return dated November 15th, filed November 23rd, 1911. Capital £500,000 in £1 shares. 491,222 shares taken up. £91,222 paid. £400,000 considered as paid. Mortgages and charges: £484,500.

**Morris & Lister, Ltd.** (202,268).—Particulars of £1,500 debentures, created February 7th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first and second debentures. No trustees.

**Buenos Ayres Port and City Tramways, Ltd.** (85,427).—Trust deed dated January 26th, 1912 (supplemental to trust deed dated June 10th, 1910), to secure £350,000 extension first mortgage bonds, ranking *pari passu* with an issue of £150,000 like bonds secured by principal deed. Property charges: Certain concessions and benefits thereof, £86,000 debenture bonds of the Buenos Ayres City and Suburban Tramways, Ltd. (ranking in priority to previous deeds), all lands, buildings and rights and easements over land and other property acquired out of proceeds of this issue and company's undertaking and other assets, subject to said trust deeds. Trustees: Beaver Trust, Ltd., 1, Queen Victoria Street, E.C.

**East India Tramways Co., Ltd.** (74,457).—Return dated December 13th, 1911. Capital, £80,000 in 15,000 preferred, 35,000 ordinary and 30,000 deferred shares of £1 each. 7,476 preferred, 33,433 ordinary and 30,000 deferred shares taken up. £1 per share called up on 7,476 preferred and 7 ordinary. £7,477 10s. paid, leaving £5 10s. in arrears. £63,426 considered as paid on 33,426 ordinary and 30,000 deferred. Mortgages and charges: Nil.

**Douglas Southern Electric Tramways, Ltd.** (45,701).—Return dated December 21st, 1911, filed January 8th, 1912. Capital, £50,000 in 30,000 preferred and 20,000 ordinary shares of £1 each. 25,973 preferred and 15,472 ordinary shares taken up. £1 per share called up on 12,566 preferred and 5,804 ordinary. £18,370 paid on 12,566 preferred and 5,804 ordinary. £23,075 considered as paid on 13,407 preferred and 9,668 ordinary. Mortgages and charges: Nil.

**Alliance Electrical Stores, Ltd.** (111,884).—Return dated January 13th, filed January 25th, 1912; capital, £25,000 in 47,500 preferred ordinary shares of 10s. each and 1,250 deferred ordinary shares of £1 each. All shares taken up; 10s. per share called up on 7 preferred ordinary; £3 10s. paid; £24,996 10s. considered as paid on 47,493 preferred ordinary and 1,250 deferred ordinary. Mortgages and charges: Nil.

## CITY NOTES.

### Yorkshire Electric Power Co.

MR. A. G. LUPTON presided at the half-yearly meeting held at the Hotel Metropole, Leeds, on February 20th. In moving the adoption of the report (see ELECTRICAL REVIEW, page 226), he said that almost all the expenditure of the year had been on extensions of mains and sub-stations, and on apparatus in customers' premises to secure new revenue. Since the report and accounts had been issued the whole of the £100,000 preference shares had been applied for, and the directors would now ask for a quotation for this stock on the Leeds Stock Exchange. The revenue of the company had continued to grow, though much delayed by the breakdown in the summer. This involved special arrangements and the installation of temporary plant, which caused them much anxiety, but by these means all serious inconvenience to the customers of the company was avoided, though at considerable extra running costs. The plant was now all at work again, and in the meantime, to further secure the reliability of the supply and give a larger margin of safety, two additional units of generating plant had been ordered. During the past year an agreement had been made with the Heckmondwike U.D.C. for a bulk supply, which would be commenced in the course of a few days. The company would then be giving a bulk supply to six local authorities in its area. In addition to these six districts, energy was being supplied to the Distribution Co. for nine other districts. The directors had always looked to bulk supply forming a large part of the company's business, and although local authorities had been slower to see the advantages of such a supply than was first anticipated, it was gratifying to find that supply in bulk was rapidly becoming a considerable proportion of the company's output. The company had taken up £8,823 in ordinary shares of the Distribution Co., which was now becoming one of the largest customers on their system. The accounts of that company for 1911 showed satisfactory progress. In addition to the connection of a considerable number of new motors by existing customers, further supply agreements had been made with colliery proprietors, textile manufacturers, engineers, and others, and the company had now a large

number of other inquiries for power under consideration. There had lately been considerable development in the use of electricity for street lighting purposes, and the company's energy was being used in a number of districts in the West Riding. In regard to the fear of a great coal strike, they had made all the preparations possible to maintain the supply.

MR. H. A. EARLE seconded the resolution, which was carried

### Underground Electric Railways Co. of London, Ltd.

THE half-yearly meeting was held on Thursday last week at Electric Railway House, Broadway, Westminster, Sir Edgar Speyer, Bart., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 189), said the directors were able to indicate fresh progress. Both the District Railway Co. and the London Electric Railway Co. had demonstrated their vitality and recuperative power. The continued advance in the District traffic was specially noteworthy. The opinion expressed by him at the last half-yearly meeting as to the prospects of this company had been realised, and the company had begun to pay dividends on its second preference stock, which meant a fresh source of income to their company, which owned the entire stock, and the outlook for further expansion was favourable. They would also notice that the London United Tramways were emerging from their depression. The physical condition of the line had been greatly improved, and they hoped that the conservative policy of the board in building up a reserve would further strengthen that undertaking. They expected that the award in the arbitration between the company and the London County Council regarding the Hammersmith and Shepherd's Bush lines would be given almost immediately, which, if it did nothing else, would remove an element of uncertainty from the company and would create a clear situation. The revenue account showed total receipts of £156,548, an increase of £10,528, or about 7½ per cent. on the second half of 1910, and the net revenue before allowing for income bond interest was £54,015, a gain of £27,586, or over 104 per cent. After referring to the income derived from investments, the chairman said that when they received the next balance sheet they would find that the suspense items on the asset side, which now amounted to about £1,000,000, would have been reduced to a little over £350,000 by means of the surplus realised in excess of the book value of the power house. With regard to the pending Westinghouse case, he had only to say that the Court of Appeal had decided in their favour. They had recently learnt that the Westinghouse Co., not content with this second decision, was carrying the matter to the last tribunal, and was appealing to the House of Lords. The most important event, however, in the fortunes of the company had been the acquisition of the London General Omnibus Co. which, subject to several confirmatory meetings, had been successfully accomplished. With regard to the future the past year had been a prosperous one for the whole country in general and for London in particular. No better index could be obtained of the course of trade and of general prosperity than the trend of railway earnings. The expansion in the earnings of the railways of this country in the past year had been a large one—nearly 3 per cent., but nowhere had the expansion been so large as in London. In the past year the gross receipts of the District Railway had shown the substantial expansion of 7 per cent., and the gross receipts of the London Electric Railways the large increase of nearly 6 per cent. He was glad to say that the outlook of 1912 was for an additional expansion in trade and in the earnings of railways, especially in those of the railways of London. It was true that at the moment the favourable outlook was completely overshadowed by the danger of trouble in the coal trade, but he trusted that some way would be found to adjust the matters in dispute, and that a spirit of reasonableness would be displayed by employers as well as by the employed. There could be no doubt that if the dispute was permitted to develop into war the blow to the prosperity of this country would be disastrous. Then, again, the international political situation had recently shown a great change for the better. With a general feeling of greater confidence throughout the world, with cheap money, active trade, large profits, and with good wages in this country, there seemed little doubt that London would enjoy an exceedingly prosperous year. Indeed, should no untoward event arise, there were grounds for expecting that 1912 would be the most prosperous year that London had ever experienced, and the Tubes, the District and the 'bus company would enjoy a greatly increased volume of business.

SIR ALGERNON WEST, G.C.B., seconded the motion, which was adopted without discussion.

At an extraordinary general meeting held on Tuesday, Sir Edgar Speyer presiding, the resolutions embodying the acceptance of the scheme for the acquisition of the ordinary stock of the L.G.O., and for the increase of the capital of the Underground Electric Co., by the creation of 1s. "A" shares, were unanimously confirmed as special resolutions.

**Aberdeen Suburban Tramways Co.**—The directors report that the profit earned for the half-year ended January 31st amounts to £1,420, making, with the sum carried forward, a balance of £2,130 at the credit of profit and loss account. The directors recommend that the sum at the credit of profit and loss account should be carried forward.



**Paisley District Tramways Co.**

MR. OWEN HUGH SMITH, chairman, presided on February 22nd at 83, Cannon Street, E.C., over the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 271), the CHAIRMAN said the traffic receipts showed an increase for the past half-year of £3,963 and a total increase of £7,032 for the full year, this being mainly due to the extension from Barrhead to Rouken Glen, which had amply justified its construction. The tea gardens at the company's terminus at Rouken Glen proved a great attraction during the year, and the concerts and other amusements provided were much appreciated. The expenses showed an increase of only £1,608 during the past half-year and £2,181 for the full year. A considerable saving in expenses was attributable to the reduced price they were paying for energy supplied by the Paisley Corporation now as compared with last year. The board had added £4,500 for the past year to reserve for depreciation, and interest had also been credited to the reserve, making £30,553 at credit as at December 31st; £10,000 had been invested in trustee securities, and the balance was in their own undertaking. After providing for debenture interest and setting aside £750 for the debenture sinking fund, the balance allowed for payment of £1,000 to the preference share sinking fund, a dividend for the half-year at the rate of 5 per cent. per annum on the cumulative preference shares, and 3 per cent. on the ordinary shares, and £2,559 was carried forward. As seen from the balance-sheet, £700 debentures had already been redeemed by the trustees.

MR. D. JOHNSTONE SMITH seconded the motion, and it was carried without discussion.

On the motion of MR. O. H. SMITH, Lord Arthur Butler was re-elected a director.

**British L. M. Ericsson Manufacturing Co., Ltd.**

THE ninth annual meeting of this company was held on February 22nd at Byron House, Fleet Street, E.C., Mr. W. M. Crowe presiding.

The CHAIRMAN first referred to the death two weeks ago of Mr. George H. Robertson, chairman of this company since its inception in 1903. The speaker then alluded to the changes which had taken place in the constitution of the company. In December last it was found necessary to form the concern into a public company, so that they could make an issue of shares to the public. The reason for issuing those shares was that the business of the company was growing enormously, and, consequently, more capital was required. A further reason was that they had to pay off the £70,000 debentures held by the National Telephone Co. The new issue would be one of 99,990 6 per cent. cumulative preference shares, and the prospectus would be issued on February 26th. Instead of the £70,000 debentures which were being redeemed, it was their intention to issue £50,000 5 per cent. first mortgage debentures, and these had already been spoken for and would be taken up as soon as they were ready to issue them. Another change which had taken place in connection with the company was that the National Telephone Co., who were half owners of the concern, were, according to agreement, paid off on January 1st last, and the 50,000 ordinary shares held by them were taken over by Messrs. L. M. Ericsson & Co., Stockholm, and their friends. He was sorry that their good friends, the National Telephone Co., had been forced through circumstances to retire, and during the past two years he had wondered to what extent this would affect their company. Regarding this, the Postmaster-General had stepped into the breach in a very large way, and had placed orders with them to a greater extent than they had ever dreamed of from the National Telephone Co. If it was a fact that the Post Office was to extend the telephone service at the rate stated in the Press, then the prospects for the future were very bright for telephone manufacturers. Certainly there was plenty of room for extension when they considered that in this country there were less than 700,000 telephones installed, and in the United States there were over 8,000,000. In Europe we were also sadly behind. Stockholm, a city much smaller than Birmingham, had one telephone for every 47 of its inhabitants; whereas Birmingham, a much wealthier city, had one for every 73 of its inhabitants; most of our other cities were in the same state. In regard to their accounts, the result of the year's working was an excellent one, namely, a net profit of £27,144, or 27 per cent. on the capital, and this, after heavy depreciation of the capital assets. The working expenses to gain this result had only increased slightly from 1909, when the net profit was £10,500. The balance-sheet showed a very healthy state of affairs. It contained not 1d. of "water." No amount was standing on the books in respect of the patent rights and goodwill, which they considered to be valuable assets of the concern. They had had the capital assets at the factory valued by Messrs. Fuller, Horsey, Sons & Cassell, and the value they put upon these was £116,768, whereas the amount standing on the books for these same assets was £86,897.

MR. HAROLD SANDS seconded the adoption of the report, which was carried unanimously.

**Lancashire United Tramways, Ltd.**

THE seventh ordinary general meeting of this company was held on Tuesday at Winchester House, E.C., under the chairmanship of the Hon. Arthur Stanley, M.P.

The CHAIRMAN, in moving the adoption of the report, said it was gratifying to state that there was a considerable improvement in the working of the combined undertaking over the year 1910. Their traffic receipts had increased by £2,261, and the earnings per car-mile amounted to 7'97d., this being the highest figure they had yet earned. The sale of electrical energy, as indicated last year, had made good progress, and showed an improvement of £900. Having obtained additional consumers in January, the current year should show a further increase of revenue from this source. The managing of their car advertising had again proved successful. The total revenue amounting to £988, being an increase of £90 over the previous year, and the expenses of this department had decreased by £91. Finally, their receipts had benefited by an increased dividend on the St. Helens holding and sundry interest to the extent of £638. The expenses showed a decrease of £1,172. This was due principally to the reduction in energy used by the cars through the installation of meters, and to economies effected in generating costs. Their expenses were as low as it was possible to work with efficiency, and compared favourably with any undertaking in the country. The claims experienced in carrying their public liability risk had proved satisfactory, and they had consequently decided to continue the arrangement for a further period. The net result of the year's operation was that in the three companies there was a profit of £19,185, against £13,824 last year, or an increase of £5,361. The sum of £3,000 had been placed to a general reserve account in the South Lancashire Tramways Co., as owing to the transfer of the generating station and other assets to that company it was essential that a reserve fund should be built up by them. A balance in profit and loss account of £121 had been carried forward. In the Lancashire Light Railways Co., Ltd., after placing £1,000 to renewals account, £924 had been carried forward. The combined total at the credit of depreciation, general reserve, and profit and loss accounts of the companies was £10,393. He hoped they would think the result showed satisfactory progress. Of course, they had been favoured with fine weather, but otherwise they had not had very exceptional advantages, and it was clear that the volume of traffic was gradually, but steadily, increasing on their lines. He would only add that they had a very good provident society amongst their men, and they were doing their best to see if they could not become an approved society under the new Act. It would be very advantageous if they could do so, so that their men could manage their own affairs. Like every other person throughout the country, they were hoping that the threatened coal strike would be averted, because they would undoubtedly feel the evil effects. He was glad to say that they had made a certain amount of provision, and that the strike could go on for a few weeks without causing them any great inconvenience.

SIR JOSEPH BEECHAM seconded the motion.

MR. HOGG said he took it that the additional profit made was disposed of by writing off depreciation.

The CHAIRMAN said it was put to reserve in the South Lancashire Tramways Co.

Replying as to the position of the company in the event of a coal strike, the CHAIRMAN said he did not know definitely how long their coal would last. He supposed that they would close down their repairing shops and run the service as long as they could. A big part of their service consisted of workmen's cars, and if the strike came that service would not be wanted.

Another SHAREHOLDER asked why it was the company placed £2,000 to the reserve fund of the South Lancashire Tramways Co., as it rather looked like a contradictory principle. They were really in a better position than the accounts would tend to show.

The CHAIRMAN said the reason why they had put the £2,000 in the South Lancashire tramways was that they had already transferred the generating station to that company, in which they held all the shares. The depreciation account was in that company before, and therefore they left it there.

The report was adopted and the retiring directors were re-elected.

**South Metropolitan Electric Light and Power Co., Ltd.**—The warrants for dividends payable on February 28th on the 7 per cent. cumulative first preference shares, and 6 per cent. cumulative second preference shares (for the half-year ended December 31st, 1911) have been posted.

**Mansfield and District Tramways, Ltd.**—The directors have declared a dividend of 4 per cent. on the ordinary shares for 1911, placing £1,200 to reserve for depreciation, &c., and carrying forward £1,132.

**Mackay Companies.**—The regular quarterly dividend of 1½ per cent. on the common shares is recommended, payable on April 1st.

**Urban Electric Supply Co., Ltd.**—A petition will be heard on March 12th, at the Law Courts in London, for confirming a special resolution reducing the capital of the company from £800,000 to £640,000.

**Ascot District Gas and Electricity Co.**—The accounts for 1911 show a profit of £5,709 on the gas department, and of £1,243 on the electricity section of the company's operations. The dividend declared is at the rate of 5½ per cent. for the year.

**Continental Notes.**—BELGIUM.—The Société d'Electricité du Borinage, of Paturages, is increasing its capital to £100,000.

• SWITZERLAND.—La Société de la Fabrique d'Accumulateurs Oerlikon, of Oerlikon, Zurich, is declaring a dividend of 20 per cent. for the last financial year, the same as for the preceding 12 months.



## North Metropolitan Electrical Power Distribution Co., Ltd.

THE directors report for the year ended December 31st, 1911, states that the revenue amounted to £15,806, an increase of £1,217, compared with the previous year. After deducting all expenses chargeable to revenue, including debenture interest, there remains a surplus of £4,383, making with the balance of £331 brought forward, a total of £4,714. The directors recommend a dividend at the rate of 5 per cent. per annum, requiring £2,500, placing to the credit of the depreciation account, £2,000, and carrying forward £214. The expenditure upon capital account during the year amounted to £1,828, of which £1,526 was in respect of extensions of mains and installations upon consumers' premises.

**Barnet Electric Supply.**—The revenue for the year amounted to £5,637, compared with £5,490 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 20,250 30-watt lamps. A public lighting agreement for a period of eight years from July 1st, 1911, has been entered into with the local authority.

**Enfield Electric Supply.**—The revenue for the year amounted to £3,056, compared with £3,080 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 16,700 30-watt lamps.

**Hertford Electric Supply.**—The revenue for the year amounted to £3,787, compared with £3,467 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 18,700 30-watt lamps.

**St. Albans Electric Supply.**—The revenue for the year amounted to £3,148, compared with £2,482 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 22,650 30-watt lamps.

**General.**—The additional connections made during the year to the mains in the four districts represented the equivalent of 7,781 30-watt lamps, making a total connection at the end of the year of approximately 78,300 lamps. The number of units sold during the year was 1,159,323, which, compared with the previous year's figure of 1,027,365, was an increase of approximately 13 per cent.

	Barnet.	Enfield.	Hertford.	St. Albans.	Total.
Purchased in B.T. units ..	528,673	203,211	261,870	261,733	1,255,487
Sold—Public lamps ..	51,819	—	6,673	—	58,492
By contract ..	306,228	43,262	67,870	121,721	539,081
Private consumers by meter ..	135,964	144,409	163,302	118,075	561,750
Total sold ..	494,011	187,671	237,845	239,796	1,159,323
Total not accounted for ..	34,662	15,540	24,025	21,937	96,164
Public lamps ..	198	—	13	—	211
Max. supply demanded ..	333 kw.	164 kw.	171 kw.	166 kw.	—

The meeting will be held to-day, March 1st, at the Electrical Federation Offices, W.C.

## London Electric Supply Corporation, Ltd.

THE Earl of Crawford, chairman, presided on Friday at Winchester House, E.C., over the meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 309) said that the balance which the board had to deal with this year was £49,463, as compared with £39,272 last year. The result of the year's working was a profit of £61,411, or an increase of £10,191 over last year. It was proposed to pay an extra  $\frac{1}{2}$  per cent. on the ordinary shares, place £5,000 to the contingencies account, and so replace the sum which they had to withdraw in 1910; add £5,000 to the reserve fund, and increase the amount carried forward by £526. They considered the year's working satisfactory, for although the units sold showed an increase of 57 per cent., yet nearly the whole of this large increase was for energy supplied for power purposes at very low rates, yielding proportionately small profits. Seven years ago their average receipts for every unit sold were over 4d., whereas at the present time they were not 2d., the decrease being over 50 per cent.; and it spoke well for the efficiency and keenness and zeal of the engineering staff that they had been able during the same period to reduce the costs of production by nearly 40 per cent. No less than 21 per cent. of this decrease had been accomplished within the year under review. A satisfactory feature of the decrease in the cost of production was that it was obtained without the assistance of the new turbine plant which was being installed, and the first set only commenced running about the middle of December. Further reductions in cost were anticipated in the current year, when the turbine plant would be running in full. The units sold to the London and Brighton Railway Co. for traction purposes showed an increase of 73 per cent. Owing to the success of the electrification of portions of the suburban system of the railway, further extensions would be opened in the course of a month or two, and they anticipated a large increase in the supply of power for that purpose during the current year. Since the service was started in January, 1909, they had, with the exception of one breakdown which lasted five minutes, owing to a fuse giving way at a critical period, given an uninterrupted supply. This was a fine record, and in connection with it he would like to read an extract from a paper by Mr. Philip Dawson, the consulting engineer of the Brighton Co., before the Institution of Civil Engineers. Mr. Dawson said "He did not like to sit down without stating how extremely satisfactory the supply of current to the Brighton Railway has been as obtained from the London Electric Supply Corporation. In the early days when the Brighton Railway first started experimenting, and before the trams were running for public traffic they probably gave the London Electric Supply Corporation some very difficult loads to cope with. He was glad to say they received practically a perfect supply, and the voltage had been so steady that it could have been used for ordinary light-

ing purposes without any ground for complaint. There has been no breakdown or failure of any form or description since they commenced running experimentally two years ago." He need not say that this was extremely high praise from such an authority, and they were very proud of it, and especially were they proud of the staff which had accomplished it. The supply of power for industrial purposes also showed a satisfactory increase, the units having increased from 3,300,000 to 6,213,000. He was pleased to say that this supply continued to increase, as manufacturers were beginning to realise the economy and facility of driving machinery by electric power, as compared with steam. Many of the large manufacturers in their area had discarded the whole of their steam plant, and had effected considerable economies in doing so. Generally speaking, the year had been one of progress, and the prospect was distinctly hopeful that the progress would continue. They were within the shadow of a great strike. They had grave difficulty with the railway trouble last year, and were within a narrow shave of running out of coal. This time they had taken more precautions, and at the present time they had six weeks' supply of coal upon the premises.

MR. R. STEWART BAIN (managing director), in seconding the motion, said the capital expenditure for the year was £73,022. This was principally for the new plant and mains in connection with the Brighton Railway Co.'s contract, and also included two large motor generators and three rotary converters to meet the increasing demand for industrial power supply. The amount spent for mains for the year was £15,490, which included about 11½ miles of new mains about equally divided between the new railway mains and the new three-phase power mains for industrial purposes. The total length of mains now laid was 190 miles. The units sold were nearly seven millions more than last year; the increases being 3,478,510 units for traction, or about 73 per cent.; 2,900,183 for industrial power purposes or about 87 per cent. increase; and 539,865 units for lighting purposes, or about 10 per cent. The receipts per unit in each division were again less than last year, but the cost of production also showed a large decrease. The works cost last year was '48d. per unit as compared with '56d. in the previous year, a reduction of over 14 per cent., and the total costs were '82d. per unit as compared with 1'03d., or a reduction of about 21 per cent. The units sold for power purposes other than traction again showed a large increase; the increase during the year being 87 per cent., and they had every reason to believe this business would go on increasing. Coal showed an increase of £8,000, this being the principal increase in the expenditure, and it was owing to the increased number of units sold. The actual cost of coal per unit sold was 0'30d., as compared with '32d., a decrease of rather over 6 per cent. This was the lowest cost of coal they had so far achieved, but when the new turbine plant was running regularly, they expected to still further reduce this, provided that there was no abnormal increase in the price of coal, owing to strikes. The average price paid for the coal during the year was 10s. 10½d., as compared with 10s. 6d. per ton last year. Wages, repairs and maintenance, stores, &c., showed a small increase, due to the larger number of units generated, but no material increase had taken place in any other items in the revenue account. He mentioned last year that they and other electric supply companies were threatened by a Bill promoted in Parliament by the Underground Railways, but they were able to come to a satisfactory arrangement with the promoters, and thus they avoided the expense of opposing the Bill. They did not anticipate that they would be put to the expense of opposing any Bills during the present session of Parliament. He would, in conclusion, confirm the chairman's remarks as to the efficiency and zeal of the staff generally, and especially of the engineering staff, under Mr. Partridge, to whose keenness and energy they owed the low costs shown in the accounts.

MR. D. HANKEY, whilst so far satisfied with the report, pointed out that the shareholders were receiving a very small return on their capital, and he suggested that if instead of placing £5,000 to the contingency the board had paid an extra 1 per cent. on the ordinary shares, it would enable them to issue further preference stock, which would be required during the year, at par.

Replying to these and other questions, MR. BAIN said they anticipated capital expenditure during the year of between £50,000 and £60,000. They were obliged to go to financiers for advice as to issuing capital, and their advice did not agree with the view expressed by Mr. Hankey. They were still going on with the litigation with the Westminster Electric Co.

The report was adopted, and a dividend of 2½ per cent. on the ordinary shares was declared.

**Bastian Meter Co., Ltd.**—In their report for the year ending December 31st, 1911, the directors express regret that the trading results of the previous year had not been maintained, chiefly owing to a reduction in prices. The sum of £300 having been written off patents and goodwill, the net amount of profit is £309, plus £646 brought forward, making £955. The directors recommend the payment of the 6 per cent. dividend on the cumulative preference shares, amounting to £121, and also a 2½ per cent. dividend on the ordinary shares, amounting to £248 for the year ending, carrying forward £587. At the meeting held at the Inns of Court Hotel, Holborn, on February 22nd, the report was adopted and the dividends were declared.

**W. T. Henley's Telegraph Works Co., Ltd.**—Subject to audit the directors have decided to recommend a dividend on the ordinary shares at the rate of 15 per cent., free of income-tax, including the interim dividend of 5 per cent., paid September 1st last. This is the same rate as for the year 1910.



### Notting Hill Electric Lighting Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the expenditure on capital account has been increased during the past year by £4,075, so that it now stands at £217,407. The expenditure on capital account exceeds the receipts by £38,051. The cost of the joint station to date has amounted to £224,340, and joint debenture stock amounting to £227,500 has been issued. This stock is subject to a cumulative sinking fund, which now amounts to £46,438 invested in trustee securities. The following table shows the progress of the company:—

		Equivalent of 8-c.p. lamps connected.	Profit.
1908	.. .. .	168,885	£19,484
1909	.. .. .	180,903	£20,859
1910	.. .. .	189,885	£22,002
1911	.. .. .	199,156	£23,557

The number of consumers is now 3,513, and with the exception of 29 they are supplied at 200 volts. The gross revenue for the year was £43,059, showing an increase of £2,028, and the net profit for 1911 is £1,555 above that of 1910. From the net profit of £23,767 have to be deducted the following sums:—Depreciation, renewal, and reserve fund, £3,000; debenture and other interest, £2,413; Kensington and Notting Hill joint debenture stock—interest, £2,411; sinking funds, £1,456; leaving a balance available for dividend of £11,486. Both classes of 6 per cent. preference shares have already received their full dividend, which absorbs £8,136 and leaves a balance of £6,350 available for dividend on the new 1s. ordinary shares. The directors therefore recommend the payment of a dividend on those shares of 4s. 6d. per share, less tax, and that the balance of £619 be carried forward. The scheme of rearrangement of the share capital which was passed by the shareholders during the year, was confirmed by the High Court of Justice on June 13th, 1911, the capital now being as follows:—Share capital £201,352 10s., divided into 2,998 6 per cent. cumulative preference shares of £10 each; 17,002 6 per cent. non-cumulative preference shares of £10 each; 27,050 ordinary shares of 1s. each; 11,402 of the non-cumulative preference shares, and the whole of the other shares have been issued, and are fully paid up. Under the rearrangement of the capital each of the old ordinary preference shares received in exchange one fully-paid 6 per cent. cumulative preference share and the right to subscribe at par for one 1s. ordinary share. Each of the old ordinary shares received in exchange one fully-paid 6 per cent. non-cumulative preference share and the right to subscribe at par for one 1s. ordinary share. Each of the founders' shares received in exchange one fully-paid 6 per cent. non-cumulative preference share and the right to subscribe at par for 24 1s. ordinary shares. All the new shares were taken up, and the rearrangement of capital was duly carried through.

The meeting is called for March 5th.

Units generated and purchased	.. .. .	3,255,199
Units sold—Public lamps	.. .. .	103,985
Private consumers by meter	.. .. .	2,232,864
Total sold	.. .. .	2,336,849
Units used on works	.. .. .	25,591
Total units accounted for	.. .. .	2,362,440
Units expended in distribution transformers and accumulators	.. .. .	892,759
Number of public lamps	.. .. .	53
Total maximum supply demanded in kw.	.. .. .	1,696

### Bath Electric Tramways, Ltd.

THE Hon. Sir James Sivewright, K.C.M.G. (chairman), presided on February 21st at Winchester House, E.C., at the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 311), the CHAIRMAN said he thought the company had to be congratulated upon the fact that it was the second year of its existence so far as traffic and profits were concerned. The summer was a good one, and verified what he had repeatedly said before, that the success of a tramway depended upon the management and upon the weather. Judging from the results, they believed they had a management second to none in the kingdom, and the weather also having been favourable, they were in the position of having had a revenue of £43,834, being an increase of £1,462 over that of the preceding year. With satisfactory results such as that, naturally the question which occurred to every shareholder, and especially the preferred shareholders, was as to why they were not paying a dividend. They had received a good many letters from shareholders, some couched in temperate language and some a little intemperate, which was not, perhaps, unnatural. No one would more heartily welcome a dividend on the preferred ordinary shares than himself, for he held no debentures or preference stock, but paid £10,000 in cash for 10,000 preferred ordinary shares when the company was formed, and he held every one of them that day. No one, therefore, would benefit more than himself if a dividend were paid on the preferred ordinary shares. The position, however, was that they were paying off the bank loan out of revenue, and now the loan, which formerly stood at £28,000, was reduced to between £22,000 and £23,000. It had been urged that they did once pay a dividend when the loan was bigger, and that was true. At that time the loan was a new one, and they anticipated being able to replace it with debentures, but that could not be done, and so the bank had objected to the payment of ordinary dividends until the loan was substantially reduced. They had done everything possible to replace the loan, and had approached most of the trust companies in London, Edinburgh and Paris, but the objection which these companies urged was not that the undertaking was not good security, but that the nature of the security was such that it could not be quoted. The security they offered was what would be called an "A" debenture security,

it being a first charge on certain work which were outside the present bond, and a second charge on works at present within the bond. He was glad to say that recently a quarter had been suggested from which it was hoped they might be able to place this, and, if that could be done, they would resume the payment of a dividend on the preferred ordinary shares. He had received a letter from Mr. Charles White, of Dundee, who said he thought that a small dividend should be paid on the preferred ordinary shares; asking if anything could not be done to attract more passengers; and suggesting that as ½d. fares had paid well in Dundee, it would be well if the board consulted Mr. Peter Fisher, the tramways manager in Dundee. With regard to the points raised, they would like to pay a dividend if the bank would permit them. They welcomed any suggestion to increase the traffic, and had run a service of motor-buses with that object in view. Mr. Fisher had been written to, and he pointed out that, of course, there was a vast difference between thickly populated towns like Dundee and Glasgow and a city like Bath. The board would have very seriously to consider before introducing ½d. fares, for whilst it was easy to reduce fares, it was not so easy to raise them. The foundry they took over last year, was paying 15 per cent. on the capital involved, and the works were so full of orders that they were seriously considering an extension. With regard to their system, the board were satisfied with its efficient working. They, of course, recognised the fact that rails would not last for ever, but at present the system was in first-rate order. It might be that, five or six years hence, they might have to replace a good number of the rails, but they had already put away £4,000 for that purpose, and could face the situation with perfect equanimity at the present moment. They had improved the system a good deal by anchors, the cost of which had been charged to revenue, although it might well have been made a capital charge. From a table published in one of the journals giving the results of the working of 17 tramway companies and 77 corporations owning tramways, he found that there was only one company which had a lower operating cost per car-mile, viz., Cork, and in that city the lighting was amalgamated with the working of the tramways. The ratio in Cork was 5'01d. per car-mile, whilst Bath came out at 5'136d. Of the local authorities only one came out lower, viz., Leith. The average working expenses of the 17 companies was 6'2d. per car-mile, and of the 77 corporations, 6'46d. The working expenses per car-mile of the Bath Co., if they deducted the London expenses and directors' fees, was 4'788d., whilst if they included these items it was 5'368d. He thought the shareholders were to be congratulated on this, and having been connected with many companies, he would say he did not know that he had ever met a better staff than they had. The board were making every effort to reduce expenses, and he hoped that before long the preferred ordinary shareholders would be receiving a dividend on their holdings.

MR. E. CAILLARD seconded the motion.

MR. FEDDEN called attention to the auditors' certificate, wherein they gave the opinion that "subject to the question of depreciation," they were satisfied. He asked if the board could not do something to get a clean balance sheet.

MR. JACOBSON (the auditor) pointed out that the board had satisfied him that the undertaking was well maintained, but there was the question of obsolescence. The auditors pointed that out, and it was a question now merely between the shareholders and the board.

The CHAIRMAN said he had told them of the money spent in the maintenance of the system, and they were gradually reducing the debentures, and putting aside a reserve for depreciation which, in his opinion, was amply sufficient.

The report was then adopted, and the retiring director re-elected.

### Waste Heat and Gas Electrical Generating Stations, Ltd.

THE directors' report to January 31st, 1912, states that the profits earned by the company during the year, after deducting administration expenses and interest paid on calls in advance, amount to £25,071 (against £21,915 in 1910), less £7,500 transferred to the credit of reserve account, as compared with £7,000. The balance brought forward from the previous year was £6,048, and the profits available are £23,619, as compared with £18,518. The directors propose to declare a dividend at the rate of 8 per cent. for the year ending January 31st, 1912, which will absorb £15,664. Of this an interim dividend at the rate of 5 per cent. per annum for the half-year ending July 31st was paid in August, 1911, amounting to £4,326: there remains to be carried forward £7,955. It is proposed to pay the balance of the dividend on March 15th, 1912, less income-tax. The negotiations for erecting further waste heat generating stations which were reported to be proceeding at the date of the last annual report, had so far advanced early in the year as to require the issue of further capital to meet the cost of construction. Accordingly the company in general meeting increased the authorised share capital from £250,000 to £350,000, and in May, 1911, the directors offered for subscription 160,000 shares at 21s. per share. The capital offered was largely over-subscribed, and the whole of the issue has now been called up. The directors deducted the expenses incurred in connection with this issue and the cost of increasing the authorised capital from the premiums received, and have transferred the balance amounting to £3,851 to the credit of reserve account. The total of the reserve account, including the transfer from the premiums and the amount set aside out of the profits of the year, now amounts to £24,351. The company's new generating plant at Grangtown for the utilisation



of exhaust steam from the works of the Tees Furnace Co., Ltd., has been completed and is now in operation. The new stations at Port Clarence and Ayresome, each of which has a capacity of 3,200 h.p., are still in course of construction but are expected to be completed during the next two months. The construction of the proposed station at Redcar, mentioned in the recent prospectus, has not yet begun, as the negotiations have not been concluded. The Bankfoot Power Co., Ltd., have completed the extensions to their Bankfoot generating station and are constructing a further station at Bowden Close. To meet the cost of construction of these new stations the Bankfoot Co. have issued £50,000 of debentures and have increased their capital by the issue of 40,000 shares of £1 each. This company has subscribed for £10,000 of these debentures, and also for £20,000 of the new share capital on which the sum of 2s. 6d. per share was paid before the end of the financial year under review. All the company's stations have been maintained in efficient repair during the year, and provision has been made against certain exceptional expenditure at the Weardale generating station. As the operations of the company have considerably extended since its incorporation, the directors propose to ask the shareholders at the annual general meeting to-day, March 1st, to increase the sum divisible as remuneration to £600 a year.

### Bruce Peebles & Co., Ltd.

MR. F. E. ANDREWS presided at the annual general meeting of this company, held at Edinburgh on February 23rd. In moving the adoption of the report (see ELEC. REV., p. 309), he reminded those present that he had always stated that the critical time for the new Bruce Peebles Co. would be the third year of its existence. It could not fail, therefore, to be very gratifying to them to learn from the accounts that they had succeeded in getting over that period in a satisfactory manner, and that in spite of the grave difficulties they had managed to turn the corner and had, in the comparatively short time of three years, converted the large annual loss at which the works were being run into a profit sufficient to provide for the interest on the debentures and still leave a small surplus. The mortgage debentures had been reduced from £75,000 to £69,050, £5,950 in all having been redeemed in accordance with the terms of the trust deed, so that they were now saving practically £300 per annum on this account in respect of interest. The amount of unsecured debentures, or income bonds as they should preferably be called, was now £66,447, and this was the total amount issued under the scheme of reconstruction. Shares to a total value of £111,181 had also been issued in the same connection. Under the scheme it was originally estimated that the new company would have to issue about £90,000 of the unsecured debentures, and about £150,000 in shares, to creditors of the old company in settlement of claims, but a certain number of these claims could not be substantiated and the total amount of unsecured debentures and shares actually issued was therefore correspondingly reduced to the figures mentioned—even with this appreciable reduction the legacy they had inherited from their predecessors, in the shape of heavy capitalisation, was obviously a serious burden and a great handicap. But all matters in connection with the old company were now finally completed; application was being made to the Court to close the liquidation, and he hoped that that was the last time there would be any necessity to refer to it. The output of the works during 1911 was appreciably larger than during the previous year, therefore though the debts they owed, which were merely their current accounts, were naturally somewhat higher than before, the debts owing to them had gone up very considerably, so that at the end of the year there was a difference in their favour of nearly £34,000; this was a very satisfactory position. But though they naturally expected an increasing business like theirs to lock up a large portion of their cash resources, he felt constrained, in connection with this large amount of debts owing to them, to mention the unreasonably prolonged periods for payment which were so frequently stipulated in electrical engineering contracts. The trend had certainly been for the terms imposed on manufacturers to become more and more onerous until they had now reached a point that was distinctly unreasonable, and he was of opinion that the time had arrived when it was essential for all concerned to make a firm stand against conditions that were inequitable. In this and various other important matters affecting them, he was hopeful that the British Electrical and Allied Manufacturers' Association would be able to exercise a beneficent influence. Practically all the leading companies and firms had now joined, and the Association was taking energetic steps to remove some of the unreasonable and unnecessary difficulties under which the whole industry had laboured and struggled for many years past. Though the volume of work given out during 1911 was certainly somewhat larger than during 1910, it could not be said that there had been any real improvement in the conditions of the electrical trade, the demand for electrical machinery being still far short of the possible output of the existing works. In consequence, the unreasonable competition to which he had referred in previous years still continued, and it had been a difficult task to keep the works supplied with orders showing a reasonable profit. He was not without hope, however, that with the continually increasing use of electrical apparatus for all kinds of purposes, the demand would gradually approximate more nearly to the capacity for supply, and prices in consequence adjust themselves to a level that would enable some return to be made on the large amount of capital invested in the industry. It must not, however, be forgotten that they always had to face competition from foreign manufacturers, who were able to import free into their markets, whilst British firms were effectively shut out of their own countries by the prohibitive

tariffs. However, they had to take things as they were and make the best they could of them, therefore they had continued to give special attention to the extension of their business both at home and abroad. In the home market they had concentrated their efforts largely on selling the class of machines which their works were especially able to turn out at favourable prices, and their endeavours in this respect had been fairly successful. But their chief aim had always been to push their business abroad, where, although the cost of obtaining orders was necessarily larger than in this country, the prices obtainable were not so absurdly low as here. He informed them last year of the steps that they had taken with regard to South Africa, India, &c., and that they had their own men permanently residing in those countries. With regard to Canada, also, they found the demand for electrical plant already so great, and the field such a promising one, that they decided to send out one of their engineers, who had a wide experience in their sales department here, to reside permanently in that country. The amount of work already obtained was encouraging, and he thought that they might look forward to increasingly satisfactory results in the future. In conjunction with some other firms, they made arrangements to be adequately represented in China, but the upheaval in that country had naturally put a stop to business. Once the revolution was settled, however, there was little doubt that progress would be both great and rapid, and they would then be in a good position to take advantage of the improved circumstances. Their policy all through had been the somewhat prosaic but very sound one of endeavouring to steadily build up a circle of satisfied customers in all parts of the world, so as to ensure a regular flow of orders into their workshops, and one of the healthiest and most encouraging signs of the past year was the very considerable increase in the number of their customers. The critical third year was passed, the enormous annual loss at which these works were formerly run had been converted into a profit, the machinery they turned out had a world-wide reputation for excellence, and there seemed to be a fair prospect of a reasonable volume of business, and though he was not very fond of attempting to forecast the future, he regarded the outlook for 1912 hopefully, and trusted that a year hence they would be able to show even more satisfactory results than those now presented to them.

### Hove Electric Lighting Co., Ltd.

THE directors' report for the year ended December 31st, 1911, contains the following particulars of the progress of the company:—

Year.	Houses.	Equiv. in 8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1907 ..	1,579	104,393	1,019,469	£23,321	£12,693
1908 ..	1,676	114,135	1,134,994	24,695	13,463
1909 ..	1,820	122,946	1,192,503	25,205	13,981
1910 ..	1,949	129,217	1,178,165	25,991	15,400
1911 ..	2, 28	1,8,200	1,139,328	24,840	14,457

There is a decrease in gross revenue of £1,151 and a reduction in working costs of £208, the net result of the year's working being a profit of £14,457, compared with £15,400 in the preceding year. With the addition of the balance £862, brought forward from 1910, and other items, the amount to the credit of net revenue account is £15,569 (compared with £15,764), from which must be deducted the dividend on the preference shares paid September 1st, 1911 (£588), the interim dividend on the ordinary shares at the rate of 8 per cent. per annum (£2,825), a provision for debenture interest accrued, and income-tax, leaving a surplus of £9,564 now available. The directors propose to place £1,500 to the renewals and depreciation account and £3,000 to the sinking fund, to set aside £588 for accrued preference dividend to December 31st last, and to declare a final dividend for the six months on the ordinary shares, payable on April 15th next, at the rate of 10 per cent. per annum, making 9 per cent. for the year. The amount carried forward, after providing for the directors' extra remuneration of £307, is £637. The renewals and depreciation account, with the addition above mentioned, will now stand at £25,604. The sinking fund account, with the above addition of £3,000 and £1,355 received by way of dividends on investments, will now amount to £43,513. The expenditure during the year on capital account has amounted to £5,292, and the machinery, buildings and mains of the company have been kept in good repair. The meeting will be held on March 6th.

### Telegraph Construction and Maintenance Co., Ltd.—

THE directors' report and accounts show a net profit of £87,515, after charging the interest on the debentures. To this sum must be added £107,578 brought forward from last year, making a total of £195,093. From this amount is deducted the interim dividend of 5 per cent., paid July 20th, 1911, amounting to £22,410, leaving £172,683 to be dealt with. Of this sum the directors propose to distribute a dividend of £1 4s. per share, together with a bonus of 6s. per share, absorbing £56,025, being at the rate of 12½ per cent., and making, with the amount already paid, a total dividend and bonus for the year of £2 2s. per share, or 17½ per cent., free of income-tax, and to supplement the reserve fund by £10,000 (making it £85,000), leaving £106,658 to be carried forward. The general business of the company during the past year has been satisfactory. The company's works and steamships have been maintained in their usual state of efficiency. As promised at the last half-yearly meeting, the shareholders were to be asked at yesterday's meeting to decide whether half-yearly meetings should be discontinued. The Earl of Selborne and Sir James Pender, Bart., offer themselves for re-election as directors.



**Northampton Electric Light and Power Co., Ltd.**

THE annual meeting was held at Northampton on Thursday last week, Alderman F. H. Thornton, presiding.

In moving the adoption of the report, the CHAIRMAN said the sale of current advanced during the year from £16,899 to £19,104, an increase of £2,505. The reserve fund had been increased to £3,000, and the depreciation fund now stood at £20,601. All round the figures were larger and more satisfactory than last year. The directors considered they had got practically a model generating station, and during the year three deputations from various parts of the country had made inspections. A deputation from Norwich had inspected the turbine, one of the first of its type, because it ran not only on high pressure but also on exhaust steam: a deputation from West Bromwich had inspected the coal elevators: and a deputation from Bridlington had been to see the equalisers. The company had made great extensions during the year, and they considered that the Weston Favell branch would prove important for the sale of current. They had laid in a large stock of coal and would, he thought, be able to meet any emergency in that respect. Alderman W. TOMES seconded the motion, which was carried unanimously.

Dividends as recommended by the directors were declared, and it was decided that the remuneration of the directors should in the future be £300 per annum, an advance of £50. Thanks were passed to the secretary, the chief engineer, and the staff for their services, and a vote of thanks to the chairman concluded the meeting.

**Prospectuses.**—*Coal Substitute, Ltd.*—The list opened on Tuesday, and was to close on Wednesday, for subscriptions for 140,000 shares of 10s. each in this parent company formed to acquire the invention of "a proved efficient substitute for coal which contains no coal or peat," and is stated to be saleable from 13s. per ton. It is said that the raw material can be produced in this and almost all other countries in abundance, but there is a contract mentioned under which the company will be able to obtain "any quantity of the raw material up to 30,000,000 tons per annum at 1s. 6d. per ton at Lisbon." It is claimed that the calorific effect of the fuel is equal to that of "good household coal," "and it lasts longer." Messrs. Sulman & Picard, chemists and assayers, who have tested the fuel, gave the following result after drying at 212° F.:—Volatile hydro-carbons and combined moisture, 46.65 per cent.; fixed carbon, 45.80 per cent.; ash, 7.55 per cent. = 100 per cent. The price to be paid for the invention and patent rights and the benefit of the contract named above, is £65,000, as to £5,000 in cash, £30,000 in shares, and the balance in shares or cash.

*Sudd Fuel (Suddite), Ltd.*—This company has also offered an issue of 120,000 7 per cent. participating convertible preference shares of £1 each at par. The company is to acquire the benefit of an agreement with the Sudan Government, giving the company the exclusive right to manufacture solid fuel from papyrus um soof and other aquatic plants, known as "Sudd," until 1922; also to acquire the exclusive right to use in Egypt and the Sudan the special machinery and process necessary, designed by Prof. Dr. Paul Hoering, of Berlin, and the plant and machinery now at Khartoum, North. The consideration to be paid to Soudan Industries, Ltd., promoters and vendors, is £118,500, payable as to £18,500 in cash and £100,000 in shares. It is stated that a laboratory test shows Suddite to contain 3.3 per cent. moisture, 7.7 per cent. ash, and 89 per cent. combustible matter.

*Portland Railway, Light, and Power Co.*—The list closes to-day in an issue, at 95½ per cent., of \$16,000,000 first and refunding mortgage 5 per cent. sinking fund gold bonds (1942) convertible into stock.

*The British L.M. Ericsson Manufacturing Co., Ltd.*—This company has this week been before the public with an issue at par of 99,990 cumulative 6 per cent. preference shares of £1 each. The list opened on Monday and was to close yesterday. The circumstances of the issue are related in our report of the company's meeting given on another page to-day.

**Falkirk Electric Construction Syndicate, Ltd.**

Mr. A. W. Tait presided at this company's meeting, and, referring to the success of the business, said it had certainly been more prosperous than during the previous year. The report of the directors, which, with the audited accounts of the syndicate and the Falkirk Tramways Co., was adopted, showed that, because of the satisfactory nature of the accounts, the directors had decided to write off in one year the whole of the expenses and discount in connection with the issue of debentures, amounting to £1,983. The profit of the Falkirk and District Tramways Co., amounting to £4,183, was transferred to the syndicate by way of dividend, while the balance at the credit of the profit and loss account of the syndicate was £4,331. The directors recommended a dividend at the rate of 4 per cent., less income-tax, on the share capital, which left £708 to be carried forward. The gross profit and loss account of the Tramway Co. showed that the traffic receipts had amounted to £17,036, while traffic, power, maintenance, and other expenses totalled £9,734, which left £7,571 to be carried forward. The total profit, after deductions for interest on mortgages and loans, and legal expenses in connection with the opposition to the Falkirk Burgh Extension Order, depreciation and sinking fund, amounted to £4,183.

**Sao Paulo Tramway, Light and Power Co.**—A quarterly dividend at the rate of 10 per cent. per annum is announced.

**Oxford Electric Co., Ltd.**—The directors' report for the year ending December 31st, 1911, states that the revenue account shows a profit (including £970 brought forward from last year) of £15,481. After providing £2,041 for debenture and other interest, also writing off £872 on account of hire-purchase installations, the balance available for dividend is £12,568. The directors propose a dividend at the rate of 7½ per cent. per annum, less income-tax, on the ordinary share capital (whereof 3 per cent. was paid in September), £7,250; dividend (5 per cent. per annum) on the preference share capital (whereof 2½ per cent. was paid in September), £2,000; to credit of reserve and renewal of plant account, £2,173, leaving to be carried forward £1,145. Reserve and renewal of plant account has been charged with the cost of plant replaced. It is estimated that at December 31st last there was the equivalent of over 135,000 lamps connected to the mains. The lamp, heating and motive power connections have continued to increase satisfactorily. The plant has been maintained in thoroughly efficient order. With the object of effecting further economies and to provide for the increasing demand, a Diesel engine with dynamo of 450-kw. capacity has been placed on order. The supply mains of the company have been extended in Charlbury, Hill Top, Minster, Portland and Southfield Roads, and in Stratford Street.

**Chelsea Electricity Supply Co., Ltd.**—The directors' report for 1911 states that the profit amounts to £37,500, which, with £2,298 brought forward and £1,450 for interest, makes a total of £41,248. After deducting interest on debenture stock £7,875, interim dividend 6 per cent. on preference shares £900, interim dividend on ordinary shares at the rate of 4 per cent. per annum £4,944, there remains a balance of £27,530, which the directors recommend shall be appropriated as follows: To credit of reserve for renewals, depreciation and contingencies, £13,180; to credit of debenture stock premium redemption fund, £704; to amount written off cost of extinction of founders' shares, £1,089; to amount written off cost of purchase of Cadogan Electric Light Co., £1,000; to final dividend on the preference shares at the rate of 6 per cent. per annum, making 6 per cent. for the year, £900; to final dividend on the ordinary shares at the rate of 6 per cent. per annum, making 5 per cent. for the year, £7,415; leaving to be carried forward £3,241. The number of 8-c.p. lamp equivalents connected was 282,376, an addition of 10,289 during the year, and the total number of units sold was 4,016,478, being 128,458 less than for 1910. The regular demand for the past year has shown a satisfactory increase, the decrease being due to the discontinuance of a large temporary supply of power.

**Llanelly and District Electric Lighting and Traction Co., Ltd.**—The directors report that the profit for 1911, including £56 brought forward, and after payment of loan and debenture interest charges, is £4,585. Out of this the interim dividend on the 6 per cent. cumulative preference shares to June last, amounting to £1,761, has been paid, leaving £2,824. The directors recommend the dividend on the 6 per cent. cumulative preference shares for the half-year to December £1,800, carrying forward £1,024. The tramways were completed early in August, 1911, so that the full system was only in operation for about five months.

**Giant's Causeway and Portrush Electric Tramway Co.**—The annual meeting was held in Portrush on February 23rd, Provost Traill, D.L., presiding. The directors' report stated that the receipts had increased from £3,877 to £4,107, with one exception the highest on record since the starting of the company, and the net profits from £1,381 to £1,546. The number of passengers had increased from 132,789 in 1910 to 136,395 in 1911. The balance, £262, against the net revenue account last year, had been turned into a balance of £167 in its favour in this year's account for the first time in 25 years. As a reserve power, to meet the contingency of another summer's drought, the directors had erected an additional electric generating station at the depot, Portrush, at a cost of £500. The profits from the year's working would have far outrun those of any previous year had it not been for the unexampled drought, as a result of which the water supply to the turbines had to be carefully conserved. The engineer's report stated that the permanent way, the power plant—electric and steam—and the rolling stock, had been maintained in an efficient condition. The number of miles run by electricity had been 33,407, at a working cost of 3½d. per mile run. The number of miles run with steam engines had been 4,048, at a working cost of 1s. 4d. per mile run. The report was adopted.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Ados, Ltd.  
Electric Timber-Seasoning and Preservation Co., Ltd.  
Improved Electric Glow Lamp Co., Ltd.  
London and Provincial Electric Construction Co., Ltd.  
MoPhail & Simpson's Dry Steam Patents Co., Ltd.

**County of London Electric Supply Co., Ltd.**—The directors have declared a final dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, and on the ordinary shares at the rate of 8 per cent. per annum, less income-tax, for the half-year to December 31st, making 6 per cent. for the year on the ordinary shares. £25,000 has been placed to reserve for depreciation, against £20,000 last year.



## MARKET QUOTATIONS.

## STOCKS AND SHARES.

Tuesday Evening.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 28th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. .. "	22/-	..
a " Oxalic .. .. .. per lb.	23d.	..
a " Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. "	42/-	..
a Ammonia, Murate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. .. "	£5 10	..
a Bisulphide of Carbon .. .. .. "	£18	..
a Borax .. .. .. "	£16 10	..
a Copper Sulphate .. .. .. "	£23	£1 inc.
a Lead, Nitrate .. .. .. "	£25	..
a " White Sugar .. .. .. "	£25	£2 5 inc.
a " Peroxide .. .. .. "	£32	..
e Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	33d.	..
a Potash, Caustic (80/82 %) .. .. per ton	£20 5	..
a " Chlorate .. .. .. per lb.	33d.	..
a " Perchlorate .. .. .. "	43d.	..
a Potassium, Cyanide (98/100 %) .. .. (for mining purposes only)	73d.	..
a Shellac .. .. .. per cwt.	68/-	..
a Sulphate of Magnesia .. .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. .. "	£6 10	..
a " Recovered .. .. .. "	£5 10	..
a " Lump .. .. .. "	£5 5	..
a Soda, Caustic (white 70/72 %) .. .. "	£10 5	..
a " Chlorate .. .. .. per lb.	33d.	..
a " Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. .. .. "	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£65	..
b " Wire, in ton lots .. .. "	£102	..
b " Sheet, in ton lots .. .. "	£120	..
p Babbitt's metal ingots .. .. .. "	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	73d.	1d. inc.
c " Tube (brazed) .. .. .. "	103d.	1d. inc.
c " " (solid drawn) .. .. .. "	83d.	1d. inc.
c " Wire, basis .. .. .. "	73d.	1d. inc.
c Copper Tubes (brazed) .. .. .. "	103d.	1d. inc.
c " " (solid drawn) .. .. .. "	10d.	1d. inc.
g " Bars (best selected) .. .. per ton	£79	..
g " Sheet .. .. .. "	£79	..
g " Rod .. .. .. "	£79	..
d " (Electrolytic) Bars .. .. .. "	£66 5	..
d " " Sheets .. .. .. "	£83 5	..
d " " Rods .. .. .. "	£71 5	..
d " " H.C. Wire per lb.	8 3/4d.	..
f Ebonite Rod .. .. .. "	5/8	..
f " Sheet .. .. .. "	4/9	..
n German Silver Wire .. .. .. "	1/11	..
h Gutta-percha, fine .. .. .. "	..	..
b India-rubber, Para fine .. .. .. "	4/7 1/2	1d. inc.
i Iron Pig (Cleveland warrants) .. per ton	49/7	8 1/2d. inc.
i " Wire, galv. No. 8, P.O. qual.	£14	..
g Lead, English Pig .. .. .. "	£16 2 6 to £16 5	2/6 inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. .. per bot.	£8 7 6	..
e Mica (in original cases) small .. per lb.	6d. to 2s.	..
e " " " medium .. .. .. "	2/6 to 4/-	..
e " " " large .. .. .. "	4/6 to 8/6	..
p Phosphor Bronze, plain castings .. ..	11d.	..
p " " rolled bars & rods .. ..	1/0 1/2	..
p " " rolled strip & sheet .. ..	1/1	..
o Platinum .. .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. .. per lb.	9 1/2d.	..
r Steel Magnet, in bars .. .. .. per ton	£55	..
g Tin, Block (English) .. .. .. "	£197 to £199	£1 dec.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/4 1/2	1d. inc.
p White Anti-friction Metals .. .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) ..	£80 7 6	..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Shakspeare.	r W. F. Dennis & Co.
h Edward Till & Co.	

**Stock Exchange Notices.**—The Stock Exchange Committee have appointed special settling days as under:—

Friday, March 1st.—Puebla Tramway Light and Power Co.—Scrip, fully and partly paid, for \$3,000,000 prior lien 5 per cent. 50-year gold bonds.

Wednesday, March 6th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 10,000 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 727,012 to 737,011).

Thursday, March 7th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 12,989 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 737,012 to 750,000).

And ordered the under-mentioned securities to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 10,000 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 727,012 to 737,011); and 12,989 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 737,012 to 750,000).

Mexican Light and Power Co., Ltd.—£1,000,000 5 per cent. second mortgage 50-year bonds (Nos. A 1 A 10,000) of £100 each, in lieu of the scrip.

THE shadow of a coal strike is still lying over most of the markets in the Stock Exchange at the time of writing, although hopes run high of a peaceful settlement after all. Prices, as a matter of fact, have held their positions with a good deal of tenacity; perhaps with more than might have been expected in the circumstances. So far as Electric issues are concerned, it may be said that the labour difficulty has had little or no influence upon quotations.

Metropolitan Railway Consolidated stock and City and South London Ordinary stock have been racing neck and neck for the honour of the biggest advance this week. The improvements are 3 and 2 respectively. The rumour connecting the City and South London line with the Crystal Palace we mentioned last week; while another one that is doing duty is that the company will shortly be included within the scope of the Underground Electric Railways combine. Metropolitan Ordinary has been bought for the same reason as that last given in connection with the City and South London, and quite possibly all the Underground lines will be joined up in course of time, although, at present, negotiations may be disclaimed by one company and another. Central London Ordinary is 1 down. Underground Electric Railway shares rose 1/2, and the Income bonds 2, it being understood that the bull account has been substantially, if still only partially, reduced. British Electric Traction are steady, with rises in both Preference stocks. South Metropolitan Preference rose 1/2, but the Metropolitan Tramways descriptions are unchanged.

In the English Electricity Supply group, Charing Cross Ordinary continue to improve, and Bromptons put on 1/2, the latter bringing the price to 8 1/2 middle. Westminster are harder at 8 1/2, St. James's rose to 8 1/2, and Edmundsons' Preference improved 1/2 to 3 1/2; the only shares to look back being Metropolitan Ordinary, which are somewhat easier. There has been a little inquiry for the Ordinary shares of the Edmundsons' Company, which has put the price up to 11s., speculative buying being stimulated by the expectation that in the course of a year or two the company might even pay a dividend upon these.

In the Foreign section, the news concerning the revolution in Mexico is read more gravely than has been the case hitherto, and most of the Mexican Light and Power issues show falls on the week. The declines range from 1/2 to 2; but we understand that the prices were marked down more in apprehension of selling than by reason of actual realisation. Confidence, of course, has been shaken in Mexican investments, and there is a lack of support to take small lines of shares when they come to market, which accentuates the prevalent feeling of depression. Mexican Light and Power fell 2, Mexico Trams losing 3 points. The feature of strength in this section is Kaministiquia Power Gold bonds, which are up no less than 5 points. Canadian General Common lost a point, and Shawinigan Water went back after its brilliant rise of last week. Canadian General Electric lost 2, and Montreal Light, Heat and Power fell 1. There was a slight weakening in Rio Trams, but the bonds are both better.

Telegraph and Telephone issues are, in the main, steady enough. The feature is a rise of 3/4 in West India & Panama Telegraphs, the report of American buying being sedulously circulated. We have already referred to the suggestion that the United States Government should take over the control of the whole telegraph system of the country, and the idea is that an influential syndicate has been formed in order to buy up the West India & Panama with a view to re-selling it to the Government later on. What foundation there may be for this statement we are unable to say, but the report has been quite sufficient to rally the price to the extent indicated. Eastern Ordinary shed the point it gained last week, but Anglo "A" continue to advance slowly.

The excitement over Marconis has subsided to a slight extent, and the shares went down on the eve of the carry-over, at which it was made obvious that a heavy bull account still exists in the shares. After touching 4 1/2 sellers, however, the price recovered to 4 3/4, the Preference moving up in sympathy. National Telephone Deferred is again a good market, with a rise of 3 points to its credit on the week. In other Telephone and Telegraph issues there is no feature.

Amongst Manufacturing shares, Castner-Kellners picked up part of their drop, but Babcocks are heavy and have given way to 6 1/2, in spite of extravagant expectations with reference to the dividend announcement. Willans & Robinson continue in request, the shares and the debenture stock all improving this week, and another noticeable movement is a rise of 2 in British Westinghouse 4 per cent. Debenture stock.

The Rubber market has been quiescent, prices being fairly well maintained, though business has sunk to small proportions.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.**

The directors have declared a dividend of 4 1/2 per cent. for the year to December 31st (on account of which an interim dividend of 2 per cent. was paid in July last) on the ordinary shares. This compares with a total of 4 per cent. for 1910.

**Mirrlees Watson Co., Ltd.**—The directors have declared a dividend for 1911 of 10 per cent. and a bonus of 5 per cent., less income-tax.

**United Alkali Co., Ltd.**—A dividend of 4s. per share, as last year, is announced, £75,000 being placed to reserve and £37,000 carried forward.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 27th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 27th.	Rise + or Fall	Present Yield p.c.		
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.		
Bournemouth & Poole, Ord. ..	10	5½	5½	8½—9½	..	5 18 11	Kensington & Knightsbridge, Ord	5	9	9	62—7½	..	6 4 4
Do. 4½ % Pref. . . . .	10	4½	4½	8½—9½ xd	..	4 14 9	Do. 4 % Deb. . . . .	Stock	4	4	92—95	..	4 4 4
Do. Second 6 % Pref. . . .	10	6	6	10½—11 xd	—½	5 9 1	Kent Elec. Power, 4½ % Deb. . .	Stock	4½	4½	80—84	+2	5 7 2
Do. 4½ % Deb. Stock . . .	Stock	4½	4½	10½—102	..	4 8 3	London Electric, Ord. . . . .	3	2	2½	1½—2	..	2 19 11
Brompton & Kensington, Ord. . .	5	10	9½	8½—9	+½	5 11 1	Do. 6 % Pref. . . . .	5	6	6	4½—5	..	6 0 0
Do. 7 % Cum. Pref. . . . .	5	7	7	7½—8½	..	4 4 10	Do. 4 % First Mort. Deb. . . .	Stock	4	4	83—92	+½	4 7 0
Central Electric Supply, 4 % } Guar. Deb. }	100	4	4	98—101	..	3 19 3	Metropolitan . . . . .	5	5	4½	2½—4½	—½	6 1 3
Charing Cross, West End & City	5	5	5½	4—4½	+½	5 11 1	Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—4½	..	4 17 4
Do. ½ % Cum. Pref. . . . .	5	4½	4½	4½—4½ xd	..	4 17 4	Do. 4½ % First Mort. Deb. . .	Stock	4½	4½	99—104	..	4 6 7
Do. " City Undertaking " }	5	4½	4½	3½—4½	..	5 9 1	Do. 3½ % Mort. Deb. . . . .	Stock	3½	3½	84—87	..	4 0 6
4½ % Cum. Pref. }							Midland Electric Corporation }	100	4½	4½	96—98	+1	4 11 10
Do. Do. 4 % Deb. . . . .	100	4	4	93—96	..	4 3 4	4½ % First Mort. Deb. }						
Chelsea, Ord. . . . .	5	5	5	4½—4½	..	5 5 3	Newcastle-on-Tyne . . . . .	5	4	4½	8½—4	..	5 0 0
Do. 4½ % Deb. . . . .	Stock	4½	4½	98—101	..	4 9 1	Do. 5 % Pref., Non-Cum. . . .	5	5	5	4—4½	..	5 11 1
City of London, Ord. . . . .	10	7	6½	13½—14½	..	4 19 1	North Metropolitan Power Sup- }	100	5	5	39—102	..	4 13 0
Do. 6 % Cum. Pref. . . . .	10	6	6	12—13	..	4 12 4	ply, 5 % Mortgages (Red.) }						
Do. 6 % Deb. . . . .	Stock	6	6	117—121	..	4 2 8	Notting Hill, 6 % Non-Cum. }	10	..	..	92—103	..	..
Do. 4½ % Second Deb. . . .	100	4½	4½	100—103	..	4 7 5	Pref. }						
County of Durham, 5 % First }	Stock	5	5	87—89	..	5 12 4	Oxford . . . . .	5	7½	6½	6½—6½	..	5 9 5
Mort. Deb. }							St. James' and Pall Mall, Ord.	5	10	10	8—9½ xd	+½	5 17 8
County of London, Ord. . . .	10	5	4½	9½—10	..	5 0 0	Do. 7 % Pref. . . . .	5	7	7	6½—7½ xd	..	4 16 7
Do. 6 % Pref. . . . .	10	6	6	11½—11½	..	5 3 3	Do. 3½ % Deb. . . . .	100	3½	3½	85—87	..	4 0 6
Do. 4½ % Deb. . . . .	Stock	4½	4½	107—109	..	4 2 7	Smithfield Markets, Ord. . . .	5	Nil	2	12—12½ xd	..	..
Do. 4½ % Second Deb. . . .	Stock	4½	4½	101—104	..	4 6 7	South London, Ord. . . . .	4	5	5	2½—3½	..	6 3 1
Edmundson's, Ord. . . . .	5	Nil	Nil	2—2	..	Nil	Do. 5 % First Mort. Deb. . . .	100	5	5	98—101	..	4 19 0
Do. 6 % Cum. Pref. . . . .	5	Nil	Nil	2½—3½	+½	Nil	South Metropolitan, 7 % Pref. .	1	7	7	1—1½	..	6 4 5
Do. 4½ % First Mort. Deb. . .	100	4½	4½	87—90	..	5 0 0	Do. 4½ % First Deb. Stock . .	100	4½	4½	97—100	..	4 10 0
Folkestone . . . . .	5	6	6½	4½—5	..	6 0 0	Urban, Ord. . . . .	5	5	..	1—1½	..	..
Do. 5 % Cum. Pref. . . . .	5	6	6	4½—5½	..	4 17 7	Do. 5 % Cum. Pref. . . . .	5	5	..	2½—3½	..	..
Do. 4½ % First Deb. . . . .	100	4½	4½	93—96	..	4 13 9	Do. 4½ % First Mort. Deb. . .	100	4½	4½	87—89	—1	5 1 2
Hove . . . . .	5	9	8½	6½—7½	..	6 4 2	Westminster, Ord, . . . . .	5	10	10	8½—8½	+½	5 12 8
							Do. 4½ % Cum. Pref. . . . .	5	4½	4½	4½—5½	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelalde, 6 % Pref. ..	5	6	6	5½—6	..	5 0 0	Monterey Rly. Light & Power, }	100	5	5	89—91	..	5 9 11
Calcutta, Ord. ..	5	8½	7½	6½—7	..	6 1 5	5 % 1st Mort. Deb. }						
Do. 5 % Pref. ..	5	6	6	5—5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7	8	192—197	—1	3 11 1
Calgary Power, 1st Mort. Bds.	100	5	5	92½—94½	..	5 5 3	Northern, Lt., Power and Coal, }	\$500	6	..	39—41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7	7½	114—118	—2	5 18 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. ..	\$100	7	7	117—121	..	5 15 8	River Plate, Ord. ..	Stock	10	..	250—260	..	3 16 11
Cordoba Lt., Power and T., Ord.	1	3	3½	7—1	..	3 0 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110—115	..	5 4 4
Do. 5 % Deb. ..	100	5	..	95—98	..	5 2 0	Do. 5 % Deb. Stock ..	Do.	5	5	100½—102½	..	4 17 7
Elec. Lt. and P. of Cochabamba, }	100	6	6	91—93	..	6 9 0	Roy. Elec. Co., Montreal, 4½ % }	100	4½	4½	100—102	..	4 8 3
6 % Bonds }							1st Mort. Deb. }						
Elec. Supply Victoria, 5 % 1st	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4	5½	129—131	—2	3 16 4
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	107—109	..	4 11 9
Eleo. Dev. Ontario, 5 % 1st	\$500	5	5	95—97	..	5 3 1	Do. 4½ % Per. Deb. ..	Stock	4½	4½	103½—105½	+½	4 5 4
Mort. Bonds }							Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	2½—3½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6	6	2½—3½	..	8 0 0	1st Mort. Deb. }						
Kaministiquia Power, 5 % G. Bs.	\$500	5	5	108—110	+5	4 11 0	Victoria Falls Power, Pref. }	1	Nil	11½d.	1½—1½	..	..
Madras, Ord. ..	5	..	..	2½—3½	..	..	West Kootenay Power and Lt., }	100	6	6	107—109	..	5 10 1
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101½—103½	+½	4 16 7	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	6	6	84—86	—1	5 16 3							
Mexican Lt. & Power, Common	\$100	4	4½	83—85	—2	4 14 2							
Do. 7 % Cum. Pref. ..	\$100	7	7	105—107	—1½	6 10 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	91—96	—1½	5 4 2							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5	5	97—99	..	5 1 0	Do. 5 % Pref. ..	1	5	5	5½—5½	—½	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8½	144—146	..	5 9 7	National Telephone, Pref. ..	Stock	6	6½	9½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4	4	93½—95½	..	4 3 9	Do. Def. ..	Do.	6	6½	124—126	+3	4 15 3
Anglo-American Telegraph ..	Stock	8½	3	66—68	..	4 8 6	Do. 6 % Cum. 1st Pref. ..	10	6	6	9½—10	..	6 0 0
Do. 6 % Pref. ..	Do.	6	6	109½—110½	..	5 8 4	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10	..	6 0 0
Do. Def. ..	Do.	30/-	30/-	25½—26	+½	5 15 5	Do. 5 % Non-cum. 3rd Pref.	5	5	5	5½—5½	..	4 12 0
Anglo-Portuguese Tel., 5 % }	100	5	5	102—104	..	4 16 1	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103—104	..	4 6 6
Mort. Deb. }							Oriental Telep. and Elec. ..	1	8	..	1½—1½	..	4 11 5
Chili Telephone ..	5	7	..	7½—7½	..	4 13 4	Do. 6 % Cum. Pref. ..	1	6	6	1½—1½	..	4 16 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86—88	..	4 10 11	Do. 4 % Red. Deb. ..	Stock	4	4	87½—89½	..	4 9 5
Cuba Telegraph ..	10	6	6½	10½—11½	..	5 6 8	Pacific and European Tel., 4 % }	Do.	4	4	98½—100½	..	3 19 7
Do. 10 % Pref. ..	10	10	10	17—18	..	5 11 1	Guar. Debs. }						
Direct Spanish Telegraph, Ord.	5	4	4½	8½—8½	..	5 6 8	Reuter's ..	8	5	5½	10½—11½	..	3 9 7
Do. 10 % Cum. Pref. ..	5	10	10	8—8½	..	5 17 8	Submarine Cables Trust ..	Cert.	6	6	130—133	..	4 10 3
Do. 4½ % Debs. ..	50	4½	4½	99—101	..	4 9 1	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	99—101	..	4 9 1
Direct United States Cable ..	10	4½	..	7½—8	..	5 12 6	Deb. Red. }						
Direct W. India Cable, 4½ % }	100	4½	4½	99—101	..	4 9 1	United River Plate Telephone	5	8	8	7½—7½	..	5 4 11
Reg. Deb. }							Do. 5 % Cum. Pref. ..	5	5	5	5½—5½	..	4 8 11
Eastern Telegraph, Ord. Stock	Stock	7	5½	136—139	—1	5 0 9	West Coast of America ..	2½	2½	2½	1½—1½	..	3 11 5
Do. 8½ % Pref. Stock ..	Do.	3½	3½	83—85	..	4 2 4	Do. 4 % Debs., 1 to 1,500 }	100	4	4	98—100	..	4 0 0
Do. 4 % Mort. Deb. ..	Do.	4	4	100—102	..	3 18 5	guar. by Braz. Sub. Tel. }						
Eastern Extension ..	10	7	5½	13½—13½	..	5 0 11	West India and Panama Teleg.	10	1½	1½	4½—4½	+½	..
Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 8	Do. 6 % Cum. 1st Pref. ..	10	6	6	10½—11½	+½	5 5 6
East and S. Africa Tel. 4 % }	25	4	4	99—101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10½	..	5 6 8
Mt. Db. Mauritius Sub. }							Do. 5 % Debs. ..	100	5	5	102—104	..	4 16 2
Globe Telegraph and Trust ..	10	5½	6½	11—11½	..	5 2 2	Western Telegraph, Ltd. ..	10	7	6½	13½—1½	..	5 0 0
Do. 6 % Pref. ..	10	6	6	13½—13½	..	4 8 1	Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3
Great Northern Telegraph ..	10	18	5½	32—33	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106—109	..	3 13 5
Indo-European Telegraph ..	25	13	5½	56½—58½	..	5 10 2	Do. 4½ % Fdg. Bonds ..	\$1000	4½	4½	101½—104½	+½	4 6 2
Mackay Companies Common ..	\$100	5	5½	81—83	..	6 0 6							
Do. 4 % Cum. Pref. ..	\$100	4	4	70—73	..	5 9 7							
Marconi's Wireless Telegraph	1	5	..	4½—4½	+½	..							
Do. 7 % Cum. Partio. Pref.	1	16	..	4—4½	+½	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 27th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 27th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. . . . .	1	Nil	Nil		Nil	Metropolitan Railway Consol. . .	100	12 1/2	49 1/2—50 xd	+3	3 15 0
Do. 5 % Pref. . . . .	1	5	5		7 5 6	Do. Surplus Lands . . . . .	100	2 1/2	68—70 xd		3 18 7
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2		5 5 11	Do. 8 1/2 % Deb. . . . .	100	3 1/2	90—92		3 16 1
Brit. Elec. Trac., 6 % Pref. . .	100					Do. 8 1/2 % Pref. . . . .	100	3 1/2	85—87 xd		4 0 6
Do. Do. Deferred . . . . .	100					Do. 3 1/2 % Con. Pref. . . . .	100	3 1/2	84—86 xd		4 1 5
Do. Do. 6 % Cum. Pref. . . .	100					Metropolitan District Ord. . .	100	Nil	33 1/2—34 1/2	+ 1/4	Nil
Do. Do. 7 % Non-Cum. Pref. .	100					Do. 6 % Deb. . . . .	100	6	144—146		4 2 2
Do. Do. 5 % Perp. Deb. . . .	100	5	5		5 1 0	Do. 4 % Deb. . . . .	100	4	96—98		4 1 8
Do. Do. 4 1/2 % 2nd Deb. . .	100	4 1/2	4 1/2		5 8 5	Do. 4 % Prior Lien . . . . .	100	4	100—102		3 18 5
Central London Railway, Ord.	100	8	8		4 5 9	Do. 4 1/2 % First Pref. . . .	100	3 1/2	89—91 xd		4 18 11
Do. Pref. . . . .	100	4	4		4 14 2	Do. 3 1/2 % Gtd. . . . .	100	3 1/2	76—78		4 9 9
Do. Def. . . . .	100	2	2		3 6 8	Metropolitan Elec. Trams, Ord.	1	5 1/2	32 1/2—33 1/2		5 13 6
Do. 4 % Deb. . . . .	100	4	4		3 18 5	Do. Def. . . . .	1	Nil	32 1/2—33 1/2		Nil
City & South London, Ord. . .	100	1 1/2	1 1/2		4 5 9	Do. 5 % Pref. . . . .	1	5	99—101		5 10 2
Do. 5 % Pref., 1891 . . . . .	100	5	5		4 11 9	Do. 4 1/2 % Deb. . . . .	100	4 1/2	100—102 1/2		4 9 1
Do. Do. 1896 . . . . .	100	5	5		4 16 2	Do. 5 % Deb. . . . .	100	5	100 1/2—102 1/2		4 17 7
Do. Do. 1901 . . . . .	100	5	5		4 17 1	Potteries, Ord. . . . .	1	2	115—117		
Do. Do. 1903 . . . . .	100	5	5		4 17 1	Do. 5 % Pref. . . . .	1	5	115—117		6 19 3
Do. 4 % Deb. . . . .	100	4	4		3 17 8	Do. 4 1/2 % Deb. . . . .	100	4 1/2	89—92		4 17 10
Dublin United Trams, 6 % Pref.	10	6	6		5 2 2	South Metro. Trams, 6 % Pref.	1	6	72—77	+ 1/2	6 17 2
Great Northern & City, Pr. f. Ord	10	Nil	Nil		Nil	Do. 4 % Deb. . . . .	100	4	72—77		5 4 0
Hastings Trams, 6 % Pref. . .	5	Nil	3 1/2			Underground Elec. Railways	10		23—24	+ 1/2	
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2		5 15 5	Do. 4 1/2 % Bonds . . . . .	100	4 1/2	99—101		4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2		4 6 11	Do. 6 % Income . . . . .	100	1	76—78	+2	
Do. 4 % Deb. . . . .	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil	24—26		Nil
Lancashire United, 5 % Deb. . .	100	5	5		5 19 1	Do. 6 % Pref. . . . .	5	Nil	24—26		Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4		4 0 10	Do. 4 1/2 % Deb. . . . .	100	4 1/2	81—85		5 5 11
London United Trams, 5 % Pref.	10	Nil	Nil								
Do. 4 % Deb. . . . .	100	4	4		5 2 7						

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . .	5	5	5 1/2	5—5 1/2		5 4 9	La Plata Elec. Trms, Ord. . .	1			21—22		
Do. 2nd Pref. . . . .	5	5	5 1/2	4 1/2—5 1/2		5 3 6	Do. Pref. . . . .	1	6	6	32—33		6 0 0
Do. 4 % Deb. . . . .	100	4	4	9 1/2—95		4 4 3	Lisbon Elec. Trams, Ord. . .	1	5 1/2	6 1/2	1—1 1/2		4 8 0
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	101 1/2—103 1/2	+ 1/2	4 7 0	Do. 6 % Pref. . . . .	1	6	6	1—1 1/2		4 16 0
Do. 5 % Deb. . . . .	100	5	5	103 1/2—105 1/2		4 14 9	Do. 5 % Deb. . . . .	100	5	5	93 1/2—97 1/2		5 2 7
Auckland Trams, 5 % Deb. . .	100	5	5	102—105		4 15 3	Madras Elec. Tr. (1904), Deb. .	100	5	5	93 1/2—96 1/2		5 3 8
Bombay Elec. S. & Trams, Pref.	10	6	6	10 1/2—11 1/2	+ 1/2	5 6 8	Manaos Trams & Lt., 1st Deb. .	100	5	5	92—95		5 5 3
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	98—100		4 10 0	Manila Elec. R. and Ltg., Bonds	\$1000	5	5	98 1/2—100 1/2 xd		4 19 6
Do. 5 % 2nd Deb. . . . .	100	5	5	98—100		5 0 0	Mexico Trams Com. . . . .	\$100	7	7 1/2	117—119	—3	5 17 8
Brisbane Trams Invt., Ord. . .	5	8	8 1/2	8 1/2—9		4 8 11	Do. Gen. Con. 5 % Bonds . .		5	5	100—102	— 1/2	4 18 0
Do. 5 % Pref. . . . .	5	5	5	4 1/2—5 1/2		4 15 3	Do. 6 % Bonds . . . . .	100	6	6	100 1/2—102 1/2	— 1/2	5 17 1
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	100—103		4 7 5	Para Elec. Rlys. & Lt., Ord. .	5	10	10	7 1/2—7 1/2	— 1/16	6 13 4
B. Columbia Elec. Rly., Def. .	100	8	8 1/2	136—141		5 13 0	Do. 6 % Pref. . . . .	5	6	6	5—5 1/2		5 9 1
Do. Pref. Ord. . . . .	100	6	6	117—121		4 19 2	Do. 5 % 1st Deb. . . . .	100	5	5	97 1/2—99 1/2		5 0 6
Do. 5 % Pref. . . . .	100	5	5	108 1/2—111 1/2		4 9 8	Perth (W.A.) Elec. Tr., Ord. .	1	2 1/2		1 1/2—1 1/2	+ 1/8	1 18 1
Do. 4 1/2 % 1st Mort. Deb. . .	40	4 1/2	4 1/2	100—103		4 7 5	Do. 5 % 1st Deb. . . . .	100	5	5	101—101 1/2	+1	4 16 2
Do. 4 1/2 % Vancouver Deb. .	100	4 1/2	4 1/2	102—104		4 6 7	Rangoon El. Tr. & Sup., Pref. .	5	6	6	5 1/2—5 1/2		5 2 2
Do. 4 1/2 % Con. Deb. . . . .	100	4 1/2	4 1/2	103 1/2—105 1/2	+ 1/2	4 5 4	Do. 4 1/2 % 1st Deb. . . . .	100	4 1/2	4 1/2	98—101		4 9 1
Calcutta Trams, Ord. . . . .	5	6		5 1/2—5 1/2		5 4 4	Rio de Janeiro Trams . . . .	\$100	4 1/2	5 1/2	116—117	— 1/4	4 5 6
Do. 5 % Pref. . . . .	5	5		4 1/2—5 1/2	— 1/4	4 16 5	Do. 1st Mort. 5 % Bonds . .		5	5	102—103	— 1/4	4 17 1
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	100—103		4 7 5	Do. 5 % Mort. Bonds . . . .	100	5	5	99—100	+ 1/4	5 0 0
Cape Electric Trams . . . . .	1	Nil	2 1/2	5—5 1/2			Sao Paulo Tram, Lt. and P. . .	\$100	10	10 1/2	197—199		5 0 6
City Buenos Aires Trams (1904)	5	5	5	5 1/2—5 1/2		4 5 1	Do. 5 % 1st Deb. . . . .	\$500	5	5	102—104		4 16 2
Do. 4 % Deb. . . . .	100	5	5	101—103		4 17 3	Singapore Trams, 5 % Deb. .	100	5	5	81—84		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98		5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95		5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100—103		4 17 1	Un. Elec. Trams Monte Video .	5	6	7	5 1/2—5 1/2		5 6 8
Kalgoorlie Elec. Trams . . . .	1	Nil		3 1/2—3 1/2		Nil	Do. 6 % Pref. . . . .	5	6	6	5 1/2—5 1/2		5 11 7
Do. 5 % A Deb. . . . .	100	5	5	91—94		5 6 5	Do. 5 % 1st Deb. . . . .	100	5	5	98 1/2—101 1/2		4 18 6
Do. 6 % B Deb. . . . .	100	5	6 1/2	58—62		8 1 4	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	104—106		4 4 11

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	Nil	6	5—5 1/2			Dick, Kerr . . . . .	1	5		27—28		5 3 1
Do. 6 % Pref. . . . .	1	9	6	2 1/2—2 1/2		7 2 2	Do. Pref. . . . .	1	6	6	31—32		5 9 9
Babcock & Wilcox . . . . .	1	26	24 1/2	6 1/2—6 1/2	— 1/2	3 17 0	Do. Deb. . . . .	100	4 1/2	4 1/2	98—101		4 9 1
Do. Pref. . . . .	1	6	6	1 1/2—1 1/2		3 13 10	Edison & Swan, A, £3 paid	5	Nil		1 1/2—1 1/2		Nil
B.I. & Helsby Cables . . . . .	5	10	8 1/2	6 1/2—7 1/2		6 17 11	Do. fully paid . . . . .	5	Nil		1 1/2—1 1/2		Nil
Do. Pref. . . . .	5	6	6	5 1/2—6 1/2		4 16 0	Do. 4 % Deb. . . . .	100	4	4	71—75		5 6 8
Do. Deb. . . . .	100	4 1/2	4 1/2	101—103		4 7 5	Do. 5 % Second Deb. . . . .	100	5	5	77—80		6 5 0
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	94—97		4 12 9	Electric Construction . . . .	2	Nil	2 1/2	3—3		
British Westinghouse, Pref. . .	3	Nil		1 1/2—1 1/2		Nil	Do. Pref. . . . .	2	7	7	1 1/2—1 1/2		7 9 4
Do. Deb. . . . .	100	4	4	63—66	+2	6 1 3	Greenwood & Batley, Pref. .	10	7	7	7 1/2—8 1/2		8 5 8
Do. 6 % Prior Lien . . . . .	100	6	6	102—105		5 14 3	Do. Deb. . . . .	100	5	5	94—96		5 4 2
Browett, Lindley, Ord. . . . .	1	Nil		1/6—2/6		Nil	General Electric, Pref. . . .	10	5	5	9—9 1/2		5 5 3
Do. Pref. . . . .	1	Nil		5/6—6/6		Nil	Do. Deb. . . . .	100	4	4	85—90		4 8 11
Brush, Ord. . . . .	2	Nil		0—0		Nil	Henley's, Ord. . . . .	5	15	10 1/2	11 1/2—12 1/2		6 2 5
Do. 7 % Pref. . . . .	2	Nil		0—0		Nil	Do. Pref. . . . .	5	4 1/2	4 1/2	5—5 1/2	+ 1/4	4 5 9
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	56—61		7 7 7	Do. Deb. . . . .	100	4 1/2	4 1/2	104—106		4 4 11
Do. 4 1/2 % Second Deb. . . .	100	4 1/2	4 1/2	87—92		10 14 4	India-Rubber, G. & T. . . .	10	10		10—12		
Callender's Cable . . . . .	5	15	10 1/2	9—9 3/4		7 13 10	Do. Pref. . . . .	10	5	5	9 1/2—10 1/2		4 17 7
Do. Pref. . . . .	5	5	5	5—5 1/2		4 15 3	Telegraph Construction . . .	12	20	10 1/2	35 1/2—37 1/2		6 7 0
Do. Deb. . . . .	100	4 1/2	4 1/2	98 1/2—100 1/2		4 9 7	Do. Deb. . . . .	100	4	4	99 1/2—101 1/2		3 18 10
Castner-Kellner . . . . .	1	17 1/2	20	3 1/2—3 1/2	+ 1/2	5 8 5	Willans & Robinson . . . .	1	Nil		1 1/2—1 1/2	+ 1/4	Nil
Do. Deb. . . . .	100	4 1/2	4 1/2	106—110 xd		4 1 10	Do. Pref. . . . .	5	Nil		1 1/2—1 1/2	+ 1/4	Nil
Crompton & Co. . . . .	3	Nil	Nil	1—1		Nil	Do. Deb. . . . .	100	4	4	61—64	+2	6 5 0
Do. Deb. . . . .	100	5	5	58—68		7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/4 per cent., February 8th, 1912.



## PROCEEDINGS OF INSTITUTIONS.

## Recent Developments in Steam Turbine Practice.

By K. BAUMANN.

(Discussion on paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, January 16th, 1912. For Abstract of paper, see page 317.)

MR. GERALD STONEY said he considered the paper the most important on steam turbines which had appeared for a long time. The necessity of dealing with high superheat and the prevention of trouble due to this high superheat—from differences of expansion, and also on account of the growth of cast-iron—was common both to the pure Rateau and to the Parsons turbines. There were two ways to get over the trouble of growth. One was to use an impulse wheel, in which, by the approximate adiabatic expansion of the steam, the temperature was reduced below a point where such growth was liable to take place. The other was to use material which would not distort permanently with superheated steam; a steel casting was such a material, and in all recent turbines of the pure Parsons type in which there was high superheat the centre portion of the casing was a steel casting. This had proved able to get completely over the trouble due to superheated steam. Alternatively, they used a Curtis wheel followed by the ordinary Parsons blading. Makers of turbines had to go with the fashion, and provide their customers with an impulse wheel, but in no case had Messrs. Parsons got a better steam consumption, or had the costs of manufacture been reduced, by the use of an impulse wheel. The maximum efficiency of a single row of blades was about 80 per cent., and this figure applied equally both to the Rateau and to the Parsons turbine. The maximum efficiency under the best conditions of a two-row Curtis wheel was 67 per cent., but they had found that under the conditions under which it had to work at the high-pressure end of a turbine, the efficiency was as low as 42 to 45 per cent., on account of the small arc of impingement and the high skin friction of the disk running in steam at considerable pressure. It wanted very short Parsons blades with very big clearances to get as low an efficiency as this: the high-pressure part of the pure Parsons turbine was practically always superior to this figure, and therefore it was possible to get the steam consumption of the pure Parsons turbine as a whole better than that of the disk and drum type. The disk and drum was working under the most favourable conditions in moderate sizes running at high speed, say, 750 to 1,500-KW. plants at 3,000 R.P.M., but when they came to low speeds, the result became much worse. For instance, a 1,000-KW. set at 1,500 R.P.M. as a disk and drum was decidedly worse than a pure Parsons machine. In comparing different sizes, it would have to be remembered that, as Mr. Baumann stated, the output of turbines was approximately inversely as the square of the revolutions. The disk and drum was useful, also in cases where a turbine had to be put into a restricted space, as sometimes happened in connection with the extension of old stations, but in cases where a new station was being laid out this did not come in, as the area taken by the turbines was a very small part of the whole station, which included boiler house, switchboard, &c. The disk and drum was also useful in small sizes, say, 500 KW. at 3,000 R.P.M., where there was a very high boiler pressure of 180 to 250 lb., in which case the pure Parsons turbine could not take the full benefit of the boiler pressure. Another point had to be considered, namely, the cutting of the impulse blades due to the high velocity of the steam. This was not so much the case if there was always high superheat, but with moderate superheat or with saturated steam it was very rapid. They had tested Curtis blading in a jet of saturated steam issuing at 150 lb. pressure, and exhausting into the atmosphere, and no material, even the hardest steel, would stand this jet without being cut for a space of only 45 hours. Several warships had been fitted with Curtis wheels, and in them it had been found that the cutting of blades had been very rapid. One battleship showed such bad cutting of the blades, even after it had only completed its trials, that it was estimated that the blades would require renewing by the time the vessel reached the other side of the world. They had never had any trouble with their labyrinth glands with pressures up to 20 or 30 lb. above atmosphere. Mr. Baumann said that for large outputs the Curtis and Rateau turbines were the better, because the disk and drum type would have to be made double-ended in the low-pressure part, which would considerably increase the cost of the turbine. This statement he could not agree to. For larger sizes they had adopted the tandem formation of turbine, which was first introduced for the 1,000-KW. turbines supplied to Elberfeld, in Germany, and recently they had made eight 6,000-KW. machines for the Lot's Road power station of the Underground Railways Co. of London to replace other turbines which were there: they had brought down the coal bill from somewhere about 3½ lb. per KW.-hour to 2½, and practically the cost of the change had been already saved. These turbines were of the pure Parsons type, and thus the efficiency that was obtained, even in the high-pressure part, was higher than could be obtained with a Curtis wheel. Dividing the turbine into two parts enabled the spindles to be kept very short; in fact, at Lot's Road the length between the shoulders of both the high-pressure and low-pressure spindles did not exceed 7 ft. Also in the small high-pressure cylinder the whole of the high temperature was dealt with, and thus distortion was minimised, besides which a steel centre could be used. Good blade height was obtained, and therefore the leakage was small. In larger sizes there was no difficulty at all about double ending, and they had not found that it appreciably increased the cost. They

did not think it advisable to go above moderate speeds for the low-pressure blades on account of the large terminal loss, as pointed out by Mr. Baumann, but in certain cases, where it was desired to go to higher speeds, they had adopted a disk form of spindle, which they had used for blowers for many years, and with which there was no difficulty in going to the same speeds as with the wheels of a Rateau turbine. Such a combination for large sizes of a small Parsons high-pressure turbine in tandem with a low-pressure one, single or double-ended, exceeded the efficiency of any combination with a Curtis wheel. In every case during the last year they had got their guaranteed consumptions on test, except in one case of a disk and drum machine. Mr. Baumann further said that he did not consider caulked-in blades to be safe for high stresses. They had never yet had a case of blades coming out due to centrifugal force, except in one or two cases which were clearly traced to bad workmanship. In tests made on their blades, it was quite common for the blade to break off rather than pull out. From what he had said, it would be seen that the maximum output of the Parsons turbine was the same as that obtainable from the disk turbine, and the diagram of fig. 2, which was a most interesting way of putting the question, practically agreed with their figures, and was equally applicable either to the drum or to the disk type of turbine. He was much interested in the statement that it had been found necessary to keep the Rateau turbine below the first critical speed. In the past, there had been great trouble with the diaphragms of the Rateau turbine where clearances had to be very fine. It was necessary in any type of compound turbine to have fine clearances at some point between one stage and the next. In the Rateau and Curtis turbines this was in the glands of the diaphragms, and in the Parsons it was between the blades and the casing or rotor. Each party, of course, claimed that his way was the best, but looking at it broadly, there was not much to choose between the two. What Mr. Baumann said about there being liability to trouble with three-bearing turbines and alternators where they were rigidly coupled together was very interesting in view of the great trouble there had been in some large turbines in the North of England that were made thus. With reference to low-pressure turbines, Mr. Baumann said that the great importance of these was pointed out by Prof. Rateau, who first installed them in 1903. Sir Charles Parsons's patent in 1894 had been, until it expired, the master patent, and the torpedo boat destroyer *Velox* was made in 1902, in which, for cruising purposes, there were reciprocating engines exhausting into the turbines. He was glad to see that the list of consumptions was headed with 68·4 per cent. efficiency in the Richardsons, Westgarth-Parsons turbine at Dunston, which was of the pure Parsons tandem type, as described above. The tables of corrections for superheat and vacuum practically agreed with their figures. He could not agree with Mr. Baumann where he stated that the Parsons turbine could not utilise very high superheat, the figures he gave being exactly in accordance with their practice. Also, he said, that the drum turbine could not be designed for as high a vacuum as the disk turbine; he (the speaker) had already shown the fallacy of this statement; the overall efficiency of a properly designed Parsons turbine was as good for 29 in. as 27 in. vacuum, and this was exemplified in the tests of the above Richardsons, Westgarth-Parsons turbine, which had a vacuum of 29·1 in. barometer 30 in., or only 0·45 lb. absolute. Mr. Baumann did not touch on the most recent adaptation of the turbine to driving low-speed machinery by the use of helical gearing. The Westinghouse Co. in America had already utilised it for driving dynamos, and Messrs. Parsons were doing the same. They had working also a rolling mill running at 70 R.P.M., driven by a 750-H.P. turbine at 2,000 R.P.M., and in marine turbine work gearing was being extensively adopted. The experimental cargo boat *Nespaian* was giving 15 to 18 per cent. better consumption than could be obtained with reciprocating engines, and two destroyers and two cross-channel boats were also being fitted with geared turbines.

MR. F. SAMUELSON said he found no mention in the paper of a Curtis turbine having been built in this country, although no fewer than 138 machines of this type had been built in sizes ranging up to 5,000 KW. It appeared that the impulse type of turbine was getting more and more popular, and the Curtis principle was gaining favour through its excellent qualities and great simplicity. The author gave curves of calculated efficiencies of Rateau and Curtis wheels with one, two and three rows of buckets. If the efficiencies given corresponded with actual efficiencies as determined by numerous tests, the single-wheel construction would be so far superior, that any other type would not exist. That this was not the case was clear from the table given where a large number of machines were compared, and taking the 3,000-KW. 1,500 R.P.M. turbine for comparison, he found that the Curtis turbine showed the highest efficiency. Curves were given of the tangential and radial stresses in turbine wheels, but no mention was made of the expansion of the wheel bore due to these stresses, and the formula given by the author did not enable one to get at these expansions. The author stated that nozzle governing complicated the governor gear to an extent not justified by the increased efficiency gained thereby. The speaker pointed out that all Curtis turbines built in Rugby were nozzle-governed, and that the governing gear was noted for its simplicity and its certainty of action. By means of nozzle governing an improved efficiency of 2 per cent. was obtained at three-quarter load, and 4 to 5 per cent. at half-load. These amounts represented quite a big saving in the coal bill in the course of a year. The value of mixed-pressure turbines was daily getting more understood and appreciated, as pointed out by the author. Most of these mixed-pressure turbines were operated in conjunction with some type of heat accumulator, and he drew attention to a most important feature—viz., the utilisation of the exhaust steam available under all conditions. The low-pressure end of the turbine being connected to an accumulator, the maximum pressure



was fixed at which the accumulator could regenerate the steam. Taking the case of a 1,000-KW. mixed-pressure turbine such as was illustrated in the paper, and assuming that the accumulator would generate at a maximum pressure of 16 lb. absolute, and that the machine required 33 lb. of steam per KW.-hour, the maximum total amount of steam passing through the low-pressure part would be 33,000 lb. of steam per hour, and the nozzles in front of the turbine were designed to deal with the full load at a maximum pressure of 16 lb. If an overload was demanded of the machine while 33,000 lb. of exhaust steam was available and they assumed the overload to be 25 per cent., it would be impossible for the steam going from the high-pressure portion of the turbine to find its way through the low-pressure wheel and at the same time admit the full quantity of 33,000 lb. of low-pressure steam. It might be therefore assumed that the steam consumption on the high-pressure part of the turbine, working, say, between 165 and 16 lb. absolute, would be about 40 lb. per KW.-hour. The low-pressure nozzles were already dealing with the maximum steam, and any further steam coming from the high-pressure wheel would find its way out of the system through the relief valve in the low-pressure pipe system, or, in other words, the accumulator would not be able to supply its available quantity of steam. 250 KW. overload at 40 lb. per KW. represented 10,000 lb. of steam, so that, instead of being able to discharge at the rate of 33,000 lb. per hour, the accumulator could only discharge at 23,000 lb. per hour, the available surplus of 10,000 lb. being blown to atmosphere from the relief valve. To overcome this difficulty, the B.T.-H. Co. had designed a mixed-pressure turbine wherein this objectionable feature was absent. With regard to the efficiency of the B.W. Co.'s mixed-pressure turbine, given as 69.8 per cent., he noticed this had been obtained with the assistance of 128° superheat. The author had dealt with corrections of superheat, &c., in the paper, and said that 4.25 per cent. better efficiency was obtained with 100° F. superheat. Referring, therefore, to tests given therein for a B.T.-H. 1,250-KW. mixed-pressure turbine, the efficiency on low-pressure steam was given as 68.2 per cent. with 24° F. Assuming that this B.T.-H. turbine had been running with 128° F. superheat, and applying the author's corrections, the efficiency would increase from 68.2 per cent. to 71 per cent.

MR. R. T. KAULA agreed with the author that for small and moderate size turbines the disk and drum type was the best design assuming the drum to be bladed on the reaction principle, but he would like to go further and say that the same held good for the larger outputs. The author's arguments against this statement were based on two main facts, viz., that the output for a given speed was limited by the heavy losses, and consequently by the diameter of the disk or drum at the low-pressure end, and, secondly, that a drum could not be run at so high a peripheral speed as a disk. As regarded the first assumption some allowance must be made for skin frictional losses, which varied approximately as the fifth power of the diameter with a disk, and about as the fourth power with a drum. There was an advantage here in favour of drum construction. The author had said that a disk without a hole in the centre could be stressed higher than one with, and he (the speaker) considered that a solid drum should be treated as the former. The well-known Willans system of blading lent itself to high-speed working, and he found that they were able to keep ahead of generator makers on the output speed curve without sacrificing economy and without adopting double-flow designs. One of the tables gave efficiencies which had been obtained on Curtis-Rateau turbines, presumably under favourable conditions, and showed a maximum efficiency of 67.9 per cent. for that design. He took it, therefore, that this was as good a figure as might be expected from this type of turbine, unless the output was increased or the steam conditions more favourable. With very few exceptions test results did not take into account the water contained in the air discharged from the condenser. The amount of water in question was approximately equal to that contained in saturated air, or at the temperature and pressure at which the air was separated from the body of water condensation.

MR. S. J. WATSON said that from what they had heard, each particular type had its advantages and its disadvantages. As far as one was able to judge, there was practically no difference at all either in their steam consumptions or in their efficiencies. In the past it had not always been possible to get the exact conditions under which test figures had been got, and the best and most important part of the paper, he considered, was that portion where the author gave the percentages of adjustments which were necessary for the vacuum and superheat of each engine. That would be found most useful to them. With regard to the regulating of nozzles, to his mind that was a question of some importance. The undertaking would have to run their machinery, at any rate, some portion of the day very much under full load. In these days of keen competition, anything that would enable them to save 3 per cent. to 5 per cent. was of no little importance.

DR. E. ROSENBERG said that in the paper it was mentioned that with exhaust turbines, for starting and paralleling, high-pressure steam was generally required, which was regulated either by hand or by a mechanical governor. He would mention an interesting installation where the necessity of high-pressure starting had been avoided by a novel electrical arrangement. When the Birmingham Corporation considered installing exhaust turbo-generators in their Summer Lane station, it was intended to use induction generators with squirrel-cage rotors which should work in parallel with the engine-driven alternators, being brought up to speed together with the alternators, no high-tension switch being provided for the turbo-generators. Going closer into this very ingenious scheme, he found that the wattless current of the additional load and also the magnetising current of the induction generator, would overload the engine-driven generators with wattless current to such an extent that this installation would have been only possible on a few of the

sets, if all the other existing generators could be used to help out with wattless current, but that it could not be used as a general proposition. They obtained, however, the desired result by supplying synchronous turbo-generators with exciters direct-coupled to them and connecting the exciter field in parallel with the field of the main generator. The rotor of the turbo-generator was also fitted with a damper. Before starting, the field of the main generator was excited. In running up to speed, the turbo-rotor could never have a speed much different from the speed corresponding to that of the main generator, because the damper acted as a squirrel cage, and if the exhaust steam did not give sufficient power in the turbine, the damper would cause the turbo-generator to run as an induction motor, or if the power from the exhaust steam in the turbine was more than that required for the no-load losses (and that, of course, would be the rule), the damper would cause the machine to act as an induction generator, giving at slight over-synchronous speed, some power back to the main generator, so helping to drive it. But already at comparatively low speed the direct-coupled exciter gave sufficient E.M.F. to pull the turbo-generator into exact synchronism, and it would remain in synchronism. This patented arrangement not only simplified the starting as far as the steam end was concerned, but also simplified considerably the switchgear, as no switches were provided on the high-tension side. As far as the exciter field of the turbo-generator was concerned, there was only an adjusting rheostat, which could be set once for all. It was necessary in this case to use a direct-coupled exciter because the exciting voltage of the main generator (440 volts) was not suitable for a turbo-generator. All the main generators of the station were supplied from common D.C. exciter mains, the exciter generators being regulated by means of a Tirrill regulator. These D.C. generators were practically loaded to their utmost of capacity. Two of these exhaust turbo-generators (Belliss & Morcom turbines with Westinghouse generators) were in service and three others were being installed.

MR. P. A. SAUNDERS considered that as the previous speakers said that the author's figures almost entirely agreed with their own, they could be taken as a standard to work upon. He did not altogether agree with the author's remarks concerning disk and drum construction. It was much harder to detect lack of homogeneity in drums than in disks. With regard to the critical speed of shafts, he thought an equally important critical speed was that of disks owing to the effect the steam might have on them whilst running due to the openings in the preceding nozzles or diaphragm. The results of the turbines supplied to Chelsea were splendid, but it would be seen from the table given in the paper that there were many firms to-day who were building turbines quite equal to these machines. He thought that the present position of turbine efficiency was largely due to improvements in the design of condensers. Reference had been made to the cutting of blades by the velocity of the steam in turbines of the compound pure impulse type. He had seen many turbines of this type opened up recently, and after many months of service not one of them showed any signs of cutting due to this cause.

MR. A. E. MCKENZIE said it must be admitted that the Curtis-Rateau or the Curtis-Parsons type ought to be made cheaper than the impulse type, but makers of plain impulse type had been able to hold their own with the makers of the Curtis turbines. He thought a little higher efficiency could be obtained with the plain impulse type, and the efficiency could be maintained longer than with the other types. Up to now no blade erosion had taken place in the turbines of which he had charge. From the central station engineers' point of view, it was not a question of  $\frac{1}{2}$  per cent. or even 1 per cent. increased efficiency; the point they had to consider was the reliability of the machine. It paid them to run a turbine right through from one week-end to the other, and use a reciprocating set for the peaks. He did not see eye to eye with Mr. Saunders when he said that the regulation should be altogether automatic. They had to deal in Manchester with heavy peak loads, but they could afford time for a man to go and open a stop valve. He had no doubt that most engineers were very glad to hear that the stripping of reaction turbine blades had been absolutely stopped; he, however, knew one station engineer on the Continent who had had three 5,000-KW. sets down by stripping. With regard to the high temperature in the Zoelly type, the plain impulse type, such as they had, was suitable to withstand that temperature. One had been running for two years with a superheat temperature of 600° F. In the last set which was installed at Stuart Street they had a De Laval turbine of 450 KW., at 500 R.P.M., for driving the circulating water. This was supposed to be the first built in this country. It had now been running for two months, and they had not had any trouble. In the Zoelly type in this country it had been usual to use nickel-steel blades. On the Continent they were going in for a brass alloy, and where a nickel blade was adopted they were now adopting a bigger percentage of nickel, as high as 25 per cent., whereas it was usual to use 5 per cent. With regard to the tests given in the paper, the most important test on the Zoelly type was remarkable by its absence. It was quite equal to, and in some cases better than, those in the paper.

MR. R. LIVINGSTONE (communicated) said that when his firm, Messrs. Dick, Kerr & Co., took up the manufacture of steam turbines they fully realised that the turbine of the future would be one in which large clearances were obtained, and low temperatures in the cylinder, provided these points were not off-set by poor steam consumptions. The type adopted was an impulse turbine, with a high velocity first wheel, and the efficiency of this type of turbine was quite comparable with that of any other make. Although the writer agreed that the Curtis-Rateau was a better type of turbine for large outputs than the Curtis-Parsons type, he considered that the author in his calculations had accentuated the difference too much. In comparing the stresses in disks with the



stresses in rings he had considered only simple disks and simple rings. In actual practice, the periphery of a disk was usually cut away to some extent to form fastenings for the blades, and this very considerably altered the stress at the periphery of the wheel, and in some cases these stresses became of greater importance than the stresses in a simple disk, so that in comparing the permissible peripheral velocities one must always take account of the detailed stresses in the disk and in the ring. Again, in comparing the permissible length of blades only the effect of centrifugal force had been taken into account, but in the longer blades which could be used in disk turbines, owing to the larger diameter of disk, the bending stress due to the force of the steam became appreciable, and this also tended to modify the comparison of output between the disk and drum turbine. The influence of these factors was not great, but it was only fair to the drum type of turbine to take them into consideration. With regard to the critical speed of turbine rotors, Prof. Reynolds deserved the credit for the theoretical investigation of this important subject, and a very thorough investigation of the critical speed of shafts with different methods of loading was made by Stanley Dunkerley in 1893. The corrections given by the author would render comparisons of the steam consumptions of the different types of steam turbines more real than they had been. Very often when a low steam consumption was obtained on test, the turbine maker claimed all the credit, whereas the whole of the credit was often due to the boiler and condenser makers.

### The Degradation of Accumulative Energy.

By A. G. COLLIS, A.M.I.E.E.

(Abstract of paper read before the SOUTH WALES INSTITUTE OF ENGINEERS at Cardiff, February 15th, 1912.)

LAST year the author read a paper before the Institute on "Breaking High and Low Potential Circuits,"\* of which the present paper is a sequel. A description is given of improvements in the design of switchgear for the relief of abnormal forces attending rupture, referred to in the title. Quick-break action may give rise to an abnormal potential stress. The rapid opening of a switch in a London supply company's undertaking, on a 6,000-volt circuit, gave a potential rise of 32,000 volts, which arced over the insulators and shorted the system, practically blowing the switch to pieces. Internal reactances limit an instantaneous short-circuit current, at the expense of regulation, but if the generator breaks down, the short-circuit current which can flow into it is only limited by the internal reactances of the other generators operating in parallel with it. External reactance also limits the maximum instantaneous value of a short-circuit current, but the potential builds up across the reactance on short-circuit, and, when interrupted, appears across the switch break, with energy more persistent than if the generator is shorted direct; and it lowers the power factor of the circuit, so that, if the circuit is being opened when the electric magnetic energy is a minimum, the potential is a maximum and punctures the insulation. Time-limit devices, to delay the opening of the switch until after the short-circuit current has reached a maximum, are unsatisfactory.

The "degradation of energy" (the reduction of energy which cannot be utilised) is the title applied by the author to his method of relieving or preventing the development of dangerous forces on the rupture of a short-circuit, without any disturbance of the continuity of supply, or modifying the power factor. He claims that he has succeeded in designing a switch which meets the problem, as shown by oscillograms.

The chief feature of the apparatus is the dielectric, which can be graded so as to prevent any predetermined rise of current. Its ingredients are chemical, together with oil, and it is practically unflammable. The arc on rupture does not vaporise it; its specific gravity is 0.79, and its viscosity apparently does not change under 230° F. Its viscosity at 60° F. is 17, and allows of the free convection of heat.

It does not thin down during increase of temperature, and is free from resinoid and carbonaceous matter. No sedimentation appeared after use. It breaks down at 7,000 volts between needles  $\frac{1}{4}$  in. apart immersed in it (see fig. 1). The new dielectric is only suitable for alternating current.

In addition to the current and pressure rating of an oil switch, its kilowatt capacity should be known; this depends on the power factor and the position of the wave on opening. An oil switch may open satisfactorily a 10,000-kw. load at unity P.F. which on a smaller load, at a P.F. smaller than unity, will entirely fail to interrupt the circuit successfully, due to the presence of a potential to restore the circuit when the current is zero. Moreover, conditions may be present which are not known to the maker or user, such as higher harmonics, approach to resonance, and inductance in the system, which all play their part.

For circuits of extra-high pressure, the author uses, as far as possible, switches with multiple horizontal breaks, which open the circuit effectively without being of abnormal size, and are cheaper in construction than the vertical-break type. He suggests that the reason is that the heavy head of oil, which is not disturbed as in the vertical break, damps out the arc more quickly, with less vaporisation.

Pressures of 60 lb. per sq. in. have been recorded in the oil on the rupture of a short-circuit on a 12,000-kw., 9,000-volt, 25-cycle turbo-generator, and other tests on voltages of 500, 2,000 and 5,000 A.C., with currents ranging from 700 to 2,200 amperes,

showed oil pressures varying from 40 to 49 lb. per sq. in., the higher values occurring with the lower voltages.

The author made tests on a power station of 20,000 kw., 25 cycles at 5,000 volts; an oil switch was used to place the total supply on a dead short across phases, with a limiting resistance in circuit of a capacity of 10,000 kw. Between the supply station and the limiting resistance there was a three-core cable of 0.15 sq. in. section, 1,000 yards long, having an impedance of 2.4 ohms. The system was entirely insulated. In the A.C. test previously published one side of the system was earthed, and the middle point of the star assumed to be at zero potential, and the phases balanced. The potential coil of the oscillograph in this instance was connected across the phases and tested across either phase, in order to see if there appeared any variation in rises. In the previous tests

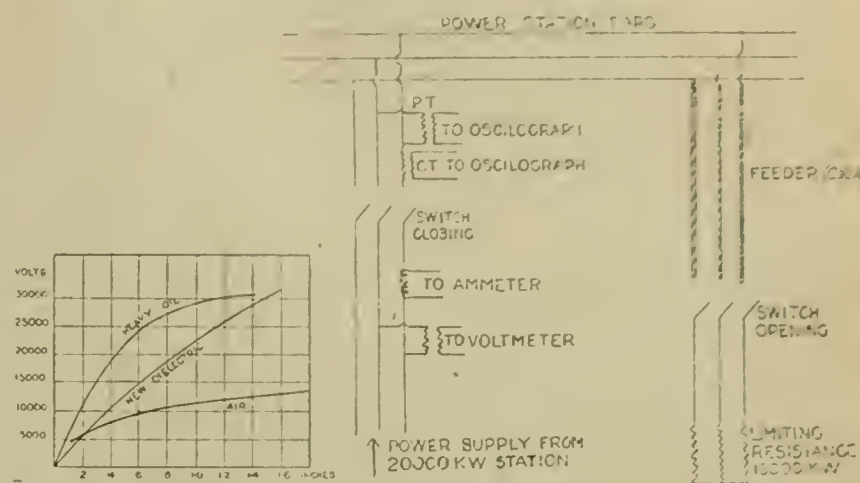


FIG. 1.

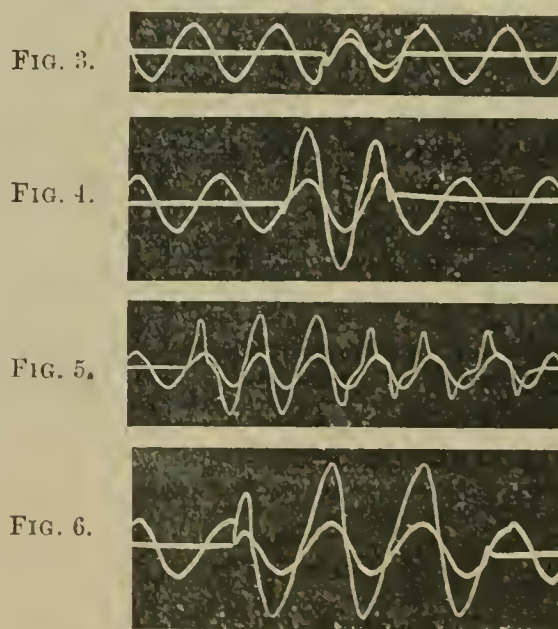
FIG. 2.

FIG. 1.—COMPARATIVE TESTS OF A.C. BREAKDOWN PRESSURE.

FIG. 2.—DIAGRAM OF CONNECTIONS FOR TESTS.

the potential coil of the oscillograph was connected across the switch. Thus when the switch opened, as one side was earthed, the potential coil of the oscillograph responded between phase and earth. In these tests the potential coil of the oscillograph operated in the secondary side of a potential transformer having a ratio of 5,000 : 100 volts connected between phases. The current coil of the oscillograph was actuated by the secondary currents of a S.P. current transformer, ratio 30 : 1, having a normal secondary current of 3.5 amperes and a maximum current of 5 amperes.

Fig. 2 shows the connections adopted; there are two switches in series, one of which, when closed, causes the other to open automatically under short-circuit conditions between phases.



OPENING 10,000-KW. SHORT AT 5,500 VOLTS.

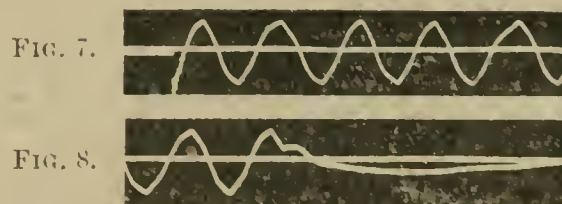


FIG. 7.—CLOSING, AND FIG. 8 OPENING, AN UNLOADED 5-MILE FEEDER.

The effect of opening a limited short of 10,000 kw. with the new dielectric is shown in fig. 3. The circuit was completely opened in  $\frac{1}{25}$  second, the potential at that instant being about 50 per cent. of the normal circuit pressure (5,000 volts). The current was 720 amperes: the short-circuit current in the subsequent tests approached 2,000 amperes. The power factor was practically unity. The rate of current rise was 90,000 amperes per second. Repeating the test with a standard oil switch with vertical movement, opening automatically by gravity, assisted by springs under tension

\* ELECTRICAL REVIEW, March 3rd, 1911.



—the switch which appeared to give the most favourable results in comparison with other oil switches—the time occupied in opening was  $1\frac{1}{2}$  periods, or 50 per cent. longer than with the new dielectric, with a current rise of 2,040 amperes on the first wave, 1,800 amperes on the last half period. The rate of current rise was about 250,000 amperes per second (fig. 4).

Fig. 5 shows the effect of opening a 10,000-kw. short with a time-limit switch, which delayed the opening of the circuit until  $2\frac{1}{2}$  periods had elapsed, the whole process to complete rupture covering six waves. The current rise on the first wave was 2,040 amperes, and on the last wave 1,200 amperes. The rate of rise of current was 250,000 amperes per second.

In Fig. 6 the circuit was broken by a switch opening with a velocity of 70 in. per second, and current began to flow at the peak of the voltage wave. The circuit was opened in  $2\frac{1}{2}$  periods. It is noticeable in this test, as in others, that the current at final rupture appears on the other side of the zero position. The rate of current rise was 300,000 amperes per second, and the second wave reached 1,920 amperes. The switch was fully opened before the circuit was entirely disconnected.

Fig. 7 illustrates the effect of closing an unloaded feeder 5 miles long, consisting of a three-core, 0.15 sq. in. cable, having an impedance of 0.69 ohm per phase. The oscillograms were taken at the extreme end of the feeder. The pressure rise in this case was 14,000 volts, which quickly fell to the normal (instantaneous) value of 8,000 volts. In another test the pressure rose to 16,000 volts.

The same feeder was opened on no load, with the result shown in fig. 8. A pressure of 3,000 volts remained on the circuit  $\frac{1}{2}$  second after the circuit was opened, finally reaching zero in  $\frac{1}{4}$  second.

Tests were also made on opening and closing D.C. circuits. On breaking an inductive load of 5,600 amperes at 500 volts, by opening a switch connected across the terminals of the circuit-breaker under test, the pressure rose 573 volts (total 1,073 volts) and the circuit was interrupted in 0.12 second (fig. 9). The breaker was of the magnetic blow-out type.

FIG. 11.—OPENING D.C. DEAD-SHORT WITH OIL SWITCH.

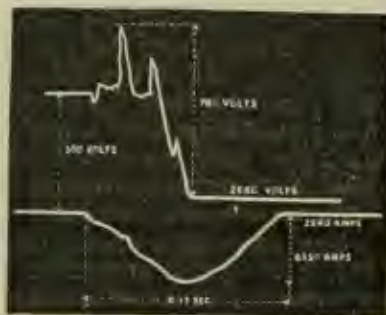


FIG. 12.—OPENING DEAD-SHORT WITH CIRCUIT-BREAKER



FIG. 9.—MAGNETIC BLOW-OUT CIRCUIT-BREAKER OPENING 5,600 AMPERES D.C. AT 500 VOLTS.

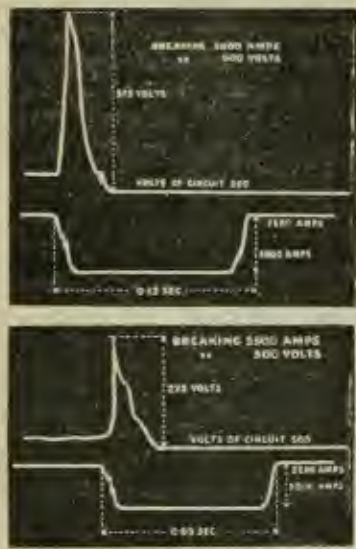


FIG. 10.—OIL-SWITCH OPENING 5,500 AMPERES D.C. AT 500 VOLTS.

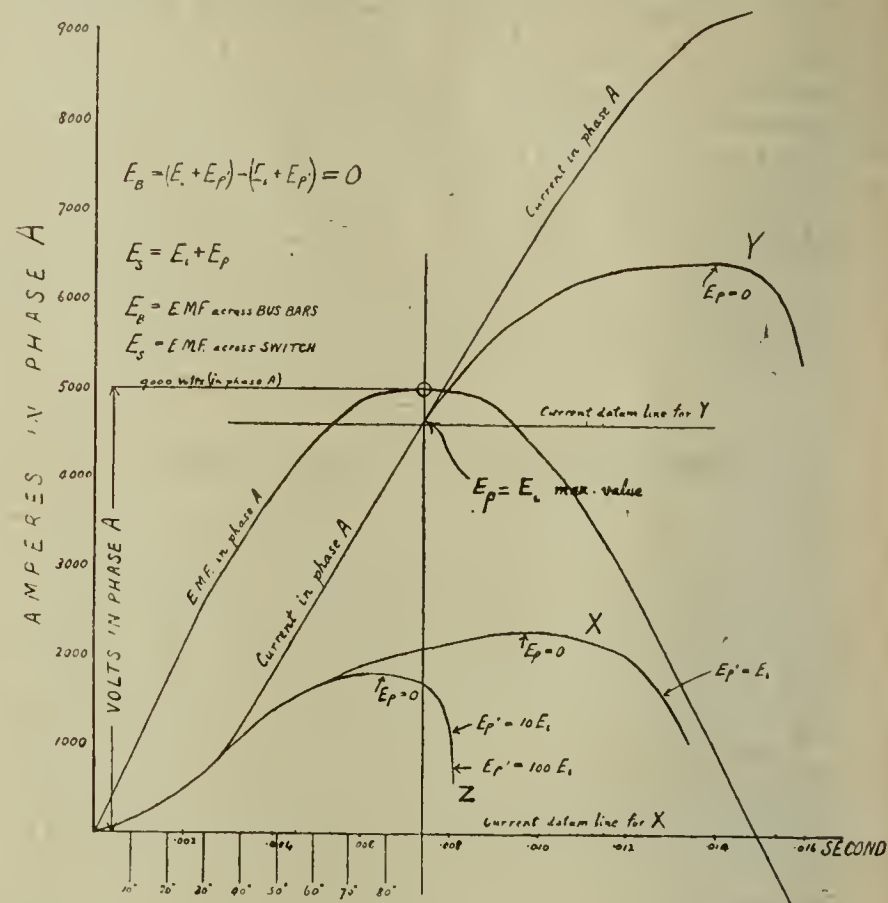
Opening a 5,500-ampere load with an oil switch gave a rise of only 225 volts (total 725 volts), as shown in fig. 10.

A dead-short on the station opened by an oil switch gave the result shown in fig. 11; the current reached 6,350 amperes, and was interrupted in 0.13 second, with a rise of 280 volts (total 780 volts); a magnetic blow-out circuit-breaker gave a rise of 410 volts (total 910), as shown in fig. 12.

The author concludes that, as in the earlier tests, the oil switch demonstrated its superiority over the circuit-breaker for rupturing a D.C. circuit, and that the new form of switch with its new dielectric as designed by the author will rupture satisfactorily a heavy short without the resultant destructive forces hitherto experienced with standard oil switches.

In the course of the discussion, MR. A. M. TAYLOR said that in the diagram he had reproduced the curve representing the rise of current in a short-circuited phase of a 5,000-kw. alternator, as given by Mr. Miles Walker in his paper read before the Institution of Electrical Engineers some two years ago. Since the current in the short circuit was a rising current, the reactance E.M.F.  $E_p$  would be counter to the induced E.M.F.  $E_i$ , and this would be the case until the crest of the current wave was reached, when this E.M.F. ( $E_p$ ) would pass through a zero value. Let them consider now what happened when the switch (with resistance steps) was opened. This caused the rate of growth of current to be checked in the manner shown by the curve X, or if the short-circuit

occurred at the instant of the crest of the E.M.F. wave the checking of the current rise would be indicated by the curve Y. In the switch which he had designed it would be perfectly feasible so to design the movement of the switch and the rate of throwing-in of the resistances that the switch should either cause the current to rise according to the curve X if the short circuit occurred at the moment of zero value of generated E.M.F., or according to the curve Y if it occurred at the moment of maximum E.M.F. So long as the current in the circuit was growing, the counter E.M.F.  $E_p$  must be in the reverse direction to the generated E.M.F. of rotation  $E_i$ , even if the switch was throwing in resistances; hence, up to this point it was impossible for the voltage across the switch to be more than the net voltage of the circuit  $E_i - E_p$ . If, however, the



switch were so designed as to cause a very sharp fall-off of the current, as indicated by the curve Z, the reactive E.M.F.  $E_p$  would have to be added to the generated E.M.F.  $E_i$ , and the sum of these two might be many times the E.M.F. of the generator, as would be the case if the curve took the form shown, and they would manifest themselves across the switch. This would account for the effect mentioned by the author as having occurred in a London station when a rise of 32,000 volts was observed on a 6,000-volt circuit. Provided, however, that the downward slope of the curve X was never at any moment greater than the upward slope of the short-circuit current of the machine, it was impossible for the reactive E.M.F.  $E_p$  to exceed the rated E.M.F. of the machine; and if the curve was made to droop at or near the point shown on the curves X and Y, when the generated E.M.F.  $E_i$  was passing through, or was in the neighbourhood of, zero; the rise of E.M.F. across the switch could not be appreciably more than, and could, if desired, be made only a fraction of, the normal E.M.F. The author rather conveyed the idea that 20,000 kw. of machinery was running during the tests, but really only some 6,000 kw. was running. The limiting resistance was so high that the conditions were comparatively not at all severe, and were only designed with a view to test certain oil switches of the ordinary type prior to their acceptance. Since the switch with the new dielectric was not tested at these tests (at which the speaker was present) care should be exercised in making any comparison. The velocity of 70 in. per second given was only a calculated velocity after 1 in. travel of the switch (at which point the main contacts opened), and neglected the damping effects of friction and of the displacement of the oil. Probably the actual velocity was considerably less. Had the switch been put on to a really serious "short" there would have been a tremendous development of energy, and the switch would probably have been blown to pieces. It was worth noting that all these oscillograms differed fundamentally from those obtained by Mr. Miles Walker under conditions of a "dead short"; in fact, the periodicity of his oscillations was approaching the double of the normal frequency, as would be expected from theory, whereas in Mr. Collis's tests they were exactly of the normal frequency. This was because in Mr. Collis's tests what was virtually a pure resistance was employed for the limiting resistance, whilst in Mr. Walker's tests it was virtually a pure self-induction. The latter condition provided a much more serious test of the switch, unless the break occurred at the crest of the E.M.F. wave, which was unusual.

#### Notes on Central-Station Practice.

A PAPER was read by MR. A. NEAVE KINGSBURY before the Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on January 17th last, from which the following extracts have been made:—The immense scope of the subject naturally only allows of comparatively superficial treatment, and emphasis is therefore laid in this paper on those points in station design and management



which are seldom raised in text-books, or even in the technical Press.

In connection with boiler and power-house details, particular stress is laid on the steam-piping system, for which natural drainage is advocated as a means of reducing the number of steam traps, with their attendant losses, to a minimum. Incidentally, it is pointed out that the adoption of graphite as a steam cylinder lubricant may effect a reduction of from 50 to 80 per cent. in the bill for cylinder oil.

Passing to the section on the electrical equipment, comment is made on the satisfactory working of commutators with air instead of mica insulation between the segments.

The advantages gained by the continual check on the staff given by recording instruments are particularly emphasised in the case of large stations, in which the coal bill may amount to from 50 to 80 per cent. of the total running costs, and mention is made of the steam consumption indicator, which depends for its operation on the difference of pressures on the sides of a disk placed in the steam range.

Perhaps the best cure for carelessness on the part of the staff is the imposition of small fines, but under the Truck Acts it is illegal to deduct such fines from wages. To overcome this difficulty, and also to interest the whole staff in the efficient operation of the station, a coal bonus system is sometimes introduced, which, though really amounting to a small increase in wages, allows the imposition of fines. Such a bonus is based on the coal cost per unit, but as this is influenced by many outside factors, the actual coal cost figure, adopted as the basis of the bonus for any month, will depend on the station output and the price of coal during that month. This figure will also have to be decreased if plant improvements are carried out, involving an increased capital expenditure. In one generating station this has resulted in a reduction of the average bonus basis from '306d. to '180d. per kw.-hour during the last six years.

The amount paid to the coal bonus fund may be divided among the staff in the following proportions:—Shift engineers and chemist, 6½ per cent. each; charge electricians, 2 per cent. each; leading firemen, 3¼ per cent. each; firemen, 3½ per cent. each; greasers and switchboard attendants, 2¼ per cent. each. Bonus working interests the men in their work, and good results have been obtained in almost every case where it has been adopted.

At the close of the paper reference is made to the recent correspondence in the electrical papers from disappointed central-station employes, who have taken up this work without realising its monotonous nature. The remedy suggested is that college men should spend at least one long vacation in a central station and thus obtain some idea of the routine before it is too late.

## LEGAL.

ATTORNEY-GENERAL v. SHEFFIELD CORPORATION.

(Concluded from page 295.)

ON February 21st further evidence was heard for the defence.

MR. JAMES SWINBURNE, further examined by Mr. SARGANT, said that it was important that the wiring in the house should be efficiently done. The suppliers of energy had the right to refuse a supply unless the house wiring was up to a certain standard.

Do you consider there is any commercial advantage to the consumer in having the wires and fittings of the house supplied by the same persons who supply the mains and give the supply?—Yes, it is obviously to his advantage.

Do you agree with what was said yesterday that it is essential for the giving of a proper supply to have proper wiring in the house as well as proper wiring of mains?—Certainly.

Cross-examined by MR. LAWRENCE: Do not the Board of Trade regulations contain a provision that the undertakers are not bound to supply electricity until they are reasonably satisfied that the consumer's apparatus and fittings are such as not to cause leaks, or in any way injure the undertakers?—Yes, that is so.

And for that purpose the inspectors of the undertakers make it a practice in every case, before connecting up their wires with the consumer's wires, to test his system?—Yes.

MR. SAMUEL EDGAR FEDDEN, electrical engineer to the Corporation of Sheffield, said he had been general manager and engineer to the electricity undertaking since 1900. Before that he held various appointments as electrical engineer to Corporations in the U.S.A., Canada, Edinburgh, Greenock and elsewhere, so that he had a very large experience in electrical undertakings.

When you took charge of this undertaking in June, 1900, was the annual turnover about £22,364?—Yes.

Was the amount for the year ending March 25th, 1910, £70,640, of which, roughly, £47,156 represented lighting and heating and £23,484 represented power?—Yes.

To what do you attribute that increase?—To our advertising by means of canvassing from the wiring and fitting department. Canvassers call upon prospective consumers and explain the benefits of the supply to them. They carry out any experiments that may be desired and generally assist people in learning what are the uses of electricity.

I believe you have devoted a great deal of thought to this matter, and are prepared to tell the Court that there are certain commercial advantages in the Corporation being at liberty to supply fittings and wire the consumers' houses.

MR. LAWRENCE objected to the question.

MR. SARGANT asked his Lordship to take the evidence subject to the objection.

HIS LORDSHIP said he did not think it was admissible, but he thought he had better admit it at present, subject to the objection.

MR. SARGANT: Now, Mr. Fedden, are there advantages when you are canvassing consumers in being able to tell them that you can supply the whole thing?—I think there are great advantages. In the first place, I think the consumer feels there is a sense of security in dealing with a Corporation. The Corporation in wiring a house will bear in mind that they are responsible to the consumer, and see that they do not put in too many lamps.

Assuming the inside wiring was done by an outside contractor. I suppose the servants of the Corporation department would have to go to the house for certain purposes?—Yes, they have to deal with all that part of the apparatus which belongs to them.

From the point of view of rapidity, do you think there is any advantage to the consumer?—Yes, because he has only to deal with one authority instead of two.

Have you known cases in which there has been delay through there being two sets of contractors?—Yes.

Is it ever necessary when you fix a motor to put an electric lamp in also?—Yes. The consumer nearly always asks to have an electric lamp fixed up in connection with the motor.

I want you to look at it from the undertaker's point of view supposing there is anything wrong. Supposing the consumer finds the light not working properly, to whom does he send?—He always sends down to us.

MR. LAWRENCE: Is that whether you have wired the house or not?—I think so where anybody has done it.

Further examined, WITNESS said the books showed that for the year ending March 25th, 1910, there were 4,193 calls. He could not say in how many of those cases the consumer had the apparatus of another contractor.

Cross-examined by MR. LAWRENCE: When you took over the management, was the wiring and fitting department conducted separately from the supply?—It was.

I understood you to say you were forced to open the arc lamp department. Do you mean it was done before you came on the scene at all?—I believe so, in February, 1900.

Where is this wiring and fitting business carried on?—At Commercial Street and at our repair shop in Suffolk Road.

Is the building in Commercial Street a separate building rented by you for the purpose of the wiring and fitting department?—No, the offices belong to the Corporation.

WITNESS added that they were general offices, and that the showrooms were open to anybody who chose to come in and buy. Lamps, fittings, &c., were purchased from the manufacturers and resold at a profit.

Is it a fact that the stock in trade in connection with this department on October 17th last was valued at £2,286?—That may be so.

WITNESS further admitted that the department supplied telephone instruments, lightning conductors, &c. He said the establishment in Suffolk Road was devoted entirely to repairs. He believed they had stopped doing repairs there for non-consumers.

Are you certain about that?—I believe I am correct. I do not absolutely know.

Do you do general engineering work there?—We do sundry repairs.

In your department have you started supplying vacuum cleaners for houses?—We have.

From your repair shop do you conduct the business of taking down and repairing shafting?—Yes.

Do you do electro-plating?—I think we send it out to be done.

Do you supply bells to people who are not using your electric light?—Yes, we have done.

It was suggested that you did that in the hope that some day they might use the light?—I think that refers to wiring.

You do supply bells and telephones to people who are not consumers of energy for lighting purposes?—Yes.

Re-examined: WITNESS said the vacuum cleaners and shafting he was asked about in cross-examination were all driven by electric power. The sales over the counter were very small compared with the customers whose names were booked.

MR. JAMES WM. WRIGHT, the City Treasurer of Sheffield, examined by MR. SARGANT, said he remembered the purchase of the electric light undertaking on December 31st, 1898. He was not treasurer then, but he was in the office. The amount handed over was £299,000, and was made up of £262,000 cash, £25,000 for debentures and £12,000 for bank balance.

It is said that the Corporation borrowed money to carry on the electric light undertaking and applied money from the borough fund?—That is not so.

In certain years were there losses. Out of what funds were they discharged?—Out of the accumulated profits of previous years' trading of the undertaking.

Have you prepared a table showing the capital expenditure on the electric light undertaking from 1898 onwards?—Yes. And with two exceptions the amount of the borrowing sanctioned has always exceeded the amount of the expenditure in each year.

Cross-examined by MR. LAWRENCE: Do you suggest that this table shows whether you have used the ratepayers' money or not in carrying on this business. Do you think these figures will give us any idea whether the ratepayers' money has been used?—I say it has not been used.

HIS LORDSHIP, to WITNESS: Do you say that the plaintiffs' charge of using the ratepayers' money is completely refuted by looking at those figures?—No, I can't say that.

MR. LAWRENCE: Do you have any special arrangement with



your bankers that if one of your accounts is overdrawn they shall not set off one against another. You know bankers have the right to do that if there is no stipulation to the contrary?—We have no special arrangement with the bank.

WITNESS was cross-examined on certain of the Corporation accounts to see if there was any separate rental value assigned to the premises used for the electric light undertaking and the repair shop. He said he knew of no book which contained any such entry. He was not concerned with the items in the accounts. All he had to see was that the accounts were in proper form. They had a proper auditor to check the items.

Have you ever transferred any balance from the electric lighting account to any other department in relief of the rates?—No balances standing to the credit of the Corporation.

MR. LAWRENCE: When you get a sanction for a loan for the purpose of the electricity department, does it say how you are to raise it?—No. The only stipulation is that it shall be repaid in a given number of years.

WITNESS explained that in 1908 they divided their banking accounts among four banks instead of having one bank. The Sheffield Banking Co. only dealt with the electricity undertaking and the education accounts. The total authorised capital expenditure on the electricity undertaking up to the end of March, 1910, was about £998,000.

MR. J. W. BARNES, commercial manager of the defendants' electrical undertaking, said he was formerly in the service of the Sheffield Electric Co., taken over by the Corporation, and he had had 25 years' experience in electrical matters. He described the kind of business done by the company at the time it was taken over, which included all electrical work. The Universal Fittings Co.'s business was transferred to the Sheffield Co. in May, 1897, but that was before he joined the latter. On the transfer the Corporation necessarily employed the officers of the old company, and also acquired the stock-in-trade. Contracts were running when the company was taken over which had to be gone on with, including the Durn Valley Waterworks Co., which was for maintenance among other things. That contract was not renewed after it ran out. At the time of the transfer the Sheffield Co. did a good deal of manufacturing of fittings, electroliers, and also the fittings required for general lighting. That trade continued to exist right down to 1910, but the trade outside the city had been stopped, and now they did not make anything except for use on their own mains.

When did they cease supplying even to persons in the area?—We can hardly say we have ceased to do that yet.

What kind of goods are on view at the showrooms?—Electroliers, standard brackets, standard lamps, glassware and lamps, pendants for rooms of any kind, radiators, cooking utensils and apparatus, &c.

Is there anything in your showroom, or which you have in stock, which is not fit to be used in connection with electric supply?—No.

What is the nature of the wiring and fitting department as carried on by the Sheffield Corporation at the present time?—Wiring and fitting of houses, shops, theatres and manufactories in the town: and for electrical power and electrical heating. There were also a large number of contracts for the cleaning and upkeep of lamps, the supply of carbons, &c. At present there were about 400 lamps kept in order by the department. They also did installations of bells in places where they did the lighting. There were a few instances where they had done the bells, but did not supply the light, but that had not been done for some time.

WITNESS added that the wiring and fitting department had been a success as regards the amount of work done, and the result had been to largely extend the supply of electricity.

Do you do a certain amount of cash business across the counter?—Yes, but it is very small.

Are the gross cash sales made across the counter as follows:—1898, £53; 1899, £71; 1901, £94; 1902, £78; 1903, £66; 1904, £71; 1905, £99; 1906, £115; 1907, £161; 1908, £177; 1909, £223; 1910, £190, and 1911, £181?—Yes, that is correct.

Can you tell what proportion of the cash sales would be represented by the sale of lamps?—I think a large proportion—probably 80 per cent.

Further cross-examined, WITNESS said all he knew about the agreement with the Yorkshire Power Co. was that the Corporation were allowed to supply the Yorkshire Co.'s area. He knew nothing of the details of the agreement. Witness had nothing to do with the apportionment of the accounts in regard to the electric light undertaking. Mr. Whiteley, the chief accountant, would be able to give full particulars of all those matters.

Re-examined by MR. SARGANT: The Corporation had not done anything themselves in regard to retaining contracts. The last telephone installation they made was about eight or nine years ago.

MR. SARGANT said the chief accountant and Mr. Seabrook, electrical engineer, would be the only other witnesses. He thought the accounts spoke for themselves, but there seemed to be some sort of suggestion that there was a bogus portion charged for rent.

MR. LAWRENCE: No, but I can't find the rent charge.

His LORDSHIP: Then you had better call the accountant.

MR. JOHN FOSTER WHITELEY, chief accountant to the Electrical Supply Department of the Sheffield Corporation for four years, examined by MR. SARGANT, produced tables he had compiled of expenditure on the department down to date, which he handed to plaintiffs' counsel.

You know that a point has been raised as to the rent charged by the general undertaking on the wiring and fitting department; was it ever suggested to you that it would be advisable to diminish the rent payable by the wiring and fitting department, so as to make it show a profit?—Decidedly not.

What was the amount fixed for the occupation by the depart-

ment of its floor?—I presume you are speaking of rent, rates and taxes?

Yes.—One-half.

In your opinion, is that a fair apportionment as regards that floor and the other part of the building?—It was at the time; it may not be now. I think it is too much at present.

WITNESS was cross-examined by MR. LAWRENCE as to an inquiry by a committee in regard to having depreciation and obsolescence reserves.

Was any portion of the amount recommended to be set aside apportioned to the wiring and fitting department?—To the best of my knowledge, no.

WITNESS explained that renewals were paid for out of the profits of the department. The whole building in Commercial Street was assessed at £200 for rating purposes.

The repair shop and factory was rated at £93 net. No interest on capital was debited to the wiring and fitting department in any of the accounts.

Re-examined, he said it was not necessary to write off depreciation. There was a fairly rapid turnover of the stock. It averaged about four months.

MR. ARTHUR H. SEABROOK said he was an electrical engineer, and since June, 1909, had been general manager and electrical engineer of the Borough of Marylebone. Before that he was with the West Ham Corporation.

MR. SARGANT: I am going to ask you some general questions as to the advantages of being able to do wiring and fitting work.

MR. LAWRENCE objected.

His LORDSHIP: It will all be subject to your objection. It is only to show how nice it would be to do the whole thing.

WITNESS gave figures showing that since the West Ham Corporation obtained powers to supply fittings there had been a great increase in the supply of energy. He attributed the increase to the facilities for trading. In 1909 the Marylebone Borough Council inaugurated a sales department under his supervision, as he had the experience of West Ham to guide him.

Speaking generally, did that result, to the best of your judgment, in an increased output?—Yes. Briefly speaking, the result was that until 1909 the output for lighting—it is mainly a lighting district—was almost stationary, and the net result was an increasing loss. After we started developing the sales department this result was totally reversed. The income from lighting went up considerably, and the loss was changed into a substantial surplus.

Speaking generally, you consider that the establishment of a wiring and fitting department added generally to the output and prosperity of the concern?—Yes. I think it is essential to compete with gas companies that we should have these powers and should exercise them. We cannot possibly develop our undertakings unless we have the same facilities as our competitors.

Further questioned, WITNESS admitted that there were disputes in Marylebone, and that some persons were contending that the department was not a success. He agreed that on the 1910 figures the sales department alone showed a loss of £1,100.

MR. DANCKWERTS put in evidence the charter of the Sheffield Corporation, dated 1843, and said that concluded defendants' case. He did not propose to address his Lordship at any length, because it was clear they were only there on the way to the higher Courts. His Lordship had intimated that he would follow Mr. Justice Neville's decision in the Leicester case, and while he (counsel) said that was wrong, he was bound in that Court to yield to its authority. That left open one or two other points. In the first place, he could quote authority that at common law a Corporation could do anything that a private individual could do.

His LORDSHIP: Do you mean whatever be its charter?

MR. DANCKWERTS: It can do anything not forbidden by its charter. He agreed that they could not use the rates which they had power to levy under the Municipal Corporation Act for any purpose not authorised by that Act. He said that whatever they could do by contract or otherwise it was perfectly lawful, and though they could not resort to the municipal rates, still the contract was perfectly valid and binding.

His LORDSHIP: Supposing a Corporation, not relying on their innate common law powers, go to Parliament and ask for specific powers and get them, can they afterwards be heard to say: We take the benefit of those specific powers, and in so far as we did not ask and get anything more, we shall exercise our common law right.

MR. DANCKWERTS said his Lordship was directing attention to the Provisional Order of 1892. He did not say that the Corporation could use anything which came into being under that Order, except as authorised by the Order; but that Order did not purport to cut down the pre-existing powers. Under the Order the Corporation could not use the undertaking authorised by that Order for supplying electricity outside the area, and therefore defendants did not claim that they were entitled to use any supply of electricity or to use the powers given by that Order for laying down mains outside the area.

His LORDSHIP said there was another point. Under their Act of 1903 the Corporation got power to sell and supply motors, but there was a restriction on them not to manufacture. Did that derogate from their pre-existing common law rights?

MR. DANCKWERTS said they did not claim to manufacture, and, therefore, it was not germane to this action. He submitted not, because the powers could co-exist. He did not think it would justify them in supplying energy outside the area because of the express prohibition. His learned friend, Mr. Sargant, was more familiar with the facts of the case, and would deal with them; but so far as he (Mr. Danckwerts) understood the evidence from 1902 onwards, the fittings departments always had a surplus. Therefore he did not think that Mr. Lawrence's cross-examination about



depreciation and sinking fund had anything to do with it. The only importance of it was to show that they had never resorted to the rates to defray the cost of the fittings department.

His LORDSHIP said, although there might be a little in it, it was quite obvious that at times the expenditure on the electricity department altogether, including the motor department, was in excess of the moneys which were actually in hand, and the excess was temporarily met by an advance by the bank, which was, of course, charged with the benefit of a bankers' lien on the moneys standing to the credit of the borough generally.

MR. DANCKWERTS said he did not agree. The bankers' lien would only extend to those funds which the Corporation could properly use to defray any particular debt of the bank; that was obvious. The bankers knew they were a Corporation and had limitations on their powers and knew where the funds came from, and therefore they would know they had not a lien on the funds. He said the Corporation never did, and did not intend to resort to the borough rate or any other rate for the purpose of defraying expenditure on the fittings department. That left him one alternative contention that he put forward now. They did not claim to supply fittings for electric lighting purposes for anything not connected with their supply, but apart from that he claimed common law powers.

His LORDSHIP: Did that state of things exist in the Leicester case.

MR. DANCKWERTS said he conducted the defence there, and he did not put forward common law rights at all there, so it was not covered by the decision of Mr. Justice Neville. As regarded the Sheffield Corporation Act of 1903, he put that forward as an alternative to the common law claim, and he claimed that that Act covered the whole bag of tricks. He thought he had covered the whole ground, and it was such a good argument he did not want to spoil it by amplifying it.

His LORDSHIP: Do you rely on the fact that your authority was to purchase the undertaking of a commercial company, which was, as a matter of fact, carrying this on as part of their business?

MR. DANCKWERTS said he did not want to do so unless he was driven to it. Under the Transfer Act, 1898, he maintained that not only were they entitled, but they were bound to carry out what the company had in hand in the shape of contracts and obligations, and further, they were bound to take their stock at a price. That stock formed the foundation of the fittings department.

MR. SARGANT said he did not know whether his Lordship wished to hear him at length on the facts.

His LORDSHIP said, with all respect to counsel, a great many of them seemed to be irrelevant to the issues he had to decide. Some of them, however, might become relevant hereafter in certain events. If Mr. Justice Neville's decision was right, it was immaterial how they paid for the department.

MR. SARGANT said he would deal with the question whether or not there had been expenditure out of public money on the department. He submitted that plaintiffs had failed to make out their case. The evidence of the city treasurer was conclusive on that point. The Borough Fund, the District Fund and the Electric Department Fund were all kept perfectly separate.

His LORDSHIP said there seemed to be two questions involved. First, whether, as regarded the electricity undertaking and the other Corporation undertakings, there was ever any borrowing from the general funds in aid of the electrical undertaking, and then there was the subsidiary question whether as between the various departments of the electric undertaking the borrowing, if there was any, could be attributed to the one or the other. If it was conclusively proved there never was a deficit and never a loss on the wiring and fitting department, one might say that under no circumstances could a deficit on the general electric scheme be apportioned to that particular department, but had he any materials for forming any satisfactory opinion on the first question. It depended on a variety of things.

MR. SARGANT said he did not think his Lordship had.

His LORDSHIP said as between the electricity undertaking and the fittings department, he did not know that a loss had been proved on the fittings department, but on the other hand, had defendants proved there was not? It really came to a question as between the electrical department and the other undertakings of the Corporation. Plaintiffs had not established that there was a loss on the fittings department, but had established that there was a loss on the whole undertaking in two of the earlier years. Did not that shift the onus on to the defendants to show that the loss was not attributable to the *ultra vires* part of the undertaking.

MR. SARGANT submitted not. The loss was only in two years, and since then there had been no loss on the whole undertaking. If the onus was on him, he submitted he had discharged it. It was clear that this fittings department was only a very small part of the whole electricity undertaking. The capital attributable to it was only some £20,000 of the whole capital of the undertaking which approached a million. At the time the undertaking suffered a loss, a great many other concerns suffered a loss through the introduction of the metallic-filament lamps. Taking the whole undertaking right through, there never was such a loss as to wipe out the accumulated surpluses. As regarded the main part of the plaintiffs' case that was admitted, and the Corporation claimed the right to do it. He agreed that where there was a mixed question of law and fact, his Lordship could not be asked to differ from Mr. Justice Neville.

MR. LAWRENCE, in the course of his reply, said he desired to say something about the question that had been raised at the last moment without notice to the plaintiffs, and after all the evidence had been given, namely, as to the common law powers of the Corporation. The charter was not pleaded, and the point was not raised in the case before Mr. Justice Neville. It might be that such an argument could not be

sustained if it was shown that the department had not been carried on at a profit and plaintiffs had had no discovery of the books on that ground. Then the defendants came and said that the onus was on the plaintiffs to prove that it was not carried on at a profit and claimed to succeed on that. He felt a little embarrassed because this point had been sprung on him, but he contended it was immaterial because he had proved utilization of moneys raised by statutory authority in carrying on this illegal department. It was clear that the Corporation had been using money borrowed from the funds. They were occupying premises for the department, which had been acquired out of the moneys borrowed for the undertaking. They were utilising money provided for a specific purpose. They were not debiting anything to this department for the use of the capital or for the use of the premises. There was not a shadow of doubt that the department would show a loss if the Corporation was not behind it. If an ordinary trader had started it, he would have had to shut up within a year. That was the vice of all this municipal trading. They sent out accounts showing a nice profit to ratepayers, who were not able to understand them, and directly a competent person came to look into the accounts they showed a loss. On the figures alone, his Lordship had ample material, even taking the defendants' own modest estimate of a fixed working capital of £20,000 for holding that there was not a single year in which the defendants had shown a profit. If it was an ordinary trader the whole thing would be mere moonlight madness.

On Friday his LORDSHIP gave judgment. He said the relator, a ratepayer in the city of Sheffield, alleged that the defendants, as the local authority for the purpose of the Electric Lighting Acts, 1882 and 1888, had acted, and were still acting, in excess of the powers possessed by them as such authority. He claimed declarations framed with a view to delimit those powers, and an injunction to restrain any further transgression of those limits. The subject matter of the relator's allegations fell under three heads—first, acts done within the area of supply; second, acts done outside that area; third, expenditure of the corporate funds and the use of the corporate property for the doing of such acts. The decision of the issues in the action turned largely on questions of law, which were not infrequently arising, and which affected many persons and bodies outside this litigation, and the parties had intimated their intention of carrying these proceedings to the House of Lords, with a view to obtaining, if possible, a final adjudication of the legal problems involved. The facts which he held to be established partly by oral and documentary evidence, and partly by admissions made before and during the hearing, were as follows. Within their area the defendants had done the following things:—(A) They had carried on, and still carried on, the trade of erecting and installing electric light fittings and wires and electric bell fittings and wires in houses and other buildings. It was not confined to work done for persons taking, or contemplating taking, a supply of electricity. They had also in similar circumstances supplied wires and other apparatus necessary for domestic or indoor telephones, and had supplied, and through sub-contractors, had installed lightning conductors. (B) They had opened, and were keeping open, a depot for the supply and sale to the public at large of electric lamps, fittings of all descriptions, bells, batteries, accumulators, switches, switchboards, voltmeters, telephones, lightning conductors, cigar and cigarette lighters, and numerous other electric fittings and accessories. (C) They had executed repairs to such installations as were enumerated in paragraph A, and had entered into time contracts for the cleaning, maintenance and supervision of arc lamps in use upon premises to which they supplied electricity. (D) Outside their area they had sold and supplied motors, electric lamps and fittings, and a large number of separate parts and accessories for electric motors. (E) They had erected and installed electric light fittings and wires and electric bell fittings and wires in houses and premises not intended to be supplied by them with electricity. (F) They had executed repairs for persons and firms to whom they had supplied such motors and fittings, and for whom they had made such installations as were referred to in paragraphs D and E. The funds expended in carrying out these operations had been supplied out of moneys borrowed under statutory powers for the purpose of the defendants' electric undertaking, or raised on temporary loan from their bankers by way of overdraft, such overdrafts being repaid out of further moneys borrowed under statutory powers. The capital sunk or invested in the wiring and fitting department of the electrical undertaking, which was the department controlling and carrying out the foregoing operations, was a sum of between £20,000 and £30,000. It appeared from the accounts that the revenue of the department had uniformly exceeded the expenditure, but in arriving at this result no charge had ever been made against the department for interest on capital, or for rent of the Corporation premises occupied for the purposes of the department, nor had any allowance been made in the department accounts for depreciated or obsolete stock. So far as the work enumerated in paragraphs A and C of this judgment, was done for consumers of electricity supplied, or about to be supplied, by defendants, the facts were brought entirely within the recent judgment of Mr. Justice Neville in the case of the Attorney-General v. the Leicester Corporation, and, in accordance with the well-established practice, he must adopt and apply the law there applied to a precisely similar state of facts, unless there was any sufficient reason for his not doing so to be found in either of the two points raised on behalf of defendants. Mr. Justice Neville's judgment was not limited to the consideration of cases falling within paragraphs A and C of this judgment. The statement of claim in the Leicester case contained allegations of a course of dealing and conduct practically identical with that he had held to be established here, and which he had detailed in paragraphs B, D, E and F. He thought, therefore, subject to the same,



qualifications that the decision was equally applicable to the matters therein referred to. The two points urged on behalf of the defendants were these: In the first place, it was said that the defendants, being a Corporation incorporated by charter, had power to do anything not expressly prohibited by the charter, and that plaintiffs could not succeed here in their claim, because they had not established affirmatively any contravention by defendants of the provisions of the Municipal Corporation Act of 1882 in relation to the Corporation finances. In his opinion, it was not open to the defendants to raise this defence. It was never suggested until their case was being summed up, and the numerous interlocutory applications, including several stoutly-resisted applications for discovery and inspection of documents, books and accounts of the defendants, had throughout been framed and proceeded on the footing that defendants had been relying solely on their statutory and not on common law powers. But even if the defence was capable of being raised, he did not think there was any substance in it. It was impossible to take any one of the impugned Acts and and dissect it and pronounce that one part of it was *intra vires* and the remainder *ultra vires*. One must look at the transaction as a whole, and the fact, if it be a fact, that the defendants had power to do part of an Act would not legalise the Act if its completion involved at any stage a slip *ultra vires* of the Corporation. In the circumstances here existing, every Act involved the application and user of money raisable for one set of purposes only to and for other and alien purposes, and, in his opinion, it was no answer to a claim to restrain repetitions of such acts to urge that a part at any rate of each transaction was *intra vires* of the Corporation. The second point taken on behalf of the defendants involved the construction of the Sheffield Corporation Act, 1903, and in particular Part IV. What were the further powers conferred by Sec. 18 upon the defendants in reference to their electric undertaking, and were such further powers exercisable outside the limits of supply? The answer to the second part of that question must, in his opinion, be in the negative. He could see no ground found in the section itself that was incompatible with any other answer, and in like manner the powers were themselves restricted. They did not extend so as to include electric motors and apparatus used for all purposes, but only electric motors and apparatus used for the specific purposes, and when the section spoke of an electric motor and apparatus used for motive-power it referred only, in his opinion, to that which was the source of the power, not necessarily even to the mechanism, shafting, or what not which transmitted the power, and certainly not to the objects to which the power was transmitted—such as the machines, lathes, or tools or bells, as had been there suggested. On all grounds, therefore, he thought the case was covered by the decision of Mr. Justice Neville, and he must make a declaration that the defendants had no power to carry on the trade or business mentioned in paragraphs 10 and 11 of the statement of claim, or the trade or business of repairing or keeping in repair installations of electric light fittings and wires in houses or other buildings, or of electric bells, fittings and wires, or any such businesses or any part thereof; or to enter into contracts for the cleaning, maintenance, supervision of arc lamps used by consumers, or to supply or install and fit up telephones and lightning conductors, or to sell, offer for sale or let on hire any telephones, cigar or cigarette lighters, electric lamps, wires and fittings and other electric accessories for use on the consumer's side of the consumer's terminals, excepting only meters and electric motors, apparatus and other things for cooking, heating and ventilating, and for motive power within the limit of the defendants' supply. In view of the appeal which was contemplated the case was not one in which he was inclined to grant an injunction, and if defendants would give an undertaking to serve notice of appeal during the present sittings he would not do more than make the above declaration and give leave to the plaintiffs to apply, if necessary, for an injunction, or generally. Defendants must pay the costs of the action.

MR. SARGANT said defendants were quite willing to give an undertaking subject possibly to this. There was a Bill in Parliament of the Corporation for the very purpose of localising their action.

His LORDSHIP: Then the appeal will be stayed, but give your notice within five weeks, if possible.

MR. SARGANT said subject to this, that the defendants have liberty to make another application should the progress of the Bill be such that it might be necessary to appeal. He further applied that taxation should be stayed.

MR. LAWRENCE objected.

His LORDSHIP said he could not stay taxation. Somebody from Sheffield would have to pay.

#### ALLDAYS & ONIONS v. F. S. LISTER.

IN the King's Bench Division on Monday, before Mr. Justice Phillimore, plaintiffs, of Birmingham and London, sued Mr. F. S. Lister, trading as the Westminster Ventilating Co. to recover the sum of £81 11s., alleged to be due in respect of electric ventilating fans supplied. Defendant alleged that the fans did not carry out the work required of them and counterclaimed damages.

Mr. Croom-Johnson was counsel for the plaintiffs, and Mr. Cannot appeared for the defence.

MR. OSWALD STOTT, manager to plaintiffs' fan department, said that he interviewed the defendant, who was setting up in the electric fan business, and it was arranged, subject to prices being right, that plaintiffs should supply defendant with their fans.

In answer to COUNSEL, WITNESS denied that he agreed that the fans supplied should be of a standard capacity, because there was no

such thing on the market; nor was any arrangement come to as to the terms of payment, beyond the ordinary terms of business. Witness certainly did not arrange that the terms of payment should be unlimited and subject to defendants' customers being satisfied. A proposal was made that there should be a scheme of working arrangement on which the parties should do business, and in February, 1909, such a scheme was submitted, but plaintiffs never agreed to it, and business relations were conducted without any such agreement being come to, plaintiffs supplying defendant with fans. Plaintiffs did not guarantee that the fans supplied would do any special kind of work beyond that which, in each case, they told defendant they would do.

Cross-examined by MR. CANNOT, WITNESS said [Mr. Lister told him he had a valuable connection in London for the sale of fans, but he denied that he (witness) was anxious that Mr. Lister should act as agent for plaintiffs. It was true the fans required for central station work were costly as a rule, and in his interviews defendant did tell him that guarantees would be required. In any case of induced draught fans, if they had been specified by plaintiff as such and did not do their work properly, no objection would have been raised to taking them back and making them efficient.

In answer to his LORDSHIP, MR. CROOM JOHNSON said the fans in dispute included two fans supplied for export to Sydney, and a fan ordered from defendant by the Kodak Co.

None of these fans, WITNESS said, were supplied on terms that they were subject to customers' approval, but plaintiffs were willing to have them back if they did not work satisfactorily. He denied that any guarantee of capacity was given by plaintiffs for these goods.

The DEFENDANT, a consulting engineer, then gave evidence, and said he traded in the name of the Westminster Ventilating Co. He had had considerable experience in the sale of electric fans. When Mr. Stott called upon him in 1909, plaintiffs had a particular type of fan; they desired to put a fan called the "Sirtus" on the market. It had not been standardised at that time, and it was arranged that defendant should use his endeavours to build up a business for the fan in London on behalf of plaintiffs. They agreed to stand by the efficiency, &c., of the fans. A verbal agreement was arrived at during subsequent interviews, with regard to the terms upon which he should take up the sale of plaintiffs' fans. The terms were that he should confine himself to placing the "Sirtus" fan on the market, and if the results were satisfactory, a definite agreement should be entered into between the parties. That definite agreement was never concluded in writing, but the practice established was that he should take up the fan and Messrs. Alldays & Onions should stand by it. Also that there should be no question of payment unless the fans were satisfactory to the people to whom they were supplied. In regard to the fans in question, plaintiffs were late in delivery, the fans had not been tested, and in one case the starter for the motor was missing. At the time of the issue of the writ, defendant objected to pay plaintiffs for the machines because the people to whom he had supplied them had not paid, and the goods were not satisfactory. Plaintiffs were thus wanting him to take all the risk.

In answer to his LORDSHIP, DEFENDANT said he had, since the issue of the writ, been paid for the fans, and he was now quite willing to pay plaintiffs. The only question he was fighting was the question of costs.

There was no other evidence, and his LORDSHIP held that there was not sufficient to show that the goods were not up to requirements. Mr. Lister had been since paid for the fans, and he entered judgment for plaintiffs on the claim and counterclaim.

#### ELLIS v. OLDHAM CORPORATION.

AT Manchester Assizes on Monday, before Mr. Justice Bray and a special jury, Ivy Ellis, aged five, claimed, through her next friend, damages from the Oldham Corporation, alleging that, through the negligent driving of a tramcar, she was so injured that she had to have her left arm amputated above the elbow, and also received injury to her leg and hip. The Corporation denied negligence, and alternately pleaded that, if there was negligence, there was contributory negligence on the part of the child.

Mr. A. A. Tobin, K.C., M.P., and Mr. Wingate Saul were for the plaintiff, and Mr. Langdon, K.C., and Mr. Roe Rycroft for the Corporation.

MR. TOBIN said the plaintiff resided with her parents at the Royal Hotel, Rochdale Road, Oldham, and on April 4th, 1911, she was crossing the road to go school when she was run down by a tramcar, with the result that she lost an arm and received such injuries to a leg that she would have to go through life limping. The child was in the infirmary for three months. The gradient of the spot where the accident happened, was one in 28, and the car was going down the gradient. Witnesses for the plaintiff would say that the car was going much too fast, and that the gong was not sounded. At a time when the children were about going to school, the driver of a car must take care, and must so have his car under control that he could avoid accidents that might happen through any ill-advised action on the part of children.

MR. CHADWICK, manager of Kershaw & Bamford's, cotton spinners, of Oldham, said he saw the car pass him, and heard a scream. He did not hear the gong, and told the driver that he had not rung his gong. The driver turned to other people, and asked them if he had not rung the gong. Witness told the driver he was not fit to drive a car.

Several WITNESSES were called, who said the speed of the car was at least 20 miles an hour when the accident happened.

On behalf of the defendants, the speed of the car was said to



have been only 8 miles an hour, and it was stated that the child emerged from behind a lorry right in front of the car, giving the driver no opportunity to pull up.

CHARLES WHITEMAN, the driver of the car, said he did all he could to avert the accident. He said he sounded the gong and applied the magnetic brake. The child was knocked clear of the car.

The jury found for plaintiff, £380 damages, in addition to £5 for the father.

#### GENERAL ELECTRIC CO., LTD., v. THE GREAT WESTERN RAILWAY CO.

IN the Court of Appeal, before the Master of the Rolls and Lords Justices Moulton and Buckley on Monday, this case was heard upon the appeal of the plaintiff company from an order of the Railway and Canal Commissioners discharging an order for discovery made by the Registrar.

It appeared from the statement of Mr. Disturnal in support of the appeal, that the plaintiff company were alleging that the defendant company had allowed undue preference to Messrs. Belliss and Morcom in the carriage of electrical machinery from Birmingham, where the factories of both firms were situated. The Registrar had ordered discovery of all the documents relating to the case over a period of three years without, it was said, having before him a single concrete case in which undue preference was given. Upon the appeal of the defendant company to the Commissioners, Mr. Justice A. T. Lawrence held that upon an application of that kind particulars of the undue preference must be shown, and that the order made by the Registrar was oppressive upon the Railway Co. The Commissioners, while discharging the order, gave the plaintiff company 10 days in which to give particulars of the instances upon which their case could be based, and the application renewed.

The learned COUNSEL said that the plaintiff company's complaint was that the Railway Co. had charged Messrs. Belliss & Morcom a lower rate for the carriage of the same class of goods as the applicants from Birmingham to certain stations on the defendant company's system, and to prove that, they required to have an order for discovery for the purpose of getting particulars from the defendant company of the consignments of electrical machinery carried for Belliss & Morcom from Birmingham to the station in question at the "exceptional rates."

Without calling upon counsel for the Railway Co., their Lordships approved the order of the Commissioners and dismissed the appeal with costs.

#### TRAMWAY CO. AND LANARK COUNTY COUNCIL.

IN the Court of Session, Lord Ormidale has interdicted the County Council of Lanark, at the instance of Lanarkshire Tramway Co. from applying any part of the sum of £7,500, paid to the County Council in respect of road widening and diversion, towards the cost and constructing new roads, the grounds of judgment being that the new roads were not diversions of highways in terms of the statute.

#### EDINBURGH TRAMCAR GUARDS.

JUDGMENT was given in the Court of Session last week in reclaiming notes for defenders in two actions brought against the Edinburgh and District Tramways Co., Ltd. In the first case a widow sues for £2,000 damages, and in the second a domestic servant claims £1,000. Both had their left legs amputated as a result of the wheels of the cars passing over them. One of the pursuers alleges that she had taken up a position so as to be clear of the car, but when it was about half way past her the lower part of her skirt was caught by the vertical stay on the right side of the car or became jammed between the main stay and the body of the car. She contends that the defenders should have had the stays guarded. The second pursuer alleges that the guards attached to the cars were worse than useless. Defenders deny fault, and plead contributory negligence, and say there was no necessity for any such guards as were suggested. They state that their cars are constructed in such a way as to occasion no danger whatever to any person using ordinary care. The First Division adhered to the decision of the Lord Ordinary approving of issues for the trial of the cases by jury with expenses.

#### OSRAM LAMP WORKS, LTD., v. Z ELECTRIC LAMP CO., LTD.

AN application was made to Mr. Justice Parker in the Chancery Division, on Monday, to fix the hearing of this patent action and incidentally to obtain for the plaintiffs further inspection.

Mr. Walker, K.C., Mr. Colefax appeared for the plaintiffs, and Mr. T. Terrell, K.C., and Mr. R. Frost for the defendants.

MR. WALTER said that the action was a long and complicated one. His Lordship would no doubt remember litigation by the Z Lamp Co. that had been before him on a previous occasion. That was sufficiently complicated, but the present action was even more so. His application to fix a day for hearing was a little complicated by the fact that there had been an order for inspection. An order was made that inspection should take place between February 1st and 14th at such times as might be arranged between the solicitors on either side. The inspection involved the defendants' secret process, and Dr. Passmore, who was to make the inspection, was not to communicate to the plaintiffs what he saw, he was only to see Sir James Dewar. Two appointments had taken place, and the defendants very properly desired that their own experts should be present

at the meeting. It was now desired that there should be another meeting, and that made it, of course, difficult to say at present what would be a convenient day for the trial. It was a case relating to filaments, and by some unfortunate mistake on the second occasion they could not get the samples, and therefore there must be another inspection. Dr. Passmore had reported to the plaintiffs what he considered to be the result of his inspection, but, of course, he could not report what he had done. He said, however, that there were two patents in respect of which there had at present been no meetings, and it was extremely important to the plaintiffs that they should ascertain something about those before the case came on for trial. What he should suggest was that the trial should stand over until towards the end of the present sittings, and if his Lordship could see his way to retaining the case they might have a day early in next sittings, provided it was inconvenient to dispose of it before Easter.

HIS LORDSHIP said that he could not fix the hearing for some little time as his list was full. To fix a day at present would be a little premature. He had a case fixed for March 15th, and another for March 20th. He might find a day somewhere about March 25th, but he would suggest that the case should be marked "not before the 18th," and then counsel could renew the application to fix a day somewhere about that date.

MR. WALTER agreed, but asked whether Mr. Terrell objected to the plaintiffs having further inspection.

MR. TERRELL: Yes.

MR. JUSTICE PARKER said that he did not know he had any application for inspection before him then.

MR. WALTER said that was so, and if the other side insisted, a formal application would have to be made in chambers. In that event the case could not come on before March 25th. If the case was marked not before that date, the plaintiffs could go for further inspection in the ordinary way.

MR. TERRELL said he objected to there being a postponement at all, and in support of his objection he had very strong affidavits. He had consented to inspection, and the other side had got more than they had any right to. He had submitted because he did not wish to delay the trial, and in consideration of that the other side had given an undertaking to give notice of trial on or before February 22nd, and they were further to apply to the Judge to fix a day for the trial as soon after March 1st as possible. That was done under these circumstances; they first of all brought actions against the customers of his clients, and they (defendants) had the greatest difficulty in getting them to bring their action. Upon their bringing their action arrangements were come to that the trial should take place early in the Michaelmas sittings. Then they applied for postponement and delivered particulars of objection. The defendants complied with everything they were asked to do, and they said that the postponements were bringing their trade to an end. They had in their possession all the further and better particulars of objection when they gave the undertaking. Having all that before them, there was only the issue of infringement, which they must have known all about when they gave their undertaking. It was only upon pressure that they brought their action. They applied for inspection and were given inspection of everything they wished to see, and all information they desired in relation thereto. The defendants had even offered to place at their disposal a room at the factory, in order that they might try experiments if they so desired. He was not resisting the application vexatiously. It was a most serious matter, as the sittings would come to end before April 3rd.

HIS LORDSHIP said he did not think he would be able to fix a day before March 18th.

MR. TERRELL: It is nothing like the last case before your Lordship, although my learned friend has tried to make out that it is very complicated.

MR. WALTER: The objections cover eight pages of print, and are the most complicated I ever read.

HIS LORDSHIP: I am sorry I cannot fix it before the 18th, on which day I have a heavy case coming on. What I will do is this. I will give you liberty—Mr. Terrell undertaking to give you further information this week or early next week—to renew the application to fix a day for the trial at anytime after the 12th.

#### DEAN v. HACKNEY BOROUGH COUNCIL.

IN the Shoreditch County Court on Monday, before his Honour Deputy-Judge Williams, William Dean, of 60, St. Mark's Road, Enfield, sued the Hackney Borough Council to recover £10 10s. for personal injuries sustained through colliding with an unlighted electric standard, which constituted a nuisance on the public highway, whilst he was driving a taxi-cab.

Mr. Martin O'Connor, barrister, appeared for the plaintiff, and Mr. J. B. Matthews was counsel for the defence.

According to the plaintiff, on November 25th he was driving his taxi-cab down Cazenove Road, Stoke Newington, at 6 p.m., when he collided with an electric light standard in the middle of the road, which was not lighted. He had just passed one standard, and thought it was the last, as he saw no light. He was very badly shaken, whilst the two passengers were very seriously injured and had entered actions against both the cab company and the Borough Council. There was a man with a bag of tools at the standard, when he recovered sufficiently to get out of the cab, whom he supposed was there to repair the light. There was no danger signal of any kind, and he thought that at least there should have been a red light.

MR. MATTHEWS said these standards had been erected in accordance with the regulations laid down by the Board of Trade. There



was nothing in the regulations binding a Borough Council to light an electric standard. They were erected in runs of nine, and a special scout who was out that night discovered that three lights had gone wrong. On investigating he found an earth in the one that was now complained of, so he disconnected it from the cable and the other lights became all right. It was impossible to do more that night.

MR. O'CONNOR: By no means. You could have had a warning light put, and the accident would not have occurred.

MR. MATTHEWS: There is nothing in the regulations to say that we shall stand beside every standard until a light fails, the proposition is too absurd.

MR. O'CONNOR: Not at all. It is discovered that a lamp has gone out, but no effort is made to apprise anyone of the danger, and therefore you turn it into a danger and a nuisance on the highway.

The amount of the damage was not disputed if there was any liability, and JUDGE WILLIAMS said the point as to whether an electric standard, which was unlighted, constituted a nuisance, was a most important one, and he would look up whatever authorities he could find on the point and reserve his judgment.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 3,415. "Reception of call-up signals in wireless telegraphy and other purposes." F. L. MUIRHEAD. February 12th.
- 3,454. "Electrical measuring and like instruments." J. W. RECORD. February 12th.
- 3,462. "Switch tripping device." W. L. SPENCE. February 12th.
- 3,479. "Continuity of electric conduit systems." M. J. RAILING and T. TAYLOR. February 12th.
- 3,497. "Switching apparatus for telephone exchange systems." E. E. CLEMENT. (Divided Application on 7,611/1911. March 27th.) February 12th. (Complete.)
- 3,523. "Means for driving an electric dynamo." A. BAKER, A. N. HAZLEHURST and LONGSTRETH'S, LTD. February 12th.
- 3,532. "Electric distribution systems." BRITISH THOMSON-HOUSTON CO., LTD., H. W. TAYLOR, F. P. WHITAKER and H. S. SPORBORG. February 12th.
- 3,540. "Electrical animal exterminators." O. N. CALVERT. February 12th. (Complete.)
- 3,552. "Registering devices for telephone systems." E. M. NORTUM. February 12th.
- 3,555. "Method of and apparatus for generating high-frequency currents." A. HEYLAND. February 12th. (Complete.)
- 3,556. "Electrically-driven fans." A. SCHAEFFER. (Addition to No. 13,623, of 1911. Convention date, February 11th, 1911, Germany.) February 12th. (Complete.)
- 3,574. "Electric fitting for the heels of boots and shoes." W. B. MINGLEY and J. H. IRELAND. February 13th.
- 3,584. "Appliances for electrically operating points, signals or other devices on electric tramways, railways and the like." C. W. BENTLEY. February 13th.
- 3,586. "Electric signalling apparatus for military, naval and other purposes." J. N. INOLIS. February 13th.
- 3,590. "Electric switches and the conductor connections thereto." H. C. SHELTON. (Sachische Gruppenwechselschalter G.m.b.H. Germany. February 13th. (Complete.)
- 3,595. "Electrical driving mechanism." T. COOPER, H. H. WALE and A. ALLSOP. February 13th.
- 3,644. "Means for applying an electrical conductive layer upon an electrically non-conductive surface." H. E. GOLDBERG. February 13th. (Complete.)
- 3,650. "Dynamo-electric generators for velocipede lamps and the like." C. SCHLICH. February 13th. (Complete.)
- 3,675. "Electric power transmission apparatus." MACFARLANE ENGINEERING CO., LTD., and W. A. MACFARLANE. February 14th.
- 3,711. "Electric incandescent lampholders." S. W. MARTYN. February 14th.
- 3,736. "Electrically-operated doors." G. KORYTOWSKI. February 14th.
- 3,746. "Lamp supports and casings particularly designed for use with electric incandescent lamps." J. S. HIGHFIELD. (Addition to 27,991/1908.) February 14th.
- 3,748. "Method of obtaining an accurate co-operation of two or more machines, apparatus, or instruments." ARTIESELSKABET HOVLANDS RADIO-TELEGRAF. (Convention date, February 16th, 1911, Norway.) February 14th. (Complete.)
- 3,752. "Treatment of metals." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 14th.
- 3,767. "Construction and method of use of electrical junction boxes and the like." E. T. R. MURRAY. February 15th.
- 3,772. "Connector for electrical wiring purposes." J. WILKIE. February 15th.
- 3,794. "Electric storage system." C. F. KETTERING. (Convention date, May 22nd, 1911, U.S.) February 15th. (Complete.)
- 3,798. "Electro-deposition of metals on articles of china, glass and other non-conductive materials." C. A. OWEN and H. A. HARVEY. February 15th.
- 3,812. "Electric searchlights." GEBR. SIEMENS & Co. (Convention date, April 29th, 1911, Germany.) February 15th.
- 3,824. "Electric valve actuation in organs." A. MACQUARIE. February 15th.
- 3,830. "Time-controlled electrical switches." G. W. FREE. (Convention date, February 15th, 1911, U.S.) February 15th. (Complete.)
- 3,840. "Electric incandescent lamps." DEUTSCHE GASOLUHLICHT (AUER GES.). (Convention date, November 4th, 1911, Germany.) February 15th. (Complete.)
- 3,879. "Brush-holders for dynamo-electric machines." S. LEES. February 16th.
- 3,884. "Combined gramophones and bioscopes for home study or amusement." G. ROBSON. February 16th.
- 3,915. "Automatically-controlled electric switches." F. P. CLIFFORD. February 16th.
- 3,906. "Renewable electric incandescent lamps." E. M. BAILEY and W. FLEWS. February 16th.
- 3,919. "Winding methods for rotating magnet coils." "VULKAN" MASCHINENFABRIK AKT.-GES. (Convention date, February 20th, 1911, Germany.) February 16th. (Complete.)

- 3,924. "Means for the electrical transmission of synchronous movements." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, October 13th, 1911, Germany.) February 16th. (Complete.)
- 3,941. "Governing mechanism." WARWICK MACHINERY CO. (1908), LTD. (Allgemeine Elektrizitäts Ges., Germany.) February 16th.
- 3,946. "Dynamo-electric machines." J. GEISLINGER and E. SCHLURICK. (Convention date, May 29th, 1911, Germany.) February 16th. (Complete.)
- 3,952. "Gas and electric light controllers." W. L. SPARKS. February 16th.
- 3,966. "Apparatus for the operation of electrical clocks by electrical waves." F. SCHNEIDER. February 16th. (Complete.)
- 3,979. "Electrolytic apparatus." J. T. NIBLETT. (Divided application on 1,671/12 January 20th.) February 16th. (Complete.)
- 3,980. "Electric cables for automatic telephone exchanges, selectors and the like." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) Divided application on 16,868/11, July 22nd.) February 16th. (Complete.)
- 4,022. "Electrical regulation or control of the flow or delivery of sewage and other liquids." A. BYRON and L. F. MOUNTFORD. February 17th.
- 4,041. "Carbon electrodes." C. C. GOW. February 17th.
- 4,061. "Telegraphy and telephony by submarine cables, long distance overhead lines and the like." J. SCHIESSLER. (Convention date, February 18th, 1911, Austria.) February 17th. (Complete.)
- 4,067. "Telephony." S. G. BROWN. February 17th.
- 4,073. "Electrical installations for lighting, heating and ventilating railway carriages and for similar purposes." J. STONE & Co., LTD., and A. H. DARKER. February 17th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

- PRODUCTION OF SOUND. Evershed & Vignoles, Ltd., and R. Evershed. 24,278. REPRODUCTION OF SOUND BY ELECTRICAL MEANS. S. G. BROWN. 29,833. December 22nd.
- CIRCUIT-BREAKING SAFETY DEVICES FOR ELECTRICAL APPARATUS AND THE LIKE. Evershed & Vignoles, Ltd., and R. Evershed. 29,880. December 23rd.

### 1911.

- ELECTRIC SAFETY HAND-LAMPS. Simplex Conduits, Ltd., and C. G. M. Bennett. 19,317. August 30th.
- METHOD OF AND APPARATUS FOR STARTING MULTI-CYLINDER COMBUSTION ENGINES. Firm of Robert Bosch. 20,623. September 18th. (September 22nd, 1910. Addition to No. 13,691 of 1910.)
- ARO LAMPS. Körting & Mathiesen Akt.-Ges. 27,669. December 9th. (April 25th, 1911.)
- ELECTRIC ARO LAMPS. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) 1,527. January 20th.
- TELEPHONIC HEARING APPLIANCES FOR DEAF PERSONS. V. D. EVANS. 3,424. February 10th.
- METHODS OF AND APPARATUS FOR THE ELECTRIC LIGHTING OF MOTOR-CARS AND OTHER PURPOSES. Van Raden & Co. and M. Metz. 3,549. February 13th.
- ELECTRIC CLOCKS. C. Fery. 4,889. February 27th. (March 1st, 1910.)
- MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. "Z" Electric Lamp Manufacturing Co. and F. Hoge. 5,061. February 28th.
- ELECTRICALLY-CONTROLLED FASTENINGS FOR RAILWAY CARRIAGE AND OTHER DOORS. C. R. Allen. 5,427. March 4th.
- TELL-TALE OR ELECTRICAL SUPERVISION APPARATUS FOR WATCHMEN AND THE LIKE. A. Goldstein. 6,157. March 11th.
- CONTROL OF ELECTRIC MOTORS. Allgemeine Elektrizitäts Ges. 6,557. March 15th. (March 15th, 1910.)
- MEANS FOR AUTOMATICALLY CONTROLLING HEAT IN ELECTRIC HEATING APPARATUS. R. Nightingall. 15,898. July 8th.
- WIND-POWER ELECTRIC STORAGE INSTALLATION OR APPARATUS. W. P. Perry. 17,006. July 25th. (Divided application on No. 13,430 of 1911, June 6th.)
- MEANS FOR CONTROLLING AND ACTUATING APPARATUS BY ELECTROMAGNETIC RADIATIONS. R. Wirth, S. Beck and W. Knauss. 18,879. August 19th.
- EXCESS-CURRENT SWITCHES. Felten & Guillaume Carlswerk Akt.-Ges. 19,592. August 30th. (August 30th, 1910.)
- INSULATION OF ELECTRIC CONDUCTORS. British Westinghouse Electric and Manufacturing Co., K. C. Randall, S. W. Farnsworth and C. L. Fortescue. 20,659. September 19th.
- REGULABLE ELECTRIC RESISTANCES. A. E. Naumann. 20,833. September 20th.
- HAND COMBINATION TELEPHONIC INSTRUMENTS. E. H. Grahame. 21,351. September 27th.
- STORAGE BATTERY ELECTRODES. H. C. Hubbell. 21,783. October 3rd.
- ELECTRIC SWITCHES. H. F. Bigge and F. R. Butt. 22,547. October 12th.
- ARRANGEMENTS FOR THE WORKING IN PARALLEL OF SYNCHRONOUS AND ASYNCHRONOUS ALTERNATING-CURRENT GENERATORS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 28,263. December 15th.

**Store Lighting.**—We have received from MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., an illustration of the toy department of a large Sheffield departmental store illuminated by means of tantalum lamps in Holophane Stiletto reflectors. The exceptional number of articles displayed can be easily distinguished in the photograph, which was taken with the lamps switched on. Illumination is undoubtedly essential for effective display, but glare is distinctly offensive. It is claimed that with the perfect diffusion obtained from Holophane glassware, the lighting is evenly distributed, and glare is eliminated. Messrs. Siemens Bros. Dynamo Works, Ltd., who supplied the lamps and glassware for the installation are prepared to place the services of their illuminating engineers at the disposal of contractors interested in this system of illumination with a view to assisting them to prepare complete and satisfactory schemes.



# THE ELECTRICAL REVIEW.

VOL. LXX.

MARCH 8, 1912.

No. 1,789.

## ELECTRICAL REVIEW.

## THE MINERS' STRIKE.

Vol. LXX.]	CONTENTS: March 8, 1912.	[No. 1789.	Page
The Miners' Strike ...	...	...	369
New Western Section of the I.E.E. ...	...	...	370
Messrs. Crossley Bros.' Dividend and Labour Troubles ...	...	...	371
Labour Problems ...	...	...	371
The "Selandia" ( <i>illus.</i> ) ...	...	...	371
Correspondence:—			
Notes on Rheostats ...	...	...	372
Our Progressing Manufacturing Firms ...	...	...	372
Electric Cooking and Heating ...	...	...	372
Earthing Mains ...	...	...	372
Legal ...	...	...	373
Business Notes ...	...	...	376
Notes ...	...	...	382
City Notes ...	...	...	386
New Engineer-in-Chief to the Post Office ( <i>illus.</i> ) ...	...	...	387
Electric Winding on the Rand ( <i>illus.</i> ) ...	...	...	388
Reviews ...	...	...	390
Electricity and Coal Supply ...	...	...	391
Electric Tramway and Railway Traffic Returns ...	...	...	398
Stocks and Shares ...	...	...	398
Share List of Electrical Companies ...	...	...	399
Exports and Imports of Electrical Goods during Jan., 1912 ...	...	...	401
Metal Market.—Fluctuations in February ...	...	...	402
Proceedings of Institutions:—			
Automatic Reversible Battery Boosters ...	...	...	402
Electric Driving in Textile Factories ...	...	...	403
Notes on Recent Electric Railway Developments ...	...	...	404
An Electrically-Operated Briquetting Plant ( <i>illus.</i> ) ...	...	...	405
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	...	406
New Patents Applied For, 1912 ...	...	...	408
Abstracts of Published Specifications ...	...	...	408
Contractors' Column ...	Advertisement pages xxiv and xxvi		

As we all along anticipated, the threatened strike of miners in Great Britain has now become actual fact, and important history is now in course of being made. On the evening of Thursday last week, the whole of the miners employed in the collieries of Great Britain laid down their tools, with the result that after the lapse of barely a week, practically every trade in the country is either at a standstill or seriously handicapped, and suffering of innocent persons is broadcast over the land. And why? All because a certain class of labourer cannot have all his own way; because he cannot have any wage he likes to demand, irrespective of the amount of work he is prepared to do! In other words, although we are told that the strike is to secure a minimum wage for poor hard-working and starving miners, who cannot, under any circumstances, earn more than a shilling or two per day, in very truth, the inner meaning of the strike is to determine who shall be the masters—workmen or employers? For many years past the miner has had very much more to say in the management of the mines than would be allowed to the worker in any other industry. The mine manager, too, has had to bite his lip and knuckle under at the dictation of the local miners' officials for so long now that he has almost become used to it, and is never surprised at any action they may take or any demand that they may make, and it is undoubtedly this—one is almost inclined to call it "weakness," but it is scarcely that; say rather—*laissez faire* policy that has made the Socialistic miners' leaders believe that they have only to command to get anything they ask for under the threat of a strike.

For days past we have seen the daily Press urging the owners to grant these poor men the minimum wage; then again demanding that the Government must force the owners to give all that the men require. Truth and fact have both been ignored; but it is only a question of time before public opinion, ever on the side of fair play and justice, will condemn the attitude of the leaders and the miners for supporting them. The truth is that the owners *have never* refused to grant the minimum wage, and the fact is that many of the workmen could earn more than the minimum they now ask for if they did an honest fair day's work every day they *could* work. That there may be individual cases of hardship we do not for one moment deny, but these are the exceptions that prove the rule, and we very much doubt whether, if the workman presented his case to the management in a proper manner, it would not be rectified. As a rule colliery managers and owners are not the hard-hearted slave-drivers that the workmen have tried to persuade the public to believe they are. The risk of having the colliery laid idle through a dispute with a workman over a few shillings, even for a single day, is too great for any manager lightly to ignore any such request—and on this score the Union is all-powerful.

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly's).

1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.



What the owners have refused to grant is to pay a minimum wage irrespective of the ability or inclination to earn such wage, and we doubt if there is a single person—even though he be a rabid Socialist—who will cavil at this refusal. No man can expect to get something for nothing—even the coalowner who rides about in a motor-car, about whom we have heard so much lately, has to do something for what he gets; and if the miner has to be assured of a certain minimum wage each time he descends the mine, without any guarantee on his part as to the amount of work he shall perform, the whole nation may as well shut up shop, for it naturally follows that every other class of workman would expect the same consideration, and bankruptcy would follow. Again, the owners have stated over and over again that they are willing to consider any details for improving machinery to regulate wages in abnormal places. The miners have never even suggested that the existing machinery can be improved, and hence one can only conclude that the abnormal place question is not so severe as we have been—*vide* the daily Press—led to believe. In spite, however, of all the injustice and unfairness of the miners' claims, the Federated employers have honestly tried to devise machinery to regulate both the abnormal place and minimum wage questions, and no fair-minded man can honestly say that their regulations were in any way unreasonable; but the leaders not only refused them, but they refused to place the terms before the miners to vote for their acceptance or rejection. So far as South Wales and Scotland are concerned, the complaint of the owners is that they have definite legal agreements with their workmen which have yet some years to run, and naturally they want some assurance, before they agree to put these on one side and accept new ones, that they will be honoured by the workmen. In short, they are sick to death of their everlasting demands and their failure to stick to their bargains. To the miner a bargain is a bargain only just as long as it suits him, or is in his favour. Another complaint, and a serious one, of all the coal-owners, is the amount of time lost by the miner, hence the insertion of the clause in the terms offered by the federated owners to the effect that if a workman did not attend 80 per cent. of the time the pit worked each week, unless prevented by illness or other justifiable cause, he was not to be entitled to be paid the minimum wage. It is a well-known fact that the time lost increases with increased wages.

To the man in the street it may—and does—appear difficult to understand the objection to a minimum rate of wages, as in most other industries there is, as a rule, a minimum daily rate, but mining is different to every other industry, inasmuch as the area covered by the workings of a coal mine make official supervision in regard to the amount of work done by each miner difficult, as the attention of the officials is fully occupied by looking to the safety of the workmen and regulating the traffic of tubs to and from the shaft. Again, in other industries experience teaches how long a workman may be occupied in doing a certain class of work, especially on a machine, and hence a foreman is easily able to judge whether a workman has done a good or fair day's work. Moreover, in many trades the good workman gets no more than his poor mate, which balances up the cost of the day's output, so to speak, but in the case of the coal-

getter he might advance a dozen excuses in the shape of some complaint regarding gas, roof, hardness of the coal, shortness of tubs, or supporting timber, &c., and no one could very well positively contradict him. We have already seen in the engineering trade the tendency of workmen to slack off when guaranteed a minimum wage, and the coal-owners have very good reasons for anticipating a like result.

As for Government interference, we think the matter may be safely left in the hands of Mr. Asquith and his colleagues, and whilst they, in our opinion, have pandered to the men just a little more than their case justified, we are glad to note, from the speech of Mr. Asquith in the House of Commons on Monday, that there is to be no compulsion put upon the owners to pay the minimum wage without some guarantee that there shall be no diminution of output. This, we think, is all the coal-owner asks for, but, at the same time, he will be justified now in also asking that there shall be some guarantee of peace before he agrees to open his mine. We are pleased to see that public sympathy is rapidly changing from the miner to the owner, as the public are really suffering, and are, we think, beginning to see that the whole strike has been brought about, not so much as the result of long suffering and hardships on the miners' part, but rather by an attempt by the Socialistic miners' leaders to force Socialism, or, at any rate, nationalisation of the mines, as a forerunner to the nationalisation of all the means of production and distribution. What will happen in the near future none can foretell; the hand of devastation is fast closing over the land, and the most we can hope for is that the present good temper will prevail, and that the end will come soon, and bring with it a lasting peace.

---

#### The Western Local Section.

ON Monday last we were privileged to be present at the birth of the latest addition to the family of the I.E.E.—the Western Local Section. As Prof. Wertheimer remarked, an infant that gave a dinner-party on its first birthday must be admitted to be a very lusty one; but there are other features which constitute it, though the last, by no means the least promising of the seven Local Sections. The area to be covered by its operations is very large, and already contains about 126 members of the Institution; it is hoped that this number will quickly be increased to 250, as there are many eligible electrical engineers in the West who have not hitherto thought it worth while to join the I.E.E., in view of their remoteness from any meeting centre. The meetings of the new Section will be held not only at Bristol and Cardiff, but wherever it may be deemed advisable. Further, not only is the chairman, Mr. W. A. Chamen, exceptionally well qualified for that position, besides having had the advantage of presiding over the Glasgow Local Section, but he is admirably supported by the hard-working vice-chairman, Mr. H. Faraday Proctor, and the indefatigable joint hon. secretaries, Mr. W. Collins, at Bristol, and Mr. S. B. Haslam, at Cardiff, and all vie with one another in their enthusiasm and determination to make the Section a success. The inaugural meeting, opened by the President, Mr. Ferranti, was conducted with a business-like dispatch which augurs well for the future conduct of affairs, and the inevitable dinner which followed was equally successful, in spite of the erratic performance of the local railways, by which several would-be guests were prevented from attending. We report the proceedings elsewhere in this issue. Passing reference was made to the initial steps that were taken two years ago, admittedly with a view to the formation of the Local Section, upon which, it will be remembered, we felt it our duty to comment somewhat severely; we cannot agree with the chairman that no soreness was left by the methods then adopted, but we are sure that there is no member of the Institution who will not join with us in the warmest welcome to the new Section and the best wishes for its future prosperity.



**Messrs.  
Crossley Bros.'  
Dividend and  
Labour  
Troubles.**

AT the annual meeting of Messrs. Crossley Bros., the chairman (Sir Kenneth Crossley), in commenting on the smallness of the dividend—namely, 4 per cent. on the ordinary shares—attributed to labour troubles the small amount of profit made during the second half of the year. At the busiest period of the year, 650 of their best machine-men and fitters ceased work. It might be thought, said the chairman, that they ought to have consented to some form of mediation. He was of the opinion, however, that unless the company were prepared to resign their position as members of the Employers' Association, and unless they were prepared to have every little difference of opinion or grievance the subject of a sudden strike, it was impossible for them to have any discussion whatever as to the matter in dispute until the men returned to work. They were fighting for the principle of negotiation first and the strike afterwards. So long as the present board were in control they would not give any encouragement to the barbarous methods of the sudden strike. If this country was to retain its position in the engineering world, employers must further strengthen themselves and their industries by absolute loyalty to each other, even though it might mean some temporary sacrifices. Mere rates of wages were not everything from the employer's point of view, and it was the employer's business to say how he wanted the work done. The workers must recognise that the comparative price of labour to do that work depended ultimately, more than anything else, on individual or collective merit, and that it was up to the workers to be worth more in order to get more by helping progress and not hindering it; then a great step forward would be made towards better conditions all round.

**Labour  
Problems.**

THE present coal strike has had the effect of directing the attention of manufacturers and others to the principles of co-partnership as a remedy for labour unrest. Whilst we are thoroughly in agreement with the principles of co-partnership, we realise that from the workmen's point of view there is not a great deal in this, because, although much is made of the fact that whilst the workmen receive individually only a fraction of the wages which the individual employer receives, it is, we believe, appreciated by the leaders of labour that if the whole of the employers' salaries were divided up among the workmen, it would not amount to very much per man per annum. The reason for this is, of course, that the workmen's wages are already paid out of the profits, and the wages of labour are, in the aggregate, many times the salaries of the employers. We are pleased, however, to note that the question of co-partnership is being seriously taken up, and a non-party petition signed by about 120 members of Parliament has been presented to the Prime Minister, recommending the appointment of a Royal Commission to inquire how far the principle of co-partnership could be applied to the industries of the country. It is interesting to note that of those who have signed the petition only about 30 are Liberal and 90 Unionist members, and we should not be surprised to learn that very few of the Labour members have identified themselves with this movement.

Whilst we are on this subject, the following letter read by Sir William Mather at the annual meeting of the shareholders of Mather & Platt, Ltd., will be of interest. Sir William Mather, as is well known, has taken a very great interest in labour problems, and few employers in England are better qualified than he to express an opinion on the subject:—

"When we look at the condition of England, at this moment threatened with a catastrophe through internecine strife between capital and labour in one industry alone, capable of arresting the nation's progress and destroying the work of a century by withholding for an indefinite period the supply of coal—greatest of all Nature's bounteous gifts in the British Isles—we must admit that the methods of barbarism are not extinct, even among us, whose civilisation is assumed to be the highest in the world."

**THE "SELANDIA."**

THROUGH the courtesy of the owners, the East Asiatic Co., and of Messrs. Burmeister & Wain, the builders, we were enabled last week to inspect the most recent and largest example of a Diesel-engined vessel which has, so far, been brought into commercial use, viz., the motor-ship *Selandia*, now on a voyage to the East. Her gross tonnage is about 5,000 tons, and her displacement nearly 10,000 tons; she is propelled by two eight-cylinder Burmeister and Wain "Diesel" type engines, each developing some 1,250 B.H.P. at a speed of 140 R.P.M., and that both owners and builders are confident of her behaviour, may be gathered from the fact that the former have two similar vessels building for them—one in Denmark and one on the Clyde—while Messrs. Burmeister and Wain are understood to have booked a number of orders for such vessels.

All this augurs well for the Diesel engine. If the naturally conservative shipowner is becoming convinced that he can trust a valuable ship, and even more valuable cargo, on a voyage to the Far East and back, to the tender mercies of a pair of large Diesel oil engines, there is good reason to believe that the old arguments as to the uncertain behaviour of such engines during long periods of continuous running in the central station will disappear.

The main engines each consist of two groups of four 20½ in. diam. × 28¾ in.-stroke cylinders mounted on an enclosed crank chamber, with the valve-driving and control gear between the groups. Each cylinder group drives cranks disposed at 180° to each other, but the crank groups are at 90° to each other. Each of the main engines requires about 500 lb. of oil per hour, and the ship is provided with double-bottom fuel storage amounting to 900 tons.

Although there is nothing electrical about the main engines except the small barring motors for turning the crankshafts over, and they can, in emergency, obtain compressed air for starting, &c., from a steam-driven Reavell compressor worked in conjunction with an oil-fired donkey boiler, yet the ship, as a whole, is of considerable interest to electrical folks, and is equipped with electrical auxiliaries practically throughout.

Duplicate 200-H.P. Burmeister & Wain "Diesel" type engines are installed, one on either side of the engine room, coupled in each case to a 220-volt D.C. dynamo and three-stage air compressor in tandem. One of these sets is normally in use for electric lighting and air compressing, but both are required to supply the electrical load when all the deck winches are being worked.

The compressors supply air at 300 lb. pressure to storage tanks in the main engine room for reversing purposes and for the compressors on the main engines, which recompress it to the 900 lb. ordinarily required for starting and fuel-injection purposes.

In connection with the electrical supply a fine marble panel switchboard is provided at the forward end of the engine room on the level of the first engine platform. It contains main generator panels on either side and intermediate panels for motor circuits, lighting, wireless telegraph, &c.

The panels are separated from the bulkhead by some feet, and ample space is provided for working behind the board.

The lighting of the ship is carried out at 110 volts, and to obtain this pressure duplicate motor-generators are installed under the switch gallery. The motors are all supplied at 220 volts, and amongst the engine room auxiliaries which are motor driven, may be mentioned duplicate circulating pumps for cylinder cooling water, duplicate oil pumps for the forced lubrication of main and auxiliary engines, a CO<sub>2</sub> refrigerator engine, and two water pumps—the latter three-throw with bilge, cold and hot water barrels.

For small repairs there are provided a lathe and drilling machine, driven by a motor fixed to the bulkhead.

Some of the engine room auxiliaries are operated by compressed air, notably a ballast pump and oil fuel pump for drawing from the double bottom storage.

It may be mentioned that the donkey boiler supplies steam for heating the stored fuel in cold weather, and thus reducing it to the necessary consistency for engine use: the



steam-driven compressor supplied from the boiler is intended solely for emergency use.

The deck machinery is all electrically operated, and includes a Hele-Shaw-Martineau electro-hydraulic steering gear, a Clarke-Chapman anchor-windlass, and a dozen deck winches for working the cargo.

In all the cases we noticed the motor starters were bracketed to the motors.

Compared with the usual steam-driven vessel as regards machinery space, it may be said that the ship has an engine room, but no stokeholds; and as the engine room is painted white, the machinery pale blue and the pipes brown, one receives an impression of cleanliness and light which is often missing in the usual ship's engine room.

The *Selandia* has no regulation funnel, and this looks odd at first: the engine exhausts are, however, led up one of the hollow steel masts, slots being provided for their emergence about half way up. We shall look forward with interest to the performance of the *Selandia*, and her sister ships, in which so much depends on the reliability of the large Diesel engine and electrically operated auxiliary machinery.

### CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

#### Notes on Rheostats.

Referring to the article under the above heading, which appeared in your publication of February 23rd, I entirely agree with "B. K." regarding the very doubtful advantages of overload attachments of a certain pattern. The writer of the article had, no doubt, in his mind overload attachments of the hinged type, where a brush affixed to the hinged armature short-circuits the no-volt spool when the armature is attracted, due to an overload occurring on the motor. It is quite true that the merits of this type of overload (generally in use) are of a very doubtful nature, owing to its tendency to stick and also its uncertain contact. The first fault, of course, may cause serious damage to the motor, whereas the second does not short-circuit the no-volt spool properly. These marked and serious disadvantages are, however, entirely removed by the use of the "plunger" type of overload, where the action is positive and not impeded, and the circuit of the no-volt spool is not shorted but broken.

D. C.

#### Our Progressing Manufacturing Firms.

In answer to "Central Station," I may say that I saw the unintentional reply furnished by Mr. Hirst, of the General Electric Co., to my letter.

On February 12th I asked a second large "progressing" firm to quote me for the globes in question. As usual, a representative called and took dimensions, &c., but up to the time of writing I am still patiently awaiting their quotation. If their quotation takes so long, Heaven knows when I will obtain the globes!!!

Will some "business" firm answer this letter, when I will certainly get into communication with them and obtain my globes? Price is now quite a secondary consideration with me.

N. D. G.

March 1st, 1912.

I think, as a representative, it is my duty to reply to "Central Station's" letter in your issue of 1st inst.

I should like to point out, first, that I have had a good mechanical and electrical training (both practical and theoretical, as my various certificates can testify); when I say practical I do not mean standing in front of a switch-board or writing up the log-book.

"Central Station" mentions the time of delivery for an 8-H.P. three-phase motor, and a small firm securing the order. In this instance I should like to say that the large firms might have had too many contracts on hand, and it

would have been out of place to guarantee delivery to within a few days.

"Central Station" does not say whether the small company *did give* delivery of the motor, &c., within the 14 days: in my experience of small companies they will promise anything so as to secure orders.

I suppose by the new tungsten lamp at Olympia, "Central Station" is referring to the 20-watt Osram. I agree with him in this, but should also like to point out that it is only with certain voltages that the 20-watt lamp has given bother in deliveries. I am willing to sell him 500 20-watt 200-volt Osrams or as many 20-watt 230-volt Mazdas as he wishes. This sentence shows I *am not* a representative of the G.E.C.

Now, to come to the point which made me write this letter and mention in the first part of it my practical experience—"Central Station" mentions the traveller calling upon him and not being able to answer his questions relating to the three-phase motor. Did it not strike "Central Station" that the traveller might have been an expert in some other department of the electrical industry?

A man might be an expert in meters and not know anything about magazine flame arc lamps; there are also plenty of men who are expert in electric bells, but are at sea as regards electric lighting.

My experience in this matter was as follows:—I was calling upon a customer in order to try and sell him motors, meters, circuit-breakers, bell material—in fact, any article pertaining to electricity. All of a sudden he informed me that he wanted "Electrical Apparatus for Epilation." I had to give in there and then, that I did not know anything about the apparatus required. I made it my business to find out what epilation meant, and called the next day upon the customer and sold him the apparatus required.

I defy "Central Station" or any other electrical engineer to be able to argue right away with all the articles the G.E.C. list in their catalogues. Just fancy the branch manager answering questions on turbo-generators to one customer, flame arc lamps to a mains superintendent, central-battery telephone installations to the Post Office engineer, and then a motoring enthusiast comes in and broaches the subject of Oleo sparking plugs.

The above subjects are to be found in different sections of the G.E.C. catalogue.

I shall finish up by asking "Central Station" and others not to be too hard on the representative who cannot reply at once to their questions, but to try and explain to him what they know; he, in his turn, might be able to tell them something they did not know.

Representative.

#### Electric Cooking and Heating.

I am obliged to your various correspondents for their remarks on my letter some weeks ago, but I think they have somewhat missed the point. In the profession, we all know—or ought to know—what can be done; but the outside public, on behalf of one of whom I originally wrote, do not know and are not told. The recent Olympia Exhibition was intended to inform them, but to my mind, after several visits, it failed. What a fine advertisement some enterprising firm could make of the cry "out with the kitchen fire!"

J. W. Meares.

Calcutta, February 14th, 1912.

#### Earthing Mains.

Is there a Board of Trade regulation to the effect that on a L.T. single-phase network of, say, 200 volts, fed from substations with transformers, the L.T. outers of distributing mains must be effectively earthed in the substations?

Inquirer.

[The earthing regulation applies only to the neutral of a three-wire system: but the outer conductor of a two-wire concentric main may be earthed, with the approval of the Board of Trade.—Eds. E.R.]



## LEGAL.

## MECHANICAL STOKER PATENT APPEAL.

IN the Chancery Division on February 29th, Mr. Justice Parker heard an appeal by the owners of Taylor's Patent No. 28,475 of 1904 from an order made by the Comptroller-General of Patents, Designs, and Trade Marks for revocation of the patent under Sec. 27 of the Patents and Designs Act of 1907.

Mr. WALTER, K.C., who, with Mr. FLETCHER MOULTON, appeared in support of the appeal, said that the patent in question related to a mechanical underfeed stoker, and the order for revocation had been obtained by the managing director of Erith's Engineering Co., Ltd. The company were the owners of an old patent here, which would expire in 1913, but in November, 1898, there was certain litigation in the United States, in which it was established that a patent there for Taylor's invention would, if worked, be an infringement of a corresponding patent of Deeley's of 1899, under which Erith's Co. were working in this country. An arrangement was come to between the parties in America, under which Taylor's patent was worked there, and machines made under it were advertised and their sale pushed in this country. Erith's Co., however, intimated that user in this country would be an infringement of their own patent, and the exploitation of the patent in this country was accordingly discontinued. The application for revocation was then made on the ground that the manufacture was mainly outside the United Kingdom. Counsel submitted that the applicants really wanted to revoke Taylor's patent in order that they might use it without paying for a licence. There was a threat of proceedings if the patent was used and then an application to revoke for non-user.

Mr. MORITZ, for Mr. Erith, who had obtained the order for revocation, contended that the motives which prompted a person to obtain revocation were immaterial. All applicants for revocation had an object of their own to serve. What had happened in America had made it plain that the appellants could work their patent at a profit, and could do so in this country if they took a licence from Erith's company, as they had originally intended to do. Had a voluntary licence been refused, they could have obtained a compulsory licence under Sec. 27 of the Act.

The Solicitor-General (Sir John Simon) and Mr. Sargent appeared for the Board of Trade.

His LORDSHIP, in giving judgment, said that it was clear that the present owners of the patent, the Lenkes Engineering Co., Ltd., even before they acquired the patent from the executors of the patentee in 1908, had taken steps in this country with a view to exploiting the patent. In 1909 it was decided in the United States that Deeley's patent was the master patent, and in consequence exploitation in this country was dropped. The only persons who could enable the patent to be worked here were the owners of Deeley's patent, Erith's company, who owned that patent, and the applicant for revocation was their managing director. It was clearly in the interest of the owners of Deeley's patent not to grant a licence to the owners of Taylor's patent. The motives of an applicant for revocation might not be material, but under all the circumstances he held that there was reasonable ground for the inaction of the appellants as regards taking steps to work the patent in this country. Sec. 27 was passed for the benefit of the public, and not primarily to confer benefits on individuals, and in considering whether a case had been made out for revocation, the Court and the Comptroller were bound to look first at the interests of the public. Without laying down any general principle, it was impossible in this case to say that non-application by the appellants for a voluntary or compulsory licence was a sufficient reason for revoking their patent, when they could not have worked the patent in this country without risk of proceedings against them for infringement. He accordingly discharged the order for revocation, but without prejudice to a future application for revocation if there was any ground for it. The decision of the Comptroller was accordingly reversed, with costs; the costs, however, before the Comptroller being limited to 20 guineas.

## Re NATIONAL TELEPHONE CO.: DEBENTURE-HOLDERS' ACTION.

IN the Chancery Division, on February 29th and March 1st, Mr. Justice Joyce heard the debenture-holders' action of *In re the National Telephone Co., Ltd.—Avebury v. The Company*.

The action was instituted by Lord Avebury and Lord Wolverhampton, as trustees for the debenture-holders of the Telephone Co., to determine the question whether, upon the true construction of the trust-deed and an arrangement made for the sale of the company's undertaking to the Postmaster-General, the debenture-holders were to be paid off at par, or whether, as they claimed, they were entitled to their principal and interest plus a premium or bonus of 3 per cent. The amount in question was, roughly, about £50,000, and that sum had, by arrangement, when the matter was before the Court upon interlocutory motion, been set aside out of the proceeds of sale pending the decision of the action.

Mr. Younger, K.C., and Mr. H. Asquith argued the case on behalf of the plaintiffs, and Mr. Hughes, K.C., and Mr. Percy Wheeler for the company.

Mr. YOUNGER said that it was a friendly action, and neither side desired to embarrass the other. The sale of the company's undertaking took place on December 31st last, and counsel contended that, by a provision in the trust deed, in certain contingencies the debenture stock was to be paid off at a premium of 3 per cent. The question for the Court was whether these contingencies had arisen

Mr. JUSTICE JOYCE, in giving judgment, said that he was of opinion that when the motion came before the Court on December 29th the plaintiffs were entitled to the injunction they asked for, because under Clause 9 of the trust deed the company had no power to sell unless it came to an agreement with the plaintiffs under the terms of Clause 6. The events contemplated in Clause 6 had not happened, and that clause, therefore, did not apply. Then there was Clause 5. In view of that clause, and having regard to the fact that a winding-up resolution had been passed by the company, the order of December 29th was dissolved. That being so, it was impossible to decide in favour of the plaintiffs. The action, therefore, failed, and must be dismissed.

## ELECTRIC LIGHT COMPANY FINED.

AT Dulverton (Somerset) Sessions on February 28th, the Dulverton Electric Light Co. were summoned for employing two lads in the station on Sunday, January 7th. Mr. O. A. Skinner, Inspector of Factories, prosecuted, and the defendant company pleaded guilty. There was another charge of not filling in the necessary information on the abstract of the Act. Fines for each offence were imposed, the total sum being £4 4s. 6d. The lads were aged 15.

## WOOD v. CONNOLLY BROS., LTD.

IN the Chancery Division on March 1st, Mr. Justice Warrington heard a summons taken out in this debenture-holder's action, to vary the Master's certificate, which found that an equitable charge on real estate of the company (who carry on the business of cable makers at Blackley, Manchester) took priority of first mortgage debentures.

Mr. CLAYSON, K.C., who appeared with Mr. SARGANT for plaintiff and applicant on the summons, said the company purchased a piece of real estate for £1,100, of which £150 was paid as deposit, and the balance on completion. The company not having the money in hand to complete the purchase, a Mrs. O'Reilly advanced £1,000 to the company and obtained a charge on the real estate in priority to the debentures. Mrs. O'Reilly was not represented by any independent solicitor, but a solicitor was employed who was also the vendor's solicitor. He, rightly or wrongly, made no inquiries into the title of the real estate. The property was conveyed to the company, and the deeds were retained by the solicitor on behalf of Mrs. O'Reilly. Counsel submitted that the equitable charge ranked after the first debentures.

Mr. CAVE, K.C., who appeared with Mr. HARTREE for the executor of the late Mrs. O'Reilly, said it had been settled that an equitable mortgagee in possession of the title deeds took priority over the debenture-holders; and, further, the mortgagee stood in the place of the vendor, who would have had a lien over the property.

His LORDSHIP refused the application to vary the Master's certificate, and gave the plaintiff leave to appeal.

## WHITE v. EAST HAM BOROUGH COUNCIL.

IN the King's Bench Division, on February 29th, before Mr. Justice Darling and a special jury, Elizabeth White (widow) claimed damages in respect of the death of her husband, who was fatally injured in a collision between his van and an electric tram-car belonging to defendants. The accident happened in Barking Road, Plaistow, last September, and plaintiff now sued the Council under Lord Campbell's Act. Defendants denied an allegation of negligence on which the action was based and pleaded contributory negligence on the part of the late Mr. White, stating that he suddenly drove his van from behind a brewer's dray and that the accident was unavoidable. The jury eventually accepted this view and returned a verdict in favour of the East Ham Borough Council. Judgment was entered accordingly, with costs.

## SACKLETVALA v. MILLER, WILSON &amp; PEGG.

AT the Liverpool County Court, on February 29th, before Judge Shand, Shapurji Dorabji Sackletvala, engineer, of 6, Lombard Street, London, sued Messrs. Miller, Wilson & Pegg, consulting and electrical engineers, of Tower Buildings, Liverpool, and Manchester, for £20 balance of salary, £39 10s. commission, and £75, being three months' salary in lieu of notice, plaintiff alleging that he was wrongfully dismissed on August 2nd. The claim was reduced to £100 to bring it within the Court's jurisdiction.

Plaintiff's case was that he was engaged to manage the Indian department in the Manchester office of the firm, the intention being that, as soon as it was sufficiently developed, he was to proceed to Bombay and then open as agent a branch office for defendants. He began duty on April 3rd, 1909, at a salary of £25 per month, 10 per cent. commission on orders and expenses, and acted until dismissed in writing in August, 1911. In the interim he acted in the firm's interests in various business transactions, and secured orders for machinery for India, these being placed with Lancashire manufacturers.

Mr. H. W. WILSON, in giving evidence, said that when he first met plaintiff, the latter suggested the opening of an office in Bombay, with himself as representative. He mentioned that there would be a chance of the firm securing an appointment as con-



sulting engineers to a big Tata hydro-electric scheme in Bombay. Plaintiff was told that he could not be started as Bombay agent until the firm were officially appointed engineers to that scheme, and pending a settlement, plaintiff urged Mr. Wilson to find him some employment, as a position he held with the Westinghouse Co. was becoming untenable. It was then verbally agreed that plaintiff should undertake certain matters for Mr. Wilson personally, his salary being paid by Mr. Wilson.

MR. T. L. MILLER, another partner, denied that plaintiff was in any way connected with the firm. The Tata hydro-electric scheme, which was a bait held out for plaintiff's appointment, was a scheme involving a capital outlay of a million and a half, and the consulting engineer's fees would have come to between £30,000 and £40,000.

The Judge held that plaintiff, anxious to secure the appointment as Bombay representative, accepted temporary employment for Mr. Wilson in his individual capacity, and he therefore gave judgment for defendants, with costs.

#### IMPORTANT EDINBURGH TRAMWAY CASE.

LORD GUTHRIE, in the Court of Session, recently approved of issues for the trial by jury of an action by a lady against the Edinburgh and District Tramway Co. for £2,000 damages in respect of injuries. Last week the company asked the Court to grant leave to appeal to the House of Lords on the grounds that averments that the car was of faulty construction, in respect that it did not have a guard or screen at the side to prevent anyone slipping underneath, and that not only was the construction of such a guard easy, but that it was practically universally used upon all systems, should be struck out of the record as irrelevant, and should not be admitted to probation. Another ground was that the case should be tried by a judge and not by a judge and jury. Leave to appeal was granted, the Lord President remarking that this was a very important case for the defenders, because the decision affirmed that a jury selected from the ranks of ordinary citizens, with not much training in mechanics, should practically settle whether the whole system of the tramways in Edinburgh was right or wrong.

#### MARTIN v. DUBLIN UNITED TRAMWAYS CO., LTD.

BEFORE Mr. Justice Kenny and a special jury at Dublin last week, the trial of this action was brought to a close. The plaintiff, Thomas Martin, is a motor chaffeur in the service of Mr. Martin Fitzgerald, of Dundrun, Co. Dublin, and his claim was for £1,000 damages for personal injuries, which he alleged he sustained by reason of the negligence of the defendant company in the keeping of the roadway between the tramways in Baggot Street in good and proper repair, and in not having a protection round the base of the poles that stand in the centre of the roadway. On July 31st last the plaintiff was driving his master's motor-car into the city. The car was deflected by an elevated stone sett in the roadway, and it ran against the iron standard which sustains the overhead wires. The car was damaged, and the plaintiff sustained terrible injuries. The defendant company denied negligence, and said that the accident was the result of the defective condition of the car, in the steering of which the plaintiff lost control.

Counsel for the plaintiff—Messrs. J. P. Powell, K.C., James O'Connor, K.C., and Mr. E. A. Swayne (instructed by Mr. D. O. C. Miley).

For the defendant company—Serjeant Moriarty, Messrs. James Chambers, K.C., Mr. Henry Hanna, K.C., and Mr. E. A. Collins (instructed by Messrs. Casey, Clay and Collins).

MR. JUSTICE KENNY said the case for the plaintiff was that the poles were an obstruction to traffic, that they should have a protecting collar of stone at the base, and also that the company were negligent in having omitted to keep the setts on a level with the tram rail. The system, as it now existed, was constructed by the tramway company under the authority of an Act of Parliament, and had the approval of the Board of Trade and of the Corporation of Dublin. Mr. Murphy, the chairman of the company, had told them that before the poles were erected there was a discussion between him and the Corporation, as to whether the poles should be placed in the centre of the roadway or the footways on either side, and that the Corporation insisted upon having them placed in the centre. Undoubtedly, two setts, if not three, were slightly elevated at the point stated in the evidence. That was to a certain extent negligence. But it was for the jury to say whether or not the motor car swerved at that particular place. Neither the plaintiff himself, nor any other witness identified the spot at which the car swerved. They had the evidence of five witnesses that the plaintiff, immediately after the accident, told them that the steering gear had gone wrong, and that he lost control of the car. Two or three expert witnesses had stated that the elevated setts could not possibly have deflected the car out of its course. On the other hand, Mr. Harris, for the plaintiff, said that it was possible. In one sense, unquestionably, they were a source of danger. In a sense they were absolutely unprotected, but relatively they were a source of danger. Compare them with other obstacles in the streets which might be said to be a source of danger. There were electric light poles, public monuments, letter boxes, in the streets. They were obstacles to persons passing along the footpaths, but were they a source of danger? Was this pillar No. 3 in Baggot Street a source of danger to the public generally, or to the ordinary traffic of the streets? In order to find for the plaintiff, the jury should find that it was a danger to some person or thing.

The questions submitted to the jury and answered by them were:—

1. Were the setts at the points where the car is alleged to have swerved in good condition and repair at the time of the occurrence?—No.
2. Were they in a condition to the satisfaction of the road authority?—Yes.
3. Were they in good condition and so as not to be a danger or annoyance to ordinary traffic?—Yes, for motor traffic.
4. Did the car swerve in consequence of the defective condition of the setts?—No.
5. Was the swerve due to some defect or breakdown of the machinery of the car?—No.
6. Was the condition of the setts the direct and immediate cause of the accident?—No.
7. Could the plaintiff by reasonable care and skill have prevented the car from striking the pillar? (No answer).
8. If so, was the occurrence caused by such want of care and skill? (No answer).
9. Was the pillar a source of danger?—No, not to traffic under proper control.
10. Was the pillar properly protected?—Yes.
11. Would the accident have taken place if the pillar had not been there? (No answer).
12. Did the occurrence take place in consequence of the pillar not being protected by a stone collar at the base?—No.

MR. JUSTICE KENNY said this was a verdict for the defendant company, and he gave judgment accordingly, but stayed execution at the request of Mr. Powell till the first day of next term.

#### LONDON AND SOUTH-WESTERN RAILWAY CO. v. BRITISH VACUUM CLEANER CO.

THE House of Lords on March 4th, by four against three, dismissed the appeal in this case. The Court of Appeal had, by a majority, affirmed the validity of the patent (No. 17,433 of 1901. H. C. Booth, extraction of dust from carpets, &c.).

#### DEAN v. HACKNEY BOROUGH COUNCIL.

WITH further reference to this case, reported in our last issue, the evidence of the plaintiff and witnesses of the collision was to the effect that, at a short distance away, the pillar with the lamp unlighted could not be distinctly seen on the night of the accident, but this was disputed by witnesses for the Borough Council, who asserted that the pillar was distinctly discernible at a distance of over 60 yards. The arc lamp inspector stated that, having found a number of lamps in the road to be working unsatisfactorily, he traced the fault to No. 8 lamp, which he cut off, and then telephoned to the works for the repair staff.

MR. SPENCER HAWES, who investigated the matter for the Borough Council, explained that the lamp was No. 8 in a series of nine lamps connected to the outers of the three-wire direct-current mains, the pressure being 480 volts. The extinction of the lamp was due to a failure of the insulation of the cable in the pillar, which created an "earth" on the circuit and upset the distribution of pressure amongst all the lamps in the series sufficiently to disturb the lighting. The duty of the inspector, on noting the defective lighting would be to find and switch out the faulty lamp so as to restore the remaining lamps to their normal working conditions. There was no indication of any neglect on the part of the officials to take the usual precautions for assuring the efficient working of the lamps and the continuity of the lighting. Cable connectors in arc lamp pillars were liable to be affected by atmospheric conditions and vibration, and protective devices were expressly provided for the purpose of cutting off the current to the lamps in the event of faults or "earths" arising. It was practically impossible to avoid occasional extinctions of arc lamps, but in practice they were very few indeed.

On the conclusion of the arguments of counsel, JUDGE WILLIAMS said that the facts did not show negligence on the part either of the Borough Council or the taxi driver, but that as to the question of the alleged nuisance of an unlighted lamp standard, he would reserve his decision in order to consider the Acts and cases bearing thereon.

Judgment was delivered by JUDGE WILLIAMS on February 26th in the following terms:—"The plaintiff claims damages for personal injuries caused as alleged in his particulars by the negligence of the defendants in leaving an electric street lamp unlighted. It was also, without objection on the part of counsel for the defendants, contended that the mere fact that the lamp in question was not alight was sufficient to make the defendants liable. The plaintiff, a taxi-cab driver, when driving his cab at about 6 p.m. on November 15th came into collision with the lamp standard and the paving at its base, the lamp which was about 28 ft. high not being alight. I find, as a fact, that there was no negligence on the part of the plaintiff. The lamp had been lighted at the usual time, but owing to a "fuse" had been rightly and properly disconnected by the defendants' servant a short time before the accident. I find, as a fact, that there was no negligence on the part of the defendants. Counsel for the plaintiff relied on Sec. 81 of the Electric Lighting (Clauses) Act, 1899 (62 and 63 Vict. C. 19), and on the case of *Sadler v. South Stafford Tramway Co.* (23 Q.B. D. 17). Counsel for the defendants replied that their lighting powers were under an electric lighting order of 1893 (which was put in), and that, therefore, the Act of 1899 could not apply. It turned out, however, that Clause 75 of the order was identical in terms with Sec. 81 of the Act. Subsequently, it was ascertained that the order had nothing to do with the public lighting of streets by the defendants. The case of *Sadler v. South Staffordshire Tramway Co.* seems to me to be clearly distinguishable. The ground of the decision was that the Statutory powers of the defendants did not authorise them to run cars along the highway upon a tramway which was in a defec-



tive condition, and that they were liable for the injury caused to the plaintiff by a car which ran off the line owing to the defective condition of the tramway, although there was no negligence and no knowledge of the defect. In the present case there was no allegation of any defective condition. It seems that the powers and duties of the defendants with regard to street lighting are those prescribed by Sec. 130 of the Metropolis Management Act, 1855 (18 and 19 Vict., C. 120), which are transferred to Borough Councils by Sec. 4, of the London Government Act, 1899 (62 and 63 Vict., C. 14). In my opinion, Sec. 130 does not impose upon the defendants any absolute obligation to keep street lamps alight during the hours of darkness, and unless there has been negligence or improper conduct they are not liable for injury arising from the fact that a street lamp is unlighted. (See *Young v. Vestry of St. Mary, Islington*, 60 J.P. 821). Here there was no negligence or improper conduct, and therefore my judgment must be for the defendants. If leave to appeal is asked, I think that it should be granted with a stay of execution until the hearing of the appeal, if entered within 21 days. It is understood that another action in connection with this accident is likely to come before the High Courts.

## BUSINESS NOTES.

**Prices Advance.**—THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., of Birmingham, announce an increase of 5 per cent. in all net prices from February 26th, in consequence of advances in raw material and in wages.

MESSRS. SIEMENS BROTHERS DYNAMO WORKS, LTD., of Caxton House, Westminster, S.W., announce that owing to increased cost of raw materials and wages, all list prices for conduits and conduit fittings are advanced by 5 per cent. as from March 4th.

**"Angold" Street Lighting.**—Amongst recent important orders received by the G.E.C. for their "Angold" magazine flame arc lamps for public street illumination, are the following:—Glasgow, over 170 lamps; Liverpool, 74 lamps. Arc lamps of the same type have also recently been supplied, and they are now in use for similar purposes in the following districts:—Southwark, St. Pancras, Birmingham, Sunderland, Poplar, Manchester, Wednesbury, Perth, &c.

**Book Notices.**—*The Engineers' Year-Book of Engineering Formulae, Rules, Tables, Data and Memoranda.*—By H. R. Kempe, M.Inst.C.E. 1912. London: Crosby, Lockwood. Price 10s. 6d.—This well-known publication, which now enters on its nineteenth year, has been extended by over 100 pages; amongst the sections which have been entirely rewritten and enlarged are those on internal-combustion engines, and reinforced concrete construction; the sections on hydraulics and hydro-electric plant, and electrical engineering, have also been revised and extended or rewritten. The section on Electrical Engineering is very comprehensive, and of a thoroughly practical nature, the tables and specifications of the leading manufacturers, as well as of the British Engineering Standards Committee, being freely drawn upon. Where possible, actual working results are given, and the figures are well up to date. It is difficult to turn over the pages of this pocket encyclopædia of engineering without being compelled from time to time to pause and peruse the contents as some interesting illustration catches the eye. The list of contributors contains many well-known names; but we regret to see that several of these are followed by those objectionable initials "C.E." A man may be justly entitled to style himself "Civil Engineer," but no man is entitled to append initials to his name without the sanction of recognised authority, and the use of these letters (which usually signify that the user is *not* a member of the Institution of Civil Engineers) is very bad form.

*Spon's Architects' and Builders' Pocket-Book.* 1912. London: E. & F. N. Spon. Price 5s. net (two volumes).—This very handy reference book is again issued in two parts—the Memoranda Section, and the Prices and Diary Section. The former is alphabetically arranged, and consists of technical information and data of all kinds covered by the title, a very wide range. Under "electric lighting" there is a slip in the note on automatic electric lighting (page 98), the statement that a storage battery is unnecessary being wholly incorrect; and on the following page it is rashly stated that cooking by electricity cannot possibly compete in cost with more common methods. In view of the wide difference between carbon, tantalum and tungsten-filament lamps, it should be clearly stated which is under consideration at any time; the data show many signs of having been drawn up in the days of carbon-filament lamps, and subsequently inadequately touched up to meet the newer conditions. For example, in the last paragraph on page 111, we are told that the cost of the light "from the company's main" is roughly about 4d. per hour per 16-c.p. lamp; with electricity at 5d. per unit (it is generally cheaper) and tungsten lamps, the cost would be 7½d., not 4d. per hour. These remarks apply also to the price-book section, where the prices given in terms of carbon-filament lamps in some cases are quite useless under modern conditions—worse, they are misleading. The note on page 193 that certain prices can be reduced 50 per cent. if metallic-filament lamps are used, is a slovenly device; the whole of the prices affected by the change which has taken place

(but which the editors still seem to regard as a contingency only for the same course was followed in the previous edition) ought to be revised in the light of modern practice.

The London Telegraph Training College, Ltd. of Morse House, Earl's Court, S.W., has sent us an illustrated brochure describing the aims and equipment of the College, which provides instruction in all classes of telegraphy—land, cable, and wireless. During recent years a workshop class has been established, and has proved very popular, as well as useful to students. For the training of wireless operators a radio-telegraph station has been erected at Acton by the company, about six miles from headquarters, and equipped with standard apparatus—three different systems being represented. The large number of signed testimonials printed in the brochure bears witness to the efficiency of the training provided by the College.

"The Electrician Wireman's Pocket-Book and Electrical Contractors' Handbook." By A. W. Robinson and W. E. Warrilow. 1912. London: Electrician Printing and Publishing Co., Ltd. Price 5s. net.

"Neuerungen im Dampfkessel und Feuerungsbau." By Oberingenieur R. Klein. Zurich: Jean Frey.

"Journal of the Institution of Municipal Engineers." Vol. III No. 4. February, 1912. London: The Institution. Price 1s.

List of Additions to Lewis's Medical and Scientific Circulating Library, 136, Gower Street, W.C.

"The Physical Review." Vol. XXXIV, No. 1. Lancaster Pa.: The Review offices.

"Coals available for the Manufacture of Illuminating Gas." By A. H. White and Perry Barker. "The Uses of Peat for Fuel and Other Purposes." By Charles A. Davis. 1911. Washington: Government Printing Office.

"Atti della Associazione Elettrotecnica Italiana." January, 1912. Milan: Stucchi, Ceretti & C.

"Proceedings of the Physical Society of London." Vol. XXIV, Part 2. February 15th, 1912. London: Electrician Printing and Publishing Co., Ltd. Price 4s. net.

"Meteorological Instruments and Weather Forecasts." London: Percival Marshall & Co. Price 6d. net.

"Journal of the United States Artillery," with "Index to Current Military Literature." Vol. XXXVII, No. 1. January-February, 1912. Fort Monroe, Va.: Coast Artillery School Press.

"Liquid Fuel and its Apparatus." By William H. Booth. Price 8s. 6d. net. "American Electric Central Station Distribution Systems." By Harry B. Gear and Paul F. Williams. Price 12s. net. "The Seven Follies of Science." By John Phin. Price 5s. net. "An Introduction to the Study of Fuel." By F. J. Briscoe. Price 8s. 6d. net. "Direct and Alternating Current Manual." By Frederick Bedell and Clarence A. Pierce. Price 8s. net. 1912. London: Constable & Co., Ltd.

"Annual Report of the Smithsonian Institution for the Year ending June 30th, 1910." Washington: Government Printing Office.

"Wiring Calculations." By G. W. Lummis Paterson. 1912. London: Scott, Greenwood & Son. Price 5s. net.

"Transactions of the Illuminating Engineering Society," Vol. VII, No. 1, January, 1912. With index to Vol. VI. Easton, Pa.: Illuminating Engineering Society. Price 75 cents.

**Dissolutions and Liquidations.**—Mr. Charles F. Cape, the receiver and liquidator of THE LANGDON DAVIES MOTOR CO., LTD., announces that he has disposed of the business as a going concern, and is not responsible for anything that may be ordered on its behalf after March 2nd.

ELECTRICAL TRUST, LTD.—A meeting is called for April 10th at 13, Finsbury Circus, E.C., to hear an account of the winding up from the liquidator, Mr. H. Garton Ash.

POWER ACCESSORIES, LTD.—A meeting is called for April 10th at 31, Budge Row, E.C., to hear an account of the winding up from the liquidator, Mr. S. P. Hutton.

CROWN ENGINEERING CO., electrical and mechanical engineers, 78, Lees Road, Oldham.—Messrs. J. Lindsay, J. Bullivant and J. Barnes have dissolved partnership. Mr. Barnes attends to debts, &c.

VENABLES & CO., electricians, 99, Cricklewood Broadway, London, N.W.—Messrs. A. V. Cooke and J. H. Painter have dissolved partnership. Mr. Painter attends to debts, &c., and continues the business.

LUMEN FITTINGS CO., chandelier and electric fittings manufacturers, Bromsgrove Street, Birmingham.—Messrs. H. Hateley and J. H. Leather have dissolved partnership. Mr. Hateley attends to debts and continues the business under the same style.

ELECTRICAL SHOWS CO., LTD.—A meeting is called for April 3rd at 6, Old Jewry, E.C., to hear an account of the winding up from the liquidator, Mr. W. G. Blakemore.

MAGNETO CO., LTD.—A meeting is called for April 3rd at 35, Newhall Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. C. H. McPherson.

**Catalogues and Lists.**—MESSRS. B. B. ROWLAND AND CO., LTD., Climax Works, Reddish, near Manchester.—Twelve-page catalogue containing full particulars, with excellent half-tone pictures, of their "Universal" motor-driven grinding machines for heavy and medium-heavy work, both direct and indirect driving types being shown; the firm's combined face and universal grinding machines, combined disk and periphery wheel ditto, heavy double tool grinding machine, with centrifugal pump, direct-driven double tool grinder, are also similarly covered in the list, as well as grinding wheels and mountings for same. A price table of grinding wheels appears at the end of the catalogue.



**MESSRS. SIMPLEX CONDUITS, LTD.,** 116, Charing Cross Road, London, W.C.—Catalogue of 120 pages containing new editions of Sections T, D, U, and M. These four sections cover the following: T, conduits and fittings; D, distribution boards, switchgear and enclosed fuses; U, Simplex flexible wiring system; M, watertight fittings and reflectors for mills, factories, ships, &c. The lines in the last of these sections have been considerably extended. Illustrations abound, and there are brief descriptions with prices very clearly arranged. The tool section has also undergone considerable revision and extension. A number of pages are now devoted to illustrations and prices of various wiremen's tools required in everyday installation work, such as screwing tackle, speed counters, micrometer gauges, portable tube vices, &c. The fuse section has been added to by the inclusion of Hope's bi-metal fuse wire, the 5 and 10-ampere sizes of which are now ready for delivery. In the section dealing with reflectors, &c., for factory lighting, there are now included pressed steel reflectors manufactured under the Holophane-Benjamin patents. A separate four-page supplementary list (I. 1.) has also been issued, giving excellent illustrations, particulars, and prices of three standardised types of Simplex time switches, suitable for operating window lights and small signs, these switches being made under the Venner patents.

Mailing Card (No. 179), illustrating and giving prices of their electric hair dryer and particulars of their electric vibrator.

**MESSRS. R. H. PATTERSON & CO., LTD.,** Forth Street Works, Newcastle-on-Tyne.—March catalogue of new and second-hand machinery for sale or hire.

**THE BRITISH INSULATED AND HELSBY CABLES, LTD.,** Prescott.—Twenty-page catalogue, with a quite effective cover, containing full descriptive information regarding the Helsby patent condensers for electric lighting with alternating current. Diagrams of connections of the parallel and series systems accompany the explanatory matter, and the cost of installing the system, as compared with that of high-voltage lamps, is discussed. Prices are set out in detail for both series and parallel systems for various voltages.

**MESSRS. LAING, WHARTON, LTD.,** 7, Great Newport Street, London, W.C.—Circular illustrating a couple of dozen types of their "L.W." fancy cascade bead shades, with fully-tabulated prices, also showing their portable electric fountains.

**THE BRITISH ALUMINIUM CO., LTD.,** 109, Queen Victoria Street, London, E.C.—Leaflet No. 122, giving particulars relating to the application of aluminium for driving pulleys. The company supply not only pure aluminium in ingot and semi-manufactured form, but also aluminium alloys suitable for such castings as pulleys, jigs, &c. Copies of the leaflet will be sent to anyone interested.

**MR. H. W. TURNER,** Nutsford Vale Works, Manchester.—Illustrated folder containing a description of his patent portable unit quick-baking oven for armatures, field coils, &c., in which, it is claimed, any armature or other work less than 17½ in. in diameter may be baked within three hours. The oven can be heated by gas or paraffin assisted by waste products from the drying chamber.

**MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD.,** Tyssen Street, Dalston, London, N.E.—16-page catalogue, containing illustrations, some technical details, and prices of their various types of tantalum drawn-wire lamps, with round and pear-shaped bulbs, also traction type, tubular flame, candle and other lamps. Views of interiors, exteriors, ships, and trains where the lamps are in service are given.

**THE LUNA METAL-FILAMENT LAMP AGENCY,** whose new address is 5, Denmark Street, Charing Cross Road, W.C., have issued a price circular of their Luna metal-filament lamps.

**MESSRS. ADAMS MANUFACTURING CO., LTD.,** Bedford.—A 56-page catalogue of electric control gear applied to wood-working machinery has been issued. The ground covered may be gathered from the following titles of the nine chapters: General Considerations; Features Essential to Good Control Gear for Wood-working Machinery; Group Driving; Individual Driving; Speed Regulation; Shunt Speed Regulators; Series Speed Regulators; Auxiliary Machines; Concluding Remarks. The book is appropriately illustrated throughout with pictures of the Adams apparatus and of saw benches, planing machines, sand-papering machines, &c., fitted therewith. The catalogue should be of service to those interested in problems met with in the electrical driving of machinery of this class, and copies can be obtained by any reader.

**MESSRS. DUNCAN WATSON & CO.,** London.—The firm are prepared to issue to electric supply companies quantities of leaflets without their name, drawing attention, by illustration and otherwise, to the advantages which the householder can secure by making use of an electric vacuum cleaner at the time of spring-cleaning.

**Belgium.**—La Société des Cables et Caoutchoux de Selessin is the name of a new company which has just been formed at Selessin, with a capital of £10,000.

**Trade Announcements.**—Owing to increased business the DETROIT ENGINE WORKS have removed from Gamage Building to larger premises at 94, Hatton Garden, London, E.C.

**THE ELECTRICAL AND MOTOR CO.,** of 3, Horse Fair, Banbury, announce that their new telephone number is "112 Banbury."

**MESSRS. ALFRED HERBERT, LTD.,** of Coventry, have just opened an office at Atlas Chambers, King Street, Leeds.

**THE AUTOMATIC STANDARD SCREW CO., LTD.,** of Halifax, has been, for family reasons, converted into a private limited company, but there will be no alteration in the conduct and management of the business.

**MR. GEO. C. BOOTH,** electrician, has opened new premises at 27, Silver Street, Whitby.

**For Sale.**—The works and business of **MESSRS. ERNEST SCOTT & MOUNTAIN, LTD.,** Gateshead, are offered for sale as a going concern. See our advertisement pages to-day.

**White City Exhibition.**—This year's event at Shepherd's Bush will be an Anglo-Latin Exhibition. Products of and matters relating to France, Italy, Spain and Portugal, will be strongly in evidence, and there will also be a South American section. A special British section is being organised wherein the exhibits will be limited to such subjects as will afford new outlets for trade with the Latin races.

**Bankruptcy Proceedings.**—The affairs of Wm. Jacob Van Haytema, the promoter of the International Telegraphic Appliances, Ltd., came before Mr. Registrar Linklater on Tuesday, at the London Bankruptcy Court, upon the debtor's application for the Court's sanction to a scheme of arrangement. Mr. E. S. Grey, Official Receiver, reported that the debtor failed in October, 1907, with provable claims £14,076 and assets that had realised £387. A dividend of 7d. in the £ had been paid, and the debtor now proposed to pay a composition of 9s. 5d. in the £ in full satisfaction of his debts. A Dutch subject, the debtor formerly traded in partnership as a banker at Amsterdam, and there failed in 1892, paying about 4s. 8d. in the £ on liabilities of £25,000. He then came to this country, and commenced business as an agent for Dutch printing firms and for the sale on commission of Dutch paintings. In 1900 he founded the Dutch Art Gallery at 14, Grafton Street, W., and in 1905 he sold that business to the Dutch Gallery, Ltd., which was wound up in May, 1906. The debtor in the following September promoted the International Art Gallery, Ltd., which was a failure, and about the same time he was engaged in endeavouring to obtain on behalf of a syndicate a concession from the Dutch Government for the installation of wireless telegraphy to the Dutch East Indies. In June, 1906, he registered the International Telegraphic Appliances, Ltd., with the object of dealing in telegraphic appliances, but no business resulted, and the company was a failure. The debtor borrowed upwards of £5,000 in connection with the negotiations for the wireless installation. Creditors pressed for payment in September, 1907, and a receiving order was obtained on the petition of a creditor. The previous failure was alleged by the Official Receiver as an offence against the Act. His Honour, upon the application of Mr. Hansell, approved the scheme.

**CHARLES OLDHAM McMILLAN,** electrician and cycle dealer, 15, High Street, Portmadoc, Carnarvonshire.—The first meeting of creditors herein was held at Crypt Chambers, Chester, on February 29th. It appeared that the receiving order was made on the debtor's own petition, and according to the accounts filed, the liabilities amounted to £100 and the assets were estimated to produce £6, leaving a deficiency of £94. The failure was attributed to bad trade, sickness in family, big rent, and large family. It was decided to leave the matter in the hands of the Official Receiver.

**HARRY THORPE,** electrician and engineer, late of High Holborn and Holloway, London.—Application for debtor's discharge will be heard at Carey Street on March 26th.

## LIGHTING and POWER NOTES.

**Allington.**—As it is proposed to have the E.L. installed at the Castle at Allington, and the Quarries, the Maidstone T.C. has applied to the B. of T. for an order empowering it to supply the energy. Allington is outside the borough area.

**Argentina.**—Messrs. Buxton, Cassini & Co., on behalf of Brazilian capitalists, have obtained a 40 years' concession from the municipality of Pelotas, Rio Grande del Sud, for the erection of an electric plant in that town. The scheme includes both public and private lighting and about 34 km. of tramway. Several German firms also competed for the concession—*Review of the River Plate*.

**Bispham.**—The electric supply was available for the first time last week, the first building to be electrically lighted being a new church. There are already 80 consumers on the books. The scheme was estimated to cost £10,000. Ten miles of cable have already been laid, the price for current being 5d. per unit for lighting, and 2d. for heating and cooking. The plant has been installed under the supervision of Mr. J. W. Speight, consulting engineer, of St. Annes. The new destructor is an experiment; the crusher, supplied by the Lightning Dust Manipulator Co., of London, has a capacity of 30 to 40 tons a day; the machine, which is driven by a 40-H.P. motor, is the first of its kind in Lancashire. The cost of the machine and building was about £750. The generating plant comprises two 60-H.P. gas engines, and two suction plants, supplied by the National Gas Engine Co. The two 48-kw. dynamos are by Bruce Peebles, and the switchboard by Kelvin & White. The battery is of about 250 ampere-hours capacity, and was supplied by the Premier Co.

**Blackburn.**—A L.G.B. inquiry into the application of the T.C. to borrow £45,170 for the electricity undertaking was recently held. The Town Clerk said the basis of the scheme was to secure new machinery to meet a demand for increased power, much of which would have to be supplied a



considerable distance from the works. The Inspector said the total capacity of the electrical station was given as 4,342 KW., and the maximum demand upon it was 3,300 KW. That gave 1,000 KW.—25 per cent.—to spare. That was usually regarded as sufficient surplus. The Town Clerk replied that this was not a surplus for all purposes. The electrical engineer said another reason for the application was the lack of suitability of certain of the existing plant. The Inspector (surprised): The portion regarded as unsuitable amounts to quite one-half of the plant. The Town Clerk said before the plant was installed there was an acute controversy as to what kind of machinery should be purchased; a considerable number were in favour of rather old-fashioned plant, and a consulting engineer of eminence was called in and advised the buying of the plant in question. That was the unfortunate history behind the matter. Referring to the future demand upon the electrical plant, the Inspector said the electrical engineer had said there was a prospect of increasing the demand by 21,000 H.P.

It was stated that the aggregate losses on the undertaking amounted to £2,969 and profits to £13,506, leaving a balance of £10,537, of which £5,164 had been used for writing off assets for renewals and £5,373 was in hand, and that a full and complete scheme of extensions had not been drawn up as yet, leading the Inspector to remark "I don't think the Board will sanction the loan until you have done something definite in the matter." The inquiry lasted nearly three hours.

**Brighouse.**—The T.C. has decided to apply to the L.G.B. for sanction to borrow £3,000 for the provision of electric cables during the next three years.

**Brighton.**—The Lighting Committee of the T.C. has recommended the investment of £100 in the provision of electric laundry irons to be let out on the hire-purchase system for eight quarterly payments of 2s. 3d. for each iron.

The Council is also recommended to adopt a scheme of wiring consumers' premises on the hire-purchase system, the work to be done by contractors, who are to be paid 1d. per unit received by the Council over 4d. per unit for current consumed by the occupants of the premises wired on the above system.

**Burton-on-Trent.**—A L.G.B. inquiry was held on February 29th into the application of the T.C. for a loan of £15,000 for electricity purposes. There was no opposition.

**Cheltenham.**—The T.C. has decided to give private consumers now paying 5½d. and 4d. per unit under the maximum demand system the option of a flat rate of 5d. per unit.

**Colne.**—The T.C. has decided to accede to the request of the inmates of the Hartley Homes to supply them with electricity at a preferential rate. A request from the Colne Tradesmen's Association for the Electricity Committee to receive a deputation to consider the question of providing electricity at a cheaper rate was agreed to, though nothing will be decided at the present juncture.

**Continental Notes.**—**FRANCE.**—A comprehensive electric scheme has been planned and partly realised by the company styled the Electric de Loire-et-Cher. Its scope is to supply lighting, motive power and traction current to the extensive region lying on both sides the River Loire, constituting a quadrilateral, of which Châteauroux, Langeais, Chartres and Châteauneuf are the boundary points. The scheme is too large to be handled by a single company, and in consequence subsidiary companies have been formed to deal with separate portions of the scheme. One of the most important of these latter is the Société des Tramways et de l'Electricité de Touraine, which, taking over certain existing departmental electric lines will, by a number of extensions, provide cheap and rapid transport of agricultural products to Paris. The main lighting and power network is divided into some five sections. The Touraine section is temporarily served by a station at Ambroise, and some 14 or 15 communes have been supplied since April last. Others are being connected. From the new generating station which is being built three distribution lines will radiate: one descending the valley of the Indre and supplying the communes on each side of that river; another following the valley of the Loire, and a third the valley of the Loir. Another section will have Orleans for centre. A third section is situated in the valley of the Cher; a fourth embraces the region about Chartres; and a fifth, the district between Sauldre and Salles. In framing this scheme the parent company has had in view the provision of cheap current and its distribution direct to the regions concerned, by means of the subsidiary companies, which, with the tramway company, constitute its exclusive clientèle.

Considerable activity in the installation of electrical machinery is observable at various French ports. At Nantes the Chamber of Commerce has adopted a report advocating the installation of nine electric cranes; at Havre the local Chamber has decided to install even electric cranes and to utilise electric power for the goods-handling appliances at the goods warehouses at Graville; at La Rochelle the Chamber has referred to the Commission des Ports a scheme of underground distribution, with a view to providing light and power around the basin of La Rochelle-Pallice, and both at Marseilles and at Brest the municipal Councils are considering schemes for the introduction of electric services.—*La Revue Pratique.*

The establishment of a co-operative generating station at Breillecourt, in the department of the Aube, is proposed, which will supply seven neighbouring communes.

A new company has lately been formed at St. Mard (Seine-et-Marne) with a capital of £28,000, and the title La Compagnie Centrale Electrique de St. Mard-sous-Tammarten to establish a central electric lighting station in the town.

**HUNGARY.**—A hydro-electric scheme, to cost 8,000,000 kronen, is mooted, to utilise the waters of the Talabor and Magyaz rivers, in the county of Miramaros, in Upper Hungary. It is proposed to found a company to carry out the scheme.—*Zeit. f. d. ges. Turbinenwesen.*

**SPAIN.**—The rivalry which has broken out between the three large electricity companies which supply Barcelona, previously alluded to, is having for result a great reduction in the prices at which current is sold. A rate of 5 centimos the KW.-hour, and even lower, is being offered to large power consumers; to smaller users a quotation of 8 centimos the KW.-hour is offered; and to the general public 10 centimos. These prices are most advantageous to industrial consumers, and even the higher rates will stimulate the majority of minor industries in which Barcelona abounds.—*Industria e Invenções.*

**BELGIUM.**—An electric generating station is to be established at the new St. Barbe-et-Guillaume collieries at Eysden in the Campine district. It will contain two sets of Brown-Boveri steam turbines and alternators of 2,000-KW. capacity each.

**Cuba.**—The *Gaceta Oficial* of Havana has published a decree authorising the T.C. of Palma Soriano, in the Province of Oriente, to take the necessary dispositions for the establishment of a central generating station for the production of light and motive power.—*La Lumière Electrique.*

**Darwen.**—The question of driving mills by electricity is not to be allowed to lapse in Darwen, despite the fact that negotiations between the Corporation and the pending lessees of a proposed new mill for electric power have failed. The owners of another mill now worked by steam have approached the Corporation for terms, and if these can be arranged electric driving will be resorted to.

**Dundee.**—The Corporation Electricity Committee last week approved of further concessions to consumers proposed by Mr. H. Richardson, the engineer. A member pointed out that, under the new House Letting Act probably all the stairs in the city would be lighted, that this was the time for the Electricity Committee to make a bid for the work, and that if the C.P. was increased it would do the department a great deal of good. In the course of further discussion, Mr. Richardson said it was time people were getting conveniences to use electricity more widely; he believed it was as cheap as gas. The town clerk having hinted that there was a likelihood of additional rating on the department, Mr. Richardson said this was most unfair. Why was it, he asked, that an electricity consumer should pay 2s. 10d. against a little over 9d. by a gas consumer? A member retorted, "Because of Parliamentary powers"; and to this the engineer replied that Parliamentary powers were not always correct, morally speaking. The revenue of the electricity department was only one-third of that of the gas department, and yet both departments paid practically the same in taxes. In the course of the discussion, it was pointed out that Aberdeen was bringing out a prov. order to put electricity on the same basis as gas.

At the same meeting it was agreed to adopt Mr. Richardson's suggestion that to meet the increasing demands on the department a new sub-station be erected in the Dock Street area. In his report the engineer pointed out emphatically that the experience of last winter and other considerations rendered it imperative that additional sub-station machinery and cables should be installed.

The "maximum demand" system of charging for current has apparently ruffled some one's feelings. A member of the Dundee Corporation Electricity Committee, referring to it the other day, said he had heard it described as the "maximum bedamned" system.

**Dudley.**—A new feeder cable is to be run from the generating station to Hall Street, and also from the generating station to Eve Hill, at an estimated cost of £4,012, owing to the existing cables being fully loaded.

**Eastbourne.**—The electrical engineer reports that the turbo-alternator recently developed vibration, which necessitated the plant being shut down. On examination, some of the blades were found to be distorted and the shaft out of truth. These matters were put right, but several days later the same excessive vibration occurred. The Electricity Committee has decided to leave the matter in the hands of the engineer, and has desired him to report upon the advisability of purchasing additional plant.

**Eccles.**—Extensions are to be carried out at the Corporation Electricity Works at an estimated cost of £3,193.

**Epsom.**—For the three quarters ending December 31st, 1911, the gross profit on the electricity undertaking is given as £436 and the net profit as £263. The Lighting Committee recommended a reduction from £4 10s. to £4 per lamp for the 429 public lamps, this meaning a saving of £214 10s. on the lighting account. The B. of T. has sanctioned the supply of electricity to certain premises at Ewell.

**Exhall.**—The P.C. has approached the Coventry T.C. with reference to a supply of current for the parish, and the Corporation has offered to give a supply on a guaranteed revenue for five years equal to 20 per cent. on the cost—£1,256 per annum. The capital outlay for mains, sub-stations, duplicate high-tension mains, &c., is estimated at £6,280.

**Glasgow.**—The T.C. has sanctioned the Electricity Committee acquiring ground in Maryhill and Trongate districts, for the purpose of erecting two sub-stations for transforming machinery.



**Grimsby.**—The Corporation electricity department has recently opened temporary showrooms in one of the main streets of the town. The premises have been fitted up in an artistic manner, and stocked with apparatus loaned by the contractors in the town, and arrangements are made so that any consumer wishing to purchase apparatus has his order executed by the contractor who has loaned it. The showrooms have been much admired, and the reflected-lighting system appears to be generally approved. Electric cooking is being actively pushed, the "Tricity" cooker being the one chosen for special attention. Mr. F. S. Grogan, of the Berry Construction Co., gave demonstrations on four days last week, the room being packed at each demonstration with people, who keenly followed his very able lecture. Various other devices and fittings are shown, and the final touch is added with an electric flashing sign over the doorway, which invites the visitor as he goes out to "Call again."

A L.G.B. inquiry was held on February 27th into the application of the T.C. for a loan of £700 for plant at the power station. There was no opposition.

**Haverfordwest.**—At a T.C. discussion on a recommendation to purchase a new gasometer, an amendment was accepted that the question of lighting be referred to a special Committee for consideration, the speaker being of opinion that the town could be electrically lighted from the river Cleddau.

**Kingston-on-Thames.**—The T.C. has applied to the L.G.B. for a loan of £13,500 for the installation of Diesel oil engines, &c., at the electricity works.

**Lagos.**—The electric lighting system is to be extended at a cost of £13,000.—*African Engineering.*

**Lancaster.**—On the recommendation of the Electricity Committee, the T.C. has reduced the price of electricity for private lighting purposes from 4½d. to 4¼d. per unit.

**London.**—**KENSINGTON.**—The Infirmary Committee of the Guardians reports that after careful consideration of a letter from the Gas, Light and Coke Co. and a report from Mr. E. Flint, architect, and Mr. Wagg, consulting engineer, on the proposals contained in such letter, it has decided to adhere to the views contained in a report, which was adopted by the board on January 4th, in favour of the installation of electric light at the infirmary, and has decided to instruct Mr. Flint to prepare a specification and estimate of the cost of such installation.

**ISLINGTON.**—The Lighting Committee has decided to charge a uniform price of 1d. per unit for current used for illuminating signs put up by wiring contractors in connection with their own businesses, providing that the Council's prices for current for lighting, heating and power are prominently advertised thereon. With a view to improving the lighting of Upper Street, the Committee has decided to put up 12 special flame lamps, which can be used on rectified circuits. The price of each lamp is £5 7s. 6d., and the special carbons required are somewhat costly as compared with those used in existing lamps.

**FULHAM.**—The Electricity Committee reports having entered into an agreement for the supply of energy required for power and lighting purposes at Earl's Court Exhibition. It was originally contemplated that the maximum demand would be 400 kw., but from the plant already installed, and the alterations which are being made, this will be increased to 600 or 700 kw. To meet this extra demand the Committee has decided to increase the cables, transformers, and ducts, and application is to be made to L.C.C. for a loan of £3,200, the estimated cost of the work. The attention of the Committee has been drawn to the very weak condition of one or two of the H.T. arc circuits, and it is of opinion that considerable improvement may be effected by the conversion of the arc to metallic-filament lighting. The Committee thinks that in the first instance, only 71 lamps should be altered. The cost of running these lamps on the present system the electrical engineer puts at £1,217. Against this would be the cost by changing over, which he puts at £1,080, which makes a difference in favour of metallic lighting of £137. The cost of changing over worked out at £650. After considering these estimates, the Committee has authorised an expenditure not exceeding £650, and has instructed the engineer to carry out the work.

**WOOLWICH.**—In connection with the tenders referred to elsewhere for the supply and erection of Diesel oil engines at the Woolwich generating station, it is proposed to install a 1,200-kw. steam turbine at the Plumstead station, in order to meet next winter's load, at an approximate cost of £4,200. The adoption of this turbine and Diesel plant will, the Electricity Committee states, at once lower the cost of generation to 16d. or 17d. per unit for fuel, as against nearly 5d. per unit in 1910, while the turbine itself will allow all the factory load to be dealt with at the Globe Lane Station. By working the stations combined, with oil, it will enable the Council to stock and store reserves which will last almost double the time at present practicable. The Committee had not been able to arrive at final figures, but the following represents approximately the cost of the present proposal:—Water-cooling tower and softening gear, £1,500; buildings, £3,500; foundations, £1,000; switchgear (seven panels), £750; 1,200-kw. turbine, £4,200. The Committee has decided, subject to the necessary sanction being obtained, to invite tenders for the supply of the 1,200-kw. turbine plant for three-phase alternating current.

**BERMONDSEY.** In view of the complaints which have been received as to the poor light given by the present arc lamps in the

borough, the Electricity Committee is making trials of various new kinds of arc lamps, with a view to improving such lighting, and a sum of £1,600 has been inserted in next year's estimate in order to cope with the expenditure incurred thereby.

**STEPNEY.**—Application is to be made to the L.C.C. for a loan of £5,000 for the provision of plant and machinery at the Limehouse station.

**Manchester.**—With a view to allaying anxiety, the Corporation Electricity Committee has issued a statement showing that it has accumulated sufficient coal to ensure a full supply of electricity for lighting, power and traction purposes for the next five or six weeks. This should prove a boon to the very numerous power consumers in the Manchester district, and to their many employes.

**N. Western Railway Bill.**—The Ashton-under-Lyne T.C. is opposing this Bill, while the Luton and Mansfield T.C.'s have decided not to oppose it.

**Port Glasgow.**—The T.C. has been advised by the Electricity Committee to sanction the proposal of local shipbuilders for securing a supply of current from Greenock Corporation. The shipbuilders offer a guarantee of £1,500 per annum to anyone supplying electricity within Port Glasgow.

**St. Helens.**—The T.C. has decided to have the Market Hall lit by electricity. Current will be supplied by the Electricity Committee at £70 a year, and the stall holders are to bear the cost of lamp renewals.

**Salford.**—The Electricity Committee has decided to enter into an agreement with Mark Fletcher & Sons, Ltd., for a supply of energy for power purposes for their works in Pendleton; the company to guarantee a minimum consumption of 25,000 units per quarter, and pay a flat rate of 8d. net per unit. The Corporation is to allow the company to consume not exceeding 5 per cent. of its power consumption in any one quarter for lighting purposes at the power rate above quoted, the balance of the lighting in one quarter to be charged at 3½d. per B. of T. unit. In the event of the company not taking the guaranteed minimum number of units for power, the balance of the minimum quantity per quarter to be charged at 8d. per unit net; coal clauses are included, and the agreement is to be for three years. The Committee has further decided to enter an agreement with Messrs. Frankenburg & Sons, Ltd., for the supply to their premises of a minimum of 50,000 units per quarter for all purposes during a period of five years at an all-round charge of 85d. per unit for the first 37,500 units consumed per quarter, and 7d. per B. of T. unit for all units consumed over the 37,500. The above-mentioned all-round rate to be allowed on condition that the company use metallic-filament or arc lamps and convert at once all motors larger than 10 H.P. to 440-volt motors.

**Skelton and Brotton.**—The U.D.C. has provisionally accepted the offer of Messrs. Graham Bros., of Middlesbrough, to light the town with 50-C.P. electric lamps at £2 5s. per lamp from September 1st to April 30th. Hitherto gas has been utilised.

**Slough.**—Great progress is being made with electric lighting at Slough. In addition to the parish church being connected, the B.G. has decided to utilise current for water pumping, and the U.D.C. has decided to have the sewage station lit by electricity. At the works of Messrs. G. D. Peters & Co., electricity has taken the place of steam plant, while the whole of their establishment is wired for electric lighting.

The L.G.B. has sanctioned the acceptance of the Slough Electric Light Co.'s tender for the workhouse installation, without the Guardians advertising for sealed tenders.

**Smethwick.**—An unopposed inquiry has been held into the application of the T.C. for a loan of £1,750 for plant necessary for working the refuse destructor plant by electrical power, and for lighting the destructor by electricity.

**Thurstonland (near Huddersfield).**—At the meeting of the D.C., particulars were submitted as to the probable cost of bringing an electric supply into the village from the mains of the Yorkshire Electric Power Co. at Storther's Hall Lane Bridge. It was decided that further information be obtained for the next meeting.

**Westham.**—Steps are being taken to form a local company to supply Westham, Pevensey, and, if possible, Pevensey Bay, with electricity. The scheme is put forward by Mr. Von Romer, and a capital of from £2,000 to £3,200 is needed to carry out the project. A sub-Committee of residents has been formed to canvass the district in order to ascertain if the scheme is workable.

**Wheatley.**—The West Riding of Yorks C.C. and the Yorkshire Electric Power Co., Ltd., have withdrawn their opposition to the application of the Doncaster T.C. for a prov. order for E.L. at Wheatley. The Corporation has agreed to a clause to the effect that no powers obtained shall interfere in any way with the present position of the Power Co.

## TRAMWAY and RAILWAY NOTES.

**Accrington.**—Recently the Court of Appeal decided, in the case of the Metropolitan Electric Tramways, Ltd., v. Tottenham D.C., that tramways are rateable as a railway for the purposes of the



general district rate. Mr. Beckett, Accrington borough treasurer, has now tabulated figures showing the effect of this decision, if put into operation, in a reduction of the contribution from the tramways to the general district rate during the next financial year. Whereas in the current year payments by the Tramways Committee to the townships of Church, Oswaldtwistle, Clayton-le-Moors and Accrington amounted to £420, the amount the tramways will have to bear next year under the new scale will be but £149, a reduction of £311.

The Tramways Committee, besides contributing £734 to the relief of rates next year, has decided to make a concession by some reduction in tram fares. Beginning on March 11th, books containing 13 penny tickets are to be issued to the public for 1s., representing a reduction of 7½ per cent.

**Blackburn.**—The Tramways Committee has decided to recommend the T.C. to increase the wages of the drivers, conductors and car-cleaners by a farthing per hour. No application had been sent in, the proposed advance being spontaneous on the part of the Committee. The advance is equal to an advance of about 1s. 3d. per week, and affects some 140 or 150 men.

**Continental Notes.**—**GERMANY.**—Although the tramway system in Berlin is almost entirely in the possession of the Grand Berlin Tramways Co. with a length of over 300 miles of track, there is a smaller undertaking known as the Berlin Electric Tramways Co., which has just concluded a fresh agreement with the Berlin City Council. This circumstance has rendered it necessary for the Berlin Tramways Co. to enter into new relations with the Siemens & Halske Co., which has hitherto been under the obligation to pay to the former the amount of any annual deficiency required to make up the payment of a dividend of 5 per cent. on the tramway share capital. It has now been arranged that in return for a cash payment of £20,000, the Siemens & Halske Co. will renounce its claim to the advances already made under this guarantee, and will also be relieved of the obligations under the guarantee. The firm will still have the right to contract for the supply of materials in so far as its prices are similar to those of other tenderers. The agreement between the tramway company and the city council disposes of all legal doubts as to the company's concession from the State, and is concluded for the period ending with 1939, when the permanent way will pass into the possession of the city free of charge. The right of acquiring the other assets of the company has been settled in a similar manner to that appertaining to the Grand Berlin Tramways Co.

**NORWAY.**—The proposal is under consideration to build an electric railway from Myrdal, one of the finest situated spots on the Bergen-Christianiana railway, through the Flamsdaal to the Sognefjord. The electric current will be supplied from one of the State-owned waterfalls.—*Der Elektrotechniker*.

**RUSSIA.**—Under the auspices of the Banque des Reports et de Fords Publics de Rivers and of the Private Commercial Bank of St. Petersburg there will be formed shortly an electric tramway company for the provision of electric tramways for the suburbs of the Russian capital. The new capital will dispose of a capital of 10,000 000 fr.—*La Lumière Electrique*.

**FRANCE.**—The French Government has introduced a Bill declaring it to be for the public utility to establish in the Department des Côtes-du-Nord of a network of local railways, of a total extent of 356 kilometres. The scheme contemplates the construction of 16 separate railways, and, although the motive power is not stated, the greater majority will probably be electrically operated.—*La Lumière Electrique*.

**THE TYROL.**—It is proposed to construct a light electric railway between S. Martino d'Olkeseria, Varone and Riva, in the Tyrol.

**SPAIN.**—La Compania Tranvias de Gijon has lately secured the concession for the construction and working of an electric tramway between La Calzada and Musel.

**ITALY.**—La Société du Chemin de Fer Electrique du Mont Fredgna et Extensions is the name of a company which has just been formed in Brussels, with a capital of £60,000, to acquire and carry on the Notre Dame de la Garde Electric Tramway at Genoa, at present in liquidation.

**SWITZERLAND.**—A railless trolley service of public vehicles on the Daimler-Stoll system has lately been put in service between Freiburg and Posieux.

**Falkirk.**—At a meeting of the T.C., a letter was read from the agent of the Falkirk and District Tramway Co., stating that it was necessary that a plan of the proposed new route of the extension of the company's system to Grangemouth should be submitted to Parliament, and hoping that the T.C. would not object. The Council agreed to the request. When the order was originally projected it was opposed by the Council on the ground that application had been made prior to the expiry of the powers granted by the previous Act. Negotiations followed with the result that opposition was entirely withdrawn.

**Glasgow.**—The coal strike and the consequent curtailment of the passenger service on the local railways has led to a big increase in the number of persons using the Glasgow Corporation tramway cars. The early morning cars at the commencement of the week were so "ru-hed" that the service had to be considerably augmented, while the regulation against standing in "double deckers" is being winked at by the authorities. The revenue is being considerably increased in consequence, and on Monday of this week a sum of £230 over that of the corresponding day of last year was drawn. It is reported that the tramway

department has sufficient coal on hand to last for three weeks and the electricity department enough for 11 weeks.

In connection with the recent decision to allow blind persons free travelling on the Corporation's tramway cars, the Sub-committee on Finance has been asked to consider as to the question of liability for accidents to blind persons using free passes, and as to the Corporation being indemnified against such accidents.

The Tramways Sub-Committee has remitted to the general manager to report upon the whole question of instituting a half-hourly service of cars, from 12 midnight to 3 a.m., in the city and suburbs.

**Haslingden.**—An electrical short circuit occurred in a tramway standard at Laneside, Haslingden, on February 28th. The heat generated made the standard red hot, and caused it to bend with its own weight. The tramway manager is of the opinion that the heavy rains started a short circuit, and established a connection between the feeder cable and the pillar, with the result that the cable and the pillar melted until both were clear.

**Hastings.**—At a recent meeting of the T.C. strong complaint was raised as to the unsatisfactory working of the Dolter system of tramways along the front line of the town. A memorial was received from residents of the Marina, and a resolution from the Ratepayers' Association. The memorialists asserted that "owing to the constant flashing, great noise and dangerous condition of the road," the running of the cars was a great and constant annoyance to visitors and residents; they further considered that many of the large houses on the Marina was vacant through the tram. The gentleman forwarding the memorial (Mr. Richard Stace) declared that if the "serious evil" were not soon remedied "every house will become vacant." In the course of discussion, Councillor Harden suggested a conference with the Tramway Co. and also the Dolter people. It was explained that the matter was already under the consideration of the Roads Committee, and it was resolved to refer the communications to that body.

**L. and Y. Railway Electrification.**—This company is making further improvements on the electric line which runs from Liverpool to Southport, the particular section to be dealt with being that between Liverpool and Sandhills Station. A statement has appeared in the Liverpool daily papers that important alterations are to be carried out "in order to enable them (the company) to maintain a better service to and from the Exchange Station and Hall Road, Southport and Aintree, which it is hoped will prevent the overcrowding of the electric trains during the busy hours of the morning and evening. It is proposed to electrify the existing steam lines, and thus provide double tracks for the electric trains. The rolling stock used in the steam trains is to be utilised in connection with the electric services, as is the case on Liverpool race days." A representative of the ELECTRICAL REVIEW, on inquiring for particulars of the "important alterations," was informed at the head office of the company that the statement in the daily Press was chiefly remarkable for its inaccuracy. It is quite true that the company is going to lay down the third rail on the eastern lines between Exchange Station and Sandhills, which is the first stopping place outwards from Liverpool.

**L. & S.W. Railway Electrification.**—According to the daily Press, the South-Western Co. has at last decided to electrify a section of its Thames Valley routes. The first portion of the work to be undertaken is expected to be the lines running from Waterloo via Wimbledon to Kingston, and from Kingston via Richmond back to Waterloo (known as the Kingston loop lines). The excuse for delay in electrification most favoured by this company's officials has always been lack of terminal accommodation at Waterloo. It is now given out that the terminal reconstruction works have sufficiently progressed to allow matters to proceed, and it is understood that the work will be begun at an early date. Possibly threatened competition may have moved the company at last.

**London.**—The Central London Railway Co. announces that the various proposals for a westerly extension of its lines in the Thames Valley are still under consideration by the board, but that no definite decision has as yet been arrived at.

One effect of the coal strike has been to induce the Brighton Co. to immediately start its electrical train services between London Bridge and the Crystal Palace, and Victoria via Tulse Hill, thus anticipating the programme by three months.

**Milnrow.**—The final length of the Milnrow tramway extension was inspected by Col. Drnutt, of the B. of T., on the 1st inst., when he passed it for immediate service. The total length from Rochdale town centre to Newbery is practically 3·2 miles. In the evening a banquet was held in celebration of the completion of the tramways. Alderman Dunning, of Rochdale, who proposed "Success to the Milnrow district tramways," said Rochdale had now entered into agreements with Norden, Bury, Heywood, Oldham, Koyton, Bacup, Whitworth, Littleborough and Milnrow.

**Northampton.**—According to a statement prepared by the borough accountant, a balance of £5,059 is anticipated to accrue from the tramways undertaking to March 31st, 1912; £1,000 of this sum is to be appropriated to the relief of the rates.

**Oldham.**—The Tramways Committee has had under consideration a proposal to institute a service between the Moor-side terminus and Grain's Bar on the railless trolley system, and the Mayor recently interviewed the B. of T. on the subject. The Committee is taking counsel's advice on the matter, and it has been decided that the general manager shall get out an estimate of



the cost. It is understood that the Corporation electricity department has a three weeks' stock of coal in hand, based on normal working.

**South Africa.**—The Krugersdorp municipality having declared against the introduction of motor omnibuses, there is a likelihood of an electric tramway scheme being introduced.—*British and South African Export Gazette*.

## TELEGRAPH and TELEPHONE NOTES.

**State-Owned Cables.**—The question of cheap cable communication between Canada and Great Britain continues to attract much attention in the Dominion. The Postmaster-General at Ottawa stated recently that a cheap cable system was the one missing link in the commercial relations between the two countries, and he regretted that Mr. Samuel was unfavourably disposed towards laying a State-owned Atlantic cable.

**Telephone Numbers as Telegraphic Addresses.**—The P.M.G. has pointed out that telephone numbers can be used as telegraphic addresses, and public notices calling attention to the arrangements and explaining the procedure have been prepared for immediate issue to subscribers and to the Press. The system appears to be regarded by many business men with marked disfavour. Telegrams thus addressed are forwarded by telephone, and this process, it is alleged, destroys all pretensions to secrecy, and may have unfortunate results.

**Wireless Telegraphy.**—The *Financial News* quotes a rumour that negotiations are under way for the absorption of the United Wireless Telegraph Co. by the Marconi Wireless Telegraph Co., Ltd. The United Wireless is now in the hands of receivers.

A collision occurred between a French mail-boat and a London steamer in the Straits of Dover last Friday, and as the French packets are not equipped with wireless telegraphy, delay was experienced in obtaining help from Dover. All the other cross-Channel boats are equipped.

Interruptions having occurred in the cables between Spain and the Canary Isles and North Africa, the wireless service of the Compania Nacional de Telegrafia sin Hilos (representing the Marconi Co.) has been brought into use to carry on the traffic.

**Wireless Telegraphy and Deep-Sea Fishing.**—The *Journal Télégraphique* states that the United States Government, with a view to affording protection to fishing boats against sudden storms, has purchased 50,000 receivers for wireless telegraphy, which will be supplied on easy terms to fishermen. The apparatus being adapted for the reception of messages only, the cost is only about £25 each. The number as given above seems excessive; possibly it is a slip for 5,000.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 11th. Electrical goods, for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (Form 26). Stores Manager, Aberaman Offices, near Aberdare.

**Australia.**—VICTORIA.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

April 2nd.—250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" March 1st.

April 23rd.—2000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

**WESTERN AUSTRALIA.**—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal*.

Paper-insulated, lead-covered cable and loading devices (Schedules 184 and 185), for the P.M.G.'s Department, Perth. See "Official Notices" February 23rd.

**Belfast.**—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" to-day.

**Belgium.**—April 1st. La Direction du Service Special d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels, is inviting tenders for the mechanical and electrical equipment of ten pumping stations in connection with the Charleroi Canal.

**Birmingham.**—March 12th. Electrical stores, for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

**Bray.**—March 19th. Stores, for the U.D.C. Electricity Works. See "Official Notices" to-day.

**Brazil.**—April 18th. The General Direction of Public Works at Pernambuco is inviting tenders for the concession for the construction and working of a system of electric tramways in the town.

**Brighouse.**—March 18th. 1,220 yd. of armoured cable, one feeder pillar and one feeder panel, for the T.C. See "Official Notices" to-day.

**Canada.**—CALGARY.—March 20th. City Commissioners. One 2,500-KW. turbo-generator set, one 1,000-KW. synchronous motor-generator, 50-KW. motor-generator and 25-KW. exciter set. Deposit £500. Particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

March 30th.—One 1,500-KW. A.C. steam turbo-generating set, and one 500-KW. A.C. generator coupled to Diesel engine, for the City Commissioners of Moose Jaw, Saskatchewan. See "Official Notices" to-day.

**SASKATOON.**—March 22nd. Water-tube boilers, induced draught plant, economisers, automatic stokers, steam feed pumps, one 2 000-KW. steam turbo-generator, turbine exciter, &c. Specification to be seen at the Commercial Intelligence Department, Board of Trade, London. Tenders to City Commissioners, Saskatoon, Saskatchewan. Deposit five per cent.

**Carlisle.**—March 13th. Lubricating oil, greases, &c., and cables, for the City Electricity Department. See "Official Notices" to-day.

**Croydon.**—March 11th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**Edmonton.**—March 13th. Electrical supplies and lamps, for the B. of G. Mr. F. Shelton, Clerk, White Hart Lane, Tottenham.

**France.**—PARIS.—March 21st. Supply and installation of six groups of electric pumps at the municipal waterworks on the Quai d'Austerlitz. Particulars, Ingenieur-en-chef, Service technique des Eaux et de l'Assainissement, 9, Place de l'Hôtel de Ville, Paris.

**Germany.**—March 16th. Prussian State Railway Offices at Berlin. Telegraph insulating material, 650 anchor-cramps, 296 050 kg. galvanised iron wire, 8,510 kg. ditto, 11,800 kg. ditto, 79,166 metres telegraph cable, &c.

**Gillingham.**—March 25th. Materials for a year for the Corporation Electricity Department. See "Official Notices" to-day.

**Glasgow.**—March 8th. Rotary converters and accessories, for the Corporation Electricity Department. See "Official Notices" March 1st.

**Greece.**—VOLO.—Supply of material for an electric lighting installation. Particulars, M. Glavani, Mayor of Volo.

**Hornsey.**—March 16th. Extension of dynamo and feeder switchboard, for the T.C. See "Official Notices" March 1st.

**Kingston-upon-Hull.**—March 26th. Extra-high-tension three-phase switchboard, and 20-ton overhead travelling crane, for the Corporation. See "Official Notices" to-day.

**Leeds.**—March 9th. 6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" February 16th.

**Leith.**—The Corporation invites alternative tenders for advertising on tramway cars. Manager, 165, Leith Walk.

**Liverpool.**—March 11th. Electrical fittings for the Select Vestry. G. W. Coster, clerk, Parish Offices, Brownlow Hill.

**London.**—L.C.C.—March 8th. Electrical installation at the Victoria Embankment Gardens conveniences, Charing Cross. See "Official Notices" February 23rd.

**MARYLEBONE.**—March 13th. Materials for a year, for the B.C. Electricity Department. See "Official Notices" February 23rd.

**SOUTHWARK.**—March 13th. Cable, for the B.C. Electricity Department. See "Official Notices" March 1st.

**L.C.C.**—Tenders are to be invited for two new engines for driving the mechanical stokers, coal conveyors, &c., at the Crossness pumping station.

**WOOLWICH.**—March 20th. 1,200-KW. three-phase turbo-alternator, with condensing plant, for the B.C. See "Official Notices" to-day.

**Manchester.**—March 13th. Two 650-800-KW. and one 750-KW. motor converters or rotary converters and static transformers, for the Corporation. See "Official Notices" March 1st.

**Merthyr Tydfil.**—March 28th. Electrical installation at the Municipal Secondary School, Cyfarthfa Castle. See "Official Notices" to-day.



**New Zealand.**—May 1st. Public Works Department. Supply to Lyttelton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Salford.**—March 11th. Stores, &c., for a year, for the Corporation Electricity Department. See "Official Notices" February 23rd.

March 21st.—Main D.C. lighting and power switchboard, for the Corporation. See "Official Notices" to-day.

**South Africa.**—Quantities of electrical and other plant and material will be required by Capetown Municipality if the plans for the proposed new mountain reservoir, about 30 miles distant, are carried out. The scheme includes the installation of a large electrical plant capable of generating current for a number of municipalities, and water purifying apparatus for treating 5,000,000 gallons daily.—*British and South African Export Gazette.*

**Spain.**—Tenders have just been invited by the municipal authorities of Campofrio (province of Huelva) for the concession for the electric lighting of the town.

**Sweden.**—March 31st. The Electro-technical Department of the Stockholm Municipality are inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). For further particulars see this column last week.

**Swindon.**—March 9th. Materials for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" February 23rd.

**Taunton.**—Single-phase transformers for the T.C. See "Official Notices" February 23rd.

**Walshamstow.**—March 22nd. Water-tube boilers, feed pump and pipework, turbo-alternators or engine-driven alternators, motor generators, rotary converters and switchgear, for the U.D.C. See "Official Notices" to-day.

**West Ham.**—March 9th. 5,000-KW. two-phase turbo-alternator, with condensing plant and two-phase E.H.T. switchgear, for the Corporation. See "Official Notices" February 23rd.

**Wrexham.**—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" February 16th.

## CLOSED.

**Belfast.**—The Tramways Committee has accepted the tender of Messrs. Dick, Kerr & Co. for the construction of tramway extensions in various parts of the city.

**Belgium.**—The municipal authorities of Ixelles last week opened tenders for the supply of a quantity of armoured cables required in connection with the low-tension electricity supply mains. One French, one Belgian, one Austrian and eight German firms competed for the order, the lowest tender being that of Messrs. Felten & Guillaume, of Mulheim-am-Rhein.

**Brighton.**—The Tramways Committee of the T.C. has accepted the following tenders:—

Mr. J. Every.—10 tons of brake blocks, £60.  
Burt Boulton & Haywood, Ltd.—10,000 paving blocks, £685.  
Huddell's Steel Foundry Co., Ltd.—Points and crossings, £731.  
P. & W. MacLellan, Ltd.—Steel rails, £1,345.  
Edgar Allen & Son, Ltd.—Stone crusher, £122.

**Bromley (Kent).**—The T.C. has received the following tenders for the electric light installation at the library extension:—

R. E. Knight	..	..	..	..	..	..	..	..	..	£67
Bromley Electric Light Co.	..	..	..	..	..	..	..	..	..	74
R. G. Knight	..	..	..	..	..	..	..	..	..	82

**Coventry.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a turbo-alternator with condensing plant, &c., at £8,639.

**Dublin.**—At the meeting of the Corporation on Monday, the tender of Messrs. Ferranti, Ltd., for the sub-station switchboard, was accepted.

**Eastbourne.**—The T.C. has accepted the tender of Messrs. Leyland, Ltd., for two motor buses, at £1,500.

**Eccles.**—The Electricity Committee has purchased the following quantities of slack for the electricity works:—

50 tons, at 13s. 6d. per ton, from the Earl of Ellesmere.  
200 tons, at 12s. 6d. per ton, from the Hindley Green Colliery Co.  
100 tons, at 12s. 6d. per ton, from Messrs. W. & J. Turner.

**Glasgow.**—The Electricity Committee has accepted the offers of Messrs. Johnson & Phillips for 30 flame arc lamps, and of the General Electric Co., Ltd., for 170 flame arc lamps for street lighting; and the offer of the North-Western Electrical Appliance Co. for lowering-gear for the lamps.

The offer of Messrs. Johnstone, Park & Co., at £344, for the electric wiring of the new Possil Park Library has been accepted by the T.C. Libraries Committee.

The Tramways Committee recommends acceptance of the offer of Messrs. P. & W. MacLellan, Ltd., for block tin, and that of Messrs. Ferranti, Ltd., for ampere-hour meters.

**Grays Thurrock.**—The U.D.C. has accepted the tender of Messrs. Vanner & Co. for all sizes of Chamberlain & Hickham ordinary and P.P. meters.

**Haslingden.**—The T.C. has ordered two sets of automatic signals for the tramway— from Messrs. Brecknell, Munro & Rodgers.

**Horsham.**—The U.D.C. has decided to renew the annual contract for meters with the Electrical Apparatus Co., Ltd.

**Keighley.**—The Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., at £425, for the supply and fixing of five new top-deck covers to existing tramcars.

**Kingston-on-Thames.**—The T.C. has accepted the tender of the Craiggpark Electric Cable Co. for 440 yards of 2 concentric paper-insulated lead-sheathed and armoured low-tension cable, at £164.

**Leyton.**—The U.D.C. has entered into contracts with Messrs. Johnson & Phillips, for a year's supply of 55,000 pairs of arc lamp carbons at £4 10s. per 1,000 pairs, and with the Oliver Arc Lamp, Ltd., for a year's supply of 65,000 pairs at £3 3s. per 1,000 pairs.

**London.**—L.C.C.—The following tenders were received for the electric lighting of the new engine-house at the Abbey Mills pumping station:—

Foot & Milne, Ltd.	..	..	..	..	..	(recommended)	£660
E. Newbald & Co.	..	..	..	..	..	..	669
Pinching & Walton	..	..	..	..	..	..	745
G. E. Taylor & Co.	..	..	..	..	..	..	802
Tredegar & Co.	..	..	..	..	..	..	859
Tilley Bros.	..	..	..	..	..	..	819

Chief Engineer's estimate, £660.

**Woolwich.**—The B.C. has accepted the tender of Messrs. Willans and Robinson, Ltd., for two 400 KW. oil engine sets at £11,459, and that of Messrs. Mirrlees, Bickerton & Day, Ltd., for two 340 KW. oil engine sets, at £9,275.

**CITY.**—An evening newspaper says that of six tenders received for rewiring for electric light at the Mansion House, exclusive of the Egyptian Hall, the lowest is that of Messrs. Pinching & Walton, at £1,529.

**Neath.**—The B.G. has accepted the tender of Mr. Wesley Evans, of Skewen, for the electric light installation at the new infirmary, at £950.

**Salford.**—The T.C. has accepted the tender of Messrs. John Ramsbottom, at £1,075, for extensions to workshops, stores and booster room at the electricity works.

**Slough.**—The tender of the Felgate Installation Co. has been accepted for the electric light installation at Slough Parish Church.

**South Africa.**—The tender of Messrs. Arthur Koppel, Ltd., for the supply of poles for the municipal electric lighting installation at Parys, Orange Free State Province, has been accepted; and that of the A.E.G. Electrical Co. of South Africa, Ltd., for the rest of the plant and material.—*British and South African Export Gazette.*

**Southampton.**—The Electricity Department has recently placed a large order for electric ovens with Mr. Bertram Thomas.

**Stoke-on-Trent.**—The Joint Hospital Board has accepted the tender of the British Westinghouse Electric Co., Ltd., for an engine, dynamo, &c., at £351; and that of Messrs. H & T. Danks, Ltd., of Netherton, Dudley, for a boiler, fittings &c., at £511.

**Worcester.**—The tender of Messrs. Hardy & Padmore, Ltd., for Rees-Roturbo pumps and Crompton motors, for £982, for the Corporation has been provisionally accepted.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 11th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.  
Tuesday, March 12th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.  
Thursday, March 14th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.  
Friday, March 15th.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.  
Saturday, March 16th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. H. S. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

**Manila Electric Railroad and Lighting Corporation.**—The directors have declared a dividend of 1½ per cent. (\$1.50 per share) for the quarter ending March 31st on the capital stock.



## FORTHCOMING EVENTS.

- Institution of Mechanical Engineers (Graduates' Association).—**Monday, March 11th. At 8 p.m. Paper on "Water Softening and Purification," by Mr. R. D. McGroarty.
- Institution of Post Office Electrical Engineers.—**Monday, March 11th. At 6 p.m. At the I.E.E. Paper on "Telegraph History," by Mr. H. R. Kempe.
- Institution of Electrical Engineers (Newcastle Local Section).—**Monday, March 11th. At 7.30 p.m. At the Arms-ron College, Newcastle. Paper by Mr. W. W. Firth on "Flashing Over in C. inmutator Machines," and Mr. J. W. Jackson on "Power-Station Running."
- Institution of Electrical Engineers (Manchester Local Section).—**Tuesday, March 12th. At 7.30 p.m. At the University, Manchester. Paper on "High-Tension Porcelain Line Insulators," by Mr. J. Lustgarten.
- Institution of Electrical Engineers (Scottish Local Section).—**Tuesday, March 12th. Meeting at 8 p.m. At 207, Bath Street, Glasgow.
- Junior Institution of Engineers.—**Tuesday, March 12th. At 8 p.m. At the I.E.E. Paper on "Railless Electric Traction," by Mr. B. D. Fox.
- Friday, March 15th.—**At 8.15 p.m. At 39, Victoria Street, S.W. Paper on "Crude-Oil Engines," by Mr. A. H. Weston.
- Saturday, March 16th.—**At 10 a.m. Visit to the Lot's Road power station, Chelsea.
- Institution of Civil Engineers.—**Tuesday, March 12th. At 8 p.m. Papers on "Roller and Ball Bearings" and "The Testing of Anti-Friction Metals" to be further discussed.
- Friday, March 15th.—**Students' meeting. At 8 p.m. Paper on "The Heat Value of Fuels," by Mr. A. E. Gladwin.
- Institution of Electrical Engineers (Yorkshire Local Section).—**Wednesday, March 13th. At 7.30 p.m. At the University, Leeds. Lecture on "Telegraphs and Telephones," by Major W. A. J. O'Meara.
- Association of Engineers-in-Charge.—**Wednesday, March 13th. At 9 p.m. At St. Bride's Institute, London, E.C. Paper on "Transmission of Power by Ropes," by Mr. E. E. Hart.
- Institution of Electrical Engineers (Dublin Local Section).—**Thursday, March 14th. Meeting at 8 p.m. At the New Royal College of Science, Dublin.
- Royal Institution.—**Friday, March 15th. At 9 p.m. Discourse on "The Origin of Radium," by Mr. F. Soddy.
- Saturday, March 16th.—**At 8 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture IV)
- Institution of Mechanical Engineers.—**Friday, March 15th. At 8 p.m. Paper on "The Diesel Oil Engine, and its Industrial Importance, particularly for Great Britain," by Dr. R. Diesel.
- South-Western Polytechnic.—**Friday, March 15th. At 8 p.m. Distribution of prizes and certificates by Sir D. Gill.
- Northampton Institute Engineering Society.—**Saturday, March 16th (not March 9th, as stated in our last issue). At 7 p.m. for 7.30 p.m. At the Holborn Restaurant. Annual dinner.
- Institution of Electrical Engineers (Students' Section).—**Saturday, March 16th. At 7 p.m. At the Trocadero Restaurant. Eighth annual dinner.

## NOTES.

**Inquiry.**—The address of makers of the new insulating material, "Seagumite," is asked for.

**The Importance of Exhibitions.**—Mr. Chas. Knott, British representative at the proposed International Exhibition at Ghent next year, attended a meeting of the Burnley Chamber of Commerce on February 29th. He characterised the Exhibition as the battle-ground of commerce, and said that in her own interests Britain should be well represented there. Britain had given way to Continental rivals simply because she had been content to stay as she was. In this particular instance she was the only country to stand aloof. It was necessary that British manufacturers and engineers of every class should wake up to a sense of the importance of this class of exhibition. Alderman Keighley, the Mayor, moved a resolution that it was high time that steps were taken by the Board of Trade to ensure British representation worthy of her arts and manufactures at the Ghent Exhibition. As an exhibitor at Brussels, he was dissatisfied with the way in which the Board of Trade carried on that exhibition. Mr. T. Crook seconded, and said that if the Board of Trade took the matter up, British manufacturers would enthusiastically follow their lead. The resolution was carried.

**Rural and Domestic Applications of Electricity.**—A policy much adopted abroad is to install rural central stations for the purpose of supplying a number of farms, rural industries, country residences and estates with electricity. By establishing a rural central station, driven by either steam, water, gas or oil, a great saving in the cost of production of electrical energy may often be easily secured.

In Germany, Northern Italy and throughout Switzerland, there is an extended use of electrical energy in agricultural communities. A network of distributing lines has been formed, owing to the scattered and numerous sources of hydro-electric power.

As an example of the extent to which a single rural central station may supply a farming community, the rural station of Besswitz may be cited. The distribution system is 145 miles long, the central station being as nearly as possible at the centre of the network; the greatest distance of supply from the station is 26 miles. The territory served, according to the *American Electrical Review* and *Western Electrician*, is 102,000 acres in extent, of which 40,000 acres are cultivated with the plough. To this network are connected 180 motors and 5,000 lamps, with a total consumption of 1,300 kW.

The energy is sold on a sliding-scale basis; 3d. per kW.-hour is

charged for lighting purposes, and for power the rate varies from 1½d to 2d., depending, of course, on the quantity consumed.

Many of the German farmers have rural industries connected with their farms, whereby they utilise their by-products, and herein lies the secret of the success of many well-to-do farmers. For example, on one of these installations there are connected four grist mills, with five motors, aggregating 105 H.P.; one tile works, with a 40-H.P. motor; one sawmill, with a 20 H.P. motor, and so on. There are also connected 20 consumers for lighting only, with a total of 343 incandescent lamps and six arc lamps.

From the above facts and figures, it will be seen that electricity can give a new stimulus to agriculture and farming, and at the same time open up a way by which the rural population can be induced to remain on the farm instead of flocking to overcrowded cities and taking up an entirely new form of work, in order to earn a living.

Electrical energy is distributed on both high-tension alternating-current and low-tension direct-current systems. Hard and fast rules cannot, of course, be laid down as to the use of either. In making comparisons, however, the following points should be remembered: In D.C. transmission the line construction is of a very simple and reliable character, and of comparatively low cost. Also, direct-current motors have a slightly higher efficiency, and will, in general, carry larger temporary overloads. The direct-current system should not, however, be used for long distances, as the pressure cannot be transformed without the use of rotating transformers. The latter are, of course, more expensive than the transformers used in connection with alternating-current systems.

In many cases energy is required in a certain section of the field for a short time only, and permanently to install a transformer on A.C. systems would often be bad policy. To fill such an emergency a portable transformer is used. It is mounted on wheels, and can be drawn by a pair of horses. It can be placed in position when required, and returned to the barn when the work is done. This plan has the advantage that a number of farmers can own such a transformer in common, and thereby save a considerable amount in first cost.

**Coal Strike Effects.**—The Foster Engineering Co., Ltd., of Wimbledon, write as follows:—"The paragraph in certain newspapers, published on Saturday, stating that 'we have been notified that the supply of electricity from the local works cannot be guaranteed from day to day,' is quite unauthorised by us, and is, in any case, absolutely without foundation. We have received no such notification, and we are quite satisfied that the precautions taken by the engineer, Mr. H. Tomlinson-Lee, are ample to see us through the coal strike as far as power goes."

The *Times* reports:—"The strike will not have any appreciable effect for some time upon the gas and electricity works which supply London with light and power. Large reserves of coal are available, and therefore it is not anticipated that for some weeks even with the probable increased demand there will be any necessity to curtail the supply. Electric tramcar services throughout Greater London will be maintained fully, and the only indication to the general public of economy in fuel will be that in the tramcars of the Middlesex County Council the electric lamps will be lighted at a later hour than usual."

In one of its articles on the injurious effect of the strike upon trade, our contemporary, on February 28th, referring to the position of works at Woolwich, gave the following as the periods for which coal was stored by firms well known to our readers:—Callender's Co., three or four weeks; Henley's Co., three weeks; Siemens & Bros. Co., two weeks; Western Electric Co., eight weeks.

The *Times* also says that the Liverpool Exhibition, which was to have been opened in May, has been postponed for 12 months on account of the coal strike. "The directors received notices from railway companies and the contractors concerned to the effect that they cannot guarantee delivery at the time specified, and the directors are therefore compelled to make the postponement."

**Electrical Trades Union.**—At the Bush Hotel, Shepherd's Bush Green, W., a lecture will be delivered on Tuesday, March 12th, at 9 p.m., by Mr. A. A. Watts, on "Socialist Action in Local and National Administration."

**Parliamentary.**—In the House of Lords on Monday, the following Private Bills were read a second time:—The Brighton District Tramways Bill, the Brighton, Hove and District Railless Traction Bill, and the Wirral Railway (Extension of Time) Bill.

**A Novel Use of the Electric Arc.**—A recent paper on "The East River Tunnels of New York," by Mr. Henry Japp, gives some particulars of special electrical melting work, which are of great interest. Where the tunnel shields met below the river it was necessary to cut them in pieces, leaving only their external shells, within which were then placed the final tunnel rings of cast-iron. The pressure of the air in which work had to be done was high, and labour is severe under these high pressures. It was, therefore, decided to employ electricity and burn the shields apart.

The current for this work was taken from the power house of Long Island City. The burning circuit was taken from the positive terminal through a water resistance built up of four barrels in parallel, with plates 18 in. × 14 in. × ½ in. With this the pressure was cut down to 50 or 60 volts at the burning tool, and the current was regulated to the work or number of tools in operation. The current then passed to earth plates in the river, having a total area of 48 sq. ft. From the negative terminal a cable ran direct to the shields of Tunnels D and B, with connections to Tunnels A and C through a small pipe driven between the tunnels. There are four lines of tunnel. The burning tool was a



carbon rod 1 ft. in length and 1 in. in diameter, bolted to a copper rod which was connected to a cable leading from the generator to a single-pole switch near the shields. There was an insulated handle with a 12-in. diameter shield of asbestos, and each man had also an asbestos mask, apron and dark eye-glasses.

Rivet heads were burned off with a current of 250 to 400 amperes per tool. This served also for light section plates. Floors and uprights about 4 in. thick required 600 to 800 amperes. The arc was from  $\frac{1}{2}$  in. to 3 in. long, and the best results were secured with about 40 volts and 600 amperes. A fair duty for 8 hours was 300 rivet heads, but as many as 530 were removed on one occasion. A specially expert man cut a 54 in.  $\times$  4 in. upright in 8 hours. The arc was so bright that several men were blinded at some distance, the blindness coming on a few hours after looking at the arc, and being accompanied by violent headache. The blindness was temporary.

The iron gave off dense fumes, which were mostly removed promptly by a foul-air blow-out pipe suspended near by. Still, much fume escaped into the tunnels and made it difficult to see to walk with the aid of a candle. But in this foul air no cases of "bends" occurred, though the air pressure was 29 lb. There was, however, no specially high CO<sub>2</sub> record. It appears that high CO<sub>2</sub> is the indicating cause of "bends," but it seems probable that high CO<sub>2</sub> is, perhaps, only the indicator of high organic impurity, and the latter may be an influence in producing "bends."

#### Institution and Lecture Notes.—PHYSICAL SOCIETY.

—At the meeting on February 23rd a paper on "A Balance Method for the Accurate Comparison of Quantities of Radium and Some of its Applications," by Prof. E. Rutherford and Mr. J. Chadwick, and one on "The Absorption of  $\gamma$ -rays by Gases and Light Substances," by Mr. J. Chadwick, were read by Prof. Rutherford. A paper on "Wave-form Sifters for Alternating Currents" was read by Mr. A. Campbell. If an alternating current of complex wave form be passed through a condenser ( $K$ ) and the primary coil of a mutual inductance ( $M$ ) in series with it, any other circuit connected across the condenser and the secondary coil (in series) will receive no component of the current of frequency  $n$  if  $\omega^2 M K = 1$ , where  $\omega = 2\pi n$ . This arrangement affords a means of totally suppressing the fundamental or any single harmonic in a complex wave form.

INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).—The annual dinner of the Students' Section will be held at the Trocadero on Saturday, March 16th, at 7.30 p.m. The President of the Institution and several members of Council have signified their intention of being present. Tickets (price 6s. each) for student members and their friends can be obtained from Mr. J. Mould, 20, The Drive, Golder's Green, N.W.

ROYAL INSTITUTION.—At a general monthly meeting of the members, the special thanks of the members were returned to Mr. J. C. Simpson for his present of an original letter from Mr. Riebau, the bookbinder to whom Faraday was apprenticed, giving some account of Faraday's early life.

SOCIETY OF ENGINEERS (INCORPORATED).—A paper on "The Trolley Vehicle System of Railless Traction" was read recently by Mr. Henry C. Adams, who stated that the total capital cost of the system was approximately £3,000 per mile of route, compared with about £10,000 per mile for electric tramways. The cost of the overhead work might be taken at from £1,250 to £1,500 per mile. The vehicles cost £700 each. The cost of obtaining Parliamentary powers might vary from £400 to £5,000, dependent upon the amount of opposition. Reasonable periods to allow for repayment of the cost of installation would be: For the Bill, 5 years; vehicles, 10 to 15 years; overhead equipment, 20 to 30 years; cables, 40 years. The cost of working was about 5½d. per car-mile. The receipts depended entirely upon local conditions; they varied abroad from 5½d. to 10½d. per car-mile; at Leeds they had been 10½d. and at Bradford 8½d. per car-mile, all of which figures showed a handsome profit. Trailer cars were attached to the omnibuses abroad, but it was doubtful whether they would be permitted in this country. Tire companies were willing to maintain the tires on trolley omnibuses at from 1d. per car-mile, dependent to some extent upon the condition of the roads. Tires had been run for 28,000 and 24,000 miles respectively on trolley omnibuses abroad. Attempts had been made to obtain payment for the use of the roads, but, in the Aberdare Bill, both Houses of Parliament declined to insert a clause requiring payment.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN LOCAL SECTION).—On Monday last the inaugural meeting of the new Western Section was held at the Merchant Venturers' Technical College, Bristol. There was a good attendance of local members of the I.E.E., and the President, Mr. S. Z. de Ferranti, was present, with Mr. J. E. Kingsbury and Mr. P. F. Rowell representing headquarters. After a brief welcome from Prof. J. Wertheimer, Dean of the Faculty of Engineering of the University of Bristol, on behalf of the University authorities, Mr. Ferranti thanked the Faculty, and proceeded to explain that the success of the existing Local Sections had led to the formation of the new one, which had been effected mainly by the efforts of Mr. W. A. Chamen and Mr. H. Faraday Proctor. The Western Section would cover practically all the West Country not already covered from Manchester, Birmingham and London, and in view of the great developments of the electrical industry in that region, there ought to be ample material for discussion at the meetings. Mr. Proctor then proposed that Mr. Chamen, the first to suggest the formation of the Section, should be elected the first chairman, and this motion, seconded by Mr. Sydney F. Walker, was carried unanimously, with acclamation.

Mr. Chamen, having returned thanks for his election, explained the peculiar difficulties which had been experienced in organising

the Section, due to the scattered area to be dealt with, and the fact that, though there were many electrical engineers in South Wales, an unduly small proportion of them were members of the Institution, owing to the impossibility of attending meetings, and otherwise sharing in its benefits. He believed that the establishment of the new Section would bring in many new members, and would thus be to the advantage of the Institution as a whole. The title of "Western Local Section" was adopted after much deliberation as the most appropriate to the circumstances, and the meetings would be held not only at Bristol and Cardiff, but also at other important towns if necessary, so as to meet the needs of all.

Mr. H. Faraday Proctor was then unanimously elected vice-chairman, and Messrs. W. Collins and S. H. Haslam were elected joint hon. secretaries—the former in Bristol, the latter at Cardiff; a Committee of 15 members was also appointed, viz.: Messrs. S. F. Walker, J. H. Bolam, L. A. Hards, H. J. F. Stewart, F. H. Corson, H. T. Sulley, J. H. Edwards, J. H. St. Hill Mawdsley, H. Collings Bishop, H. D. W. Lewis, D. E. Roberts, A. Sinclair, R. Rutherford, and Arthur Ellis.

For the day of meeting, Monday was adopted *pro tem.*, and it was proposed that the members should dine together before the meeting. The by-laws were referred to the Committee. Votes of thanks were accorded, to the University authorities, who had promised to provide free accommodation for the Bristol meetings, and to the South Wales Institute of Engineers for accommodation at Cardiff.

The occasion was celebrated by a dinner at the Royal Hotel, at which about 100 were present. After the loyal toasts, Mr. Alderman Pearson proposed "The Institution of Electrical Engineers," expressing the gratitude of the Council of the I.M.E.A. for hospitality in their magnificent building, and the hope that the new by-laws would provide more funds and enable the Institution to continue the good work it was doing. He had known the President for 20 years, and graphically described his first meeting with him at Deptford, at which he was so impressed with Mr. Ferranti's enthusiasm and confidence in the future of electricity that he had never wavered in his support of the electricity supply undertaking of the Corporation of Bristol.

Mr. Ferranti expressed his interest in Alderman Pearson's reminiscences, and described the successive changes which had come over the Institution and its proceedings. Formerly there was a constant flow of new inventions and ideas, but nowadays the supply of electricity had attained to a commonplace level of reliability; it was, therefore, no longer practicable for the Institution to maintain its position as a purely scientific society. It should look after all things electrical and the interests of all electrical men: it was, therefore, necessary to broaden the basis of membership and take in all the people whose life-work was electrical. They must have a very large membership in order to be very strong and able to help in all electrical matters. They were celebrating the birth of a new Section, a most auspicious occasion, by means of which they hoped to bring the Institution home to the Western members, and to increase the membership, and he was pleased to have had the honour and privilege of assisting at the inception of the Western Local Section.

Mr. J. E. Kingsbury proposed "The Western Local Section," which title he said he would supplement by the words "Of the Institution of Electrical Engineers"; for he wished to point out that though the I.E.E. began as a society of very small things, its constitution had been so wisely drawn that it had been able to cover the ever-expanding field of electrical industry, and would continue to maintain its position in the future. The science had by no means reached finality; there would be as great developments in the future as in the past. The Institution had one great source of strength that other similar societies did not possess—namely, its Local Sections—each of which should remember that it formed only a small part of the greater body, and should thresh out its difficulties for the sake of its fellows. The Western Section, for example, might well attack the problems of electricity in mining, to the advantage of all branches of the Institution. Being a Western man himself, he felt great satisfaction in attending at the birth of the Western Section, and he had never seen a more lusty off-spring or a better set of officers. Mr. Chamen, in responding, first thanked the President for his presence at the inauguration of the new Section, and then explained the circumstances attending the choice of name, the proposed arrangements for meeting at various centres, &c. He thanked the members for electing him as the first chairman, and claimed their hearty co-operation with him in that office.

The chairman then proposed the health of Mr. H. Faraday Proctor, who had done all the hard work; he referred to the events of two years ago, when the newspapers censured their proceedings, but he said that Mr. Kingsbury had been with them from the first, and he thanked him for his kindly interest in the new Section. The toast was accorded musical honours, and Mr. Proctor responded, expressing his indebtedness to the hon. secretaries, Messrs. Collins and Haslam, who had worked very hard and interviewed most of the members within the area, with most satisfactory results. He emphasised the difficulties peculiar to the Section, as well as the importance of calling it into existence for the sake of both the members and the membership. Personally he attached greater value to the benefits of the social side than to the reading of papers.

Mr. D. Roberts proposed "The Visitors," and Dr. Wertheimer replied. Mr. Martin Price, secretary of the South Wales Institute of Engineers, was also to have replied, but owing to the vagaries of the local train service was unable to be present.

An excellent programme of music and song was interspersed with the speeches, and special mention should be made of the accomplished performance of Mr. F. Gardner, a violin virtuoso, well-known in Bristol.



On Wednesday last week, a lecture was given by Mr. Charles Bright, F.R.S.E., at Caxton Hall, Westminster, on the subject of "Inter-Imperial Cable Communications: A Non-Party Question." The lecturer emphasised the importance of cheap cable communication between all parts of the Empire, as a means of developing Imperial trade and circulating news. Everyone of the 13 cables between the United Kingdom and Canada was to-day under American control, and this offered serious possibilities in the future; provision should be made for the exchange of communications with Canada outside American influence. It was only by State aid and State control that the situation could be saved; a low tariff throughout the Empire could then be established. A universal penny-a-word tariff was impracticable, but he foreshadowed a common Imperial tariff of 6d. a word.

**Appointments Vacant.**—Engineer-in-charge for the Sunderland Corporation Electricity Works (50s.); electrical engineer for the Newport Corporation Electricity and Tramways undertaking (£100); fitter-driver for the Cleckheaton U.D.C. Electricity Works; engineering and mechanical draughtsman for the Stoke-on-Trent Corporation Electricity Department (£104); full-time assistant in the Electro-Chemistry Department, Northampton Polytechnic Institute (£120). See our advertisement pages to-day.

**A Claim for "Open-Contract" Work.**—On Wednesday last week, at the Guildhall, before Ald. Sir V. Morgan, Bart., an action was brought by F. E. Brown, a mechanic lately employed by Mr. H. W. Sullivan, against the latter in respect of a claim for a sum of £5 19s. 1½d, which was alleged to be due to plaintiff whilst in his employ. The plaintiff, who conducted his own case, sought to establish his claim on the grounds of an alleged unconditional promise made to him by Mr. Sullivan's late manager, alleged custom of the trade, and usage in the defendant's factory. The defendant was represented by Mr. W. Shakespeare. It transpired, in the course of evidence, that the work in dispute was to detailed drawings and specification, and not experimental work; nevertheless, the plaintiff contended that, on the above-mentioned grounds, he was entitled to be paid at the rate of 1s. an hour.

Mr. Sullivan's late manager, his present manager, and a number of his present employes, as well as a member of the executive of the Scientific Instrument-Makers' Trade Society, were called as witnesses by the plaintiff. The late manager denied the alleged promise, and the magistrate dismissed the case without calling upon the defendant for evidence, on the ground of failure to establish any of the bases of the plaintiff's claims. The defendant waived the question of costs.

An important principle was involved in this case—namely, that an employe should not be able to insist on special payments over and above the trade-union rate of wages, unless his work met with the approval of the employer. Had the plaintiff succeeded in establishing his case, it would have constituted a precedent for raising the wages above the trade-union limit on "open-contract" work, without regard to the results achieved or the length of time expended on the job.

**Quantitative Investigations on Wireless Telegraphy over Long Distances.**—L. W. Austin, writing in the *Physikalische Zeitschrift*, details the final results of the investigations undertaken in 1909 and 1910 between the Brant Rock station and the cruisers *Birmingham* and *Salem*, with a view to ascertaining the relationship between the current strength in the receiving and transmitting aërials with various long distances between the latter. On account of the indefinite variations observed during night trials, only measurements taken when the whole distance traversed by signals is under full daylight can be given any quantitative importance. Even by day, the absorption of æther waves varies greatly with the season, and is considerably less in winter than in summer.

Investigations with 1,000-m., 1,500-m. and 3,750-m. waves confirmed the result already adduced by Duddell and Taylor, that the intensity of waves transmitted over sea diminishes in direct proportion to the distance. Observations were made over various distances up to 1,000 nauts between the two cruisers and up to 1,200 nauts between Brant Rock and the *Birmingham*. Apart, however, from the decrease in intensity of reception with increasing distance of transmission, there was observed a further absorption depending upon the wave-length employed and also affected by the distance of transmission. It was found that the strength  $I$  of the receiving aerial current, when transmitting waves of length  $l$  over a distance  $d$  was given by—

$$I = \frac{k}{d} l^{-\Delta d}$$

where  $\Delta$  and  $k$  are constants determined by experiment.

Further, taking into account the heights  $h_1$ ,  $h_2$  of the sending and receiving antennæ, and denoting by  $I_s$  the current in the sending aerial, and by  $\lambda$  the wave length, the receiving aerial current  $I$  is given by:—

$$I = 4.25 \frac{I_s h_1 h_2}{\lambda d} l^{-\frac{0.0015 d}{\sqrt{\lambda}}}$$

( $I$  and  $I_s$  in amperes; length in kilometres).

Whence it appears that, so long as the resistance of the antennæ remains constant, the intensity of reception is directly proportional to the product of the heights of the aërials, and inversely proportional to the wave length.

**Social Events.**—The Sixth Annual Staff Ball of the Electric and Ordnance Accessories Co., Ltd., took place on Friday last at the Imperial Hotel, Birmingham. Some 120 members of the staff were present, with their wives, sisters and other friends.

and an enjoyable time was spent from 8 p.m. until 2 a.m. Everybody was grateful to the M.C. (Mr. W. H. Waller) and stewards (Messrs. W. Corrie and C. Brittlebank) for the able manner in which they performed their duties. The ball is stated to have been the most successful ever held by the staff.

On Saturday, 2nd inst., the second annual dinner and smoking concert of the London Electric Power House, Lot's Road, Sick Benefit Club was held in the Pier Hotel, Chelsea, a large number being present under the chairmanship of Mr. J. W. Towle, the chief engineer; Mr. J. H. Millen, station superintendent; and Mr. P. R. Wray, sub-station superintendent, were also present. After the loyal toasts were given, the success of the club was proposed by leading stoker O'Keefe, and seconded by Mr. O'Reilly, who spoke of the past and present success of the club. A successful musical programme was given by the employes, helped by outside artistes, under the management of Mr. Bert Folgate. A few words of thanks to the chairman for his support by Mr. J. Gough, of the boiler house, closed the proceedings.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Electricity Supply Committee of the Stoke-on-Trent T.C. has granted the following increases of salary:—MR. C. H. YEAMAN, Borough electrical engineer, from £500 to £700 maximum, by £50 per annum; MR. H. W. EDWARDS, resident engineer at Burslem, from £180 to £185; MR. W. A. TURNBULL, resident assistant engineer at Stoke, from £180 to £185; MR. S. G. MARSTON, mains superintendent at Hanley, from £140 to £145; MR. D. C. REDFERN, mains superintendent at Stoke, from £130 to £135, subject to acting as mains superintendent in the Longton and Fenton areas. Increases have also been granted to numerous subordinate members of the staff.

MR. J. E. STAMP has been appointed a temporary assistant at the Barrow Corporation electricity works.

MR. GEO. OLLIER, of the Blackpool Electricity Works, has been appointed assistant electrical engineer, by the Bispham-with-Norbreck U.D.C.

The Elland U.D.C. has appointed MR. W. C. KNOWLES, assistant engineer at the Cleckheaton Electricity Works, as electrical engineer, at a salary of £150 per annum. There were 180 applicants.

On leaving to become chief assistant electrical engineer at Erith, MR. R. H. MAYNE has been presented by the electricity staff at St. Helens, with a dispatch case and a number of technical books.

The Derby T.C. has appointed MR. G. DARDEN, as assistant mains superintendent.

On Thursday last week at the St Helens Corporation electric power station, MR. F. J. HELSBY was presented with a suit case, on the occasion of his leaving to take up the position of chief clerk at the Wrexham electricity works.

On Wednesday evening, March 6th, MR. M. R. MCCracken, assistant shift engineer of the Lot's Road power house, was presented by Mr. J. W. Towle, chief engineer, on behalf of the operating staff, with a silver-plated tea service and tray on the occasion of his marriage.

**Tramway Officials.**—MR. N. J. YOUNG, of the Bristol Tramways and Carriage Co., Ltd., who has been appointed manager to the Newport (Mon.) Tramways and Electricity Undertakings, has been presented by his colleagues with a silver fish service.

**General.**—At a meeting of the Senate of the University of London recently, MR. E. KILBURN SCOTT was officially recognised as a teacher of Electrical Engineering at University College for students proceeding to the B.Sc. degree. Mr. Scott had already been "recognised" by the University for Electrical Design at the Northampton Institute, London, where he has been on the teaching staff since 1898, except for four years spent at the University of Sydney. Mr. Kilburn Scott has also given special courses of lectures this session at Finsbury Technical College and the Polytechnic, Regent Street.

MR. G. F. METZGER announces that he has changed his address from Manchester to Shepherdswell, near Dover, and all communications should be addressed there until further notice.

MR. H. J. ALEXANDER, who has held the position of chief rate fixer at the Electric and Ordnance Co.'s works at Aston for the past 10 years, has just left in order to take up an important position in Manchester. His colleagues, in order to show their appreciation of his abilities, both in the works and outside, organised a smoking concert at the Central Restaurant, Corporation Street, Birmingham, on the evening of March 1st, and during an interval in the programme they presented him with a gold half-hunter, suitably inscribed. A good muster of his friends both past and present were in attendance, and in making the presentation the chairman wished him every success in his new sphere. The programme was an extremely good one; especially do we understand that to have been the case regarding one turn given by a member of the motor design staff, which consisted of topical allusions to idiosyncrasies to be noticed in the E. and O. A. Works.



We understand that MR. OSWALD DEWEY, who has been with the Reason Manufacturing Co., Ltd., for the last six years, is joining the Isarin-Zachlerwerke, of München, as their sales engineer for the British Isles. Prior to joining the Reason Co., Mr. Dewey held the position of chief salesman in the meter department of Messrs. Ferranti, Ltd., Hollinwood.

The subject of a sketch under "Men of the Day," in *Mayfair* (February 29th) is MR. GEORGE BALFOUR, of Balfour, Beatty & Co., Ltd., who is interested in various electrical enterprises, and has figured in recent years in the world of politics. Mr. Balfour is only 40 years of age. He was an assistant in the Edinburgh Corporation electricity works at the time of their opening some 17 years ago, and since then he has had experience of power station, tramway and other electrical and financial affairs.

**Obituary.**—COLONEL G. E. GOURAUD.—The death of Col. Gouraud, which we recorded in our last issue, removes from the scene one of the pioneers of electrical enterprise. His connection with the introduction of the phonograph and his association with the "Emperor of the Sahara" have been referred to in the obituary notices published in our daily contemporaries, but Colonel Gouraud's memory requires that his work in connection with the telephone and the electric light should be recalled. He was the London representative of the Mercantile Trust Co., of New York, when the telephone was first heard of. Having previously some relations with Edison in connection with automatic telegraphs, he obtained an interest in his European telephone rights and carried on the active management of the business. He formed the Edison Telephone Co. in London, and the first exchange on the Edison system was in his office, which was also the Mecca of the representatives of the Press seeking information regarding the new system of distribution and sub-division of the electric light which was to revolutionise the world's lighting. There were not wanting critics who suggested that the trans-Atlantic telegrams had a Stock Exchange purpose, for the fall in gas shares was serious. But such suggestions were entirely unfounded. The telephone enterprise had been launched when the "perfected phonograph" was introduced. The interest in this was great, and there would have been no difficulty in enlisting considerable public capital in it, but the formation of a company for its commercial exploitation was delayed. Social success was a great aim of the Colonel, and the phonograph was used to that end until public interest was on the wane. Invitations were issued to "At Homes" "to meet Mr. Edison," which meant to hear Mr. Edison's voice on the phonograph. Colonel Gouraud was one of the "Celebrities at Home" of *The World* (October 17th, 1888). In the well-known style of those articles, the Colonel's house, horses and ambitions are set forth:—"On the crest of Beulah Hill, midway between the Crystal Palace and Streatham Common, you come somewhat abruptly on an archway of moulded terra-cotta. The letter G is interwoven with a sabre, a pen and flashes of lightning, on a shield in the centre of the pediment, and through the gate of hammered ironwork you catch a glimpse of a view of surpassing beauty. . . . If he had only known of your visit, telephone and phonograph, the fastest going tandem in England, would have brought you from Herne Hill in less than half the time it took the train to reach the High Level Station. . . . When the exigencies of business caused his sojourn in England to be indefinitely prolonged, he pitched his tent on Beulah Hill, resolved to send his sons to Harrow, and settled down quietly to the full enjoyment of English life." But "Little Menlo" was, in later years, to have other occupants, for the enthusiasm and other admirable qualifications which were of great advantage in the inception of an enterprise did not enable him to work with others to its successful accomplishment. He was a man of kindly thought and good ideas which could, with advantage, be left to others to carry out. But the enthusiast and the *visionnaire* sometimes find it difficult to keep in touch with practical questions, and before long he ceased to be connected with the valuable enterprises which he helped to start. His connection with M. Lebaudy as Postmaster-General, or some such office, of the Empire of Sahara, is to be regretted, but may be charitably considered as a development of some mental bias which found early expression in his use of the phonograph for the purpose of social success. The device over the Beulah Hill gateway was characteristic of the man. The "G" was necessarily the centrepiece; of the sabre and his right to wear it he was proud; of the pen he could make good use, and flashes of lightning were by no means infrequent. Though much misunderstood by his contemporaries, he was a pioneer who did some good and useful work, and amongst his early associates there are those who acknowledge indebtedness to him for beneficial influence; and of him retain kindly memories.

## NEW COMPANIES REGISTERED.

**John C. Fuller & Son, Ltd.** (120,563).—This company was registered on February 29th, with a capital of £10,000 in £1 shares, to take over the business of an electrical and general engineer, recently carried on by G. Fuller as "John C. Fuller & Son," at Woodland Works, Wick Road, Old Ford, E., and to adopt an agreement with G. Fuller. The subscribers (with one share each) are:—G. Fuller, Elm Croft, Hutton, Essex, electrical engineer; G. J. A. Fuller, Badwell Cottage, Draycot Road, Walsstead, Essex, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are G. Fuller, G. J. A. Fuller and L. Fuller; qualification, £1,000; remuneration of chairman, £1,000 per annum; of others, £340 each per annum. Registered by Tarry, Sherlock and King, 17, Serjeant's Inn, E.C.

**Fletcher's Electric Fittings, Ltd.** (120,514).—This company was registered on February 27th, with a capital of £1,000 in £1 shares, to take over the business of an art metal worker and gas and electric fittings manufacturer, lately carried on by E. Fletcher at 59, Key Hill, Birmingham. The subscribers (with five shares each) are:—E. Fletcher, 124, Hampstead Road, Handsworth, Birmingham, manufacturer; A. R. Page, 59, Woodfield Road, King's Heath, Birmingham, manufacturer; S. E. Hill, 41, Cambridge Road, King's Heath, Birmingham, manufacturer. Private company. The number of directors is not to be more than five; the first are E. Fletcher, A. R. Page, and S. E. Hill; qualification five shares. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Titan Lift Co., Ltd.** (120,405).—This company was registered on February 21st, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of lifts, hoisting appliances and electric machines, electrical engineers and contractors, and to acquire the business of the Titan Lift and Electric Co. in London, and to adopt agreements (1) with the Titan Co., Ltd., of Copenhagen, and (2) with R. Selby. The subscribers (with one share each) are:—R. Selby, 18, Brompton Square, S.W., gentleman; A. J. Owen, 30a, Cato Road, Clapham, S.W., clerk. Private company. The number of directors is not to be more than five; R. Selby is the sole managing director; qualification, £1. Registered office, 18, Red Lion Street, Holborn, W.C.

**Electric Speller, Ltd.** (120,448).—This company was registered on February 23rd, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of automatic and other apparatus for displaying advertisements or other information, &c., and to adopt an agreement with H. Tas and A. Cohen. The subscribers (with one share each) are:—H. Tas, Albion House, New Oxford Street, W.C., inventor; A. Cohen, 6A, Maddox Street, Regent Street, W., gentleman. Private company. The number of directors is not to be less than two or more than six; the first are H. Tas and A. Cohen; qualification, 250 shares; remuneration, £50 each per annum (chairman £75), and 5 per cent. of the net profits, free of income-tax. Registered office, 5, Robert Street, Adelphi, W.C.

**A. T. Speedometer Co., Ltd.** (120,406).—This company was registered on February 22nd, with a capital of £1,200 in £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers of and dealers in mechanical apparatus of all kinds, &c., to acquire the business carried on by V. Korting, P. Rufer and G. Rensch, at 140, Long Acre, W.C., as the A. T. Speedometer Co. The subscribers (with one share each) are:—T. F. Bowman, 62, London Wall, E.C., solicitor; S. A. Sharpe, 62, London Wall, E.C., cashier. Private company. The number of directors is not to be less than two or more than seven; the first are V. Korting, G. Rensch and P. Rufer; H. Koffol and M. Brooke are the managers; remuneration as fixed by the company. Registered office, 140, Long Acre, W.C.

**Imeson, Finch & Co. (1912), Ltd.** (120,457).—This company was registered on February 23rd, with a capital of £5,000 in £1 shares, to take over the business of electrical, mechanical, tramway and general engineers, lately carried on by Imeson, Finch & Co. Ltd., at Stockton-on-Tees. The subscribers (with one share each) are:—C. A. Brentnall, 30, Southfield Road, Middlesbrough, merchant; W. Anderson, 45, Kensington Road, Middlesbrough, secretary; F. Smith, 140, Portland Street, Middlesbrough, accountant. Private company. The number of directors is not to be less than two or more than five; the first are J. W. Brown and C. A. Brentnall. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**C. J. Thursfield & Co., Ltd.** (120,493).—This company was registered on February 26th, with a capital of £7,000 in £1 shares, to take over the business of designers and manufacturers of electric light fittings, metal workers and founders carried on at Cecil Works, Clement Street, Birmingham, as "C. J. Thursfield & Co.," and to adopt an agreement with C. J. Thursfield. The subscribers (with one share each) are:—C. J. Thursfield, The Mynd, Alvechurch, Worcester, manufacturer; A. Shirlaw, 139, Cannon Street, E.C., manufacturer. Private company; the number of directors is not to be less than two or more than five; the first are C. J. Thursfield and A. Shirlaw. Registered office, Cecil Works, 42, Clement Street, Birmingham.

**M. R. W. Syndicate, Ltd.** (120,365).—This company was registered on February 20th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, oil combustion, gas and electrical motors, dynamos, cycles, &c. The subscribers (with one share each) are:—F. Allen, 16, Eastcheap, E.C., solicitor; J. Allen, 16, Eastcheap, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office: 56, Cannon Street, E.C.

**Modern Kitchens, Ltd.** (120,503).—This company was registered on February 26th, with a capital of £1,000 in £1 shares, to develop and turn to account the inventions of A. F. Berry in connection with electrical heating and cooking. The subscribers (with one share each) are:—R. Dand, 34, Norfolk Street, W.C., secretary; W. S. Mason, 105, Everhot Road, Stroud Green, N., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by W. O. Vizard, 10, Norfolk Street, Strand, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**J. Marse & Co., Ltd.**—Particulars of £500 second debentures, created February 6th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Ozonair, Ltd.** (84,770).—Return dated January 1st, filed January 9th, 1912. Capital, £20,000 in 10,000 preference, 4,900 ordinary and 5,000 "B" and 100 founders' shares of £1 each. 5,000 preference, 4,900 ordinary, 5,000 "B" and 100 founders' shares taken up. £14,900 paid on the preference, ordinary and "B." £100 considered as paid on the founders'. Mortgages and charges: Nil. (Original capital, £5,000 in 4,900 ordinary and 100 founders' shares of £1 each. Increased to £10,000 in April, 1909, and to present amount in April, 1911.)

**Liverpool Electric Cable Co., Ltd.** (71,099).—Return dated January 4th, filed January 15th, 1912. Capital, £10,000 in £1 shares. All shares taken up. £7,833 paid. £2,167 considered as paid. Mortgages and charges: Nil.

**Costa Rica Electric Light and Traction Co., Ltd.** (56,447).—Return dated January 3rd, filed January 11th, 1912. Capital, £10,000 in £1 shares. All shares taken up. £7 paid. £129,953 considered as paid. Mortgages and charges: £271,050.

**Spagnoletti, Ltd.** (94,447).—Return dated January 13th, 1912. Capital, £20,000 in £1 shares; 12,352 shares taken up; £2,707 paid; £1,645 considered as paid. Mortgages and charges: £12,500.



**Blackpool, St. Anne's and Lytham Tramways Co., Ltd.** (59,184).—Return dated December 25th, 1911, filed February 10th, 1912. Capital £125,000 in 50,000 preference shares of 18s. each, and 99,900 ordinary and 100 management shares of 16s. each. All shares taken up. £72,000 paid in cash. £53,000 considered as paid on 65,000 shares. Mortgages and charges: £165,000.

**Aluminium Corporation, Ltd.** (106,421).—Trust deed dated February 13th, 1912 (supplemental to trust deed dated May 18th, 1910, securing £50,000 mortgage debenture stock), charged on rights affecting and various lands in Carnarvonshire. Trustees: London General Investment Trust, Ltd., 12, Moorgate Street, E.C.

**Telephone Co. of Egypt, Ltd.** (17,824).—A memorandum of satisfaction to the extent of £2,200 on February 14th, 1912, of trust deed dated July 27th, 1904, and three supplemental deeds of acknowledgment, securing £200,000 debenture stock, has been filed.

**Kilowatt Publishing Co., Ltd.** (90,715).—Issue on February 15th, 1912, of £400 debentures, part of a series of which particulars have already been filed.

**Electromobile Co., Ltd.**—Issue on February 15th, 1912, of £162 15s. debentures, part of a series of which particulars have already been filed.

**Anglo-Norwegian Aluminium Co., Ltd.** (92,830).—Particulars of £25,000 debentures, created by resolutions of December 18th, 1911, and January 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future. No trustees.

**Metalite, Ltd.** (110,919).—Debenture dated February 15th, 1912, to secure £2,713 4s., charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. P. Oulton, 9 and 10, Pancras Lane, E.C.

**Electrical Installations, Ltd.** (91,050).—A memorandum of satisfaction to the extent of £50 on February 26th, 1912, of debentures dated December 5th, 1906, securing £1,500, has been filed.

**La Plata Electric Tramways Co., Ltd.** (101,431).—Trust deed dated January 31st, 1912 (supplemental to trust deed dated May 26th, 1909), to secure £70,000 5 per cent. first mortgage debenture stock, ranking *pari passu* with £30,000 similar stock created by principal deed. Property charged: Concessions, lands, tramways, buildings and hereditaments, and the company's undertaking and property, present and future, including uncalled capital. Trustees: River Plate Trust Loan and Agency Co., Ltd., 52, Moorgate Street, E.C.

**Electrical Advertising Co., Ltd.**—Debenture dated February 14th, 1912, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. F. Kennedy, 13 and 14, Abchurch Lane, E.C.

**Newtons, Ltd.** (48,936).—Mortgage or charge dated January 16th, but not actually executed until February 13th, 1912, as verified by Statutory Declaration, to secure £1,000. Property charged: Freehold land and buildings in Herbert Street and Cyril Street, Rowbarton, Taunton, with fixed plant and machinery. Holders: A. E. Newton, Cutsey, near Taunton; H. N. Hickley, Taunton; and L. G. Caunter, Trentishoe Mansions, Charing Cross Road, W.C.

**Balehin, Schulz & Co., Ltd.** (98,799).—Debenture dated February 12th, 1912, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. J. Hayward, 6, Argyle Place, W.

**Pontelec Welding Patents, Ltd.** (107,935).—Issue on February 22nd, 1912, of £200 debentures, part of a series of which particulars have already been filed.

## CITY NOTES.

### Financial Transactions on the Continent.

THE share capital of the *Elektrizitäts Gesellschaft vorm H. Poege, of Chemnitz*, is to be raised to £175,000 by the issue of new shares of £50,000. The new shares have been taken over by the Dresden Bank at the price of 110 per cent.

The *Elektro Treuhand Bank*, which was jointly formed by the A.E.G. and the Siemens & Halske Co., is now being brought into actual existence with a share capital of £1,500,000, and is to be domiciled at Hamburg. The first transaction of this financing institution relates to the Hamburg Elevated Railway, the principal section of which will be opened for traffic at the beginning of March.

The recent extraordinary general meeting of the *Elektrizitäts Gesellschaft vorm Schuckert & Co., of Nuremberg*, sanctioned the proposed increase in the share capital of £500,000 to £3,500,000. The proceeds of the issue are partly intended to meet the company's half-share in the loan of £1,000,000 recently decided upon by the two proprietary companies in the Siemens-Schuckert Works, and partly to meet the money requirements which have arisen in connection with other undertakings of the Nuremberg company. A banking syndicate, headed by the Vereinsbank, of Munich, has agreed to take over the new shares at the price of 131 per cent., and will, in due course, offer them to the shareholders in the Schuckert Co. at 140 per cent.

The *Deutsch-Üeberseerische Elektrizitäts Gesellschaft (German Transmarine Electricity Co.)*, whose expansion of capital in recent years has been considerable, has just passed a resolution to make a fresh issue of £1,000,000 in new shares, thus increasing the share capital to £6,000,000. It is intended to apply the proceeds chiefly to meeting the current year's monetary requirements in connection with the large extensions of the supply works in Buenos Ayres, which are needed for satisfying the much greater demands for public lighting and for the underground railways. The shares are to be offered to existing shareholders at the price of 130 per cent. The development of the share capital is shown by the fact that it was raised from £1,800,000 to £3,000,000 in 1906, to £4,000,000 in 1909, £4,500,000 in 1910, and to £5,000,000 at the beginning of 1911. In addition, the loan capital amounts to £4,250,000 at

present, the undertaking representing one of the largest German investments abroad.

The Deutsche Bank announces that the directors of the *St. Petersburg Electric Lighting Co.*, of 1886, have decided to increase the share capital from 30,000,000 to 40,000,000 roubles, by the emission of 10,000,000 roubles of new ordinary shares. In addition to providing for the extinction of floating liabilities, the money to be raised will be devoted to extensions of the supply works in St. Petersburg, Moscow, and Lodz. It is denied that the company intends to become financially interested in new supply works in Moscow for which a Belgian company is endeavouring to raise capital in Belgium and France, and for which the Moscow city council granted a concession a few months ago.

The *Bank für Elektrische Unternehmungen, of Zurich*, which is associated with the A.E.G., of Berlin, is making a fresh issue of 4½ per cent. bonds amounting to £400,000. The repayment of the loan is to take place at the nominal value as from July 1st, 1926, although the right is reserved of giving notice of total redemption in July, 1921. As in the case of previous loans, so in the present instance is no special guarantee given to the bonds, although the bank undertakes not to raise any other loans with special security before the whole of this loan is repaid. The share capital of the bank amounts to £2,400,000, and the total bond issues, inclusive of the new loan, represent £2,480,000. The dividends paid in the past four years have been uniformly at the rate of 10 per cent.

**Stock Exchange Notices.**—The Committee have appointed special settling days as under:—

Thursday, March 21st.—Ruston, Proctor & Co., Ltd.—Further issue of 15,000 ordinary shares of £10 each, fully paid (Nos. 35,001 to 50,000).

Friday, March 22nd.—Dryden Timber and Power Co., Ltd.—Fully-paid scrip for £154,300 6 per cent. first mortgage sinking fund gold bonds.

Marconi Wireless Telegraph Co. of Canada, Ltd.—1,000,000 shares of \$5 each, fully paid.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.—5 per cent. first mortgage gold bonds.

To appoint a special settling day in:—

Sun Power Co. (Eastern Hemispheres), Ltd.—10,507 ordinary shares of £1 each fully paid, Nos. 1 to 7, 150,008 to 155,007 and 160,008 to 165,507.

And to allow the following securities to be quoted in the Official List:—

Monterey Railway, Light and Power Co.—Further issue of £200,000 5 per cent. first mortgage debenture stock.

**Davis & Timmins, Ltd.**—The directors report that, for the year ending December, 1911, the net profit, including £8,046 brought forward, after allowing for depreciation and commission to manager, was £22,162. The interim dividend paid in September last on the preference shares absorbed £1,800, that on the ordinary shares at the rate of 6 per cent. per annum for the half-year to June 30th, 1911, £1,410. There has been placed to general reserve account the sum of £2,000, leaving a balance of £16,952 to be dealt with. The directors propose a six months' dividend on the preference shares, at 6 per cent. per annum, to December, 1911, requiring £1,800; a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year to December, 1911, making 8 per cent. for the year, absorbing £2,350; a bonus of 5 per cent. out of profits, £2,350; leaving to be carried forward, £10,452.

**Prospectuses.**—*Alby United Carbide Factories, Ltd.*—This company is offering until to-day 150,000 5½ per cent. cumulative convertible preference shares of £1 each at par, the money being necessary for increasing the capacity of the plant at the Odda Factory and the general extension of the company's business.

*Alabama Traction, Light and Power Co., Ltd.*—The list was to close yesterday in respect of an offer of \$6,000,000 first mortgage 5 per cent. 50-year gold bonds at \$90 per bond of \$500.

*Kentucky Traction and Terminal Co.*—The L. and S. W. Bank has lately offered for subscription \$1,000,000 5 per cent. first and refunding mortgage sinking fund gold bonds in this company.

**Alley & MacLellan, Ltd.**—The directors report that the profit from trading for the year to December 31st, after meeting all necessary charges, is £18,086, plus balance from last year, making £19,537. After paying a half-year's dividend on the preference shares at the rate of 5½ per cent. per annum, amounting to £1,683, the directors have transferred to reserve fund £4,287, and they recommend payment of dividend on the preference shares for one and a-half years to December 31st, 1911, at the rate of 5½ per cent. per annum, less tax, absorbing £5,049-£1,690 is carried forward.

**Western Telegraph Co., Ltd.**—The directors have declared the second quarterly interim dividend of 3s. per share for the year ending June 30th, 1912, being at the rate of 6 per cent. per annum.

**County of Durham Electrical Power Distribution Co.**—The directors have declared a dividend of 5 per cent. for the year to December 31st on the preference shares.

**Globe Telegraph and Trust Co., Ltd.**—The directors have declared an interim dividend of 2s. per share on the ordinary shares.

**Continental.**—SWITZERLAND.—La Société Suisse pour l'Industrie Electrique, of Basle, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

(Continued on page 392.)



## NEW ENGINEER-IN-CHIEF TO THE POST OFFICE.

AN official announcement appeared in the daily Press last Friday, stating that the Postmaster-General had appointed Major O'Meara, C.M.G., R.E., to be Engineering Special Commissioner charged with the duty of examining and reporting upon the telegraph and telephone systems of Europe. The notice continued :—"Major O'Meara has been engineer-in-chief of the Post Office since April, 1907, but unfortunately the state of his health is not such as to enable him to retain this office. Mr. W. Slingo, one of the assistant engineers-in-chief of the Post Office, has been appointed by the Postmaster-General to be engineer-in-chief, in succession to Major O'Meara."

Mr. William Slingo, the new engineer-in-chief of the British Post Office, commenced his business career on the commercial side of the Telegraph Department of the General Post Office (in fact, at the Central Telegraph Office) in 1870. Mr. Slingo must be regarded as one of the pioneers of technical education, for in 1876 he founded the Telegraph School of Science at the General Post Office, having then only five students under his tuition. He remained as principal of this school until 1898, by which time the membership had reached the high total of 850. He

was also head of the electrical section at the People's Palace, which is now known as the East London Technical College. In 1898 the Telegraph School of Science at the General Post Office was closed, and the work in connection therewith was transferred to the Northampton Polytechnic Institute, Clerkenwell. Consequently, Mr. Slingo's services were transferred to the engineering department of the Post Office, where he was employed in the first instance as a first-class technical officer. In this capacity, Mr. Slingo established Hughes Duplex working between London and the Continent, and he also developed a system of secondary battery working which was applied to a considerable extent to the telegraph offices in

the United Kingdom. At the close of 1903, Mr. Slingo was promoted to the position of superintending engineer of the North Wales Engineering District, with headquarters at Liverpool, and in this capacity he acquired considerable experience in telegraph and telephone engineering practice. In January of last year he returned to the General Post Office, London, to fill the post of assistant engineer-in-chief. His appointment to the high position of engineer-in-chief dates from the 1st inst., and he succeeds in that capacity a no less distinguished public servant than Major W. A. J. O'Meara, C.M.G., R.E.

During his career in the Post Office service, Mr. Slingo has seen enormous developments in the telegraph and telephone services, and he has witnessed as many as four transfers. In the first year of his service, the transfer of the telegraphs to the State was accomplished; in 1889, the undertakings of certain of the submarine telegraph companies were absorbed in the Post Office service; in 1896, the trunk telephone services were transferred to the State, and at the dawn of the present year the local telephone services hitherto controlled by the National Telephone Co. were



W. SLINGO, ENGINEER-IN-CHIEF TO THE GENERAL POST OFFICE.

transferred to the Post Office. In view of the transfer of the company's plant and staff to the State, the preparation of the inventory and the valuation of the company's plant, and the forthcoming arbitration proceedings in connection with that valuation, it will be realised that Mr. Slingo has taken up the reins of a great Department at a time of considerable public importance.

Mr. Slingo's reputation as an author of technical literature is world-wide. Chief among his publications is the book on "Electrical Engineering," the authorship of which he shared with Mr. A. Brooker. Mr. Slingo is 56 years of age.



## ELECTRIC WINDING ON THE RAND.

The West Rand Consolidated Gold Mines, Ltd., is at present working one shaft (the East shaft) and sinking a second on

who purchased such parts as drums, brakes, drum shafts, and bearings, from the Dingleische Maschinenfabrik A.G. under the terms of the order. The mechanical equipments of both hoists are almost identical, in spite of the difference in the loads. The services for which these hoists are designed, are :—

## Hoist No. 1. Hoist No. 2.

Inclination of shaft to horizontal ...	50°	50°
Length of shaft ...	3,000 ft.	3,000 ft.
Hoisting speed ...	2,000 ft. per min.	2,000 ft. per min.
Weight of rock per wind ...	1,200 lb.	6,000 lb.
Weight of skip ...	7,560 lb.	5,500 lb.
Weight of rope ...	8,500 lb.	6,000 lb.

Each hoist is equipped with two drums, 10 ft. diameter  $\times$  3 ft. 9 in. wide between flanges, which run loose on the drum shaft, and are driven by multi-tooth clutches sliding on hexagonal sections of the shaft. The clutches are operated by hand-wheels on the driver's platform.

Post brakes are provided on each drum, of the segmental type, supported in the centre, and applied by weights. Compressed-air engines with "Iversen" valve gear are used for releasing the brakes. Interlocks are provided so that the brakes cannot be released on a drum that is not clutched to the main shaft. Compressed air for operating the brakes is

obtained from a small compressor driven through gearing by a 16-H.P. three-phase 50-period 4,500-volt squirrel-cage induction motor, fitted with automatic starting and stopping gear controlled by the air pressure.

The position of either cage in the shaft is indicated by two dial depth indicators driven one from each drum through gearing. Each indicator has two points, one moving slowly during the entire travel of the skip and the other moving

an estate of nearly 2,000 claims situated around Krugersdorp, about 20 miles from Johannesburg. Their crushing capacity at the end of 1909 was about 30,000 tons per month, and in 1910 about 70,000 tons per month, and with the completion of the new shaft this figure will be greatly augmented.

The West shaft of this mine, which is at present in course of sinking, is a seven compartment shaft, and is being driven downwards at an angle of 50° to the horizontal to an estimated distance of 3,000 ft. Sinking was commenced by means of a temporary headgear and two small steam sinking engines, and at the same time an order was placed for two double-drum electric winding engines—one suitable for a 6-ton useful load, and the other for a 3-ton useful load.

By the time the electric winding engines were installed, the permanent headgear was completed, and the shaft had been sunk to a sufficient depth to permit of economical hoisting with the electric hoists. The permanent headgear, is built entirely of steel. The engine room is remarkable as it is built of brick, and is very commodious, whereas the usual engine room on the Rand is of corrugated iron construction.

The two hoists were supplied complete, and their erection supervised, by the British Westinghouse Co., Ltd.,

very rapidly during the final part of the wind, so as to increase the accuracy of stopping. Automatic devices are provided, which bring the skips to a dead slow speed at the tips, and stop the hoist dead should the skips pass that level, irrespective of any action on the part of the driver.

The electrical equipment is designed for operation on the

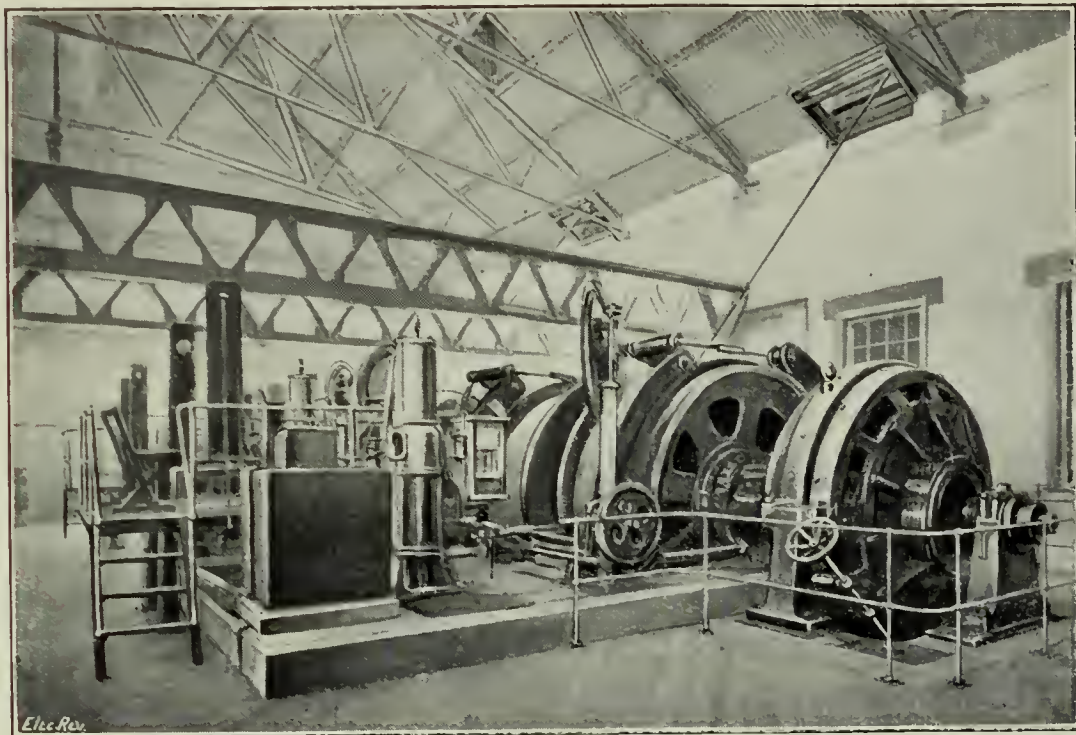


FIG. 1.—450-H.P. WESTINGHOUSE MOTOR DRIVING 3-TON HOIST.

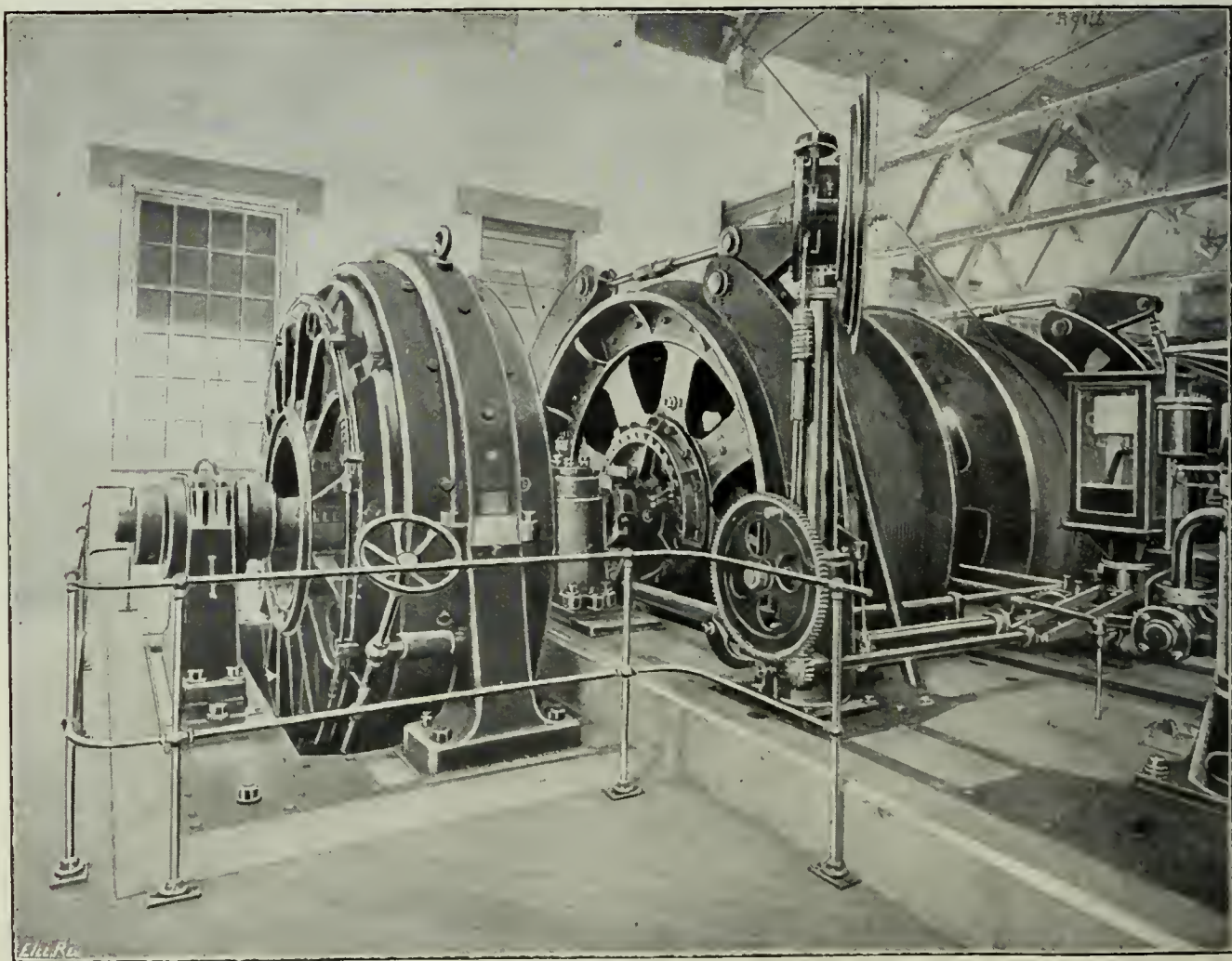


FIG. 2.—750-H.P. HOIST MOTOR: WEST RAND CONSOLIDATED MINES.



now well-known Ward-Leonard system. The winding motors are directly coupled to the drum shaft, and in each case operated at 60 R.P.M. On hoist, No. 1, there is a 750 B.H.P., 60-volt D.C. motor provided with commutating poles; fig. 2 shows this motor together with some of the mechanical parts. Hoist No. 2 is provided with a 450-H.P. D.C. Westinghouse motor, shown in fig. 1, together with the drum, driver's platform and other gear.

Power for the winding motors is obtained from two motor-generator sets, arranged so that either hoist may be driven by either motor-generator, provision also being made for the third equipment in contemplation. The interchange switchgear for the motor-generators is shown in fig. 5.

Each motor-generator set comprises a 200-volt, three-phase, 50-period, slip-ring induction motor, directly coupled to a D.C. generator and an exciter. The arrangement of the set for No. 1 hoist may be seen in fig. 4. The A.C. supply for driving the motors of the motor-generator sets is purchased from the Victoria Falls and Transvaal Power Co., Ltd.

In the Ward-Leonard system, the speed and direction of rotation of the winding engine are controlled entirely by altering the strength and direction of the D.C. generator in the motor-generator set. This is carried out by means of a special face-plate controller illustrated in fig. 7. By means of this controller, any desired speed may be obtained up to full speed in either direction, the speed corresponding closely to the position of the driver's lever, irrespective of the load. These controllers are fitted with stops controlled electrically from the bank so that half-speed cannot be exceeded when men are being raised.

An emergency device is provided for each hoist, arranged

is thus a safeguard against practically any danger that might arise.

A four-panel switchboard, illustrated in fig. 3, is used for controlling the supply of power to the two winding engines, and is arranged to permit of extension when



FIG. 3.—FOUR-PANEL SWITCHBOARD, WINDING ENGINE HOUSE.

required. The switchboard is equipped with one A.C. and one D.C. panel for each hoist, the former for the motor, and the other for the fields of the various D.C. machines.

Although the Ward-Leonard system may be readily adapted for use with a fly-wheel so that no peaks are reflected into the mains, no attempt has been made to equalise the load of these winding engines, since the stations of the Victoria Falls and the Transvaal Power Co. are large enough to be untroubled even by the heavy peaks of the large winding engines in use on the Rand.

In conclusion, thanks are due to the engineers of the General Mining and Finance Corporation, who permitted the reproduction of the photographs. &c.

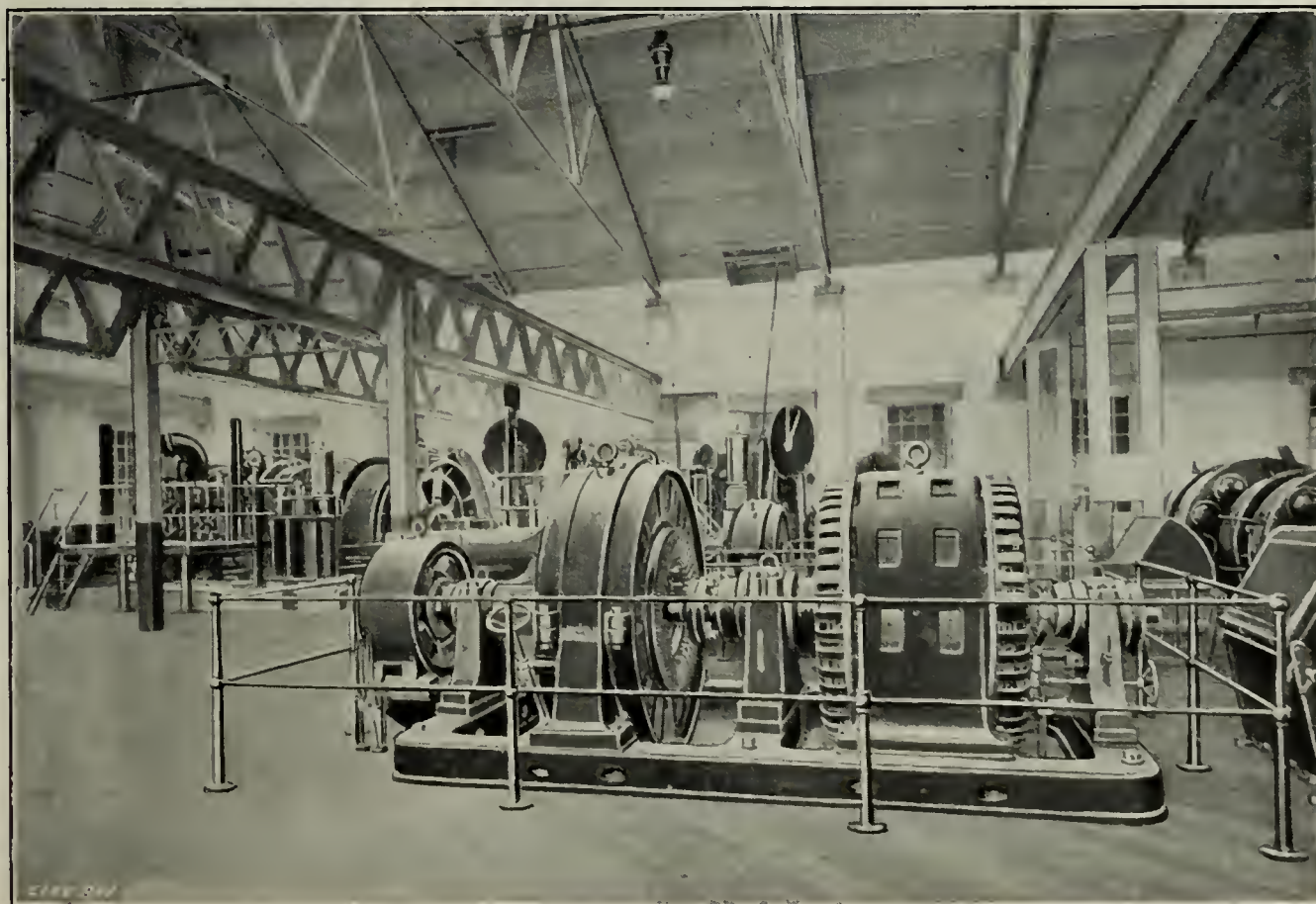


FIG. 4.—VIEW IN WEST RAND WINDING ENGINE HOUSE, SHOWING 650-H.P. MOTOR-GENERATOR IN FOREGROUND.

and connected so that the hoists are quickly stopped in case of—(1) overwinding; (2) failure of power supply; (3) failure of exciting current; (4) overloads; (5) failure of air supply; (6) operation of driver's emergency lever. There

Refreshments were served during an interval after the twelfth hand. The prizes were presented by Mrs. Knowles. These functions are becoming increasingly popular. The first, held in the January of last year, resulted in an attendance of about 150, whilst at that held in January, this year, 210 attended.

**Whist Drive.**—On Thursday last week at Messrs. Slater's Baltic Restaurant, Leadenhall Street, E.C., a large gathering assembled in connection with the Siemens staff whist drive. Some 320 members of the staff and their friends spent a thoroughly enjoyable social evening. Mr. L. A. Thomson officiated as M.C., and Mr. W. H. Hitchcock as Hon. Secretary. There were 13 prizes.



## REVIEWS.

*Power House Design.* By J. F. C. SNELL. London: Longmans, Green & Co. 1911. Price 21s. net.

This book is the first volume of an electrical engineering series which is being brought out by Messrs. Longmans, and deals with the complete design of electric power stations. Special originality is not claimed by the author, and the book consists principally of the collection and classification

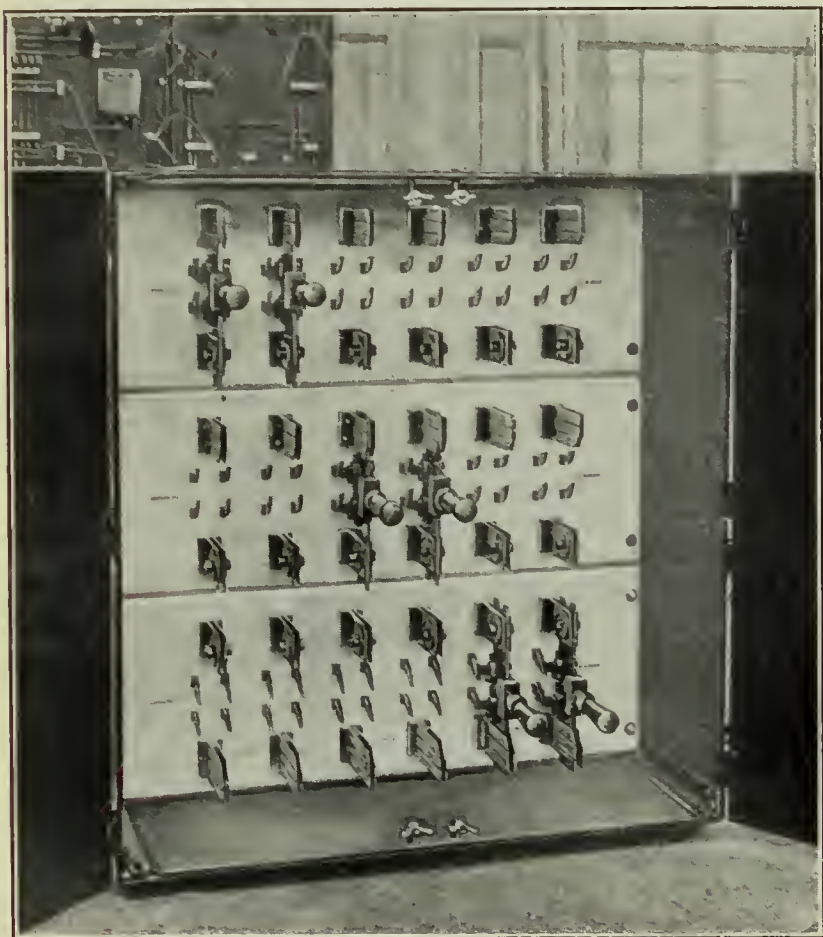


FIG. 5.—TRANSFER PANEL, SHOWING SWITCHES, WEST RAND WINDING PLANT (p. 389).

of the wide experience which he has obtained during the last 20 years, together with that of other eminent engineers.

A short introduction and Chapter I deal respectively with the general principles underlying powers-tation design, and with commercial systems of supply now in use for different classes of work. A useful feature lies in the fact that the load factors, which may reasonably be expected for all usual types of generating station, are given.

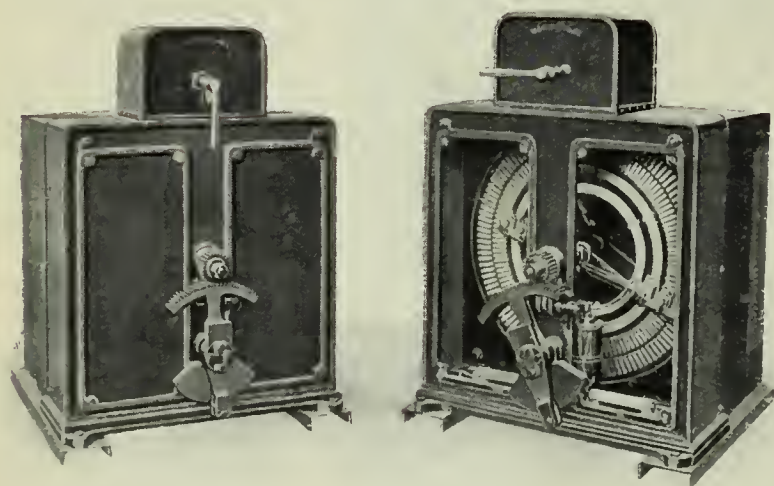


FIG. 7.—FIELD CONTROLLERS, WEST RAND WINDING PLANT (p. 389).

Chapter II is a well-written essay on the choice of a site for a power station, and the type of plant to be installed thereon. Good information is given as to the size of units in relation to load factor, stand-by plant, and so on. An emphatic plea is put in for simplicity in design, with which we are entirely in accord.

The important subject of buildings receives attention in Chapter III. The architecture of power-station buildings is treated in a dignified and forcible style by the author, and

we are quite in sympathy with his remarks. It is difficult to see how any rational being can justify the capital expenditure on the elaborate ornamental stonework, &c., which is so commonly used abroad, and occasionally in this country. Foundations, steelwork specifications, brick chimneys and various costs receive satisfactory treatment. The necessary buildings for gas power stations are described, and examples given from English and foreign practice.

Chapter IV deals in a definite manner with steam-raising plant. Boilers of modern types, boiler settings, mechanical draught, feed water, ash disposal, water-softening, &c., all receive adequate description. A mistake occurs on page 85, in that it is stated that a squirrel-cage induction motor can be given three regular speeds by means of a controller and resistances. As is, of course, well known, the only way of varying the speed of a squirrel-cage motor is to put separate windings on the stator for the speeds required, and thus make it possible to alter the number of poles in use. The introduction of resistance into the stator circuit certainly reduces the torque and lowers the efficiency of the motor, but the speed of the machine is entirely fixed by the frequency of the supply and the number of poles on the motor. Another slip occurs on page 84, where a motor is spoken of as "the squirrel-cage three-phase slip-ring type." The design of steel chimneys is entered into in a fairly thorough manner, and it is interesting to note that a wind pressure of 28 lb. per sq. ft. on the projected area of a circular chimney is taken for calculating the overturning effect. It is worthy of note also that the author favours steam-driven feed

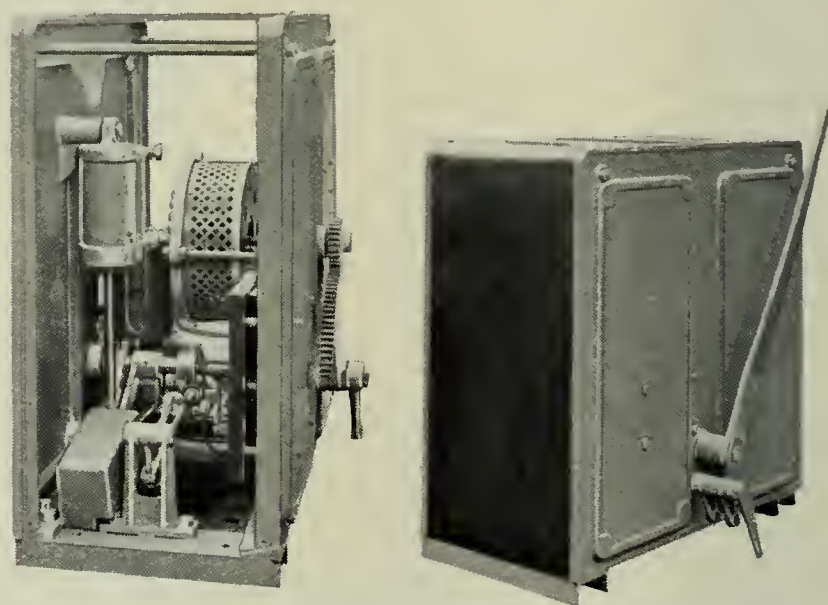


FIG. 6.—EMERGENCY DEVICES AT THE WEST RAND MINES (p. 389).

pumps, instead of the motor-driven type that has come into use of late.

Steam and feed pipe systems are next described. A number of useful tables are given relating to the flow of steam, velocity of steam in pipes, dimensions of pipes, and so on. The importance of drainage in steam ranges is recognised, and the subject receives special consideration. We are pleased to see a photograph and a good description of a rotary strainer.

Chapter VI is devoted to steam-driven prime movers. Lengthy descriptions of very large obsolete low-speed engines are omitted. The author suggests that 750 to 1,000 kW. marks the lower limit for the economical application of steam turbines and the upper limit for high-speed reciprocating engines, and the reviewer is inclined to agree with him. A good deal of information is given with regard to steam consumption, the value of superheating, &c. The various types of steam turbines are described in a concise and interesting fashion, and the author inclines to the idea that the impulse type will out-last the pure reaction type for large sizes. Some useful ideas are given with respect to water loads for testing purposes.

The design and construction of condensers, cooling towers, air-pumps, &c., receive the attention their importance justifies in Chapter VII. A large number of curves and tables are given, which will prove useful to designers of such apparatus.

Chapter VIII is a lengthy one, dealing with gas and oil engines, producers and superfluous-heat generating stations. The advantages and disadvantages of internal-combustion



engines generally are carefully analysed by the author, and we agree, on the whole, with his conclusions. When the cost of fuel is low, combined with a low annual load factor, there can be little question that gas engines will not favourably compare with steam plant, in spite of their much higher thermal efficiency. Some useful data and figures are given regarding repairs, maintenance, depreciation, &c. The section dealing with oil engines is chiefly devoted to the Diesel engine, and the matter on waste-heat stations, while very good as far as it goes, is somewhat brief.

Hydro-electric power stations are next discussed. The fundamental problem to be solved in this class of engineering is the minimum flow of water, and the probable frequency and duration of such flow, and the author has duly appreciated this. The selection of appropriate turbines for different heights of fall and dams, head races and penstocks, receive the treatment they merit. Representative examples of modern practice are given, together with a number of good illustrations. Practically all that is really essential regarding hydro-electric practice is included, although the author refers the reader specially interested in this work to one of the bulky books on this particular section of power station design.

Chapter X deals with the general design and lay-out of switchgear, and is well illustrated by a number of plates. The essential features of good design are well and clearly pointed out, and the examples of switchboards that are described in detail are well up-to-date. We are glad to see that continuity of supply is made a special point.

Practical notes on generators, motors, boosters, transformers, &c., occupy the next chapter. These notes will be found to be of considerable value, and the practical constants relating to the design of machines are always on the safe side. For example, the author advises the restriction of the generator pressure to 6,600 volts. In the United States the superior limit for this voltage is considerably higher. The author's views as to the best type of commutator for direct-current turbo-generators are, perhaps, open to question, although this point is largely a matter of opinion only at the present stage of the art. Batteries are treated in a highly satisfactory style, and we should have liked to see rotary converters discussed in a like manner. Perhaps, more than any other, this chapter shows the author's intimate acquaintance with modern and stringent specifications.

The last chapter consists of a useful discussion on the design of small power houses and sub-stations for shipyards, factories, docks, &c., and sufficient information and examples are given to enable an engineer to put down a station of this character to suit any special local conditions.

The book concludes with five appendices dealing with water-tube boilers, velocities in circulating water pipes, electricity regulations, chimney cooling towers and tests of steam feed pumps.

The book is wonderfully free from printers' errors, the one or two that do occur being easily detected. It contains 17 folding plates and 186 illustrations. A special feature which must be commended is the information given regarding the capital cost of practically the whole of power station plant. It may be said that at the present time these figures are on the top side. The book will undoubtedly be of the utmost value to engineers who have to put down a power station without the aid of expert assistance.—H. G. S.

**Educational Notes.**—Now that so much attention is being directed to the necessity for giving young electrical engineers some training in commercial work, it is of interest to note that the City and Guilds of London Institute has definitely decided to establish an examination in Quantities and Estimates for Electrical Engineers. A class for teaching the subject to mechanical engineers was started at the Northampton Institute, London, five years ago, and in 1909 Dr. R. M. Walmsley, the principal, decided to start a similar class for electrical students, Mr E. Kilburn Scott, M.I.E.E., being appointed lecturer. Experience has conclusively shown that the subject is one that can be taught in class quite as well as the purely technical details of engineering. The Battersea Polytechnic started a course last year, and no doubt other institutions will take it up now that an examination is to be held.

## ELECTRICITY AND COAL SUPPLY.

At a time when coal is no longer supplied to them from day to day, and they are compelled to fall back upon reserves, electric lighting authorities will be anxious to know their position with regard to the public. What is the obligation of a supply authority to continue to provide energy irrespective of the price of fuel? Penalties are imposed by statute on any "undertakers" who "make default in supplying electricity to any owner or occupier of premises to whom they may be required to supply energy"; but the penalties to be inflicted on the undertakers "Shall in no case exceed in the aggregate in respect of any defaults not being wilful defaults on the part of the undertakers the sum of £50 for any one day." The same Act provides that "in no case shall any penalty be inflicted in respect of any default, if the Court are of opinion that the default was caused by inevitable accident or *force majeure*, or was of so light or unimportant a character as not materially to affect the value of the supply." The latter part of this proviso is not likely to assist the supply authorities in the present crisis. A shutting-down owing to lack of coal could hardly be said to be a stoppage of a slight or unimportant character. The question is, could it be said to be due to inevitable accident or *force majeure*? In ordinary commercial transactions, the risk of a strike is within the contemplation of the parties. If a man undertakes to deliver goods by a certain day, and is prevented from doing so by a strike causing delay in transport, or a strike which prevents his obtaining the necessary fuel for manufacturing the goods, these are risks thrown upon him and not upon the purchaser. They cannot even be said to amount to *force majeure*. In the case of electricity supply, however, the Court appears to have a wide discretion; and it is considered that the industrial war in which the country is now plunged would fully justify any magistrate in holding undertakers free from responsibility. Strange to say, there is no case which can be said to be in point. Mention may be made, however, of the *Sun Insurance Co., Ltd., v. Dublin Corporation* (1899), where it was held that the fusion of an electric cable, which caused the breakdown of supply, was an "inevitable accident" for which the Corporation was not to be held responsible. In another case (*Marylebone Vestry v. Metropolitan Electric Supply Co.* (1900)), the company were summoned for making default in supply to the workhouse and vestry premises on certain days. The company admitted the default, and contended that the same was due to inevitable accident caused by a great increase in the demand for electricity which had exceeded their expectations. After an adjournment of the summons for three months, a small fine was imposed.

As to the expedient of raising the price, it is doubtful whether this could be done, having regard to the contract which is entered into with each consumer.

If prices could be raised one distinct advantage would accrue, namely, a certain amount of waste would be checked.

**Rifle Range.**—On February 28th the new miniature rifle shooting range at the Recreation Hall of the Paisley District Tramways Co. was opened in presence of over 100 of the employés and a large and representative gathering of the inhabitants of the district, who take an active interest in the Tramwaymen's Recreation Club. The first shot, which proved to be a bull's eye, was fired by Miss Lillian Charles, the famous world's shot, who then, in a short and appropriate speech, declared the range open and wished the members all success in their shooting. Her father, Major Charles, on behalf of his wife, his daughter, and himself, handed over to the rifle range, as a present from the Three Royal Dreadnoughts (this being their professional *nom de guerre*) a handsome silver cup standing about 12 in. high, which is to be competed for in any manner the general manager may think best in the interests of the club. Captain Coutts, the tramway manager, in accepting the gift, asked Miss Charles to accept a jewelled bangle from the members of the society as a memento of her visit to Paisley, and as a token of their appreciation of her presence with them that day. Afterwards the company were entertained to tea, and Miss Charles gave an excellent exhibition of shooting by piercing 3d. pieces set up face on and cutting them through edge on, as she also did some visiting cards; the visitors retained these as souvenirs of the occasion.



## CITY NOTES.

(Continued from page 386.)

**Westminster Electric Supply Corporation, Ltd.**

MR. J. BROWNE MARTIN presided at the offices, Eccleston Place, Westminster, on February 28th, over the annual meeting of this company.

In moving the adoption of the report (see ELEC. REV., page 308), the CHAIRMAN first referred to the death of Mr. E. Boulnois, one of the original directors, and to the election in his place of Mr. Montague Gluckstein, who had many interests in their area. They sold last year nearly one million units more than in 1910, and their receipts were £6,000 higher. The larger part of the increase had been in power and heating, and they were also on the right side as to lighting, which was satisfactory as showing that they were getting over the temporary set-back due to the metal lamp. The costs were increased by £3,000, but £2,000 of that was due to the legal expenses incurred, mainly owing to the ineffective attempt to get their excessive rating assessments reduced to more reasonable proportion. The result was that they were only carrying to net revenue £2,700 more than they did a year ago. With regard to the future, one often heard some say that the sale of electricity for lighting purposes must have reached a saturation point. It always seemed to him that this point bore some relation to another they had all heard of called the vanishing point. If it had been anywhere except on the horizon, they could never have hoped to recover from the advent of the metal lamp, which he had alluded to as a difficulty. Difficulties were made to be overcome, and when they were surmounted they were all the better for having encountered them. It was so in their case. The metallic lamp made it certain that electricity would be the universal agent for lighting, even for those who had to be the most careful with regard to cost, whilst for those who were willing to use electricity with carbon lamps, it opened up a new system by means of concealed and reflected light, which was almost impossible before, because of the expense. Heating and cooking, the working of lifts, driving motors, and, in fact, almost every conceivable purpose, opened up an almost unlimited future, and their extension of business in this direction must be very large indeed. No one who was not constantly engaged in this business could have any idea of the variety of applications of electricity. Now, it was not too much to say that no matter what they wanted done they could do it better and more economically by electricity than in any other way. He hoped the shareholders would spend a few minutes in the demonstration rooms they had established in that building, as it would give them some idea of what was practical now. Their area was mainly residential, afforded a very large field for the sale of electricity for all household and domestic purposes. The company bade fair to be as successful in the future as in the past and the best service the shareholders could render was to tell everyone what they would see in the company's showroom downstairs.

MR. HAYES FISHER, M.P., seconded the motion.

Replying to questions by MR. PALGRAVE SIMPSON and MR. REYNELL, the CHAIRMAN said the item of special charges was in respect of the 28,000 preference shares issued in December, 1910. The issue had not been quite taken up by the shareholders. They were prepared for the coal strike.

The motion was carried.

The CHAIRMAN proposed that a dividend at the rate of 10 per cent. be declared.

CAPTAIN BAX, in seconding, remarked that to maintain a dividend of 10 per cent. with the advent of the metallic-filament lamp was very satisfactory.

The motion was carried.

MR. R. WALLACE, K.C., moved the re-election of the retiring directors, and CAPTAIN BAX, in seconding, said that in 1891 they had 750 consumers, against 10,000 now. In 1891 they sold 600,000 units, and the average price obtained was 7½d. per unit. Last year they sold 18,000,000 units, and the average price was 3½d. per unit.

The motion was carried.

**North Metropolitan Electrical Power Distribution Co., Ltd.**

THE meeting of this company was held on Friday last at the Electrical Federation Offices, Kingsway.

MR. JAMES DEVONSHIRE, who presided, in moving the adoption of the report (see ELECTRICAL REVIEW, page 532), said the directors were able to recommend an increase in dividend from 4 per cent. to 5 per cent., after allowing £2,000 for depreciation purposes, which compared with £1,500 for the previous year. The past year had, therefore, been one of satisfactory progress. The gross revenue showed an increase of £1,217, which was an improvement of 8½ per cent., whilst the expenses had increased by £621, equivalent to only 6½ per cent. in excess of 1910. The amount available for appropriation, £4,715, showed an improvement of £883. A striking feature was the ratio which the net revenue bore to the capital expenditure. The revenue had amounted to £15,806, which was no less than 23½ per cent. upon the total capital expenditure (£67,075). It was not easy to make any comparison with other electrical undertakings, but he believed the position of the company was unique in that respect. It was only fair to say that the explanation lay in the arrangements which the company had with the North

Metropolitan Electric Power Supply Co. under which that company supplied them in bulk with their electrical energy, and so relieved them from any expenditure on generation, or even transforming plant or buildings. The revenue had expanded in connection with each of their four undertakings with the exception of Enfield, where there was a small decrease of £26. While that was due to the temporary loss of certain power business, it was also to be explained by the fact that their arrangements with the Power Co. had been somewhat varied. If the directors' proposals were agreed to, the amount of the depreciation fund would be raised to £5,200. Although it might be argued that that was a small figure, it had to be remembered that the capital expenditure was principally in connection with mains upon which depreciation was certainly small; and, indeed, under certain circumstances, there might be an appreciation. For instance, if the price of copper were to rise to £100 per ton, there probably would be an appreciation. In the balance-sheet there was an item of £561, expenditure on the Wembley Electric Lighting Order. That would disappear during the current year, as, in response to their application to the Board of Trade, they had received a notification that the Department would revoke the order, and they would consequently write it off out of revenue.

MR. W. L. MADGEN, in seconding the resolution, said the chairman had drawn attention to the very gratifying feature in the accounts that the ratio of gross revenue to total capital was so high as 23½ per cent. Some few years ago he (Mr. Madgen) had occasion to get out similar figures for a number of undertakings, both municipal and private, and he found that 12 or 15 per cent. was a very high figure. Times had changed, of course, and if one got out a similar list now, they might find that the ratio had improved, but, none the less, 23½ per cent. was very gratifying to them. From the point of view of the community in the north of London, the position was also very satisfactory, because they got their current for lighting, power and other purposes at as low a price, if not lower, than any similar districts in or around London. One was often told, in mentioning the low rates at which people in North London got their current—districts such as Barnet and Hertford—that everything was very dear in London, but it should also be remembered that the output was very large in London, and the striking comparison still remained that in small places, such as Barnet and Hertford, current could be obtained for domestic or industrial purposes as cheaply, if not more cheaply, than in large London districts. That advantage principally arose from their association with the power company which had large main generating stations at Willesden and Brimsdown, and it was interesting to note, from the point of view of towns elsewhere which had not yet been provided with an electrical supply, that since the power company with which they were associated commenced operations, no separate isolated generating stations had been started within the company's area, which covered an extent of over 300 square miles. The position of the company was in all respects highly satisfactory, and the shareholders were to be congratulated upon the results.

The report was adopted.

**Chelsea Electricity Supply Co., Ltd.**

THE annual meeting was held at Winchester House, E.C., on Tuesday, Sir Irving Courtenay presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 355), said that the figures showed some further improvement, the revenue being higher and the expenses slightly less. The revenue had increased, though a large temporary supply for power which they furnished in 1910 was discontinued at the end of that year. As they had, nevertheless, improved the position by about £1,000, he thought they were entitled to look for good results in the coming year. The usual amounts had been placed to reserve, and £1,000 had been written off the cost of purchase of the Cadogan Electric Light Co., the addition to the amount carried forward being much the same as last year, and the dividend recommended was the same, namely, 5 per cent. for the year. The actual addition to capital expenditure was small—£5,260—£1,000 of this being on machinery, and £2,500 on mains. The title of No. 5 account was now reserve for renewals, depreciation and contingencies. The amount placed to depreciation account had always been based on the life of the property and plant as estimated by the engineer, and the yearly small increase in the sum set aside had been arrived at by actuarial calculations, so as to write off the value of the property during the period of its life. It had been deemed advisable to alter the title of the account to which the provision was placed, and thus make it more elastic. The total number of units sold during 1911 showed a decrease as compared with the output for the previous year. This decrease, however, was satisfactorily explained by the fact that in the previous year they had the benefit of a comparatively large demand for motive power purposes in the execution of some special engineering work. They did not expect to connect additional supplies during 1911 to make up entirely for the reduction in units sold due to the discontinuance of this temporary power load. As a matter of fact, the progress made in securing additional customers during the past year had been quite satisfactory, and although the total output in units was slightly reduced, the total value of the units sold showed an actual increase of £450. The explanation of this was that the supply for the temporary power purposes in 1910 was sold at a lower price per unit than that which was obtained for the additional supplies for lighting and general purposes in 1911. They connected the equivalent of 10,289 8 c.p. lamps during the year, which was about the average of the additional connections made during the previous three years. The extension of a permanent connection, as distinguished from a temporary demand, such as he had referred to,



was therefore quite satisfactory. When there was a reduction in the output in units, such as occurred in the last year for the reason he had mentioned, it was naturally not always possible to keep down the working costs in the same proportion, as some charges, such as wages, superintendence and general maintenance of plant were practically the same for varying outputs within reasonable limits. It was, therefore, satisfactory to be able to report that, notwithstanding the reduction in the output, the works cost per unit sold last year was no higher than it was for the previous year. This result was due to a further economy which had been effected in the fuel cost per unit. The situation in the coal trade had naturally caused a certain amount of anxiety. They, however, gave careful consideration some months ago to the whole question of their fuel supplies and to the possible developments that might arise, with the result that they made steady and gradual preparations for eventualities. Although these preparations necessarily meant some additional charge to their expenses, they had not had to pay panic prices for their special coal reserves. For reasons that they would readily appreciate, he did not consider it politic that he should disclose details of their exact position, and he trusted they would be satisfied with his assurance that they had made ample provision for the maintenance of their supply of electricity in Chelsea for a long period. One result of the labour troubles that was very possible, was an increase in the price of coal. Metal-filament lamps were now very generally in use by their customers. It was probable that the reduction in the price of these lamps, and the placing on the market of lamps of lower powers, might lead to a still more widespread use of this class of lamp. They were always keeping this point in mind and carefully watching developments; but he was very confident that the progressive increase in the use of these lamps would be gradual, and that it would not adversely affect their business. Electric lighting with metal filament lamps was now so cheap that the public had become accustomed to a higher standard of lighting generally, and they would not want to revert to lamps of such low lighting power as were used to a considerable extent some years back. The great cheapening in the cost of electric lighting had also led to its general use in the basements and servants' quarters in private houses, as well as in small premises, where formerly it was looked upon as somewhat of a luxury. With regard to the sale of electricity for uses other than lighting, such as for heating purposes, for use with cooking accessories, electric irons, ventilating fans, and for general power purposes, they continued to make steady progress. The number of units sold for use in this manner increased from 687,961 in the year 1910 to 797,781 last year, the corresponding increase in revenue amounting to £270. They kept their customers constantly informed of any progress which was made in apparatus for electric heating, cooking, and other special purposes, and their staff were always at their service to give information and advice on these points as well as on all electric lighting matters. They had increased their investments by £17,000, bringing them to over £44,000 in first-class securities. There were some signs that a fair amount of rebuilding was now not far off. Some of the poorer class of buildings had already been demolished, leaving space for the erection of better class residences, and, with leases now falling in, the possibilities of the expansion of their business were by no means exhausted. They would have noticed that the L.C.C. had appointed a Committee to report on the position of the supply of electricity in London, and their deliberations might be expected to extend over a considerable period. Meanwhile the companies and the municipalities had not been idle, but their inquiries had been protracted owing to the complicated nature of the problem both from an engineering and a financial aspect. As far as that company was concerned they were not producers in bulk, and he could only repeat what he had said formerly, that they were prepared to avail themselves of a bulk supply whenever it should become commercially practicable.

MAJOR W. F. WOOD seconded the motion, and it was carried without discussion.

The retiring director, Major Wood, was re-elected.

### South Metropolitan Electric Light and Power Co., Ltd.

THE meeting of this company was held on the 26th ult. at Winchester House, E.C., Mr. H. St. John Winkworth presiding.

The CHAIRMAN said it was with greater satisfaction than for some years past that the directors laid before them the accounts for the year. The units sold amounted to 4,855,580, an increase of 15.4 per cent. Every branch of their business showed improvement, and there had been a considerable increase in the use of electricity in the home for purposes other than lighting. In the revenue account they had for the first time put the figures for the previous year for comparison. The sales of electricity produced £47,636, an increase of £5,987, or 14.37 per cent. The total gross revenue amounted to £51,613, an increase of £6,926. On the other side, coal cost £1,036 more, the greater part of which was accounted for by the extra work done, and the remainder was due to special expenses incurred in increasing their stock of coal last summer. They had been accumulating a large stock of coal on their vacant land at Blackwall Point, and had now sufficient in hand for about 10 or 11 weeks' supply. There were small increases in oil, waste, salaries of engineers and wages in generation, but wages in distribution were a little less, as the meter-readers were transferred in September last to the commercial side and their wages now figured in the management expenses. On repairs and maintenance they spent £1,978, an increase of £740, which included the cost of several renewals and improvements carried out during

the year. Management expenses were about 10 per cent. larger, on account of the increase of work done. Development expenses were a little less, due to the large and increasing business at the company's showrooms, which had enabled them to considerably augment their outside staff, and at the same time reduce the net cost of development. The total expenditure he had dealt with amounted to £20,541, representing 39.8 per cent. of their gross receipts, or about the same as for the previous year. The cost per unit sold amounted to 1.01d., the same rate as for the previous year. They had net revenue £31,072, or £4,063 more, which represented a return of 5½ per cent. on the average capital expenditure, as compared with 4.91 per cent. for the previous year. Capital expenditure had been restricted as much as possible. The principal items were for mains £11,516, transformers and sub-stations £1,194. About £3,000 was the balance of cost of laying down the extra-high-tension system to Catford, which had now been in operation over eighteen months, and continued to give satisfaction. On machinery and plant £2,440 had been expended, principally for the cost of laying a new 42-in. pipe into the river. Machinery and plant had been credited with £6,500, being the cost of the two Clench engine sets, which were removed during the year. The total expended during the year on capital account was £18,621, and after deduction of the amount written off, the net addition was £12,021. The depreciation account had been debited with the £6,500, and credited with the amount realised by the sale of the old plant. The space occupied by the Clench sets was now available for the installation of further plant, and in order to meet the growth of the business—the kilowatts connected having increased from 7,281 to 8,056 during the year, which would be substantially increased during the current year, several important orders having been received which were not yet connected—the directors had decided to order a new 1,500-kw. turbine, which, with the necessary boilers, switchboard, &c., was estimated to cost about £16,000, payable during the present year and next year. The estimated ordinary expenditure for 1912 would be about £10,000. The business of the West Kent Electric Co. was being steadily developed. Although the profit on sales for the first complete year to December 31st last was not quite sufficient to cover the whole of the expenses, it was hoped that they would be able to earn a reasonable profit for the current year. Arrangements had been made for giving a supply at North Cray, and negotiations were proceeding with the view to affording a supply of power and light at St. Mary Cray, Orpington, Crayford, West Wickham, and other places. The 35-watt equivalents showed an increase of 22,145, which was the largest increase they had had, if they excepted the year 1904, when the undertaking of the Crystal Palace and District Co. was taken over. The new lamp points connected were 13,198, as compared with 10,309 for the previous year, an increase of about 28 per cent. Extension orders during the year reached the gratifying figure of 423, an increase of 25 per cent. over the previous year. This was a promising feature of the business, affording increased revenue without additional capital expenditure. The business at the showroom had been organised so as to retain the goodwill of contractors working in the district, and the convenience to consumers, and prospective consumers, of being able to get reliable fittings and apparatus on the spot at a very reasonable cost, had been much appreciated, upwards of 2,750 transactions having taken place during the year. Efforts are continually being made to popularise the light, the cost of which was now found to be in many cases less than the cost of lighting by gas. Every year it became the more general practice for builders to wire new houses for electric light, and leave everything in readiness for incoming tenants, and owners of empty houses were gradually beginning to see that the installation of the electric light assisted them in securing new tenants. During the past year building in the company's area had been practically at a standstill, but the prospects for the present year showed signs of considerable development. The company's outdoor staff had been still further strengthened, and an active campaign was being pursued. The orders received during the present year substantially exceeded those for the corresponding period of last year, and the outlook for the future was very promising. At any rate, provided good sense prevailed in the coal-mining industry, he saw nothing to prevent the steady increase in their receipts which was up to that day continuing.

MR. H. W. BOWDEN (managing director and engineer-in-chief) in seconding the resolution, said that last year he referred to the equipment and completion of the extra-high-tension scheme, which he was pleased to say was working well. The cables served their largest sub-station at Catford, where the load had steadily increased from 700 kw. to about 1,000 kw. The sub-station supplied the more congested areas of the Lewisham district. In regard to their distribution system, the efficiency had improved from 75.9 per cent. to 77 per cent. The higher efficiency was partly accounted for by the greater demand for power units within a short radius of the works, but it also showed that the extra new high-tension scheme was working efficiently. The output on feeders (i.e., at the power house) had increased from 5.54 million units to 6.3 million units, or approximately ½ million units. The increase for this year to date was 26.1 per cent. For the corresponding period last year 6.6 per cent. In regard to their cost of working, they compared favourably with any London company, although their output was only ½ that of some of the larger undertakings. Their coal per unit sold was 35d., compared to 34d. The slight increase was partly accounted for by the higher price of fuel, and partly by the larger proportion of reciprocating plant (which was the older plant) being in commission during the year owing to the increasing demand for power. The other items under works costs remained the same. At the last meeting, a shareholder asked if he could



give a comparative table of costs, which, with their permission, he would do. In this table he referred to the companies in numerical order, the undertaking having the lowest total cost being No. 1, and where the figures for the year 1911 were not available, he had taken the figures for the previous year. The table was as follows:—

	Output in million units.	Total cost per unit.
No. 1 Co. London Electric Co., with a railway load ...	21	·82d.
„ 2 Co. The South Met. Co.	4·8	1·01
„ 3 Co. ... ..	4·1	1·03
„ 4 Co. ... ..	25·2	1·08
„ 5 Co. ... ..	25·7	1·12
„ 6 Co. ... ..	16·9	1·18
„ 7 Co. ... ..	9·9	1·39
„ 8 Co. ... ..	18·9	1·52
„ 9 Co. ... ..	12·2	1·53
„ 10 Co. ... ..	6·0	1·76
„ 11 Co. ... ..	4·1	1·79
„ 12 Co. ... ..	2·2	2·08
„ 13 Co. ... ..	2·6	2·19

The table showed that their company occupied the second place, with an output of less than one-fifth of that of the large undertakings. Quite recently he had visited some of the most modern and up-to-date power houses in this country and on the Continent, and he had no hesitation in saying that for their output they were keeping well abreast of the times. In regard to the lighting, perhaps the most encouraging result for the year was the large increase in new customers and extensions on the existing network of cables.

MR. POWELL criticised the increase of 60 per cent. in the cost for repairs and maintenance, and asked if the engineer had fully considered the question of oil plant. If one was to believe all one heard, oil was going to knock spots off the turbine. Speaking of his own experience of the company he was connected with, they had actually put down oil plant, and when it ran, as it was hoped to in a next month or two, they expected to get infinitely better results than they were likely to get from the turbine, and certainly from steam plant. It was a question of saving £2,000 or £3,000 a year on running alone.

MR. H. BOOT thought it was time the board got a hustle on and paid a dividend. As the engineer of a station entirely dependent on the Diesel oil engine, he might say they were not altogether the wonderful blessing which the Press cracked them up to be. Like other engines they had their drawbacks, and if it did not come in fuel it came in the shape of repairs. The units they were putting down at Greenwich were of such a capacity that to put down a similar capacity in oil plant would be out of the question.

The CHAIRMAN said they all regretted that they could pay no dividend, but the conditions of the trust deed for the debenture-holders precluded them from doing so at present. He unhesitatingly said that the company had a fine future before it.

MR. BOWDEN said that Mr. Boot had really answered the question about the oil engines. It was true that repairs were heavy, but they had been unusually light in past years.

The report was adopted, and the retiring directors re-elected.

### Para Electric Railways and Lighting Co., Ltd.

THE directors' report states that the revenue for the year to November 30th, after providing for all expenses in Para, is £115,530; adding thereto the balance of exchange, interest, and transfer fees, £7,764, and deducting therefrom London office expenses and interest and sinking fund on debenture stock, £46,886, there remains a balance of £76,409. The directors have made the following transfers to reserve accounts, viz.:—Depreciation and renewals reserve, £15,000; contingencies reserve, £10,000; leaving £51,409; add balance brought forward, £7,433, together making £58,843. An interim dividend for six months of £3 per cent. on £295,000 preference shares was paid on September 1st, amounting to £8,850; it is now proposed to pay a final dividend of £3 per cent. on £320,000 preference shares (making 6 per cent. for the year), which will absorb £9,600; an interim dividend for six months of £5 per cent. on £389,510 ordinary shares was paid on September 1st, amounting to £19,475; it is now proposed to pay a final dividend of £5 per cent. on £389,510 ordinary shares (making, with the interim dividend, £10 per cent. for the year), which will absorb £19,475, leaving to be carried forward £1,442.

The meeting was held on the 28th ult. at the Cannon Street Hotel, E.C., Sir W. Evans Gordon presiding.

The CHAIRMAN said that the reduced net earnings were wholly due to an increase in the operating expenses of £38,640. The generating station expenditure had increased by £19,498. Their business, both tramways and lighting, had increased during the year; the number of units generated was better by 30 per cent., but the cost of operating the station had increased by nearly 50 per cent. The principal cause was due to the works carried out during the year by the Port of Para. They destroyed their former facilities for landing and handling coal, and until November gave them no new facilities. They were now receiving coal over their new quay wall, not in a manner altogether satisfactory, but under better conditions than during most of the past year. The increase in business had necessitated an increase in the capacity of the plant, and they decided to take this opportunity to put out of use a portion of the least efficient of the old plant. They had already partly installed new plant of a capacity of 1,200 kw. (displacing

old plant of 480 kw.). This work when completed would effect a net increase of about 25 per cent. in their station capacity. Their condensers had been replaced by others of a different and more efficient type, as well as of larger capacity, and this had also entailed new steam and exhaust piping. Within a few weeks this new plant should be in full operation, and an important part of the unfavourable condition of last year's working would be eliminated. The increase in the item of wages, salaries, &c., amounting to £11,404 was due to the fact that they were giving a much heavier service. The increase in the maintenance item amounted to 15 per cent., which might be accounted for to some extent by the increase in the business, both tramway mileage and output of power; expense under this head had, however, been abnormally increased by replacement of some cables. The general expenses had increased by £4,062. Reviewing the operating expenses, as a whole, he thought he might say that, due to several temporary conditions, the expenses of last year were abnormal, and while, on account of the rise in the rate of wages, they were not likely to fall back to quite so low a percentage of the gross receipts as obtained in 1910, they should, nevertheless, be substantially reduced in the current year. He had received a telegram from Para that morning stating that the surplus for February this year was £6,190, as against £5,365 in the corresponding month last year. The gross revenue from tramways had increased from £178,957 in 1910 to £199,116 in 1911, being an increase of 11 per cent. The gross receipts from lighting and power business had increased from £83,796 in 1910 to £89,540 in 1911, being an increase of 7 per cent. The net number of new customers connected during the year was 550, and the total equivalent of 16-C.P. lamps connected to their system had increased from 42,648 in 1910 to 50,309 in 1911, being an increase of 18 per cent. The revenue per lamp connected had fallen off somewhat, since practically all the carbon lamps had been replaced by metallic-filament lamps, but the total results of the gross revenue side had been entirely satisfactory. When he addressed them last year, he called attention to the sum standing in the profit and loss account under the heading of "Balance of Exchange." There was a similar sum in this year's accounts, slightly smaller than last year, but nevertheless substantial. This was due to their having again in the past year kept their accounts on the basis of 15d. to the Brazilian milreis, whereas the actual exchange had never fallen during the year below 16d., and they had therefore made a profit on every remittance to London. As the exchange had been officially fixed by the Brazilian Government now at 16d., and this rate had been maintained for some time, they were altering their accounts and were now keeping their books on the basis of 16d. to the milreis. During the year they spent on capital account £29,645. The principal item for which this expenditure was made was on the increase of their lighting distribution system by adding heavily both to their underground, overhead, and transformer systems. The new customers connected also necessitated a heavy increase in meters. The large addition to the power plant accounted for more than half of the total capital expenditure. The capital expenditure during the year now current would be materially smaller than last year, but so long as the company was a live and progressive one capital expenditure would continue. In view of this expenditure, and the heavy expenditure during the preceding year, the directors found it necessary to issue 5,000 of the authorised £5 preference shares which had been held in reserve for this purpose. These shares were sold at a small premium, the amount of which had been deducted from the current year's capital expenditure. The company still had in reserve 14,000 of these preference shares, which could be issued when necessary to provide for future developments of the undertaking. The directors were advised that £15,000 was sufficient to set aside annually to cover renewals required from time to time in the plant of the undertaking, in addition to the numerous small renewals paid for as maintenance. All the plant was maintained in a high state of efficiency, and all ordinary minor renewals were charged directly to maintenance, but occasionally whole units of the plant wore out or became obsolete, and funds must, therefore, be provided in order to pay for these renewals when they occurred. They were further setting aside £10,000 for the contingency reserve against any possible special claims or losses in connection with the company's business. As to the future, he could only say that their plant was increased in capacity and efficiency, and it was not unreasonable to assume that the business would continue to grow with the continually improving conditions in Para.

MR. E. C. CHESTON seconded the motion, which was adopted.

**British Electric Transformer Co., Ltd.**—The directors' report for the year 1911, states that the result was satisfactory. The accounts show that after paying all manufacturing costs and expenses of administration there remains a net profit of £19,833, plus £1,373 brought forward, making the total available balance £21,206. The board recommend that out of this there be allocated to depreciation reserve, £1,000; to reserve account, £7,000; preference dividend of 6 per cent. for the year, £1,904; a dividend of 10 per cent. on the ordinary shares (3 per cent. of which was paid as an interim dividend on September 1st, 1911), £6,940; extra remuneration to the directors, £99; carrying forward £3,363. The annual meeting to-day will be followed by an extraordinary general meeting, at which shareholders will be asked to approve of the increase of the capital from £125,000 to £200,000, by the creation of 50,000 new 6 per cent. cumulative preference shares and 25,000 new ordinary shares of £1 each.



### Waste Heat and Gas Electrical Generating Stations, Ltd.

THE fifth annual meeting of this company was held on March 1st at Newcastle-on-Tyne. MR. F. STIRLING NEWALL, in moving the adoption of the report (see ELECTRICAL REVIEW, p. 353) said that the total issued capital of the company was £320,000, the whole of which had been paid with the exception of a small number of calls still in arrear. The issue of new capital offered in May last was largely over-subscribed. The existing shareholders applied for more than one-half of the issue. Their shareholders had, however, increased by 425 since last annual meeting. The new capital was issued at 21s. per share, and the premiums more than paid for the cost of the issue. The capital expenditure on generating stations owned by the company now amounted to £201,752. When the new stations at Grangetown, Port Clarence, and Ayresome were completed, this amount would be increased by about £46,000, against which the directors had made advances to the extent of £27,502. The company's investments had cost £32,591, consisting of 39,996 shares of £1 each in the Bankfoot Power Co., Ltd., on 20,000 of which only 2s. 6d. per share had as yet been paid, and £10,000 of debentures in the same company. These debentures carried interest at the rate of 5½ per cent. per annum, and the shares held during the past year yielded a return of 10 per cent. There was a further amount to be paid on the 20,000 shares which had just been taken up amounting to £17,500, and after these calls had been paid the company's investments would amount to £50,091. The directors had under consideration proposals for the erection of a further generating station, but these negotiations had not yet been concluded. They had transferred the sum of £7,500 out of the profits of the year to the reserve and depreciation account, and they had also transferred to this account the premiums received on the new issue of capital after deducting the expenses of the issue, and the reserve account now amounted to £24,351. There was a reference made in the report to certain exceptional expenditure at the Weardale generating station. This was the result of some slight subsidence necessitating rather expensive repairs to some of the plant. The amount of this expenditure, if any, which might have to be borne by the company, was not yet ascertained, but the directors had considered it wise to make provision against any indirect expenses which might fall on the company and not be recovered. The whole of the stations in operation had been maintained in thoroughly efficient repair by the electric power companies under the terms of the contracts under which they worked the stations for them. He was pleased to report that the arrangements they made with the owners of waste heat on the one side and the electric power companies on the other, were more and more appreciated as time went on. Owners of waste heat, who had thought it would be more profitable to erect a generating station for themselves than to make an agreement through them with the electric power company, had found that considerably more capital had to be expended in order to obtain a proper stand-by supply, and had in the end approached them with a view to getting rid of the surplus electrical energy which they could not themselves use. Under their company's agreements, the whole of the electricity which was generated from the waste heat or gas, as the case might be, was disposed of, and the profit to the waste heat owner was thereby considerably increased, while he also obtained a reliable stand-by supply without the expenditure of any capital. The national coal strike had now actually begun. It would, of course, affect the company, as they derived their waste heat from coke ovens and blast furnace works which would all stop working, but they hoped sincerely that the stoppage would not be of long duration.

MR. E. LLOYD PEASE seconded the adoption of the report, and it was carried unanimously. The dividend resolution was also passed.

### City of London Electric Lighting Co., Ltd.

THE report of the directors for 1911 says that the capital expenditure upon additions, extensions, and replacement, was £45,814, making £2,467,909, less the amount written off prior to December 31st, 1910, £274,670; and further amount written off in respect of buildings, plant, and other works dismantled during 1911, £47,274; making the net expenditure as at December 31st, 1911, £2,145,966, showing a net deduction from capital account during 1911 of £1,460.

The first debenture stock premium redemption account has been credited with £1,441 from revenue for interest, raising the amount at the credit of redemption account to £61,485. £50,000 has been transferred from net revenue account to reserve account. The balance at credit of reserve account stands at £269,291. In addition there are:—First debenture stock premium redemption account, £61,485; leasehold redemption account, £4,253; standing reserve for doubtful debts, &c., £2,155; dividend equalisation account, £14,000; amount to be carried forward to 1912, £25,943; making the total reserves, £377,127.

The total revenue for the year was £289,105, plus interest on investments and discounts, £2,480, making £291,585. From this are deducted the following:—Expenses of generation and distribution, £64,666; repairs and maintenance of buildings, machinery, plant, mains and other works, £11,117; rent, rates, taxes, management expenses and special charges, £53,935; leaving £161,867, plus £27,656 brought forward, making £189,523. Of this sum there have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, &c., £3,032; interest on first and second debenture stock for the year, £31,546; interest transferred to debenture stock premium redemption account, £1,441; leasehold redemption account, interest and appropriation, £260;

staff superannuation fund, £387; stores written down, £960; loss on sale of investments, £172; transfer to reserve account, £50,000; leaving available for dividends on preference and ordinary shares and for carry forward, £101,725. The total dividends for the year:—Six per cent. on the preference shares and 8 per cent. on the ordinary (compared with 7 per cent. for 1910) require £75,782, leaving to be carried forward £25,943. The following are the comparative statements:—

REVENUE.	Dec., 1909.	Dec., 1910.	Dec., 1911.	+ over 1910.
Gross revenue ..	£288,161	£282,120	£291,524	£9,455
Net revenue ..	160,656	156,755	161,866	5,111
Div. on ord. shares..	7%	7%	8%	—

Private supply: average price obtained:—

1905.	1906.	1907.	1908.	1909.	1910.	1911.
2.78d.	2.67d.	2.63d.	2.55d.	2.49d.	2.45d.	2.99d.

The following show the total number of customers and connections (private supply) after allowing for disconnections on account of removals, substitutions of metallic-filament lamps, &c.:—

	1909.	1910.	1911.	+ over 1910.
Number of customers ..	13,338	13,876	14,246	370
kw. connected (inclg. power and htg.)	35,915	37,127	39,122	1,995

On February 14th, 1912, there were 40,127 kw. applied for, 39,387 connected, and the customers numbered 14,318. The following are the total units (including public lighting):—

	1910.	1911.
Generated ..	23,939,348	30,527,715
Sold ..	25,183,380	26,633,759
Metered and used by company ..	1,022,253	1,183,635
Expended in distribution ..	2,827,407	2,710,321
Maximum supply demanded, kw...	17,767	17,762

The total units sold during 1911 show an increase of 1,450,379.

The power and heating supplies continue to show a steady increase, the total sold for these purposes in 1911 being:—Power, 8,397,066 units; heating, 1,673,072 units = 10,070,138 units, equal to 39.6 per cent. of the total units sold for private supply.

The tender of the company to continue the lighting of approximately the same streets as hitherto for a period of 10 years, but on a revised scale of rates, has been accepted by the Corporation. The fixing of this definite period will enable the company to inaugurate an improved system of lighting. It is hoped that the economies which the modern system may render possible will assist in counterbalancing the reduction in the gross revenue due to the revised rates. The board have agreed to regard the acceptance of the new tender as being in substitution for the contract for the eastern district of the City, as to the validity of which a difference of opinion existed between the Corporation and the company. Considering all the circumstances, the directors regard the new arrangement made with the Corporation as satisfactory. A very large stock of coal has always been maintained at Bankside Works, as one of the most necessary precautions against any interruption in the supply of energy.

To provide against the eventuality of a coal strike additional storage space has been filled with coal so that the stock is now sufficient for the full requirements of the works for some months to come, even assuming that all further deliveries of coal were stopped. In addition oil fuel is held in reserve. This position has given great satisfaction and confidence to some of the largest customers who visited the works to assure themselves of the company's ability to cope with any difficulty which might arise. The Corporation of London (Bridges) Act, 1911, when originally deposited as a Bill, interfered with the company's property. As a result of negotiations with the Corporation a special clause for the protection of the company has been embodied in the Act, which, amongst other things, provides for the exchange of certain specified lands, which, when carried into effect, should improve the site of the company's works.

The meeting is called for Wednesday, March 13th.

### Charing Cross, West End and City Electricity Supply Co., Ltd.

THE directors report that the result of the year's working has been satisfactory. The gross earnings of the West End undertakings from sales of current, rents, &c., were £140,922 in 1911, as compared with £142,675 in 1910. The expenses, including depreciation, were £80,408, as compared with £83,688, and the net earnings were £60,514, as compared with £58,988. Including £9,954 brought forward and £1,311 for interest, and paying interest on the debenture stock, there is a balance on net revenue account of £53,949, out of which have been paid the dividend for the year on the preference shares, amounting to £18,000, and an interim dividend for the first half-year at the rate of £5 per cent. per annum on the ordinary shares, amounting to £10,000, leaving £25,949 to be dealt with. A final dividend is recommended on the ordinary shares for the second half-year at the rate of £5 per cent. per annum, making £5 per cent. for the year, absorbing £10,000, carrying forward £15,949, as against £9,954 carried forward last year. The company has now connected to its West End mains a total equivalent of 650,386 8-c.p. (or 30 watt) lamps. The total is made up as follows:—444,723 in lighting, 21,757 in heating, and 182,536 (7,301 H.P. = 5,476 kw.) in motive power, and 1,370 bulk supplies.



The gross earnings of the City undertaking from sales of current, rents, &c., were £145,072 for 1911, as compared with £141,476 for 1910. The expenses were £84,356 for 1911, as compared with £82,741 for 1910, and the net earnings were £60,716, as compared with £58,735. Including £23,576 brought forward and paying interest on the debenture stock, loans and advances, there is a balance on net revenue account of £54,158, out of which has been paid the dividend on the preference shares amounting to £18,000, leaving to carrying forward £36,158, as compared with £23,576. The company has now connected to its City mains the total equivalent of 625,865 S.C.P. (or 30 watt) lamps:—324,144 in lighting, 41,933 in heating, and 246,488 (9,859 H.P. = 7,395 KW.) in motive power, 13,300 in bulk.

The chief engineer certifies that the plant and machinery at the several stations of the company have been maintained in a high state of efficiency. The advisability of giving up the Lambeth station has been under consideration for some time, and when the lease expired in 1910 it became the duty of the board finally to decide upon the course to be adopted. If the Lambeth station had been retained it could only have been at a considerably enhanced rent. On the other hand, it was found that by expending a moderate amount of capital in the acquisition of modern machinery, sufficient plant to replace that at Lambeth could be erected at the existing sub-stations of the company. The board accordingly decided to give up the Lambeth station, as by adopting this course the rent and expenses of the station would be saved, and the use of more economical machinery secured. This decision has of necessity involved the writing off of a large sum out of the reserve and depreciation accounts, but the company has already derived considerable advantage from the change, and the board look forward to increased benefits in the future.

The meeting is called for Tuesday, March 12th.

	West-End undertakings.	City undertaking.
Units generated .. .. .	7,302,671	30,177,604
Units bought .. .. .	11,280,388	2,069,311
Units sold—Public lamps ..	440,940	—
Other sales .. .. .	13,161,681	—
Total .. .. .	13,602,621	26,865,277
Used on works, and transmission and dis- tribution losses .. .. .	4,980,438	5,381,638
Total accounted for .. .. .	18,583,059	32,246,915
Public lamps .. .. .	166	—
Total supply demanded, kw. ..	6,317	12,062

### Kensington and Knightsbridge Electric Lighting Co., Ltd.

COLONEL R. E. CROMPTON, C.B., took the chair at the meeting of this company, held at 148, Brompton Road, S.W., on February 29th.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 309), said it gave the shareholders the amount available for dividend and the amount they had now accumulated as a reserve and renewal fund, which was considerably in excess of their ordinary share capital, which, he hoped, they would think very satisfactory. The output of the year had slightly decreased. They had sold about a quarter of a million units less than last year, but this need not alarm them, because the decrease was due to the cessation of the contract for the supply of power to the contractor who was constructing the tunnel for the London County Council in their district, and which lasted for two years, and might be looked upon more or less as a windfall during the time it lasted. Apart from this, the figures for light and power in the district showed an increase—not a large one, but it was steady. Filled as their district was, any increase could only be looked forward to where there was rebuilding of premises, and in the increased use of electricity for purposes other than lighting. The increase which had taken place was, therefore, satisfactory, and it was due to the considerable improvements that had taken place in the apparatus for utilising electricity in a residential district, such as cooking, heating, and, last of all, the cleansing of premises by means of vacuum apparatus. At any rate, their officials told them that the prospects of future increase in this direction were very hopeful, and that in future years they might fairly count upon reducing the proportion which the fixed expenses bore to the total output. With regard to the introduction of the metal-filament lamp, which a year or two ago they looked upon with some dread, they now found that they had passed the crucial period and the probability was that it would be an unmixed benefit to them. It was practically certain that the sale of light demanded by their consumers was altogether on a higher plane than it used to be, and none of them would like to go back to the scale of lighting which they were content with in the days of the old carbon lamp. The total income for the year was £80,729, or about £1,500 less, but he would at once call their attention to the fact that on the expenditure side it showed that the reduction of income was more than met by the reduction they had succeeded in obtaining in the items of rates and taxes and landlords' charges. The high figure at which these items had stood in the past had been a source of anxiety to the directors, and it was only this year that he was able to point to a reduction. The reduction, however, had not yet reached the figure to which they hoped to attain. The cost of generating electricity, both at their own station and at the joint station at Wood Lane, remained practically the same as last year, and it would be unreasonable to expect that these costs could be reduced to any considerable extent, as the stations were as efficient as it was possible to make them, and compared favourably in that respect with any plant in London. Therefore, any future reduction in the total cost of generation could only come from a better load factor. The balance carried to net revenue account was £26,821, as compared with £25,786 last year.

The total expenditure on capital account had been £386,000, so that they had expended £91,549 in excess of the total capital, and, of course, this sum was represented by their reserve and renewal fund. The change over to the full pressure of 400 volts was about two-thirds complete, and until it was complete they would not get the full advantage of reduced cost. He supposed he would be expected to make some remarks about the coal question, and he thought they would be more favourably situated than some other people. They had eight weeks' supply at their ordinary rate of use of their coal. Another point on which, no doubt, they would expect him to say a few words was the recent accident they had had with their mains. It was an accident of very considerable extent, and might have been a very costly one to shareholders, and they were tremendously indebted to the mains staff for the prompt way in which they met the difficulty and minimised the inconvenience of their customers; and they had also to thank the consumers for the great consideration they showed the company. He was glad to say they had received practically no complaints, although, no doubt, their consumers were put to great inconvenience. He had been congratulated by brother chairmen and engineers of other works in London upon the highly successful way in which it was met by their staff. They did not know the cause, and it probably was the usual joint cause—an escape of gas affecting their mains. But whether it was due to the fault of the gas company or some deterioration in their own mains, or whether it was due to the interference of the Post Office people in laying their cables, they did not know, and probably never would know. These accidents often had the effect of concealing themselves, as the later explosions and other things which took place obliterated the traces of the first short-circuit. It was sufficient to say they had come out of it very well, and the cost had been low—about a tenth of what he estimated when the thing was going on. He need hardly say that it was a source of intense anxiety to everyone concerned, and they were very glad when it was all over.

MR. R. WALLACE, K.C., seconded the motion.

MR. MAKINS suggested that in the accounts the figures of the previous year should be put down so that shareholders might see where the differences were. He would like to know the cost of the accident referred to.

The CHAIRMAN said the board would bear the suggestion in mind. The cost of the accident was so inconceivably small that at the moment he dare not quote it, in case there was still more work to do than they thought there was.

MR. MAKINS compared the accounts of the Chelsea Co. and the Kensington Co. at some length, and suggested that the cost of management in their company was considerably higher than in the Chelsea. He also thought that the auditors should make a note of the fact that the reserve fund was invested in the business.

The CHAIRMAN, in reply, said that if Mr. Makins examined an analysis of the accounts of the two companies, he would find that their management expenses were smaller than those of the Chelsea. With regard to the investment of the reserve in the business, the shareholders would benefit when the London County Council came to purchase the undertaking, inasmuch as it would be purchaseable at its value.

The report was then adopted.

On the motion of the CHAIRMAN, seconded by SIR H. BLISS, a dividend for the half-year of 5 per cent., making 9 per cent. for the year, was agreed to.

### County of London Electric Supply Co., Ltd.

THE directors report that the capital expended during the year 1911 on account of London districts was £49,646, making the net total expenditure for those districts £1,813,746. The balance brought forward was £1,358, and the balance from revenue account for the year, after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £126,228, making £127,586 available. Of this, interest on the first and second debenture stock (including stock sold during the year) and interest on temporary loans to December 31st, 1911, less income-tax, absorb £45,779, and there is carried to reserve for depreciation, repairs, renewals, &c., £25,000, leaving the balance for distribution for the year at £56,807. Interim dividends on 55,000 6 per cent. preference shares and on 40,000 ordinary shares at the rate of 4 per cent. per annum, for the half-year ended June 30th, 1911, less income-tax, were paid, absorbing £23,071, and leaving for further distribution £33,736. The directors now recommend a further half-year's dividend on the 6 per cent. preference shares, and a further dividend on 40,000 ordinary shares for the half-year ended December 31st, at the rate of 8 per cent. per annum, less income-tax, these absorbing £30,604, and leaving £3,132 to be carried forward.

The applications received during the past year were equivalent of 3,484 kw., making 41,339 kw. The total units sold were 20,450,787, as against 16,985,687, an increase of 3,465,100 units, or 20 per cent. The number of consumers increased during the year from 16,883 to 18,459. The balance of the first and second debenture stock has been disposed of during the year. Under the powers conferred by the London Electric Supply Act, 1908, the work of interconnecting the company's power houses at Wandsworth and Finsbury has been carried out during the year, thus giving the company's consumers additional security for the continuity of their supply, and enabling the company to make more economical use of the generating plant installed in the two power houses. During the past year the City and South London Railway has been connected to the company's mains, and supply is now available. In view of the crisis in the coal trade, the directors have made arrangements for the storage of an extra quantity of coal, to ensure continuity of supply in the event of a strike taking place. The



board announce that, after long and careful consideration, they have been able to arrange, through one of the leading life assurance companies, for a scheme of staff superannuation, on the basis of the company contributing thereto in proportion to the salary of each member coming under the scheme, and all members of the staff have availed themselves of the opportunity thus afforded them. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares at the rate of 6 per cent. per annum, making  $5\frac{1}{2}$  per cent. for the year. The business of the Coatbridge and Airdrie Electric Supply Co., Ltd., shows satisfactory progress. There is an increase of 888 kw. applied for, and an increase of 846,292 in the units sold, raising the total sales to 3,538,320 units, as against 2,692,028 units in 1910.

The directors have unanimously elected Mr. H. B. Renwick, previously general manager and secretary, to a seat on the board, and have further appointed him managing director. Mr. F. C. McQuown, previously assistant secretary, has been appointed secretary.

The meeting is called for Monday, March 11th.

Units generated .. .. .	27,363,728
Units sold—Private consumers by meter .. ..	20,450,787
Total .. .. .	20,450,787
Used on works .. .. .	2,461,654
Total accounted for .. .. .	22,915,441
Not accounted for .. .. .	4,448,287
Total max. supply demanded .. .. .	11,7000 kw.

### Bournemouth and Poole Electricity Supply Co., Ltd.

THE directors' report for 1911 states that the capital expended during the year on account of the Bournemouth Order, 1890, the Poole and Branksome Order, 1897, the Christchurch and District Order, 1899, and the Pokesdown Order, 1902, amounted to £7,749, making the total £460,206. The balance brought forward from 1910 was £1,400, and the balance from the revenue account for 1911, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries is £35,441, making a total of £36,841 available. From this there is deducted interest on debenture stock and interest on temporary loans, less income-tax, £8,876; leasehold and special redemption funds and interest, £1,697; amount written off suspense accounts, £637; amount carried to reserve for depreciation, &c., £5,000; leaving the balance for distribution for the year £20,631. Interim dividends on the  $4\frac{1}{2}$  per cent. preference shares, on the 6 per cent. second preference shares, and on the ordinary shares at the rate of 5 per cent. per annum for the half-year ended June, less income-tax, amounting to £9,358 have been paid, leaving for further distribution £11,273. Final dividends on the  $4\frac{1}{2}$  per cent. preference shares and on the 6 per cent. second preference shares for the half-year ended December, less income-tax, have also been paid. The directors now recommend a final dividend on the ordinary shares for the half-year ended December at the rate of 6 per cent. per annum, less income-tax. The above final dividends absorb £10,064, and leave a balance of £1,209 to be carried forward.

The total applications received at December 31st last amounted to 7,632 kw., an increase of 535 kw. for the year. The total units sold for all purposes were 3,078,316. The directors of the Richmond (Surrey) Electric Light and Power Co., Ltd., have declared a dividend of 6 per cent. on the ordinary shares for the year. The board have arranged through one of the leading Life Assurance Companies, for a scheme of staff superannuation on the basis of the company contributing thereto in proportion to the salary of each member coming under the scheme.

Units generated .. .. .	3,808,862
Quantity sold—	
Public lamps .. .. .	22,750
Private consumers by meter .. .. .	3,055,566
Total sold .. .. .	3,078,316
Used on works .. .. .	392,208
Total accounted for .. .. .	3,470,524
Not accounted for .. .. .	338,338
Public lamps .. .. .	129
Total maximum supply demand, kw. .. ..	2,282

### Harrow Electric Light and Power Co., Ltd.

IN their report for 1911 the directors state that during the year 72 new consumers, representing 22 kw., have been connected, the consumers at the end of the year being 1,381, representing 1,213 kw. The economy which consumers have effected in the consumption of electrical energy by the use of the metal lamp, has again reduced the sales in a large number of cases, but notwithstanding this the output shows an increase of 35,928 units, the total amounting to 457,489 units. There is a balance of £1,400 of the  $4\frac{1}{2}$  per cent. debentures still available for issue, and applications from shareholders, debenture-holders, and consumers, are invited. The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, is £2,265. Out of this the final dividend on the preference shares requires £375, a dividend is to be paid on the ordinary shares at the rate of 5 per cent. per annum requiring £1,667, and £223 is to be carried forward. The directors have provided out of the year's profits £2,500 for depreciation purposes. A site in College Road has recently been secured for the new offices and showrooms which will be erected shortly. The provisional order to extend the area of supply as confirmed by Parliament under the title of the Harrow and District Electric Supply Order, 1911, relates to portions of Wealdstone adjoining the Harrow area, the supply of electrical energy to which can easily be furnished from the company's existing generating station.

Mr. J. N. STUART, who presided at the meeting held on February 22nd, said that the total revenue had, for the first time, reached £10,000. They were now feeling greatly the effect of the increasing use of metallic-filament lamps. An analysis of the accounts of about 200 consumers, who had been chosen as typical regular consumers, showed that they had paid the company £500 less than in the previous year. While regretting the reduction in the revenue, the directors were quite content to have it so, for the cheaper the light, the more popular would it become. In regard to their proposed new premises, it was hoped that a good showroom in a central position would enable the company to demonstrate to the public the great advantages of the use of electricity in a way they had not been able to do before. In regard to the coal strike, they had a sufficient stock of coal to carry on for seven or eight weeks. That was as much as they could find room for, and they had to make special arrangements to find space to stock such a large quantity—over 300 tons.

### British Engine, Boiler and Electrical Insurance

Co., Ltd.—We are informed that, at the annual meeting of the shareholders, held at the offices, Manchester, on March 1st, the chairman (Mr. Longridge) remarked that, while increased competition from accident insurance companies had not interfered with the usual steady increase in the volume of business, the claims for the year 1911 had been abnormally heavy. This was not to be accounted for either by lack of vigilance in the selection of risks or by diminished efficiency in the matter of inspection, and though he might be accused of frivolity in making the suggestion, he was inclined to think that climatic conditions affected the result. It was an admitted fact that boiler claims were unusually heavy in a year when there was a dry summer and the supply of feed water was deficient both in quality and quantity. It was not so easy to trace a connection between the weather and the breakdowns of either engines or electrical plant except that a sudden frost such as had recently been experienced would certainly increase the claims for breakdowns among gas engines, but, be the cause what it might, the claims ratio for 1911 had been unusually high. The percentage of breakdowns among insured plant did not vary much, and it was higher than either owners or makers were disposed to admit, but with the spread of the company's business, their costs, both for periodical inspections and for the supervision of repairs, were proportionately reduced. Out of the disposable balance of £17,025, it was proposed to carry £7,000 to reserve fund, to write off £250 from furniture and instruments, and after declaring a dividend of 5s. per share, with a bonus of 3s. per share (less income-tax in both cases), there would be £2,091 to carry forward to next account.

### Northallerton Electric Light and Power Co., Ltd.—

The annual meeting was held on 28th ult., Mr. John Hutton presiding. The chairman said that the past year had been fairly satisfactory. They proposed to carry their net profit (£318) to the reserve fund to provide for depreciation and further capital expenditure. They had ordered a Diesel engine, which they believed would be of great service to the company and a great economy in producing the current. An agreement had been made with the Urban Council for the public lighting of the town for a period of five years, which was satisfactory, as the question of that contract from year to year was a matter of anxiety without such an agreement. The arrangement they had made with Messrs. Baillie and Dobree to act as consulting engineers had been very satisfactory and of great assistance to their resident engineer-manager, Mr. H. W. Milnes. The chairman referred to the excellent manner in which Mr. Milnes had conducted the management of the business. They were steadily increasing their consumers and their profit, and they were within sight of becoming a good dividend-paying company.

### W. T. Henley's Telegraph Works Co., Ltd.—

The directors' report for the year 1911 says that the accounts show a net profit of £83,831. After payment of directors' and auditors' fees, and debenture interest, and making allowance for depreciation of buildings, plant, machinery, &c., there remains £62,704, making, with £27,311 brought forward, a total of £90,015. After adding £2,403 to the reserve in respect of depreciation of Consols and other trustee securities (bringing that amount up to £8,797), the directors have transferred £10,000 to the general reserve account, and they recommend the payment of a dividend on the ordinary shares of 15 per cent., free of income-tax, of which an interim dividend of 5 per cent., free of income-tax, was paid on September 1st last. These payments will, together with the preference dividend for the year, amount to £53,153, leaving a balance of £36,862 to be carried forward. The dividend warrants for the ordinary shares will be posted on March 11th. The directors record the death of Right Hon. Sir Alfred Comyn Lyall, K.C.B., G.C.I.E., and they have elected to fill the vacancy Mr. R. J. Hatton, M.I.Mech.E., M.I.E.E., who has been for many years chief engineer of the company. Mr. Martin Roberts and Mr. R. J. Hatton come up for re-election. The meeting is called for Monday, March 11th.

### Aberdeen Suburban Tramways Co.—

Mr. George J. Walker, presiding at the half-yearly meeting of this company, said that the profit earned for the half-year ending January 31st, amounted to £1,419, which was larger than the profit for the corresponding period last year. The total sum in the meantime standing at the profit and loss account was £2,130, which the directors recommended should be carried forward as usual. The report was adopted.



ELECTRIC TRAMWAY AND RAILWAY  
TRAFFIC RETURNS.

## STOCKS AND SHARES.

Tuesday Evening.

Locality.	Fort- night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen ..	Feb. 28	2,718	+ 150	89	58,282	+ 8,405	14.4	..
Ayr ..	Mar. 2	3 3	— 2	12	12,713	+ 137	8	..
Bath ..	Feb. 27	1,406	+ 108	9	6,008	+ 211	14.75	..
Birkenhead ..	Mar. 3	2,227	+ 175	48	55,018	+ 2,051	18.68	..
Birmingham Corp.	Feb. 24	20,815	+ 6,887	47	1,182	+ 94,798	56.4	..
Blackburn ..	" 28	2,115	+ 193	48.5	55,411	+ 4,579	14.69	..
Blackpool Corp.	" 29	921	— 45	8	62,398	+ 7,885	11.87	..
Blackpool-Fleetw'd	Mar. 4	571	+ 46	8	2,805	+ 119	8	..
Bournemouth ..	Feb. 28	2,561	+ 264	48	84,629	+ 1,111	21.95	..
Bradford ..	" 24	10,861	+ 665	47	25,678	+ 15,431	56	1.2
Brighton ..	Mar. 3	1,592	+ 68	48.5	48,957	+ 2,693	9.5	..
Bristol ..	" 1	12,274	+ 1,188	9	54,016	+ 4,821	30.5	..
Brit. Elec. Trac. Co.								
Airdrie ..	Feb. 23	596	+ 124	8	2,160	+ 461	3.65	..
Barnsley ..	" 23	400	+ 50	"	1,422	+ 140	..	..
Barrow ..	" 23	624	+ 141	"	2,813	+ 685	5.87	..
Devonport ..	" 23	975	+ 155	"	3,747	+ 112	8.85	..
Gateshead ..	" 23	2,084	+ 39	"	7,733	+ 113	11.25	..
Gravesend ..	" 23	397	+ 45	"	1,511	+ 167	6.5	..
Greenock ..	" 23	1,415	+ 234	"	5,205	+ 704	7.25	..
Hartlepool ..	" 23	468	+ 54	"	1,772	+ 171	6.72	..
Kidderminster ..	" 23	196	+ 27	"	684	+ 18	..	..
Leamington ..	" 23	286	+ 26	"	1,051	+ 73	..	..
Merthyr ..	" 23	394	+ 10	"	1,410	+ 7	2.9	..
Metropolitan ..	" 23	15,722	+ 1,501	"	62,405	+ 5,852	22	..
Middleton ..	" 23	572	+ 16	"	2,019	+ 34	8.5	..
Mid. Joint Com'tee	" 23	6,219	+ 449	"	22,182	+ 541	..	..
Oldham—Ashton	" 23	1,107	+ 70	"	4,127	+ 216	9.13	..
Peterborough ..	" 23	238	+ 41	"	865	+ 125	5.31	..
Potteries ..	" 23	4,666	+ 322	"	15,018	+ 790	29	..
Rothsay ..	" 23	92	+ 13	"	384	+ 51	2.75	..
Southport ..	" 23	417	+ 18	"	1,720	+ 13	8.17	..
S. Metropolitan ..	" 23	1,416	+ 49	"	5,216	+ 100	..	..
Swansea ..	" 23	2,114	+ 105	"	8,572	+ 430	12.5	..
Tynemouth ..	" 23	274	+ 14	"	1,021	+ 85	3.75	..
Weston-s-Mare ..	" 23	54	+ 20	"	200	+ 74	8	..
Worcester ..	" 23	482	+ 26	"	1,790	+ 51	5.75	..
Wrexham ..	" 23	187	+ 17	"	705	+ 46	..	..
Yorks. Wool. Dist.	" 23	2,087	+ 145	"	7,833	+ 219	17	..
Miscellaneous ..	" 23	403	+ 24	"	1,507	+ 48	..	..
Burnley ..								
Burnley ..	Mar. 2	2,626	+ 181	..	..	..	11.78	..
Burton-on-Trent ..	" 3	5 8	— 1	48	13,786	+ 720	6.6	..
Bury ..	" 3	2,671	+ 115	48.5	61,112	+ 4,582	22.5	..
Cardiff ..	" 2	4,614	+ 300	48	11,704	+ 8,555	17.85	..
Chatham and Dist.	Feb. 29	1,572	+ 25	9	6,513	+ 50	14.98	..
Cork ..	" 29	864	+ 29	9	3,146	+ 7	9.89	..
Croydon ..	" 23	8,200	+ 228	47	83,554	+ 5,432	11.6	7.5
Darlington ..	Mar. 2	430	+ 28	49	10,805	+ 1,002	4.87	..
Darwen ..	" 1	494	+ 20	48	12,745	+ 819	4.36	..
Dover ..	Feb. 24	382	+ 50	47	11,798	+ 1,549	4.75	..
Dublin ..	Mar. 1	10,387	+ 207	9	45,577	+ 2,588	54.25	..
East Ham ..	" 4	2,221	+ 2.8	48	13,080	+ 3,435	7.87	..
Exeter ..	" 1	656	+ 36	48	1,134	+ 1,026	5.5	..
Glasgow ..	" 2	36,297	+ 150	..	742,446	+ 41,445	98	2.5
Hastings ..	Feb. 29	1,419	+ 42	..	..	226	19.3	..
Huddersfield ..	Mar. 2	3,618	+ 97	48	91,909	+ 7,807	29.5	1
Hull ..	" 2	6,014	+ 467	48	141,875	+ 8,096	14.6	..
Ilkeston ..	Feb. 29	251	+ 1	48	6,280	+ 146	3.8	..
Ipswich ..	" 24	710	+ 61	47	20,570	+ 1,911	10.5	..
Kilmarnock ..	" 24	256	+ 14	41	6,694	+ 465	4.25	..
Lancashire United	" 28	2,222	+ 111	9	1,281	+ 63	3.9	..
Leeds ..	Mar. 2	14,857	+ 97	48	362,161	+ 23,907	57.5	..
Leicester ..	" 2	5,219	+ 495	..	..	..	20	..
Leith ..	" 2	1,182	+ 85	41.5	26,954	+ 2,019	8.72	..
Liverpool ..	Feb. 24	22,749	+ 1,189	7.5	90,194	+ 5,592	116	..
L.C.O. ..	" 21	85,008	+ 4,542	..	2,052,811	+ 10,655	139.5	7.27
London United	Mar. 2	10,912	+ 83	9	47,071	+ 79	..	..
Lowestoft ..	" 2	265	— 4	22	3,513	+ 18	3.5	..
Manchester ..	" 2	32,632	+ 2,160	48	780,542	+ 41,450	105	..
Newcastle ..	" 2	8,298	+ 194	..	206,431	+ 15,294	31.3	..
Newport ..	Feb. 24	679	+ 59	47	33,201	+ 1,128	7.25	..
Oldham ..	Mar. 3	3,908	+ 269	49	94,494	+ 4,135	28	..
Pontypridd ..	" 2	774	+ 23	48	19,917	+ 17	5.5	..
Portsmouth ..	" 2	1,718	+ 59	48	103,301	+ 7,204	15.25	..
Preston ..	Feb. 28	1,415	+ 4	45	37,318	+ 2,416	10	..
Rotherham ..	" 29	1,311	+ 54	47.5	33,112	+ 2,547	12	..
Salford ..	Mar. 4	4,718	+ 129	48.5	23,188	+ 9,599	41	..
Sheffield ..	Feb. 27	6,600	+ 462	48	312,188	+ 19,858	40	..
Southampton ..	" 28	2,281	+ 264	48	18,924	+ 6,717	11	..
Southend-on-Sea ..	" 28	916	+ 2.2	48	32,036	+ 4,959	7	..
South Shields ..	Mar. 2	1,122	+ 44	48	29,924	+ 3,119	10.26	..
Swindon ..	Feb. 7	140	+ 12	45.5	7,261	+ 815	3.7	..
Tyneside ..	" 28	816	+ 40	9	3,489	+ 191	11	..
Wallasey ..	Mar. 2	1,924	+ 21	48.5	52,504	+ 6,342	8.72	..
Walthamstow ..	" 2	1,345	+ 88	48	35,516	+ 2,415	9	..
West Ham ..	Feb. 22	5,203	+ 494	47	127,666	+ 11,211	15.25	..
Wolverhampton ..	" 23	1,910	+ 23	48	47,184	+ 2,156	13.75	..
Gen. London Rly.								
Gen. & S. Lon. Rly.	Mar. 2	10,006	— 540	9	45,905	— 2,709	6.82	..
Dublin-Lucan Rly.	" 3	6,634	— 214	9	30,615	— 763	7.26	..
G.N. and City Rly.	" 1	115	+ 8	9	525	+ 1	7	..
L'pool Overh'd Rly.	" 2	8,424	+ 249	9	15,442	+ 1,442	8.5	..
Llandudno-Col. Bay	" 3	2,910	+ 195	9	13,322	+ 964	6.6	..
Lond. Elec. Ry. Co.	" 1	288	+ 18	15.5	1,764	+ 163	6.5	..
Mersey Railway ..	" 2	29,305	+ 1,441	9	131,600	+ 6,560	21.25	..
Metropolitan Rly.	" 2	4,103	+ 106	9	18,717	+ 492	4.5	..
Met. District Rly.	" 3	83,608	+ 3,919	9	154,533	+ 1,617	25.75	..
Anglo-Argentine ..	" 2	26,810	+ 1,818	9	114,462	+ 6,602	25	..
Auckland ..	Feb. 25	47,309	+ 1,716	..	40,425	+ 11,475	..	..
Bombay (B.E.T.) ..	" 9	17,810	+ 1,214	..	137,169	+ 11,018	28.8	..
Brisbane ..	" 19	6,266	+ 671	8	8,012	+ 669	..	..
Brit. Columbia Rly.	Jan.	17,184	+ 2,126	..	..	..	..	..
Calcutta ..	Mar. 2	7,942	+ 389	..	..	+ 5,029	..	..
Cape Electric T.Ld.	"	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	Jan.	2,884	..	..	..	..	20.5	..
Lisbon ..	"	..	..	..	..	..	..	..
Madras ..	Feb. 29	1,429	+ 259	8	6,154	+ 829	..	..
Montevideo ..	Feb.	85,121	+ 5,221	4	125,833	+ 13,357	..	..
Perth (W.A.) ..	Mar. 1	8,791	+ 505	9	16,967	+ 2,569	29	..

\* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

NOTWITHSTANDING the gloomy aspect presented on Monday by the news from the various districts connected with the coal strike, markets in the Stock Exchange stood up with a surprising amount of strength against the gathering factors of depression. For this the reason was to be found in the general expectation that the Government would intervene with a definite scheme to bridge the gap now cleft between masters and men. On Tuesday the air was full of rumours pointing to early settlement, and prices recovered in all departments.

The Home Railway market naturally felt a good deal of the force of the dulness and subsequent reaction upwards. The features of the week are furnished by remarkable rises in Metropolitan Consolidated and Central London Ordinary stocks, the rise being no less than 8½ in one case and 9 in the other respectively. City and South London has jumped 3½ to 38, Central London Deferred gained 4, and the Preferred 1. At the same time, London General Omnibus stock has been rising; Underground Electric income bonds have improved, taking the shares with them; London United Tramways Debenture stock gained ½; and Districts rose 1½—the theory being that very substantial buying is in progress for the purpose of obtaining further control over the transport system of the metropolis. These very considerable advances stood out all the more conspicuously from the weakness apparent in other parts of the Home Railway market, and even the levels reached after the rises just mentioned were not the highest touched, some slight decline occurring from the top prices. The Central London rise is linked also with a statement that the line is to be extended into the South-Western districts of London; while, with regard to City and South London, we think we have already mentioned the rumour that a further extension southwards is in contemplation.

British Electric Traction is steady, without much change after their recent rises—in fact, the two Preferred stocks have gone back a little, though the Second Debenture gained a point. Metropolitan Electric Tramway issues are unaffected by the control excitement already referred to.

Of the electrical companies abroad, Mexican descriptions are still rather inclined to weakness on account of the revolution news which continues to show a very unsettled state in that country. United States intervention was threatened at one time last week, and this the market regarded with a good deal of apprehension, as liable to cause fresh violence on the part of the Mexicans, though ultimately no doubt it would be for the benefit of the country. However, on balance, Mexican Light and Power Common is 1 lower, while the Tramways shares are ½ up at 118½, the company's 5 per cent. First Bonds being unaltered at 99, allowing for deduction of the coupon. Rio Trams are again in some favour, putting on 2 points, and Sao Paulos have risen to 199. British Columbia Electric Deferred and Preferred are a trifle duller, but the pre-ordinary stocks have recovered from the effect of the recent issue of Vancouver Debenture, and show a tendency to harden. Rangoon Electric Preference shares are weaker, falling ¼. There have been many inquiries lately in the market for quotations of the Delhi Electric Trams and Light shares, the inquiry being prompted by the transference of the capital from Calcutta to this city. There is, however, no price for the shares, and, so far as we have been able to ascertain no market has been made in them. United Electric Trams of Monte Video are better, and Winnipeg Electric Debenture put on a point.

Turning to the English Electricity Supply stocks and shares, Charing Cross Preference are not quite so good, but County of London Ordinary continues to ascend, the report and statement being considered highly satisfactory. Notting Hill Preference have risen to 10½, and the rest of the alterations in this market—what few there are—have for their cause in most cases the deductions of the dividends last Thursday.

Excitement in the Telegraph market has calmed down very considerably, and Marconis have given way, although, after all, to a comparatively slight extent. In their case, as in that of so many others, the fall is ascribed to what may happen in the event of the coal strike being protracted. West India and Panama shares are slightly harder, while the Anglo group keeps steady and the Eastern stocks show small rises in the Debenture issues. Reuters shed ¼ of their recent big advance, American Telephone and Telegraph Capital stock put on 4 points, and Mackay Companies shares have risen on the better feeling perceptible amongst American securities. The Globe Telegraph and Trust Company has declared its usual quarterly dividends this week, and there is no change in the prices of either class. National Telephone Deferred went down ½, but in other Telephone descriptions there is little going on.

In the Manufacturing section, Babcock & Wilcox again show ½ loss. Callender's Cable are ¼ lower, and Castner's are ¼ down. The price of India-Rubber shares has been narrowed to the disadvantage of the holder, the quotation accordingly showing a nominal fall of ½ on the week. Rubber shares had a smart spurt on the rumours about the coal strike being settled, the market also being supported by the excellent prices obtained by the leading companies for advance sales.

**Metropolitan Electric Supply Co., Ltd.**—The directors recommend the payment of a dividend for the half-year ended December 31st last at the rate of 4 per cent., making 4 per cent. for the year 1911. This compares with 5 per cent. per annum for 1910.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividend for	Closing Quotations March 5th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations March 5th.	Rise or Fall	Present Yield p.c.
Bournemouth & Poole, Ord.	10	5 1/2	5 1/2	84 - 9 1/2	5 18 11	Kensington & Knightsbridge, Ord.	5	9	6 1/2 - 7 1/2	6 4 2	
Do. 4 1/2 % Pref.	10	4 1/2	4 1/2	84 - 9 1/2	4 14 9	Do. 4 % Deb.	Stock	4	92 - 95	4 4 3	
Do. Second 6 % Pref.	10	6	6	10 1/2 - 11	5 9 1	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	80 - 81	5 7 2	
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	4 1/2	10 - 10 1/2	4 8 3	London Electric, Ord.	3	2	1 1/2 - 1 1/2 xd	3 1 2	
Brompton & Kensington, Ord.	5	10	9 1/2	8 1/2 - 9	5 11 1	Do. 6 % Pref.	5	6	4 1/2 - 5	6 3 1	
Do. 7 % Cum. Pref.	5	7	7	7 1/2 - 8 1/2	1 4 10	Do. 4 % First Mort. Deb.	Stock	4	80 - 82	4 7 0	
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 - 101	3 19 3	Metropolitan	5	5	8 1/2 - 9	6 1 3	
Charing Cross, West End & City	5	5	5	4 - 4 1/2	5 11 1	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2 - 4 1/2	4 17 4	
Do. 1 1/2 % Cum. Pref.	5	4 1/2	4 1/2	4 1/2 - 4 1/2	5 0 0	Do. 4 1/2 % First Mort. Deb.	Stock	4 1/2	59 - 104	4 6 7	
Do. "City Undertaking"	5	4 1/2	4 1/2	3 1/2 - 4 1/2	5 9 1	Do. 3 1/2 % Mort. Deb.	Stock	3 1/2	84 - 87	4 0 6	
Do. 4 1/2 % Cum. Pref.	100	4	4	98 - 96	4 3 4	Midland Electric Corporation	100	4 1/2	96 - 98	4 11 10	
Do. Do. 4 % Deb.	5	5	5	4 1/2 - 4 1/2	5 5 3	4 1/2 % First Mort. Deb.	5	4	3 1/2 - 4	5 0 0	
Chelsea, Ord.	Stock	4 1/2	4 1/2	98 - 101	4 9 1	Newcastle-on-Tyne	5	5	4 - 4 1/2	5 11 1	
Do. 4 1/2 % Deb.	10	7	8	138 - 14 1/2	4 19 1	Do. 5 % Pref., Non-Cum.	5	5	4 - 4 1/2	5 11 1	
City of London, Ord.	10	6	6	12 - 13	4 14 4	North Metropolitan Power Sup-	100	5	99 - 102	4 18 0	
Do. 6 % Cum. Pref.	10	6	6	117 - 121	4 2 8	ply, 5 % Mortgages (Red.)	10	10	10 - 11	5 9 1	
Do. 5 % Deb.	Stock	5	5	100 - 103	4 7 5	Notting Hill, 6 % Non-Cum.	5	7 1/2	6 1/2 - 6 1/2	5 9 5	
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	87 - 89	5 12 4	Oxford	5	10	8 - 8 1/2	5 17 5	
County of Durham, 5 % First Mort. Deb.	Stock	5	5	93 - 10 1/2	5 3 3	St. James' and Pall Mall, Ord.	5	7	6 1/2 - 7 1/2	4 16 7	
County of London, Ord.	10	6	6	11 1/2 - 11 1/2	4 2 7	Do. 7 % Pref.	100	3 1/2	85 - 87	4 0 6	
Do. 6 % Pref.	Stock	4 1/2	4 1/2	107 - 109	6 0 0	Do. 3 1/2 % Deb.	5	Nil	12 - 12	6 3 1	
Do. 4 1/2 % Deb.	Stock	4 1/2	4 1/2	101 - 101	6 0 0	Smithfield Markets, Ord.	4	5	2 1/2 - 3 1/2	4 18 0	
Do. 4 1/2 % Second Deb.	Stock	4 1/2	4 1/2	2 1/2 - 3 1/2	Nil	South London, Ord.	100	5	99 - 102	6 4 5	
Edmundson's, Ord.	5	Nil	Nil	87 - 90	5 0 0	Do. 5 % First Mort. Deb.	1	7	1 - 1 1/2 xd	4 10 0	
Do. 6 % Cum. Pref.	5	Nil	Nil	4 1/2 - 5	6 0 0	South Metropolitan, 7 % Pref.	100	4 1/2	97 - 100	4 19 0	
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	4 1/2	4 1/2 - 5 1/2	4 17 7	Do. 4 1/2 % First Deb. Stock	5	5	4 - 4	5 1 2	
Folkestone	5	6	6	53 - 96	4 13 9	Urban, Ord.	5	5	2 1/2 - 3 1/2	5 16 0	
Do. 5 % Cum. Pref.	5	5	5	64 - 7 1/2	6 4 2	Do. 5 % Cum. Pref.	5	5	4 1/2 - 5	4 6 9	
Do. 4 1/2 % First Deb.	100	4 1/2	4 1/2			Do. 4 1/2 % First Mort. Deb.	100	4 1/2	4 1/2 - 5		
Hove	5	9	9			Westminster, Ord.	5	10	4 1/2 - 5		
						Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2 - 5		

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 1/2 - 5 1/2 xd	5 2 2	Monterey Rly. Light & Power,	100	5	5	88 1/2 - 90 1/2	5 10 6
Calcutta, Ord.	5	8 1/2	7 1/2	6 1/2 - 7	6 1 5	5 % 1st Mort. Deb.	5	8	192 - 197	2 11 1	
Do. 5 % Pref.	5	5	5	4 1/2 - 5 1/2 xd	4 16 10	Montreal, Lt., H. and Power	\$100	5	39 - 41	12 3 10	
Calgary Power, 1st Mort. Bds.	100	5	5	92 1/2 - 94 1/2	5 5 3	Northern, Lt., Power and Coal,	\$500	5	250 - 260	3 16 11	
Canadian Gen. El. Com.	\$100	7	7 1/2	114 - 118	5 18 8	5 % 1st Mort. Bonds	Stock	10	110 - 115	5 4 4	
Do. 7 % Pref.	\$100	7	7 1/2	116 - 120	5 16 8	Do. 5 % Deb. Stock	Do.	5	100 1/2 - 102 1/2	4 17 7	
Cordoba Lt., Power and T., Ord.	1	3	3 1/2	7 - 1	3 0 0	Roy. Elec. Co., Montreal, 4 1/2 %	100	4 1/2	100 - 102	4 8 3	
Do. 5 % Deb.	100	5	5	95 - 98	5 2 0	1st Mort. Deb.	5	5	128 1/2 - 130 1/2	3 16 8	
Elec. Lt. and P. of Cochabamba,	100	6	6	92 - 94	6 7 8	Do. 5 % Con. 1st Mort. Bonds	\$100	4	107 - 109	4 11 9	
6 % Bonds	100	6	6	83 - 86	5 16 3	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	10 1/2 - 10 5 1/2	4 5 4	
Elec. Supply Victoria, 5 % 1st	100	5	5	92 1/2 - 94 1/2 xd	5 5 10	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	99 1/2 - 101 1/2	4 8 8	
Mort. Deb.	\$500	5	5	92 1/2 - 94 1/2 xd	5 5 10	Vera Cruz Lt., P. and T., 5 %	100	5	92 1/2 - 94 1/2	5 5 10	
Elec. Dev. Ontario, 5 % 1st	10/-	Nil	Nil	92 1/2 - 94 1/2 xd	5 5 10	1st Mort. Deb.	1	Nil	11 1/2 - 11 1/2		
Mort. Bonds	1	6	6	108 - 110	4 11 0	Victoria Falls Power, Pref.	100	6	10 1/2 - 10 1/2 xd	5 12 8	
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	101 1/2 - 103 1/2	4 16 7	West Kootenay Power and Lt.,	100	6	10 1/2 - 10 1/2 xd	5 12 8	
Do. 6 % Pref.	1	6	6	84 - 86	5 16 3	1st Mort. 6 % Gold					
Kaministiquia Power, 5 % O. Bs.	\$500	5	5	82 - 84	4 15 3						
Madras, Ord.	5	5	5	105 - 107	6 10 10						
Melbourne, 5 % 1st Mort. Deb.	100	5	5	91 - 96	5 4 2						
Mexican El. Lt., 5 % 1st M. Bds.	5	5	5								
Mexican Lt. & Power, Common	\$100	4	4								
Do. 7 % Cum. Pref.	\$100	7	7								
Do. 5 % 1st Mort. Gold Bds.	5	5	5								

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4 1/2	7 1/2 - 7 1/2	5 0 6	Monte Video Telephone, Ord.	1	6	6	1 - 1 1/2	5 6 3
Do. 5 % Deb. Red.	Stock	5	5	97 1/2 - 99 1/2	5 0 6	Do. 5 % Pref.	1	5	5	8 1/2 - 9 1/2	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8 1/2	148 - 150	5 6 8	National Telephone, Pref.	Stock	6	6 1/2	99 1/2 - 102 1/2	5 17 1
Do. Collat. Trust	\$1000	4	4	91 - 96	4 3 4	Do. Def.	Do.	6	6 1/2	123 1/2 - 125 1/2	4 15 7
Anglo-American Telegraph	Stock	3 1/2	3	66 - 68	4 8 6	Do. 6 % Cum. 1st Pref.	10	6	6	94 - 10	6 0 0
Do. 6 % Pref.	Do.	6	6	110 - 111	5 8 1	Do. 6 % Cum. 2nd Pref.	10	6	6		6 0 0
Do. Def.	Do.	30/-	30/-	25 1/2 - 26	5 1 5	Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/2 - 5 1/2	4 12 0
Anglo-Portuguese Tel., 5 %	100	5	5	100 - 102 xd	4 18 0	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	103 - 104	4 6 6
Mort. Deb.	5	7	7	7 1/2 - 7 1/2	4 13 4	Oriental Telep. and Elec.	1	8		12 - 13	4 11 5
Chili Telephono	Stock	4	4	86 - 88	4 10 11	Do. 6 % Cum. Pref.	1	6	6	12 - 14	4 16 10
Commercial Cable, Stlg. 4 % Deb.	10	6	6 1/2	104 - 11 1/2	5 6 8	Do. 4 % Red. Deb.	Stock	4	4	87 1/2 - 89 1/2	4 9 5
Cuba Telegraph	10	10	10	17 - 18	5 11 1	Pacific and European Tel., 4 %	Do.	4	4	98 1/2 - 100 1/2	3 19 7
Do. 10 % Pref.	10	10	10	34 - 35	5 6 8	Guar. Debs.	8	5	5 1/2	104 - 11 1/2	3 10 11
Direct Spanish Telegraph, Ord.	5	4	4 1/2	8 - 8 1/2	5 17 8	Reuter's	6	6	6	130 - 131	4 10 3
Do. 10 % Cum. Pref.	5	10	10	99 - 101	4 9 1	Submarine Cables Trust	Cort.	6	6		
Do. 4 1/2 % Debs.	50	4 1/2	4 1/2	7 1/2 - 8	5 12 6	Telephone Co. of Egypt, 4 1/2 %	Stock	4 1/2	4 1/2	99 - 101	4 9 1
Direct United States Cable	10	4 1/2	4 1/2	99 - 101	4 9 1	Deb. Red.	5	8	8	72 - 72	5 4 11
Direct W. India Cable, 4 1/2 %	100	4 1/2	4 1/2	83 - 85	4 2 4	United River Plate Telephone	5	5	5	52 - 52	4 8 11
Reg. Deb.	Stock	7	5 1/2	100 1/2 - 102 1/2	3 18 1	Do. 5 % Cum. Pref.	5	5	5	13 - 14	3 11 5
Eastern Telegraph, Ord. Stock	Do.	3 1/2	3 1/2	13 1/2 - 13 1/2	5 0 11	West Coast of America	2 1/2	2 1/2	2 1/2	4 - 4	97 - 99
Do. 3 1/2 % Pref. Stock	Do.	4	4	94 1/2 - 101 1/2	4 1 1	Do. 4 % Debs., 1 to 1,500	100	4	4	97 - 99	-1 1 0 10
Do. 4 % Mort. Deb.	Do.	7	5 1/2	99 - 101	3 19 3	guar. by Braz. Sub. Tel.	10	1 1/2	1 1/2	4 1/2 - 4 1/2	5 5 6
Eastern Extension	10	7	5 1/2	11 - 11 1/2	5 2 2	West India and Panama Teleg.	10	6	6	10 1/2 - 11 1/2	5 6 8
Do. 4 % Deb.	Stock	4	4	13 1/2 - 13 1/2	4 8 1	Do. 6 % Cum. 1st Pref.	10	6	6	10 1/2 - 11 1/2	5 6 8
East and S. Africa Tel. 4 %	25	4	4	56 1/2 - 58 1/2	5 9 1	Do. 6 % Cum. 2nd Pref.	10	6	6	10 1/2 - 11 1/2	5 0 0
Mt. Db. Mauritius Sub.	10	6	6	83 - 86	5 10 2	Do. 5 % Debs.	100	5	5	102 - 104	4 16 2
Globe Telegraph and Trust	10	5 1/2	5 1/2	71 - 71	5 8 1	Western Telegraph, Ltd.	10	7	6 1/2	13 1/2 - 14	5 0 0
Do. 6 % Pref.	10	6	6	42 - 43	5 8 1	Do. 4 % Deb.	Stock	4	4	99 - 101	3 19 3
Great Northern Telegraph	10	18	5 1/2	3 1/2 - 3 1/2	5 8 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106 - 109	8 13 5
Indo-European Telegraph	25	13	5 1/2			Do. 4 1/2 % Fag. Bonds	\$1000	4 1/2	4 1/2	102 - 105	4 5 9
Mackay Companies Common	\$100	5	5 1/2								
Do. 4 % Cum. Pref.	\$100	4	4								
Marconi's Wireless Telegraph	1	5									
Do. 7 % Cum. Partio. Pref.	1	16									

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 5th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 5th.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. ..	1	1910. Nil	1911 Nil		£ s. d.	Metropolitan Railway Consol. ..	100	1910. 12½	1911. 12½		£ s. d.
Do. 5 % Pref. ..	1	5	5		7 5 6	Do. Surplus Lands ..	100	23½	22½		3 18 7
Do. 4½ % Deb. ..	100	4½	4½		5 5 11	Do. 8½ % Deb. ..	100	3½	3½		3 16 1
Brit. Elec. Trac., 6 % Pref. ..	100					Do. 9½ % Pref. ..	100	8½	8½		4 0 6
Do. Do. Deferred ..	100					Do. 9½ % Con. Pref. ..	100	3½	3½		4 1 5
Do. Do. 6 % Cum. Pr'f. ..	100					Metropolitan District Ord. ..	100	Nil			Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100					Do. 6 % Deb. ..	100	6	6		4 2 2
Do. Do. 5 % Pern. Deb. ..	100	5	5		5 1 0	Do. 4 % Deb. ..	100	4	4		4 1 8
Do. Do. 4½ % 2nd Deb. ..	100	4½	4½		5 7 2	Do. 4 % Prior Lien ..	100	4	4		3 18 5
Central London Railway, Ord.	100	8	3		3 15 11	Do. 4½ % First Pref. ..	100	8½	4½		4 18 11
Do. Pref. ..	100	4	4		4 13 0	Do. 9½ % Gtd. ..	100	8½	8½		4 9 9
Do. Def. ..	100	2	2		3 2 6	Metropolitan Elec. Trams, Ord.	1	5½	5½		5 13 6
Do. 4 % Deb. ..	100	4	4		3 18 5	Do. Def. ..	1	Nil			Nil
City & South London, Ord.	100	1½	1½		3 16 11	Do. 5 % Pref. ..	1	5	5		5 10 2
Do. 5 % Pref., 1891 ..	100	5	5		4 11 9	Do. 4½ % Deb. ..	100	4½	4½		4 9 1
Do. Do. 1896 ..	100	5	5		4 16 2	Do. 5 % Deb. ..	100	5	5		4 17 7
Do. Do. 1901 ..	100	5	5		4 17 1	Potteries, Ord. ..	1	2			
Do. Do. 1903 ..	100	5	5		4 17 1	Do. 5 % Pref. ..	1	5	5		6 19 3
Do. 4 % Deb. ..	100	4	4		3 17 8	Do. 4½ % Deb. ..	100	4½	4½		4 17 10
Dublin United Trams, 6 % Pref.	10	6	6		5 2 2	South Metro. Trams, 6 % Pref.	1	6			6 17 2
Great Northern & City, Pr'f. Ord	10	Nil			Nil	Do. 4 % Deb. ..	100	4	4		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	8½			Underground Elec. Railways	10				
Do. 4½ % Deb. ..	100	4½	4½		5 15 5	Do. 4½ % Bonds ..	100	4½	4½		4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2½	2½		4 6 11	Do. 6 % Income ..	100	1	1½		
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil			Nil
Lancashire United, 5 % Deb. ..	100	5	5		5 19 1	Do. 6 % Pref. ..	5	Nil			Nil
London Elec. Railwys, 4 % Deb.	100	4	4		4 0 10	Do. 4½ % Deb. ..	100	4½	4½		5 5 11
London United Trams, 5 % Pref.	10	Nil									
Do. 4 % Deb. ..	100	4	4		5 1 11						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5	—	5½	5	4	9	La Plata Elec. Trms, Ord.	1	..	..	2½	—	2½	..	..	0
Do. 2nd Pref.	5	5	5½	4½	—	5½	5	3	6	Do. Pref.	1	6	6	1	—	1	..	6	0
Do. 4 % Deb.	100	4	4	9½	—	95	4	4	3	Lisbon Elec. Trams, Ord.	1	5½	6½	1	—	1½	..	4	8
Do. 4½ % Deb.	100	4½	4½	101½	—	103½	4	7	0	Do. 6 % Pref.	1	6	6	1	—	1½	..	4	16
Do. 5 % Deb.	100	5	5	103½	—	105½	4	14	9	Do. 5 % Deb.	100	5	5	93½	—	97½	..	5	2
Auckland Trams, 5 % Deb.	100	5	5	102	—	105	4	15	3	Madras Elec. Tr. (1904), Deb.	100	5	5	93½	—	96½	..	5	3
Bombay Elec. S. & Trams, Pref.	10	6	6	103½	—	11½	5	6	8	Manaos Trams & Lt., 1st Deb.	100	5	5	92	—	95	..	5	5
Do. 4½ % Deb.	100	4½	4½	98	—	100	4	10	0	Manila Elec. R. and Ltg., Bonds	\$1000	5	5	99½	—	101½	+1	4	18
Do. 5 % 2nd Deb.	100	5	5	98	—	100	5	0	0	Mexico Trams Com.	\$100	7	7½	117½	—	119½	+½	5	17
Brisbane Trams Invt., Ord.	5	8	8½	8½	—	9	4	8	11	Do. Gen. Con. 5 % Bonds	..	5	5	98	—	100 xd	..	5	0
Do. 5 % Pref.	5	5	5	4½	—	5½	4	15	3	Do. 6 % Bonds	100	6	6	100½	—	102½	..	5	17
Do. 4½ % Deb.	100	4½	4½	100	—	103	4	7	5	Para Elec. Rlys. & Lt., Ord.	5	10	10	6½	—	7½ xd	..	6	18
B. Columbia Elec. Rly., Def.	100	8	8½	135	—	140	—1	5	14	Do. 6 % Pref.	5	6	6	5	—	5½ xd	+½	5	9
Do. Pref. Ord.	100	6	6	116	—	120	—1	5	0	Do. 5 % 1st Deb.	100	5	5	97½	—	99½	..	5	0
Do. 5 % Pref.	100	5	5	109	—	112	+½	4	9	Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1½	—	1½	..	1	18
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100	—	103		4	7	Do. 5 % 1st Deb.	100	5	5	101	—	104	..	4	16
Do. 4½ % Vancouver Deb.	100	4½	4½	102	—	104		4	6	Rangoon El. Tr. & Sup., Pref.	5	6	6	5½	—	5½	—¼	5	6
Do. 4½ % Con. Deb.	100	4½	4½	104	—	106	+½	4	5	Do. 4½ % 1st Deb.	100	4½	4½	98	—	101	..	4	9
Calcutta Trams, Ord.	5	6	..	5½	—	5½	..	5	4	Rio de Janeiro Trams	\$100	4½	5½	118	—	119	+2	4	4
Do. 5 % Pref.	5	5	5	4½	—	5½	..	4	16	Do. 1st Mort. 5 % Bonds	..	5	5	102½	—	103½	+½	4	16
Do. 4½ % Deb.	100	4½	4½	100	—	103	..	4	7	Do. 5 % Mort. Bonds	100	5	5	99	—	100	+1	5	0
Cape Electric Trams	1	Nil	2½	..	..	..	..	..	..	Sao Paulo Tram, Lt. and P.	\$100	10	10½	198	—	200	..	5	0
City Buenos Aires Trams (1904)	5	5	5	5½	—	5½ xd	..	4	6	Do. 5 % 1st Deb.	\$500	5	5	102	—	104	..	4	16
Do. 4 % Deb.	100	5	5	101	—	103	..	4	17	Singapore Trams, 5 % Deb.	100	5	5	81	—	84	..	5	19
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93	—	98	..	5	2	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93	—	95	..	5	5
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100	—	103	..	4	17	Un. Elec. Trams Monte Video	5	6	7	5½	—	5½	+½	6	1
Kalgoorlie Elec. Trams	1	Nil	..	..	—	..	..	Nil	..	Do. 6 % Pref.	5	6	6	5½	—	5½	..	5	11
Do. 5 % A Deb.	100	5	5	91	—	94	..	5	6	Do. 5 % 1st Deb.	100	5	5	99	—	102	+½	4	18
Do. 6 % B Deb.	100	5	6½	68	—	62	..	8	1	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105	—	107	+1	4	4

## MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	Nil	6	5—	3					Dick, Kerr . . . . .	1	5	34—	34			5	9	1
Do. 6 % Pref. . . . .	1	9	6	33—	32			7	2	Do. Pref. . . . .	1	6	34—	1 3/4			5	9	9
Babcock & Wilcox . . . . .	1	26	24 1/2	63—	60 1/2	—	1/2	3	18	Do. Deb. . . . .	100	4 1/2	4 1/2	97—	100	—1	4	10	0
Do. Pref. . . . .	1	6	6	1—	1 1/2			3	13	Edison & Swan, A, £3 paid . . . . .	5	Nil	1 1/2—	1 1/2			Nil		
B.I. & Helsby Cables . . . . .	5	10	8 1/2	63—	7 1/2			6	17	Do. fully paid . . . . .	5	Nil	1 1/2—	2 1/2			Nil		
Do. Pref. . . . .	5	6	6	54—	6 1/2			4	16	Do. 4 % Deb. . . . .	100	4	4	71—	75		5	6	8
Do. Deb. . . . .	100	4 1/2	4 1/2	101—	103			4	7	Do. 5 % Second Deb. . . . .	100	5	5	77—	80		6	5	0
British Thomson-Houston, Deb. . . . .	100	4 1/2	4 1/2	92—	95 xd			4	13	Electric Construction . . . . .	2	Nil	2 1/2	3—	1				
British Westinghouse, Pref. . . . .	3	Nil		1—	3 1/2					Do. Pref. . . . .	2	7	7	1 1/2—	1 1/2		7	9	4
Do. Deb. . . . .	100	4	4	62—	65	—1		6	3	Greenwood & Batley, Pref. . . . .	10	7	7	7 1/2—	8 1/2		8	5	8
Do. 6 % Prior Lien . . . . .	100	6	6	102—	105			6	14	Do. Deb. . . . .	100	5	5	94—	96		5	4	2
Browett, Lindley, Ord. . . . .	1	Nil		1/6—	2/—					General Electric, Pref. . . . .	10	5	5	9—	9 1/2		5	5	3
Do. Pref. . . . .	1	Nil		5/—	6/—					Do. Deb. . . . .	100	4	4	87—	92	+2	4	7	0
Brush, Ord. . . . .	2	Nil		0—	1 1/2					Henley's, Ord. . . . .	5	15	10 1/2	11 1/2—	12 1/2		6	2	5
Do. 7 % Pref. . . . .	2	Nil		0—	1 1/2					Do. Pref. . . . .	5	4 1/2	4 1/2	5—	5 1/2 xd	+ 1/2	4	5	9
Do. 4 1/2 % Deb. . . . .	100	4 1/2	4 1/2	54—	59 xd			7	10	Do. Deb. . . . .	100	4 1/2	4 1/2	104—	106		4	4	11
Do. 4 1/2 % Second Deb. . . . .	100	4 1/2	4 1/2	87—	42			10	14	India-Rubber, G. & T. . . . .	10	10		10—	11	— 1/2			
Callender's Cable . . . . .	5	15	10 1/2	8 1/2—	9 3/4	— 1/4		7	17	Do. Pref. . . . .	10	5	5	9 1/2—	10 1/2		4	17	7
Do. Pref. . . . .	5	5	5	5—	5 1/2			4	15	Telegraph Construction . . . . .	12	20	10 1/2	35 1/2—	37 1/2		6	7	0
Do. Deb. . . . .	100	4 1/2	4 1/2	98 1/2—	100 1/2			4	9	Do. Deb. . . . .	100	4	4	99 1/2—	101 1/2		3	18	10
Castner-Kellner . . . . .	1	17 1/2	20	3 1/2—	9 1/2	— 1/2		5	10	Willans & Robinson . . . . .	1	Nil		1 1/2—	1 1/2		Nil		
Do. Deb. . . . .	100	4 1/2	4 1/2	106—	110			4	1	Do. Pref. . . . .	5	Nil		1 1/2—	1 1/2		Nil		
Crompton & Co. . . . .	8	Nil	Nil	1—	3 1/2					Do. Deb. . . . .	100	4	4	61—	64		6	5	0
Do. Deb. . . . .	100	5	5	58—	68			7	7										

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.



## EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1912.

If the figures which we record herewith are any indication, the year 1912 opens well as regards electrical business. In all three sections (exports, imports and re-exports) the January totals are well above the averages obtaining last year.

In the export section the total of £467,471 compares with £375,208 in December, and was, in fact, exceeded on only one occasion last year.

The import total of £228,245 is more than £20,000 in advance of the previous month's figures, and the re-exports total of £35,325 for January, constitutes a record in our returns.

As regards the exports, the satisfactory total is largely due to

the flourishing state of the cable and machinery export trade, the former business being valued at £102,000 for the month, while the latter exceeded £190,000 in value. Telegraphic exports at over £66,000 are also above the recent level.

In the case of the imports, the machinery, and telegraphic and telephonic sections show an improvement on the December returns, while glow lamp imports show some falling off, and other items remain stationary. During the month India was an exceptionally good customer of ours, while Japan, South America and Australia also contributed largely as purchasers. German imports into this country remained steady, but the United States nearly doubled its contribution of December last.

## Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	£ 910	£ 528	£ 324	£ 48	£ 120	£ 47	£ 10,476	£ 68	£ 763	...	£ 95	£ 264	£ 13,643
Germany and German W. Africa ...	1,199	722	...	576	...	69	2,938	...	10	...	...	...	5,514
Netherlands and Java ...	404	1,064	5	...	25	9	2,354	...	23	...	27	763	4,674
Belgium ...	545	414	54	28	623	71	1,215	526	1	...	1,253	44	4,874
France and Fr.W. Africa ...	1,826	38	334	14	99	1,043	9,098	882	6	50	331	285	14,006
Portugal ...	164	102	30	...	10	...	306	...	4	...	267	30	913
Spain, Canary Isles and Spanish N. Africa...	273	59	158	12	11	384	1,121	...	...	...	12	48	2,078
Switzerland, Italy and Austria-Hungary ...	548	2,930	76	23	81	148	2,141	215	13	...	...	7,533	13,708
Greece, Roumania and Turkey ...	26	378	63	...	...	...	33	...	29	...	...	98	627
Channel Isles, Gibraltar, Malta and Cyprus...	30	78	97	59	...	40	113	...	6	...	8	1,762	2,193
U.S.A., Philippines and Cuba ...	31	10	114	509	54	49	392	...	4	25	...	645	1,833
Canada and Newfoundland ...	609	474	95	1,176	69	3,231	9,425	...	302	115	273	1,102	16,862
British West Indies, British Honduras and British Guiana ...	48	...	332	10	...	133	268	3	...	...	9	97	900
Mexico and Central America ...	20	158	37	...	...	...	585	...	1	...	1,055	305	2,161
Peru, Uruguay and Paraguay ...	13	735	218	12	...	43	1,219	129	23	...	53	18	2,463
Chile ...	408	315	369	...	...	66	5,012	7	92	...	23	884	7,176
Brazil ...	1,694	1,112	22	828	...	796	5,473	1,456	29	...	301	21,815	33,526
Argentina ...	3,140	9,118	1,129	350	590	11	10,141	741	2,665	819	322	728	29,754
Colombia and Ecuador ...	...	...	37	...	...	...	143	...	4	...	139	...	323
Egypt, N. Africa and Persia...	226	427	147	117	...	2	722	123	230	...	433	705	3,132
British West Africa and St. Helena ...	9	16	71	...	31	...	537	...	28	...	136	5,421	6,249
Rhodesia, O.R.C. and Transvaal ...	2,145	1,858	523	1,358	248	178	4,185	18	66	52	35	191	10,857
Cape of Good Hope ...	1,780	3,776	659	282	80	424	5,488	226	189	...	164	340	13,408
Natal ...	666	7,967	557	270	16	75	2,321	27	673	...	115	9	12,696
Zanzibar, Brit. E. Africa, Mauritius & Aden	87	261	250	38	12	...	70	11	150	...	112	15,049	16,040
Madeira and Portuguese Africa ...	235	396	77	75	16	69	215	...	4	...	127	14	1,228
China and Siam ...	875	1,726	177	466	19	37	1,269	...	49	...	16	...	4,634
Japan and Korea ...	773	551	16	40	890	2,447	32,124	9,831	8	...	1,092	266	48,038
India ...	4,580	14,419	2,770	2,070	302	234	27,214	1,440	3,017	189	2,716	981	59,932
Ceylon ...	173	537	195	...	21	476	69	1,245	323	...	305	125	3,469
Straits Settlements and Fed. Malay States...	716	246	211	83	56	852	632	78	865	...	40	278	4,057
Hong Kong ...	581	775	44	13	27	143	1,480	40	19	94	9	198	3,423
West Australia ...	510	477	76	236	45	...	792	326	136	...	278	3,408	6,284
South Australia ...	1,275	6,514	326	348	38	4	1,574	34	27	...	319	18	10,477
Victoria ...	1,037	13,774	2,133	1,046	75	71	6,219	524	5,437	19	2,938	260	33,533
New South Wales ...	4,722	12,777	503	1,254	17	681	12,592	1,833	150	28	1,470	1,156	37,183
Queensland ...	574	3,041	131	161	...	...	1,835	3,649	...	...	471	398	10,260
Tasmania ...	18	37	10	33	...	7	...	...	...	...	...	...	105
New Zealand and Fiji Islands ...	1,886	14,190	404	579	18	21	5,169	761	447	...	639	1,124	25,238
Total, £	34,756	102,000	12,774	12,114	3,484	11,861	166,960	24,193	15,793	1,391	15,683	66,362	467,471

## Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	14	12	...	82	23	...	4,505	...	285	55	9,946	14,922
Germany ...	1,479	3,923	1,764	25,693	7,170	2,188	49,811	224	2,220	7,998	36,314	138,784
Holland ...	66	45	...	2,388	629	...	9	...	...	42	...	3,179
Belgium ...	512	948	129	50	19	64	2,705	...	417	770	9,243	14,857
France ...	171	248	715	883	484	1,089	520	...	1,363	2,883	1,539	9,895
Switzerland ...	19	396	433	13	...	...	811	...	...	4	20	1,696
Italy ...	4	264	...	...	...	37	...	...	...	...	2,296	2,601
Austria-Hungary ...	...	1,305	...	822	306	55	15	...	167	270	82	3,022
United States ...	2,230	422	344	3,503	2,194	...	8,774	15,666	243	446	3,781	37,603
Total, £	4,495	7,563	3,385	33,434	10,825	3,433	67,150	15,890	4,695	12,468	63,221	226,559

Additional imports: Canada, goods, £2; machinery, £1,594. Spain, carbons, £90.

## Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	21,834	1,117	...	3,153	446	...	7,171	...	194	371	1,039
----------------------------------------	--------	-------	-----	-------	-----	-----	-------	-----	-----	-----	-------

TOTAL EXPORTS: £467,471.

TOTAL RE-EXPORTS: £35,325.

TOTAL IMPORTS: £228,245.

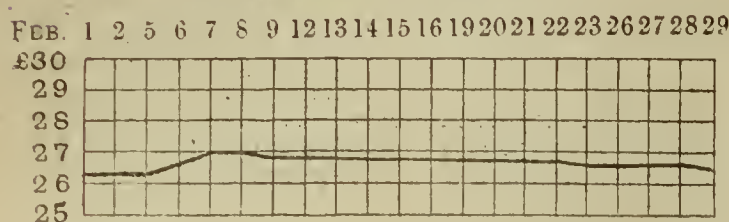
NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.



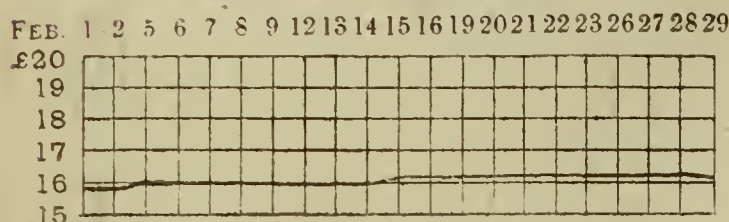
## METAL MARKET.

Fluctuations in February.

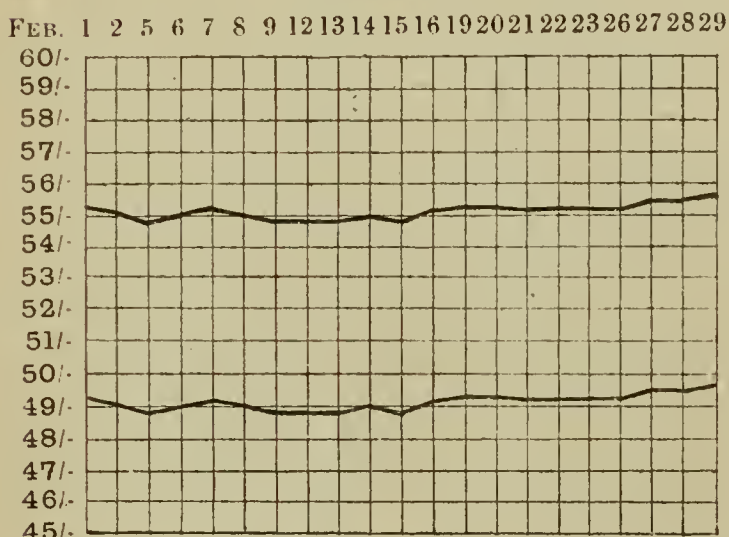
## SPELTER (G.O.B's.).



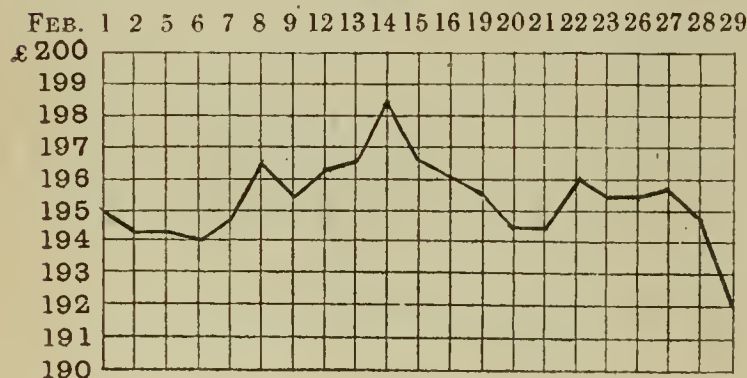
## LEAD (ENGLISH).



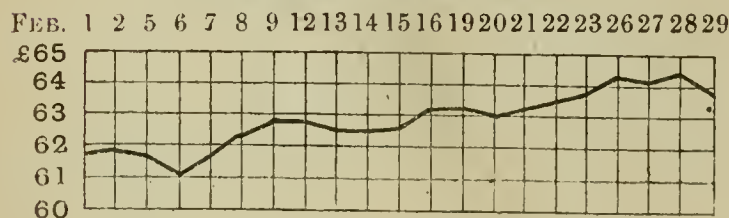
## IRON.



## TIN.



## COPPER (G.M.B's.).



## PROCEEDINGS OF INSTITUTIONS.

## Automatic Reversible Battery Boosters.

Discussion on paper read by MR. R. RANKIN before the INSTITUTION OF ELECTRICAL ENGINEERS at Birmingham, February 14th, 1912. For abstract of paper see ELECTRICAL REVIEW, December 8th and 15th, 1911.)

MR. A. M. TAYLOR was not quite convinced that the way in which automatic reversible boosters were worked was necessarily the best. Unfortunately for the battery, it was not at present a strictly reversible machine, nor would it be until it was suited for the same rate of charge and discharge. The automatic booster was undoubtedly a very valuable piece of apparatus, particularly because it dealt with the battery as a whole, and so avoided any disturbing cause tending to make one cell behave differently from another. He understood that on the Continent and in America automatic means had been employed, using regulating cells exclusively for the discharges, and he thought that there was a danger of such means entering into serious competition with boosters in this country if the size and cost of the latter were not kept in check. This result could be obtained by sacrificing, to some extent, the feature of the automatic booster whereby the battery was charged in the intervals between the discharges; it would be in no way at a disadvantage compared with regulating cells, since these would also suffer from the same weakness. He was not at all convinced that the making-up of a load at the generating station in this way was of such great importance, and he believed that the disadvantage would be more than compensated for by the greater capacity of the battery to deal with severe discharges which would be obtained by the method he proposed. Briefly, this was to increase the number of cells in the battery above that required merely to float upon the line, and to employ series-parallel grouping of the boosters for the purpose of putting the final charge into the battery late at night or early in the morning. In those cases where the average load did not possess a constant value throughout the whole day, there would be a very decided gain in employing series-parallel arrangements, and they could reduce the size of the booster to very nearly half. If the booster could be arranged to be coupled in series or parallel at will, it would be quite feasible to give any charge required by the battery at any time of the day. He had worked out a switching arrangement which could be operated without any adjustment of the booster field or interruption of the current. It would be found that owing to the reduction in the amount of boost required and in the size of the booster, the current taken from the battery to drive the booster was so much less than before, that the reduction in the output of each cell throughout the whole battery was sufficient to pay the capital value of the increased number of cells, while the energy losses in the booster must obviously be less with the smaller booster, and the general efficiency was improved.

MR. F. W. FOSTER did not agree that in the case of a works generating its own electricity for lighting and for a very highly fluctuating power load, the economy shown by a battery booster attained its maximum. The load factor in most works where a battery booster plant would be proposed was better over the working hours than over the working hours of a central station, which were 24 hours to the day and included many periods of light load. The disadvantage of over-compounding a generator and booster was best corrected by altering the compounding of the generator to level compounding by means of a diverter or definite alterations of the series turns on the generators, for he was of the opinion that it was inadvisable to use over-compounded generators with over-compounded boosters, and believed that general opinion now advised level compounding of the generators, or even plain shunt winding at stations of moderate or large capacity. The sluggishness of the inductive lag of the diverter circuits in obtaining relative values could surely be overcome by using tapings on the series coils and a selector switch, if the inaccurate working mentioned by the author was worth serious consideration. As the author had claimed traction and similar loads as within the legitimate field covered by battery booster plant, he pointed out the great advantage of end-cell regulating gears as used on the Continent. These were automatic in action and resulted in much higher economy—they were lower in first cost, more robust, and less liable to damage when short-circuit conditions arose.

DR. C. G. GARRARD suggested that the sluggishness due to the fact that the diverter was non-inductive while the field coil in parallel with it was highly inductive could be got over by making the diverter inductive. With reference to the split-pole converter mentioned, the simplest way of looking at the action of this machine was to regard it as a question of distortion of E.M.F. wave form. The D.C. voltage of a converter was given by the maximum value of the E.M.F. wave, while the A.C. value was given by the R.M.S. value of the wave. By splitting the pole face, the wave form was distorted so that the relation between the maximum and R.M.S. values could be altered. The overshooting effect mentioned in connection with the Entz booster was of great importance not only in connection with that type but also with the Tirrill regulator. It was rather extraordinary at first sight that either of these regulators should act with the rapidity with which they did act. Their rapidity of action seemed to depend upon this overshooting principle, viz., the initial change in field excitation voltage was made much larger than was actually required to take charge of the alteration in the load. Directly, however, the required regulation was obtained, the action was suddenly stopped and an over-regulation was prevented.

MR. R. RANKIN, in reply, said it was very possible that the present methods of operating automatic boosters might be improved upon

**Electrical Engineers in Bombay.**—“The increasing demand for electrical machinery and appliances for Indian factories has brought out quite a representative body of electrical experts from different manufacturers. Mr. W. Lusk is now in Bombay looking after the interests of the General Electric Co., of New York, whilst Messrs. Preace & Paris are inquiring into business prospects on behalf of the Westinghouse Co. The Lancashire Dynamo and Motor Co. is now being represented by Mr. W. Cook, the expert engineer for Messrs. Sorabji Shapurji & Co. Mr. Saunders, of Messrs. Siemens Brothers, is also on the spot to negotiate the business in connection with the mill installations of the Tata Hydro-Electric Power Supply Co. There are several other inquiries, including the electrification of a native State on a large scale, the promoters being well-known Bombay citizens.”—*Indian Textile Journal*.



Undoubtedly it was a bad thing to try to store energy in a battery at too high a rate, and some boosters absolutely refused to do it, but he would point out that there were some externally regulated boosters with which it was possible to limit the charging current to a desirable value and allow the generator current to decrease, and at the same time to get a good equalising action for normal working and avoid the extreme conditions with which Mr. Taylor had dealt. With regard to regulating switches, what must be the state of affairs with them if so many difficulties were encountered with the use of boosters? Mr. Taylor's figures and curves seemed to him to apply to installations and conditions for which an automatic booster would not be required. In all ordinary central stations an automatic booster was only useful on traction, which was only a part of the load, and very often only a minor one. An inspection of a steel works load chart would show that what he said in the paper was correct. The results given in the table\* were for such a load with a maximum mean load of about 600 amperes with peaks to about 1,500 or 1,600 amperes of short duration occurring rapidly one after the other during the whole period of working. Two 800-ampere generators would be required to handle the load without the battery and booster, whereas, with them, one at about  $\frac{1}{3}$ -load was sufficient, having only a steady load to handle and giving a constant voltage. The average mean load over the whole period of the test connected with the table was about 300 amperes. The other works mentioned in the paper employed gas engine-driven generators, which were probable compounded, but with a load like that outlined above, the compounding was of little avail. Regulating the voltage would not give the advantage of a steady load, whereas a proper battery and booster would give both steady load and voltage. Traction and similar loads were not only within the field covered by battery booster plants; they were the ideal loads for automatic plant. On such loads instantaneous reversibility of action was the ideal aimed at in the equalising plant, and cell regulating switches would be worse than useless. Their action must be infinitely slower than the most sluggish booster. With regard to Dr. Garrard's remarks, an inductive diverter would be rather costly, and as it would be used with the most expensive kind of booster, that is one with a laminated field probably, it would place this kind of booster at a still greater disadvantage as far as price was concerned.

#### Electric Driving in Textile Factories.†

ON February 12th, under the auspices of the HUDDERSFIELD TECHNICAL COLLEGE TEXTILE SOCIETY, Mr. John Shaw, of Manchester, delivered a lecture on "Electric Driving in Textile Factories."

The LECTURER said that over 10 years ago the advocates of electrical driving for textile mills first began their campaign in this country. Since that date the pioneers had by their strenuous and persistent efforts overcome the early opposition and difficulties, and had demonstrated the justice of their early claims by having set to work successful installations in all parts of the kingdom and in all branches of the industry. He could confidently assert that electric driving by polyphase induction motors had firmly established itself as the best known means for transmitting unaltered the regularity of speed from the prime mover to the driven machine. It was seven years since he secured the first contract given in the United Kingdom for the complete electrical driving equipment for a new mill, viz., the Acme Spinning Co.'s mill at Pendlebury. Since that date many important contracts had been carried out by various firms, and to-day statistics showed that upwards of 50,000 B.H.P. in motors had been installed in this kingdom alone. The lecturer's personal portion of that amount was over 30,000 H.P., and he was in the probably unique position of being able to say that he had never yet installed electric driving in any single concern but that extensions to the original installations had followed. Since the Acme Spinning Co.'s mill was started in December, 1905, there had been a continuous demand for electric driving; further, it had been an increasing demand, the contracts secured varying in the writer's case from 3,155 H.P. in 1905, to 7,579 H.P. in 1910, and nearly 8,000 H.P. in 1911. The earliest installations were all carried out on the so-called group system of driving, and the motors were consequently of large individual capacity. The reason for the adoption of that course was obvious; capital cost had to be kept down. Greater sub-division of mills into smaller sections had always been advocated by electrical engineers, in order to provide closer supervision and greater control over the output, and it was interesting to note that in the seven years the average size per motor had dropped from 45 H.P. in 1905 to just over 20 H.P. in 1911.

Since the main characteristic of polyphase induction motors was to reproduce exactly the turning moment with which the main generator was driven, it followed that a shaft so driven had the same regularity of speed as the main engine. That method of procedure had necessarily involved reconsideration and special designing of millwrighting work to be used in connection with these motors, by reason of the fact that the shafts were required to run at higher speeds than obtained in the mechanically-driven mills. Speeds increased and shaft and pulley diameters decreased, bearing centres merely being the determining limit of both speed and size of shaft. The largest diameter of shaft in the Acme Spinning Co.'s mill, which contained 1,350 H.P. in motors, was 3 in., transmitting 200 H.P. at a speed of 585 R.P.M., and driving cotton mules. In another large mill containing over 1,700 H.P. in motors, 300 H.P. was being transmitted through a shaft  $3\frac{1}{2}$  in. diameter running at a speed of 585 R.P.M., driving cotton and doubling frames. The

same thing applied also to other branches of the industry, such as woollen, worsted, jute, flax, &c., particularly as regards the spinning and twisting sections. In two different woollen mills he had installed line shafts  $2\frac{1}{2}$  in. diameter, running at 585 R.P.M., driving woollen mules, one transmitting 175 B.H.P. and the other 150 B.H.P. Both mills were of shed construction, and the shafts were carried from the roof gutters. The first drive was installed on the understanding that should any difficulty arise due to vibration, the motor should be taken down and the rope pulleys and ropes provided free of cost to the purchaser for driving the shaft at ordinary speed. Both drives had been running with perfect success for over two years. In all cases of high speeds, not only did the writer design the motor application, but also the shafting and millwrights' work, since his experience proved it to be equally essential in obtaining good results that the shafting should be right as well as the motors and electrical equipment. More troubles had been experienced in electrical installations due to those details than from any other cause. Work which might be good enough to run at 300 to 350 revolutions would not be satisfactory when running at 580 or 725 revolutions, although by giving due attention to all the details it was just as easy to make it satisfactory and capable of running without vibration and with a minimum amount of friction loss. Bearing on the friction loss in shafting at those high speeds, one shaft installed in 1905, transmitting 150 H.P. at 485 revolutions, 3-in. diameter to  $2\frac{1}{2}$  in. in 13 bearings, and with 25 ropes on loose pulleys, ran for 4 minutes 20 seconds after current was shut off from the motor.

The natural result of the adoption of such line shaft speeds was to reduce the diameters of the driving pulleys, making them more nearly the same size as the machine pulleys. The lecturer's experience proved to him that the smaller the ratio between driver and driven pulley, the better and sweeter the drive, and the smaller the slip, with consequent longer life to the driving belt or rope.

Subdivision of mills into sections or departments had, of late years, been carried out to a much greater extent than originally obtained. Whether it was commercially sound to carry it so far as to drive each machine by its own motor he was not prepared to say. In his opinion, based on the results of experience with both the group and individual driving of textile machines, each case required consideration on its own merits; while it might be right to adopt individual driving in one case, it might be equally wrong to adopt it in another.

By far the majority of electrical installations were for the conversion of old mills to the newer driving method, and naturally the question arose as to the time lost in making the alterations. Necessarily, there was some time lost in each instance, as it was almost impossible to carry through a complete reorganisation of all the driving arrangements of a large mill without interfering with its working. In four mills recently converted, one containing over 1,800 H.P. in motors, the second 1,100, the third 1,700, and the fourth 1,300, the average total stoppage of the mill due to the substitution of electrical for mechanical driving was one day in each case.

A very great proportion of the benefits derived from electrical transmission was dependent on the regularity of turning of the prime mover driving the electric generator. The steam turbine was a prime mover which provided a turning moment of practically perfect regularity. It was peculiarly well adapted to the requirements of electrical driving, although, owing to its speed of rotation, necessary to obtain good economy, not well adapted to driving by any other known means. When considering such delicate fabrics as were found in textile mills of all descriptions, the advantage of such a turning moment was self-evident. Its economy, steam consumption and first cost were at least equal, if not superior, to those of the best reciprocating sets, and present-day practice was towards the adoption of the turbine for all industrial purposes. Practice favoured the adoption of large units from 1,000 to 5,000 kw. capacity. It was a significant fact that, of the total of 50,000 H.P. of motors installed in textile works, probably more than one-half was driven from the mains of either Corporations or public supply companies. Wherever it was possible, there was no doubt that taking power from an outside source was commercially sound. Instead of sinking capital in non-producing boilers and engines, consumers might invest that capital in producing machinery, and be relieved of all anxiety and worry as regards the maintenance of their power source and the keeping of it abreast of the times. Capital locked up in producing machinery was much more remunerative than the same amount sunk in boilers and engines.

Even, however, in those cases where an outside supply was not available, the steam turbine held its own in competition with other methods of generating power. Apart from its superior turning moment, so valuable in connection with textile work, its cost to-day was no more than that of the steam engine. Its applicability and facility of providing, without loss, steam for heating for such places as required it, was unequalled.

Further, the steam turbine lent itself peculiarly well to those cases where the existing engines, already overloaded, were required, owing to exigencies of trade, to provide power for extensions.

**The Lighting of Machine Shops.**—Referring to this article in our last issue, the BENJAMIN ELECTRIC, LTD., write pointing out that the American Holophane D'Olier reflector can only be used with Edison screw lamps, and is not designed for English-made lamps, whereas the Holophane-Benjamin line of steel reflectors has been designed for English use.

\* ELECTRICAL REVIEW, December 18th, 1911, p. 1003.

† From the *Huddersfield Examiner*.



## NOTES ON RECENT ELECTRIC RAILWAY DEVELOPMENTS.

[CONTRIBUTED.]

THE tardy development of main-line electric traction in this country is in remarkable contrast with the progress already effected in Continental countries. Two causes mainly responsible for this state of affairs are: (1) The existence of large waterfalls near or on the routes of the railways, provides energy at a cost below the minimum attainable in coal-fired generating stations; (2) many of the railways concerned are entirely new lines, so that it is a question only of *difference* in capital costs between steam and electrical systems; there is, in such a case, no capital to be sunk in *conversion*.

Each fresh route opened establishes more firmly the economic possibilities of electrical operation, and the following notes deal with a few of the more important results of the experience now gained and present interesting leading data regarding the rolling stock in special cases.

*General Advantages and Effects of Electrification.*—It appears from the results realised in a number of schemes of various descriptions, that an electric railway, if not actually cheaper in first cost than the equivalent steam line, offers, in any case, such operating economies as fully justify any additional capital outlay which may be incurred. In a number of cases electric locomotives have run 50,000 miles between overhauls, with only running adjustments of the brakes, whereas a steam loco requires coaling every 150 miles or so and needs washing out and overhauling at frequent intervals. The advantage it possesses in this respect alone compensates for the usually higher energy bill of the electric locomotive.

On short-distance and suburban lines, the advantages of electric traction are incontrovertible, and though it is not so easy to make out a case on paper for the electrification of long-distance lines, Continental experience is annually affording additional proof of the overall economy secured. Electrical railways are subject to energy losses in transmission lines which are, however, compensated for by the high efficiency of the large stationary generating units at the central station. Coal sheds, water tanks and similar equipment are unnecessary on an electric railway. Lighter trains may be profitably employed, and a more frequent service may be adopted. Branch lines may be increased in number, and from the termini of such may be erected trolley-bus routes, further to increase the area of traffic collection. The handling of trains is considerably simplified by electrification and, in goods service, in particular, the rapid working of heavy trains is much facilitated by electric traction.

Continental lines are investigating the problem whether a railway should erect its own generating station or purchase energy from one or more independent stations along the route. In the case of long-distance routes, it would certainly appear advisable to adopt the latter course if possible. In this country, in the absence of appreciable water power, we may hope for the erection of large co-operative central stations in the coal fields.

In a number of Continental areas, industrial development and the progress of railway electrification have proved to be interdependent. Industrial development, already realised or imminent, justifies the erection of electric railways, which then lead to the rapid further development of the districts served. The strategic possibilities (in weakness or strength) of electric railways, though of relatively small importance in this country, are a crucial consideration in Continental States, and it is satisfactory to note that the Prussian War Department has admitted that electric railways are no more liable than steam railways to interruption by hostile forces in case of war.

*Question of Supply System: Examples of Rolling Stock.*—For short-distance lines, the direct-current system of operation is economically feasible, and, on account of its well-known convenience, is usually adopted. Where, however, large amounts of energy have to be transmitted over long distances, high-tension A.C. distribution becomes imperative, and the choice of system is practically confined to single or three-phase current. Single-phase working requires only a

single overhead line, and a single bow at each collector point, as against three lines and triple bows in a three-phase system. Three-phase locomotives have the advantage (where it may be regarded as such) of full draw-bar pull at all speeds. Three-phase motors are essentially constant-speed machines, and hence allow of very high schedule speeds, the huge power required to maintain speed at times being readily provided by the reserve capacity of the generating plant. On the other hand, such high speed is not always desirable on heavy routes, and with steady improvements in the single-phase traction motor (resembling in its general characteristics the series D.C. motor), this type is being generally preferred on the Continent. Single-phase current at 15,000 volts and 15 cycles per second is practically standard on Swiss railways; in Germany, Austria, Hungary, and Norway, 10,000 volts 15 cycles single-phase supply is common; and the French Chemin de fer du Midi is adopting 12,000 volts 15 cycles single-phase current for its electrified section.

On the Dessau-Bitterfeld lines, various experimental electric locomotives have been tested: those by the A.E.G. have variously been equipped with motors of 1,000, 950, and 800 H.P., and the Siemens locos are of 1,800, 1,250, 1,100, and 800 H.P. The standard now adopted is 1,800 H.P. per loco with single-phase motors running at 307 R.P.M., giving a maximum train speed of 74 miles per hour. The Maschinenfabrik Oerlikon are reported to have completed an exceptionally powerful single-phase locomotive, yielding 2,000 effective H.P. on 15,000 volts 13-17 cycles supply.

A powerful type of three-phase locomotive, which has been adopted by the Italian Giovi line for goods service, has five wheels coupled, and is driven by two 3,000-volt, 15-cycle, three-phase motors at 45 or 22½ km. per hour, according as the motors are in parallel or cascade. Maximum gradients of 3½ per cent. and curves of 400 m. radius are encountered on this line, and when handling 540-ton goods trains, one locomotive hauls and one pushes, while for 680-ton trains, one hauls and two push.

The Piedmont and North Railway (U.S.A.), an inter-urban line, 125 miles in length, employs 55-ton D.C. locos, driven by four 1,500-volt interpole motors geared to the axles, for hauling 800-ton freight trains. A very heavy type of motor coach used on the Dermuls-Mendelpen line (Tyrol) weighs 28 tons empty, carries 40 passengers, and is driven at a maximum speed of 16 M.P.H. by four 70-H.P. direct-current motors. The gradients traversed are very severe, hence each coach is equipped with vacuum, magnetic, short-circuit and hand brakes. The latter alone yield 23,800 kg. pressure at the wheel rim with a force of 50 kg. applied at the hand wheel.

For goods sidings and yards, battery locomotives present the advantages of high weight per axle (and hence high draw-bar pull without slipping), and avoidance of elaborate overhead equipment for current supply (which equipment, besides being very costly to install in such a case, is, in parts, little used).

The use of petrol-electric motor vehicles enables the advantages of electric traction to be realised on short-distance and branch lines where the capital cost of a regular overhead or track supply equipment would be prohibitive. The Buffalo, Roch. and Pittsburg Railway employs a type of petrol-electric vehicle seating 69 passengers (97 maximum—a wide range, but thus quoted); a 100-gallon gasoline tank needs refilling after 200 miles' run. The general electrical and mechanical driving provisions are, broadly, similar to those on the G.W.R. units (which seat 45 passengers and attain a normal maximum speed of 20 M.P.H.).

The lightness of electric locomotives necessitates a careful concentration of weight on the driving wheels. This naturally requires the placing of the motors over the latter, but it is important that the arrangement adopted does not involve the whole motor vibrating with the axles. Chiefly for this reason, gear coupling of motors to the axles and the use of "built-on" armatures and "frame-mounted" fields have given way to the apparently unnecessary and artificial method of driving through connecting rods. The motor is mounted on the main framing, and power is transmitted from its shaft to the driving wheels through a preliminary gear reduction and countershaft, if necessary, by connecting rods. It is not advisable to get the centre of gravity of the com-



pleted locomotive too low, or the rail wear at curves will be very severe.

The collector bow has, of course, quite replaced the trolley wheel for high power high-speed working, but there is room for improvement in many existing designs by lightening the moving parts. The capital cost of overhead equipment may be greatly reduced by employing lighter supporting structures than are at present common. On the Simplon and Giovi lines, quite light piping supports have proved perfectly satisfactory.

The whole matter of railway electrification constitutes a vast problem, to which no adequate treatment can be given in any single contribution, and it has here been the writer's aim to collect a few of the chief results derived from recent Continental experience. In conclusion, it may be noted that factors, in addition to those remarked above, which have undoubtedly fostered Continental progress in electric railway schemes are:—(1) The vast capital so readily placed at the disposal of electrical concerns by Continental banks and financiers in general; (2) the great practical interest displayed by various Governments, notably those of Switzerland and Germany, in the possibilities and realisation of electrification proposals.

### AN ELECTRICALLY-OPERATED BRIQUETTING PLANT.

As the world's supply of metalliferous ores is getting more restricted, mining engineers and metallurgists are turning their attention more and more closely to the problems involved in the utilisation of the cheaper grades of ore which, in former times, were regarded as unsuitable for profitable working, and some very interesting processes have been introduced within recent years for the purpose of rendering these ores into a form suitable for use in the blast furnace. One of the chief difficulties which has hitherto been experienced in the utilisation of some ores is their state of fine mechanical division, and in order to overcome this difficulty numerous schemes have been suggested depending, in some form or other, upon the compression of these fine ores into briquettes or blocks of sufficient hardness to withstand, even in a heated condition, the mechanical pressure to be found in the blast furnace, and at the same time of

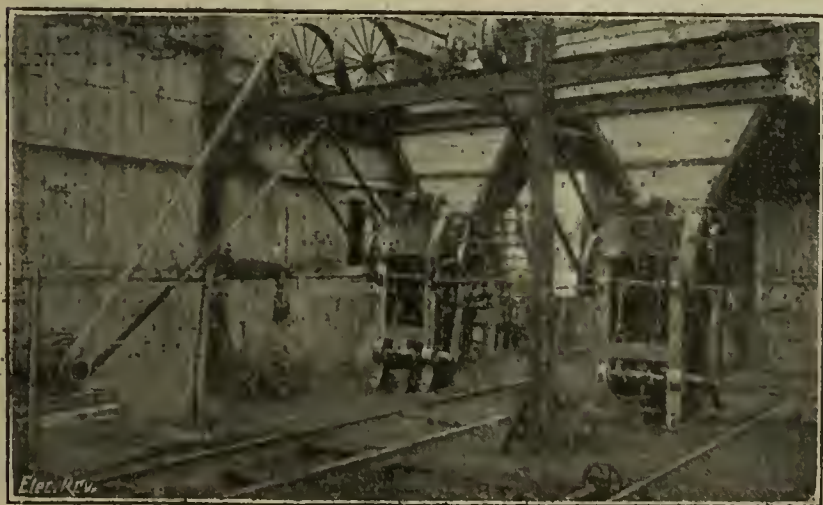


FIG. 1.—ELECTRICALLY-OPERATED BRIQUETTING PLANT.

sufficient porosity to enable the heat action to come quickly and intimately into contact with the particles of ore contained in each briquette. There are, of course, numerous methods by which such ores can be agglomerated, some of which depend on the addition to the mass of a binder of organic or inorganic material. Although this has been adopted in some cases it is open to the objection that the weight content of the briquette in terms of actual ore is considerably reduced by the binder used, and in some cases doubt has been thrown upon the actual value of some of the binders used when exposed to the action in the blast furnace. The process which appears to have met with better results is the agglutination or sintering of the ore itself, by previous heat treatment, no additional binder being used.

When ores are treated in this way the first stage is their delivery in a suitably moist form to the briquetting press, where the mass is pressed heavily into moulds, giving them a firm and homogeneous structure. When this has been accomplished the briquettes are loaded on to trucks and then treated in some form of furnace, which may range from the ordinary brick kiln, which by the way is sometimes rather wasteful of fuel required for heating the bricks, to furnaces of the Hoffmann, Grondal Kjellin, or other special types. When the blocks leave such furnaces, the material, which was previously soft and friable in nature, is found to be sintered together and of sufficient hardness to withstand transport and firing in the blast furnace together with fuel.



FIG. 2.—MACHINE FOR BRIQUETTING ORE.

The bricks are also sufficiently porous to allow free play of the heated gases upon the ore.

One of the pioneering firms in the development of ore briquetting both in this country, on the Continent and in America is the Grondal Kjellin Co., who have both in the briquetting press and in the furnace developed special features which are worthy of interest. The presses are made of a very simple but solid nature, depending in their action on the raising of a ram or tup, which subsequently falls by gravity upon the material to be compressed; this action proceeds with great rapidity, the feed of the ore being automatic, as also the ejection of the bricks. The kiln consists of a long tunnel of rectangular form with a furnace about its middle point, which furnace may be either coal fired, or, as in some cases, heated by means of producer gas. Through the rectangular flue a series of steel wagons passes slowly upon which are placed the bricks which have to be sintered. The wagons are butted together closely, and their sides fit into sand troughs, thus preventing any escape of heated gases, the bulk of which therefore passes over and through the bricks on the wagons. These bricks enter at the end from which the spent gases escape, and therefore on their way towards the furnace they are subjected to a steadily increasing temperature, which first of all drives off all moisture and then produces a sintering action. When they have passed the furnace they meet the incoming air which cools them, so that they are delivered from the kiln in a comparatively cold condition. The heat of the bricks is thus transferred to the air, which arrives at the point of combustion in a preheated condition. The whole process is therefore most economical.

It will be seen that at any rate as far as the briquetting portion of this process is concerned, a fine field is opened up for electric power, which is likely to become extended in the future as the supply of raw ore of good class becomes diminished. An interesting plant of this nature has recently been erected at the works of the Bede Metal and Chemical Co., Ltd., of Hebburn-on-Tyne, which produces about 140 tons of ore briquettes in each day of 24 hours, the process being a continuous one. This plant is illustrated in our views, fig. 1 showing the general appearance of part of the briquetting plant, while fig. 2 shows one of the briquetting machines at close quarters. This plant is interesting to electrical engineers from the fact that the electric drive is used in order to operate the briquetting



presses, and it has been found in operation that the whole system is most economical in working, and gives very fine results as to the briquettes produced, as they are hard enough to stand handling in transport or delivery and working in even the large blast furnaces which are now taking the place of the smaller plants which were formerly found to be of sufficient capacity to deal with the iron production requirements in this country. In view, therefore, of the increasing scarcity of ore which can be directly treated in blast furnaces and the increasing size of the furnaces themselves, it will be found worth while for electrical engineers to pay attention to the opportunity which is being afforded by the development of briquetting plant of this description.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### The "Omega" Testing Set.

This testing set has been placed upon the market by MESSRS. CECIL HODGES & CO., LTD., of Balfour House, Finsbury Pavement, E.C., who claim that it fills the requirements of electrical engineers for a high-class, reliable, self-contained ohmmeter and generator at a reasonable price. The instrument is enclosed in a polished teak case

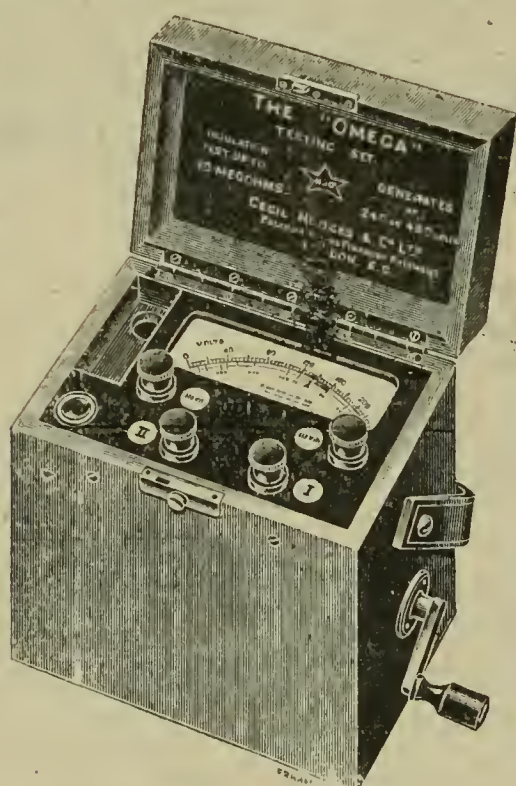


FIG. 1.—"OMEGA" TESTING SET.

on rubber feet, having a leather strap handle. The generator, as can be seen from the illustration, is fitted in the same case with the deflecting galvanometer, and the instrument is so arranged that with it the following tests can be made:—

1. Insulation resistance on a live circuit.
2. Insulation resistance on a dead circuit.
3. Measurement of the voltage of a live circuit.

The method of connecting-up the terminals of the instrument for these different purposes is very simple and easily understood. The apparatus weighs under 12 lb.

### Universal Conduit Boxes.

A recent addition to the Simplex steel conduit system is a universal conduit box, designed with the object of providing one fitting for all the varied purposes which are met with in the

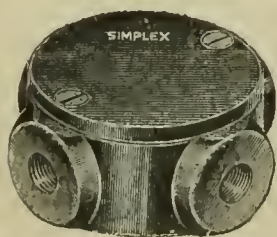


FIG. 2.—UNIVERSAL BOX WITH DISK FOR ACCESSORY.

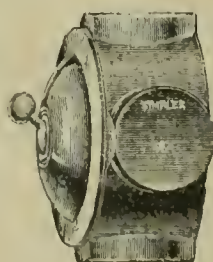


FIG. 3.—BOX WITH SUNK SWITCH.

average conduit installation. This box may be used as an ordinary junction box, a ceiling rose box, switch, pendant, or plug box, as desired. It is intended to meet the wants of the contractor, who can obtain these boxes ready drilled and tapped, but with the out-

lets stopped by means of small screwed plugs, which can be removed as desired, according to the number of ways wanted.

These boxes are supplied by SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham.

### The "Gem" Electric Twin Sweeper.

This machine, which is being placed on the market by MESSRS. DUNCAN WATSON & CO., of 62, Berners Street, W., embodies the good points of other suction cleaners combined with new ideas and improvements. One of the principal features of the twin sweeper lies in its having two slots or cleaning nozzles; in this way double the amount of actual cleaning is accomplished with one stroke of the sweeper. Each slot is 7 in. long, giving a total of 14 in. cleaning surface, whereas the majority of machines cover about 4½ in. to 6 in. The base of the

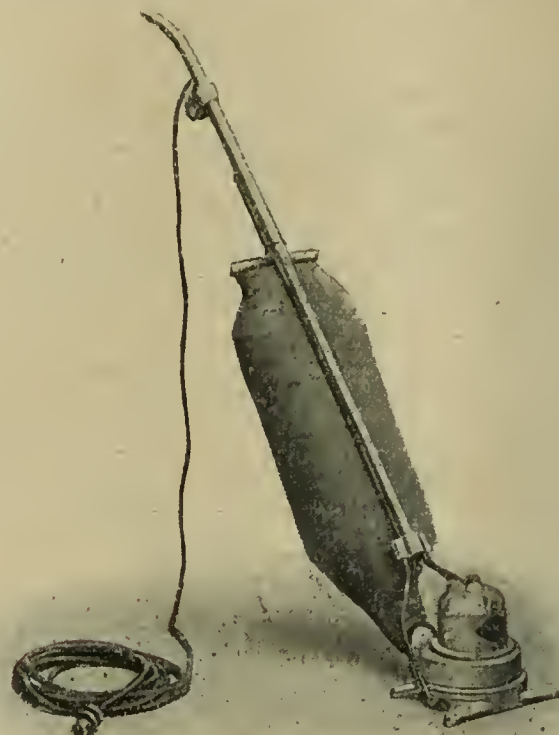


FIG. 4.—THE "GEM" TWIN SWEEPER.

twin sweeper is arched, and between the two slots there is always a free passage for air on both sides, which means that the full volume of air is utilised at all times. The accompanying illustration shows the cleaner ready for use.

The handle is hinged, and can be operated from a vertical or horizontal position, and, owing to the manner in which it is connected to the machine, the cleaner is always in contact with the carpet and in just the proper position for cleaning. When not in use the machine stands upon its face or flat surface, the handle being kept in a vertical position by an automatic-catch arrangement, so that the machine occupies but little space, and can be conveniently placed in a corner, where it is out of the way and handy for use.

The motor and fan casings are of aluminium, and the handle nickel-plated, so that none of the parts can become rusty, and the machine presents a very attractive appearance. The machine takes about 100 watts.

### Vickers Adjustable Reamer.

MESSRS. VICKERS, LTD., of Vickers House, Broadway, S.W., have for some time past been manufacturing an adjustable reamer which has enjoyed a considerable amount of popularity. This reamer gave excellent results in practice, but it could only be considered as a high-class finishing tool. Having devoted considerable attention to the production of a reamer that could be used for a roughing as well as a finishing cut, Messrs. Vickers, Ltd., are now supplying a tool which fulfils these conditions. It is illustrated in figs. 5 and 6 herewith.



FIG. 5.—VICKERS PATENT ADJUSTABLE REAMER.

The construction of the tool is simple; it consists of the shell, cone-bolt, retaining ring, lock-nut and blades. The shell is of steel, slotted and recessed to receive the cone-bolt C C and blades B B; the top of the shell is recessed to receive the key of the Morse taper or cylindrical arbor A. The cone on which the blades rest is interrupted and



threaded to take the collar, so that the internal edge of the blade rests on two truncated cones.

The lower end of the cone-bolt is graduated, and each division corresponds to a fractional part of an inch, or metric variation, in the diameter of the reamer. The other end of the bolt is threaded to take the lock-nut L.

The collar R screws on to the parallel and threaded part of the cone-bolt, and has a blind key-way which engages with a small pin let into the shell. The collar is thus fixed with regard to the shell, and any rotary movement of the cone-bolt results in its displacement in an axial direction.

The blades are strips of carbon or high-speed steel, and are wedge-shaped, so that the cutting edges are parallel when the blades are resting on the cone-bolt; they are also recessed so as to ride freely over the collar.

The adjustment of the tool is extremely simple. The operator, having dismounted the reamer from the arbor, inserts a box spanner

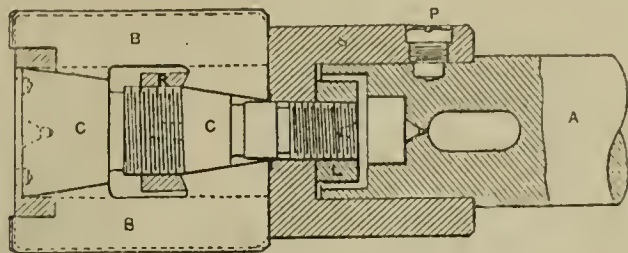


FIG. 6.—SECTION OF REAMER.

and slacks out the locking-nut slightly; he then places an adjusting key in the pin-holes of the cone-bolt and turns it slowly in a clockwise direction.

Each small division on the face of the cone-bolt corresponds to  $\frac{1}{1000}$  in. variation in diameter, and each larger division to  $\frac{1}{100}$  in., so that 10 large divisions must pass the zero mark to increase the diameter by  $\frac{1}{100}$  in. With metric sizes each division is equal to  $\frac{1}{100}$  mm. This done, the adjusting key is removed and the lock-nut screwed home, when the tool is ready for business. The removal of the box spanner and adjusting key prevents the reamer being tampered with. The displacement of the cone-bolt is comparatively small, and permits of a blind hole being reamed out, independently of the diameter to which the tool is set.

The new reamer is capable of taking a heavy cut with complete success. The blades are interchangeable, and the cost of a new set is very small when compared with the price of a solid reamer of equal diameter. Should the blades require regrinding, no special jig is required, as the reamer can be placed in the grinding machine and the blades touched up in the usual manner.

#### Drum Type Star-Delta Starters.

MR. GEORGE ELLISON, of Victoria Works, 17 and 18, Warstone Lane, Birmingham, has put on the market a totally enclosed starter of the drum type on the star-delta principle, for starting squirrel-



FIG. 7.—STAR-DELTA STARTER, AS MOUNTED ON WALL.

cage three-phase motors; it is made for 20 H.P., at 200 to 550 volts, or 10 H.P., at 110 volts, and is shown with and without the cover in the accompanying illustrations. The starter cannot be left in the starting position, and as it completely isolates the motor in the

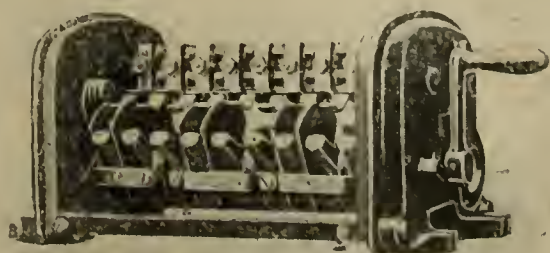


FIG. 8.—STARTER WITH COVER REMOVED, SHOWING DRUM AND ADJUSTABLE CONTACT FINGERS.

off position, a main switch is unnecessary. An interlocking mechanism can be added if required, to ensure operation in correct sequence. The contacts are adjustable for wear, and are easily renewable; they are designed to carry 50 amperes continuously.

#### Steel Reflectors.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have recently introduced a line of steel reflectors manufactured on the Holophane-Benjamin patents. We illustrate in fig. 9

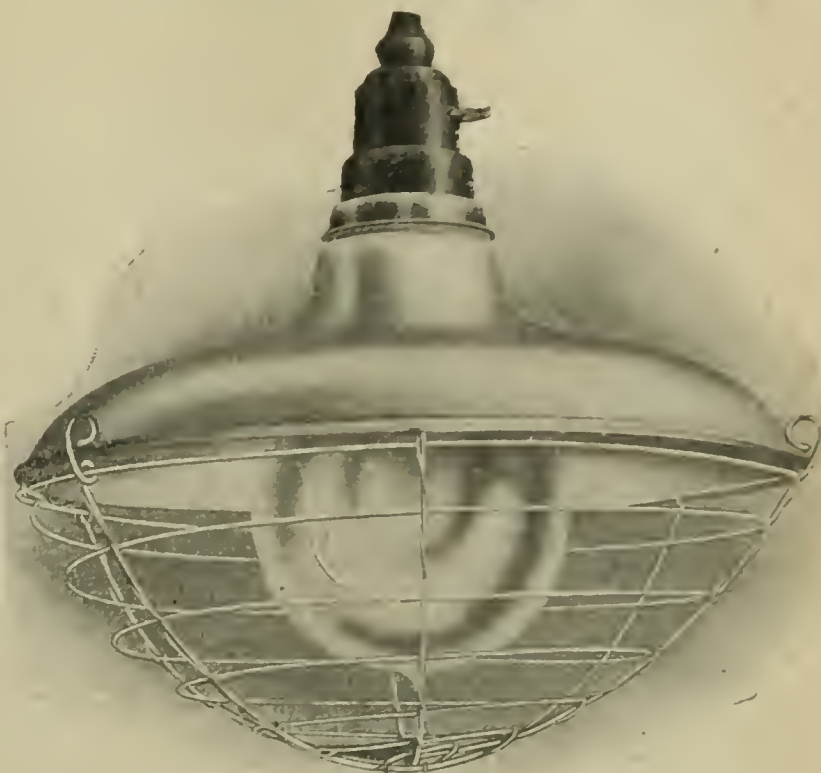


FIG. 9.—ENAMELLED STEEL REFLECTOR FOR FACTORY LIGHTING.

a vitreous enamelled steel reflector of this type for factory and shop lighting, or for outside lighting in conjunction with a water-tight holder. The reflector is designed with a  $1\frac{1}{2}$ -in. hole to take a

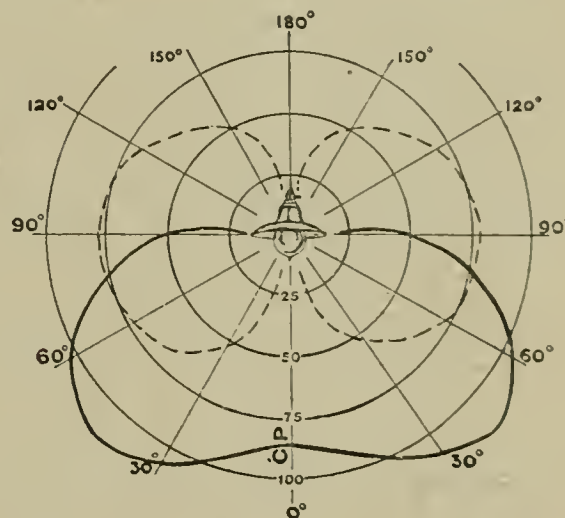


FIG. 10.—C.P. CURVE FOR 100-C.P. LAMP AND REFLECTOR.

standard cord grip holder, is 12 in. diameter, and suitable for use with lamps up to the 100-C.P. round bulb size. The candle-power curves in fig. 10 show the class of illumination to be expected.

#### "Cracore" Solid Bitumen Cables.

A new type of bitumen cable has been brought out and patented by MESSRS. W. T. GLOVER & CO., LTD., of Trafford Park, Manchester. Until quite recently it was impossible to manufacture twin-core bitumen insulated cables of the solid type (that is, having no fibrous materials on or between individual cores), owing to the fact that the mechanical pressure between the cores of twin cables was such as to necessitate the use of these fibrous coverings as a means of reinforcing the mechanical structure generally.

In the "Cracore" cables the makers overcome this difficulty by laying each bitumen-insulated core in a cradle of vulcanised bitumen, which is shaped to a suitable section to receive it. The mechanical pressure between the cores, instead of being concentrated along the line of contact, is thus well distributed over the surface of this central cradle-shaped web. It is thereby made possible to dispense with the support formerly provided by the tapes and braids on individual cores, and by applying their ribbed sheath of bitumen overall, Messrs. Glover secure all the advantages of their well-known patent solid three-core bitumen cables.

This "Cracore" construction can be applied to multicore cables as well as to twin cables, and it is particularly advantageous to do so for multicore cables which have conductors, say, of less than 7/16 S.W.G.

**Algerian Tramways.**—The T.C. of Bône is contemplating the establishment of electric tramways and the erection of a generating station at an estimated cost of £30,000.



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co.,  
Electrical Patent Agents, 285, High Holborn, London, W.C., and at  
Liverpool and Bradford, to whom all inquiries should be addressed.

- 4,090. "Electrically heated cooking utensils." W. F. PERRY. February 19th.
- 4,091. "Apparatus to be fitted to an engine room telegraph which will cause a bell to ring should the engines be set going in a direction contrary to the order on the telegraph." A. H. BAKER. February 19th.
- 4,106. "Enumeration of telephone calls." S. D. WILLIAMS. February 19th.
- 4,119. "Mechanism for the automatic control of reversible electric currents." G. INRIG and L. INRIG. February 19th.
- 4,125. "Process or method of nickel plating." W. FUERHAKE. February 19th. (Complete.)
- 4,127. "Rotatory pot-shaped troughs for electrolytical baths." M. HUTTIG. February 19th. (Complete.)
- 4,140. "Process for the complete utilisation of ring-spinning machines driven by electro-motors capable of control." J. KEMMERICH. (Convention date, February 18th, 1911, Germany.) February 19th. (Complete.)
- 4,165. "Circuit arrangements for polyphase series motors." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, February 18th, 1911, Germany.) February 19th. (Complete.)
- 4,167. "Method of ignition in internal combustion engines." GASMOTOREN-FABRIK DEUTZ. (Convention date, March 27th, 1911, Germany.) February 19th. (Complete.)
- 4,179. "Telephone systems and apparatus therefor." E. A. MELLINGER. February 19th.
- 4,185. "Electro-mechanical device for recording and reproducing sounds and optical impressions." M. E. THOMAS. February 19th. (Complete.)
- 4,186. "Dynamo-electric machines of the homopolar type." BRITISH THOMSON-HOUSTON Co., LTD. (J. E. Noeggerath, United States.) February 19th.
- 4,187. "Dynamo-electric machines of the homopolar type." BRITISH THOMSON-HOUSTON Co., LTD. (J. E. Noeggerath, United States.) February 19th.
- 4,233. "Electro-magnetic device for warning against theft and burglary." H. L. C. NEUILLY. (Convention date, September 11th, 1911, France.) February 20th. (Complete.)
- 4,250. "Incandescent electric lamps." S. C. C. MITCHELL. February 20th.
- 4,251. "Electrodes or anodes employed in the prevention of corrosion in steam boilers and other liquid-containing structures." P. E. G. CUMBERLAND. (Divided application on 19,637/1911, September 4th.) February 20th. (Complete.)
- 4,264. "Trolley sockets for electric traction systems." E. M. MUNRO and R. E. T. CONSTRUCTION Co., LTD. February 20th.
- 4,275. "Electrically-operated safety suspending or retaining apparatus for winding, hauling, and analogous plant." CROMPTON & Co., LTD., and W. J. PICKEN. February 20th.
- 4,276. "Signalling systems for party line telephones and the like." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States.) February 20th.
- 4,283. "Means for accelerating or retarding the variations of electric fields." ALLMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET. (Convention date, February 24th, 1911, Sweden.) February 20th. (Complete.)
- 4,303. "Electric couplings." H. APPENZELLER. (Convention date, February 20th, 1911, Germany.) February 20th. (Complete.)
- 4,358. "Electric telephones." L. G. HAMMER. February 21st.
- 4,365. "Electric arc lamps." A. G. WAY and C. F. G. THORKELIN. February 21st. (Complete.)
- 4,382. "Brush or the like for the medicinal application of electricity." H. WEISS. February 21st. (Complete.)
- 4,383. "Protecting continuous-current electric systems, and means for use therein." ELECTRIC CONSTRUCTION Co., LTD., and J. McMILLAN. February 21st.
- 4,399. "Electric heating devices." G. COOPER. February 21st.
- 4,407. "Telegraphy and telephony by submarine cables, long-distance overhead lines, and the like." J. SCHIESSLER. (Addition to 4,061/1912. Convention date, April 3rd, 1911, Austria.) February 21st. (Complete.)
- 4,458. "Electro-magnetic reversing gear." B. BRUKWICKI. February 22nd. (Complete.)
- 4,460. "Alternating-current dynamo electric generators." AKT.-GES. BROWN, BOVERI ET CIE. (Convention date, February 22nd, 1911, Germany.) February 22nd. (Complete.)
- 4,498. "Construction of two-way electric switch." G. MARKT. February 22nd.
- 4,525. "Motor vehicles with electric transmission." CROMPTON & Co., LTD., J. C. MACFARLANE and H. BURGE. February 22nd.
- 4,529. "Dynamo electric generators." BRITISH THOMSON-HOUSTON Co., LTD., and E. GARTON. February 22nd.
- 4,552. "Distribution and measurement of electricity." E. BOOTH and N. R. BOOTH. February 23rd.
- 4,577. "Electric switches." M. J. RAILING and J. STRACHAN. February 23rd.
- 4,585. "Transmitter for printing telegraph systems." P. ETIENNE. (Convention date, February 24th, 1911, Germany.) February 23rd. (Complete.)
- 4,586. "Electric lighting and the like." E. B. WATSON. February 23rd.
- 4,588. "Electric vapour apparatus with several liquid electrodes." ELEKTROTECHNISCHE INDUSTRIE M.B.H. (Convention date, November 10th, 1911, Germany.) February 23rd. (Complete.)
- 4,592. "Brush-holders for dynamos, electric generators or electric motors." MORGAN CRUCIBLE Co., LTD. and J. E. GRANT. February 23rd.
- 4,595. "Electric cut-outs for overhead conductors." F. PETRAS. February 23rd.
- 4,598. "Spring coupling for shafts." R. BOSCH (firm of). (Convention date, March 22nd, 1911, France.) February 23rd. (Complete.)
- 4,655. "Telephones." E. R. TIMMIS. February 24th.
- 4,670. "Stuffing boxes employed for packing and sealing the ends of electric cables in joint boxes and the like." J. STRATTON and E. A. CLAREMONT. February 24th. (Complete.)
- 4,671. "Method of and means for joining electric wires and cables." J. STRATTON and E. A. CLAREMONT. February 24th. (Complete.)
- 4,682. "Switchboards used in connection with electrical installations on motor-cars and like vehicles." C. A. VANDERVELL and A. H. MIDDLEY. February 24th.
- 4,688. "Brush-shifting mechanism for dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD., and A. P. YOUNG. (Divided application on 13,650, 1911, June 7th.) February 24th.
- 4,691. "Speed-regulating devices, more especially for use in connection with electrically controlled continuous spinning frames." SOC. JACQUET FRERES. (Convention date, February 24th, 1911, France.) February 24th. (Complete.)
- 4,698. "Telephone exchange circuit." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) (Addition to 11,251, 1910.) February 24th. (Complete.)
- 4,699. "Interrupter for electric ignition of internal-combustion engines." A. G. BLOXAM. (Firm Robert Bosch, Germany.) February 24th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

- AUTOMATIC TIME-SWITCH. H. F. J. Thompson and J. H. Bowden. 2,283. January 30th.
- SEPARATORS AND SHEATHS FOR ELECTRODES OF SECONDARY BATTERIES. J. De Karavodine. 2,493. January 31st.
- DEVICE FOR ELECTRICALLY IGNITING MINERS' SAFETY-LAMPS. J. Prestwich. 2,552. February 1st.
- WIRELESS SIGNALING. R. Fessenden. 2,617. February 1st. (February 2nd, 1910.)
- ELECTRICAL SYSTEMS AND APPARATUS FOR RAILWAY SIGNALING. J. P. O'Donnell and British Pneumatic Railway Signal Co. 2,887. February 4th.
- SWITCH SYSTEMS FOR ELECTRIC LIGHTING. J. A. W. Ward and F. A. Walmisley. 2,911. February 4th.
- ELECTRIC HEATERS. M. M. Kohn. 2,968. February 6th.
- FUSIBLE ELECTRIC CUT-OUTS. British Thomson-Houston Co. and E. B. Wedmore. 3,764. February 4th.
- ELECTRICAL FUSE BOXES. G. Austin. 3,779. February 15th.
- ELECTRICAL HEATING AND COOKING DEVICES. N. Prentice. 3,883. February 15th.
- ELECTRIC CONDUCTORS. H. Evans and St. Helens Cable & Rubber Co. 3,996. February 16th.
- ELECTRIC SWITCH FOR CONTROLLING A COMBINATION OF ELECTRIC CIRCUITS. Peto & Radford, Ltd., and H. M. Genese. 4,521. February 22nd.
- PROCESS AND APPARATUS FOR TRANSMISSION TO A DISTANCE, BY ELECTRICITY, OF PICTURES, WRITING AND THE LIKE. R. de Bernochi. 8,017. March 28th. (April 1st, 1910.)
- ELECTRICAL SWITCHES OR DISTRIBUTING DEVICES. V. R. Rawlings. 10,318. March 28th.
- ELECTRIC HEATING DEVICES. British Thomson-Houston Co. (General Electric Co.) 10,549. May 1st.
- ELECTRODES FOR SECONDARY GALVANIC CELLS. H. P. R. L. Porsche and J. A. E. Achenbach. 10,859. May 4th. (January 27th, 1911.)
- VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.) 11,140. May 8th.
- ELECTRICALLY-CONTROLLED VALVES. A. N. Nicholson and A. W. Brooking. 12,118. May 19th.
- SUPPORTING DEVICES FOR ELECTRIC ILLUMINATING BODIES. J. Friedreich. 13,026. May 30th. (May 30th, 1910.)
- APPARATUS FOR THE CONTROL OF GAS VALVES AND ELECTRIC SWITCHES. A. J. Boulton. (Kanagy & De Smet.) 14,427. June 24th.
- REGISTERING CIRCUITS FOR AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 15,129. June 28th. (June 28th, 1911.)
- WIRING OF ELECTRIC INSTALLATIONS. H. W. Handcock. 18,131. August 10th.
- ELECTRIC OSCILLATION CIRCUITS AND THEIR CONNECTIONS. W. P. Thompson. (Ges. für Drahtlose Telegraphie.) 18,231. August 11th.
- ELECTRODES FOR ELECTRICAL FURNACES. Planawerke Akt.-Ges. für Kohlenfabrikation Ratibor. 18,733. August 19th. (October 6th, 1910.)

## 1912.

- STARTING MEANS FOR VAPOUR ELECTRIC DEVICES. F. Conrad. 37. January 1st. (January 7th, 1911.)
- ADJUSTABLE INDUCTANCE COILS. R. A. Fessenden. 546. January 4th. (February 2nd, 1910. Divided application on No. 2,617 of 1911. February 1st.)
- TELEPHONE RECEIVERS. A. Rosenberg. 600. January 8th. (Divided application on No. 2,612 of 1911. February 1st.)

**A Campaign against Labour Union Tyranny.**—In view of the widespread feeling in favour of the repeal or amendment of the Trade Disputes Act, 1906, a measure that has been described as "the charter of labour union terrorism, violence and outrage," the Council of the Liberty and Property Defence League invites the co-operation of all those who desire to safeguard the freedom of labour and the interests of the public against the evils of "peaceful persuasion" in a national demand for the alteration of the law. The many scandalous examples recently witnessed of the manner in which the legalised intimidation exercised by mobs of labour union pickets and their followers results in the destruction of personal rights and the disturbance of public order have convinced all peaceful citizens of the need for not only strictly limiting the powers of the unions as regards picketing, but making the unions responsible, like all other classes of the community, for their actions. It is unlikely that Parliament will move in the direction desired unless an organised public protest is made against the continuance of the existing menacing and lawless state of things. The unions represent a minority of the wage-earning classes of the country; but, owing to the fact that this minority is organised, it is powerful in defence of its claim to enjoy, under the sanction of the law of the land, the right to threaten, bully and attack the unorganised majority. The Council of the League suggests that public petitions in terms similar to the resolutions adopted by the Justices of Liverpool and other places should be placed for signature in all parts of the country, and these should be sent, when complete, to local Members of Parliament for presentation in the House of Commons. The Council also suggests that wherever practicable public meetings should be held in support of an amendment of the law: and that the question should be raised at political meetings, at which either a member or a Parliamentary candidate is present. It is believed that by these means the true feeling of the country may be demonstrated, and Parliament moved to action. The secretary of the League will be glad to send copies of petitions where desired, and to give advice as to the methods of the suggested campaign. Communications should be addressed to the offices of the League, 25, Victoria Street, Westminster.



# THE ELECTRICAL REVIEW.

VOL. LXX.

MARCH 15, 1912.

No. 1,790.

## ELECTRICAL REVIEW.

## COMPULSORY ARBITRATION IN TRADE DISPUTES.

Vol. LXX.]	CONTENTS: March 15, 1912.	[No. 1790.	Page
Compulsory Arbitration in Trade Disputes	...	...	409
The Desire of the Britisher Abroad	...	...	410
The I.E.E. and the Domestic Consumer	...	...	411
Smoke Abatement Conference and Exhibition	...	...	412
Reversible Boosters ( <i>illus.</i> )	...	...	412
Notes from Canada	...	...	414
Correspondence:—			
Drawn-Wire Tungsten Lamps	...	...	414
Transformer Design	...	...	414
Our Legal Query Column	...	...	415
British Manufacturers in Australia	...	...	415
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	...	415
French Telephone Cable, 1912 ( <i>illus.</i> )	...	...	417
Legal	...	...	417
Business Notes	...	...	419
Notes	...	...	426
City Notes	...	...	430
Market Quotations	...	...	436
Stocks and Shares	...	...	436
Share List of Electrical Companies	...	...	437
Electric Power in a Japanese Shipbuilding Yard ( <i>illus.</i> )	...	...	439
Electrical Scheme for Melbourne: An Important Proposal	...	...	440
A Photometric Investigation of Mercury Vapour Lamps ( <i>illus.</i> )	...	...	441
Proceedings of Institutions:—			
High-Voltage Tests and Energy Losses in Insulating Materials ( <i>illus.</i> )	...	...	443
Specifications	...	...	446
New Patents Applied For, 1912	...	...	448
Abstracts of Published Specifications	...	...	448
Contractors' Column	...	Advertisement pages xxii and xxiv	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. BERLIN: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION

# READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

AMONGST the host of persons who are recommending divers methods of settling the dispute in the coal trade is the advocate of "compulsory arbitration."

He does not stop to explain that arbitration which is compulsory is not arbitration at all. In so far as a Compulsory Arbitration Act provides a special tribunal to adjust differences between masters and men it is well enough; thousands of people in commercial circles are choosing arbitration instead of litigation every day. But it is when the element of compulsion appears that a deadlock must be reached. The employer cannot be compelled to keep his mines open, the pitman cannot be made to go to the coal-face. Lacking that "sanction" which goes to the root of the administration of justice in every country, this method of adjusting differences is foredoomed to failure. All this, and much more, can be learnt by contemplation of the results of compulsory arbitration in some of our Colonies.

If the examples which are already on record were only read, marked and learned by the advocates of compulsory arbitration, their zeal would assuredly be abated in a marked degree, for the working of the New South Wales Conciliation Act serves to show that the men have it in their power to "drive a coach and four" through any order of Court which says that they shall work for any particular wage.

In 1903 the miners in the collieries of the Northern district of New South Wales united by their Lodges to form the Colliery Employees Federation as a legal personality under the Arbitration Act, so that the machinery of the Act might be made applicable. The employers formed a similar union. The Arbitration Court was called upon to give an award on disputed points between these two bodies, and it complied with the application, the award setting, *inter alia*, a rate of 1s. 9d. per ton as a hewing rate. The owners and miners were free to contract on the basis of the award. In January, 1903, the miners of the Rhondda Lodge—one of the Lodges of the Employees Federation—being dissatisfied with the above rate, threw down their tools without notices, and went on strike, and rendered idle the mines of the company, Messrs. Smeddon and Laidley, Ltd. These owners, parties to the award, proceeded against the Federation for penalties fixed in the award. The proceedings were conducted in the Arbitration Court, and it was admitted during the argument that the officers of the Federation had tried to dissuade that particular Lodge from acting as it did, and had reprobated the strike: also, that it was customary, in the case of that industry, that 14 days' notice should be given in order to enable a master or a miner legally to terminate the contract of service. The Court held that, as regarded the Federation, no breach of the award had occurred. The fact that the officers of the Federation, immediately on learning



of the resolve of the Rhondda miners to strike, had endeavoured to get them back to work, was held to be conclusive that the Federation was not liable. There remained the miners of the Rhondda Lodge to be considered. The various points settled in, and provided by, the award had been observed. But the award had not made any provision to compel a continuance of the contract under the terms of the award. However, as the miners had struck work without giving the usual 14 days' notice, they would be liable to prosecution as strikers under a provision of the Arbitration Act. The position caused by this decision was not, to say the least, such as was to be expected from a Court whose business it was to bring about a state of permanency in industrial matters. The expense and labour of finding an award was thrown away, as, on the judgment, it was in the power of either of the parties to terminate their contract under it by giving 14 days' notice of their intention. In fine, it appears that if the miners chose to terminate the contract without giving such notice, then the employers could only prosecute them—a proceeding not of the most satisfactory nature; for it might be that in a given case there would not be sufficient gaol accommodation in the country to hold the strikers. The decision will also suggest possibilities in the way of keeping a party under an award clear from penalties, even when certain elements of that party should be guilty of the breaches.

Another case serves to show that the very men who invoke the mediation of the conciliation tribunal are not always prepared to accept its decision as final.

In the early part of 1904 the Newcastle (New South Wales) Coalminers' Federation, consisting of a group of local trade unions, applied to the Court for a readjustment of the hewing rate. The employers, of course, were represented at the hearing of the application, which resulted, to the chagrin of the applicants, in a reduction of the rate. The men at two mines in Teralla, consisting of one union, immediately went on strike, in spite of the advice of their officials. The strikers were theoretically liable to a fine or imprisonment for defying the decision of the Court; but it was impossible to enforce the fine, because both the men and the union were without funds.

The New Zealand Conciliation Act, which has been in force for some years, has also been difficult to apply in practice.

It appears that, in one case, where the Court of Conciliation had decreed payment of a minimum wage by the masters, the firm found that, since the award was made, they had had to dispense with six hands who were unable to earn the minimum wage of £2 8s. a week. Before the award the men received 35s. to 36s. a week, which the employers considered sufficient for the class of work performed. The employers were willing to retain four or five of these hands, provided they obtained a permit to work for a lower wage than that prescribed by the Court. The secretary of the union was applied to, but he refused to grant permits to enable the men to work at the wages named. In another industry it was found that the wages of boys, as fixed by an award, resulted in a loss for the employers. The minimum wage for lads up to 16 years of age was fixed at 10s. a week, with an increase of 5s. per week for each year above that age. The trade being a skilled one, the employers considered that 10s. a week was too much for a beginner, who, during his first

year, was really not worth more than 5s. or 6s. a week. One firm in this industry had in their employ a very small lad, who had been in their employ for nine months, and was earning 6s. a week when the award was made; owing to his age, his wages had to be increased to £1 a week, and as the firm could not continue to pay him the increase, he was, after a few weeks, discharged.

We have seen how ineffectual compulsory arbitration has been in the Colonies; is there anything to lead one to believe that it would be more successful in England? For some years the Board of Trade has had power to intervene in trade disputes with the consent of the parties. Upon many occasions awards have been made. We can recall no instance where an employer has refused to honour such an award, but the men have frequently declined to abide by an adverse award, either by going on strike or in some other manner. Even if the award had all the force and solemnity of a judgment, the same course would be open to those who dissented from it. The truth is, of course, that voluntary arbitration has broken down, and if this is the fate of a voluntary system, anything which savours of compulsion must be foredoomed to failure.

---

## THE DESIRE OF THE BRITISHER ABROAD.

---

SOMETIMES, basing our comments upon actual evidence placed before us, we have felt compelled to refer to the apparent want of loyalty to British manufacturing of some British engineers at Home. How far it accounted for the largeness of the volume of electrical machinery imported into the British Isles during 1911, who can say? The subject is distasteful, and we gladly leave it in order to express satisfaction at the spirit of loyalty that is sometimes evidenced among electrical engineers who have left the Home country and settled in the Colonies or in foreign parts. During the past few years the departures of electrical men to take up appointments in other countries have been numerous. Every week we have recorded movements of this kind, and while naturally we regret the loss of associates, we welcome the exodus, especially when the emigrants are men who have learnt intimately of the excellence of British electrical work, and of the reliability of the British manufacturer. The average Englishman when he goes abroad does not forget his Home, and prominent in his thoughts of England will ever be his knowledge of our ability to meet requirements, the ordering of which it may be in his power to influence homeward. When the hundreds of men who have recently gone abroad read these lines as they smoke their pipes in calmer reflection than, perhaps, was possible here, they will once more remember that "England expects . . . that every man shall do his duty" by the British manufacturer.

We think that of all the letters that we receive from readers abroad (it is by no means *all* complaint and criticism that we as editors receive), those from our contributors and private correspondents who are eager to keep in touch with Home are among the most entertaining. They tell us that we are to them the link between the new and the old associations, and they show us that, however they may be interested and charmed by the people of other countries,



they want to keep strong every tie which knits them to their blood relations. Sometimes they feel, owing to the difficulties of travel and so forth, that their own kith and kin residing apart from them in the same colony are as far away from them as are we, and they obtain first information of these men's movements and undertakings from our own pages. There are parts of the world where, in the natural course of events, years must elapse before this state of things is materially altered, but it is not so everywhere, and if we can do anything to assist Englishmen or Scotsmen, Irishmen or Welshmen, to come closer together in countries where it is more within geographical possibility, we ought to do it. We have received a letter from a correspondent in Canada which inclines us to touch this subject just now. Thither, during the last few years, scores, we believe hundreds, of young electrical engineers have gone from these shores. In Australia an electrical man arriving from this country associates himself with Australians who are British in experience and in requirements. In South Africa the same thing largely obtains. But what of Canada? There we know all too well that the influence of the United States in electrical affairs has so far been powerful, and the Englishman, if he desires to associate himself with men of a like profession, finds himself surrounded with a United States electrical atmosphere rather than with an English one. Is it desirable to bring about a change? And if so—how can it be done? Let our correspondent speak for himself:—

“Have you any idea how the I.E.E. would look upon a proposal to form a Canadian Section and exchange papers, &c.? As far as I am aware, the only electrical societies existing here are branches of the A.I.E.E., and as an Englishman I object to feeling that we are affiliated to America instead of to the ‘old country.’ The proposal made above is not original, so evidently there are others, besides myself, who have somewhat similar feelings. Nothing would please me better than to assist in the formation of such a branch, which would constitute one more link with home, if it be possible to do so.

“American methods and standards are already very largely in use here, and unless a stand be made against their adoption, it will be found, as the country grows and becomes more settled, more and more difficult to introduce British methods and standards.

“I think that the I.E.E. at home might be decidedly the gainer if papers were exchanged with a Canadian Section, as the conditions and methods here are entirely unknown to the average engineer and manufacturer at home, and certainly there are many pieces of apparatus, &c., in England, which, if known, would be useful over here. As the Canadian Section grew in importance and membership it would, no doubt, be possible for an interchange of visits to be made which would be still more beneficial to both parties. Canada is almost daily getting nearer to England owing to better steamship service.”

Is it beyond the ability of the Institution of Electrical Engineers to cater for past, present, and prospective members in the manner suggested? We have just witnessed the inauguration of a Western Section—why not one Farther West? It will be said that the territory is too large to cover with one local section, and that electrical engineers from this country are scattered far and wide there. It may be that at this stage that would prove an insuperable difficulty, but we

do not desire to anticipate the difficulties. What we are anxious to have considered by the Institution, and by the B.E.A.M.A. as well perhaps, is whether some means or other cannot be devised for meeting the need expressed so sincerely by our correspondent and felt by many others who have not written. The question really has an important bearing upon the position of British electrical trading in Canada. American influence has been in the ascendancy far too long in Canadian electrical enterprise and engineering, and it is doubtful whether the necessity has yet been fully realised here for doing something substantial to counteract it. The present time seems to us the psychological moment for action, for there are certain evidences of a Canadian leaning toward this country electrically because of a weariness of American ways.

#### **The I.E.E. and the Domestic Consumer.**

THE recent announcements of the President of the Institution, with reference to the campaign which that body is about to undertake with a view to promoting the extension of domestic electricity supply, are of the greatest interest to all electrical engineers. The two tariff papers by Messrs. Seabrook and Lackie are understood to form part of this scheme, which aims at obtaining a closer understanding of the domestic consumer and his ways, as a preliminary, we suppose, to the discussion of suitable ways and means of ensuring that he shall embrace to the utmost the hygienic and pecuniary advantages incidental to the use of electricity in the home.

We believe that a great many supply authorities still treat “other uses,” on the part of the domestic consumer, superficially. No doubt their excuse is found in the great facility with which apparatus for making “other uses” of gas can be obtained in their localities, and which, more often than not, turns the scale in its favour, even where electric lighting is solely used.

It is no secret that the gas cooker, for instance, has been the salvation of the gas industry, and its universal adoption may be traced almost entirely to the fact that it can be obtained almost as easily as a pound of sugar; the cost of the gas used in it has never been a factor of importance with the user, who indeed pays at lighting rates, and does not scruple to waste gas at that price.

Electricity supply is not on all fours with gas supply, but obviously there are many features connected with the latter which are worthy of most careful study: and perhaps more important than all others is the admirable business and financial organisation which has so successfully filled the great gap between the gas main and the gas consumer. For it must be admitted that at the bottom of the very complex matter which the Institution has decided to probe, there lies the question of finance.

Of the various determining factors, cost of energy is not so important as cost of apparatus, and cost of capital is more important than all. Mr. Highfield referred to this side of the question of electricity supply during the discussion on the earlier tariff paper, when he emphasised the necessity of a sufficient profit margin to ensure the necessary flow of capital into the business. He said it was essential to keep in view the main object of a tariff, which was to extract from the consumer the largest revenue at such a price as would enable a rate of profit to be earned which would attract the investor, or words to that effect; and, further, that unfortunately, owing to so much electrical energy being sold under municipal control, the importance of a sufficient return on the capital was to some extent overlooked—money for municipal enterprises being obtained on the security of the rates, not on the security of the business.



It is almost unnecessary to analyse these remarks closely; one may infer from them that private enterprise, which has full powers to develop electricity supply in any direction, is limited by financial exigencies from doing so, cautious business methods being indispensable to the maintenance of dividends; while municipal electrical enterprise, able to obtain capital cheaply and irrespective of ordinary commercial considerations, and working with the avowed object of providing cheap electricity supply at cut prices and facilitating the means of using it, is, generally speaking, equally impotent to carry out its object to the full.

This is a contradictory state of affairs which calls for discussion, and we commend it to the consideration of those who are about to deal with the problem of extended domestic supply.

Can private enterprise afford to place the electric cooker before the user on the same terms as the gas industry is offering throughout the country, or will it be left for municipal capital to obtain powers, to do this work? Some method of co-operation, involving neither party in questionable methods, appears to be the only probable solution of the matter, which includes questions of manufacturing as well as selling and using.

#### Smoke Abatement Conference and Exhibition.

THE arrangements for this important Exhibition and Conference, which is to be held in the Royal Agricultural Hall, Islington, N., during the fortnight commencing March 23rd, are now well in hand, and elsewhere we print the full programme for the Conference, which is to extend over the three days March 26th, 27th and 28th. The last International Exhibition of this character was held in London in the year 1881, and there ought to be considerable progress to record in the methods and apparatus for securing the smokeless combustion of fuel, that have been worked out and applied practically in the 30 years that have elapsed since that Exhibition.

It is, of course, unfortunate that the Exhibition and Conference should be overshadowed by the great coal mining strike, and one can only hope that this may be settled before the Exhibition opens. To many it may seem in fact somewhat ironical to hold a Smoke Abatement Exhibition during a great coal miners' strike, when the chief problem confronting manufacturers is how to obtain any coal to burn, rather than how to burn it without producing smoke.

But the strike will certainly help to concentrate people's attention on the subject of the more economical use of coal, since it will probably lead to a permanent increase in the cost of fuel; and the cleaner skies and atmosphere resulting from the almost complete suspension of manufacturing operations in the great centres of industrial activity, will prove a useful object lesson in the advantages that may be expected to result in the future from the more scientific and smokeless combustion of solid fuel.

The participation of foreign manufacturers and inventors in the Conference and Exhibition has not been so great as was expected or hoped, many manufacturers stating that a fortnight's exhibition was too short to enable them to recoup themselves for the necessary expenditure of exhibiting. Dr. Louis Ascher, of Königsberg, Mr. T. A. Willard, of Boston, and Herr Ing. Nies, of Hamburg, have promised, however, to read papers at the Conference, and will thus help to preserve the international character of the gathering. Under the presidency of Sir William Richmond, Sir William Ramsay and Lord Justice Moulton, the Conference should be well attended, and the discussions on the papers promised ought to prove both useful and stimulating. A time limit must, however, be strictly enforced both on readers and on their critics, otherwise the results will be disappointing, for Smoke Abatement Societies and Leagues contain many cranks, who are disposed to long-windedness. The suppression of "bores" is an art which every good chairman must excel in, and, most of all, the chairmen of Smoke Abatement Conferences.

## REVERSIBLE BOOSTERS.

By C. TURNBULL.

MR. RANKIN'S excellent paper on "Automatic Reversible Boosters" has brought forth several problems which may bear further elucidation. Take, for instance, the common requirement that a booster should keep the load constant on the generator. Probably many people imagine that one best which will show the straightest line on the chart of the generator recorder. Yet an analysis of the facts will show that this idea is not justified by experience, save in exceptional cases. If the usual load factor in a traction station were about 30 per cent., with an output which did not alter much from hour to hour, we could deal with it admirably by a suitable combination of generator and battery with booster, the latter having about twice the capacity of the former on short-period rating. Unfortunately, one rarely meets with such conditions. The ordinary traction load is something like this. A little current may be required for night-shift work, and somewhere after 4 a.m. power is needed for workmen's cars, which will make a heavy demand for a short period. The load will then be quiet until 8 o'clock, after which the serious work begins. For the remainder of the day current will go out in a number of rushes when people are taken to business and when they return therefrom, with slack periods in between. If readings on the traction watt-hour meters be taken at the half hours, and if a curve be plotted from these readings, it will be found that the output varies nearly as much as in the case of the lighting board load, and that heavy and quiet times are as much marked in the one case as in the other. The heaviest load is usually about 5 o'clock in the afternoon, when workmen's cars come in, laden with the sons of toil, followed shortly after by the business men. Saturday afternoons and holidays provide special problems, sometimes very difficult to meet. In some towns there are heavy peaks at regular intervals when a number of cars start off together, laden with passengers from ferries, the peaks being aggravated when the landing place is at the bottom of a steep hill.

Small systems are greatly troubled with peaks, particularly in hilly districts, as there the number of cars is not sufficient to steady the load. One may add that the difficulty has been greatly increased by the use of meters in cars, as, to save current, drivers get up speed quickly and then coast as much as possible. This heightens the peaks while diminishing the daily output. May one hope that arbitrators will take note of this when settling prices to be paid for traction current.

The actual conditions of traction supply then are totally different from the ideal case mentioned above. Generally speaking, the load factor is less than 30 per cent., while the battery is usually of smaller capacity than the generator, instead of being twice as large, as required to meet ideal conditions. Batteries are usually put in as an afterthought, their function being to take only the peaks which are too heavy for the generator. They are, therefore, much too small to keep a constant load on the generator. One may illustrate the working by a concrete illustration. Suppose that the traction generator is of 200 kw. capacity (small powers being easy to think about), the output being 1,500 units per day, while the peaks go up to 350 kw. Let the battery be of 100 kw. We may run the early and late load by the battery, while the generator may be run from 8 o'clock in the morning until 11 o'clock at night, that is for 15 hours. If it is run at full load all this time it will turn out 3,000 units, a surplus of 1,500 units to overcharge the battery, while the peaks of 350 kw. will be met by overloading the battery 50 per cent. We are thus placed on the horns of a dilemma, for if we reduce the load on the generator to about 100 kw., so that 1,500 units may be out in the day, we shall be unable to meet the peaks, while if we keep the generator up to 200 kw. to meet the peaks, we must waste half the output. This shows clearly that we must not expect to run traction generators at constant load with batteries and boosters, except under unusual conditions. The practical method of working with a battery is something like this. Early morning load up to about 8 a.m. will



be taken by the battery and booster, the latter being compounded to compensate for drop in the battery during heavy rushes of current. The steam set will be run up after eight o'clock, and the booster may be adjusted to keep nearly full load on the generator, when, as the outside load is usually slack during the morning, the battery will soon become fully charged. As soon as the cells gas freely, the booster may be adjusted so that it responds only to peak loads without putting any appreciable charge into the battery. Sometimes, if the outside load be small, sufficient

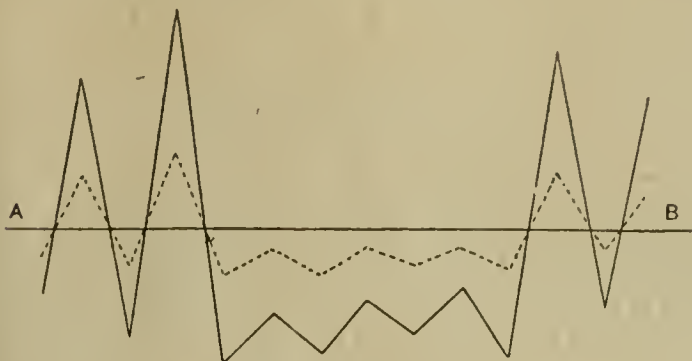


FIG. 1.

current may be run off the battery to bring its pressure slightly below that of the bus-bars, when it may be paralleled with the generator without the booster, which will be satisfactory until the load increases again. In many stations, much of the day traction load is of a perfunctory nature, with occasional spasms, and it is not until late afternoon and evening that there is much life in it. In such places one must run things with minimum loss, and every dodge to save waste must be made use of.

Consideration of the problem shows that most economical running will be obtained where the battery does the smallest amount of work, that is where the battery merely takes such load as the generator cannot easily carry, while ensuring that the pressure is kept reasonably steady. The diagram, fig. 1, will serve to make this clear. In the first case, constant load is kept on the generator as shown by line A B, and it will be noted that not only is there a tendency to put too much current into the battery, but the latter has to take heavy overloads, in which the generator might

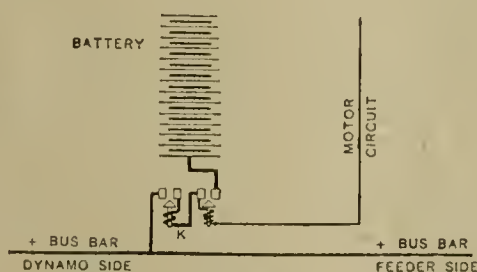


FIG. 2.

easily assist. In the second case, the generator load varies with the outside load, as shown by dotted line, so that the peaks are taken without excessive overload on both battery and generator, while the work done by the battery is a minimum. The latter method is obviously much the more economical. It might be thought from these considerations that the old differential booster would fill all requirements, but a moment's reflection will show that something more is needed. For if the bus-bar pressure be 550 volts, we may put in 270 cells, which give a good working voltage for the battery and do not put too much work on to the booster. The pressure per cell will vary between 2.5 and 1.8 volts, giving us a variation of battery pressure of from 675 to 486 volts. The old differential booster cannot compensate for this automatically, although modern boosters will deal with such variations easily enough. It is less easy, however, to adjust some types of modern booster so that they will cause the generator load to vary with the outside load, so that the work done by the battery may be a minimum.

**Circuit-Breakers.**—A point may be mentioned here in connection with circuit-breakers. It has happened that the

booster-motor breaker has come out leaving the booster breaker in. The booster then becomes practically a series motor without load, and as such may attain to a speed which will cause the armatures to burst. To overcome this the breakers may easily be arranged so that the motor is left on the bus-bars if its breaker comes out, while it is left on the battery if the battery breaker comes out. This has the further advantage that the booster is always left running if one breaker comes out, so that paralleling in is quickly accomplished. The arrangement is shown in the diagram, fig. 2.

**Shunting of Series Turns.**—Some discussion has taken place on the problem of getting shunted series turns to respond instantaneously to sudden changes of current. Obviously, a sudden rush of current will begin by passing wholly through a non-inductive shunt, leaving the inductive turns to waken up some time afterwards. The delay may be sufficiently long to interfere with the proper working of the booster. Inductive shunts may be used, but they only partially solve the problem, and are not altogether satisfactory. A better method is to shunt part only of the series turns on the booster fields, so that the current must always pass through some of them. Suppose, for instance, that there were 20 turns on the fields, and we arrange to shunt, say, 10 or 15 of them, then the current must always go through the five or ten unshunted turns, so that quick response of the booster is assured.

**Saving Resulting from Use of Batteries and Boosters.**—When thinking of putting down batteries and boosters, people often ask what will be the saving from the addition. One can only answer that it depends on circumstances. We may best illustrate this by taking two extreme cases. In our first example, we will consider a station which supplies the traction load in a hilly district with comparatively few cars, so that the current is of an extremely peaky nature. The traction generators are just too small to meet the peak loads singly, and it is necessary to run two sets all the time. The motor load on the lighting mains is also too much for the lighting battery, so that a further generator is run on the lighting board. We have thus three sets running all day long to supply an output which might be supplied by one were the load factor suitable. The station costs are necessarily high, and consequently charges must be maintained at a high level. A battery and booster are, therefore, installed, and along with this a motor-generator to act as a link between the traction and lighting boards. (Alternatively, where there is room, it is better to couple both traction and lighting generators to one engine, as in this case we are able to run one comparatively large engine at a good load).

With the new arrangement the entire load of the station may be handled with one generator instead of three, and naturally there is a great reduction in the costs of running. The station will now be in a position to quote cheap rates for power supply, and the yearly loss may be transferred into a handsome profit.

We may now consider conditions where the result of installing a battery and booster will be very different, although really entirely satisfactory. In this case we will suppose that the traction generator is just too small to take the peaks, although it can grapple with the greater part of the load without much trouble. The running costs are at a minimum as the engine is run with a good load factor, but the results are less pleasing to the cars, which often stop on hills, or even run backwards when the engine slows down and drops the line pressure. The engineer determines to put down a battery and booster rather than run up another set. The natural effect of the addition is that costs go up owing to battery losses, in spite of some saving due to the running early morning loads on the battery only, while capital expenditure is also increased. There should be no grumbles, however, at this, but the engineer should rather compare his costs with what they would have been if he had run up another generator on his load instead of putting down a battery, while he should compare the capital cost of the addition with the value of the steam plant which would be required otherwise.

In conclusion, one may point out that the beneficial use of batteries is not confined to small stations. On the contrary, very large plants, such as those at Manchester elec-



tricity works and at the Newcastle-upon-Tyne tramways power station, have found that large savings may be made by the use of batteries and boosters in conjunction with their steam plant. The saving in Manchester is specially noteworthy, as the plant there is of a size to which many people would have expected that no benefit would have accrued from the use of a battery.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE growth of the Canadian West is well shown by the following figures, which give the percentage increase in the population of the Western Provinces during the past 10 years :—

Alberta ... ..	424.0 %
British Columbia ... ..	103.0 %
Manitoba ... ..	80.0 %
Saskatchewan ... ..	386.0 %
Total increase ... ..	174.0 %

It is impossible for this country to keep pace with her own requirements in manufacturing under present conditions, and there is every indication that this state of things will continue for several years to come.

During 1911 no less than 1,459 miles of railway track have been laid, and within the past two months 260 locomotives have been ordered by the various railway companies; immense quantities of steel rails are also on order for this year. If the railways find it necessary to strain their resources to the utmost, as they are doing, in order to meet the demands made upon them, there is certainly business to be obtained by other people as well.

The Province of Ontario is to have an outlet on Hudson Bay, while that of Manitoba is to have its limits extended up to that northern outlet, and will, therefore, be no longer termed the "postage stamp" province.

The proposed new line of fast steamships to cover the distance between England and Halifax in  $4\frac{1}{2}$  days, will, if it come into existence, make a considerable difference to the trade of the Dominion in the east, while the opening of the Panama Canal will greatly augment that of the ports on the western coast.

Among other developments which are likely to take place as a result of the efforts to make Hudson Bay commercially useful for navigation is the exploitation of the great mineral wealth of Northern Ontario and Quebec and the western shore of the Bay itself, which is said to be one of the richest copper beds in the world.

It is quite impossible to forecast what will be the growth of this country within the next decade; if unscrupulous company promoters are kept in check, so that public confidence is not destroyed, the development in shipping, railway mileage, power utilisation, road building and other great matters are certain to be phenomenal, and will be accompanied by equally large advances in trade of every kind. These are not the views of the writer only, or of a few people, but those of all the foremost men in the land, and it is generally recognised that the chief difficulty will be to keep pace with requirements in every direction.

Reference was made in these notes some little time ago to the large increase which has recently taken place in the number of advertisements in the technical papers here, inserted by British firms. This increase is still going on, and the latest issue of one of the papers referred to makes special mention of the fact that the number of branches here of well-known British firms is also being rapidly increased.

A Bill has just been submitted to the Provincial Government of Saskatchewan asking for an inquiry to be made into the deposits of lignite in the province, which are said to be of great extent; it is probable that the question of the utilisation of this material for the production of power by generating producer gas from it will be considered.

A company has just been formed to develop 10,000 H.P.

at Seven Falls, St. Ferreol, about 25 miles from the city of Quebec; the whole of this energy has been contracted for by various industries, &c., in the district.

A large sawmill is being erected in British Columbia which is to have a generator of 1,600 kW., and over 20 motors of various sizes ranging from 200 H.P. down to  $7\frac{1}{2}$  H.P.

The Willow River, a tributary of the Fraser River in the same province, has been surveyed, and a recent report states that some 50,000 H.P. could be obtained by suitable development.

The Dominion Government is considering the question of a national system of telephones and telegraphs similar to the British one.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Drawn-Wire Tungsten Lamps.

I would appreciate space in your columns to state the facts concerning several important questions in regard to drawn-wire tungsten lamps.

The first relates to the performance of the drawn-wire tungsten lamp on alternating-current. Statements have been made to the effect that a drawn tungsten wire filament suffers from "off-setting" with reduction of life on alternating as against direct current. This question has been definitely settled long ago by extensive tests, which have demonstrated positively that the drawn-wire tungsten filament gives equally satisfactory life on either alternating or direct current.

Mazda lamps with drawn-wire filaments are guaranteed to give equally good life on alternating current as on direct current, and to give results equal in all other respects to any obtained with the previous types of pressed filament, while possessing a marked advantage in respect of durability.

Another point relates to the durability of the drawn-wire tungsten filament during life service. Statements have been made to the effect that the drawn-wire tungsten filament loses in strength after being burned, and is no stronger than the pressed filament after some hours of use. The fact is that the tungsten drawn-wire filament is many times stronger than the old pressed filament, not only at the beginning, but at any time during the life of the lamp.

Another point that needs correction is the statement that the problem of drawing filaments of pure tungsten was solved in Germany. The fact is that the credit for the development of a filament drawn from pure tungsten must be given to the General Electric Co., of America, alone. Furthermore, their associates, the British Thomson-Houston Co., were the first actually to manufacture and supply such filaments in this country. The other development of a so-called drawn tungsten wire is not a filament drawn from pure tungsten, but one drawn from an alloy of tungsten with another metal. From this alloy after drawing, the auxiliary metal is expelled by heat, leaving the tungsten in a similar condition to that which is found in the pressed or squirted filament.

The real drawn-wire tungsten filament, such as the Mazda filament, is drawn from a block of tungsten—pure tungsten from start to finish, and it is this development for which credit must be given to America.

F. W. Willcox.

London, E.C., March 8th, 1912.

### Transformer Design.

As the ELECTRICAL REVIEW does not reach India until some considerable time after its publication, I have only just seen Mr. C. Franklin Tubbs's letter pointing out a serious error in my book on "Alternating Currents." The ratio in question is correctly given by him. I need not enter here into any explanation of how the error had arisen, but must content myself with thanking Mr. Tubbs and expressing my regret that he should have been put to so



much inconvenience. I am asking the publishers to insert in future a *corrigendum* sheet into all copies of the book before issuing them for sale.

Alfred Hay.

Bangalore, India, February 20th, 1912.

### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"A. C. P." writes:—"If a builder gives an order for the electric installation in a new building, and then does not meet the account at the proper time, what redress has the contractor? Can he remove the wiring, or as much of the same as can be removed without causing damage to the building?"

\* \* It may be stated at once that the contractor would have no power to remove the wiring as suggested. As soon as wires and fittings are laid or affixed in a house they become the property of the owner of the building, and to remove them would be to incur the risk of an action for damages for trespass at the hands of the building owner. As to the remedy of the wiring contractor, he may of course sue the builder, but, upon the facts as stated, such an action would probably not be very fruitful. However, such an action would probably result in a judgment, and the judgment debt might be used to garnish moneys due to the builder in the hands of the building owner. The only risk in that case would be that such a garnishee would be the subject of a forfeiture clause, whereby the employer has a right to forfeit in certain events all moneys due.

### BRITISH MANUFACTURERS IN AUSTRALIA.

THE Australian Association of British Manufacturers and their Representatives has a good record to show for the first year of its existence, which ended at December last. We have been favoured with a copy of the first annual report, from which we gather that there are now 169 members, 71 of these being British manufacturers, and 98 representatives of British manufacturers, representing 629 British manufacturers. The subscriptions received amounted to £254, and the disbursements to £177, leaving a balance of £77 in hand.

Several matters have been brought before the Executive Council, and at least one has already had results beneficial to British trade, and it is expected that further benefits will accrue in the near future. We quote the following from the report:—

#### Duty on Electrical Machinery.

During the passage of the recent Tariff Amendment Act through the Federal Parliament, this Association was successful in obtaining a preference of 5 per cent. for dynamo-electric machines of British manufacture over those of foreign manufacture. In the original Bill, as brought forward by the Government, it was proposed to include generators for direct coupling to steam turbines (on which the duty previously was: foreign, 5 per cent.; British, free) under the heading of dynamo-electric machines, where the duty would have been, for either British or foreign, up to 200 H.P. 20 per cent., and over 200 H.P. 12½ per cent. In this form the Bill passed through the House of Representatives, but, on its coming before the Senate, representations were made by this Association and interviews had with Ministers, with the result that the duty chargeable on articles falling under this item is now: up to 200 H.P., foreign 25 per cent., British 20 per cent.; and over 200 H.P., foreign 17½ per cent., British 12½ per cent.; giving a preference of 5 per cent. to British manufacturers which has not hitherto been enjoyed for any dynamo-electric machines other than generators for direct coupling to steam turbines.

#### Catalogue Duty.

A deputation of members was introduced to the Minister for Trade and Customs by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Australia, in order to make representations urging that British manufacturers' illustrated catalogues be admitted into the Commonwealth free of duty. The deputation was sympathetically received by the Minister, and it is confidently anticipated that a recommendation with regard to this matter will be placed before Parliament in the near future.

#### Queensland Income-Tax.

Representations having been made by several members, protesting against certain powers claimed by the Queensland Commissioner of Taxes to levy income-tax on manufacturers' manufacturing profit on goods sold in Queensland through an agent visiting that State, the matter has been energetically taken up by your Executive Council. British manufacturers and chambers of commerce have lately shown some considerable interest in reference to this matter, and it would be of considerable assistance to this Association if British firms would send in copies of any demands for returns for assessment for income-tax addressed to them by the Queensland Commissioner of Taxes, together with copies of any replies, so that the Association might be fully seized of the position,

when the Association will be pleased to advise them in the matter. The information in this office regarding this matter may also be taken as being applicable to Income-Tax Acts of other States.

#### Post Office Contracts.

Objections to the conditions, under Clause 9 (c) in the General Conditions of Contracts for the supply of material to the Postmaster-General's department, penalising tenderers 1 per cent. per week on the whole contract if any portion of the contract should be late delivered, have been made by several members of the Association. Your Executive Council are now pleased to be able to report that H.M. Trade Commissioner in Australia has had several interviews with the Postmaster-General and permanent members of of the staff at the instance of this Association, the result of which is that the Postmaster-General now advises that it is the intention of the department to modify this clause to the extent of calling on the contractor to pay only on that portion of the contract the delivery of which has been delayed. Mr. Frazer, however, further indicated that the percentage the department would claim would be more than 1 per cent., and that the penalty would be enforced against any and every contractor, unless under very exceptional circumstances.

We print the foregoing to show the useful character of the work so far done by the Association. The Executive Council urges all representatives to induce their British manufacturing firms to join the Association. "In order to obtain a sufficiently large subscription list, it is absolutely essential that British manufacturers, as well as their representatives, should become members and pay their subscriptions."

We hope that every British electrical manufacturer who exports goods to Australia will come forward and support this very useful Association in a practical manner.

Mr. Percy Rosling (546-550, Collins Street, Melbourne) is the president, and Mr. R. H. Butler, jun., is hon. sec., *pro tem*.

### NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

#### The "Mego-Meter" Insulation Testing Set.

This instrument is similar in construction to other testing sets already on the market, inasmuch as it consists of a generator capable of generating direct current, which is used in combination with an indicating instrument, on the dial of which the insulation resistance is read directly in megohms in the usual way. It is exceptionally simple in use, very easy running, and has the great advantage of being comparatively very light, weighing only 11 lb. The instrument is made for two maximum testing voltages



FIG. 1.—"MEGO-METER" INSULATION TESTING SET.

namely, 240 volts and 480 volts. With the 480-volt instrument tests can also be made at 240 volts, and similarly with the 240-volt instrument at either 240 or 120 volts, four terminals being provided for this purpose.

The instrument can also be used as a voltmeter for testing the voltage of an installation, or for making tests on a D.C. installation, which is carrying current, by making use of the voltage of the system itself in place of that given by the generator contained in the apparatus.

This device has been put on the market by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C., and we understand that it is being taken up very extensively.

#### New G.E.C. Instruments.

Several new instruments have been included by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., in their list, Section M. just issued. Fig. 2, p. 416, shows their moving-iron type switchboard voltmeter, for D.C. and A.C., which is now made in three sizes, and for a great variety of ranges; this is now fixed



with a central stem instead of three screws. Air dashpots are used to make the movement dead-beat. Fig. 3, on the other hand, shows a portable moving-coil D.C. instrument, which is made for one to



FIG. 2.—G.E.C. "APERIODIC" VOLTMETER, TYPE C.

three ranges in one, and for a great variety of ranges. The "Salford" standard portable D.C. testing set is illustrated in fig. 4; this combines a voltmeter with five ranges and an ammeter, also with five ranges, of the moving-coil type, with four shunts



FIG. 3.—G.E.C. PORTABLE MOVING-COIL AMMETER.

carried in the cover of the case, and covered with a hinged lid. The complete set, capable of reading up to 600 amperes and 600 volts, weighs 16 lb. Mention should also be made of the

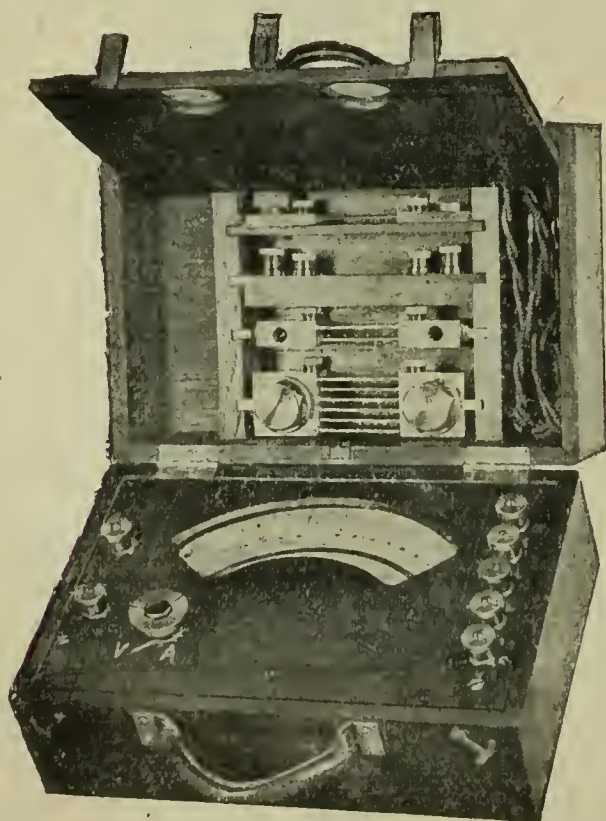


FIG. 4.—"SALFORD" PORTABLE D.C. TESTING SET.

"Sumpner" A.C. wattmeters, Aron meters taking up to 5,000 amperes, &c.

### Multiple-Switch Motor Starters for Large D.C. Motors.

The ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.E., have recently introduced a multiple switch motor starter, in which all the switches are interlocked so that they can only be closed in the proper order.

The first switch is different from the others, being a circuit-breaker and having special renewable carbon arcing tips. It is fitted with no-volt and overload releases, and cannot be closed unless all the other switches are open. The closing of it, however, does not put the current through the motor at all. This is only effected when the next lever, which is of the knife-switch type, is put in, consequently if an overload exists at this moment, the first lever or circuit-breaker will open, and having done so, it cannot be closed unless the knife switch is first opened. The arrangement is thus completely fool-proof.

The starters can be fitted with semi-enclosing or completely enclosing covers for the switch fronts if desired. We illustrate in fig. 5 a starter without cover.

### Cinematograph Resistance.

A new type of stand-by cinematograph resistance has been introduced by MESSRS. AUSTIN WALTERS & SON, of 57, Lower Mosley Street, Manchester, which we illustrate herewith (fig. 6). This shows a bank of five 15-ampere sections so arranged that by means of knife switches a current up to 75 amperes can be obtained.

The first switch gives a starting current of 30 amperes, the second 45, the third 60, and the last 75 amperes, so that when all the switches are in, a 15-ampere current passes through each section.

The switches can either be arranged on the frame, as illustrated, or on separate brackets to fix in the operator's box, and the cables

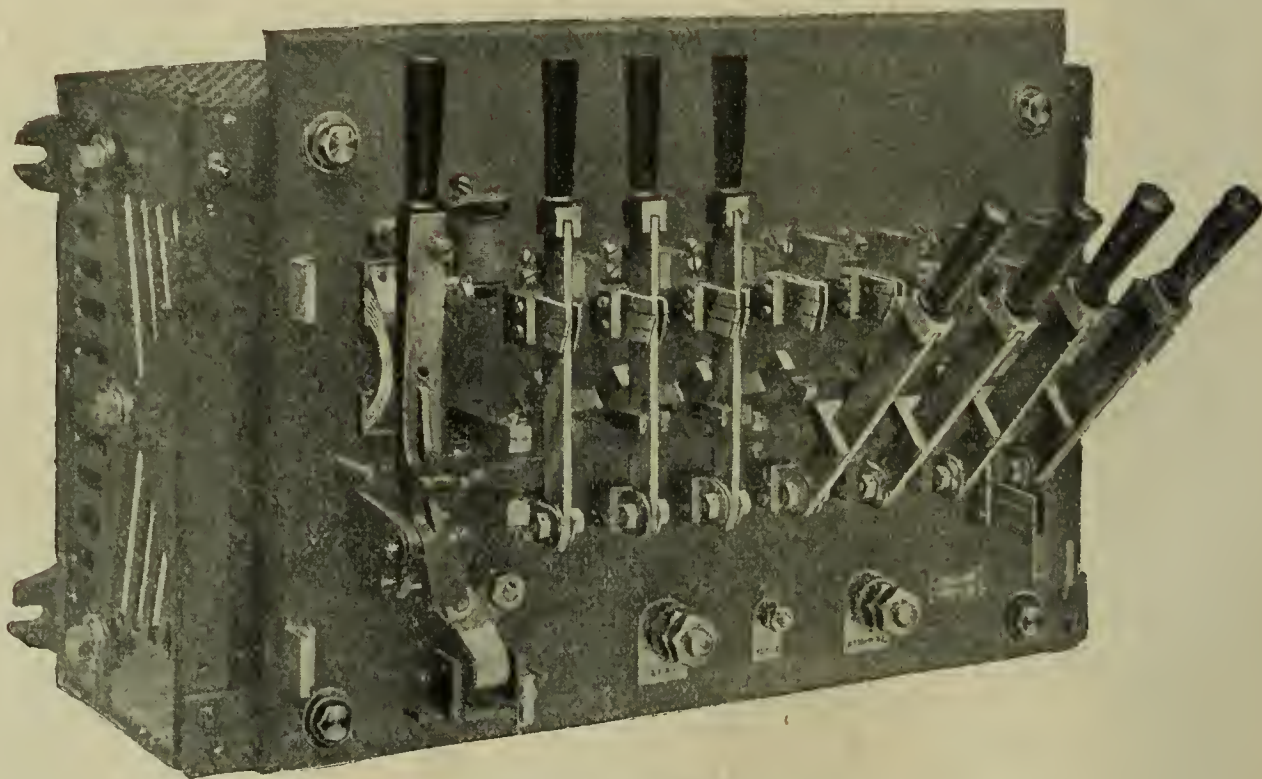


FIG. 5.—E.A.C. MULTIPLE-SWITCH MOTOR STARTER.

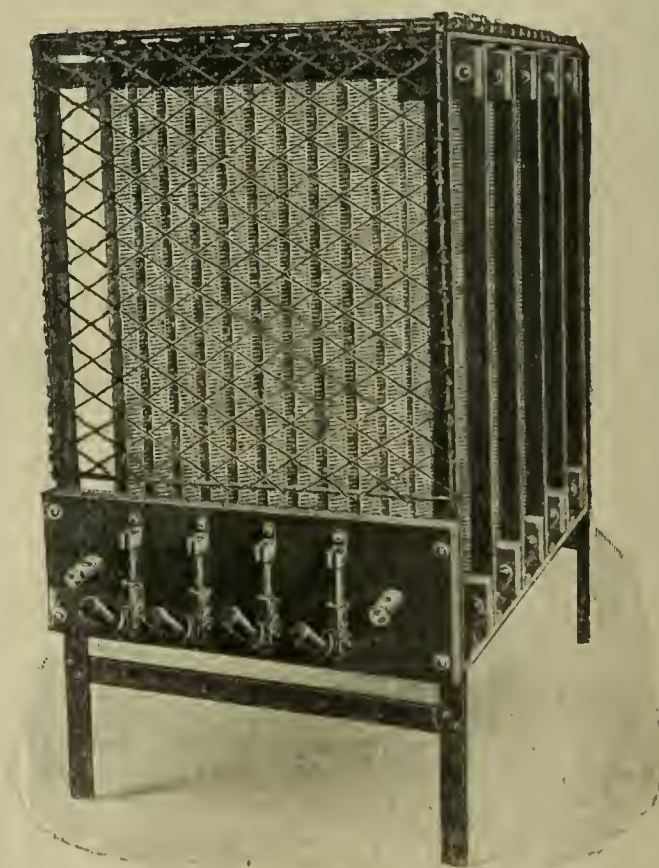


FIG. 6.—WALTERS CINEMATOGRAPH RESISTANCE.

run back to the resistance, which can be put in any convenient place. The slates are all bushed and mica-insulated, and non-corrosive resistance wire is used throughout.



### "Vickers" D.C. Motor Control Panel.

Amongst other new types of switchgear, the ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., are introducing the standard motor control panel shown in the accompanying illustration, with the lid open. In this, as in their other controllers, the units are of wire wound upon porcelain bobbins, being therefore incombustible, and they are so mounted in the case that they can be readily renewed if necessary. The contact maker is constructed on the same principle as the brushes of a motor—namely, it consists of a brass brush, which is kept in contact with the studs by means of a coil spring bearing on a cross piece, so that although the brushes and contacts may wear, the same even pressure is maintained throughout the life of a brush. Up to 50 amperes, stud contacts are fitted, and above this current the contacts are renewable.

The motor control panel consists of a starter, together with an ironclad combined quick-break lever switch and fuses, as illustrated. The switch is essentially suitable for industrial use, owing to its substantial construction and fool-proof features. The fuses are mounted between the switch blades, so that when in the "off" position they are entirely dead, and can be renewed without danger of shock; also the cover of the switch can only be opened when the switch is in the "off" position.

A combined motor starter and shunt speed regulator is constructed on similar lines to the standard starters, with the addition of a number of shunt regulating contacts. Two arms are provided, one for starting up, and the other for regulating. The regulating arm is provided with a handle, so that in starting up it pushes the

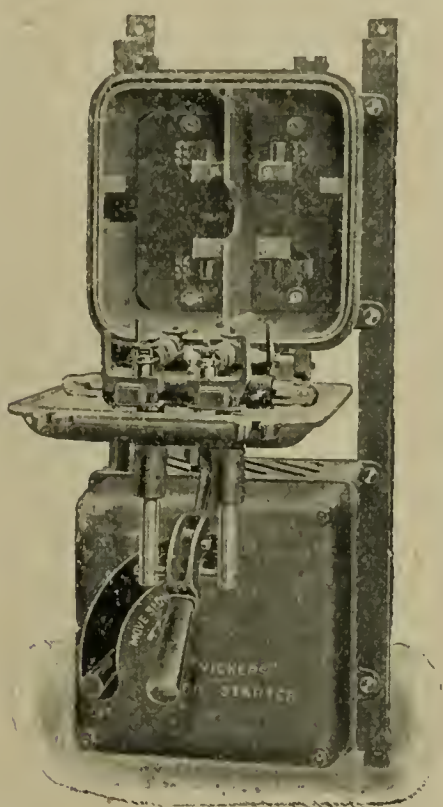


FIG. 7.—"VICKERS" STANDARD CONTROL PANEL.

starting arm before it, and when in the "on" position the starting arm is held in place by the no-volt coil, when the regulating resistance can be cut out as desired. With this combined starter and regulator the field is connected directly across the mains until all the starting resistance is cut out, so that it is impossible to start the motor with a weak field. An ample number of regulating contacts is provided, allowing of 100 per cent. increase in speed, the number of contacts varying from 19 to 30, according to the size

### The "Field Plug."

MESSRS. FIELD BROS. & CO., LTD., of 25, Budge Row, E.C., have introduced a new type of wall plug, characterised by the use of a patent contact. This is shown in section in fig. 8. It will be seen

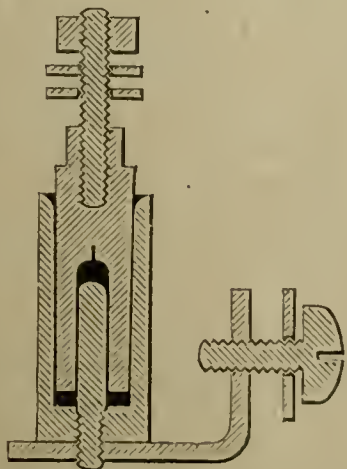


FIG. 8.—SECTION OF CONTACT OF "FIELD PLUG."

that, besides the sleeve, there is a central pin, and the pins of the plug are bored and turned so as to fit both inside and out, ensuring



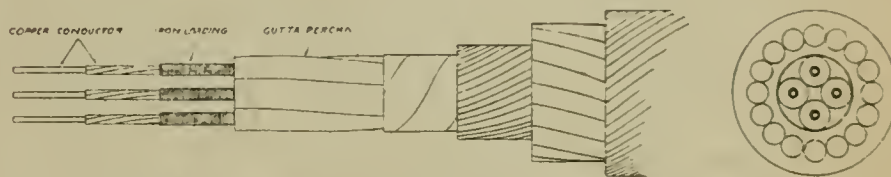
FIG. 9.—PARTS OF SOCKET AND PLUG.

a good metallic contact. The parts of a two-pin plug and socket to carry 8-10 amperes are shown in fig. 9.

### THE NEW FRENCH TELEPHONE CABLE.

THE accompanying drawing shows the details of construction of the new telephone cable recently laid between Abbotseliff and Cape Gris-Nez by the Telegraph Construction and Maintenance Co., Ltd., on behalf of the French Administration of Posts and Telegraphs.

It will be seen from the diagrams that the cable is of the continuously loaded type, and it is therefore of special interest, because it enables a direct comparison to be made with the Pupin coil-loaded cable laid between the same points to the order of the British Post Office. It is claimed for this type that it has none of the mechanical objections that are inherent in the coil-loaded type. In external



DETAILS OF CONTINUOUSLY-LOADED TELEPHONE CABLE.

appearance and in general cable construction it is identical with ordinary submarine cables, and therefore presents no increased difficulty either in laying, picking up, or in repairs.

The copper conductor, which weighs 300 lb. per nautical mile, consists of a central copper wire surrounded by five copper tapes according to the method introduced by Mr. Willoughby Smith, and the inductance loading is obtained by surrounding the conductor with a close helically-wound layer of .012-in. steel wire, the whole being covered in the usual way with gutta-percha to a diameter of .412 in.

The cable, in all its stages of manufacture, was submitted to rigorous tests by the technical representative of the French Administration, and was found to have successfully met all the requirements of the specification. The attenuation constants as measured after submersion and at a frequency of 1,000 alternations per second were found to be .00996 and .00987 per loop kilometre for the two circuits respectively.

### LEGAL.

#### THE NORTHERN LIGHT, POWER AND COAL CO.

ON the 8th inst., Mr. Justice Eve, sitting in the Chancery Division, had before him a motion in connection with the action Shrimpton v. the Northern Light, Power and Coal Co.

MR. GORE BROWN, K.C., appearing for Mr. Shrimpton, whose address is 46, Queen Victoria Street, London, said the defendant company's head office was in Ottawa, Canada, and its London premises in Moorgate Street. The motion was for an injunction to restrain the company from acting on the terms of a resolution passed at a meeting of debenture-holders in August, 1911. The terms of the resolution in question were that the company should be empowered to issue \$1,000,000 of prior lien bonds. Those bonds would be in priority to the first mortgage 5 per cent. gold bonds, which were issued at the formation of the company. The plaintiff's reason for asking for the injunction was that the resolution was passed by debenture-holders at a time when they were under a misapprehension, because of alleged substantial untrue representations of existing facts that were made at the meeting by the chairman of directors. Before going further, he would explain how that suggested representation arose. According to the prospectus of the



company, an arrangement had been made with Messrs. Fuller and Treadwell, the promoters of a company called the Klondyke White Channel Gold and Gravel Mining Co., that they would take from the Northern Light Co. a considerable quantity of electric power. At the meeting of debenture-holders, continued counsel, it was explained that the Klondyke Co. had not carried out that contract, and the revenue of the company had, therefore, not come up to expectations. The contract, however, was enforceable against the Klondyke Co. and Messrs. Fuller & Treadwell, and it was proposed that action should be taken. It was upon that representation, and a statement that a sum of £61,000 would be claimed, that the debenture-holders passed the resolution, although Mr. Shrimpton voted against it. It had since been ascertained that the Klondyke Co. never executed that contract. At the meeting the question was asked whether Fuller and Treadwell were men who could pay if the action against them was successful, and the chairman, Sir Godfrey Longdon, replied in the affirmative.

MR. P. O. LAWRENCE, K.C. (for the company): Not one of those present at the meeting was opposed to the resolution.

After hearing the matter further, his LORDSHIP delivered his judgment, and said that he could not grant the injunction asked for. The motion was a strange one, for, although the plaintiff purported to be acting for the whole of the debenture-holders, nobody but himself had come forward to say that he was misled by the alleged misrepresentation. He came to the conclusion, too, that there was no evidence of an untrue representation by the chairman at the meeting, for there was no doubt that that gentleman stated at the time what were the facts, for there was an action pending against the Klondyke Co., and the company believed they had a good claim on the contract. Therefore, the motion would be dismissed, with costs to the defendant company.

#### UNDERGROUND ELECTRIC RAILWAYS CO. AND OMNIBUSES.

IN the Chancery Division, on the 9th inst., Mr. Justice Warrington heard the petition of the Underground Electric Railways Co., Ltd., for the confirmation by the Court of a proposed alteration of the company's memorandum and articles of association, which had been unanimously passed at the meetings of the company.

MR. CLAUSON, K.C., said the alteration would enable the company to carry on the business of proprietors, manufacturers and dealers in omnibuses, cabs, and public and private conveyances and vehicles of every description, whether controlled or drawn by steam, gas, oil, electricity or other mechanical power, or by animal traction; and of general carriers, railway and forwarding agents, &c.; and to acquire, by purchase or otherwise, controlling or other interests in any stocks, shares or securities of any company carrying on any such business.

His LORDSHIP sanctioned the alteration as proposed.

#### FRAUDULENT USE OF ELECTRICITY.

AT Chester-le-Street Police Court, Co. Durham, on 6th inst., John Johnson, an electrician, of Birtley, was summoned for having fraudulently used electricity belonging to the County of Durham Electric Distribution Co. between October 8th and 18th last. Mr. W. S. Burton prosecuted on behalf of the company.

The evidence was to the effect that in Morris Street, where the defendant lives, there are 17 houses supplied with electricity through one meter. Each house was charged a flat rate of 6d. per week in summer and 9d. per week in winter, and limited to seven 8-C.P. lamps and one 16-C.P. lamp, a total of 72 C.P. It was discovered that more electricity was passing through the meter than should have done. It was therefore changed and a new one put in. The old one was tested and was found correct, and inquiries were therefore made. On October 9th it was discovered that the defendant was working in a shed in the yard of the house which he occupied with his mother, and there was an electric light burning there. On October 17th three of the company's officials went there, and found that a connection had been made from the scullery to the shed, that there were three 32-C.P. lamps in use and apparatus for obtaining electric power and the charging of accumulators. These, however, were not in use. It was found that, in addition to the lamps in the shed, there were also lamps burning in the scullery and kitchen. The defendant admitted to one of the officials that he had made a mistake, and that it would not occur again.

Johnson pleaded "not guilty" to the Bench, and said that while the lamps in the shed were burning there were no lights in the house. He did not know that he was acting contrary to the law.

In consideration that this was the first case of the kind taken in the district under the company's Order of 1895, it was decided to treat the defendant leniently, and he was fined £3 and £1 11s. 6d. costs.

A charge against the defendant's mother, Elizabeth A. Johnson, who was a party to the contract with the Distribution Co., was withdrawn.

#### CHARGE AGAINST A TRAVELLER.

BEFORE Judge Lumley Smith at the Central Criminal Court last week, Thomas Brittain Johnson, 43, commercial traveller, pleaded not guilty to an indictment charging him with converting to his own use sums of money entrusted to him for his employers, the Electrical Co., Ltd., 122, Charing Cross Road, London, W.

Mr. Frampton appeared for the prosecution, while the defendant was represented by Mr. H. S. Schultess Young.

MR. FRAMPTON explained that the charges against the defendant were based on the Larceny Act of 1901, and there were five separate conversions alleged against him. The defendant was engaged by the Electrical Co. on June 1st of last year as their traveller in the south-eastern district of London and a portion of Kent. As remuneration the defendant was to receive commission at the rate of 25 per cent. and it was a condition of the agreement under which he was engaged that he should remit all sums received by him for his employers within 24 hours of the money being handed to him. From time to time the defendant obtained orders for goods, and was paid his commission. Last December the defendant's employment was determined by the Electrical Co., and when inquiries were made the subject matter of the present charges was brought to light. In June of last year the defendant brought to the prosecutors an order from a firm carrying on business in Penge. The goods in question were delivered, but the company had never been paid for them. The defendant, however, had received the sum of £6 19s. 7d. in payment for the goods, and had never accounted for the money. On June 28th he received an order from a Penge tailor; the goods were delivered, and the defendant arranged to have a suit of clothes from the tailor in part payment. The clothes cost £4, and a cheque for the balance of the account, amounting to £2 15s., was given to the defendant, which he kept. He also received £6 17s. 6d. from a firm of estate agents at Penge for goods supplied, but none of the money ever reached his employers. In another instance the defendant sold goods to a tailor, and in part payment had a costume made for his wife, the difference being paid to him in cash; none of that money ever reached his employers. When arrested, the defendant said he must admit owing the prosecutors some money, and all they could do was to sue him for it.

For the defence it was argued that the matter was one that should have been dealt with in a civil court, and the defendant should have been sued for any amount that was due to the prosecutors.

The jury returned a verdict of not guilty, and the defendant was discharged.

#### URBAN ELECTRIC SUPPLY CO., LTD.

MR. JUSTICE NEVILLE, sitting on Tuesday last for the disposal of company business, had before him a petition by this company for the reduction of its capital. The matter has already been referred to in our "City Notes."

There was no opposition, and his Lordship sanctioned the reduction as proposed.

#### UNITED LIGHTING AND MAINTENANCE CO., LTD., v. WM. LIESEGANG.

IN the High Courts, on Tuesday last, the Official Referee, MR. MUIR MACKENZIE, gave judgment for a sum of £478 8s. 9d. in favour of the plaintiff, against defendant, trading as Liesegang & Kosch, of Magdeburg, Germany, in respect of a contract for the supply of electric lamps.

It appeared that defendants agreed to supply plaintiffs with 50,000 electric lamps, but failed in their deliveries, with the result that plaintiffs claimed the above sum as loss of profit and extra expense for having to buy on the market to supply customers.

No appearance was put in for the defendants.

#### ACTION AGAINST A LAMPMAKER.

IN the Chancery Division, on March 11th, Mr. Justice Swinfen Eady gave judgment for the plaintiff in an action by the Public Trustee (for the beneficiaries under the will of one Frank Griffiths) against Mr. Ernest Bohm, electric lamp-maker and general electrician, asking for an injunction to restrain defendant from committing a breach of a covenant under which he was the lessee of No. 45, Hillmarton Road, Holloway. Plaintiff complained that the lease of the house in question was granted to defendant on one condition, among others, that it should be used as a private dwelling-house only, but, in breach of that covenant, defendant had carried on the manufacture and sale there of electric lamps.

In his defence, MR. BOHM denied that his acts amounted to a breach of the covenant of his lease, inasmuch as he had only carried out experiments in connection with his electrical business in the cellar of No. 45, Hillmarton Road; his business was really carried on at a workshop in St. George's Road.

Having heard evidence on both sides, however, his Lordship granted the injunction asked for.

**The Manchester Electro-Harmonic Society.**—The first smoking concert will be held on Friday evening, 22nd inst., at 7 o'clock, in the Marble Hall, Albion Hotel, Manchester, at which the president, Mr. S. L. Pearce, will take the chair. An excellent programme has been arranged by the musical director, Mr. W. J. Smith, and we are asked to state that the committee will be very pleased to see as many gentlemen present as possible. Tickets, admitting two gentlemen, may be obtained from the Hon. Secretary, 24, Brazennose Street, Manchester, or from any member of the committee.



## BUSINESS NOTES.

**Private Arrangement.**—A private meeting of the creditors of D. W. A. ROBERTS, trading as D. Roberts & Co., Station Street and Junction Road, Eastbourne, electrical engineers, convened by Mr. C. R. L. H. Harvey, the largest creditor, was held on Monday at the Great Eastern Hotel, E.C. Mr. Mills, solicitor for Mr. Harvey, explained that his client held a mortgage on the debtor's lease, &c., and a charge upon the book debts in respect of advances made to the debtor, and on February 15th the mortgagee appointed Mr. H. H. W. Perkins, of Eastbourne, accountant, receiver under the mortgage. The object of the meeting was to receive a report and statement of affairs from Mr. Perkins, and to consider a scheme providing for the payment of the debtor's liabilities, and allowing him to continue the business. Mr. Perkins submitted a statement of account showing a surplus over liabilities of £199. He said that the debtor commenced business in small premises in Station Street in 1904, having previously been engineer-in-charge of the Eastbourne Electric Lighting Works. He started without capital, and, therefore, had been handicapped throughout his career, and on various occasions he had borrowed money from Mr. Harvey, which had been repaid with the exception of £200, which was secured by a mortgage dated September, 1908, and a loan of £70 from the same gentleman. The business, which began in a small way, had been progressive and prosperous, the trading amount for 1911 showing a turnover of £4,828, a gross profit of £1,071, and a net profit of £506. The premises in Station Street are held on a lease upon which Mr. Harvey holds a mortgage, and the Junction Road garage was held under an agreement for a lease. Each of these premises is in a desirable situation, and consequently both leases are of considerable value. They had not, however, been valued, and did not appear in the statement of affairs. Four writs had been issued, and the largest trade creditor was in a position to issue execution. There was also claims for rent, rates, &c., which had to be met at once. The debtor has been appointed electrical expert to the Devonshire Park Co., Eastbourne, from which he received £3 a week besides a profit on the sale of sundries. Mr. Perkins stated that the debtor had undoubtedly good prospects if given time to free himself from the pressure caused by shortness of capital. Mr. Mills suggested that the business should be continued by the debtor in the usual way, at a salary, and subject to the supervision of a trustee to be appointed on behalf of the creditors. Mr. E. Hawkins, C.A., having gone into the position on behalf of the largest creditors, recommended the acceptance of the proposal, and calculated that under it the creditors would get about 10s. in the £ in six months, and the balance in the future. There was a lengthy discussion, and eventually it was resolved to take a deed of assignment, subject to Mr. Harvey giving up his security, the trustees to have power, on the instructions of the committee of inspection, to sell the business as a going concern or to wind it up, whichever they thought fit. Mr. H. H. Perkins, accountant, of Eastbourne, and Mr. E. H. Hawkins, of Charterhouse Square, E.C., were appointed joint trustees with a committee of inspection. The following are creditors:—

Anglo-American Oil Co. . . . .	£182	Eastbourne Corporation . . . . .	£27
East London Rubber Co. . . . .	90	Avon Rubber Co. . . . .	56
Harvey, C. R. L. E. . . . .	68	Lanchester Motor Co. . . . .	40
Bransom, Kent & Co. . . . .	45	Phleumatic, Ltd. . . . .	35
Soddy, R. J. . . . .	90	Swires . . . . .	65
General Electric Co. . . . .	29	City Ignition Co. . . . .	21

**Prices Advance.**—MR. G. BRAULIK announces that owing to the recent advance in the cost of platinum and the large increase in cost of all raw materials, prices of bells, buzzers, relays, &c., listed in his Section "B" bell catalogue, have been advanced. Prices of indicators, brass pushes and other lines have also been advanced by 10 per cent.

**Preventing Vibration.**—Amongst recent orders to insulate foundations against vibration, the KORFUND Co. have received the following:—

Belfast.—Two 120-H.P. Diesel engines.  
Sheffield.—One 300-H.P. Hornsby Stockport gas engine.  
South Shields.—Picture Palace, one petrol-generator set.  
British Museum Station.—B.T.H. motor and Sirocco fan for Ozonair plant.

**"Metroflam" Arc Lamps.**—In our "Contracts Closed" last week it was stated that the Glasgow Corporation had accepted the offer of MESSRS. JOHNSON & PHILLIPS, LTD., for 30 flame lamps. We now learn that the order received by the firm is for 48 "Metroflam" magazine flame lamps, having a specified duration of 120 hours. This makes a total of 248 "Metroflam" lamps for the Glasgow street lighting. The following is a list of some important orders booked by the firm recently for these lamps:—

Blackpool Corporation, 154 lamps; Great Central Railway (Immingham Dock), 200 lamps; Croydon Corporation, 58 lamps; Hawthorn, Leslie & Co., Ltd., 66 lamps; Newcastle Corporation Tramways, 22 lamps; Palmer's Shipbuilding & Iron Co., Ltd., 60 lamps; Charing Cross, West End and City Electricity Supply Co., Ltd., 150 lamps.

**Bankruptcy Proceedings.**—E. D. HAWKER and A. S. FINCH, lately carrying on business as the British Accessories Co., at 119, Pentonville Road, N.—A sitting of the London Bankruptcy Court was held on Wednesday, March 6th, for this public examination. The accounts showed debts £517, and assets valued at £71. It appeared from the evidence of the debtors that they commenced business in November, 1910, with £100 capital as electrical manufacturers, and traded until last October, when, being without working capital, they abandoned the business. In February, 1911, they purchased the patent rights for this country in an advertising

device called the "Albright Sign," together with the goodwill, stock, &c., of a business in connection therewith, and afterwards exploited the device in conjunction with their other business. The failure was attributed to lack of capital, loss in trading, and to loss on the purchase of the sign business. The examination was concluded.

**British Trade with Japan.**—THE FAR EASTERN ADVERTISING AGENCY, LTD., of Craven House, Kingsway, are preparing for circulation in Japan, where their head offices are situated, a "Buyers' Guide" in the Japanese language, entitled the "Japanese Register of British Trades." A special feature will be a classified index of manufacturers and exporters. They invite firms of standing in Great Britain to send in entries without delay, as the compilation is now near to completion.

**Thermit Welding.**—MESSRS. THERMIT, LTD., London, have received the order for the welding of the joints on the Belfast City Tramway extensions, amounting to about 7 miles double track. They have also orders in hand for welding at the following, among other places:—Blackpool, Bradford, Bristol, Liverpool, Manchester, Newcastle-on-Tyne, Sheffield, Rotherham, Southampton, West Hartlepool, Southend.

**Book Notices.**—"Journal of the Institution of Electrical Engineers." February, 1912. London: E. & F. N. Spon, Ltd. Price 5s. net.—The issue for February contains the following papers: Chairmen's Addresses at Manchester, Dublin, Scottish, Yorkshire and Newcastle Local Sections; High-Voltage Transmission, by W. T. Taylor; The Mechanical Design of Direct-current Turbo-Generators, by R. Roberts; National and International Standards for Electrical Machinery, by Dr. R. Pohl; Small Electricity Supply Undertakings, by P. A. Spalding; The Mutual Attractions or Repulsions of Two Electrified Spherical Conductors, by Dr. A. Russell; Total Loss and Hysteresis of Magnetic Sheet Materials, by A. C. Campbell, H. C. Booth, and D. W. Dye.

"Applied Science," Vol. V, No. 4. February, 1912. Toronto: University Engineering Society.

"Memoirs of the College of Science and Engineering." Vol. III, Nos. 7 and 8. January, 1912. Kyoto, Japan: Imperial University.

"The School of Mines Quarterly." Vol. XXXIII, No. 2. January, 1912. New York: Columbia University. Price 50c.

"Storage Batteries." By Harry W. Morse. London: Macmillan and Co. Price 6s. 6d. net.

"Science Abstracts." Sections A and B. Vol. XV, Part 2. February 26th, 1912. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net.

"Proceedings of the American Society of Civil Engineers." Vol. XXXVIII, No. 2. February, 1912. New York: The Society.

"Bulletin of the Iowa State College Engineering Experiment Station." Vol. IV, No. 6. December, 1909. Ames, Iowa, U.S.A.: The College.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVIII, Nos. 1, 2 and 3. November, 1911, and January and March, 1912. Newcastle-upon-Tyne: The Institution.

**Coal Strike Delays.**—In case any of our country readers should find this copy of the ELECTRICAL REVIEW coming to hand a few hours later than usual, will they kindly note that it is due to curtailment of the railway service consequent upon the continuance of the coal strike. The Great Northern Railway Co. have suspended the East Coast Scotch Express leaving King's Cross Station at 5.5 a.m., week days, until further notice. Correspondence for places in England and Scotland, usually forwarded by this train, will be sent by the earliest subsequent trains on the same line of railway, or by other routes, but unavoidable delay in the delivery of all classes of correspondence will result from the suspension of the train in question, and the general curtailment of the services on the various lines of railway.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., issued a notice to their customers, dated March 1st, to the effect that in view of the general coal strike they were unable to depend on the supply of material necessary to enable them to proceed with work in progress, and although they had taken the precaution to lay in, as far as possible, a stock of supplies which would help them to some extent, it was inevitable that there must be delay in the completion of a very great many orders in hand. Guarantees and promises for the delivery of apparatus now on order, as also those which might be given in connection with new inquiries, must be contingent on delays due to the strike.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., have issued the following notice from Caxton House, S.W., under date March 12th: "We beg to advise you that owing to the existing coal strike and its consequences, we are suffering delays at our Stafford Works and in the receipt of raw materials and of materials from our suppliers and sub-contractors, which will inevitably delay the progress of the work now in hand. We therefore regret that we are obliged to give notice that any promise or guarantee we have given for completion of our orders in hand, and any given, or to be given, in connection with new inquiries, must be subject to delays caused by the strike, and that we can take no liability whatever in respect of any loss, damage or injury caused thereby. We would ask indulgence in respect of these delays, the inconvenience resulting from which we are doing our best to mitigate."

**Catalogues and Lists.**—MESSRS. ANDRE CITROEN AND Co., 27, Queen Victoria Street, London, E.C.—New edition of their brochure, entitled "Citroen Gears at Work." It contains a number of new illustrations of these gears working under a great variety of conditions.



**THE STURTEVANT ENGINEERING CO., LTD.**, 147, Queen Victoria Street, London, E.C.—Pamphlet containing particulars of their small-power slow-speed steam turbines, notes on the advantages claimed, and a table of dimensions, speeds and powers. Also a new edition of their 18-page catalogue (No. 1,021) of high-pressure fans for foundry work. Electric high-pressure fans are illustrated and described, also air valves, countershafts, and sheet-steel air piping.

**MESSRS. EASTMAN & WARNE**, 241 and 243, Acton Vale, London, W.—Catalogue of 16 pages, giving particulars of their electrically-heated apparatus, the system of construction, advantages claimed, notes on the loadings of heating apparatus, &c. The manufactures, in which the firm has made remarkable headway since it began experimental work on electric irons some eight years ago, include "Hot-point" domestic irons, laundry and factory irons, "Eadisk" cookers and hot plates, the "Belenus" electric boiler recently described in our pages, soldering irons, branding irons and muffers, and various accessories. We understand that the branding irons, as exhibited at Olympia last autumn as an example of the degree of heat that could safely be obtained with the "Hot-point" iron, have been the subject of a number of repeat orders from those who bought the irons during the Exhibition run.

**MESSRS. PERRY & GRINSELL, LTD.**, 1 and 2, Leopold Street, Birmingham.—A 24-page catalogue of electric heating and cooking apparatus has been issued. The manufactures appearing and priced in the list comprise electric kettles in brass, copper and tin, porridge pots, frying pans, food-warmers, warming plates, cooking plates, large and small ovens, oven and grill, electric irons and connectors. The list is well produced, and the front page bearing the maker's name is perforated for removal by contractors, &c.

**THE GENERAL ELECTRIC CO., LTD.**, 67, Queen Victoria Street, London, E.C.—New catalogue (M Section, ninth edition) of about 50 pages, containing illustrated descriptions and tabulated prices of measuring instruments, a number of new lines being included. Switchboard instruments, portable instruments, recorders, meggers and bridge meggers, "Aron" meters and time-switches, these are some of the variety particularised. Special attention is directed to the type "C" moving iron aperiodic instruments, 6-in. dial portable instruments, standard portable testing sets (the "Salford"), and the "Aron" watt-hour shunted clock-type meter. Some of these are referred to in our "New Devices" to-day.

**MESSRS. FELD BROS. & CO., LTD.**, 25, Budge Row, London, E.C.—24-page pamphlet containing illustrations, and with full particulars of prices very clearly shown, of various materials used by contractors in electric light and power installation work, motors (from  $\frac{1}{2}$  to 26 H.P.), cables and flexibles, "Graetzin" metal lamps, tantalum lamps, "Sunshine" flame arcs, carbons, lamp-holders, switches, ceiling roses, wall plugs, casing, shades, Holophane glass-ware, &c. At the new Polytechnic in Regent Street, visited by the King and Queen on Monday, the building is fitted throughout with "Graetzin" metal lamps and Holophane glass reflectors supplied by Messrs. Feld Bros. & Co.

**MESSRS. SIEMENS BROS., DYNAMO WORKS CO., LTD.**, Tyssen Street, Dalston, London, N.E.—Eight-page price list (W.L., 1.) dealing with "Wotan" pure drawn tungsten wire lamps, the front cover of which bears a reproduction in colour of their "Wotan" lamp poster now being displayed on the London underground railways. The pamphlet contains illustrations and prices of all grades of these lamps that are now on the market. Also a new 24-page price list (D4) of Holophane glass-ware, including the latest types of reflector bowls in the "Stiletto" and "crystal" types. Several pages are occupied with illumination data for electrical contractors' reference. Among other specialities in the list is the "Bank" unit, consisting of a "Stiletto" reflector of either intensive or extensive type, with a green opal shade to slip over the exterior prisms of the Holophane reflector, the whole being supported by a screwless gallery. The fitting can be fixed to any ordinary bank or counting house standard for efficient desk illumination. The "Billiard" unit, which is also shown, consists of a Holophane glass shade surrounded by a green conical cardboard shade surrounding the outer prisms which directs the light over the billiard table.

**THE SILENT ELECTRIC CLOCK CO.**, 192, Goswell Road, London, E.C.—Leaflet showing a view of a corner of their fitting and testing room, where a number of clocks of various sizes for the Home Office are being tested. The master clock consists of one of their little half-seconds master movements fitted to a case with 12-in. dial.

**THE ARMORDUCT MANUFACTURING CO., LTD.**, Farringdon Avenue, London, E.C.—Leaflet illustrating in colour their "Rainbo" colour changing electric lantern for cinematograph theatre and other advertising service.

**Big Typewriter Contract.**—**THE WESTERN UNION TELEGRAPH CO.** has ordered 10,000 typewriters from the Underwood Typewriter Co., delivery to be given at the rate of 1,000 a month.

**For Sale.**—**MESSRS. G. N. DIXON & CO.** will, on March 27th and 28th, sell by auction at Trefriw, North Wales, a quantity of electrical mining, ore dressing and contractors' plant. See our advertisement pages to-day.

**Chloride Contracts.**—**THE CHLORIDE ELECTRICAL STORAGE CO., LTD.**, have recently received an order from the Admiralty for a battery-booster plant for H.M. Dockyard, Simons Bay, South Africa. An Entz booster and Chloride battery was recently installed at the Leith Docks, and a somewhat similar plant was shipped to Egypt for the Soudan Government Railways. The company are just completing the erection of a battery of 230 cells for the Wolverhampton Corporation, with a capacity of 7,000 ampere-hours at the three-hour rate.

**Trade Announcements.**—**MESSRS. SCHOLEY & CO., LTD.**, of 151, Queen Victoria Street, E.C., have appointed Mr. C. W. Fairweather, jun., of Cathedral Buildings, Dean Street, Newcastle-on-Tyne, to be their representative for the Newcastle district.

**MESSRS. ENGINEERING AND ARC LAMPS, LTD.**, announce that their Chingford Works being inadequate to cope with the demand for Beacon flame lamps and other specialities, their St. Alban's Works have been extended and further equipped with up-to-date tools; the manufacture of Gilbert and Davy arc lamps will now be carried on solely at Sphere Engineering Works, St. Albans, Herts, and all communications should be addressed there.

**MESSRS. DAVID BROWN & SONS (HFD.), LTD.**, of Park Works, Lockwood, Huddersfield, announce that arrangements have been made for the reconstruction of their business by the formation of a new company, bearing the same name as the existing company, but with a largely increased capital, in order to cope with increasing trade. Part of the capital has been offered to the public and has been fully subscribed. The existing company will be wound up voluntarily (the liquidator being the secretary, Mr. T. E. Whiteley), and all the assets will be transferred to the new company. All accounts incurred since September 30th last will be received and paid by the new company. The business will be continued under the same management.

**THE LANGDON-DAVIES MOTOR CO.**, of Southwark Works, Deverell Street, S.E., have acquired the whole of the assets and goodwill of the Langdon-Davies Motor Co., Ltd., as a going concern, and they will continue to manufacture every type of motor made by the old company. They announce that they are removing to a new works equipped with modern machine tools, and they intend to maintain the reputation of the L.D. motor as a British-made machine. The present plant, which is inadequate to meet the demands made upon it, is to be disposed of, but this will in no way affect the continuity of the business. The staff is being retained as in the old company, the only alteration being in the management.

The business of the late **MR. WM. COGGER**, electrical engineer, 9, Earl Street, Maidstone, will be continued by his son, Mr. W. E. Cogger, senior.

**Liquidations.**—**RUGBY SCHOOL ELECTRIC LIGHTING CO., LTD.**—A meeting is to be held on May 13th at Rugby, to hear an account of the winding-up from the liquidator, Mr. A. E. Donkin.

**RE-ORGANISATION AND CONTROL SYNDICATE, LTD.**, 2, Coleman Street, E.C.—First meetings of creditors and contributories respectively, March 26th, at Carey Street, W.C.

## LIGHTING and POWER NOTES.

**Accrington.**—Three applications have been made to Accrington Mill Building Co. for a plot, between Peel Mill and Milnshaw Park, for the purpose of erecting a weaving shed. The land is nearly an acre in extent, and, if worked by electricity, the shed will hold about 700 looms of standard width, along with preparation machinery. The individual drive system is generally regarded in this part of Lancashire to be the most economical. An experiment on these lines is being tried with some 22 looms in the Accrington locality, and this is being watched by many manufacturers with the greatest interest.

**Argentina.**—The Municipality of Coronel Vidal (Province of Buenos Ayres) has accepted the tender of Mr. F. Maya for installing the electric light in that town.

**Axbridge.**—The R.D.C. has decided to assent to the application of the Winscombe E.L. Co. for permission to extend the overhead supply mains to Cheddar.

**Barking.**—With reference to the application of the U.D.C. for a loan of £11,000 for E.L. purposes, the L.G.B., as the result of the recent inquiry, has advised the Council to call in an independent expert engineer to report upon the whole position of the undertaking, and particularly as to whether the proposed extensions are required, and, if so, as to what form the extensions should take. It is further pointed out to the Council that at the time of the inquiry, the E.L. account was overdrawn to the extent of £5,040. In reply, the Council has informed the L.G.B. that it has considered the matter carefully and for a long period.

**Birkenhead.**—As a result of the agitation carried on for some time by users of electrical energy residing outside the borough area, the T.C., on 6th inst., decided to reduce the charges to consumers in Bidston, Necton, Upton and Prenton from 7d. to 5d. per unit.

**Blackburn.**—We understand from the engineer, Mr. Wheelwright, that the concluding sentences of our note last week on the recent L.G.B. inquiry at Blackburn are liable to mislead readers. The inspector's remark that he did not think the Board would sanction the loan until something definite was decided, referred only to one sum of £2,400 for improvements, &c., in condensing water supply, and not to the whole scheme of improvements, which we understand was presented in complete form and accepted by the inspector. We regret that the note should have left an erroneous impression.



**Blackburn.**—It is stated that the Tramways and Electricity Committee has carefully considered the effect of the coal strike on these departments. The coal at the electricity works would enable them with great care to go on for a month. They intended to reduce the tramway service by about 50 per cent., which would give them a considerable decrease in the coal consumption. They also intended to reduce lighting on the tramway routes as well as other routes. The big lamps would be put out altogether and the smaller middle lights utilised.

**Bognor.**—A B. of T. inquiry was held on March 8th into the application of Mr. Wm. Tate for powers to supply electricity within the township. Mr. Tate, who is chairman of the U.D.C., has already a generating station supplying a number of large buildings, and his scheme includes a three-wire system of supply. The estimated capital expenditure, including about £3,000, the value of the existing generating station, which is to be extended, is £22,050, and it is proposed to supply current at 5d. per unit. The gas company opposed the application.

**Bootle.**—The T.C., at its meeting on March 6th, unanimously approved the recommendation of the Electricity Committee with regard to the extension of the electricity works at a cost of £43,755, outlined in the report of Mr. T. D. Clothier, borough electrical engineer, submitted to the Council on December 6th, 1911. In accordance with the resolution of the T.C. passed on January 3rd (ELECTRICAL REVIEW, January 12th), "That before the Council approves the scheme an independent electrical engineer be appointed to criticise the scheme, such person to be a practical engineer in charge of an electric works giving a public supply, and to be appointed by the President of the Municipal Electrical Association," the extension scheme had been submitted to Mr. C. E. C. Shawfield, who reported: "After carefully reviewing your engineer's recommendations, I am of the opinion that the scheme is a sound and well-considered one, and based upon the latest central station experience." The matter was brought up on the minutes of the Finance Committee, which contained a recommendation declaring that in the Committee's opinion the expert's report was satisfactory, and that the Electric Power and Lighting Committee should proceed with the scheme.

**Brechin.**—The Corporation, which recently took steps to acquire the local gas undertaking from a company, has to face the unusual problem of modification or annulment of its agreements with the electricity company, which carries out the street lighting. The North of Scotland Electric Light and Power Co. has had the contract for lighting the streets since 1902, but it has apparently occurred to the Council that a gas lighting system would be cheaper. How the problem will be solved is a matter of importance also to Montrose, a neighbouring burgh, which is in a somewhat similar position as to its agreements with the same company regarding public lighting. In the case of Brechin, it was stated in a supplementary agreement that the T.C. would take from the company sufficient energy for the lighting of the whole of the streets wherein main cables are laid, "always providing that the expense of lighting the public streets shall not exceed the present cost of lighting the streets by gas, and the company undertakes that the streets lighted by electric light shall be at least as well lighted as they are now by gas." The electric system is up to date, and the lighting only cost £462 in 1911.

**Bray.**—A L.G.B. inquiry has been held concerning the application of the Urban Council for sanction of a loan of £3,500 for the purpose of extending the municipal electric lighting works. Mr. J. McCaul, accountant, gave evidence, and stated the electric light undertaking had not paid in the past, but that it was doing so now. He attributed the latter fact to the increased consumption for private use. In reply to the Inspector, he said they had done wiring in private houses. Mr. Bradshaw objected that the Council had no power to do that. Mr. McCaul stated that the practice had been discontinued since Mr. Bradshaw threatened to take an action against the Council. In reply to the Inspector, Mr. McCaul said a credit balance on the electric lighting account in 1911 of £120 had been applied to the relief of the general rates. He further stated that there was a debt of £1,000 on the electric lighting works, which was covered by an overdraft on the bank, which was guaranteed by members of the Urban Council. Mr. Sowter, the Council's electrical engineer, said that if they increased the price of electricity they would lose a very large number of customers. He believed that the new machinery would last 20 years, the period of the loan. They expected to make a profit by the increased number of consumers.

**Brighton.**—The T.C. has, by 25 votes to 19, rejected a scheme of assisted wiring of consumers' premises. The opposition was based on the ground that the scheme would be unremunerative.

**Burnley.**—The Electricity Committee has considered its estimates for the ensuing year, and has recommended that if the profits anticipated during the year ending March 31st, 1913, are sufficient for the purpose, £4,500 be paid into the borough fund. The Committee considered a letter from Messrs. Lupton Bros., and the electrical engineer submitted a return showing the charges made in 32 towns for electrical energy supplied for lighting purposes during restricted hours. It was decided that the Council be recommended to charge 2d. per unit for electrical energy used for lighting purposes between sunrise and sunset, the consumer in each case to pay the cost of the special meter necessary to record the consumption of electrical energy during the period. This is a reduction of 1d. per unit.

**Canada.**—In all probability a great electric power plant will be erected at the Chats Falls, 30 miles west of Ottawa, on the Ottawa River. This was intimated a few days ago by Hon. Adam Beck, of the Ontario Ministry, and head of the Hydro-Electric Commission. The Commission has taken steps to expropriate the Chats Falls and develop power, largely for the City of Ottawa, but for many other towns in the vicinity. The water available at Chats Falls is sufficient to develop 120,000 to 150,000 H.P., and is thus equal to the supply at Niagara.

Mr. Thomas Surtees, who has thoroughly investigated the question of Ottawa River powers, gives Chats Falls 141,000 H.P. A report indicates that extensive additions to the plant of the Electrical Development Co., at Niagara Falls, will be made. The power house is to be extended to the south, the addition to be erected costing over \$200,000. Four more power units are to be installed, increasing the power development from 80,000 H.P. to 120,000 H.P., and the transmission line to Toronto will be duplicated. Altogether a sum of about \$1,000,000 will be spent by the company on the contemplated improvements.

**Carnarvon.**—The National Electric Construction Co., Ltd., has applied for an additional provision to be introduced into its Bill confirming the wiring agreement with the Carnarvon T.C.

**Continental Notes.**—FRANCE.—La Société Hydro-electrique de la Haute Bourne is the name of a new company which has lately been formed at Grenoble with a capital of £20,000 to put down a plant to utilise the water-power of the River Bourne in the generation of electrical energy for lighting and power purposes.

GERMANY.—A municipal commission appointed by the city of Flensburg, is about to make a journey to Berlin with a view to studying the various systems of municipal electric undertakings, as a preliminary to the establishment of an electric service in Flensburg.—*Elek. und Maschinenbau.*

One of the largest overland central stations in existence is in course of completion in the kingdom of Saxony. It is that of the Groba electricity union, which comprises four principal districts composed of 850 localities. The generating station is situated at the works of the Lauchhammer Co., at Lauchhammer, which commenced trial working at the end of January. The electrical energy is transmitted at a pressure of 100,000 volts to Riesa, whence it is passed by means of a ring main to five transformer stations, and thence into a distributing system having a total length of 740 miles, covering an area of 1,150 square miles. It is said that commercial considerations have induced the union to use copper and aluminium in equal halves for the overhead lines.

BELGIUM.—La Société des Ateliers de Constructions Electriques, of Charleroi, has recently completed a generating station at Brée, for public and private lighting purposes, which is of more than passing interest, inasmuch as it is an attempt to provide electricity for small villages which have hitherto been unprovided with any means of lighting other than is afforded by oil lamps. The town of Brée is situated in the north-east of the province of Limburg, close to the Bois-le-Duc Maestricht Canal; it has only about 1,700 inhabitants, but the outlying villages bring the population of the district up to nearly 4,000. In order to bring home to the people the advantage of electric lighting, circulars were issued showing in plain language its relative cost contrasted with oil lamps, the result being sufficiently satisfactory to enable the authorities to carry their projected electrical undertaking into effect.

RUSSIA.—According to the *Mining Journal*, apropos of recent announcements of fresh discoveries of gold on the Lyamur, near Nikolaieffsk (Far East), an imposing programme of gold exploitation on the Amur is set down for the coming open season, when the Ochotsk Co.'s gold mines, which are said to have been leased to the English Orsk Co., will be exploited on a large scale by means of electric dredges. On the right shore of Lake Shyla, about eight miles away from the mines, a station will be built.

**Cuba.**—Senor Antonio Ramos Valderas has been authorised to establish in Sancti Spiritus an electric generating station with the object of supplying electric energy to the town of Sancti Spiritus and the districts of Zaya del Medio, Cabaiguán and Guayos. Senor A. G. Bornsteen also is to establish an electric generating station in Güira de Melena, Province of Havana.—*Board of Trade Journal.*

**Darwen.**—The Corporation has entered into arrangements to supply electric power for an extension of Hillside Mill. There is also a possibility that at least one of the new mills being erected in the town may be similarly supplied.

**Doncaster.**—The T.C. has decided to carry on experiments in public lighting with electric and gas lamps, before definitely deciding upon a scheme.

**Dover.**—The War Office has applied to the T.C. for a reduction in the price asked for a supply of current to buildings on the Eastern Heights, for which a rate of 4d. per unit is asked.

The Council has decided to offer a reduction of ½d. per unit on the terms offered.

**Dundee.**—On the new dock quay to be constructed at Dundee, the cranes will be electrically operated. It is proposed to have eight travelling cranes each with a lifting capacity of 30 cwt., and one travelling crane with a lifting capacity of 5 tons, the power for these cranes being supplied from the Corporation electric power station. It is also under consideration to erect a 120-ton crane for the service of shipbuilders and engineers, at a cost of £15,000 for the crane, and £5,000 for foundations.



**Dunoon.**—After spending over £40 on a deputation to the B. of T. in order to get an extension of time in which to carry out the Electric Lighting Order (1906), the T.C. has decided by six votes to five to allow the order to drop. The B. of T., it will be recalled, was willing to grant an extension of a year, but the Council wanted a longer period.

**Frome.**—At the monthly meeting of the U.D.C. on Monday, the Clerk reported that the B. of T. had now approved of the draft deed of agreement for the transfer of the electricity works to Messrs. Edmundson, and that the document would be ready for sealing during the present month.

**Iceland.**—The great waterfalls in which Iceland abounds lie mostly far from the coast and from the inhabited districts, which is the reason why they have up to the present remained unutilised. Quite lately, however, a French company has purchased a tract on the south coast near Thorlakshavn and also several large waterfalls in the uplands. These are of an estimated aggregate capacity of 200,000 H.P. and it is intended to construct a good port and work the factories to be erected there by electricity. A beginning is to be made with a factory for the manufacture of nitrogen by the Birkeland-Eyde process.—*Elektrotechnische Zeitschrift*.

**Isle of Wight.**—Mr. Wm. H. Marshall, consulting engineer, of Southsea, has been appointed by the Isle of Wight Central Railway Co. to prepare a scheme for electric light and power at their workshops, stations and wharves, including a complete scheme of electric cranes and electric capstans and locomotives for shunting trucks at the Madeira Wharf, Cowes.

**Itchen.**—Electricity supply matters at Woolston, near Southampton, have been advanced a further stage by the appointment at the last meeting of the U.D.C. of Messrs. May & Hawes, consulting engineers, to draw up a scheme for the establishment of an electric supply undertaking for the district.

**Lancaster.**—The T.C. has reduced the price of energy for private lighting from 4½d. to 4¼d. per unit.

**Llanfairfechan.**—The U.D.C. has decided to engage an expert to report on the feasibility of lighting the district with electricity, and the cost thereof.

**L. & N.W. Railway Bill, 1912.**—We are informed that in consequence of the widespread opposition, Clauses 34 to 37 in this Bill will be withdrawn by the promoters when it reaches the Committee stage.

**London.**—**HAMMERSMITH.**—The Electricity Committee has decided to enter into an agreement with the Notting Hill Engineering Co. for the supply of current for lighting purposes, and for the driving of the whole of the company's machinery. This agreement is subject to the company being charged, as a consumer whose accounts for power supplied amount to over £100 per annum, 1½d. per unit less 33½ per cent. discount for energy for both power and lighting purposes provided that the amount of energy used for lighting and charged at the rate mentioned shall not exceed 20 per cent. of the total consumption per annum. In order to comply with the requirements of the L.C.C. as to the provision of six testing stations, the Committee has decided to use the Council's underground sub-stations for the purpose, and to purchase the necessary recording instruments at a cost not to exceed £225.

**HACKNEY.**—The Finance Committee reports that the estimated surplus on the electricity undertaking for the year ending March 31st, 1912, will amount to £8,098, and that, in view of the substantial amount standing to the credit of the reserve fund, it has decided that for the half-year ending March 30th next £1,992 of the above-mentioned surplus shall be allocated to the credit of the general rate account, and that the balance of the profit for the current year be allocated to the credit of the general rate for the half-year ending March 31st, 1913. An expenditure not to exceed £80 has been authorised for the installation of six recording voltmeters and the provision of a standard voltmeter and recording leakage indicator (to be obtained from Elliott Bros. at a cost of £69 5s.), including the necessary fixing and connections, in order to comply with the requirements of the L.C.C. to establish testing stations for recording the pressure of supply.

**CAMBERWELL.**—A letter has been received by the B.C. from the B. of T. in connection with the Camberwell Electric Lighting Order, 1896, to the effect that the company had agreed when rendering its accounts for 1911 that it would remove from those of the Camberwell undertaking the item of £24,512 which had been charged to those accounts for many years under the heading of "Machinery." By this arrangement the Board hoped the litigation between the Council and the company would be satisfactorily concluded. A reply is to be sent to the effect that the Council notes with satisfaction the striking-out of the machinery item, and asking the Board to require the company to furnish the Council with detail particulars of the items amounting to nearly £12,000 charged to capital account and having reference to the purchase of lands.

**HORNSEY.**—At the last meeting of the Council, Councillor Double asked why it was that the estimated surplus of the undertaking for the year ending March 31st, 1913, was only £1,025, as against £1,738 for the 12 months ending March, 1912. In reply, Councillor Moritz said that the decrease was partly due to the increased cost of loans, and partly to alterations to arc lighting, which come out of revenue. At the same meeting it was decided to defer the matter of reducing the flat-rate charge. An amendment was moved by Alderman Wilson referring back the report, with a recommendation that the matter should be reconsidered in the autumn. In round figures, he said, they made last year £2,000 profit out of private

consumers, which he considered too much. A charge of 4½d. instead of 5d. per unit would help the undertaking considerably. This amendment was, however, negatived, as was also a further amendment to reduce the flat rate to 4¼d.

A conference has taken place between the B. of T. and representatives of the electric supply companies in London, to consider questions arising out of the strike, such as fuel supply and street lighting.

**MARYLEBONE.**—The general manager of the undertaking (Mr. A. H. Seabrook) reports a satisfactory increase in the sale of energy during the December quarter, the total number of units sold being 4,449,078, as against 4,112,087 for the corresponding period in 1910. Taking the gross income from the sale of energy to consumers and meter rentals, they had a total of £60,460, as against £57,890 in the previous year. The expenditure for the quarter amounted to £15,829, as against £12,386 in 1910.

**Loughborough.**—The T.C. has approved of the proposed agreement with the Brush Electrical Engineering Co. for supply to it of all the power required for the works, subject to certain minor alterations asked for by the company. The guaranteed minimum consumption is 1,250,000 units per annum, and the T.C. has agreed that in the event of the company not using the minimum (for which it has to pay) in one year, the units so paid for may be deducted from the excess over the minimum in the two following years. The Council also agreed to retain Mr. J. F. C. Snell as consulting engineer in connection with the proposed extensions of plant.

**Malling.**—The R.D.C. has assented to current being supplied to premises at Allington, including the Castle, by the Maidstone T.C.

**Nelson.**—The Electricity Committee has resolved, and the T.C. has confirmed the recommendation, that application be made to the L.G.B. for sanction to borrow £3,000, the sum estimated to be required during the next four years for mains and services, including £757 already expended.

**Newport (Mon.).**—The T.C. has arranged to supply electricity for power to the Cardiff Dry Dock Co., who have taken over the Tredegar Dry Dock. This will mean a demand for energy costing from £600 to £1,000 a year.

**Nuneaton.**—An inquiry has been held by the L.G.B. into the T.C.'s application for sanction to borrow £7,000 for new plant in connection with the electricity undertaking. There was no opposition.

**Oswestry.**—The Corporation has decided to have electric light installed in the Council chamber.

**Rochdale.**—The gas and electricity workers have written to the T.C. asking for an increase of wages. The wages of the ordinary labourers at the Gas and Electricity Works have been 5½d. per hour for a 55½ hours' week, which works out at 25s. 6d. weekly. The Union asked for an advance of ½d. per hour, which would represent 27s. 9d. per week. The Council in committee on the 7th inst. decided to grant an increase of 6d. per week, making the wages 26s., which, it is believed, will be accepted.

**Runcorn.**—The U.D.C. has resolved that electric pumping be substituted for the present steam plant at the Waterworks. It is estimated that the cost of pumping by electricity will be 1'26d. per 1,000 gallons as compared with 2d. at present. The Council has decided to proceed with the work of laying new and enlarged mains at a total cost of £2,000.

**St. Helens.**—The Electricity Committee of the T.C. has entered into an agreement to supply electricity for 10 years to the Greengate Brick and Tile Co., for an annual payment of £400. A scheme to supply the Parr district is to be prepared.

**Sheffield.**—The Corporation E.L. department, which recently found its output for motor-driving going up by leaps and bounds owing to the emergency adoption of electric driving in works which were short of coal, and which considered the question of restricting the supply, has made a "find" of 3,000 tons of coal, and so will be able to avoid the threatened curtailment of supply to power users.

**Stretford.**—The Electricity Committee has received an application from the Stretford Gas Co. for a supply of electricity, and has decided to give this at a flat rate of 1½d. per unit net subject to a minimum consumption of 25,000 units per annum for a period of five years.

**Stourport.**—The B. of T. has informed the U.D.C. that it has revoked the E.L. order of the Kidderminster and District E.L. Co., so far as it relates to the Council's area. As stated in a recent issue of the ELECTRICAL REVIEW, the Council supported the revocation of the order.

**Swindon.**—The T.C. has applied to the L.G.B. for a loan of £6,500 for the provision of a Diesel generating set at the electricity works.

**Torquay.**—The T.C. has decided to apply for a loan of £7,000 for mains extensions.

By a reduction in the price of energy, power consumers are to be supplied at a maximum price of 1½d. per unit net. Private consumers who have at least six 30-watt lamps connected, or whose premises are electrically lit throughout, are to be supplied with energy for any purpose but lighting or motive power, at a flat rate of 1d. per unit.



**Turton.**—The U.D.C. has received from the L.G.B. sanction to a loan of £4,450 for electricity purposes, and the scheme is to be proceeded with forthwith. Current is to be supplied to private persons at 5d. per unit.

**Uruguay.**—The Government is pushing forward its project for the nationalisation of all the electric power houses. The directors of the Montevideo electric power house have been instructed to prepare a report on all existing stations, and also the towns which have not got electric lighting. Tenders will be called for the erection and equipment of the new works.—*Review of the River Plate.*

**Wednesbury.**—The Corporation has decided, as an experiment, to light the lamps in the Market Place by electricity until the end of December.

**Wimbledon.**—The Electric Lighting Committee has decided to appoint sub-committees to consider the advisability of providing additional generating plant, and coal hoppers and conveying plant, at the electricity works. Sanctions have been received from the L.G.B. to the borrowing of £505 for cables laid in ducts, £1,515 for cables laid direct in ground, and £850 for transformer sub-stations and equipment.

**Winchester.**—The T.C. is recommended to light electrically 36 public lamps, at a cost of £2 13s. 3d. each per annum.

**Wolverhampton.**—The sum of £2,125 is to be transferred from the profits of the Corporation electricity undertaking for the year ending March 31st, 1912, to the credit of the improvement fund.

## TRAMWAY and RAILWAY NOTES.

**Bradford.**—In a special report on the subject of  $\frac{1}{2}$ d. fares, Mr. C. J. Spencer, general manager of the city tramways, is very hostile to the institution of any fares less than 1d. The 1d. fare, says Mr. Spencer, is the mainstay of the city's tramway undertaking and the source of the profit. After extensive inquiries, he reports that though not prepared to recommend a universal 1d. fare within the city as yet, he thinks the time may come when that would be practicable. Mr. Spencer is also strongly opposed to cheaper workmen's fares and passes. There is, however, considerable outcry in the city for cheaper fares for the short distance traveller.

**Brazil.**—The British Vice-Consul at Sao Joao d'el Rey reports that some local capitalists have under consideration the formation of an electric tramway company. As, however, the existing supply of electric power is insufficient for this purpose, it would be necessary to make a new dam and to install new turbines at the falls of Carandahy. The estimated cost is about £6,600.—*Board of Trade Journal.*

**Birkenhead.**—The T.C. has decided to purchase six new cars for the New Ferry route, at an estimated cost of £4,404. Each car will hold 80 passengers.

**Burton-on-Trent.**—The Tramways Committee has decided to expend £6,492 on track maintenance during the next five years.

**Canada.**—With a snowfall of 11 in. one night recently, the Ottawa street cars were very little delayed; 13 "sweepers" were constantly employed, which kept the tracks free of snow. When cars first started in Canada they did not run at all in winter, as it was thought impossible to keep the tracks clear of snow. Ottawa was the first city to use "sweepers," which proved a complete success. Now deep snowfalls have no terror for the cars.

**Continental Notes.**—GERMANY.—The proposed conversion by the Government of Baden of various subsidiary railways to electric traction has advanced a stage towards realisation. Among these is the Wiesenthal railway, which proceeds from Basle, via Lorrach to Schopfheim and Sackingen. The power is to be supplied by the hydro-electric works near August-Wyhlen, which is being built jointly by the town of Basle and the Rheinfelden Co., and is to be completed in a few months. The conductor network for the Wiesenthal railway has already been finished, and the working of the line is expected to be begun this year. The second State railway to be transformed is the Murgtal line, which connects Rastatt with Forbach via Germsbach. It is proposed to erect a State power station at a cost of £750,000 on the Baden-Wurtemberg frontier, in the vicinity of Raumunzach for the operation of the railway and for other purposes.

RUSSIA.—The city of Moscow intends, in the course of the present year, to raise a loan of 37,000,000 roubles for various public works, including the electric conversion of street tramways, enlargement of the power station, and increase of the rolling stock. For the latter purposes 7,900,000 roubles are allocated. The first four years' working of that portion of the city's tramways already electrified have given the most satisfactory results, the income having steadily risen from year to year.—*Elek. u. Maschinenbau.*

ITALY.—Plans are being prepared in respect of a projected electric tramway to connect the towns of Foggia and Lucera.

FRANCE.—A scheme for the electrification of the Paris suburban railways on the Ouest-Etat system is again under consideration. Among the lines it is proposed to electrify are those running from the Gare St. Lazare, Paris, to Auteuil, Issy, Versailles, St. Germain and Argenteuil.

SPAIN.—A concession has recently been granted in respect of a projected light electric railway between Renteria and the French frontier.

DENMARK.—Negotiations are pending between the city authorities of Aalborg, in Denmark, and the Allmanna Svenska Elektriska Aktiebolag for the establishment and working of an electric tramway system which will be supplied with continuous current from the municipal station.

**Crewe.**—The electrical engineer to the Corporation has been instructed to submit a report as to the cost of providing additional plant at the electricity works necessary for a service in the borough of four cars on the railless trolley system, and to obtain the latest information from Leeds and Bradford as regards cost of running and installation, with the extra cost (if any) entailed in road maintenance consequent upon the use of railless cars. Information is also to be obtained as to the initial outlay, upkeep, and general expenditure on four motor-buses.

**Dundee.**—On the ground that the cost of living has risen, the Corporation tramway men have made application for a wage increase of 2s. all round, and Mr. Peter Fisher, the manager, has been asked to report as to wages and conditions in other centres.

**Lanarkshire.**—It was stated at a meeting of Cambuslang P.C., that as a result of a petition signed by 600 householders in the Halfway district for a better service from the Lanarkshire Tramway Co., Mr. Moller, the general manager, is to lengthen the  $\frac{1}{2}$ d. stages, and to put on additional cars.

**London.**—The *Financial News* says it is frankly acknowledged that efforts are being made to bring the Metropolitan and Central London Railways within the District-Underground-L.G.O.C. combine. The chief purpose of the arrangement is said to be reduced operating expenses and greater efficiency.

The L.C.C. is to sell the portion of the Highgate Hill tramways in Hornsey, to the Middlesex C.C., for £6,377. A 30 years' agreement is to be entered into by the L.C.C. for working the route, at a yearly rent of £357.

**Manchester.**—In submitting the minutes of the Tramways Committee at the T.C. on the 6th inst., Alderman Bowers, chairman, asked the Council to confirm the Committee's proposal to rescind the resolution relating to the acceptance of a tender of an American firm (the Lorain Steel Co., of Johnstown, U.S.A.) for the supply of steel tramway rails, and that in lieu thereof the tender of Messrs. Walter Scott, Ltd., of Leeds, be accepted for the supply of 3,250 tons of steel tramway rails manufactured in accordance with the Sandberg process, at the price of £7 5s. per ton. The Council agreed. It was stated that the American rails were in every way suitable and would have cost between £2,000 and £3,000 less, but that they could not be delivered in time.

**Walsall.**—The net profit on the Corporation's tramway undertaking for the past year has amounted to £1,575, and it is proposed by the Tramways Committee that this shall be carried to the reserve fund, which will then total £29,956.

**West Ham.**—The Sub-Committee appointed to negotiate with adjoining authorities respecting tramway matters in the Council's Bill in Parliament reports that, in connection with lighting of the tramway route of the proposed extension to Wanstead, it has agreed to bear the cost of such lighting subject to the Wanstead Council agreeing to pay £37 10s. per annum towards such cost. With regard to the section relating to railless cars, and to the request of the Wanstead Council that such clause should be withdrawn from the Bill, it has decided not to accede to this, but, in lieu thereof, negotiations should be carried on with a view to an amendment of the clause being made providing that the power to run such vehicles should not be exercised in the Wanstead area without the consent of that authority.

**Wolverhampton.**—It has been decided to transfer £3,777 from the profits of the Corporation's tramway undertaking to the credit of the borough fund.

## TELEGRAPH and TELEPHONE NOTES.

**Anglo-French Telephone Service.**—An agreement regulating the telephone service between the United Kingdom and France was signed on February 5th, and was published last week. The charges will depend upon the situations of the centres in communication, and will range from 2 fr. 50 to 7 fr. 50, the latter fee being charged for communication with Scotland or Ireland.

**Attendance at Telephone Exchanges.**—The Post Office has issued a statement to the effect that it was the National Telephone Co.'s practice to refuse to open small exchanges in country districts unless the number of minimum subscriptions at £6 for measured-service, or £8 for residence unlimited-service, was sufficient to cover the cost of attendance at night as well as during the day, or unless subscribers would pay higher rates. The Post

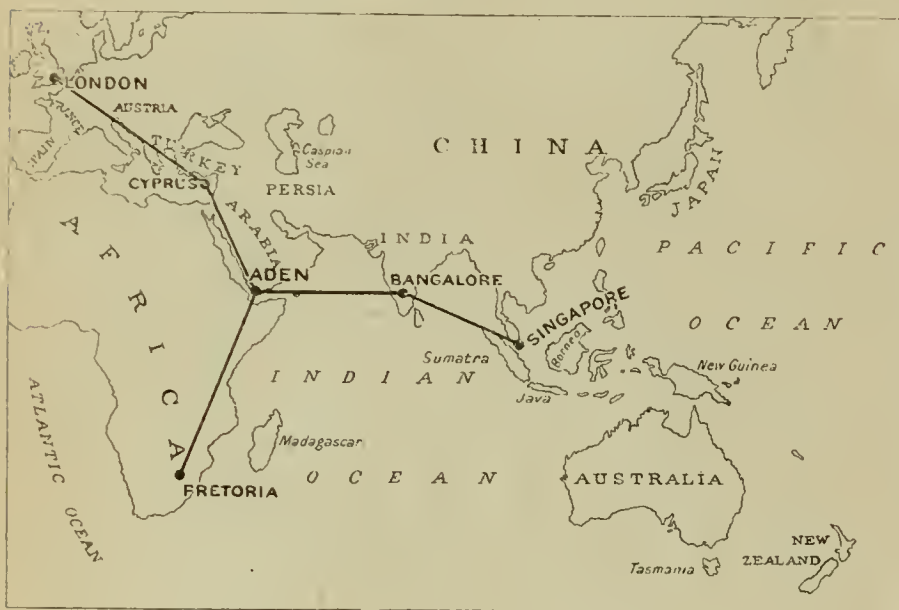


Office has opened many small exchanges in recent years in districts not served by the company for small groups of two or more subscribers at the minimum measured-service rate of £5 a year. In a comparatively few cases the only premises available are not occupied at night, but when night attendance is available small disturbance fees for the occasional night calls have been charged to prevent an increase in the loss incurred in providing day service. At all new exchanges the conditions offered to subscribers will include continuous service.

**Australia.**—The Postmaster-General has decided to commission Mr. J. Hesketh, chief electrical engineer to the department, to make a tour of the world for the purpose of learning the latest improved methods of dealing with large bodies of business, giving special attention to means adopted in the United States and Europe, and particularly with respect to automatic telephones and telegraphs. Pending the receipt of Mr. Hesketh's report, the new switchboard for Perth will be held back.—*Australian Mining Standard*.

**Compulsory Wireless Installations.**—According to the *Marconigraph*, the Spanish Government has decreed that from August 1st, 1912, all vessels carrying passengers or mails, or more than 50 persons on a trans-Atlantic voyage, shall be equipped with wireless telegraphy.

**Imperial Wireless Telegraph System.**—The Postmaster-General has accepted the tender of Marconi's Wireless Telegraph Co., Ltd., for the construction of all the long-distance wireless stations required for the first section of a comprehensive scheme embracing the whole Empire. The British and Colonial Governments have decided to proceed with the erection of stations at London, Egypt, Aden, Bangalore (India), Pretoria, and Singapore, at a cost of £60,000 each, exclusive of site, foundations and buildings. The Marconi Co. will operate the stations on behalf of the Government for the first six months, and will receive 10 per cent. of the gross receipts of all the long-distance stations for a period of 28 years from the completion of the first six stations. The Government, however, may terminate the agreement at the end of 18 years, in which event they will cease to have the right to use any of the company's patented processes or apparatus. The establishment of these stations will lead to the erection of others



in adjacent countries, and will thus tend to increase the traffic, and it is anticipated that their operation will reduce the rates now charged for telegraphic communication with and between the Colonies. A further advantage is that the Admiralty will be able to communicate quickly with the Fleet in almost any part of the world this side of Hong Kong. The accompanying map indicates the positions of the new stations, except that Egypt will be substituted for Cyprus. Australia and New Zealand are, providing their own stations, and will thus come into the chain while towards the west there is already a network of some 24 stations on British territory, besides the new Spanish stations and others in communication with Clifden and Poldhu. As regards the Australian stations, those at Melbourne and Sydney are ready, and one at Perth is nearly complete; others are to be erected at Hobart, Brisbane, Adelaide, Port Moresby (Papua), and Thursday Island. The present contract, which requires Parliamentary sanction, will probably be completed in 12 months.

**Guernsey Telephones.**—The revenue statement for the year ended December 31st, 1911, shows that working expenses amounted to £1,919, office and general expenses to £2,502, and depreciation and sinking fund payments to £1,813, making a total of £6,234; the revenue from all sources was £6,727, leaving a net profit balance of £493. The mileage of overhead wire (double) increased by 46 to 1,356 miles; underground wires remained practically stationary at 823 miles. The total number of calls was over 1½ million, averaging 2·2 per day per subscriber and 5 per day per public telephone. There were 1,628 subscribers' lines and 62 public telephones. The total capital expenditure amounts to £44,324, and the sinking-fund repayments to £2,174. The reserve funds for depreciation and contingencies amount to £15,804, but of this £11,352 has been expended on construction work; to replace the latter sum, £740 has been placed in a special sinking fund. The

net reserve, therefore, amounts to £5,192. The loan of 1905 was £32,000, of which £2,714 has been repaid.

**The World's Cables.**—Some interesting statistics regarding ocean cables are supplied by the *Elektrotechnische Nachrichten*. Germany possesses at present four cable companies. The Deutsch-Atlantische Telegraphen-gesellschaft owns two cable lines to America and one to Vigo, in Spain; the network has a length of 17,728 kilometres. The Deutsch-Amerikanische Co. has 10,718 kilometres of cables. The Deutsch-Niederländische Co.'s cable in the South Sea (Menado-Jap-Guam-Shanghai) has a length of 6,336 kilometres, and, finally, the Osteuropäische Co.'s cable between Constantza (in Roumania) and Constantinople has a length of 343 kilometres. In the aggregate these four companies, whose headquarters are in Cologne, control a network of 35,122 kilometres. The two French companies have a total cable length of 51,959 kilometres; the six American, 62,888 kilometres. In London are the seats of 18 English cable companies, which control a network of 241,327 kilometres. The English network is thus seven times the size of the German. The largest English company, the Eastern Telegraph, alone possesses 75,932 kilometres of cable. Two other companies, the Eastern Extension, Australasia and China Telegraph Co., and the Western Telegraph Co., have each networks 44,000 kilometres in extent. English pre-eminence is, therefore, overwhelming. The United States and France are pushing vigorously ahead. It is, says our contemporary, to be hoped that Germany will not rest satisfied with past exertions, but will continue to extend her cable network.

**Telephone Rates Abroad.**—In reply to a question in the House of Commons, the Postmaster-General stated that in Austria the unlimited-service rate for areas with more than 20,000 subscribers was £16 13s. a year. In Germany, the corresponding rate was £9, but the German Administration had stated that this rate was very unremunerative in the case of large users. In Switzerland all telephone service was given on a measured-rate basis. In New York the telephone service was given entirely on a measured-rate basis, and the unlimited-service rates were exceptional in other large cities. In Chicago and Boston these rates were about £26 a year. In London the unlimited-service rate was £17 a year, but this covered calls to distant parts of the area, which, in other countries, would be regarded as interurban or trunk calls, and for which special fees would have to be paid. Outside London, although there were many agreements in force at the obsolete unlimited-service rate of £10 a year, there had been no current unlimited-service rate for business connections since 1907, but for private residences there was still an unlimited-service rate of £8 a year.

**Telephones and Infection.**—As a result of renewed bacteriological investigations, the P.M.G. has announced that the transmission of tuberculosis through the medium of the telephone mouthpiece is practically impossible. This confirms the conclusions arrived at on previous occasions.

**Turkey.**—The telephone network of Constantinople, now under construction, is designed for 10,000 subscribers, but this figure may be raised to 18,000. To business houses the yearly charge for 550 conversations will be 137·5 fr. Private residents will pay 200 fr., and 20 centimes additional per conversation from one town to another. The network, the cost of which will be about £125,000, will, it is expected, be completed in about 20 months.—*L'Industrie Electrique*.

**West Indies.**—The Colonial Secretary has informed the Acting-Governor of British Guiana that the proposals contained in the report of the Royal Commission on Trade Relations between Canada and the West Indies, regarding the acquisition by the State of the cables owned by the companies operating in the West Indies, the duplication of cables, and the provision of wireless stations, cannot be carried out. He favours the erection of wireless stations by the local Governments where possible.

**Wireless Ocean Post.**—The Deutsche Betriebsgesellschaft für drahtlose Telegraphie has inaugurated a kind of ocean post of much service to travellers. The passenger on a boat, say from Lisbon to Rio, writes his letter on an ordinary telegram form and hands it to the telegraph official on board, who immediately wires it to the nearest ship going in the desired direction. The receiving ship records the message on a special form and encloses it in an envelope which is posted on arrival at port. The sender of the ocean letter is thus able to communicate with his correspondent in half the time he would have been able to do had he waited till he arrived at his destination. The cost of these ocean letters is five marks 30 words, plus 50 pfennigs for postage.—*Elek. u. Masch.*

The Blackpool tower, 500 ft. in height, is to be made a wireless station during the encampment of the West Lancs. Division of Territorials, near Blackpool, in August.—*The Marconigraph*.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Accrington.**—March 23rd. Stores for the Tramways Committee for a year. H. Pilling, general manager.



**Australia.**—VICTORIA.—April 2nd. 250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 2nd.—10,000 metal-filament lamps, for the Melbourne City Council. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" March 1st.

April 23rd.—2000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

QUEENSLAND.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" to-day.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

**Austria-Hungary.**—BANJALUKA (BOSNIA).—April 10th. Tenders are invited for the erection complete of a hydro-electric station on the Urba River, for the supply of light and power to the city and suburbs. Only tenders for the complete installation will be considered. Terms, 15 kronen, of the municipality. Deposit 20,000 kronen. Offers, with the superscription "Offert zur Zahl 1,146 für die Electricitätsanlage," to be addressed to the Stadt-magistrat, Banjaluka.—*Elek. u. Maschinenbau.*

**Belfast.**—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

**Belgium.**—April 1st. La Direction du Service Special d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels, is inviting tenders for the mechanical and electrical equipment of ten pumping stations in connection with the Charleroi Canal.

**Bray.**—March 19th. Stores, for the U.D.C. Electricity Works. See "Official Notices" March 8th.

**Brighouse.**—March 18th. 1,220 yd. of armoured cable, one feeder pillar and one feeder panel, for the T.C. See "Official Notices" March 8th.

**Bristol.**—March 28th. Separate tenders for the following, for the Guardians, for Southmead Workhouse:—(2) Boilers, economisers, steam pipes, &c. (deposit £5); (3) electric light generating plant; (4) electric light wiring and fittings; (5) laundry machinery, motors and appliances. Deposits for 3, 4 and 5, £2 each. J. J. Simpson, Clerk to the Guardians, St. Peter's Hospital.

**Canada.**—CALGARY.—March 20th. City Commissioners. One 2,500-KW. turbo-generator set, one 1,000-KW. synchronous motor-generator, 50-KW. motor-generator and 25-KW. exciter set. Deposit £500. Particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

March 30th.—One 1,500-KW. A.C. steam turbo-generating set, and one 500-KW. A.C. generator coupled to Diesel engine, for the City Commissioners of Moose Jaw, Saskatchewan. See "Official Notices" March 8th.

SASKATOON.—March 22nd. Water-tube boilers, induced draught plant, economisers, automatic stokers, steam feed pumps, one 2,000-KW. steam turbo-generator, turbine exciters, &c. Specification can be seen at the Commercial Intelligence Department, Board of Trade, London. Tenders to City Commissioners, Saskatoon, Saskatchewan. Deposit five per cent.

**Cape Town.**—April 24th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

**Cardiff.**—March 21st. Electric light sundries, for a year, for the City of Cardiff Mental Hospital, Whitchurch. Clerk and Steward of the Hospital.

**Edinburgh.**—March 23rd. Are lamp globes, cast-iron pipes and pavement boxes, and underground conduits, for the Electricity Department. Deposit 10s. Mr. F. A. Newington, engineer.

**France.**—PARIS.—March 21st. Supply and installation of six groups of electric pumps at the municipal waterworks on the Quai d'Austerlitz. Particulars, Ingenieur-en-chef, Service technique des Eaux et de l'Assainissement, 9, Place de l'Hôtel de Ville, Paris.

March 21st.—The municipal authorities of Moisy-le-Sea (Seine) are inviting tenders for an installation of electric lighting in the Town Hall.

**Gillingham.**—March 25th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" March 8th.

**Govan.**—March 26th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

**Greece.**—PIRAEUS.—March 31st. Three electric cranes of 10, 6 and 2 tons respectively for the Harbour Board. Com. Int. Dept., Board of Trade, London.

**Halifax.**—March 26th. Electrical fittings, for six months, for the Board of Guardians. A. T. Longbotham, clerk, Carlton Street.

**Hornsey.**—March 16th. Extension of dynamo and feeder switchboard, for the T.C. See "Official Notices" March 1st.

**Kingston-upon-Hull.**—March 26th. Extra-high-tension three-phase switchboard, and 20-ton overhead travelling crane, for the Corporation. See "Official Notices" March 8th.

**London.**—L.C.C.—Tenders are to be invited for two new engines for driving the mechanical stokers, coal conveyors, &c., at the Crossness pumping station.

March 26th.—Electrical installation at the Morden Terrace School. See "Official Notices" to-day.

KENSINGTON.—March 28th. Telephone installation at the Infirmary in Marloes Road. Clerk to Guardians, at the Infirmary.

WOOLWICH.—March 20th. 1,200-KW. three-phase turbo-alternator, with condensing plant, for the B.C. See "Official Notices" March 8th.

H.M. OFFICE OF WORKS.—March 26th. Carbon and metal-filament lamps for one year. See "Official Notices" to-day.

BETHNAL GREEN.—April 2nd. Telephone cables, for the B. of G. See "Official Notices" to-day.

**Merthyr Tydfil.**—March 28th. Electrical installation at the Municipal Secondary School, Cyfarthfa Castle. See "Official Notices" March 8th.

**New Zealand.**—May 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Rhodesia.**—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting London Agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

**Rosario.**—The *Review of the River Plate* says it is reported from Rosario that the municipality will shortly call for tenders for the extension of the electric tramways. Several firms are said to be interested in the business.

**Russia.**—In the course of the present year the Russian Postal Ministry intend to establish on the shores of the Arctic four wireless stations. Three stations will be fitted with ordinary apparatus, while the fourth will have a specially powerful equipment. The cost is estimated at 230,000 roubles. Tenders are to be called for. Further particulars may be had from the Ministry of Posts and Telegraphs, St. Petersburg.—*Elek. u. Masc.*

**Salford.**—March 21st. Main D.C. lighting and power switchboard, for the Corporation. See "Official Notices" March 8th. Electric, telephonic, and fire alarm installations at the Infirmary, for the Board of Guardians (over £2,000). Lacey & Sillar, engineers.

**Sweden.**—March 31st. The Electro-technical Department of the Stockholm Municipality are inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). For further particulars, see this column for March 1st.

**Tonbridge.**—March 18th. Cables, meters, arc lamp carbons, &c., for a year, for the U.D.C. H. W. Peach, clerk, Tonbridge Castle.

**Walthamstow.**—March 22nd. Water-tube boilers, feed pump and pipework, turbo-alternators or engine-driven alternators, motor generators, rotary converters and switchgear, for the U.D.C. See "Official Notices" March 8th.

**West Hartlepool.**—April 2nd. (a) 300-KW. storage battery and booster (b) rotary converting plant for the Corporation Electricity Department. See "Official Notices" to-day.

**Wigan.**—March 25th. Stores and materials for the Corporation Electric Light and Tramways Departments. See "Official Notices" to-day.

## CLOSED.

**Australia.**—The following contract acceptances are notified in the *Australian Mining Standard*:—

VICTORIA.—P.M.G.'s Department.—100 common-battery table telephones, at £2 6s. 4d. each, 10,000 protectors at 3s. 4d. each, 30 miles of telephone cable, 208 pairs conductors at £494 per mile.—Western Electric Co. (Aust.), Ltd.

QUEENSLAND.—P.M.G.'s Department.—Condensers, relays, resistance boxes, sounders, switches, &c.—British Insulated and Helsby Cables, Ltd.

20 spring inkwriters, at £16 11s. each; 20 sounders, Morse P.O. pattern, at £1 6s. each.—Siemens Bros. Dynamo Works, Ltd.

55 keys, platinum wire, relays, transmitters, &c.—I.R.G.P. and T. Works Co., Ltd.

**Belgium.**—La Société des Ateliers de Constructions Electriques, of Charleroi, last week submitted the lowest tender to the Belgian State Railway authorities in Brussels for the supply of a 25-ton electric travelling-crane. Three other firms competed for the order.



**Birkenhead.**—The Corporation has accepted the tender of Messrs. Siemens Bros.' Dynamo Works, Ltd., for six tramcars, for £4,404.

**Burnley.**—The Electricity Committee has accepted Messrs. Siemens Bros.' tender for lead-covered paper-insulated cable required for the tramway extension to Harle and Syke.

**Blackburn.**—The T.C. has accepted the following tenders for the electricity works:—

The Micanite and Insulators Co., Ltd.—Micanite sheet, red fibre sheet.  
R. W. Blackwell & Co., Ltd.—Insulating paint, P. & B. insulating tape, Kurkee insulating tape.  
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—India-rubber solution, self-adhesive compound tape.  
Siemens Bros. & Co., Ltd.—Plain linen tape.  
Vacuum Oil Co., Ltd.—Crank-chamber oil, cylinder oil.  
Electrical Apparatus Co.—Motor-starting switches.

**Bury.**—The Corporation has accepted the tender of Messrs. Ferranti, Ltd., for high-tension switchgear.

**Lexden and Winstree.**—The B. of G. received the following tenders for installing the electric light at the work-house:—

Williams & Co., Colchester..	..	..	..	(accepted)	£127
Joslins, Ltd., Colchester ..	..	..	..	..	185
Mr. Peacock ..	..	..	..	..	146

**Liverpool.**—Tenders for the supply of materials to the electric supply department for 12 months have been accepted by the Corporation as follows:—

Cables and accessories for street mains.—Callender's Cable and Construction Co., Ltd.  
Wood casings and sundries.—P. L. Jones & Co.  
C.I. troughs and boxes.—Whyman's Foundry Co., Ltd.; J. Allan, Sen., and Son, Ltd.; and E. Wilson & Co.  
Carbon filament lamps.—Electrical Co., Ltd.  
Insulated cables and wires.—Anchor Cable Co., Ltd.; British Insulated and Helsby Cables, Ltd.; and Ward & Goldstone.  
Carbons for arc lamps.—Wm. Geipel & Co.; General Electric Co., Ltd.  
Brass and copper castings.—R. Roberts & Sons.  
Electric fittings and sundries.—Sykes & Sugden; British Insulated and Helsby Cables, Ltd.; and Edison & Swan United Electric Light Co., Ltd.

The Corporation has accepted the tender of Messrs. R. Wearing and Sons, West Derby, Liverpool, for work and material required in connecting up the high-tension switch-rooms at Nos. 1 and 2 stations, and the erection of the tanks for the new Worthington cooling towers at the Lister Drive power station, the amount being £2,967.

**London.**—HAMMERSMITH.—The following are recommended for annual contracts for the Electricity Department:—

Arc lamps and globes.—City Glass Co. (five tenders submitted).  
Metal-filament lamps.—General Electric Co., Ltd. (Osrams), £183 (15 tenders for lamps of English manufacture; five foreign).  
Electrical goods.—Veritys, Ltd. (seven tenders).  
Meters (ordinary).—Ferranti, Ltd. (eight tenders).  
Meters (prepayment).—Ferranti, Ltd. (six tenders).  
Insulated wires.—General Electric Co., Ltd., £188 (24 tenders).  
Packing and jointing materials.—Hobdell, Way & Co. (11 tenders).  
Tubes and screws.—Pryke & Palmer (seven tenders).  
Joint boxes and connections.—W. Lucy & Co., £461 (four tenders).

The Committee has deferred the consideration of tenders for the supply of oils, cable ducts, and conduits and fittings, and does not recommend the acceptance of any tender for carbon-filament lamps or for carbons.

The Westinghouse Brake Co., Ltd., of London, manufacturers of the Westinghouse-Morse rocker-joint chain, have just received from the Port of London Authority what is thought to be the largest single order for chain drives on record in this country, viz., eight drives aggregating 880 H.P. Further progress has been made in the manufacture of these chain drives, which are now made in various pitches up to 3 in. A ten-page booklet of illustrations just issued relating to the system, shows, among other things, an illustration of 3 in. and  $\frac{1}{2}$  in. links.

**Manchester.**—The Corporation has accepted the tender of Messrs. W. Scott, Ltd., Leeds, for the supply of 3,250 tons steel tramway rails, manufactured according to the Sandberg process, at £7 5s. per ton. The Tramways Committee had previously decided to accept the tender of the Lorain Steel Co., Johnstown, U.S.A., but the latter could not deliver in May. The Committee therefore rescinded its decision, and accepted Messrs. Scott's tender.

**Newport (Mon.).**—The B. of G. on Saturday accepted the tender of Messrs. R. Alger & Sons, of Newport, for electric light fittings.

**Sheffield.**—The following tenders have been accepted by the T.C.:—

Biennial supply of electrical fittings.—David Ashton & Co.; T. A. Ashton and Co.; Taskers, Sons & Co.; Renton, Holdsworth & Co.  
36 high-tension switches.—A. Reyrolle & Co., Ltd., £392.  
Two water-tube boilers, mechanical stokers, economiser and all accessories, at Sheaf Street power station.—Stirling Boiler Co., Ltd., £5,312.

**Torquay.**—The T.C. has accepted the tender of Mr. H. A. Bessemer, at £272, for wiring and installing electric light at the new pavilion.

**Wolverhampton.**—The Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for additional high and low-tension switchgear for the Chillington sub-station, at an estimated cost of £375. An additional transformer of not less than 300 kw. capacity is to be purchased and erected at the same sub-station, at an approximate cost of £250.

## FORTHCOMING EVENTS.

**Institution of Civil Engineers.**—Friday, March 15th.—Students' meeting. At 8 p.m. Paper on "The Heat Value of Fuels," by Mr. A. E. Gladwin.

**Junior Institution of Engineers.**—Friday, March 15th. At 8.15 p.m. At 39, Victoria Street, S.W. Paper on "Crude Oil Engines," by Mr. A. H. Weston.  
Saturday, March 16th.—At 10 a.m. Visit to the Lot's Road power station, Chelsea.

**Royal Institution.**—Friday, March 15th. At 9 p.m. Discourse on "The Origin of Radium," by Mr. F. Soddy.  
Saturday, March 16th.—At 8 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture IV.)  
Saturday, March 23rd.—At 8 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture V.)

**Institution of Mechanical Engineers.**—Friday, March 15th. At 8 p.m. Paper on "The Diesel Oil Engine, and its Industrial Importance, particularly for Great Britain," by Dr. R. Diesel.

**South-Western Polytechnic.**—Friday, March 15th. At 8 p.m. Distribution of prizes and certificates by Sir D. Gill.

**Northampton Institute Engineering Society.**—Saturday, March 16th (not March 9th, as stated in our last issue). At 7 p.m. for 7.30 p.m. At the Holborn Restaurant. Annual dinner.

**Institution of Electrical Engineers (Students' Section).**—Saturday, March 16th. At 7 p.m. At the Trocadero Restaurant. Eighth annual dinner.

**Illuminating Engineering Society.**—Tuesday, March 19th. At 8 p.m. At the Royal Society of Arts. Papers on "The Lighting of Printing Works and Offices," by Messrs. F. W. Goodenough and Justus Eck.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Tuesday, March 19th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "High-Speed Radio-Telegraphy," by Mr. B. A. Robinson.

**Institution of Electrical Engineers (London).**—Thursday, March 21st. At 8 p.m. Discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes," to be opened by Mr. S. Z. de Ferranti.

**Physical Society.**—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A 2,000-Frequency Alternator," by Mr. W. Duddell; "A New Method of Comparing Capacities," by Mr. A. Campbell; and "The Coefficients of Cubical Expansion of Fused Silica and Mercury," by Mr. H. Donaldson.

**Association of Engineers-in-Charge.**—Saturday, March 23rd. At 6.30 p.m. At the Holborn Restaurant. Annual dinner.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 18th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Tuesday, March 19th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.

Thursday, March 21st.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Friday, March 22nd.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.

Saturday, March 23rd.—Mobilisation week-end run at Fort Coalhouse for "D" Company. Parade at Fenchurch Street Station (L.T. and Southend Railway) at 3.10 p.m. Dress: Service dress, putties, great-coats, belts and haversacks. No arms will be taken.

Saturday, March 23rd.—Annual course of musketry. The shoot arranged for this date is cancelled.

Shere.—The week-end run at Shere will be held on 23rd inst. for "A" and "B" Companies. Members wishing to attend please notify headquarters early. Time of trains, &c., will be notified by postcard.

(Signed) P. H. S. CAMPBELL, Capt. R.E. and Adjt.,

For Officer commanding L.E.E.

## NOTES.

**Parliamentary.**—AGRICULTURAL LIGHT RAILWAYS.—Mr. Rowntree asked the President of the Board of Agriculture (1) whether his attention had been called to the development of agricultural light railways in Belgium and other countries since 1886, and whether he would be prepared to appoint a small committee to report as to what steps it would be necessary to take to establish in this country an effective system of agricultural light railways, and (2) whether his attention had been called to the small development of agricultural light railways under the Light Railways Act of 1896, and whether the commissioners appointed under that Act had reported to him as to the cause of the comparative failure of the Act to develop agricultural light railways in this country.

Mr. Buxton replied that the Board of Trade was fully acquainted with the position of light railways in Belgium and he did not think the appointment of a committee would serve any useful purpose. The Light Railway Commissioners had from time to time in their annual reports referred to the question of the comparatively slow development of agricultural light railways in this country, and he hoped that the Light Railways Bill which he had introduced would facilitate the promotion of light railway undertakings.

**COMMITTEE.**—A Select Committee consisting of Sir Luke White, Mr. J. E. Gordon, Sir C. Quilter and Mr. Millan has been appointed to consider the following Bills:—London Electric Railways, Edgware and Hampstead Railway, Metropolitan District Railway and Ramebottom U.D.C. Railway.



**METROPOLITAN ELECTRIC TRAMWAYS BILL.**—The *Times* reports that the order for the second reading of the Metropolitan Electric Tramways Bill, notices for the rejection of which stood in the names of six hon. members representing both sides of the House, was read in the House of Commons on 11th inst. and discharged, and the Bill withdrawn.

**L.C.C.—London United Tramways Award.**—According to the *Daily Telegraph*, the sum to be paid to the London United Tramways by the L.C.C. for the Company's tramways in the County of London, exclusive of any allowances for past or future profits, or any compensation for compulsory sale, or other consideration whatsoever, is £248,653, divided as follows:—

Permanent way and metals ... ..	£33,964
Overhead electrical equipment ... ..	2,803
Ducts, cables, and manholes... ..	8,941
Cars ... ..	21,125
Special Expenditure:—	
Deposit with Hammersmith B.C. ... ..	1,000
Proportion of payment to Treasury ... ..	1,359
Street widenings ... ..	35,462
Road lowerings ... ..	1,250
Parliamentary expenses ... ..	15,500
Chiswick depot and power station ... ..	127,249
Total ... ..	£248,653

The L.C.C. is to pay the whole of the costs.

It may be pointed out, with respect to the item concerning the ducts, cables, and manholes, that the tramway company claim £10,437 instead of the £8,941 allowed. The company further maintain that they are entitled to a larger proportion of the payment of £10,000 made to the Treasury than the £1,359 awarded by the referee. They further claim £4,500 paid by them to the Fulham District Board, and another £1,000 paid to the same body.

In respect of the above items, the referee's award has been stated in the form of a special case, as has also his award with regard to the cost of street widenings and legislative expenses. Should the L.C.C. succeed in getting the award for the latter items set aside, the referee has determined that the Council shall pay, on behalf of the first item, £4,000 only, and with regard to the second item of £15,500 nothing at all.

**Building Exhibition. Manchester.**—Of the two Exhibitions at present open in Manchester, perhaps the one at the City Hall will appeal most to the electrical engineer. Progress is marked by the fact that practically all wood-working machines and tools are separately driven by electric motors. The tendency in all modern works is for a separate and electrical drive for every unit, and that this practice makes for highest plant efficiency is now well known. A distinct departure from ordinary practice is noted in the Marino electro-galvanizing process. Unlike the general method of coating iron with zinc, which consists of dipping the iron into a bath of molten zinc, the process is a cold one.

In the process, mineral acids are entirely eliminated, and by the use of an effective reducing agent in the solution the surface of the iron is rid of any film of oxide which might be present. The zinc is then deposited on a clean surface, ensuring absolute adhesion. The solution being rich in the required mineral, on account of its great solvent power, and as it cannot be decomposed under ordinary conditions, the rate of depositing may be high. It is possible to deposit 1 to 2 gm. of zinc per ampere-hour at a pressure of 2 volts, so that the efficiency is nearly 100 per cent. There being no heat required, it is possible to galvanize springs, &c., as the qualities of the iron are not impaired. Many interesting examples are on view, including valve bodies, nuts, screws, &c.

A number of interesting push-button service lifts for hotels, &c., by Brady & Co., Manchester, are to be seen. Instead of wire ropes steel tapes are employed, being greased as they pass through the gear bedplates. Since no balance weight is required, the lifts are worth consideration.

**Legal.**—THE OSRAM LAMP WORKS, LTD., v. THE Z. MANUFACTURING CO., LTD.—This patent action was mentioned to Mr. Justice Neville, in the Chancery Division, again on Wednesday, March 13th. Mr. Walter, who represented the plaintiffs, reminded his Lordship that permission had been given to apply to fix a day for hearing after March 12th, and Mr. T. Terrill, for the defendants, said they were most anxious to have the case tried during the present sittings, and if his Lordship could see his way to take it, they would be glad.

His Lordship asked as to the probable duration of the hearing, and Mr. Terrill said he did not think it ought to take long, as his Lordship was familiar with the patent.

Mr. Walter did not know that. The question in this action, he said, was not the same as that raised in the previous action before his Lordship.

His Lordship said he could not take the case before the 24th or 25th of the present month.

Mr. Terrill said the hearing would take four or five days, but Mr. Walter said his learned friend was sanguine. If he had said 8 or 10 he thought it would have been nearer the mark.

Mr. Justice Parker said if the parties did not mind the case being part heard, he would start it at these sittings, but he did not see how it could be finished before Easter.

Mr. Terrill said he would much rather it was not opened these sittings, if it could not be concluded.

Accordingly, the hearing stands adjourned until next sittings, when, in the ordinary course, it will come before Mr. Justice Warrington.

**DECISION IN THE ACTION AGAINST SOUTH SHIELDS CORPORATION.**—The hearing of the action in which John William Young and his wife claimed £80 damages from the South Shields Corporation in respect of shock sustained by Mrs. Young, through a flash of electricity caused by the fusing of an overhead tramway wire, at the foot of Fowler Street, on July 8th last, was resumed by Judge Bonney, at a special sitting of South Shields County Court, on 11th inst. The circumstances were reported in our issue of February 16th.

On 11th inst. further evidence was called on behalf of the plaintiff.

Mr. Meynell submitted that there was no case against the defendants. There was no actual injury to the lady, and no evidence of anything to cause her reasonable fear for her safety. Secondly, he argued that there had been no negligence on the part of the defendants. The tram conductor, he pointed out, was on the roof of the car holding the trolley, and this was a precaution that was ordinarily taken in Shields. Trolley poles were liable to come off the overhead wires at junctions, and there was no means known to stop it.

Evidence was given by the motorman, the conductor of the car, Mr. L. Harvey, manager of the tramways, and others; and after a lengthy hearing, the Judge found that no negligence had been proved, and gave judgment for the Corporation.

**Domestic Electricity.**—In connection with the discussion on the extension of domestic uses of electricity, to be opened by the President of the Institution of Electrical Engineers on the 21st inst., it is a matter of great importance to know why it is that electricity is not more largely used for domestic purposes. It is the object of the proposed discussion to find out and to bring about a clear understanding of all the causes and reasons which militate against its general adoption. Electrical men will then be in a position to discuss remedies and to take concerted action in the interests of electricity, and to the great benefit of the public. Some suggested causes are as follows: Price of energy; cost of electricity-using apparatus (radiators, cookers, iron-heaters, &c.); failure of electricity-using apparatus; want of knowledge of what electricity can do economically and well; the great facilities given by the suppliers of gas in the way of hiring apparatus on very low terms to induce consumption; cheap coal, cheap gas, cheap oil; natural objection to change; installation of houses; cost of service from street where more power required; the unsatisfactory tenure of electrical undertaking, which renders the raising of capital for giving a cheap supply so difficult; also want of good enough business methods in pushing sales; want of educational work; want of advertising.

Among the uses of electricity, other than lighting, may be cited cooking, water-heating, heating rooms, ironing, vacuum-cleaner driving, and small power uses for boot-cleaning; knife-cleaning; refrigerating; pumping, &c., also the operation of lifts.

We touch on this matter in our "Leaderette" columns this week.

**Paisley Tramways Staff.**—On Thursday last week, the Paisley District Tramways Co. held the last of their monthly dances for the winter. Several interesting presentations took place, the storekeeper being presented with a pipe, and Miss Alexander (Traffic Department) with a gold pendant and chain, for their services in connection with the dances during the winter.

On the previous day the final lecture for the season was delivered in connection with the Paisley District Tramwaymen's Recreation Club. Dr. Bruce, the leader of the Scottish National Antarctic Expedition, lectured on "A Trip to the Antarctic." There were present some 500 tramwaymen and friends.

**Electricity Supply Rifle League.**—At a meeting held at the Shoreditch Electricity Works on Tuesday last week, it was decided to form a Miniature Rifle League, as above, confined to members of the electricity supply stations in the London district. A circular letter had been sent to 50 stations, and replies had been received from 28. It was found that rifle clubs existed at the Central, Hackney, Ilford, Shoreditch, Stepney and Westminster works, whilst the question of forming clubs was under consideration at half-a-dozen other works. Representatives of Hackney, Ilford, Shoreditch and Westminster attended the above meeting, and decided to form a League at once, to be composed of teams from the six aforementioned clubs. Draft rules were drawn up to be circulated amongst the interested clubs, and a further meeting will be held next week at the Westminster Electricity Works to confirm them. Teams will consist of eight men, six to count, and it is hoped to shoot the majority of the matches shoulder to shoulder at 25 yards' range. Communications on the subject should be addressed to Mr. E. Mathews, hon. sec., 396, Mare Street, Hackney.

**Fuel Economy and Bonuses.**—A Central-Station Manager writes:—"May I suggest, through the medium of your useful and appreciated columns, that the present period of high fuel prices might prove a seasonable opportunity in which to ventilate by correspondence the question of saving fuel by bonuses on economies effected by improvements in firemen's work, &c.?"

Our "Correspondence" columns are open to any of our readers who wish to adopt this timely suggestion.

We understand that Mr. Crowther, as a result of experiments, has arranged with the scavenging department to deliver to the Worksop electricity works a sufficient quantity of dry refuse to keep the plant running for 16 hours per day out of the 24, reducing the weekly coal consumption by 50 per cent.

**Indian Wiring Rules.**—A revised series of wiring rules for electrical installations has lately been issued by the Bombay Fire Insurance Association.



**Imports and Exports in February.**—The trade returns for February (which this year had one working day more than the corresponding month of 1911) show an increase in value of imports by £3,648,463, an advance of £1,837,209 in exports, and an increase of £730,463 in re-exports.

*Electrical goods and apparatus imported* (other than machinery and telegraph and telephone wire) advanced by £29,251, making the figure for the month £134,995, the increase for the year so far being £43,442.

*Machinery imported* advanced by £58,376 to £509,569.

*Electrical goods and apparatus exported* increased by £27,261 to £252,989, the increase for the year so far being £99,356.

*Machinery exported* advanced by £118,293 to £2,346,656.

**The Lighting of Railway Trains.**—In his report to the Board of Trade on a collision which occurred on January 29th between two passenger trains near Saltley, on the Midland Railway, Major Pringle points out once more the liability of gas-lighted coaches to take fire. In the case under consideration, "the escaping gas ignited in some way, difficult to ascertain, and set fire to the floor of the vehicle. Fortunately a number of men from the adjoining goods yards were quickly on the spot, and the fire was extinguished with water from the express engine before it obtained any strong hold upon the woodwork. Fortunately also, there was no wind to fan the flames, and there was comparatively little difficulty in getting access to the fire, as the coach kept an upright position on the rails. But the circumstances clearly point to the desirability of either abandoning the use of gas for lighting purposes or of making such structural alterations and additions which will lessen the liability of fire arising therefrom."

In our opinion, to strengthen the gas cylinders is mere temporising; the only sure remedy is to root them out, and adopt electric lighting.

**The Bermondsey Council and the L.C.C.**—Mr. T. C. Ekin, of the L.G.B., held an inquiry on Monday with reference to the refusal of the L.C.C. to sanction the borrowing of £18,563 for the extension of the Council's electricity undertaking. The Town Clerk (Mr. F. Ryall) represented the Bermondsey Borough Council; Mr. Bullivant the L.C.C.; and Mr. Sydney Morse the Bermondsey Municipal Association, who opposed the loan.

Mr. Bullivant at the outset explained that it was not the intention of the County Council to call any witnesses. They had refused to sanction the loan because the B.C. had declined to supply certain information. He held that after the present inquiry the L.G.B. must refer the matter to the County Council for their final decision.

The Inspector said he considered that the refusal of the L.C.C. to sanction the loan was an unqualified refusal.

The Town Clerk gave the usual statistical information, and said so far there had been spent on the work for which the loan had not been sanctioned, £7,000. Application for the loan was made to the L.C.C. on March 7th, 1911, and the tenders for the plant and buildings were accepted by the B.C. on June 10th. The refusal of the L.C.C. to sanction the loan was not notified until November 14th. The L.C.C. desired certain information, which was not supplied. The application for the loan was made on the same forms and in the identical terms as former loans, which had been invariably sanctioned. In 1907 the maximum demand for electricity was 730 kW., but in 1910 it had risen to 1,834 kW.; during the last 12 months the demand had fallen to 1,701 kW. The cost of generating in 1907 was 2'56d. per unit, but in 1910 it was 0'65d., which was the second lowest in London, Hackney being the lowest. In the first three years of the undertaking, 1901-3, there was a loss of £2,405, but the profits since then had amounted to £7,319. The amount of the loss had been made up from the rates, no portion of the profits being used for that purpose. Of the profits, £3,522 had been invested; £3,006 was reserve for capital works; £633 charged on revenue; and £180 unattached. They had no depreciation fund beyond the annual repayment of loans.

The Inspector remarked that he noticed the amount for public lighting in the accounts was very large—£4,019—or something like 16 per cent., and the Town Clerk replied that the charge for public lighting was 1'75d. per unit, about the average for London. In Stoke Newington it was 2'69d., and in Hackney 1'11d.

Mr. J. Buckman, the borough treasurer, was called, and said he considered that the L.C.C. were going outside their bounds, and asking for information they were not entitled to.

Mr. Bullivant asked that two letters offering a bulk supply from the County of London Electric Supply Co. should be read. Terms had been offered to the Borough Council, which had been refused, and they were entitled to know what those terms were.—The Inspector ruled that they were confidential documents, and he could not call upon the Council to disclose them; no doubt the Town Clerk would supply him with copies of the letters; the Town Clerk agreed.

Mr. Morse said the whole contention was that it would be much cheaper for the Council to obtain a bulk supply than to extend their plant. He then read the letters from the County of London Electric Supply Co. The first, dated December 18th, stated that the company was prepared to supply the Council with current for all-night public lighting in St. Olave's parish, Tooley Street, on the basis of ½d. per unit. The second letter stated that the company would supply and install a rotary converter having a capacity of 800 kW. in the council's generating station, the council undertaking the cleaning and running of same, and in view of guaranteeing a load factor of not less than 40 per cent. with a maximum demand of 800 kW. on the particular plant, the company would charge the low rate of ½d. per unit for L.T. direct current. The arrangement would be for a term

of years, say, five to commence with, with a minimum annual consumption to be mutually agreed on. A third letter offered to supply at £3 10s. per kW., plus 0'33d. per unit, with a guarantee of a million units annually.

Mr. Buckman said the committee, he understood, considered these offers, and did not regard them as satisfactory.

Mr. Morse: We have examples that you are selling electricity at about half what it costs to generate.

The Inspector said the average cost of generating for 1910 was 1'28d., and the average price 1'35d.

Mr. Morse: There must be some mistake.

The Inspector: I must abide by these figures unless you can prove that they are wrong.

In reply to Mr. W. H. Ecroyd, L.C.C., Mr. Buckman said this was the first time the London County Council had asked for information about private companies, and the first time a loan had been refused because private information had not been given.

Mr. W. E. J. Heenan, the electrical engineer, gave details of the new plant, &c. These were as follows:—1,250 kW. steam dynamo, £6,052; foundations, £185; entrance to engine room, £80; condensing plant to deal with 40,000 lb. of steam, £5,030; foundations, £135; three water-tube boilers, each capable of evaporating 15,000 lb. of steam, £5,830; foundations, £310; boiler-feed pump, £350; foundations, £20; alterations to boiler house, £879. Contracts for these had been accepted, and some of the work had been done.

The Inspector: Suppose sanction is not given for the loan. What is going to occur?

The Town Clerk: If we do not get the sanction it simply means that we shall have to have an additional 5d. rate.

Mr. Heenan further said the company's offer was out of the question on the ground of cost.

Mr. Morse: If you once began to take a bulk supply from the company, there is no reason why you should not take your whole supply from them.

Mr. Owen Smith, a director of Haye's Wharf, Ltd., Bermondsey, was also called to give evidence against the application for the loan; he said he was a member of the Committee of the Municipal Association, which represented a large proportion of the ratepayers, and thought the matter had not received due consideration from the Council.

On Tuesday Mr. C. P. Sparks, consulting engineer to the County of London Electric Supply Co., at the second day's proceedings, gave evidence opposing the granting of the loan. He said a part of the present plant at the Bermondsey station was now, no doubt, obsolete, although only a part of the loan sanctioned for its purchase was paid off. If there was a demand to any great extent for electricity in Bermondsey in the near future the Council's present site would have to be abandoned, and he was sure the present station, along with the plant, would be obsolete, and of no use in 20 years' time. Bermondsey was an important industrial area in which power was required.

The Inspector: Practically 75 per cent. of the electricity supplied by the Council at the present time is for power.

Witness said in the future it would be even greater. He thought that the proposed 1,250-kW. dynamo might last for 20 years, if the work did not outgrow the plant; but in Bermondsey they had a developing business, and he thought 10 years would be an extreme period for the life of this plant. And if a plant would only last 10 years, the loans should be paid in those years. They would have to face the fact of an increased price of coal, but the County of London Electric Supply Co. in their offer for five years, would take the risk of any increase in the price of coal. The possibility was that at the end of five years the Council would be able to enter into a new contract on more favourable terms. The Council would get a very much lower price if the public lighting was open to public tender. In the parish of St. Olaves an offer had been made to the Council to supply current for street lighting at ½d. per unit, but that had not been accepted. Supposing the price for public lighting had been reduced to ¾d. per unit, it would have entirely wiped out any profit balance the Council showed. He suggested that ¾d. was the highest figure that should be charged for public lighting, for if tenders were accepted in opposition to the Council, it would be reduced to ½d. per unit. The whole of the Council's balance and reserve fund had grown through the overcharging for public lighting.

Mr. H. R. J. Burstall, consulting engineer to the London Electric Supply Corporation, corroborated.

Councillor Eddis, secretary of the Bermondsey Municipal Association, handed in a list showing that the subscribers to his Association numbered 207.

The Town Clerk: Only 207, out of a total population of 125,000.

Counsel having addressed the Inspector, the inquiry closed in the usual way.

**Copper.**—The returns for February, now to hand, embodied in Messrs. Merton's statistical circular, show brisker demand and consequent rise in prices. It will be interesting to compare these with returns for the present month. The visible supplies, 51,507 tons, are 4,063 tons less than those for the preceding month-end. Supplies from North America to this country are nearly one-third above the average, from Spain just above, from Chili well over, and from Australia rather below. Deliveries, at 52,743 tons, are the highest for some years, the average for this year not exceeding 42,300 tons. The stock of fine copper in Rotterdam has decreased 1,300 tons, and that in Hamburg 300 tons. The world's visible supply for the end of January, excluding Holland and Germany, was 85,159 tons. The American supplies on the same date amounted to 29,589 tons, a reduction of 10,346 tons on the returns for December 31st.



**Appointments Vacant.**—Wireless telegraph operator, for the Government station, Fiji Islands (£200); engineering and mechanical draughtsman, for the Corporation Electricity Department, Stoke-on-Trent (£104); mains superintendent for the Borough Electricity Department, Plymouth (£3); mains assistant and meter tester for the Borough Electricity Department, Bridlington (£90). See our advertisement pages to-day.

**International Smoke Abatement Exhibition.**—The following is the programme of conferences and lectures to be held during the run of the Exhibition at the Royal Agricultural Hall:—

**SECTION A.**—March 26th, 1912, at 11 a.m. and 2.30 p.m. Chairman, Sir William B. Richmond, K.C.B., R.A. (President, Coal Smoke Abatement Society.)

*Smoke Pollution.*—(1) Its economical and artistic effects. (2) Effects on animal and plant life.

**SECTION B.**—March 27th, 1912, at 11 a.m. and 2.30 p.m. Chairman, Sir William Ramsay, K.C.B., F.R.S.

*Smoke Abatement.*—(1) Work done and to be done in organising preventive action.

(2) The Physics of Smoke Abatement. Apparatus and practical expedients for the abolition of smoke, both industrial and domestic.

**SECTION C.**—March 28th, 1912, at 11 a.m. and 5 p.m. Chairman, Lord Justice Fletcher Moulton.

*Law and Legislation.*—(1) The existing law and its administration, both at home and abroad. Comparative legislation.

(2) Proposed new legislation.

**Coal Strike.**—As we go to press the prospects of an early settlement are not very encouraging. All that can be said is that there is a movement in the right direction. Meanwhile the industrial position throughout the whole country is becoming desperately serious, and whenever peace may come it is certain that we shall feel the effects of the calamity long after normal working of the collieries is resumed. The users of power continue to feel the benefit of the electric drive and their consequently decreased immediate dependence upon coal. Electricity suppliers in most places will be able to meet the normal demand for some weeks yet, but in places circulars have been issued suggesting the exercise of economy. In the House of Commons notices have been issued by the Serjeant-at-Arms suggesting the exercise of special economy in the use of electric current and gas in all rooms. Factory owners in various places have been urged to put their men on part time spread over a longer period rather than to work full time and then abruptly close.

**Institution and Lecture Notes.**—Mr. W. H. Telfer, Glasgow, general manager of the Wilson's & Clyde Coal Co., recently delivered an address on "Electricity in Mining Operations" to a meeting of colliery managers and mining electrical engineers at Hamilton. Mr. Telfer said that in Lanarkshire, more extensively, and, he believed, more successfully than in any other coalfield, they had been able to work very thin seams of coal, thanks to the adoption of electric power for coal cutting and coal-face conveyors. One of the greatest dangers attending the use of electricity was the risk of fire, but even that risk could be pretty well eliminated. Where they had a coal seam which gave off gas very freely, or was subject to outbursts of gas, or produced a lot of fine explosive dust in working, electricity should not be used at the face at all. If power was required at the face in such a seam, compressed air could be used. For a very gassy mine where a lot of power was required all over underground, he believed strongly in having both compressed air and electricity. In the majority of pits worked with safety lamps, the gas given off was easily diluted and carried away. In such cases, and provided there was not explosive dust in quantity, he considered an electric motor as safe as a safety lamp.

**PRINTING CRAFTS GUILD.**—A paper was recently read by Mr. R. F. Singleton before this society at the Manchester School of Technology, on the subject of "Electrical Driving: Its Application to Wharfedale and Platen Printing Machines." The author advocated individual driving of such machines and placed the saving of power by dispensing with belting and shafting at from 25 to 70 per cent. A comparison of power costs by Manchester gas and electricity was included, favouring the latter. In discussing the paper, Mr. Fishenden expressed a preference for open-type motors, boxed in, as enclosed-type machines, besides being less efficient, were liable to accumulate dust and oil, and in case of internal smouldering, were difficult to get at. A Mr. McVay (according to the *British and Colonial Printer and Stationer*), argued that the gas engine had advantages in its overload capacity, and that a 5-H.P. motor would be required where a 2-H.P. gas engine would be sufficient! Possibly the reporter has transposed his remarks.

**INSTITUTION OF ELECTRICAL ENGINEERS (LONDON).**—A lecture was to be given last night by Messrs. T. Stevens and J. B. Cox, entitled "Notes on an Avalanche which occurred on the Wellington (U.S.A.) Tunnel Electric Railway," with lantern slides.

**INSTITUTION OF ELECTRICAL ENGINEERS (DUBLIN SECTION).**—A meeting of the Section was to be held yesterday to hear a paper on "Peat as Gas-engine Fuel: New Developments," by Mr. Thomas Tomlinson.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—At a meeting of the West of Scotland Branch recently, a paper was read by Mr. J. R. Laird, Niddrie, on "Electricity Applied to the Scottish Shale Oil Industry." Mr. Laird explained that until 1901, the oil works in Scotland had not centralised their power. In 1901, however, the pioneer scheme for electrifying oil works was carried out by the Oakbank Oil Co., Ltd. Since then almost all the Scottish oil companies had centralised their power and adopted electrical dis-

tribution. This had revolutionised the industry, and enabled the local firms to compete with oil companies abroad, who had not to do any mining or retorting, but simply to bore for the oil.

A lecture was given before the Leeds University Engineering Society on the 4th inst., by Mr. W. E. French, on the subject of "Safety Devices applied to Electrical Apparatus used in Mines."

Mr. T. McCall White last week submitted a paper on "Electric Motors and their Application to Power Driving" at a meeting of the Manchester Association of Students attached to the Institution of Civil Engineers.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Hammersmith B.C. has before it a scheme, prepared as the result of an investigation of municipal salaries in London, under which it is proposed to raise the maximum salary of the borough electrical engineer from £600 to £750. It appears that the present salary of Mr. G. G. BELL, who has held the office for between 15 and 16 years, is £700. The maximum for the chief assistant engineer is to be advanced from £300 to £400 by increments of £20 (Mr. F. HILL's present salary, after nearly 15 years' service, is £350); the maximum of the station superintendent is to be raised from £300 to £350 by increments of £10 (Mr. R. H. PATERSON's present salary is £300).

At a meeting of the Dundee Town Council, Mr. N. Macdonald objected to the salary of Mr. H. RICHARDSON, the Corporation electrical engineer, being raised by £50, and moved disapproval of the recommendation. Mr. J. M. Nairn, convener of the Electricity Committee, moved that the increase be granted, remarking that if any man deserved an increase it was Mr. Richardson, who had done splendid work for the city. On a vote, the increase was granted by 20 votes to 8.

The Electric Light Committee for the Bath T.C. has again recommended the Council to increase the salary of Mr. C. A. NETHERCOT from £160 to a maximum of £175 per annum.

The Newport (Mon.) tramway and lighting staff has presented a case of silver spoons and tongs to Mr. COLLINGS BISHOP, late Borough Electrical Engineer and Tramways Manager, and a gold mounted umbrella to Mrs. Bishop. The Electricity Committee has accepted the resignation of Mr. L. DU VERGE, Deputy Borough Electrical Engineer and Tramways Manager.

The Darlington T.C. has appointed Mr. K. F. BISHOP as Shift Engineer at the Electricity Works at £130 per annum, rising by two annual increments to a maximum of £156.

In our description last October of the undertaking of the Tientsin Gas and Electric Light Co., Ltd., at Tientsin, we mentioned that the station was run by a European staff, consisting of Mr. G. Paton and one other "foreign assistant." The latter is now in charge of the station. By name he is Mr. C. D. STEWART, A.M.I.Mech.E., and lest anyone should be misled by the description of "foreign assistant," we may remark on his own authority that he is "a loyal and true Britisher," and is "not a foreigner to the business nor to anything else, save the country in which he is living." Mr. Paton, as our readers will remember, left the company a short time ago to take up other work in China.

**Tramway Officials.**—On March 7th the Aberdeen Corporation tramway officials presented Mr. W. T. YOUNG, the traffic superintendent, with a case of cutlery on the occasion of his departure for Oldham, where he is taking up a similar position. Mr. R. S. Pilcher, general manager, made the presentation.

MR. THOMAS HOLDEN, leading linesman in the Liverpool tramways overhead lines department, has been appointed chief linesman, in place of Mr. J. M. LAMB, resigned.

MR. W. J. GALE, assistant engineer on the Milnrow tramways of the Rochdale T.C., has resigned, and left for Calgary, North-West Canada.

**General.**—MR. G. E. WRIGHT, electrical engineer to the North-Western Railway, Lahore, India, will not arrive in this country on furlough until the beginning of April. It is his intention during his stay here to make a fairly complete tour of inspection of the leading electrical manufacturing undertakings, and to prepare a report thereon with special reference to Indian requirements. He also hopes to be afforded the opportunity of visiting central stations in which there have been noteworthy developments since he was here some six years ago.

MR. D. HERVEY SLACK, A.C.G.I., of the firm of Messrs. Bauer and Imrie, chartered patent agents, 72, Cannon Street, E.C., has recently been elected a Fellow of the Chartered Institute of Patent Agents, and we are informed that the style of the firm will in future be Bauer, Imrie & Slack. Mr. Slack has had considerable practical experience, especially in electrical engineering, which will be of great advantage to him in his work.

MR. GEO. MASON, electrician to the Sherburn Hill Colliery (Co. Durham), has taken up a more important position with the Broomhill Colliery Co.

MR. J. H. THOMAS, late of the A.E.G. Electric Co., has left Berlin for the Far East, to take up a position there.

MR. JOHN PENDREICH has resigned his position as representative of the General Electric Co., Ltd., Glasgow, in order to join the firm of Millar & Stewart, wholesale agents for electrical supplies, Hanover Street, Edinburgh.



The *Australian Mining Standard* states that MR. A. DIRCKS, electrical engineer, of Victoria, is to carry on the duties of chief Commonwealth electrician during the absence, in America and Europe, of Mr. Hesketh.

On the occasion of the laying of the foundation stone of the new County Hall on 9th inst., his Majesty the King conferred the honour of knighthood upon MR. MAURICE FITZMAURICE, the chief engineer to the L.C.C., and upon MR. EDWARD WHITE, the chairman of that body.

The Burnley Guardians have created a new post at the workhouse, this being an engineer-in-chief, at £208 per year. MR. W. E. ATKINSON, who has been appointed, will be responsible for the plant for heating, hot water supply, laundry and kitchen, electrical generating plant and battery, and all pumping plant, &c.

MR. J. S. B. PLUMMER, who for many years acted as secretary to the Armorduct Manufacturing Co., Ltd., is shortly starting for a trip round the world on behalf of the firm.

**Obituary.**—J. D. GIBBS.—We regret to learn that Mr. John Dixon Gibbs died on the 6th inst., at the age of 78. Mr. Gibbs came prominently before the electrical world in 1883 in connection with the Gaulard & Gibbs secondary generators, which were patented by Mr. Lucien Gaulard and himself. These secondary generators were the forerunner of the modern transformer, and at their introduction in the year 1883 they were the source of very considerable discussion and opposition. They were exhibited at Turin, where the first International Prize and Gold Medal was awarded to Messrs Gaulard & Gibbs for their work in this connection. At the Exhibition held at the Royal Aquarium in 1883 these secondary generators were shown and excited a good deal of comment. Between the years 1883 and 1886 Gaulard & Gibbs installed their system on the Metropolitan Railway having their generating station at Edgware Road and lighting five of the Metropolitan stations, the secondary generators being arranged in series on a primary wire about 15 miles in length. At the Inventions Exhibition of 1885, several of the courts were lighted by Messrs. Gaulard and Gibbs, who were awarded a gold medal for the successful working out of a system of distribution of electricity by induced currents. The Grosvenor Gallery installation was erected in 1885 for lighting portions of Regent Street, Bond Street and Oxford Street by means of the secondary generators. In the year 1885 the Gaulard & Gibbs system was taken up by Mr. George Westinghouse for the United States, who had a complete installation sent out to him at Pittsburg. The secondary generators of Messrs. Gaulard & Gibbs were from a modern point of view extremely crude, but it must be remembered that at the date at which they were brought out, alternating-current distribution by means of the transformer system was unknown, and they were the first to attempt the distribution of electricity by such means. It is strange to realise the amount of opposition that was raised to this system, and great credit is due to Messrs. Gaulard & Gibbs for their persistence in spite of all opposition, for the faith in their system which they championed. They clearly realised the enormous possibilities that would arise from the use of transformers, and they persisted in spite of all obstacles, in developing the apparatus in which they had such faith. They risked their all in the work, and the developments of the past 25 years have proved that their faith in the possibilities of the transformer system were justified. Lucien Gaulard died some years ago; his native place has erected a statue in recognition of his work.

## CITY NOTES.

### W. T. Henley's Telegraph Works Co., Ltd.

THE meeting of this company was held on Monday at 13 and 14, Blomfield Street, E.C., Mr. George Sutton, M.I.E.E., the managing director, presiding.

The CHAIRMAN explained that he was occupying that position in the absence of Mr. Sydney Gedge, the chairman, owing to a domestic bereavement. Proceeding to propose the adoption of the report (see *ELECTRICAL REVIEW*, page 397), Mr. Sutton said he was sure it was with much pleasure that the shareholders had received the report. On the debit side of the balance-sheet it would be noticed that they had increased the reserve fund by £10,000 out of the profits of the year. On the credit side £13,000 had been added to the property during the year, which was rather smaller than the previous year, when they added nearly £25,000. The reason for it being only £13,000 this year was because they had had so much other work to do that they had not been able to give the time and attention they otherwise would have done to rebuilding and putting down new machinery. They had written off £2,403 for depreciation on their investments. The stock had increased during the year, but that was due to the larger turnover. It had gone up by some £17,000 or £20,000. He was not dissatisfied with the turnover in value, it was as high as in the best year they had had—that was the preceding year of 1910. In quantity it was larger, but it had varied from the previous year by large contracts showing a falling off, whereas what he might call the bread-and-butter business, and, therefore, the business which gave a larger percentage of profit than the contract business, had increased. The home trade had increased, and the Colonial trade had increased, but the foreign trade showed a falling off. The competition for business, both at home and

abroad was very keen, and perhaps the foreign buyer was not so well acquainted with the reliability of certain manufacturers as were British or Colonial buyers, and was more likely to buy inferior goods because of the lower prices. They had in Great Britain a well-known standard for insulated wires and cables; it was made by an association of the leading cable-makers in this country, and was a synonym for the best work: but there were British houses not forming a part of the association which apparently did not think it incompatible with fair trading to advertise, list, and sell cables—sometimes cables made in foreign factories—as being made to the standard of that association. They tried to reap where they had not sown. The home buyer and the home consulting engineer was usually well able to discriminate, but the foreign firm might not be. They would observe that the net profit was larger than in the previous year because of a less amount being written off for depreciation—£11,800, against £17,200. That was due to the fact that not so much machinery had been scrapped, and the value at which that machinery, plant and building stood on the books was added to the year's depreciation. Then the increase of the available balance was due also to the fact that £2,400 was reserved against gilt-edged securities, as compared with £6,400 in the previous year. The reserve for bad debts was the largest they had had for some years, due to the fact that they had not received payment for any of the cable they supplied to the Thames Ironworks Co. for use on H.M.S. *Thunderer*: the amount was increased by upwards of £2,000 on that account. But nevertheless the important outstanding fact was that they had presented to them the best balance-sheet and profit and loss account which the company had so far produced. The only unpleasant and disquieting feature of the year was the strike at the Gravesend works, and even that had its compensation, for it demonstrated the loyalty and regard for their interests of the larger works at North Woolwich, at which not one man left his work, notwithstanding the pressure brought to bear on the men by the union and the men on strike at Gravesend. It was often said that, unlike the private employer, the limited liability company was not in touch with the people it employed. That might be sometimes true, but it was not true in respect to their factories. Of course he did not know all their workpeople, although he was personally acquainted with very many of them, but they all knew him, and they all knew, and they availed themselves of the knowledge, that they could communicate with him if they wished to do so. When the strike at Gravesend occurred he was in the north of Europe, and on the receipt of a telegram informing him of the strike he wired back a notice to be posted outside the works that he was coming home at once and would see the disaffected men at the works at a certain time and discuss their grievances with them. He was there at the appointed time and not a man came to see him; the notice on the gate had been torn down. But he might weary them if he were to go into the whole history of that stormy six weeks—how every obstacle was put in the way of the company carrying on its business, how stones, bricks and mud were thrown, how loyal men were assaulted on their way to and from their work, so that they had to feed and lodge them on the premises; how their very houses were besieged by men, so that in some cases the company had to send their wives and children away, and how, on one occasion, some 2,000 men were round the works and were prevented from breaking in the gates, by the exit from the gates of a body of police whom he had summoned because of the threatening state of affairs, and how, at last, the men came back to their work without any request for new terms or conditions. It was an iniquitous strike. They did not discriminate between Union or non-Union labour. They paid better wages than other industries in the district. Their workshops were the best that money and skill could obtain. But they found that there were men in the works who were acting for the Union in getting their hands to become members and spreading discontent amongst them. They wanted to be just, they even wished to be generous with their men, but they refused to be dictated to by a Trade Union, and the financial state of the company was such that they were not to be coerced into doing that which might be unfair to their interests, even if they had to struggle with a Trade Union for ten times the period of last year's strike. He took the opportunity of expressing on behalf of the shareholders his appreciation of the services of those of their people who, often under great trial, were loyal to them and did any kind of work which was required of them under the exigencies of the situation, and to their people at North Woolwich for their loyalty and many expressions of sympathy which they received from them during the course of the strike.

The EARL OF GALLOWAY seconded the report, and it was adopted.

### Vera Cruz Electric Light, Power and Traction, Ltd.

—The directors have declared a dividend, subject to audit, of 2 per cent. in respect of the year 1911.

### South Metropolitan Electric Light and Power Co., Ltd.

—The debenture stock register and register of transfers will be closed from March 18th to 31st for the preparation of warrants for interest at the rate of 4½ per cent. per annum, payable April 1st, for the half-year ended that date.

### Rees Roturbo Manufacturing Co., Ltd.

—The directors' report for the fourteen months to December 31st, shows that after deducting £3,356 brought forward, there is a debit balance of profit and loss account of £1,544.

### British Insulated and Helsby Cables, Ltd.

—The directors have declared a dividend of 6s. per share, making 10 per cent. for the year, £51,000 being placed to reserve and depreciation, and £63,000 is carried forward.



### Brompton and Kensington Electricity Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the revenue account shows a credit balance of £30,692, which, with the balance of £7,443 brought forward, and £939 balance of interest received and accrued, makes a total of £39,075. After deducting £1,663 for interim dividend on the 7 per cent. cumulative preference shares, and £6,861 interim dividend at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that the sum remaining, viz., £30,550, be dealt with as follows: To credit of depreciation account (maintaining this fund at £80,000), £6,063; dividend on the preference shares for half-year ended December 31st, £1,612; dividend on the ordinary shares for half-year ended December 31st at the rate of 11 per cent. per annum, making 10 per cent. for the year (free of income-tax), £8,461; to credit of reserve fund account (raising this fund to £30,000), £6,000; directors' additional remuneration, £557, leaving to be carried forward £7,858.

The following table shows the progress of the business:—

Year.	35-watt lamps con- nected.	In- crease in lamps.	No. of cus- tomers.	Gross receipts.	Expend- iture.	Net receipts.	Aver. price per unit.	Div. ord. shares.
1908	224,826	10,910	4,593	£53,113	£25,318	£27,795	4.17d.	10%
1909	235,802	10,976	4,883	£50,791	£23,710	£27,081	4.18d.	10%
1910	246,974	11,172	5,163	£50,597	£23,917	£26,680	4.26d.	10%
1911	259,554	12,580	5,453	£54,730	£24,038	£30,692	4.29d.	10%

In view of prospective development, the directors propose to carry on such portion of the company's business as may not come within the scope of its provisional order by means of a subsidiary company. To carry out this departure in the most effective way, some alteration in the company's articles is necessary, and acting under legal advice the directors are availing themselves of this opportunity to bring the company's articles up to date.

The meeting was called for March 14th, and resolutions were then submitted, altering the articles and deciding as follows:—

That the agreement entered into between this company and the Brompton and Kensington Accessories Co., Ltd., dated March 6th, 1912, and subscribed for identification by the chairman of this meeting, whereby this company has sold to the Brompton and Kensington Accessories Co., Ltd., for the sum of £2,611 2s. 6d. payable in cash, all its interest in the leasehold premises, 254, Earl's Court Road, Kensington, S.W., and the goodwill, stock-in-trade, and effects of its business of supplying electrical apparatus, utensils and accessories as mentioned in the said agreement, be and the same is hereby confirmed.

### Notting Hill Electric Lighting Co., Ltd.

THE annual meeting was held on March 5th, at Winchester House, E.C. Sir W. Crookes, O.M., F.R.S., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 353), remarked that this was their twenty-fifth annual meeting, and they looked back with satisfaction on the progress made during a quarter of a century. In the accounts the share capital was in the altered form, in accordance with the scheme of rearrangement of capital which was agreed upon last year. The founders' shares had disappeared, and were replaced by the new 1s. ordinary shares. If they required new capital, it would be seen that they still had £56,000 6 per cent. preference shares unissued. The capital expenditure for the year was £4,074 on machinery, mains and meters. The machinery purchased consisted of a new motor generator set to deal with the increased demand. The total capital expenditure now stood at £217,406. They had received additional capital during the year amounting to £1,352, being the profits of the issue on 27,050 new 1s. ordinary shares. They had spent more capital than they had received to the extent of £38,054, and that had been provided by using the reserve fund in the business instead of issuing further capital. The profit had increased from £22,003 to £23,557. The actual increase in revenue was £2,000, and it was a most satisfactory feature that the whole of this would have been extra profit but for one item on the expenditure side, £461 charged against the account for the rearrangement of capital. For that excellent result thanks were due to the whole of the staff. The balance available for dividend was £14,486, compared with £12,905. £3,000 had been allocated to the depreciation fund, which was considered sufficient, especially as the capital expenditure had been very small for many years past. The depreciation, renewal and reserve fund account showed net figures of £37,493 to meet depreciation of the undertaking, and the board believed that that total was ample, considering the good position in which the plant was maintained at the expense of revenue. The amount of electricity sold during the year was 2,336,849 units. The houses connected were 3,513 and the lamps connected 199,156. The amount of profit available for division amongst the ordinary shareholders, after allowing for debenture interest, was £14,486. Of this, the preference shares had taken £8,136, which left £6,350 for division between the holders of the new 1s. ordinary shares. The board had carefully considered the question, and had decided to recommend the payment of a dividend on those shares of 4s. 6d. per share, carrying forward the balance of £618. They considered that a wise precaution in view of the unsettled state of the labour world. Had the expenses of the rearrangement of the capital not been charged to revenue and its balance utilised, the dividend would have been over 5s. He was glad to be able to tell the shareholders that the men had shown their loyalty to the company, and in order to recognise this the board were considering a scheme of co-partnership by which the men should receive, by way of bonus, a sum proportionate to the profits realised. He felt sure that that proposal would meet with the approval of the shareholders. The dividends which the board recommended would have amounted, had the shares not been

divided, to 8½ per cent. for the old preference and ordinary shares and £6 per share for the founders—more than they had ever received before. The great advantage in the re-arrangement was that the holders could now estimate the real value of their security. The non-cumulative preference shares paid 6 per cent., and could not be repaid at par until 1931, and allowing that they were so repaid, on an actuarial calculation they yielded 4½ per cent. if purchased at £12. The security was ample, as, after paying £6,442. the dividend on the shares, there was £6,350 left. In other words, the margin of security was 100 per cent. With regard to the future, the outlook was promising, and the demand for current showed no signs at present of any diminution, so that provided the trouble in the coal trade could be settled without a serious rise in prices—they had a reserve of two months' supply—he saw no reason to doubt that the company would continue its prosperity. The London County Council had recently appointed a special committee to consider the whole question of the electric supply to London, and the shareholders might be assured that, whatever arrangements were come to, they would safeguard the interests of the company as far as it was possible.

MR. A. E. FRANKLIN, J.P., seconded the motion.

MR. DAWES, after congratulating the board upon the present position and prospects of the company, said he was very pleased to hear from the chairman that they contemplated a scheme of co-partnership with the workpeople. Even if they looked at it from a selfish point of view, wherever similar schemes had been tried it had been found that the proprietors had got back all and possibly more than they had given to the men, because, naturally, men felt a greater interest in their work when they were participating in the profits.

MR. CORNER also congratulated the board upon their determination to adopt a co-partnership scheme.

The CHAIRMAN, in reply, said that the scheme was only in its preliminary stage. They were going to meet a deputation of some of the men and discuss the question with them before anything definite was done.

The report was then adopted.

### Slough and Datchet Electric Supply Co., Ltd.

DURING 1911 capital expenditure was incurred to the amount of £5,479, bringing the total up to £54,634. The following table from the report shows the progress of the company, the equivalent of 6,139 additional lamps of 8 C.P. having been connected last year:—

Year.	Lamps and motors connected.	Units sold.	Profit.
1909	16,380	335,983	£3,288
1910	17,976	332,295	£3,165
1911	24,115	426,136	£3,421

The total net profit available for distribution is £4,073, £1,000 is to be set aside to the depreciation fund, bringing it up to £4,750, and the directors recommend that out of the remaining net profit a dividend of 5 per cent. be declared, less income-tax, and that the balance of £390 be carried forward.

The mains, works, plant and machinery have been maintained in an efficient condition out of revenue. A new engine and dynamo of 200 H.P. were installed during the latter part of the year, which are showing considerable saving in the cost of producing the current, and another set of similar capacity is in course of erection. This new plant was found necessary to meet the growing demand for electricity in the district, and there is every indication that the economies effected by the new plant will result in a considerable reduction in the working costs and a corresponding increase in net profits.

### South London Electric Supply Corporation, Ltd.

THE directors' report for 1911 shows that the gross receipts were £44,515, and the expenditure £19,272, leaving a profit balance of £25,243, plus £1,002 brought forward, making £26,245 available. After providing for depreciation on plant and machinery (£6,000), debenture and other interest accrued, &c., £12,337, there remains to be carried to the general balance sheet £13,908. Out of this the board recommend the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, amounting to £13,000, carrying forward £908. At the end of 1911 there were connected to the company's mains the equivalent of 250,721 (35-watt) lamps. The plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The ratio of total costs to revenue has been maintained at 43 per cent. At the last quinquennial revision the rateable value of the company's property was, after prolonged negotiations, raised so as to involve an increase of £600 per annum in the rates.

Units generated	5,662,815
Sold to consumers and public lamps	4,479,487
Used on works	371,010
Total	4,850,497
Used in distribution	812,348
Total kw. connected	8,770

The meeting is called for March 19th.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers, during the four weeks ended January 26th, 1912, was 692,244, compared with 537,547 units in the corresponding four weeks of 1911.



### Scarborough Electric Light Supply Co., Ltd.

AT the annual meeting held at Scarborough on March 4th, the CHAIRMAN (Mr. Alderson Smith, J.P., D.L.) said that the balance-sheet was a little disappointing, but they knew the cause.

Though they had more customers and gave better satisfaction, the use of the new metallic-filament lamps had diminished the amount they actually received. There was £155 less for electrical energy than the preceding year, and for the sale of lamps £101 less. If they could but get more people to become customers their prosperity would increase; but so few of the houses in Scarborough belonged to the people who lived in them that there was difficulty about putting in the electric light.

MR. A. A. CAMPBELL SWINTON (managing director) seconding the report, said the question of metallic-filament lamps was one that had been interesting him for years. In addition to being concerned with that company, he was also concerned with the management of electricity supply in, he thought, 49 different towns in Great Britain, and had special means of seeing what was taking place. When people changed, the first effect was to largely reduce the amount of their bills. The second effect was that they attracted more consumers as electric light became cheaper and competed more readily with gas. Throughout the country the effect had been the same. There was a fall in the consumption of practically every electric supply company, and then a gradual recovery due to more people coming on. In some places this had been much more rapid than in others. In Scarborough, owing to local circumstances to which the Chairman had alluded, it had been almost slower than anywhere else. They could safely say now that they had touched bottom, and were beginning to improve by taking on more customers. His own view was that the company's prospects were now likely to improve as time went on. With regard to depreciation, he had had two letters from shareholders. One accurately pointed out that railway companies put nothing aside for depreciation, and why should the Electric Supply Co. do so, as if they put the £1,000 they had put to depreciation this year to paying more dividend, they could pay 4 per cent. instead of 3. The other shareholder took the opposite view, and would like to see the whole 3 per cent. as well put to depreciation. Well, this year, in addition to the £1,000 to depreciation, they had spent £1,112 on upkeep. In 1910 they similarly spent £1,068, and he thought they also put £1,000 to depreciation. They kept everything up to date out of revenue, and what they put to depreciation must be looked upon as a provision for renewing plant when it became worn out. The first thing they would want to renew would be the boilers. There seemed an idea that the price of electricity in Scarborough was high. Of course they could not compare it with Leeds, which was supplying about 15 times as much electricity. Take Bridlington. In Scarborough they charged less, although Bridlington had a supply of public lamps for which they got over 3d. per unit, which was a large price for public lighting. The supply in Scarborough was cheaper on the average to the private consumers than at Bridlington. In Whitby it was slightly less, but again, they had a large amount of public lighting, for which they got good prices. York was hardly comparable, but there they got over 2d. a unit for the tramway route. In Scarborough they got only 1½d. They had not been able to arrange it there that the people who travelled on the tramways should pay part of the electric lighting bill. They had no public lighting in Scarborough, and they had to supply the tramways, which paid badly.

The CHAIRMAN said that they had coal to last for six weeks' consumption at full use.

MR. HUTTON (a shareholder) argued that the local conditions must determine their price and policy. He complained that some of the consumers had never been met since the supply started, and they should consider the question of bringing down the cost to those who paid the maximum rate. There was a general feeling that if the price could be reduced even a little it would alter the attitude of the public towards the supply.

MR. CAMPBELL-SWINTON replied that to reduce the price might increase the number of consumers, but it would mean more capital expenditure, and he did not know whether they would get it with a large expenditure. The only policy for the company was a quiet one.

A dividend of 3 per cent. was declared.

### Telegraph Construction and Maintenance Co., Ltd.

THE meeting of this company was held on February 29th, at 38, Old Broad Street, E.C., the Earl of Selborne, K.G., presiding.

The CHAIRMAN first went briefly through the accounts. The net profit for the year amounted to £87,515. plus £107,577 brought forward, making £195,093, from which was deducted the interim dividend of 5 per cent. paid in July last. The directors now proposed to distribute a further dividend of 10 per cent., together with a bonus of six shillings (6s.) per share, and to add £10,000 to the reserve fund, which left £106,658 to be carried forward. He would draw a comparison between the balance-sheet of this year and that presented to them a year ago. Taking, first of all, the debit side, they would see that the capital and debentures stood at exactly the same figure as they did last year. When they came to the item of debts owing by the company, and reserves for insurance and contingencies, the figure was very considerably larger this year than last, and a little explanation of that matter was required. The increase was mainly made up in this way—rather a peculiar circumstance—they had received payment for a considerable amount of cable not yet delivered, and, therefore, they had put that payment to a suspense account, which swelled the item under the head of debts owing by the company and reserves

for insurance and contingencies. The reserved fund, they would notice, stood at £75,000 instead of £50,056. That was owing to the increase they authorised last year, and he was going to ask their authority for a further increase of £10,000 to the fund. The profit and loss, of course, showed a falling off. That was due to the fact that this year, although they had been able to do steady work, they had not had the special feature of the previous year. Turning to the credit side of the account, he drew their attention first of all to the item property, consisting of freehold and leasehold premises, machinery, plant, stocks of stores, materials, &c. Last year that item stood at the unusually small figure of £205,000 odd. This year it stood at £569,000 odd. The very large figure shown this year was more in accordance with experience. The reason was that their stocks of materials in hand were much larger this year than they were at that particular time last year—a mere accident in the process of manufacture—also the amount of cable under construction, as also the amount of cable completed but not yet delivered. Amounts owing to the company, and cash at bankers, and in hand, were both less than last year, which, of course, was the natural result of the fact that the first item was increased. Sundry securities showed a diminution of, roughly, £20,000. They were careful not to over-estimate the value of the securities or the property, although they did not carry depreciation to an extravagant extent. As regarded leasehold property, machinery, and plant, their practice was to be conservative and cautious in their estimate, to remember that in the nature of affairs such property was transitory and apt to deteriorate in value, and if they erred at all in respect of the valuation they put on that part of their property, they valued them too low rather than too high. He now turned from the accounts to the actual resolution that he was going to move. The past year lacked the special features of the year before, although it was not a year that could by any means be considered unsatisfactory in its results. But they felt that that was a moment in which it was their absolute duty to be cautious and conservative in the policy they recommended. He was happy to say that the relations between their employes and the company were excellent, but they could not conceal from themselves that there is an unrest in the industrial world over which they had no control, but which might fundamentally affect their business during the coming year. Therefore, with a year before them which they could not characterise but as a year of anxiety, they felt that a cautious policy was the right one.

SIR JAMES PENDER seconded the adoption of the report and the dividend declaration, and the resolution was carried unanimously.

The CHAIRMAN then submitted the following resolution to the meeting: "That the holding of half-yearly general meetings be discontinued."

MR. COLIN F. CAMPBELL seconded, and after some remarks from a shareholder, this resolution was also carried unanimously.

### Hove Electric Lighting Co., Ltd.

THE annual meeting of this company was held on March 6th, at Salisbury House, E.C., Mr. Carleton F. Tufnell presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 354), said that the capital expenditure during the year had amounted to £5,292, of which £880 had been expended on mains, £379 on meters, and £4,025 on additional machinery and tools. The increase in the last item was accounted for principally by the introduction of a new steam turbine set. There had again been a decrease in the number of units sold, no doubt chiefly due to the metal-filament lamp. Those lamps were now being made for low candle-powers, and they were largely used in passages and servants' quarters where the lights were generally in use for long hours. The consequent cheapening of the electric current was bringing them more consumers. During 1911 they connected up 179 houses, the largest number in any one year since their commencement. The number of lamps connected (equivalent in 8-C.P. lamps) had been 8,983, compared with 6,271 in 1910. Then again, the period covered by the report had embraced probably the finest and lightest summer on record, whilst the winter months had likewise been peculiarly free from fogs and dark days, with the very natural result that their revenue had suffered somewhat. The new exhaust steam turbine set, was put into use on September 22nd last, and it had been running satisfactorily, and the economy in the coal consumption which resulted fully justified the capital outlay. Every provision had been made for carrying on the business during the coal strike.

MR. H. A. HOARE seconded the motion, and the report was adopted.

**Stewarts & Lloyds, Ltd.**—The directors after setting aside £70,000 for depreciation, have (says the *Financier*) declared the following dividends:—Six per cent. per annum on the preference shares for the half-year to December 31st; 10 per cent. per annum on the preferred ordinary shares for the half-year; and 1s. per share on the deferred shares for the year. £70,000 is placed to reserve, and £86,000 is to be carried forward.

**O. C. Hawkes, Ltd.**—The directors' report states that the net profits, after making ample provision for depreciation, &c., leave an available balance of £6,453. The directors have paid a year's dividend of 5 per cent. per annum on the preference share, and £1,000 is to be added to the reserve fund, making this £33,000, and £1,203 is carried forward. It is expected that the current year's trading will show substantial improvement.



### Metropolitan Electric Supply Co., Ltd.

THE directors' report for the year ending December 31st, 1911, states that the capital expenditure has now reached a total of £1,989,832, being an increase during the year of £53,301. The gross revenue amounted to £182,622, as compared with £172,737 in 1910, being an increase of £9,885. The working expenses amounted to £88,005, an increase of £9,722. The balance at the credit of the revenue account, before providing for depreciation, is £94,617. The directors have set aside £17,000 as an addition to the depreciation and reserve fund, which now amounts to £277,355, carrying to the credit of the net revenue account (No. 5) £77,617. This sum, with the balance brought forward, interest and dividends on investments, and other receipts, makes a total of £88,413. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains a balance of £42,357. An interim dividend of 2s. per share (being at the rate of 4 per cent. per annum) on the ordinary share capital, amounting to £20,000, was paid on August 10th, and the directors recommend that a further dividend of 2s. per share (being at the rate of 4 per cent. per annum) on such shares be now paid, making a total distribution for the year of 4s. per share, or 4 per cent. This will absorb a further sum of £20,000 and leave a balance of £2,357 to be carried forward. In order to make provision for capital requirements the directors, under the powers conferred upon them by the Articles of Association and in accordance with the terms of the trust deed of the company's 3½ per cent. mortgage debenture stock, have created a further £190,000 of like stock, of which £43,074 was subscribed for and allotted in the course of the year. The Bill promoted by the company to legalise an agreement with the District Council of Acton for the purpose of acquiring their provisional order, received the Royal Assent on June 30th, and the company is now in possession of the undertaking. The company have acquired a controlling interest in the Brentford Electric Supply Co., Ltd., and have entered into an agreement for supplying that company in bulk. An agreement has also been concluded with the Uxbridge and District Electric Supply Co., Ltd., for a bulk supply in the district of Greenford. Owing to the unsettled state of the transport and coal trades, additions have been made to the large reserves of coal which are always stored at Willesden. These reserves will, it is hoped, enable the company to maintain its supply for fully 10 weeks from the commencement of the coal strike. During the year new connections representing the equivalent of 66,553 8-c.p. (30-watt) lamps, equal to 1,997 kw. were added to the company's system, making a total connection of 957,037 lamps. The stations, machinery and plant have been maintained in a satisfactory condition. The directors regret that Mr. Frank Bailey has resigned his seat on the board.

The meeting is called for March 19th.

### Charing Cross, West End and City Electricity Supply Co., Ltd.

THE annual meeting of this company was held on Tuesday, at 60, St. Martin's Lane, W.C., Mr. W. F. Fladgate, M.V.O., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 395), said that last year was certainly a very troublesome one for all undertakings of the kind. For two months they were seriously affected by the strike of August last, during which time they had to pay practically double the price for coal. Of course they had their coal contracts, but they contained the usual strike provisions, and the result was they had to buy coal as and when they could, at any price at which it could possibly be procured. Speaking after many years' life in London, he never expected that one would have lived to see their works, as they did, under the guard of the military forces of the country. Under those circumstances, he was glad to be able to say that the result of the working of the whole year had been of a satisfactory character. In the West End, with the exception of the writing off at Lambeth Station, the figures for 1910 and 1911 were very close. The total revenue of the West End in 1910 was £142,675; last year it was not quite so much—£140,922; but as against that the expenses had dropped from £72,687 in 1910 to £69,408. In each case the same amount of £11,000 had been set aside for depreciation, and the result of the working was that for 1910 they had a sum of £58,987 and for 1911 £60,513. Adding the carry forward and interest earned last year, after paying the debenture interest, they had a sum of £53,849 to be dealt with. Out of that sum they had paid the preference dividend, which absorbed £18,000, and the interim dividend on the ordinary shares, which absorbed £10,000, leaving a balance of £25,949. They had thought it right to keep the dividend at the same rate of 5 per cent., and to carry forward no less than £15,949, which they thought a prudent thing to do having regard to the present state of the labour market, and also to the possibilities of the future. Referring to the Lambeth station, the result of the writing off of that station was, that whereas at the end of last year they had very large reserves, they now brought forward only £84,621, and it would be the care of the directors to consider how, consistently with the rights of the present shareholders, that reserve fund could again be built up. The demand in the West-End for power and lighting was still increasing. The reason of their average price being as low as it was, was that the demand for power and heat amounted to no less than 45.9 of their total. Their transmission losses were better last year, having declined from 28 per cent. to 26 per cent. Referring to the City undertaking, the progress there had been somewhat more satisfactory than in the West End. Their takings for 1911 amounted to £145,071,

as against £141,475—an increase of a little over £4,500—while the expenses, which in 1910 were £62,700, only rose to £84,355. They had carried out the same policy in dealing with the net revenue as last year. They had paid interest on the debenture stock and the dividends on the preference shares and the whole of the balance was brought forward to the general revenue account, bringing it up to the respectable sum of £36,158, or an increase of £13,000 odd over the carry forward of last year, which amounted to £23,570. They had not specifically transferred that money to the depreciation account, although they could do so if they thought well later on. In the city the demand for power went on increasing and was now very considerably larger than the demand for lighting. The transmission losses were 26 per cent. as against 27 per cent. last year. Referring again to the Lambeth station, the Chairman gave a history of the undertaking and said that, when the time came for them to consider how they were to deal with it, modern science came to their assistance and they were able to put in modern machinery in their sub-stations by which they were able to generate electricity at a price which, when applied to low tension units, was about 26 per cent. less than they could generate it at Lambeth and transmit to this side of the river. They had, therefore, given up the station and sold the machinery for what it would fetch, which he regretted to say was a very low figure. They had written off £173,562 for the station, leaving a balance of £84,621. He was persuaded that the directors had taken the right course in scrapping the plant there and writing off the loss from their reserves. At the present time the whole of their plant was of a modern and efficient character, and as far as its actual value was concerned, he did not know that it was substantially below that at which it actually appeared in their books. They hoped that for a long time to come they would not want any large expenditure for new machinery—the engineer told him that something between £20,000 and £30,000 was all they would want for some considerable time to come. After mentioning that the Insurance Act would cost the company about £500 or £600 a year, the chairman said that the present position of affairs was one that involved very serious consideration. He was glad to say that they had in their bunkers enough coal to keep them going for five or six weeks, but they could not help feeling that it was absolutely necessary to use the greatest possible care in husbanding their resources as far as possible; whether the strike was going to continue or not it would be foolish for anyone to prophesy. It was a dire calamity, and he hoped that the Government might be able to deal with it in some way to prevent its recurring in the future. The L.C.C. had appointed a Committee to consider the future of the electric supply question. He need not say that they would do their best to look after the position of their company. They had already formed a joint committee of local authorities and the London companies for the purpose of considering what was best to be done, which committee had done a good deal of work. They had considered how far a big bulk supply could be given by completing a trunk line to supply the greater part of London. Personally, he had very great doubts whether that would be a wise course. They did not know the future of electric energy, and he did not look with any favour on any scheme involving a very large amount of capital for the purpose of laying a main which, it might be, would not be wanted at all 10 or 20 years hence.

MR. JOHN M. GATTI seconded the motion.

Replying to MR. MAKINS, the CHAIRMAN said they were trying to raise the price they obtained for their power, and they were succeeding. With regard to the Act of 1908, if it had been passed as an entire Act, a great deal of good would have come out of it, but the most useful provisions of the Act were cut out, and at the time he thought it would be very difficult to work under. A certain amount of progress had been made, and two companies had taken advantage of it. They were endeavouring at the present moment to make use of the Act to get certain economies in working with one or two of the other companies, but there were great difficulties in the way of arriving at any arrangement which would be of any practical use to them.

The report was adopted.

**Madras Electric Tramways (1904), Ltd.**—The directors' report (says the *Financier*) shows a gross profit of £17,065, plus £853 brought forward, making £17,919. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund, there remains £5,699. The directors propose a dividend of 2 per cent. per annum on the ordinary shares, carrying forward £1,104. The traffic receipts show an increase of 8.49 per cent. upon 1910. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund. The reserve arising from the debenture stock sinking fund now amounts to £3,830. The two extensions referred to in previous reports are being constructed and will be opened for traffic in the autumn. These extensions are being financed by temporary loans, but it is proposed, as soon as the lines have been opened to make a further issue of debenture stock and shares to repay the loans and to provide further working capital.

**Western Telegraph Co., Ltd.**—The directors have declared a second quarterly interim dividend of 3s. per share, free of income tax, being at the rate of 6 per cent. per annum.

**Cuban Telephone Co.**—The directors have declared a dividend of 1 per cent. for the quarter ending March 31st.



### Direct Spanish Telegraph Co., Ltd.

THE directors' report for 1911 shows that after providing for interest on and redemption of debentures, and for the dividend on the preference shares there is a balance of £8,326. Of this, £5,000 has been transferred to the reserve fund, the directors have distributed a bonus to the company's staff in celebration of the Coronation of H.M. King George V., costing £704, and they now recommend the payment of a final dividend for the half-year ended December 31st, 1911, at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, amounting to £1,293, making, with the interim dividend paid on October 1st, 1911, a total distribution of 4 per cent. for the year. The balance, viz., £36, is to be carried forward. Compared with 1910 the traffic receipts show an increase of £195, and the working expenses an increase of £144.

The Bilbao cable became interrupted on June 28th last, and was promptly repaired by the cable steamer *John Pender*, communication being restored on July 1st. The cost of this repair, viz., £4,125, has been charged to revenue. In view of the recent extensive breaks of the Bilbao cable, which was laid in 1881, and the great inconvenience caused thereby to the company's customers, the directors considered it necessary to thoroughly repair that cable, including a new shore-end at the Spanish landing place at Arrigunaga. This work was successfully carried out by the Eastern Telegraph Co.'s cable steamer *John Pender* in September, 1911, the interruptions to communication during the progress of the operations lasting 10 days. The cost of this work, viz., £33,060, has been placed in suspense, and it is the intention of the board to gradually write the sum off the reserve fund. Since the last report of the directors, the transfer of the company's telegraph station from Falmouth to Kuggar (Cornwall) has been completed, and the new overhead system works satisfactorily. The company's old underground line between Falmouth and The Lizard, laid in 1881, having been taken out of circuit, the original cost of the line, viz., £2,710, has been deducted from the capital expenditure account, and the cost of the land purchased by the company at Kuggar, and the new telegraph station erected thereon, has been added to that account. The directors report with extreme regret the death of the Marquis of Tweeddale, K.T., who had been chairman since 1896. Sir John Denison-Pender, K.C.M.G., has been elected chairman. Sir Albert James Leppoc Cappel, K.C.I.E., has joined the board.

### County of London Electric Supply Co., Ltd.

MR. J. B. BRAITHWAITE presided at Winchester House, E.C., on Monday, at the meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 396), said he told them last year that he would be disappointed if they did not have considerably improved results to show them for the year upon which they were then entering, and he was happy to say that that hope had been fully realised. So far as the balance-sheet was concerned, they would find that the capital expenditure upon their undertaking had been increased during the year to the extent of £49,000. The actual expenditure had been about £67,000, but they had written off obsolete machinery to the extent of £18,000, so that the net increase appearing in the balance-sheet was £49,000. Of that capital expenditure, 55 per cent. was on mains, and they did not put in new mains unless they had the customers waiting to take the supply from them, therefore every penny they spent on mains became immediately remunerative. During the year they had added 1,576 new customers, making their total consumers at the present moment 18,459. The capital expenditure had been provided by selling the balance of their first debenture stock, of which there was on last year's balance-sheet £10,000 odd unsold, and the additional £50,000 of second debenture stock which was authorised some time ago. That provided them with about £60,000 additional capital, and the balance had been made up by a slightly increased loan from their bankers. That was the only change in the balance-sheet so far as the capital was concerned. With regard to revenue, the gross revenue showed an increase of £24,618 for the year, being 13'14 per cent., and that compared with an increase last year of £10,118, or 5'7 per cent., so that they would see their gross increase of revenue for the past year was nearly 2½ times what it was for the previous year, and the percentage of increase had risen from 5'7 to 13'14, which, he thought, was thoroughly satisfactory. As a matter of fact, their increase was the largest of any of the London electric supply companies, and by a considerable amount. The next one to them was the London Electric Supply Co., but a great portion of their increase was due to their supplying current to the Brighton Railway. Turning to the net revenue, of the £24,618 gross increase they had succeeded in retaining £15,298 as net, or at the rate of 13'79 per cent. increase. That was, he thought, a very satisfactory feature, in view of the railway strike in August last, which naturally cost them something in increased cost of coal and other matters, and augured well for the continuance of their prosperity. As a matter of fact, the percentage of their works cost to their gross receipts again showed a small decrease this year, in spite of the extra cost they had had to pay for coal during the railway strike. The figures for the last three years would perhaps interest them, they would then see the steady progress they were making. In 1909 their working costs were 41½ per cent. of their revenues. In 1910 that figure had fallen to 40'4 per cent. About £3,000 of the increased revenue had been absorbed by increased capital charges. In the course of three years they had increased the amount placed to depreciation from £16,000 to £25,000 per annum, and they hoped to make further additions to it in the future. Then they had raised the sum carried forward by £1,774, and they were giving them £4,000 more in the way of dividend on the ordinary shares, raising the dividend for the year from 5 per cent. to 6 per cent. If they came to analyse the expenses account, there were one or two points which were of interest. For instance, one of the great increases in their expenses for the past year had been in the item of rates. They had to pay £1,980 more in rates than they had in the previous year. The only other really important difference in the expenses was in the cost of generation, that had cost them £4,824 more, of which about £1,350 was due to the railway strike

and the balance was due to their increased business. They had also made a larger provision to their reserve for bad debts to the extent of £1,000, which was merely a matter of prudence, which he was sure they would approve. They sold during the past year 20,450,787 units, showing an increase of 3,465,100 units over the previous year, or 20 per cent. For lighting they sold 7,161,234 units, and for power 13,289,553 units. It was near enough to say that one-third of their output had been used for lighting and two-thirds of it for power. With regard to lighting, what he had told them on previous occasions had turned out to be correct. They might remember that when the metallic-filament lamp was first introduced there was a tendency on the part of some of the companies to take fright at the large reduction in their current consumption. They had always taken the other line, feeling sure that any invention which tended to decrease the cost of electricity was bound to tell in their favour, and that expectation had been verified. As to motive power, he thought those manufacturers who were dependent upon their, and other, electric companies for their supply were rather to be envied at this time of stress while the coal strike was going on. They had stored a large quantity of coal, and unless the strike should last a very abnormal time, he hoped that at the end they would be able to say that they had not had to reduce their supply to any of their customers. Regarding the future outlook, up to the present moment the lamps applied for this year were equivalent to 995 KW., as compared with 340 KW. for the corresponding period of last year—nearly three times as many. They could not expect that rate of increase to continue—probably part of it was due to the coal strike. As regarded units sold, they showed an increase of 9 per cent. so far this year, and in cash revenue they showed an increase of 4½ per cent. gross, and 5 per cent. increase in net earnings. There was, therefore, every indication that, subject only to labour troubles or unforeseen circumstances, they were entering upon a year of even greater prosperity than the one just completed. With regard to their subsidiary companies, Bournemouth was just maintaining its dividend, but at Coatbridge very great progress had been made. There had been an increase of 31 per cent. in the units sold, and an increased profit of £2,493. Since last year they had effected the inter-connection of their City Road and Wandsworth stations, and now they could transmit current from one to the other. That gave greatly increased security to their consumers, and, at the same time, it should lead to considerable economy in the consumption of coal.

MR. J. SHAW, K.C., seconded the motion.

Replying to MR. MAKINS, the CHAIRMAN said they were taking the fullest possible advantage of the 1908 Act, and at the present time they were in negotiation with other electric supply authorities to give them a bulk supply.

The report was adopted.

### National Telephone Co., Ltd. (In Liquidation).—The

following is the supplemental report of the directors for the half-year ended December 31st, 1911 :—"The income accrued in respect of the business of the half-year amounts to £1,872,258, as compared with £1,744,111 for the corresponding period of 1910, an increase of £128,146. The working expenses for the half-year amount to £1,050,047, as compared with £1,015,413, an increase of £34,604. The net result for the half-year (after deducting the Post Office royalties amounting to £179,362) is a profit balance of £642,850, as compared with £561,056 for the corresponding period of 1910, being an increase of £81,794. The rentals carried forward for unexpired terms of running contracts amount to £1,474,569, as compared with £1,413,376 at the corresponding period of 1910, being an increase of £61,193. Of the amount of £520,286 shown by the net revenue account, £218,750 has been absorbed by the dividends paid on January 9th, 1912, in respect of the half-year ending December 31st 1911. The balance of £301,536 has been transferred to the reserve fund account, bringing the total of that fund to £4,645,944. £150,256 has been expended on capital account during the half-year in the erection of 11,428 additional exchange and private stations, and in the construction of underground works. On January 29th, 1912, £3,000,000 was received from H.M. Postmaster-General on account of the purchase money in respect of the plant, property and assets of the company acquired by him, and arrangements were made for the repayment on the same date to the debenture stockholders of the whole of the outstanding 3½ per cent. and 4 per cent. debenture stocks of the company. The board have to lament the death of their esteemed friend and colleague, Mr. George Hunter Robertson, of Liverpool, which occurred on February 7th last. They desire to place on record their high appreciation of the valuable services which he rendered to the company from the very early days of the telephone enterprise."

### Cambridge Electric Supply Co., Ltd. — Mr. D.

Munsey presided at the annual meeting held on February 27th. He said that the company was in a very satisfactory condition. During the year they had made a bigger stride than ever before in their 20 years' existence. Meter charges were reduced from 10s. to 6s., and as the result of nine months' experience they had lost £100 by that arrangement, but it would help business in the long run. They were in a very strong position respecting coal.—Mr. A. A. C. Swinton, in seconding, said that they were beginning to see the other side of things; the effect of the reduced revenue due to the metal lamps was passing away, and before long they would have as much revenue as before. Their basis would be stronger with more consumers at lower prices.—The report was adopted.



### Gateshead and District Tramways Company.

THE directors report that the total revenue for 1911 amounted to £55,982 and after deducting all expenses chargeable to revenue, including repairs and maintenance, interest on mortgages, and £2,743 placed to renewals account, there remains a profit on the year's working of £22,420, plus £848 brought forward, making £23,268. Of this there is to be placed to the reserve fund £4,500, to sinking fund for redemption of mortgages £2,033, to dividend on £12,610 6 per cent. preference shares £757, to dividend on £120,000 5 per cent. preference shares £6,000, to dividend on ordinary shares at the rate of 6 per cent. per annum, in respect of which an interim dividend for half-year ended June 30, 1911, at the rate of 5 per cent. per annum was paid in September, £8,100, carried forward £1,878. Interest derived from investments has been added to the reserve fund and renewals account. After the above appropriation the total at credit of reserves, renewals and sinking fund accounts will be £51,932. The expenditure chargeable to the capital account during the year amounted to £1,346 13s. 8d., making the total £334,389. The general trade of the district was satisfactory during 1911, and the traffic receipts consequently show a gratifying increase. The net profit is substantially higher but in view of the present unrest in the industrial world, the directors considered it advisable that the amount carried forward should be increased. Meters were fixed to the cars during the latter part of the year and have resulted in a reduction in the quantity of electricity used. Satisfactory arrangements have been made with the P.A.Y.E. London Syndicate, Ltd., for the conversion experimentally of the nine cars operating the Bensham and Saltwell routes to the pay-as-you-enter system. Most of the important tramway undertakings in Canada and America have adopted the system with advantage, and it is hoped that equally satisfactory results may be obtained in this country.

	1910.	1911.
Number of passengers carried .. ..	12,061,249	12,705,177
Average receipts per passenger .. ..	1.03d.	1.02d.
Average expenditure per passenger .. ..	.56d.	.55d.
Proportion of expenses to receipts .. ..	54%	54%
Number of Cars in Stock .. ..	52	51

The route mileage is 12.16 miles.

### British Electric Transformer Co.

THE annual meeting was held on Friday last at Salisbury House, E.C., Mr. J. F. Albright presiding.

The SECRETARY (Mr. J. C. Wrist), owing to the indisposition of the chairman, read the speech which that gentleman had prepared. In this the chairman said that on the asset side of the balance-sheet there had been an addition of £4,956 for freehold land, buildings, plant, &c. That was expenditure in connection with some extensions recently carried out to their works at Hayes, which were rendered necessary by the expansion in the business during the past year. The increase in investments of about £6,000 was due to the fact that they had invested some of their spare cash in railway debentures, which could, of course, be readily realised when they were requiring further cash for the purposes of the business. The reserve account stood at about £7,886, and they proposed adding this year a further £7,000 to this item, making a total reserve of £14,886. Although they had not earmarked this reserve account in the balance-sheet, they would now have a substantial reserve against patents, goodwill, and other contingencies. The directors were of opinion that it was the safest and best policy for the company to build up a reserve as much as possible in what he might term these times of prosperity, and so put the concern on as sound a financial basis as possible, rather than pay away unduly large dividends. The 10 per cent. was decided upon as the ordinary dividend because it was considered the least the shareholders could be fairly offered after such a prosperous year. Summing up the report and comparing it with last year, they would see the profit was 63 per cent. more; they were paying 66 per cent. more to the ordinary shareholders; they were transferring 40 per cent. more to reserve, and were carrying forward 145 per cent. more. He trusted that they would consider this result satisfactory. They had been doing a considerable and increasing amount of manufacture of "Tricity" cookers during the past year. He was of opinion that there was a growing demand for this class of apparatus, the orders coming in in a steady manner from all parts of the world. They had come to the conclusion that the "Tricity" business could be more rapidly and advantageously developed if the company had the sole rights in connection with it, and it was partly with that object that he would ask them presently to pass a resolution increasing the capital. The directors felt that it was most necessary in the best interests of the company to broaden the basis of its manufactures, and they believed that the additional turnover which might be reasonably expected from the sale of the "Tricity" cookers should in the future form such a source of revenue that the profits earned for the past year could be maintained or even augmented. As regarded the general prospects of the business he had no wish to prophesy, but he might tell them as a matter of fact that the year 1912 found them with more orders in hand than did the year 1911, which had been a record year.

MR. G. BERRY, in seconding the resolution, said that in regard to the business of the past year, the most important development had been that due to the manufacture of "Tricity" cookers, nearly 4,000 of which were, he understood, in use. The demand increased very rapidly during the year, and for the last six months was nearly double that of the preceding six. The increase continued, doubtless, owing to the recommendation of satisfied users. The ever-increasing price of coal, taken with the diminishing supplies

magnified this matter into one of national importance. It had been computed that if the present electric light users alone were enabled immediately to install "Tricity" cookers in place of coal ranges for cooking, a saving of several million tons would result annually.

The report was adopted.

At a subsequent extraordinary general meeting the following resolution was carried:—"That the capital of the company be increased from £120,000 to £200,000 by the creation of 50,000 new 6 per cent. cumulative preference shares and 25,000 new ordinary shares of £1 each."

The proceedings then terminated.

### Windsor Electrical Installation Co., Ltd.

THE directors report that during 1911 the capital expenditure amounted to £1,039, making the total £90,350. The additional expenditure represents extensions of mains, also the purchase and equipment of machinery erected at the company's transformer station at Eton for regulating the supply of current taken in bulk from the Slough and Datchet Electric Supply Co., Ltd. The profit for the year (including £357 brought forward) is £6,718. Of this, debenture interest absorbs £797; dividend on 5 per cent. preference shares, £1,108; depreciation, renewal, and reserve fund, £1,750; and directors' fees, £350; leaving a balance available for dividend on the ordinary shares of £2,712. Out of this the directors recommend that a dividend of 4½ per cent., less income-tax, be paid on the ordinary shares, and that £593 be carried forward. By setting aside £1,750, the depreciation, renewal and reserve fund will amount to £17,000, and the directors now recommend that this fund be further raised to £18,000 by the transference of £1,000 from the dividend equalisation account, and that the balance of £450 of the dividend equalisation account be transferred to the credit of the free-wiring account. During the year new lamps were connected equivalent to 2,414 of 8 C.P., the total connected being 50,055 lamps.

**W. T. Glover & Co., Ltd.**—The directors' report for the year ending December 31st, 1911, shows that the result of the trading is a credit balance of £33,453, plus £5,521 brought forward = £38,975. From this are deducted:—Directors' remuneration, voted March, 1911, £1,000; directors' expenses during 1911, £63; interest at 4½ per cent. on first mortgage debenture stock, £4,250; interest at 5 per cent. on second mortgage debenture stock, £3,800; written off investments, as per balance-sheet, £775; leaving £29,087, less appropriation for payment to trustee of second mortgage debenture stock, £4,000. It is proposed to pay the dividend on the 5 per cent. cumulative preference shares (£100,000), less income-tax, absorbing £4,708 to transfer to first mortgage debenture redemption fund, £2,500; to pay a dividend on ordinary shares (£114,850) at the rate of 5 per cent., less income-tax, requiring £5,407; to pay a bonus on ordinary shares, at the rate of 2½ per cent., less income-tax, £2,704; transferring to reserve fund, £5,000, and carrying forward £4,767. The directors have pleasure in recommending the payment of the dividend on the 5 per cent. cumulative preference shares for the year ending December 31st, 1911, and also the payment of a dividend at the rate of 5 per cent. and a bonus at the rate of 2½ per cent. on the ordinary shares for the same period. After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £30,500, the redemption fund for the second mortgage debenture stock at £20,000, and the reserve fund at £15,000. The meeting will be held at Trafford Park on March 18th.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Cuban Telephone Co.—Further issue of £120,000 5 per cent. first mortgage convertible bonds (Nos. 2,001 to 2,500 of £200, and 9,414 to 9,613 of £100 each).  
Montreal Water and Power Co.—Further issue of £25,000 4½ per cent. first mortgage prior lien gold bonds of £100 each (Nos. 8,698 to 8,947).

**Greenock and Port Glasgow Tramways Co.**—The directors report that the total revenue for the year 1911 amounted to £38,949. After deducting all expenses, including interest, payments to Corporations, and the provision of £2,250 for renewals account, the available balance is £13,298, as against £9,445. The directors recommend (says the *Financier*) carrying to reserve sinking fund for loan redemption £1,776, to depreciation and reserve account £1,200, to dividend at the rate of 5 per cent. per annum on the preference shares £3,500, to dividend at the rate of 5 per cent. per annum on the ordinary shares £5,750, carrying forward £1,072.

**Vickers, Ltd.**—The directors recommend a final dividend of 1s. per share (free of income-tax) on the ordinary shares, making 2s. per share, or 10 per cent., for the year, writing off £100,000 from goodwill and patents account, and carrying forward £205,031.

**Hadfield's Steel Foundry Co., Ltd.**—For the year 1911 the directors recommend that in addition to the interim dividend of 1s. per share paid in August last on the ordinary shares (£1 each) a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 6d. per share (all free of income-tax), carrying forward the balance of £46,758.

**New Issue.**—The Consolidated Gas, Electric Light and Power Co., of Baltimore, is now offering \$700,000 ordinary stock to existing holders at par.



## MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	" Nitric .. .. per "	22/-	..
a	" Oxalic .. .. per lb.	2 3/4d.	..
a	" Sulphuric .. .. per cwt.	5/6	..
a	Ammoniac Sal .. .. per "	42/-	..
a	Ammonia, Muriate (large crystal) per ton	£29 10	..
a	Bleaching powder .. .. "	£5 10	..
a	Bisulphide of Carbon .. .. "	£18	..
a	Borax .. .. "	£16 10	..
a	Copper Sulphate .. .. "	£22 15	5/- dec.
a	Lead, Nitrate .. .. "	£25	..
a	" White Sugar .. .. "	£25	..
a	" Peroxide .. .. "	£32	..
e	Methylated Spirit .. .. per gal.	2/6	..
a	Potassium, Bichromate, in casks per lb.	3 3/4d.	..
a	Potash, Caustic (80/82 %) .. per ton	£20 5	..
a	" Chlorate .. .. per lb.	3 3/4d.	..
a	" Perchlorate .. .. "	4 1/4d.	..
a	Potassium, Cyanide (98/100 %) .. "	7 1/4d.	..
	(for mining purposes only)		
a	Shellac .. .. per cwt.	68/-	..
a	Sulphate of Magnesia .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. .. "	£6 10	..
a	" Recovered .. .. "	£5 10	..
a	" Lump .. .. "	£5 5	..
a	Soda, Caustic (white 70/72 %) .. "	£10 5	..
a	" Chlorate .. .. per lb.	3 3/4d.	..
a	" Crystals .. .. per ton	£3 5	..
a	Sodium Bichromate, casks .. per lb.	3d.	..
METALS, &c.			
b	Aluminium Ingots, in ton lots .. per ton	£67	£2 inc.
b	" Wire, in ton lots .. .. "	£102	..
b	" Sheet, in ton lots .. .. "	£120	..
p	Babbitt's metal ingots .. .. "	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis) per lb.	7 1/4d.	..
c	" Tube (brazed) .. .. "	10 1/4d.	..
c	" (solid drawn) .. .. "	8 1/4d.	..
c	" Wire, basis .. .. "	7 1/4d.	..
c	Copper Tubes (brazed) .. .. "	10 1/4d.	..
c	" (solid drawn) .. .. "	10d.	..
g	" Bars (best selected) .. per ton	£80	£1 inc.
g	" Sheet .. .. "	£80	£1 inc.
g	" Rod .. .. "	£80	£1 inc.
d	" (Electrolytic) Bars .. .. "	£68 5	£2 inc.
d	" Sheets .. .. "	£85 5	£2 inc.
d	" Rods .. .. "	£79 5	£2 inc.
d	" H.C. Wire .. per lb.	8 3/4d.	1 1/2d. inc.
f	Ebonite Rod .. .. "	5/3	..
f	" Sheet .. .. "	4/9	..
n	German Silver Wire .. .. "	1/11	..
h	Gutta-percha, fine .. .. "	..	..
h	India-rubber, Para fine .. .. "	4/10 1/2	3d. inc.
i	Iron Pig (Cleveland warrants) .. per ton	50/8 1/2	11 1/2d. inc.
i	" Wire, galv. No. 8, P.O. qual.	£14	..
g	Lead, English Pig .. .. "	£16 5	inc.
m	Manganin Wire No. 28 .. per lb.	6/6	..
g	Mercury .. .. per bot.	£8 12 6	5/- inc.
e	Mica (in original cases) small .. per lb.	6d. to 2s.	..
e	" " " medium .. .. "	2/6 to 4/-	..
e	" " " large .. .. "	4/6 to 8/6	..
p	Phosphor Bronze, plain castings .. "	11d.	..
p	" " rolled bars & rods .. .. "	1/0 1/4	..
p	" " rolled strip & sheet .. .. "	1/1	..
o	Platinum .. .. per oz.	185/-	..
d	Silicium Bronze Wire .. .. per lb.	9 3/4d.	..
r	Steel Magnet, in bars .. .. per ton	£55	..
g	Tin, Block (English) .. .. "	£194 to £196	£3 dec.
n	" Wire, Nos. 1 to 16 .. per lb.	2/3 1/2	1d. dec.
p	White Anti-friction Metals .. per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.) .. "	£29 15	12/6 dec.

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Shakspeare,	r W. F. Dennis & Co.
h Edward Till & Co.	

## STOCKS AND SHARES.

Tuesday Evening.

WITH every day bringing new aspects of the coal-strike position into focus, it is very difficult to write upon matters to which the subject is cognate, when, by the time the paper is in the hands of the reader, the whole state of affairs may have altered. The Stock Exchange remained fairly confident all through, putting prices better after the strike had actually broken out, and giving the bears rather a bad time in all the markets. In Home Rails, of course, the labour situation has dominated everything else; but, so far as the electrical stocks are concerned, other factors have been at work to which even the coal strike influence was subservient.

Central London Ordinary parted with 4 points of the 9 which it gained last week, and the Deferred stock fell 2, against the rise of 4 previously. City and South London Ordinary shed 3, and Metropolitans went back 1 1/4, which is, of course, not much after their sharp rise of last week, amounting to 8 1/4 points. Districts retained their improvement, but the whole market is less enthusiastic about the amalgamation prospects, upon the strength of which prices were rushed up so sharply quite recently. Underground Electric Railways are unchanged. The dislocation of traffic on many of the steam lines has not spread to the electrically-worked companies so far, which is a tribute to the management that had the foresight to lay in sufficient stocks to maintain full services for at all events some time.

British Electric Traction issues are a little easier, the two Preferred and the 6 per cent. Preference stocks going back to some extent. There has been a rise in Great Northern and City Preferred Ordinary, which caused the price to harden to 35s. middle. Beyond these alterations, the list is comparatively colourless.

Surprise has been occasioned that Electricity Supply shares of the London companies should have remained so steady at the time when their coal supplies were threatened. As a matter of fact, changes have been rather in favour of holders during the past fortnight than against them, and this week the tendency is still the same. Chelseas rose 5s. to 4 1/4, but the main rise is that secured by City of London Ordinary shares, the price at 15 showing a rise of 22s. 6d. County Preference hardened a little, and London Electric Preference have also improved. Metropolitans went back 1, these being the only shares in this department to show a decline on the week.

There is an idea current in some quarters that the buying of City of London Ordinary shares may be connected with the fact that the Corporation has the right to take over the undertaking in 1914 upon special terms as applied to the private and public parts of the concern. Rumours of negotiations are also in the air, to the effect that the Corporation means to buy up the concern in advance, if necessary, and the price is talked to £20 per share. What truth there may be in both these rumours it is impossible to say, but the buying has certainly been of the class commonly called "knowing," and the jobbers have been rather badly caught out of shares.

Shareholders in the Brompton and Kensington Company are asking for information with regard to the subsidiary, which it was suggested in the report should be formed, in order to comply with the limitations of the company's provisional order. Up to the time of writing, nothing has transpired with regard to this, but it is not unnatural that Brompton proprietors should be enquiring as to what they may expect.

Affairs in Mexico have been very unsettled, and all kinds of rumours got into circulation as to the amount of damage the revolutionaries propose to do to the various companies of the power, lighting and similar descriptions. These reports had the effect of bringing out a certain amount of stock, but, on the whole, the movements are insignificant. Mexican Light and Power Preferred fell 1, and the First Mortgage bonds 1/2. Mexico Trams are 1/2 down, and the bonds are also a little lower. Monterey Debentures lost a similar amount. Apart from Mexicans, the group in general is steady to firm. Rio Trams rose 1 1/2, Sao Paulo Debenture hardened to the same extent, and the shares advanced to 200. Shawinigan Capital stock put on 1/2, and Cordoba 5 per cent. Debentures gained a point. British Columbia issues are better, the chief gain being 2 points in the company's Preferred Ordinary stock. There are a few other movements of 1/2 to 1—some up, some down—but none of them possess any particular importance. The investor is still putting money into these foreign securities, his suspicion of the home-grown articles being emphasised by the uncertainty and the depression brought about by the coal strike and the prospects which open from the contemplation of the power which the Trade Unions wield.

The Telegraph market is distinguished by fresh rises in Marconis, in which the Canadian and Spanish Companies' shares have participated. Indeed, Canadian Marconis are perhaps the feature of the week, suddenly rising from 18s. to 28s. within the course of a few days. The special settlement in the shares takes place next week. Spanish Marconis at 1 1/2 are better, while the parent company's shares at 4 1/4 buyers are 1 1/2 higher. West India and Panama fell back to 4 1/4, and the Preference also show a tendency to dwindle. The Anglo group is only fairly steady, Anglo Deferred being 1/2 off. There has been a sharp drop in Eastern Telegraph Ordinary on account of a mild recurrence of the Marconi fever which demoralised the market so badly a few years ago, and from the effect of which it has never wholly recovered. Eastern Extensions fell 1/2; Globe Ordinary and Preference both gave way, all for the same reason. Cuba Telegraphs are 1/2 lower, and Direct United States 1/2 down; while amongst Telephone descriptions the only important alteration is a rise of 3 1/2 in National Telephone Deferred, this bringing the price to 128 middle. The Third Preference hardened to 5 1/2.

Manufacturing issues are not much affected this week by the labour troubles. British Insulated remain at 7, the dividend declaration being at the usual rate of 6s.—making 10 per cent. for the year. Henleys rose 10s., but India-Rubbers went back a trifle. The buying of Babcocks was resumed, with the result that the price recovered to the tune of 1/2, being up to 6 1/2 again. The Rubber market is decidedly strong, and the demand for the commodity at this week's Mincing Lane sales was sufficiently good to put a bright complexion upon most of the share prices in the Stock Exchange.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 12th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 12th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	8½ — 9½	..	5 18 11	Kensington & Knightsbridge, Ord	5	9 9	6½ — 7½	..	6 4 2
Do. 4½ % Pref. ... ..	10	4½ 4½	8½ — 9½	..	4 14 9	Do. 4 % Deb. ... ..	Stock	4 4	92 — 95	..	4 4 3
Do. Second 6 % Pref. ...	10	6 6	10½ — 11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80 — 84	..	5 7 2
Do. 4½ % Deb. Stock ...	Stock	4½ 4½	10½ — 102	..	4 8 3	London Electric, Ord. ... ..	8	2 2½	17½ — 18½ xd	..	3 18 2
Brompton & Kensington, Ord. ...	5	10 9½	8½ — 9	..	5 11 1	Do. 6 % Pref. ... ..	5	6 6	4½ — 5 xd	+ ½	6 0 0
Do. 7 % Cum. Pref. ... ..	5	7 7	7½ — 8½	..	4 4 10	Do. 4 % First Mort. Deb. ...	Stock	4 4	90 — 93	+ 1	4 6 0
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	98 — 101	..	3 19 3	Metropolitan ... ..	5	5 4½	8½ — 9½	— ½	6 3 1
Charing Cross, West End & City	5	5 5	4 — 4½	..	5 11 1	Do. 4½ % Cum. Pref. ... ..	5	4½ 4½	4½ — 4½	..	4 17 4
Do. 4½ % Cum. Pref. ... ..	5	4½ 4½	4½ — 4½	..	5 0 0	Do. 4½ % First Mort. Deb. ...	Stock	4½ 4½	99 — 104	..	4 6 7
Do. " City Undertaking " }	5	4½ 4½	8½ — 4½	..	5 9 1	Do. 3½ % Mort. Deb. ... ..	Stock	3½ 3½	84 — 87	..	4 0 6
Do. 4½ % Cum. Pref. }	100	4 4	93 — 96	..	4 3 4	Midland Electric Corporation }	100	4½ 4½	96 — 98	..	4 11 10
Chelsea, Ord. ... ..	5	5 5	4½ — 5	+ ½	5 0 0	Do. 4½ % First Mort. Deb. }	5	4 4½	8½ — 4	..	5 0 0
Do. 4½ % Deb. ... ..	Stock	4½ 4½	98 — 101	..	4 9 1	Newcastle-on-Tyne ... ..	5	5 5	4 — 4½	..	5 11 1
City of London, Ord. ... ..	10	7 8	14½ — 15½	+ 1½	5 3 3	Do. 5 % Pref., Non-Cum. ...	5	5 5	4 — 4½	..	5 11 1
Do. 6 % Cum. Pref. ... ..	10	6 6	12 — 13	..	4 12 4	North Metropolitan Power Sup- }	100	5 5	99 — 102	..	4 18 0
Do. 5 % Deb. ... ..	Stock	5 5	117 — 121	..	4 2 8	ply, 5 % Mortgages (Red.) }	10	.. ..	10 — 11	..	5 9 1
Do. 4½ % Second Deb. ...	100	4½ 4½	100 — 103	..	4 7 5	Notting Hill, 6 % Non-Cum. }	5	7½ 6½	6½ — 6½	..	5 9 5
County of Durham, 5 % First }	Stock	5 5	87 — 89	..	5 12 4	Oxford ... ..	5	10 10	8 — 8½	..	5 17 8
County of London, Ord. ...	10	5 6	9½ — 10½	..	5 18 5	St. James' and Pall Mall, Ord.	5	7 7	6½ — 7½	..	4 16 7
Do. 6 % Pref. ... ..	10	6 6	11½ — 11¾	+ ½	5 2 2	Do. 7 % Pref. ... ..	100	3½ 3½	85 — 87	..	4 0 6
Do. 4½ % Deb. ... ..	Stock	4½ 4½	107 — 109	..	4 2 7	Do. 3½ % Deb. ... ..	5	Nil 2	1½ — 1½	..	..
Do. 4½ % Second Deb. ...	Stock	4½ 4½	101 — 104	..	4 6 7	Smithfield Markets, Ord. ...	4	5 5	2½ — 3½	..	6 3 1
Edmundson's, Ord. ... ..	5	Nil Nil	3 — 8	..	Nil	South London, Ord. ... ..	100	5 5	99 — 102	..	4 18 0
Do. 6 % Cum. Pref. ... ..	5	Nil Nil	27 — 32	..	Nil	Do. 5 % First Mort. Deb. ...	1	7 7	1 — 1½ xd	..	6 4 5
Do. 4½ % First Mort. Deb. ...	100	4½ 4½	87 — 90	..	5 0 0	Do. 4½ % First Deb. Stock ...	100	4½ 4½	97 — 100	..	4 10 0
Folkestone ... ..	5	6 6½	4½ — 5	..	6 0 0	Urban, Ord. ... ..	5	5 ..	1 — 3	..	..
Do. 5 % Cum. Pref. ... ..	5	5 5	4½ — 5½	..	4 17 7	Do. 5 % Cum. Pref. ... ..	5	5 ..	2½ — 3½	..	..
Do. 4½ % First Deb. ... ..	100	4½ 4½	93 — 96	..	4 13 9	Do. 4½ % First Mort. Deb. ...	100	4½ 4½	87 — 89	..	5 1 2
Hove ... ..	5	9 9	6½ — 7½	..	6 4 2	Westminster, Ord. ... ..	5	10 10	8½ — 8½ xd	..	5 16 0
						Do. 4½ % Cum. Pref. ... ..	5	4½ 4½	5 — 6½	+ ½	4 5 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. .. ..	5	6	6	53 — 57 <sup>3</sup> / <sub>8</sub> xd	..	5 2 2	Monterey Rly. Light & Power, }	100	5	5	88 — 90	— <sup>1</sup> / <sub>2</sub>	5 11 1
Calcutta, Ord. .. ..	5	8 <sup>1</sup> / <sub>2</sub>	7 <sup>1</sup> / <sub>2</sub>	6 <sup>1</sup> / <sub>2</sub> — 7	..	6 1 5	5 % 1st Mort. Deb. }						
Do. 5 % Pref. .. ..	5	5	5	4 <sup>1</sup> / <sub>2</sub> — 5 <sup>1</sup> / <sub>6</sub> xd	..	4 16 10	Montreal, Lt., H. and Power ..	\$100	7	8	192 — 197	..	3 11 1
Calgary Power, 1st Mort. Bds.	100	5	5	92 <sup>1</sup> / <sub>2</sub> — 94 <sup>1</sup> / <sub>2</sub>	..	5 5 8	Northern, Lt., Power and Coal, }	\$500	5	..	39 — 41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7	7 <sup>1</sup> / <sub>2</sub>	114 — 118	..	5 18 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. .. ..	\$100	7	7	116 — 120	..	5 16 8	River Plate, Ord. .. ..	Stock	10	..	248 — 258	— 2	3 17 6
Cordoba Lt., Power and T., Ord.	1	3	3 <sup>1</sup> / <sub>2</sub>	7 — 1	..	3 0 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110 — 115	..	5 4 4
Do. 5 % Deb. .. ..	100	5	..	96 — 99	+ 1	5 1 0	Do. 5 % Deb. Stock .. ..	Do.	5	5	101 <sup>1</sup> / <sub>2</sub> — 103 <sup>1</sup> / <sub>2</sub>	+ 1	4 16 7
Elec. Lt. and P. of Cochabamba, }	100	6	6	92 — 94	..	6 7 8	Roy. Elec. Co., Montreal, 4 <sup>1</sup> / <sub>2</sub> % }	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	101 — 103	+ 1	4 7 5
6 % Bonds }							1st Mort. Deb. }						
Elec. Supply Victoria, 5 % 1st }	100	5	5	83 — 86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4	5 <sup>1</sup> / <sub>2</sub>	129 — 131	+ <sup>1</sup> / <sub>2</sub>	3 16 4
Do. Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds }	\$500	5	5	107 — 109	..	4 11 9
Elec. Dev. Ontario, 5 % 1st }	\$500	5	5	92 <sup>1</sup> / <sub>2</sub> — 94 <sup>1</sup> / <sub>2</sub> xd	..	5 5 10	Do. 4 <sup>1</sup> / <sub>2</sub> % Per. Deb. .. ..	Stock	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	103 <sup>1</sup> / <sub>2</sub> — 105 <sup>1</sup> / <sub>2</sub>	..	4 5 4
Do. Mort. Bonds }							Toronto Power, 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	Do.	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	99 <sup>1</sup> / <sub>2</sub> — 101 <sup>1</sup> / <sub>2</sub>	..	4 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1 <sup>1</sup> / <sub>2</sub> — 1 <sup>1</sup> / <sub>2</sub>	— 3 <sup>1</sup> / <sub>2</sub>	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92 <sup>1</sup> / <sub>2</sub> — 94 <sup>1</sup> / <sub>2</sub>	..	5 5 10
Do. 6 % Pref. .. ..	1	6	6	108 — 110	..	8 0 0	1st Mort. Deb. }						
Kaminstiquia Power, 5 % G. Bs.	\$500	5	5	2 <sup>1</sup> / <sub>2</sub> — 3 <sup>1</sup> / <sub>2</sub>	..	4 11 0	Victoria Falls Power, Pref. ..	1	Nil	11 <sup>1</sup> / <sub>2</sub> d.	1 <sup>1</sup> / <sub>2</sub> — 1 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	..
Madras, Ord. .. ..	5	..	..	102 — 105	— 1	4 15 3	West Kootenay Power and Lt., }	100	6	6	104 <sup>1</sup> / <sub>2</sub> — 106 <sup>1</sup> / <sub>2</sub> xd	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5	5	84 — 86	..	5 16 3	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	82 — 84	..	4 15 3							
Mexican Lt. & Power, Common	\$100	4	4 <sup>1</sup> / <sub>2</sub>	104 — 106	— 1	6 12 1							
Do. 7 % Cum. Pref. .. ..	\$100	7	7	91 — 96	..	5 4 2							
Do. 5 % 1st Mort. Gold Bds.	..	5	5										

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph .. ..	10	Nil	4 1/2	7 1/2 - 7 3/4	..	..	Monte Video Telephone, Ord. ...	1	6	6	1 - 1 1/2	..	5 6 3
Do. 5 % Deb. Red. .. ..	Stock	5	5	97 1/2 - 99 1/2	..	5 0 6	Do. 5 % Pref. .. ..	1	5	5	3 1/2 - 3 1/2	..	5 10 6
American Tel. & Teleg., Cap.	\$100	8	8 1/2	148 - 150	..	5 6 8	National Telephone, Pref. ..	Stock	6	6 1/2	99 1/2 - 102 1/2	..	5 17 1
Do. Collat. Trust .. ..	\$1000	4	4	94 - 96	..	4 3 4	Do. Def. .. ..	Do.	6	6 1/2	127 - 129	+ 3 1/2	4 13 0
Anglo-American Telegraph ..	Stock	3 1/2	3	66 - 68	..	4 8 6	Do. 6 % Cum. 1st Pref. ..	10	6	6	94 - 10	..	6 0 0
Do. 6 % Pref. .. ..	Do.	6	6	110 - 111	..	5 8 1	Do. 6 % Cum. 2nd Pref. ..	10	6	6	..	..	6 0 0
Do. Def. .. ..	Do.	30/-	30/-	25 1/2 - 25 1/2	- 1/2	5 15 5	Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/2 - 5 1/2	+ 1 1/2	4 15 3
Anglo-Portuguese Tel., 5 % }	100	5	5	100 - 102 xd	..	4 18 0	New York Tel., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	103 - 104	..	4 6 6
Do. Mort. Deb. }	100	5	5	100 - 102 xd	..	4 18 0	Oriental Tel. and Elec. ..	1	8	8	1 1/2 - 1 1/2	..	4 11 5
Chili Telephone .. ..	5	7	..	7 1/2 - 7 1/2	..	4 13 4	Do. 6 % Cum. Pref. .. ..	1	6	6	1 1/2 - 1 1/2	..	4 16 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 - 88	..	4 10 11	Do. 4 % Red. Deb. .. ..	Stock	4	4	87 1/2 - 89 1/2	..	4 9 5
Cuba Telephone .. ..	10	6	6 1/2	10 - 11	- 1/2	5 6 8	Pacific and European Tel., 4 % }	Do.	4	4	98 1/2 - 100 1/2	..	3 19 7
Do. 10 % Pref. .. ..	10	10	10	17 - 18	..	5 11 1	Do. Guar. Debs. }	8	5	5 1/2	10 1/2 - 11 1/2	..	3 10 11
Direct Spanish Telegraph, Ord.	5	4	4 1/2	3 1/2 - 3 3/4	..	5 6 8	Reuter's .. ..	6	6	6	130 - 133	..	4 10 3
Do. 10 % Cum. Pref. .. ..	5	10	10	8 - 8 1/2	..	5 17 8	Submarine Cables Trust ..	Cert.	5	5	..	..	..
Do. 4 1/2 % Debs. .. ..	50	4 1/2	4 1/2	99 - 101	..	4 9 1	Telephone Co. of Egypt, 4 1/2 % }	Stock	4 1/2	4 1/2	99 - 101	..	4 9 1
Direct United States Cable ..	10	4 1/2	..	7 1/2 - 7 1/2	- 1/2	5 16 3	Do. Deb. Red. }	5	8	8	7 1/2 - 7 1/2	..	5 4 11
Direct W. India Cable, 4 1/2 % }	100	4 1/2	4 1/2	99 - 101	..	4 9 1	Do. 5 % Cum. Pref. .. ..	5	5	5	5 1/2 - 5 1/2	..	4 8 11
Do. Reg. Deb. }	100	4 1/2	4 1/2	99 - 101	..	4 9 1	West Coast of America .. ..	2 1/2	2 1/2	2 1/2	1 1/2 - 1 1/2	..	3 11 5
Eastern Telegraph, Ord. Stock	Stock	7	5 1/2	129 - 133	- 6 1/2	5 5 3	Do. 4 % Debs., 1 to 1,500 }	100	4	4	97 1/2 - 99 1/2	+ 1/2	4 0 5
Do. 3 1/2 % Pref. Stock .. ..	Do.	3 1/2	3 1/2	82 1/2 - 84 1/2	- 1 1/2	4 2 10	Do. guar. by Braz. Sub. Tel. }	10	1 1/2	1 1/2	4 1/2 - 4 1/2	- 1/2	..
Do. 4 % Mort. Deb. .. ..	Do.	4	4	100 1/2 - 102 1/2	..	3 18 1	Do. 6 % Cum. 1st Pref. ..	10	6	6	10 1/2 - 11 1/2	..	5 6 8
Eastern Extension .. ..	10	7	5 1/2	13 - 13 1/2	- 1/2	5 3 8	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 1/2 - 10 1/2	..	5 6 8
Do. 4 % Deb. .. ..	Stock	4	4	9 1/2 - 10 1/2	..	3 18 10	Do. 5 % Debs. .. ..	100	5	5	102 - 104	..	4 16 2
East and S. Africa Tel. 4 % }	25	4	4	99 - 101	..	3 19 3	Western Telegraph, Ltd. ..	10	7	6 1/2	13 1/2 - 14	..	5 0 0
Do. Mt. Db. Mauritius Sub. }	10	6	6	12 1/2 - 13 1/2	- 1 1/2	4 10 7	Do. 4 % Deb. .. ..	Stock	4	4	99 - 101	..	3 19 3
Globe Telegraph and Trust ..	10	18	5 1/2	84 - 88	..	5 9 1	Western Union Tel., 4 % Bnds. A }	\$1000	4	4	106 - 109	..	3 13 5
Do. 6 % Pref. .. ..	10	13	5 1/2	56 1/2 - 58 1/2	..	5 10 2	Do. 4 1/2 % Fdg. Bonds ..	\$1000	4 1/2	4 1/2	102 - 105	..	4 5 9
Great Northern Telegraph ..	25	5	5 1/2	83 - 86	..	5 16 3							
Indo-European Telegraph ..	\$100	4	4	71 - 74	..	5 8 1							
Mackay Companies Common ..	\$100	1	5	4 1/2 - 4 1/2	+ 1 1/2	..							
Do. 4 % Cum. Pref. .. ..	1	16	..	4 1/2 - 4 1/2	+ 1 1/2	..							
Marconi's Wireless Telegraph	1	..	..	4 1/2 - 4 1/2	+ 1 1/2	..							
Do. 7 % Cum. Partio. Pref.	1	..	..	4 1/2 - 4 1/2	+ 1 1/2	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 12th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 12th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	12 1/2	17 1/2		13 5 9
Do. 5 % Pref. ..	1	5	5		6 13 4	Do. Surplus Lands ..	100	2 3/4	2 7/8		3 18 7
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 5 11	Do. 3 1/2 % Deb. ..	100	3 1/2	3 1/2		3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100					Do. 3 1/2 % Pref. ..	100	3 1/2	3 1/2		4 0 6
Do. Do. Deferred ..	100					Do. 3 1/2 % Con. Pref. ..	100	3 1/2	3 1/2		4 1 5
Do. Do. 6 % Cum. Pr'f. ..	100					Metropolitan District Ord. ..	100	Nil			Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100					Do. 6 % Deb. ..	100	6	6		4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5	5		5 1 0	Do. 4 % Deb. ..	100	4	4		4 1 8
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2		5 7 2	Do. 4 % Prior Lien ..	100	4	4		3 18 5
Central London Railway, Ord. ..	100	8	8		4 0 0	Do. 4 1/2 % First Pref. ..	100	8 1/2	4 1/2		4 18 11
Do. Pref. ..	100	4	4		4 13 0	Do. 3 1/2 % Gtd. ..	100	3 1/2	3 1/2		4 9 9
Do. Def. ..	100	2	2		3 4 6	Metropolitan Elec. Trams, Ord. ..	1	5 1/2	5 1/2		5 13 6
Do. 4 % Deb. ..	100	4	4		3 18 5	Do. Def. ..	1	Nil			Nil
City & South London, Ord. ..	100	1 1/2	1 1/2		4 10 3	Do. 5 % Pref. ..	1	5	5		5 10 2
Do. 5 % Pref., 1891 ..	100	5	5		4 11 9	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		4 9 1
Do. Do. 1896 ..	100	5	5		4 16 2	Do. 5 % Deb. ..	100	5	5		4 17 7
Do. Do. 1901 ..	100	5	5		4 17 1	Potteries, Ord. ..	1	2			
Do. Do. 1903 ..	100	5	5		3 17 8	Do. 5 % Pref. ..	1	5	5		6 19 3
Do. 4 % Deb. ..	100	4	4		5 2 2	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		4 17 10
Dublin United Trams, 6 % Pref. ..	10	6	6		Nil	South Metro. Trams, 6 % Pref. ..	1	6			6 17 2
Great Northern & City, Pr'f. Ord. ..	10	Nil				Do. 4 % Deb. ..	100	4	4		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	8 1/2			Underground Elec. Railways ..	10				
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 15 5	Do. 4 1/2 % Bonds ..	100	4 1/2	4 1/2		4 9 1
Isle of Thanet Trams, 5 % Pref. ..	5	2 1/2	2 1/2		4 6 11	Do. 6 % Income ..	100	1	1 1/2		
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord. ..	5	Nil			Nil
Lancashire United, 5 % Deb. ..	100	5	5		5 19 1	Do. 6 % Pref. ..	5	Nil			Nil
London Elec. Railways, 4 % Deb. ..	100	4	4		4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 5 11
London United Trams, 5 % Pref. ..	10	Nil									
Do. 4 % Deb. ..	100	4	4		5 1 11						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2	+ 1/16	5 3 6	La Plata Elec. Trms, Ord. ..	1			2 1/2	2 1/2			
Do. 2nd Pref. ..	5	5	5 1/2	5 1/2		5 3 6	Do. Pref. ..	1	6	6	1 1/2	1 1/2		6 0 0	
Do. 4 % Deb. ..	100	4	4	9 1/2		4 4 3	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	1	1 1/2		4 8 0	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	10 1/2		4 7 0	Do. 6 % Pref. ..	1	6	6	1	1 1/2		4 16 0	
Do. 5 % Deb. ..	100	5	5	10 3/4		4 14 9	Do. 5 % Deb. ..	100	5	5	9 3/4	9 7/8		5 2 7	
Auckland Trams, 5 % Deb. ..	100	5	5	10 2		4 15 3	Madras Elec. Tr. (1904), Deb. ..	100	5	5	9 5/2	9 7/8	+ 1 1/2	5 2 7	
Bombay Elec. S. & Trams, Pref. ..	10	6	6	10 1/2		5 6 8	Manaos Trams & Lt., 1st Deb. ..	100	5	5	9 3	9 6	+ 1	5 4 2	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	9 8		4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	9 3/4	10 1/2		4 18 6	
Do. 5 % 2nd Deb. ..	100	5	5	9 8		5 0 0	Mexico Trams Com. ..	\$100	7	7 1/2	11 7	11 9		5 17 8	
Brisbane Trams Invt., Ord. ..	5	8	8 1/2	8 1/2		4 8 11	Do. Gen. Con. 5 % Bonds ..		5	5	9 6 1/2	9 8 1/2	- 1 1/2	5 1 6	
Do. 5 % Pref. ..	5	5	5	4 1/2		4 15 3	Do. 6 % Bonds ..	100	6	6	100	102		5 17 8	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100		4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 1/2	7 1/2	- 1/8	7 0 4	
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	135		5 14 4	Do. 6 % Pref. ..	5	6	6	5	5 1/2		7 0 4	
Do. Pref. Ord. ..	100	6	6	118	+ 2	4 18 4	Do. 5 % 1st Deb. ..	100	5	5	9 7 1/2	9 9 1/2		5 0 6	
Do. 5 % Pref. ..	100	5	5	109 1/2	+ 1/2	4 8 11	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2		1 1/2	1 1/2		1 18 1	
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	100		4 7 5	Do. 5 % 1st Deb. ..	100	5	5	10 1	10 4		4 16 2	
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	102		4 6 7	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5	5 1/2	- 1/4	5 9 1	
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	104		4 5 0	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	9 8	10 1		4 9 1	
Calcutta Trams, Ord. ..	5	6		5 1/2		5 4 4	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	11 3/4	12 0 1/2	+ 1 1/2	4 3 0	
Do. 5 % Pref. ..	5	5	5	4 1/2		4 16 5	Do. 1st Mort. 5 % Bonds ..		5	5	10 2 1/2	10 3 1/2	+ 1/4	4 16 5	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99	- 1	4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	9 9	100		5 0 0	
Cape Electric Trams ..	1	Nil	2 1/2				Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	19 9	20 1	+ 1	5 19 6	
City Buenos Aires Trams (1904)	5	5	5	5 1/2		4 6 0	Do. 5 % 1st Deb. ..	\$500	5	5	10 3 1/2	10 5 1/2	+ 1 1/2	4 14 9	
Do. 4 % Deb. ..	100	5	5	101		4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	8 1	8 4		5 19 1	
Colombo Elec. Tr. & Lt., 5 % Deb. ..	100	5	5	9 8		5 2 0	Southern El. Tr. B.A., 5 % Deb. ..	100	5	5	9 3	9 5		5 5 3	
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100		4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2	5 3/4		6 1 9	
Kalgoorlie Elec. Trams ..	1	Nil				Nil	Do. 6 % Pref. ..	5	6	6	5 1/2	5 3/4		5 11 7	
Do. 5 % A Deb. ..	100	5	5	9 1		5 6 5	Do. 5 % 1st Deb. ..	100	5	5	100	103	+ 1	4 17 1	
Do. 6 % B Deb. ..	100	5	6 1/2	5 6	- 2	10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb. ..	100	4 1/2	4 1/2	10 5	10 7		4 4 1	

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6				Dick, Kerr ..	1	5		3 1/2	3 1/2		5 8 1	
Do. 6 % Pref. ..	1	9	6			7 2 2	Do. Pref. ..	1	6	6	1 1/2	1 1/2		5 9 9	
Babcock & Wilcox ..	1	26	24 1/2			3 15 7	Do. Deb. ..	100	4 1/2	4 1/2	9 7	100		4 10 0	
Do. Pref. ..	1	6	6			3 13 10	Edison & Swan, A, £3 paid	5	Nil		1 1/2	1 1/2		Nil	
B.I. & Helsby Cables ..	5	10	10 1/2			6 17 11	Do. fully paid ..	5	Nil		1 1/2	2 3/4		Nil	
Do. Pref. ..	5	6	6			4 16 0	Do. 4 % Deb. ..	100	4	4	7 1	7 5		5 6 8	
Do. Deb. ..	100	4 1/2	4 1/2			4 7 5	Do. 5 % Second Deb. ..	100	5	5	7 7	80		6 5 0	
British Thomson-Houston, Deb. ..	100	4 1/2	4 1/2			4 13 9	Electric Construction ..	2	Nil	2 1/2	3	1			
British Westinghouse, Pref. ..	3	Nil				Nil	Do. Pref. ..	2	7	7	1 1/2	1 1/2		7 9 4	
Do. Deb. ..	100	4	4			6 5 0	Greenwood & Batley, Pref. ..	10	7	7	7 1/2	8 1/2		8 5 8	
Do. 6 % Prior Lien ..	100	6	6			5 14 3	Do. Deb. ..	100	5	5	9 4	9 6		5 4 2	
Browett, Lindley, Ord. ..	1	Nil				Nil	General Electric, Pref. ..	10	5	5	9	9 1/2		5 5 3	
Do. Pref. ..	1	Nil				Nil	Do. Deb. ..	100	4	4	8 7	9 2		4 7 0	
Brush, Ord. ..	2	Nil				Nil	Henley's, Ord. ..	5	15	10 1/2	12 1/2	13	+ 1/2	5 15 5	
Do. 7 % Pref. ..	2	Nil				Nil	Do. Pref. ..	5	4 1/2	4 1/2	5	5 1/2	xd	4 5 9	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2			7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	10 4	10 6		4 4 11	
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2			10 14 4	India-Rubber, G. & T. ..	10	10		9 1/2	10 3/4	- 1/2		
Callender's Cable ..	5	15	10 1/2			7 17 11	Do. Pref. ..	10	5	5	9 1/2	10 1/2		4 17 7	
Do. Pref. ..	5	5	5			4 15 3	Telegraph Construction ..	12	20	10 1/2	35 1/2	37 1/2		6 7 0	
Do. Deb. ..	100	4 1/2	4 1/2			4 9 7	Do. Deb. ..	100	4	4	9 9 1/2	10 1 1/2		3 18 10	
Castner-Kellner ..	1	17 1/2	20			5 10 4	Willans & Robinson ..	1	Nil					Nil	
Do. Deb. ..	100	4 1/2	4 1/2			4 1 10	Do. Pref. ..	5	Nil		1 1/2	1 3/4		Nil	
Crompton & Co. ..	3	Nil	Nil			Nil	Do. Deb. ..	100	4	4	6 1	6 4		6 5	
Do. Deb. ..	100	5	5			7 7 1									

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/2 per cent., February 8th, 1912.



## ELECTRIC POWER IN A JAPANESE SHIPBUILDING YARD.

THE marvellous development of Japan has ceased to be a nine days' wonder, and engineers in the Western world are now prepared to accept the fact that in the Far East the centres of industry have developed considerably, and will, in every probability, have to be reckoned with as closely by European engineers as Germany, which is

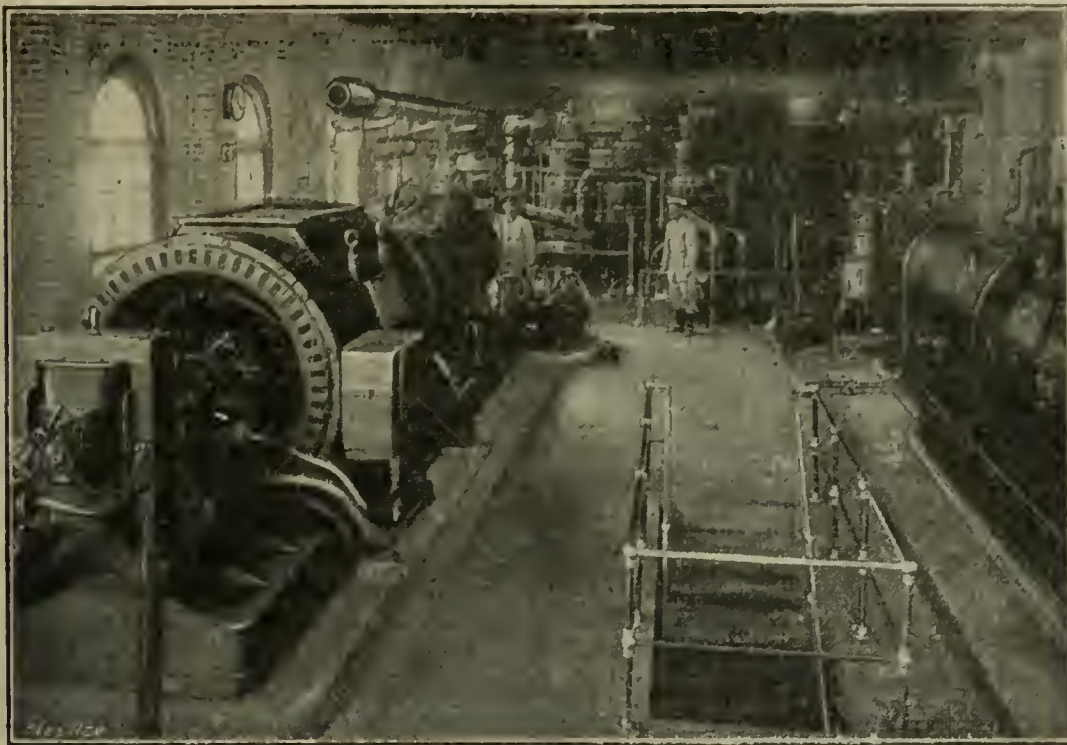


FIG. 1.—CENTRAL POWER HOUSE, AKUNOURA ENGINE WORKS, JAPAN.

giving the world an example of what modern competition means. It is, perhaps, a matter of some pride to British engineers that Japan owes much to Englishmen for initiating the forward movement, which has done so much in placing Japan in the forefront of the nations in an engineering as well as in a political sense. In no department of engineering is this more manifest than in that of shipbuilding and the allied engineering industries. Japan is similar to Great Britain in the fact that it owes its position among the world powers very largely to its naval strength, and this has involved a steady policy on the part of the Japanese Government towards the concentration of ship-building activity so far as possible within its own realms. Not many years ago the Japanese Navy was largely constructed in Great Britain; but it is doubtful whether the large shipbuilding enterprises in this country, gigantic though they are, and equipped for the cheap and rapid construction of warships of the largest sizes, are getting the same number of orders for Japan as they were in former times. This is a perfectly natural outcome of the internal development of Japan, and reflects no discredit whatever upon British industry. An encouraging feature of the situation is that, although the actual position of manufacture is changed to a considerable extent, there are interests and alliances, both in the commercial and political world, which operate favourably towards the maintenance of a strong mutual interest and sympathy between engineers in Great Britain and Japan.

This being the case, it is of advantage to refer to what is probably one of the oldest shipbuilding firms in Japan, and one which certainly stands in the forefront of Japanese marine engineering enterprises, the Mitsu Bishi Dockyard and Engine Works. This resembles our own great shipbuilding and marine engineering works, such as Vickers, Palmer's, and Armstrong, Whitworth's, in that it is capable

of dealing with the construction of warships and vessels of the merchantile marine, right away from the raw material to the finished ship, with the exception, perhaps, of such patented manufactures as are only made by firms possessing patent rights. Even here the firm mentioned has made arrangements with some of the outstanding engineering firms of the older world for the manufacture of machinery which is protected by patents. One of the best examples of this branch of the work is the production of Parsons marine turbines for the Far Eastern territories.

It is not proposed in this article to deal in a general way with the shipbuilding and marine engineering features, but to emphasise more particularly the very large way in which electric power has been utilised in the operation of these works. It is almost a foregone conclusion that the equipment of a new works involves the utilisation of electric power, as in these days electricity is recognised as one of the most valuable adjuncts to marine engineering operations. We have, however, in the Mitsu Bishi Dockyard and Engine Works at Nagasaki, a very interesting object lesson on the quickness of the Japanese to adapt themselves to most modern ideas. The Nagasaki works are not of mushroom growth. They have been in existence since 1856, and therefore it would not be wondered at if the owners of these works had adhered to older forms of power, when it is remembered that even in this country there is a considerable amount of conservatism in this respect. Electric power has,

however, been adopted on a most remarkable scale, the advantages of a centralised power plant having been realised in the very fullest sense.

Fig. 1 illustrates the central power house which is situated at the Akunoura engine works, and which supplies electric current to over 200 motors, having a total brake-horse-power of 4,303. These motors are utilised to drive the machines in the various departments and in addition to this, electric lighting is installed to the extent of

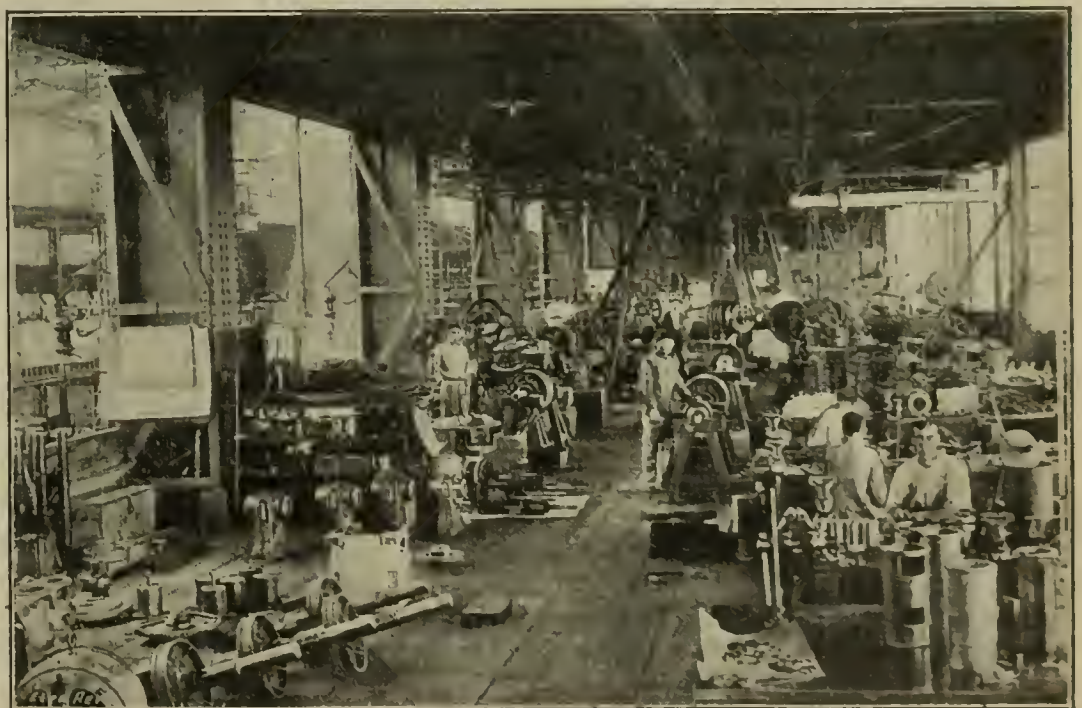


FIG. 2.—ELECTRICAL SHOP, MITSU BISHI WORKS, JAPAN.

about 3,000 incandescent lamps and 200 arc lamps on the whole premises. The generators are of two types, there being both a low-tension direct-current system, and a high-tension alternating-current distribution. The generators for the low-tension network comprise one 500-kw. direct-current generator, two 100-kw. direct-current dynamos, and two 225-kw. direct-current dynamos, generating together 1,150 kw. Besides this 1,542 h.p. of plant, there is a 300-kw. direct-current dynamo coupled to a three-phase induction motor, this unit providing a link between the high



and low-tension distribution systems. On the high-tension alternating current system the generators consist of two Parsons patent 500-kw. turbo-alternators direct-coupled to turbines of the Parsons type. These generators operate at 3,450 volts, and are used for the supply of current to a sub-station erected at Tategami, and to electric pumps operated on the No. 1 dock of the firm. It is interesting to note that while one of these generating sets was manufactured by Messrs. Parsons & Co., of Newcastle-on-Tyne, the other set was manufactured by the Mitsu Bishi Dockyard and Engine Works under licence from Messrs. Parsons.

Besides the above plant a central power house contains two direct-current dynamos each of 25-kw. capacity for the purpose of meeting the requirements of vessels in dock, the aggregate generating capacity of the power house being 2,200 kw., or approximately 3,000 H.P. It may be added that there is a set of Tudor storage batteries numbering 132 cells, with a capacity of 3,000 ampere-hours. Steam constitutes the motive power of these generators and dynamos, and is supplied by two Mitsu Bishi Nesdrum boilers and seven Babcock & Wilcox boilers.

Reference was made above to the high-tension transmission effected to the Tategami sub-station. This sub-station is situated in the Tategami shipyard for the supply of current in that direction, the outfits consisting of two 200-kw. rotary converters which convert the 3,450-volt alternating-current from the central power house for supply to a 250-volt direct-current distribution. Without attempting to specify categorically the power plant which is driven by the high and low-tension systems, it may briefly be stated that both as regards the engineering department, platers' and fitters' sections and other engineering sections of the works, and the shipyard itself together with the berths, these are fully equipped electrically both for power and lighting, and the developments displayed in this have fully equalled the most advanced methods of application practised in our home dockyards. Special reference, however, may be made to the electric shop, which is attached to the engineering section, and which is illustrated in fig. 2. Part of the three-storeyed bay of the erecting shop is allotted to this electric shop, which is fitted with a 3-ton automatically-driven electric lift, a 3-ton overhead truck, a 5-ton electric crane, and all the necessary appliances for the manufacture of and repairs to Parsons turbo-alternators, together with the construction of generators and motors of every description for use in steamships. A considerable amount of work is also carried on in general electrical machines and tools, and, of course, the maintenance of electrical outfit of the works themselves is carried on in this department.

From the above notes it will be apparent that, very far from lagging behind western ideas with regard to the application of electricity to marine engineering, there is, in every probability, more than one aspect of the matter which should afford food for thought for the engineering staffs of British marine engineering works, and for this reason we are much indebted to the general manager of the Mitsu Bishi Dockyard and Engine Works for his courtesy in providing us with the above information.

## ELECTRICAL SCHEME FOR MELBOURNE: AN IMPORTANT PROPOSAL.

[FROM AN AUSTRALIAN CORRESPONDENT.]

PEOPLE in Great Britain who know of Melbourne only by repute, and think of it as a great city, would be astonished at its electrical backwardness, if they could be suddenly transported here on some magic carpet of Arabian design, or a long-distance aeroplane of Western European manufacture. It is hardly too much to describe it as many years behind Sydney in the applications of electrical power. The most obvious manifestation of its backwardness is afforded by its antiquated cable tram service. Every other Australian capital—Sydney, Brisbane, Adelaide, Perth, Hobart—has an

excellent electrical system; and all of them, with the exception of that of Adelaide, have been in operation for a considerable number of years; while even provincial centres—such as Ballarat, Bendigo, Lannceston, Fremantle, Kalgoorlie, and Leonora have their electrical services. In one or two of the Melbourne suburbs the municipalities have inaugurated systems of their own, but the city itself, the inner circle of suburbs, and the connection between these, are dependent upon an altogether effete cable service, slow, expensive, ill-lighted, and subject to breakdowns. This is not likely to be superseded for some four or five years, as the company's concession yet has that period to run; but there is a chance that its hands may be forced, or that it may be bought out before the expiry of its term. The probability of this happening is increased by the fact that there is urgent need, not only for the electrification of the tramway system, but also for the electrification of the suburban railway lines, which are run by the Government, and on which the congestion of traffic during the busy hours of the day is becoming more and more a serious problem, and one that is crying aloud to be dealt with without delay.

Melbourne is thus ready for a vast electrical scheme, and such a scheme is now forthcoming. The sponsors are the Victorian Mineral Development Co., and a number of English electrical firms, and it is understood that an expenditure of between two and three million sterling is contemplated. It is proposed to use for the generation of electricity certain brown coal deposits in the neighbourhood of Morwell, a small country town some 80 miles east of Melbourne, the proposal being to transmit the current along two double-circuit lines, each independent of the other, the voltage decided upon being 110,000. The lines are to be borne on towers 70 ft. high, and standing 250 ft. apart, the sag bringing the lines between the towers to within 20 ft. of the ground. Each circuit will be worked upon insulating swivels, and special care will be taken to avoid damage by lightning. The turbine generating plant at Morwell will, if the scheme be carried out, be the largest in Australia, having a capacity of 15,000 kw. From a central station at Oakleigh, 10 miles from Melbourne, the current will be transmitted to sub-stations throughout the whole of the metropolitan area.

The scheme is the outcome of a visit paid to Melbourne and Morwell last year by a trio of German experts, Messrs. Karplus, Turk and Hoffmann. One of these, Mr. Hoffmann, is a leading authority on brown coals, and his services were loaned by the Prussian Government; another, Mr. Karplus, is an electrical expert in the employ of Messrs. Siemens Bros.; and the third, Mr. Turk, accompanied them to do the necessary computing. Although the three experts naturally maintained strict silence when here, it is known that they were greatly impressed with the possibilities of the Morwell coal.

The field has been known and held for very many years without ore being exported with any adequacy. If the evidence of bores may be trusted, there is a vast tonnage of brown coal lying beneath a heavy ore burden, capable of removal by a high degree of hydraulic power to be derived from a neighbouring creek, so as to make the deposit workable by ordinary quarrying methods. There are said also to be very large deposits of lime in the district, and as these assay 95 per cent. of pure lime, there is a probability of the establishment of works for the manufacture of carbide of calcium and various coal products; and it is believed that, owing to the cheapness with which power could be obtained in Morwell, that town would become a great manufacturing centre, and it is expected, too, that a great impetus would be given to Melbourne as a manufacturing city. It is in the cheapness with which, it is reckoned, the brown coal can be won from the ground and put into the furnaces, that this great scheme has its chance of success. The coal is very low in heating power when compared with the excellent black coals of New South Wales; but the exhaustive trials made in Germany of shipments of the Morwell coal show that it gives a heat far in excess of that produced by the best German brown coals, which have been found exceedingly valuable for such purposes as that for which it is proposed to utilise the Victorian deposit.

To turn this deposit to a marketable use would in itself be a great gain to the State. When tested by the State Mines



Department many years ago, it was found by a diamond bore to be more than 800 ft. in thickness, and was declared to be the biggest known coal seam in the world. But an exhaustive trial showed it to be of very little use for railway purposes in its natural state. Briquetting was then resorted to, and great anticipations were indulged in, but these were all falsified by the event. However, some briquettes made from the coal in Germany were pronounced to be 20 per cent. above the average made in that country and Austria from local brown coals. The failure in the Victorian experiments was in not raising the temperature to a degree sufficient to cause the agglutinative elements to liquefy to such an extent as to enable them to adhere. The three experts already mentioned are understood to be of opinion that, when properly briquetted, as in Germany, the Morwell coal will prove thoroughly satisfactory. If, as was asserted by the Victorian Coal Commission, its heating properties in such circumstances are only 10 per cent. below those of average New South Wales black coals, the fact that it is little more than 50 per cent. of the price of such coals is a matter of very great importance. It is worthy

a low intensity, and previously calibrated against standard incandescent lamps. This mercury-vapour sub-standard was

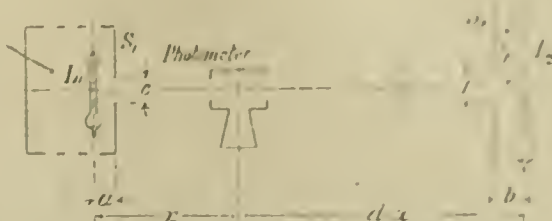


FIG. 2.

of the Cooper-Hewitt type, as shown in fig. 1, and had a length  $L = 10$  cm., inner diameter  $d_{ri} = 2\frac{3}{4}$  mm. The normal current (*i.e.*, current at the minimum voltage point) for this lamp was about  $3\frac{1}{2}$  amperes, but the lamp was worked at only  $2\frac{1}{2}$  amperes for the tests.

Such a lamp, after burning for about 100 hours at normal current to effect the initial blackening of the glass,

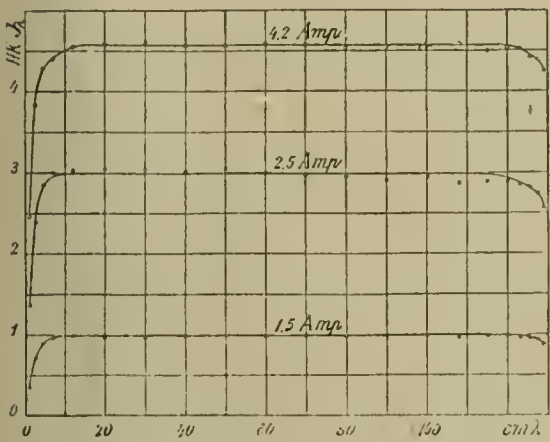


FIG. 3.

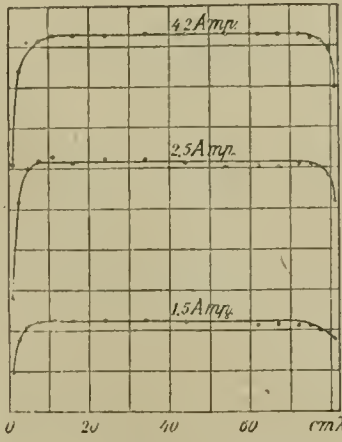


FIG. 4.

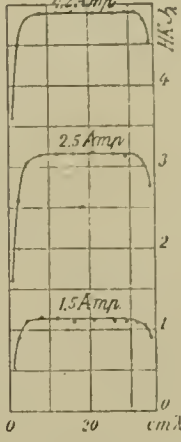


FIG. 5.

of mention that it will produce gas up to only about half the power of Newcastle (N.S.W.) coal, while its tar and ammonia percentages are very low.

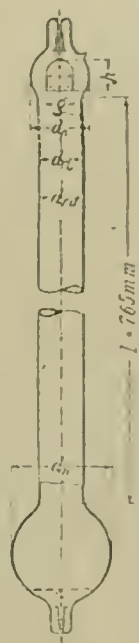


FIG. 6.

### A PHOTOMETRIC INVESTIGATION OF MERCURY-VAPOUR LAMPS.\*

THE points dealt with in this investigation are :—(1) The distribution of light intensity along the length of a tubular mercury-vapour lamp :

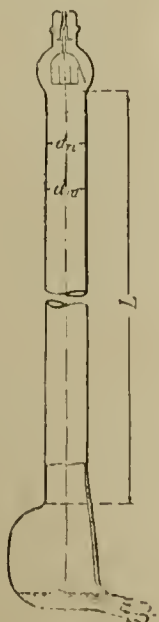


FIG. 1.

- (2) The effect of the tube diameter on the light intensity and efficiency, and
- (3) The comparison of the behaviour of such a lamp on direct and alternating currents.

The photometric measurements were made with a Bunsen photometer against a short mercury-vapour lamp worked at

which always occurs, and if kept at a constant room temperature and run at a reduced current, forms a very satisfactory and steady standard. This particular lamp only fell off about  $1\frac{1}{2}$  per cent. after being used for 300 hours. It gave 2.95 hefners per cm. length. This standard  $L_1$  was enclosed in a perforated box, as shown at  $s_1$ , fig. 2, having a vertical opening  $c$  (which could be varied in length between 10 mm. and 50 mm.) facing the photometer. At the other end of the 230-cm. photometer bench the lamp under test ( $L_2$ ) was fixed behind a large screen  $s_2$  with an opening  $f$ .

For the first series of tests a lamp was made of the Cooper-Hewitt type, as in fig. 1, using a carefully selected piece of glass tubing, with a clear length of arc of 130 cm.

This was supplied with direct currents of 1.5, 2.5 and 4.2 amperes, and, after burning it for two hours to ensure a steady condition, a set of photometer readings was made with the lamp shifted step by step so as to bring all points of the lamp from the positive up to the negative electrode, opposite the photometer opening. The results are given in fig. 3.

The lamp was then cut down to 82 cm. clear length of arc  $L$ , and the tests were repeated, with the results shown in fig. 4.

Finally, the length of arc was reduced to 36 cm., and the readings shown in fig. 5 were obtained.

These tests show that whilst the C.P. is constant for at least the central third of the length of the lamp, it falls off somewhat at each end. The ratio—

$$\frac{\text{Average C.P. per cm. of whole lamp}}{\text{C.P. per cm. of central third}}$$

works out with considerable constancy to .98.

For the second series of tests, to determine the effect of the tube diameter, a set of six similar lamps was made up as in fig. 6, all 76.5 cm. long, and having the following dimensions :—

\* Abstract of an article by Dr. J. Pole, *E.T.Z.*, February 15th, 1912.



Internal diameter ( $d_{ri}$ ) = 8.6, 15.6, 25, 35, 45.8 and 61.5 mm.  
 External diameter ( $d_{ra}$ ) = 9.9, 17.6, 27.1, 37.5, 47.6, and 66 mm.  
 Diameter of positive bulb ( $d_p$ ) = 19.2, 25.4, 34.4, 48, 61.6, and 80.8 mm.  
 Diameter of negative bulb ( $d_n$ ) = 22.5, 40.5, 63.4, 89, 116, and 152.5 mm.  
 Diameter of positive electrode ( $q$ ) = 9, 13, 17, 24, 31, and 38 mm.  
 Height of positive electrode ( $h$ ) = 11, 14, 19, 25, 24, and 35 mm.

The positive electrodes were of iron, and the bulbs were spherical and not blackened. The above dimensions were carefully chosen, so that at normal current the lamps were all working with about the same electrode current density, and under the same internal temperature conditions.

Photometer readings were taken for the central point of each lamp with various currents, starting from the lowest current, which could be kept constant with the aid of considerable self-induction in the circuit, and going up to the current at which the + electrode just began to glow, and beyond which the lamp could not be worked satisfactorily.

The results obtained are given in figs. 7 and 8, curve IV referring to the tube of smallest diameter, and curve IX to that of largest diameter.

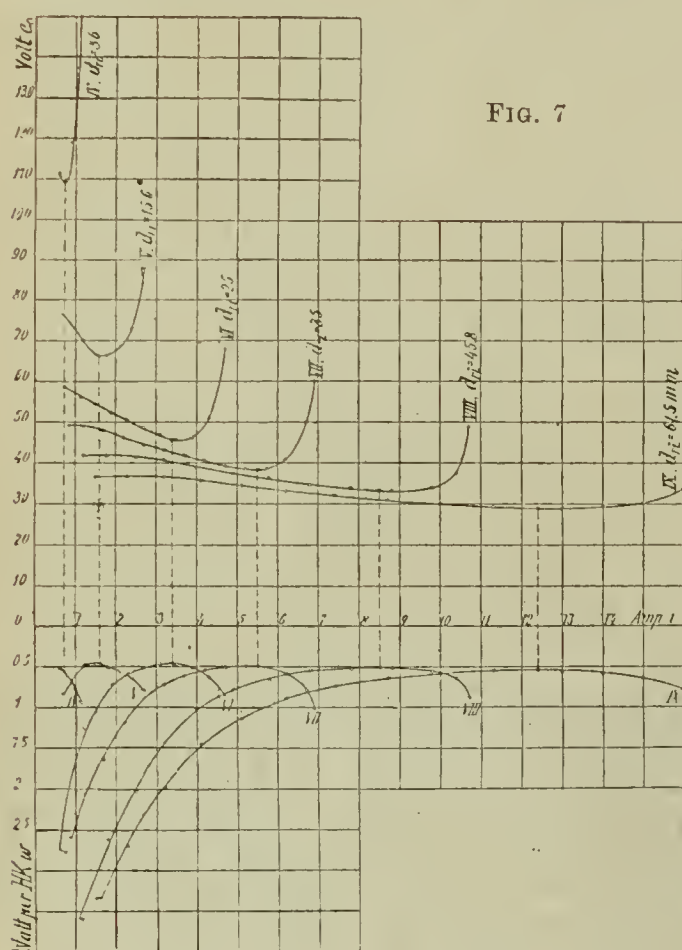


FIG. 7

Fig. 7 gives the connection between lamp current ( $i$ ) and lamp voltage ( $e$ ), and fig. 8 that between current ( $i$ ) and the watts per average C.P., and per cm. length of

$$\text{lamp} = W = \frac{e \times i}{.98 \times L \times J},$$

where  $L$  = length of lamp in cm.

$J$  = hefners per cm. of length of lamp at central part of lamp.

It will be seen that the minimum consumption in each case occurs at the "normal" current (*i.e.*, at that current for which the terminal voltage is a minimum) and has the almost constant value of .5 watt per hefner, neglecting the losses in the regulating resistances.

Finally, for the purpose of comparing alternating-current and direct-current lamps a special lamp was made as shown in fig. 9. It was provided with two iron positive electrodes  $a_1, a_2$ , a main negative mercury electrode  $c$ , and an auxiliary anode  $a_3$  for maintaining the arc. The lamp was arranged for connection either to an A.C. supply from an auto-transformer ( $T$ ) or to a D.C. supply by throwing over the switch  $S$  to position II or position I (fig. 10).

In order to maintain the ionisation of the cathode  $c$  at the instants of zero current a constant direct current of 1 ampere was kept flowing from the auxiliary anode  $c$  to the cathode  $c$  through the resistance  $R_3$ , as shown.

The A.C. supply voltage was regulated by means of an

auxiliary adjustable transformer, and the D.C. voltage by the regulating resistance  $R_2$ . The divided small resistance  $R_1$  was inserted merely to ensure the equal loading of the two anodes  $a_1, a_2$  on D.C. The degree of pulsation of the rectified alternating current through the lamp could be varied by introducing more or less of the inductance  $L_1, L_2$ .

In the absence of suitable apparatus for taking up the curve shape of the supply current, Dr. Pole used three ammeters to determine the nature of the current:  $M_1$  was an

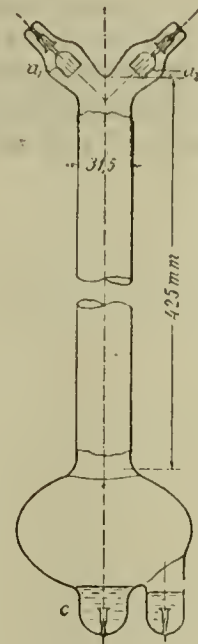


FIG. 9.

ordinary moving-coil Weston instrument reading the average value  $i_1$  of the pulsating current through the lamp;  $M_2$  was a hot-wire ammeter reading the R.M.S. value  $i_2$  of the whole current; and  $M_3$  was an induction ammeter reading only the effective value  $i_3$  of the alternating part of the current. For a pure sine wave of current  $i_3^2 = i_2^2 - i_1^2$ .

The tests were made by switching on the lowest value of direct current  $i_1$ , and keeping this on until a steady state was reached, and then taking a photometer reading at the centre of the lamp.  $S$  was then switched over on to the A.C. supply with the greatest amount of inductance in circuit (*i.e.*, smallest pulsations of current), and the A.C. supply voltage was regulated until exactly the same reading  $i_1$  was obtained on the Weston meter,  $M_1$ , as before on the D.C. test. When a steady state was again reached, the photometer reading was repeated. The inductance in the circuit was then reduced somewhat by short-circuiting  $L_1$ , and the current  $i_1$  was again regulated to the same value, and another photometer reading was taken. Finally  $L_2$  was also cut out and another photometer reading taken. The lamp was then

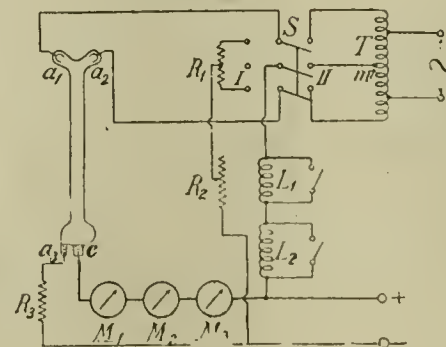


FIG. 10

once more switched on to D.C. and the whole test repeated with a higher value of  $i_1$ .

In this way readings were obtained between  $i_1 = .3$  amperes and  $i_1 = 5$  amperes, and all the tests show with remarkable unanimity that for a given direct-current reading  $i_1$  the candle-power is exactly the same, whether used on direct current or on alternating current.

**Canadian General Electric Co., Ltd.**—The directors have declared a quarterly dividend of  $1\frac{1}{4}$  per cent. for the three months to March 31st, being at the rate of 7 per cent. per annum on the common stock. A half-yearly dividend of  $3\frac{1}{2}$  per cent. for the six months to March 31st (7 per cent. per annum) has also been declared on the preference stock.



PROCEEDINGS OF INSTITUTIONS.

High-Voltage Tests and Energy Losses in Insulating Materials.

By E. H. RAYNER, M.A., M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, February 8th, 1912.)

THE present paper describes experiments which have been made during the last three years on some insulating materials which are commonly used in electrical apparatus working at a high voltage. The work has been carried out at the request of the Engineering Standards Committee. The point on which information was specially requested was whether damage to insulation of electrical plant was more likely to be caused by a short application of a high test voltage, or by a longer application of a lower voltage. A research of this nature labours under the great disadvantage that the results depend very largely on such physical conditions as temperature and humidity. These important external influences, and, very commonly, the great variation of a large number of successive similar experiments from their mean, often largely mask the effect looked for.

For the purpose of this research the Engineering Standards Committee presented to the laboratory the necessary generating plant. This consists of a 20-KW., 200-volt, 40 to 60 cycle motor-alternator with field resistances, a transformer of 100,000 volts, and a subsidiary auto-transformer, constructed by the British Westinghouse Co. For the accurate measurement of high voltages the Laboratory has added an electromagnetic precision voltmeter of 500 volts, together with resistances amounting in all to 99·5 times that of the instrument. By this means 100,000 volts can be measured. The voltmeter and its resistances were made by Hartmann & Braun, while the switchgear and the mounting for the whole apparatus were made at the Laboratory. A large electrically heated oven has been constructed for doing experiments at any temperature up to 200° C.

For the experiments described in the latter portion of the paper a high-voltage electrostatic watt-meter with the necessary resistances and switches was constructed. This has been used for power measurements up to about 15,000 volts. Unless otherwise stated, a frequency of 50 cycles per second has been used. Temperatures are in °C.

For the application of the voltage to oiled fabrics, &c., brass electrodes were used, with well-rounded edges (fig. 1, No. 1). These were replaced later by others of sharper curvature at the edge, as it was found that the increased voltage stress was more than compensated by the weakness caused by the heating due to increased

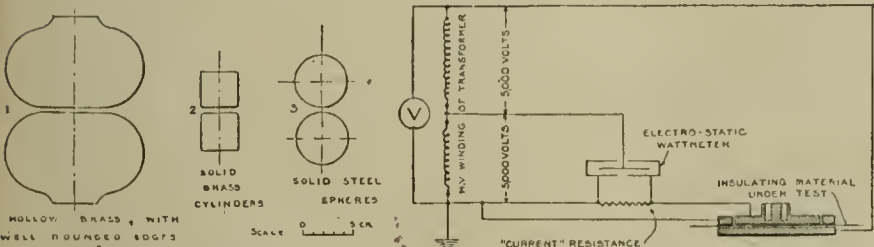


FIG. 1.—ELECTRODES. FIG. 2.—WATTMETER TEST USING GUARD-RING.

brush discharge when edges of large radius of curvature were used (No. 2). The effective surface of these electrodes was a circle of 38 mm. (1·5 in.) diameter, the edge being rounded to a radius of about 3 mm. ( $\frac{1}{8}$  in.). For the experiments on mica, steel spheres 5 cm. (2 in.) in diameter were employed (No. 3). One of the first tests on the materials was to find how electric stress at breakdown varies with the number of sheets used. These materials are always used in several layers in high-voltage machinery, and these experiments gave information as to the number of layers which might be considered most suitable for further testing of the material.

Table A gives the results of a series of tests of breakdown using from one to ten layers of thin oiled paper. The voltage was in each case raised to the value given in Table A, so that breakdown occurred in about 20 to 40 seconds. It will be noted that when several thicknesses are tested the voltage per sheet falls as the number of sheets is increased. When only two

TABLE A.—THIN OILED PAPER, 0·095 mm.

Voltage per sheet.		Voltage per sheet.	
Sheets.		Sheets.	
1	1,080	5	1,920
2	1,995	7	1,770
3	2,300	8	1,800
4	2,210	10	1,770

or three layers are tested the voltage per sheet rises. This is due to the thinness of the sheets, as the weakest parts of a sheet are generally much weaker than the average when the sheets are of so thin a material as this. On putting two or three thicknesses together, the weak spots in one sheet are generally covered by stronger parts of the others. The results on somewhat thicker oiled materials show a fall in voltage per layer when more than two layers are tested together. For still thicker materials the voltage per layer falls from the first

owing to the decreased proportional effect of small local variations in the thickness and quality of the material and to the less efficient cooling of the metal electrodes (Table C).

TABLE C.

Number of sheets.	Average breakdown voltage per sheet.		
	Oiled cloth, No. 5, 0·14 mm.	Oiled cloth, No. 7, 0·18 mm.	Red Empire paper, 0·17 mm.
1	3,600	5,780	4,720
2	3,750	4,020	4,110
3	3,250	3,410	3,370

A series of tests was made by subjecting portions of the material (four thicknesses, 0·095 mm.) to 4,000 volts for 5 minutes only, and then determining the breakdown voltage. This was found to average 9,180 volts. Alternate portions of the sheet were tested in a similar way, but without the previous application of the 4,000 volts. The average breakdown voltage was 9,140, showing that the short application does not produce any measurable depreciation.

The same pressure, 4,000 volts, applied for periods of 15, 30 and 60 minutes, produced a lowering of the breakdown voltage by 8, 14 and 11 per cent. respectively—the last result showing the uncertainty of such tests.

A common method of working is to apply a high voltage and to observe how long the material will withstand this before being pierced. The following tests (Table E) show the kind of results obtained:—

TABLE E.

Thin Oiled Paper, 0·095 mm. (Four Thicknesses).		Oiled Cloth, No. 5, 0·14 mm. (Three Thicknesses).	
Voltage.	Time elapsing before failure.	Voltage.	Time elapsing before failure.
15,000	0·0 seconds	10,000	3·7 seconds
12,500	0·5 "	9,000	10·3 "
11,000	1·2 "	8,000	14·6 "
10,000	4·6 "	7,000	78·0 "
9,000	14·0 "	6,500	617·0 "
8,000	105·0 "		

Working on these lines, one method of determining whether a material has suffered by any treatment is to subject it to a voltage which will break it down, and to compare the time required with that required by similar material which has not been subjected to the treatment in question. The breakdown voltage should be such that the time of breakdown does not exceed about a minute.

It was discovered that very small temperature alterations would make considerable differences in the time of breakdown. Variations in the humidity of the atmosphere also had a marked effect (Table H).

TABLE H.

	Air de-siccated with calcium chloride (1 week).	Dry day.	Damp day.	Air saturated with moisture (1 week).
Oiled cloth, No. 5 (three thicknesses) ...	11,160	8,300	7,150	5,850
Oiled cloth, No. 7 (two thicknesses) ...	10,800	9,000	7,550	6,400
Oiled paper (two thicknesses) ...	9,750	8,200	8,300	7,300

Results obtained from experiments on materials after artificial drying would have to be modified to a very uncertain extent in order to make them applicable to materials in a damper condition. Experiments were, therefore, generally done varying one condition at a time as far as possible, doing control experiments on similar material not subjected to the physical condition in question.

The great effect that temperature will often have on the time of breakdown of highly stressed insulation is shown in the following table of results of tests on oil cloth at three temperatures.

TABLE J.—No. 12, OILED CLOTH (ONE THICKNESS).

Volts applied.	Time of breakdown.		
	Air temperature. 11° C.	Air temperature. 14° C.	Air temperature. 18° C.
7,000	21·0 minutes	8·3 minutes	25·0 seconds
8,000	13·5 seconds	10·0 seconds	8·5 "

A long time test may have a very serious effect. After treatment at 5,000 volts for one hour, 7,000 volts caused failure in one-sixtieth of the time required in the case of fresh material.

In all these experiments it was found that breakdown very rarely occurs between the flat surfaces of the electrodes, but generally takes place at a point just outside, where the curvature of the electrodes introduces an air-gap of about a millimetre. The material here is in a weaker state for two reasons: It is not subjected to the cooling of the metal electrodes to the same extent as if it were in intimate contact with them, and there is considerable evolution of heat due to the maintenance of brush discharge in the air when the stress is sufficiently high for its production. The results show how serious is the weakening, due largely to chemical change, which is produced by the brush discharge when long continued.

Electrodes with flat surfaces continued in curves of large radius impose a greater stress on these materials than electrodes with sharper curves, on account of the comparatively large area of insulation subject to the influence of brush discharge, and perfectly square edges might impose still less stress. In fact, material was



found to fail in 17 seconds using electrodes the edges of which had a curvature of 3 mm., while 22 seconds was required when square edges were used.

The effect of metal in contact with highly stressed insulation is materially to retard temperature rise and breakdown by reason of its thermal conductivity and heat capacity. The thermal properties of the electrodes are of less importance when the electric stress is so high that breakdown takes place in a few seconds.

To obtain further information on the relative damage caused by a short application of a high voltage and a long application of a lower voltage, experiments were made in the following manner. If a given insulating material be equally damaged at various voltages by being subjected to a steady application of electric stress till it is about to be punctured, then, just before breakdown, samples subjected to a high voltage for a short time and others to a lower one for a much longer time ought to be equally weakened. If, however, as is usually assumed, a prolonged stress at a lower voltage is more exacting than a short one at a higher voltage, the two specimens at the moment when they are about to puncture would

TABLE Q.—No. 12, OILED CLOTH (ONE THICKNESS).

Voltage.	Time of breakdown.	Period of application of voltage.	Further period at 6,500 volts.
7,000 ...	28.6 sec.	14.3 sec.	29.2 min.
6,000 ...	30.3 min.	15.1 min.	9.5 sec.
5,500 ...	81.0 min.	40.5 min.	0.8 sec.
	Fresh material	...	28.8 min.

be differently weakened. As it is impracticable, generally, to stop a test a few moments before breakdown, it is more convenient to take, say, half the time required to pierce the material at any given voltage. After this treatment the specimens which have been subjected to different voltages in this manner may be tested at such a voltage as will give a conveniently discriminating time of breakdown.

In Table Q is given the result of one experiment on these lines. Similar samples were tested at 7,000, 6,000, and 5,500 volts, and were found to fail after 28 seconds, 30 minutes, and 81 minutes. Other specimens were then treated for half the above times at the same voltages. In order to equalise the temperature conditions they were then left for the night and were tested next-day at 6,500 volts. The time required to puncture is given in the last column. It will be noted that the portion treated to the highest voltage agrees with the test on fresh material.

This weakening effect is most conspicuous on the surfaces of the material where the air has free play, and where the destruction of the surface glaze by the brush discharge is greatly facilitated. If more than one thickness of material is tested the inner surfaces protect one another to a great extent, and the weakening does not appear to be so pronounced.

The irregularity of results in a research of this nature, and the difficulties caused by sensitiveness to temperature and humidity, increased the desirability of some new instrumental method of studying the nature of electric stress on insulation. From the beginning the importance of some apparatus to measure the energy loss due to alternating stress on these materials had been kept in view. For this purpose a quadrant electrometer was made, and was used in conjunction with an arrangement of guard-ring electrodes (fig. 2).

A few degrees in the atmospheric temperature may make all the difference as to whether insulation will endure for a very long time or will inevitably fail. The wattmeter shows perfectly what the course of the experiment is likely to be.

In an experiment on oiled cloth, the initial watts were 0.028 per sq. cm., and gradually rose to 0.039, becoming very nearly steady at this value. The temperature of the electrode rose from 2.2° to 9.0°, changing only 0.2° in the last 10 minutes, while the air temperature remained between 0° and 1° during the time of the experiment.

In a similar experiment done at an air temperature of about 15° C. the initial watts were about 0.04 per sq. cm., as against 0.028 at about 2° C. The rapid increase of energy loss with temperature was so great that at about 40 minutes there is a point of inflection in the temperature curve, which becomes "explosive" with the concave side uppermost. The wattmeter gives unfailing notice of the impending breakdown of the insulating material, which, in this case, took place 25 minutes later. The exceedingly rapid rise of the watt curve in the last few minutes is especially remarkable, the final value being 20 times the initial, while half the rise takes place in the last half-minute.

Samples of the same material were dried in a desiccator for 22 hours over calcium chloride. They were then tested at 10,000 volts, and the heating effect was found to be reduced to about one-third of what it was in the experiment last described, the test being made at atmospheric temperature. The consequence is that the loss by radiation and convection is sufficient to balance the internal heating, and the material could endure a very long time. These specimens have been run for periods aggregating many hours at intervals over several months with very little alteration.

An experiment was made using two thin mica sheets completely covering each side of the varnished cloth. These sheets were such that they would just stand 10,000 volts alone. By this means it was expected that a much higher temperature would be reached, which experiment showed to be the case. The material was examined when the temperature was about 100° C., and showed little sign of damage; the experiment was stopped on the thermometer in the top electrode attaining 120° C., when the cloth was found to be distinctly scorched. The curve of watts rises normally for about half an hour, very rapidly attains a maximum, then drops and varies irregularly about a fairly steady average value. This rapid rise and fall must, I think, be due to the driving out of

loosely held water at about 100° C. The temperature curve faithfully reflects these changes.

All these experiments demonstrated the importance of the brush discharge in the air, when stressed above its breakdown point, in promoting temperature rise and serious chemical change, when long continued. A lengthy series of experiments was done to determine the potential gradient at which the consequent energy loss in air commences, and measurements were also made of the power lost as the stress is raised above this critical value; the results were described in the discussion on Mr. Watson's paper.\*

In testing both pure mica and thick micanite in air, the material very rarely fails between the electrodes, but at an indefinite distance up to, perhaps, 50 mm. away from the metal in the case of thick micanite, and to about half the distance in the case of thinner mica.

A large amount of work on the testing of micanite has been done at the laboratory, especially on behalf of Government departments, the general results being briefly as follows:—The heating caused by the brush discharge in air, especially when high voltages and thick materials are used, has been found to be very serious. The material rapidly becomes hot and softens around the electrodes, swells by internal vapour pressure, and is finally pierced. It is well known that immersion in oil in general greatly reduces the electric strength of good insulators, the breakdown voltage often being reduced by 50 per cent. In the case of thick micanite, however, this effect is often more than counterbalanced by the almost entire extinction of the brush discharge. In the case of thinner qualities immersion in oil is generally of little or no value. Very much depends on the quality, and the effect of immersion in oil cannot be predicted in the case of ordinary commercial micanite. For instance, while thick boards of ordinary brown commercial micanite, 2.5 mm. thick, generally give better results by being immersed in oil, it has been found that similar thicknesses with the adhesive material largely pressed out give worse results in oil.

Generally speaking, thin qualities up to about 1 mm. will withstand a stress of 20,000 volts per millimetre in air for 10 minutes. Above this thickness, up to 2.5 mm., there is more difficulty in making material which will withstand this stress, and usually the material withstands the voltage longer under oil.

Mica may be run very near the breakdown point for a long time, and is unaffected by ordinary temperatures met with in machines. In making watt tests on mica, it was found that though the material heated, probably almost entirely owing to the brush discharge in the surrounding air, yet the watt loss did not increase with time—a very different result from that obtained when using oiled cloth.

Tests in air on pure mica are limited to comparatively small voltages and thicknesses of material. Sheets of mica are limited in size to 6 or 8 in., and in thicknesses above 0.2 mm. sparking round the edge takes place above about 18,000 volts.

The results of tests are shown in the upper curve in fig. 3. As in the case of micanite, the material very seldom fails where it is in contact with the metal electrodes, but at a distance up to 25 mm. away. In these experiments the electrodes used were two steel balls 50 mm. (2 in.) in diameter.

The lower curve shows the average result of testing under ordinary transformer oil. The results in general show an electric strength about one-half that in air.

A long time of voltage application appears to have a weakening effect, which is probably mostly due to temperature rise. For instance, a sheet of mica 0.040 mm. thick which failed at 10,000, 10,200, and 10,400 volts, when the voltage was raised to these values in about 20 seconds, was subjected to 8,000 volts and failed in 70 seconds. Another place was subjected to 7,000 volts and the material held up for over two hours and was not punctured.

Under oil, mica will stand for a long time a voltage very little below that which will puncture it in a few seconds. Pertinax insulating material is made by rolling thin paper on a mandrel. During the process the paper is covered with hot varnish, and the excess is squeezed out by a heavy roller. This material forms a tough and strong form of insulation suitable for many purposes. It was supplied in the form of tubes of 11 mm. external diameter, the walls being 1.5, 3 and 4 mm. thick. The tubes were 50 cm. long. They were tested by applying the voltage between mercury which filled the hole and a layer of tin foil tightly wound round the middle of the tube for a length of 34.5 cm.

The diagrams have been plotted with watts per square centimetre of outside surface. The heating, as in previous experiments, is entirely due to insulation losses.

Fig. 4 shows the results of experiments at 5,000, 4,000, 3,500 and 3,000 volts on the Pertinax tube of the largest bore. The curve A<sub>1</sub> repeated and continued in A<sub>2</sub> on one-tenth the scale of ordinates shows the effect of the application of 5,000 volts producing failure in 12 minutes. B<sub>1</sub> and B<sub>2</sub> are the results at 4,000 volts, failure resulting in 31 minutes, while C and D are tests of 160 minutes at 3,500 and 3,000 volts.

Near the dividing line, only a slight alteration in the conditions such as a rise of temperature or frequency was required to produce the condition leading to failure. This indicates very clearly the difference between these insulation losses under alternating potentials and losses due to a resistance effect alone. The latter would be independent of the frequency, while most of the tests on these materials which have been made to determine the effect of frequency indicate that, when working under the potential gradients met with in practice, a large proportion of the loss is proportional to the number of cycles of alternating stress in a given time and is therefore of the nature of a hysteresis effect.

\* *Journal of the Institution of Electrical Engineers*, vol. 45, p. 5, 1910.



Fig. 5 shows the result of a test on the thickest walled Pertinax tube. The lower curve A represents the course of an experiment at 6,000 volts for 130 minutes, and the upper curve gives the result of a second experiment on the same tube at 7,000 volts. These curves are similar to several previous ones.

The conception of a condenser with series resistance seems to represent the physical condition of ordinary insulating materials. From this point of view a dielectric may be considered to be not a

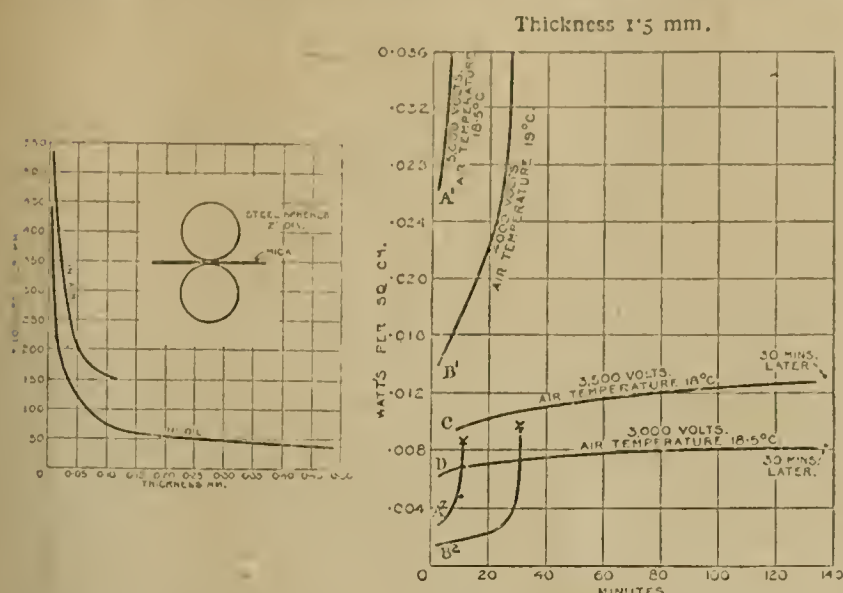


FIG. 3.—TESTS ON MICA.

FIG. 4.—PERTINAX TUBING.

single condenser with a series resistance, but an immense number of very minute condensers, perhaps of molecular dimensions, each with a series resistance. The whole thickness of the dielectric would be made up of an almost infinite number of such condenser and resistance systems in series. In practice we can but obtain a measure of the single equivalent condenser and resistance. As the insulation is heated the energy loss increases rapidly.

On the theory of a condenser and series resistance, the increase in energy loss as the temperature rises may be due to an increase in the condenser capacity, more than sufficient to compensate for a diminution in the resistance. This would alter the distribution of voltage between the two so that the actual watts are increased.

The measurement of the electrical properties of solutions of salts shows also an increase of capacity and diminution of resistance with rise of temperature, which indicates that, in organic materials, the energy loss is probably largely of an electrolytic nature.

A long series of experiments was made on material supplied by the British Westinghouse Co., similar to the Pertinax tubing. It was in the form of tubes with an external diameter of 23.5 mm., and thickness of wall 1.9 mm.

The upper curves A to G (fig. 6) show the results of a series of experiments at 5,000 volts, an experiment being stopped when the energy developed in the insulation amounted to about 16 watts. It will be noted that there is an apparent progressive weakening after

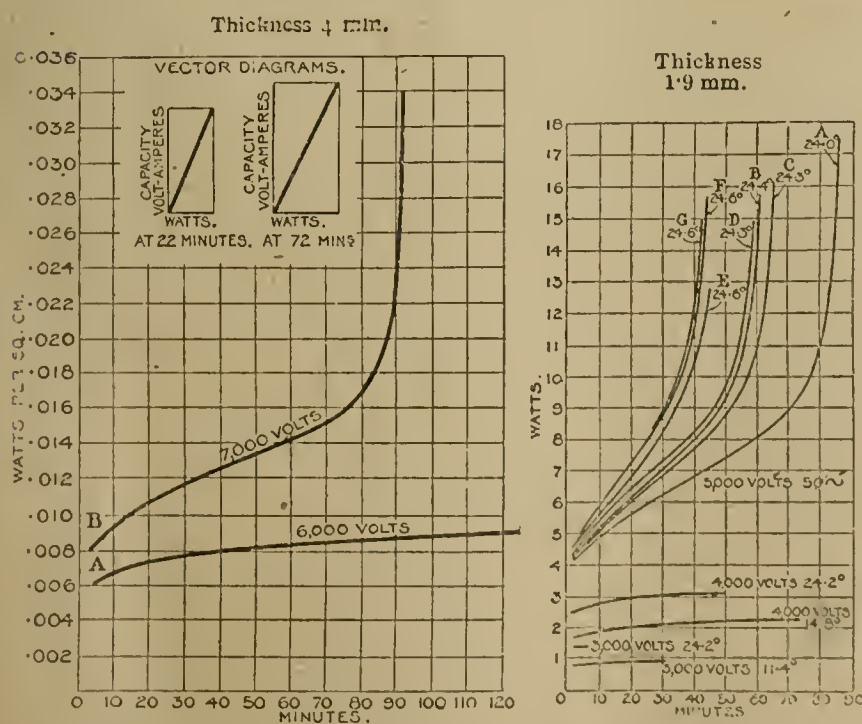


FIG. 5.—PERTINAX TUBING.

FIG. 6.—WESTINGHOUSE PAPER TUBING.

each run, the watt curve rising more quickly. Some of the difference is probably the effect of permanent change, but experience shows that it is mostly due to the slightly higher temperature of the later experiments. At the bottom of the same figure are results of two experiments at 4,000 volts and two at 3,000, which give a good idea of the rapid rise of energy loss with voltage.

All the experiments show that if the deteriorating effect of such applications of electric stress as are here described is to be judged by the course of a subsequent application under similar conditions, it is necessary that temperature, voltage and frequency should be the same to a very high degree of accuracy. Under the average

conditions of these experiments a change of 1 per cent. in the time of reaching 10 watts would be produced by a change of 1 in 10,000 in the voltage, or a change of 0.02° of temperature, or a change of 0.1 per cent. in frequency. These limits would require special apparatus for their attainment. The margin of the voltage variation is probably impracticable.

The results of tests on one sample of paper-insulated cable are quite similar to those obtained on other organic material.

Experiments were made on a piece of rubber tubing with an electrolyte inside and out. As the result of a series of tests lasting a fortnight, it was found that a progressive increase in energy loss ensued. At 6,000 volts, 50 cycles, the watts initially were 0.44, and at the end 45. The power factor at the beginning was 7 per cent., and nearly independent of the voltage. At the end the watts increased much faster than the square of the voltage, and the power factor was 30 per cent. at 2,000 volts and 95 per cent. at 6,000 volts. Repeated attempts to measure the insulation resistance at 1,000 volts (direct current) showed it to be well above 200 megohms, while at the end the apparent resistance was less than 1 megohm. At the beginning the watts varied nearly as the frequency, while at the end a change in frequency produced practically no change in the watts. This fact pointed to the conclusion that the loss was associated with a true ohmic conductance. The only explanation seemed to be that while under a high electric stress, a great reduction in the ohmic resistance of the rubber took place, and that ordinary tests at a few hundred volts might give no indication of this effect.

This property may be found to have considerable technical importance, and the practice of immersing rubber cables intended for high voltages in water for many hours previous to the ordinary tests may be distinctly undesirable.

**Conclusions.**—The results of the experiments on oiled fabrics show that when subjected to voltages sufficiently high to break down the surrounding air, a rapid decrease in electric strength is produced, which is largely due to the damage produced by the brush discharge. This action is the more pronounced when a few layers of material are tested, as the surfaces in contact with the metallic electrodes suffer most. This effect increases with time, and as a comparatively small lowering in voltage corresponds to a great increase in the time required to produce rupture, the effect of a long application is very generally more deleterious than that of a short application of a higher pressure.

An increase in humidity, temperature, or electric stress results in an increase in the rate of heat production, and the temperature may rise till destruction takes place, even if the insulating material be protected by sheets of mica, which are sufficient to withstand the voltage.

The results of the experiments on comparatively thick-walled tubes of varnished paper give time-energy curves of substantially the same form. They indicate that the temperature rise produced by the electrical heating of the insulation produces but little permanent change, provided the rapid final increase is not allowed to take place.

#### DISCUSSION.

MR. MILES WALKER, in opening the discussion, remarked on the comprehensive results given, which corroborated those obtained by previous experimenters. He assumed that the author's object was to discover whether a short high-voltage test or a long moderate-voltage test was best. So far as theoretical considerations went, a broad view must be taken of what had been done. In order to find exactly the condition of affairs in any material under test, it was necessary to consider jointly the watts lost and watts radiated. The speaker showed diagrammatically that the radiation curve, showing heat dissipated, must overlap the watts lost curve (heat generated) in practice, otherwise the risk of failure was present. The practical test of the manufacturer was intended to break down the material if its insulating properties were impaired but not if it were saturated with damp. A moderate pressure applied for a long time might not show up a weak spot in the damp insulation at all, and a high voltage applied for a short time was much more effective in showing, in such a case, what the manufacturer wanted to know, i.e., defective insulation.

DR. J. A. FLEMING said that, as the result of recent investigations he had carried out, he agreed with the author's conclusions. It would appear impossible to explain the behaviour of many dielectrics without admitting separate conductivities for alternating and direct currents. Alternating conductivity increased with dampness and rising temperature. The conductivity and other properties of insulating material were worthy of most careful study at the present time. He wondered whether the author considered oil or air insulation was best for ordinary transformers. They knew that internal brush discharges were very damaging, and that oil insulation was very useful in preventing them, although air insulation had been recommended by some people.

MR. A. R. EVEREST said that experiments made with varnished cloth showed that with very brief applications of from 1/2 to one-tenth of a second, pressures 20 and 60 per cent. greater than were usual for 15 seconds could be withstood, and these results were confirmed by some given in the paper. In the case of time tests, corona and brush discharge effects had to be considered. Corona effects took place in a large alternator when it was tested for long at rest, and ozone pockets formed, which would not occur if it were running and ventilated. In some cases of this kind artificial ventilation had been provided to avoid this unnatural condition.

DR. ALEX. RUSSELL touched on the question of electric strength of materials, pointing out that under the conditions of the tests on very thin mica sheets there would be considerable electrostatic attraction between the electrodes. The author's tests were of great



value, and appeared to cover similar ground to those of Dr. Fleming.

MR. G. L. ADDENBROOKE referred to investigations carried out by himself on the same subject some years ago, and to the varying results on similar material with alternating and direct current, and

MR. RAYNER, in briefly replying, said the high-voltage test for a limited period appeared to be preferable.

### Specifications.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, February 13th, 1912.)

By FRED. S. SELLS.

HALSBURY'S "Laws of England" says:—"A specification is a detailed description of building, engineering, or other works executed, or proposed to be executed." Ball, on "Law Affecting Engineers," says:—"A written description and plans, more or less complete, defining the methods of construction, &c., to be used, prepared by the engineer for the approval of the employer and for the guidance of the contractor."

One of these authorities in law makes a point of saying it is a "detailed" description, the other admits that it is "more or less" complete, and rather a guide than definite instructions.

If there is already such a vital difference in the interpretation of the word "specification," can we wonder that the opinions as to how a specification should be drawn up in practice are equally conflicting? In many cases the want of clearness in specifications is the first bone of contention. Clearness, however, does not necessitate elaboration of detail. I hold it to be advantageous to both sides, if only such details are inserted as refer to the requirements of the purchaser.

A specification must, of course, include all the following points: Quantities; performance (with very clear indications as to rating); capacity; emergency requirements; conditions and regulations to be observed to comply with local or other authorities, such as fire insurance, Home Office, &c.; time of completion and penalties as far as they are not covered by the "general conditions," guarantees, maintenance, tests, and conditions of same; extras. There will be a number of other points covered by the "general conditions" which are customarily expressed in a separate document.

As regards construction and manufacturing details, however, it seems much better, with a few exceptions, if the specification allows as much latitude as possible. The tenderer should be asked to give information upon specific details of construction and design which may be of interest, as is already done regarding steam consumptions, combined efficiencies, air-gaps, &c. At the same time, the tenderer should be invited to give his reasons for adopting certain practices, to state where, if at all, he had adopted it before, and to supply such photographs or drawings as make it quite clear what is in his mind. A number of engineers have already adopted the practice of making their specifications open in some respects, and, if this were done all round, it would help the engineer, as well as the manufacturer.

To my mind the accepted commercial meaning of the word "specification" is the written, printed, or "understood" construction of an article, piece of plant, or works, or the enumeration of the detailed requirements for the execution of a certain performance.

In Germany, France and America, a specification, as a rule, is identical with standard practice. The want of standards, the want of recognised and acknowledged authorities, is a great drawback under which we suffer.

The oldest and plainest form of "specification" is that agreed upon or arrived at by practice and experience of an ordinary article, and commonly accepted as a standard. Unfortunately, in this country we have very few of such standards. Where "Standards" have been set up during the last few years they have not been accepted unquestioningly by the profession, and therefore the manufacturers had to be cautious in adopting them.

The next grade of specification is that drawn up by a professional man for the special purpose of obtaining tenders. Such a specification should contain a detailed enumeration of articles required, stating where and how they are to be fixed. It seems to me, however, out of order that goods should be called for in a specification under a nomenclature which does not denote a specific manufacture or construction, but is a mere indication that a certain dealer supplies them, that dealer having the option of changing the manufacturer at any time so long as he continues to apply his own trade name. Many such instances are happening through the specifier not always knowing who is a manufacturer and who is a factor only.

We know it is the endeavour of consulting engineers to advise their clients to have the most up-to-date, the most economic, and the best-manufactured plant. We also, to our regret, know from our daily experience, that the number of interpretations of these desiderata is almost equal to the number of consulting engineers in practice. Why? Because of the absence of standards, and perhaps because of the absence of some uniformity of education and experience. The trouble may also be partly due to the aloofness of the average consultant from the workshops of the manufacturer. I feel certain that a closer and more regular intercourse between the manufacturer and consultant would result in benefit to both purchaser and contractor. The majority of manufacturers now gladly throw open their works to consultants at all times, and not merely for hurried visits to their test rooms.

When we consider that even to-day, we have hardly any recognised standards in the most simple apparatus required for the carrying out of our work, I think we must all admit that we are far worse

off than other countries, and that our consulting engineers are confronted with considerably greater difficulties than any other professional men.

It is gratifying that our various institutions are strengthening themselves by broadening the basis of their operations, and we can only hope that, as time goes on, their work will be sufficiently recognised and supported by the industry and the profession to enable them to establish standards on a larger scale.

So far, nearly every specification a manufacturer or contractor receives is different from anything else he has had before, and whilst this may have been necessary in the early days, it seems hardly necessary to-day.

As technical knowledge and experience has developed during the last 25 years, so has the standard of commercial honour and integrity, and I do not think it either right or necessary that specifications should contain anything which was originally meant to prevent dishonesty. I am glad to say that a large number of leading consulting engineers have already adopted larger-minded methods, but it has, as yet, by no means become general practice.

To-day the weak and incompetent have been weeded out, and there are two kinds of manufacturers left in the running: One, the large firms, who employ the best designers, constructors and engineers whom money can procure, and, apart from their knowledge, the firms are nearly all companies where each employé knows that only good work will hold profit and credit to his concern. The personal element in such organisations is sufficiently strong to combat any attempt at shoddy or incorrect workmanship.

The other kind of manufacturers are the smaller concerns who have specialised in their particular sphere, and they could not have survived if they had not brought brain, character, and the best machinery and tools into their respective spheres, and to them applies the same as I have just said about the large organisations as a whole.

Would it not be a far happier state of affairs if the consulting engineers, instead of drawing up specifications, each of which is a masterpiece of originality, were to adopt standards where standards are in existence; to accept standard practice where standard practice is established; and to ask the manufacturers in their specifications to put forward their own suggestions? Their work would then consist of going through all the various manufacturers' recommendations and suggestions, to decide which is the best-designed and most serviceable plant, and then arrive at a decision which is the best for his client to have, taking into account at the same time the various prices.

This is already done by some, unfortunately too few, and it is a good many years since one of our leading consultants, Sir Alexander B. Kennedy voted himself an adherent to this policy. If it were to become general practice it would encourage manufacturers to establish, where patents, &c., allow it, more standards amongst themselves, and the natural results would be that instead of every article, or every machine, that goes through a shop being different, they would be more alike; manufacturers could produce in larger quantities, which in itself would be a guarantee of better work, deliveries would be quicker, and the cost of production would be reduced, to the ultimate benefit of the consumer.

As regards municipal and supply company engineers, the circumstances are in many cases the same as with consulting engineers. The great difference lies in the fact that this class of engineer has more frequently to be prepared for the acceptance of the lowest tender, without having the same opportunity as the consulting engineer to explain the difference in the offers, and as long as municipalities are governed as they are at present, their engineers will, as far as "detail" is concerned, not be able to alter the present practice in this respect. In his case it must also be remembered that he is even more a specialist in his particular work than the independent consultant, and that in many cases he has more experience of what is actually required than the manufacturer.

There seems to be a fashion in electrical engineering as in most other things, and we find that if one station engineer adopts a new scheme, the principle will in quick succession be adopted by others; nevertheless, the variety of opinions expressed in the specifications is sometimes astounding, and brings for the manufacturing side of our industry unnecessary trouble and expense. Another reason why the municipal engineer must go into more details in his specifications is the fact that he is governed by standing orders, and the specification and tender ultimately form part of the sealed contract.

Another important point which refers chiefly to central station work is the question of cross-tendering between manufacturers of the steam and electrical side, and it has often been suggested that it would be far better if the specifications for combined plant were to be issued separately to the turbine or engine builders, and to the electrical engineers. It is not suggested that two contracts should be given out, but that two separate prices should be received, and that the engineer should choose his own combination. Quite recently a move has been made in this direction by a number of leading manufacturers of engines and generators, and it is hoped that the principle adopted by them will be appreciated and supported by the purchasing and specifying engineers.

Another kind of specification with which the municipal engineer is frequently called upon to deal is with regard to installations connected to his mains. Once regulations of this kind are issued, they should be strictly enforced; otherwise, instead of being a boon, they become a menace and a danger to the trade.

Quite a number of corporations specify that only pure Para rubber must be used in their flexibles, and I should like any member of this Institution, whether engaged in the rubber trade or not, to



come forward and say that he can in every case decide, after the material has gone through certain mechanical processes, whether the rubber is pure Para or not. I have quite recently obtained a delivery of pure Para strip from a leading manufacturer in this country. I submitted it to a leading manufacturer of undoubted repute abroad; and now I have in my possession both a signed guarantee from the supplier that the material is pure Para rubber, and a signed statement from the other manufacturer that it is not.

If we, who handle thousands of pounds' worth of such material, and the manufacturers who make it, have such difficulty in discriminating as to what is pure Para and what is not, how can it be expected that others outside the trade can do so?

It happens very frequently that articles which have once been passed, because they have a certain identification mark, continue to be passed, although in the meantime the supplier (who need not be a manufacturer, and very often is not) has changed his source of supply. Whilst the article has the same trade-mark as it had previously, on close inspection it will be found that it does not comply with the corporation requirements, but has, nevertheless, been allowed to go on the circuits for years.

The contract should clearly state whether penalties, or rather liquidated damages, are to be paid in case of non-completion to time on the whole amount of the contract, or only on the non-completed part, particularly in cases where the non-completion does not prevent the purchaser from the useful enjoyment of the other part.

The Arbitration Clause should be most explicit, and it is, in my opinion, undesirable that under engineering contracts the engineer acting for the employer should be the sole arbitrator. The Arbitration Act of 1889 should be good enough for anybody.

The contract form should be most explicit regarding the much-disputed item of extras, especially in those contracts where the engineer has power to vary his requirements during the execution of the work. It should also provide a clause as regards any consequences which might arise from the introduction of variation in the work originally called for in the specification.

In those specifications where payment can only be obtained under certificate of the engineer, the contract form should specifically stipulate that these certificates cannot be reasonably withheld, and where the time of the last payment is determined by the completion of the successful tests on site, or by the time the purchaser has started to work the plant, the contract form should specifically mention that the purchaser has no right to delay the test or the putting to useful work of the plant. It should furthermore provide a definite time for payment in those cases where delays occur through no fault of either of the contracting parties. I suggest the general adoption of the following clause which appeared in the specifications issued by Mr. C. H. Wordingham when he was in consulting practice:—"The engineer undertakes that he will consider all drawings submitted by proposing contractors as confidential, and that he will not show any such drawings to other manufacturers, whether they are tendering for this specification or not."

#### DISCUSSION.

MR. T. L. MILLER thought the paper was really a plea for the adoption of standards of manufactures by manufacturers, but it must not be forgotten that electrical engineering was a progressive science, and what might be standard to-day, became out of date next year. The British Engineering Standards Committee had avoided, as far as possible, the standardisation of manufactures. It was impossible to impose one standard on all manufacturers throughout the country, and to do so would stop progress entirely. It had been his practice for a good many years to state in the specification that contractors should state the standards which they had adopted in their own practice. So long as those standards would give the specified results, that was all that was required; to attempt to specify more closely would only add expense. He agreed with Mr. Sells that consulting engineers, and all engineers who were required to specify for machines, should keep in close touch with the works. He considered that a consulting engineer's duty was not only to see that the client got full value for his money, but also that the contractor was fairly dealt with. His own method had been to ask for a very considerable number of details of the plant by means of schedules to be filled up by the manufacturers. With the schedules and details before him, it was possible to adjudicate on the tenders received, and it could then be left very largely to the manufacturers to specify their own standard practice. He agreed that an engineer should not be the sole arbitrator of his own specification, as it was very unsatisfactory.

MR. S. L. PEARCE said with regard to the Standards Committee, there was still an enormous amount of work to be done. To take only two instances, he might refer to the question of standardisation of overload ratings; at the present time the position seemed to be pretty well chaotic up and down the country, especially since the introduction of turbo-alternating machinery. Then they had the other question of measuring temperature rises. On these questions alone something could be done to standardise details of very great importance to electrical manufacturers. Street lighting was rather a burning question at the present time, and he was not without hope that before long something in the nature of a standard specification might be evolved as the result of the joint deliberation of all parties interested. They ought to bear in mind that there was a great deal of difference between a specification drafted by a civil engineer and a specification drafted by an electrical or mechanical engineer. It was well known that the civil engineer was responsible not only for the general scheme, but also down to the very smallest details; the contractor was only responsible for the actual construction. That was not the case with an electrical or mechanical engineer; he did not design the plant or the details of the machinery—this should be left to the

manufacturers. With regard to the type of specification, the one which he thought would ultimately (having regard to the question of standards being adopted) be finally adopted was that in which the engineer would protect himself and specify the main outlines of the work which had to be carried out; he would in greatest detail specify the performance of the plant, and would call from the contractor for the most important details such as the question of overload capacities and temperature rises, and so forth; and the contractor would have to submit with his tender a detailed specification of his standard practice, accompanied with descriptive matter and with complete plans. If that were done the manufacturer would be enabled to supply standards, or at any rate, standard parts, where his ordinary standards would be subject to modifications due to local conditions. The specification which was simply drafted in terms of results alone was undoubtedly vague, and would lead to a great deal of trouble in interpretation. He did not see how one should do as the author seemed to suggest, viz., set up one standard for an engineer who was not working for a municipality, and another for the municipal engineer. Cross tendering was a matter which must be left to the manufacturers themselves. What municipal engineers wanted was to have one man responsible, and it was not for them to dovetail together the various parts of a main contract between the various manufacturers. He gathered from Mr. Sells that he did not believe an engineer should specify any particular make of plant. He disagreed from that entirely. Where an engineer had studied his own conditions, and came to the conclusion that one particular type of plant would best meet his requirements, he was quite right to specify that type of plant.

MR. BEVIS said that unfortunately, in a very large number of instances when standards were arrived at, they were ignored by the majority of people concerned. What was wanted was not so much standards, as a standard authority. He was quite sure that if they had a standard authority that was recognised throughout the whole country, they would attain better results, and manufacturers would be able to work more cheaply, and at the same time give better value for the money. A few years ago Para rubber was the standard of high-quality rubber. To-day that standard was not quite up to the plantation rubber, which was a product of the original Para. It was only the cleverest experts in the rubber trade that could tell the difference. To get everybody on the same level, pure rubber should be called for and not "Para." If the best quality rubber was wanted, then "cut sheet" should be specified. Where a specification was clear and well drawn up, and stated explicitly the results required, it was astonishing how close the tenders were for that work.

MR. A. B. ANDERSON said a specification must be just, explicit, and must make reasonable allowance for that commercial rectitude to which Mr. Sells properly referred. To get the best work was the object of any specification. They must allow for and cultivate good faith, without which neither the electrical nor any other industry would prosper.

MR. G. LAYTON said that something should be done immediately to get specifications into a simple standard form, and so get rid of a mass of matter, so that they might know where to look for the vital points. If the salient points were before them, a tender could readily be made, but where they were buried, they were very difficult to find, and it was easy to overlook them. The same remarks applied as regarded general conditions. A schedule was one of the finest forms of discriminating between the values of various pieces of mechanism, but schedules must not go too far, and he had seen schedules going into the merest details. Cross tendering was undoubtedly a very serious matter at the present day, a great deal of work being absolutely thrown away.

MR. EUSTACE THOMAS said there were not many things capable of being put down as standards. If consulting engineers or purchasers would state what their requirements were, and also state certain things considered very essential, they would get all that could be expected. It was the manufacturers who had to get together, and not the engineers who first drew up the specifications.

MR. J. FRITH advised consulting engineers to be careful in regard to what they put on the outside sheet of their specification. It was no good putting on the outside that it was a 100-kw. machine, and on the inside that it was a 500 kw. That specification might get into the hands of a non-technical estimator, and he might estimate for it on the size printed on the outside sheet. It did no good to pretend the machine was smaller than it actually was, as was largely done. With regard to specifying results, if a dynamo was required to give a certain output, and they specified that output, together with speed, efficiency and temperature rise, had they not done enough?

MR. W. CRAMP said the consulting engineer was justified in his existence to a great extent by the manufacturers themselves. He had with him a tender which had been sent in to a specification for an ordinary wiring job. It started with the usual covering letter, and on the back of the tender were given certain conditions under which the job was quoted for. On referring to these conditions, it would be found that most of them contradicted the general conditions of the specification. In spite of the fact that rubber cable was specified, 3-core lead-sheathed was offered. On the main switchboard, although it was an A.C. system, 2 moving-coil voltmeters were offered, and 2 volt-meter switches 0.50 amps. The consumption of the lamps was given as 12 watts per c.p. It was this sort of thing that necessitated the employment of a consulting engineer to protect the buyer.

MR. F. S. SELLS said in reply to Mr. Eustace Thomas that what he proposed was to make a start with standardisation, and to ask the consulting and municipal engineers to agree to assist the manufacturers. He thought he had been misunderstood a good



deal as regarded what he meant by standards. What he meant was that each manufacturer should have his own or somebody else's standards. That would still mean a healthy competition between themselves. He did not see how the industry could suffer by that. It was not absolutely necessary for one manufacturer to make everything. Abroad it was entirely different. Replying to Mr. Miller, the author said he did not say that there was the possibility of every consulting engineer having the same idea on a given subject. In other professions there was a certain standard practice. If a consultant was called in and prescribed a certain thing, in the electrical industry, he did not insist on its being done. If a medical man was called in and his advice was not followed he threw up the case. He perfectly agreed with Mr. Pearce regarding one's own standards, and that of course could only be brought about by having authorities in the profession, which the author himself was asking for, but those authorities would never be established unless they were supported from the manufacturers as well as from the profession. He agreed that there was nothing in the standing orders which bound the municipal engineers to accept the lowest tender, though sometimes consulting engineers had better means and opportunities of convincing their clients that the lowest tender was not always the best. He had found that the municipal engineer had not the same opportunity of explaining the differences in the tenders to his committee. If the profession continued very much longer to take excessive advantage of the quarrelling of the manufacturers, in a few years' time they would be very sorry for it, because the time would come when manufacturers would be forced into what many people were afraid of, viz., a combination, that would force prices very high. He, of course, agreed with Mr. Pearce that an engineer should specify the most suitable plant for his requirements; on the other hand, however, he should not ask for tenders. He thought that for a beginning they should state their grievances, and hear the grievances of the other side, and when both sides had discussed the matter in an Institution like theirs they would get some tangible results.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 4,715. "Electric lamps and reflectors therefor." C. H. KRUGER and C. W. COLLINSON. February 26th.
- 4,716. "Apparatus for providing electric light on motor road vehicles." T. CLARKSON and W. J. MORISON. February 26th.
- 4,730. "Alkaline electric accumulators." W. N. STEWART. February 26th.
- 4,745. "Screens for rendering luminous projections thereon visible in full light." NEW THINGS, LTD. (E. O. Zechmann, Germany). February 26th.
- 4,762. "Production of high frequency electric oscillations." W. C. M. NICHOLSON and F. E. E. G. SCHREIBER. February 26th.
- 4,773. "Telephones." T. W. TATTERSALL. February 26th. (Complete.)
- 4,780. "Negative carbons for electric searchlights." GEOR. SIEMENS and Co. (Convention date, April 28th, 1911, Germany.) February 26th. (Complete.)
- 4,781. "Revoluble joint or swivel coupling for electric conductors." M. CRONIN. February 26th.
- 4,783. "Electric incandescent lamps." C. F. STILLMAN. February 26th.
- 4,791. "Apparatus for controlling and recording the consumption of electrical energy." H. GOTTSCHALK. February 26th. (Complete.)
- 4,792. "Electro-magnetically operated circuit-breakers." W. SCHROEDER. February 26th. (Complete.)
- 4,820. "Safety electric lamp." A. SADLER. February 26th.
- 4,823. "Electric incandescent light emitting metalline mantle bodies." E. M. BAILEY and H. F. McDOWELL. February 27th.
- 4,843. "Process for the production of active substances for lead storage battery plates with the aid of material obtained in the form of thin sheets." A. RICKS. (Convention date, June 13th, 1911, Germany.) February 27th. (Complete.)
- 4,851. "Electrically-heated clothes or portions of clothing." A. POLLAK. (Convention date, March 17th, 1911, Germany.) February 27th. (Complete.)
- 4,885. "Lightning arresters." K. W. G. J. STOFFELS and J. BERKELBACH VAN DER SPENKEL. February 27th. (Complete.)
- 4,887. "Wear-resisting bodies and methods of manufacturing the same." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) February 27th. (Complete.)
- 4,939. "Time-recording device applicable for use with telephones." R. W. BLADES. February 28th.
- 4,975. "Suspenders for overhead electric cables." C. E. ELDER. February 28th. (Complete.)
- 4,983. "Telephone exchange systems." P. JENSEN. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) February 28th. (Complete.)
- 4,984. "Telephone exchange systems." P. JENSEN. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) February 28th. (Complete.)
- 4,991. "Electric arc lamps." G. E. TATE. February 28th.
- 4,995. "Electrically operated driving systems." CROMPTON & Co., LTD., J. C. MACFARLANE and H. BURROE. February 28th.
- 5,026. "Tungsten or the like metal-filament and a process of manufacturing same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany). February 28th.
- 5,027. "Tungsten or the like metal-filament and a process of manufacturing same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany). February 28th.
- 5,028. "Drawn metal-filament and a process of manufacturing same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany). February 28th.
- 5,035. "Intercommunication telephone systems." H. G. WHITE and I. H. PARSONS. February 29th.
- 5,053. "Insulators for telegraph, telephone and other electric wires and cables." T. TAYLOR. February 29th. (Complete.)
- 5,054. "Insulators for telegraph, telephone and other electric wires and cables." T. TAYLOR. February 29th. (Complete.)
- 5,055. "Absorption dynamo-meter." S. GRIFFIN. February 29th.
- 5,071. "Couplings or joints for electrical cables and the like." C. J. BEAVER and E. A. CLAREMONT. February 29th. (Complete.)

- 5,083. "Electrical conductors." G. H. WILSON. February 29th.
- 5,084. "Bulb for electric glow lamps." W. K. PARTINGTON. February 29th.
- 5,805. "Magnetic treatment of hair." W. R. PRESLAND and W. R. HERWIN. February 29th.
- 5,129. "Electroliters, gasoliers, chandeliers, lamp brackets and other gas, electric or candle-lamp supports." P. BETEGH. February 29th.
- 5,170. "Portable electric battery lamps." H. F. JOEL. March 1st.
- 5,206. "Covering for electric cables." C. J. BEAVER and E. A. CLAREMONT. March 1st. (Complete.)
- 5,210. "Process for the electro-deposition of nickel." S. O. COWPER-COLES. March 1st.
- 5,217. "Mine exploders." STERLING TELEPHONE AND ELECTRIC Co., LTD. (Schaffler & Co., Austria.) (Addition to 12145/1911.) March 1st.
- 5,221. "Telephone or other electric bell extension." C. RAWSON. March 1st.
- 5,278. "Electric photographic copying machines." J. B. HALDEN. March 2nd.
- 5,210. "Electric switches." H. W. COX. March 2nd.
- 5,501. "Multiple electric arc lamps." GES. FÜR MASCHINEN-UND METALL-INDUSTRIE m.b.H. (Convention date, March 2nd, 1911, Germany.) March 2nd. (Complete.)
- 5,302. "Sparking plugs." H. ZIMMERMANN and R. SLABY. (Convention date, March 10th, 1911, Germany.) March 2nd. (Complete.)
- 5,322. "Grouping of electrical distributors such as fuses or safety devices for controlling branch circuits." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, March 3rd, 1911, Germany.) March 2nd. (Complete.)
- 5,336. "Leading electric or other power into revolving structures." R. H. S. BACON and F. W. H. SHEPHERD. March 2nd.
- 5,345. "Metal vapour alternating-current rectifiers and similar apparatus." HARTMANN and BRAUN Akt.-Ges. (Convention date, March 2nd, 1911, Germany.) March 2nd. (Complete.)
- 5,352. "Automatic block system for preventing collision between trains." A. J. ICARD. (Convention date, March 29th, 1911, France.) March 2nd. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- AUTOMATIC SECTIONING MEANS FOR LIMITING ACCIDENTAL INTERRUPTIONS OF ELECTRIC CURRENT SUPPLY IN CENTRAL STATIONS. E. Brandenburg. 21,001. October 8th. (October 8th, 1910.)
- ELECTRIC CIRCUIT CONTROLLING DEVICES. E. M. Hewlett. 23,734. October 2nd. (October 29th, 1910.)
- APPARATUS FOR ACTUATING AND LOCKING POINTS OR SWITCHES ON RAILWAYS. J. P. O'Donnell and British Pneumatic Railway Signal Co. 15,343. November 14th. (Divided application on No. 2,887 of 1911. February 4th.)
- POLE CHANGERS FOR ELECTRIC MOTORS FOR USE IN CONNECTION WITH ELECTRICAL SYSTEMS OF OPERATING RAILWAY POINTS AND THE LIKE. J. P. O'Donnell and British Pneumatic Railway Signal Co. 25,344. November 14th. (Divided application on No. 2,887 of 1911. February 4th.)
- SELF-REGULATING ARC LAMPS. Physikalische Laboratorium Mechanisch-Technische Werkstatte Hans Thoma Ges. 27,817. December 24th. (December 12th, 1910.)
- MINERS' ELECTRIC SAFETY-LAMPS. F. A. Hailwood. 436. January 7th.
- APPARATUS FOR THE MANUFACTURE OF ELECTRIC RESISTANCES. J. A. Hirst and P. F. Brook. 2,926. February 6th.
- ELEVATOR OR HOIST FOR RISE-AND-FALL ELECTRIC LIGHT FITTINGS AND THE LIKE. A. J. Ware. 3,165. February 8th.
- ELECTRIC LIGHTING SYSTEMS INTENDED MORE PARTICULARLY FOR RAILWAY CARRIAGES AND SIMILAR VEHICLES. Electric and Ordnance Accessories Co., F. H. M. Langley and H. W. Price. 3,238. February 8th.
- ELECTRICAL INFLUENCE MACHINES. Morris & Lister, Ltd., D. K. Morris and F. A. Watson. 3,701. February 14th.
- ELECTRICAL APPARATUS FOR THE MANUFACTURE AND WELDING OF METAL ARTICLES. S. Jevons. 3,838. February 15th.
- TRANSMITTER FOR SIGNALLING BY ELECTROMAGNETIC WAVES. F. J. Chambers. 4,488. February 22nd.
- TELEGRAPHIC SYSTEMS. P. Faiella. 4,520. February 27th. (February 27th, 1910.)
- ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co.) 5,620. March 6th.
- ELECTRIC CUT-OUTS. R. Schweitzer and S. Conrad. 6,443. March 14th.
- AUTOMATIC REGULATING DEVICES FOR ELECTRIC SUPPLY SYSTEMS. H. Lake. (United States Light and Heating Co.) 7,528. March 25th.
- ELECTRICALLY-CONTROLLED VALVES. A. H. Nicholson and A. W. Brooking. 8,899. April 10th.
- ELECTROMAGNETIC LIFTING APPLIANCES USED WITH CRANES. Steel, Peech and Tozer, Ltd., and H. E. Bowen. 9,951. April 11th. (Addition to No. 30,075 of 1910.)
- SECONDARY GALVANIC BATTERIES. H. P. R. L. Pörsche and J. A. E. Achenbach. 9,944. April 24th. (April 27th, 1910.)
- ELECTRODES FOR SECONDARY GALVANIC CELLS. H. P. R. L. Pörsche and J. A. E. Achenbach. 9,945 and 9,946. April 24th. (May 9th, 1910.)
- ELECTRIC SWITCHES. W. T. Henley's Telegraph Works Co. and E. E. Judge. 10,747. May 3rd.
- DYNAMO-ELECTRIC MACHINES. F. Newton. 10,758. May 3rd. (Addition to No. 15,423 of 1910.)
- ELECTRIC ARC LAMPS OF THE OPEN-ARC TYPE. F. R. Boardman, R. V. Boardman and F. Boardman. 11,872. May 17th.
- SYSTEMS OF ELECTRIC DISTRIBUTION. British Thomson-Houston Co. and F. P. Whitaker. 12,918. May 29th.
- GENERATION OF ALTERNATING ELECTRIC CURRENT. E. Rosenberg. 12,099. May 1st.
- MAGNETO-ELECTRIC LAMP APPARATUS FOR VEHICLES. S. Luy. 13,490. June 3rd.
- AUTOMATIC SWITCHES OR CUT-OUTS FOR USE IN CHARGING SECONDARY BATTERIES FROM DYNAMO-ELECTRIC MACHINES. A. H. Midgley and C. A. Vanderveil. 15,039. June 27th. (Cognate application, No. 19,870 of 1911.)
- RECORDING COUNTER FOR TELEPHONIC CONVERSATIONS AND SIMILAR PURPOSES. Association des Ouvriers en Instruments de Precision. 15,126. June 28th. (July 1st, 1910.)
- ELECTROMAGNETIC CIRCUIT-BREAKERS. Compagnie des Compteurs Aron. 16,962. July 24th. (July 27th, 1910.)
- TELEPHONE CABINETS. O. Sterkel. 17,441. July 31st.
- METHODS OF AND APPARATUS FOR COOLING ELECTRICAL MACHINERY. F. G. Baum. 19,760. September 5th. (September 7th, 1910.)
- ELECTRIC INCANDESCENT LAMPS. S. Euler. 20,643. September 18th.
- ELECTRIC SWITCHES. H. Lucas and O. Lucas. 21,495. September 29th.
- SPARKING-PLUG FOR INTERNAL-COMBUSTION ENGINES. H. E. Mills. 21,616. September 30th.
- PROTECTIVE DEVICES FOR ELECTRIC LAMPS. W. E. Perty and S. Davies. 23,781. October 27th.



THE

ELECTRICAL REVIEW.

Vol. LXX.

MARCH 22, 1912.

No. 1,791.

ELECTRICAL REVIEW.

Vol. LXX.]	CONTENTS: March 22, 1912.	[No. 1791.	Page
The Illusion of the Minimum Wage	...	...	449
The Fruits of the Coal Strike	...	...	450
Peat Fuel	...	...	451
Artistic (?) Lamp Standards	...	...	451
Electricity in the Domestic Ménage	...	...	451
The Successes and Failures of Profit-Sharing and Co-Partner-ship	...	...	452
Proposed Electrification of the Chilian State Railways	...	...	453
Flue Gas Explosions	...	...	454
An Electric Motor-Car with Edison Storage Battery	...	...	455
An Electric Kitchen in Marylebone (illus.)	...	...	456
New Electrical Devices, Fittings and Plant (illus.)	...	...	457
Legal	...	...	458
Reviews	...	...	459
Business Notes	...	...	460
Notes	...	...	467
City Notes	...	...	471
Stocks and Shares	...	...	475
Electric Tramway and Railway Traffic Returns	...	...	476
Share List of Electrical Companies	...	...	477
Artistic Street Lamp Standards (illus.)	...	...	479
Volume Changes in Accumulator Electrodes (illus.)	...	...	481
Trade Statistics of British India	...	...	482
Proceedings of Institutions :—			
Peat as Engine Fuel	...	...	483
Flashing-Over in Commutator Machines (illus.)	...	...	484
The Röntgen Society	...	...	485
The Electric Driving of Rolling Mills	...	...	486
Parliamentary	...	...	486
Foreign and Colonial Tariffs on Electrical Goods	...	...	487
New Patents Applied For, 1912	...	...	488
Abstracts of Published Specifications	...	...	488
Contractors' Column...	...	Advertisement pages xxii and xxiv	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers.

PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque.

BERLIN: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION

READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ILLUSION OF THE MINIMUM WAGE.

Now that the Government are committed to the principle of a minimum wage in connection with one of the most important industries of this country, it is not without the bounds of probability that attempts will be made to extend it in other directions. Appetite in these matters grows with eating ; and if the Proletariat are given an inch, they have a well-known propensity for taking an ell.

One cause will operate to induce those who belong to other Trade Unions to persuade the Government to decree a minimum for the benefit of their members. The success of nearly every undertaking depends upon the supply of cheap coal. Dear coal means increased cost of production, and increased cost of living. It will, therefore, involve a demand for higher wages ; and sooner or later the tidal wave recently set in motion will reach that great section of the community which makes its living by the supply of electricity and the manufacture of electrical machinery. In these circumstances it is not unprofitable to examine the views of some of the older economists on this question of the minimum wage.

There are some people who are sufficiently dense to refuse to believe that a universal rise in wages leaves the community no richer than it was before. A simple illustration must be our first and last effort to reason with such as these. An artisan from one of our Colonies was boasting that the minimum legal wage in his industry was 8s. a day. He was pitying the lot of an English comrade who could earn but 3s. 6d. at the same trade. The following dialogue was then heard :—"What do you pay for your cottage in New Zealand ?" "15s. a week," was the reply. Upon which the Englishman remarked, "I can get all the house I want for 5s. What do you pay for boots ?" "Oh, I can get a decent pair for 30s." When the Englishman realised that he could get a pair of boots for 10s., he began to think that the New Zealander's 8s. a day left him not much better off than those who lived on a pittance in the old country.

No less an authority than John Stuart Mill, writing so long ago as 1867, discussed the theory of minimum wage. He said : "A plan which has found many advocates among the leaders of the operatives is that councils should be formed, which in England have been called local boards of trade, in France '*conseils de prud' hommes*,' and other names, consisting of delegates from the workpeople and from the employers, who, meeting in conference, should agree upon a rate of wages and promulgate it from authority, to be binding generally on employers and workmen ; the ground of decision being, not the state of the labour market, but natural equity ; to provide that the workmen shall have reasonable wages, and the capitalists reasonable profits."

One might almost suppose that Mr. Asquith had the work



which contains this passage before him when he framed his first proposals for the settlement of the Coal Strike, which have since been embodied in the Coal Mines Bill, but he omitted the element of compulsion so far as the workmen were concerned. If he was, in fact, guided by this principle, it is a pity that he did not read on, in order to understand the views of the greatest political economist of the last century upon the proposal which it embodies. Mr. Mill points out that the rate of wages which results from competition distributes the whole wages fund amongst the whole labouring population; and that if law or opinion succeeds in fixing wages above this rate, some labourers must necessarily be kept out of employment. As it is not the intention of the philanthropists that these should starve, they must be provided for by a forced increase of the wages fund; by a compulsory saving. "It is nothing," writes Mr. Mill in memorable words, "to fix a minimum wage, unless there be a provision that work, or wages at least, be found for all who apply for it." He goes on to say that if the moral influence of opinion does not induce the rich to spare from their consumption enough to set all the poor to work at "reasonable wages," it is supposed to be incumbent on the State to lay on taxes for the purpose, either by local rates or votes of public money.

Into the objections which he advances to the principle of the minimum wage, we need not follow Mr. Mill further than to say this: He points out that it involves the imposition of a burden on the community, which can only be borne by increased taxation. In effect it tends to encourage the belief that everyone has a right to be supported by the State. It would not be "to each according to his sacrifice," but "to each according to his need."

It will be said, of course, that much has happened since Mill voiced his objection to the minimum wage; but it is material to notice that he objected to it even if the element of compulsion could operate against men as well as masters. Although, under the Bill discussed in Parliament this week, there is no compulsion in law, it is manifest that there will be compulsion on the employers in fact. An agreement to work for less than minimum wage is to be void; but the men are not to be compelled to produce at least a minimum quantity for the minimum wage.

Industries like that with which this journal is primarily concerned may not appear to be closely affected by the establishment of a minimum wage for miners; but it is the admission of the principle which is so dangerous, and those who control the electrical world will be justified in taking any steps which may be necessary to prevent the spread of any movement in the direction of a national strike.

---

## THE FRUITS OF THE COAL STRIKE.

---

WRITING at a time when the strike is still unsettled, the framing of any prophecy must be dangerous for the reason that we cannot foretell all the outcomes, and in peering through the mists of conflict, we cannot see all the indications of reef or shoal which in clearer times warn us to steer in safe courses. The immediate prospects are bad enough in all conscience, but matters of immediate menace are better whispered of in the council chamber than bawled amid the throng of the idle market place, where the frenzied pestilences of panic may take birth.

Matters of political opportunism, sometimes misnamed statecraft, are of necessity precluded from the columns of a technical journal. In them, however, we can discuss immediate and remote problems which will confront us when the strike is settled. The condition of the electrical manufacturer will be an anxious one. Himself both participant in and sufferer through the cut-throat policy of putting in low tenders in times of poor demand and bad trade, the present year had, save for the labour cloud, opened smoothly. It is scarcely an exaggeration to say that, in commercial tendering, the competition had become rather a matter of delivery than of price. Large outputs had made his works load factor satisfactory, and raised hopes in many cases of satisfactory dividends. Activity had brought with it certain troubles of its own. Porcelain, copper, and iron castings were hard to get—in some cases even work had not been started on contracts until the expiration of the contract date, for lack of raw material to feed the machines. Then again, there had been competition for suitable labour, for in some areas local supplies had been exhausted. Such evils of good trade were, however, endurable, although it was irksome to feel that the pestilential "ca' canny" policy was often preventing his men from working "all out" and making hay while the sun of good trade was shining.

As a whole, the engineering industries of this country have not been so full of work since the boom of 1873, and we have to realise the sorrowful fact that the coal strike has abruptly arrested this, and that it is doubtful whether we can pick up our stride again. At the best, some months must elapse after the nominal ending of the strike before manufacturing conditions become normal in regard to securing raw material. Raw material in hand will be exhausted by those firms who are still able to raise steam from their reserves of coal, or can obtain power from power stations. To obtain more castings or forgings will mean waiting until the iron and steel industries get under way and proceed to distribute their output among those keenly competing for it. The electrical manufacturers of this country will, therefore, be well deserving of all the latitude that can possibly be extended to them by their customers.

Another of the effects of the strike will be that of the greatest incentive to economy and efficiency that can be conceived. For one thing, it will have done more to promote thermal efficiency and fuel conservation than either the Report of the last Royal Commission on the duration of our coal fields or many lectures on thermodynamics. Fuel conservation must imply not only plant thermally efficient, but the economical utilisation of the power produced by the securing of the best load factor. The colossally extravagant domestic grate must be restricted in its use and give place to electricity and gas for domestic cooking and heating.

Bulk supply and sub-station distribution must replace many of the small lighting and power stations with bad load factors. No strike was ever designed to reduce the cost of production of the commodity concerned, so that both the position of the internal-combustion engine will be strengthened, and in the getting and handling of coal labour-saving machinery must to an increasing degree tend to reduce the amount of labour required. We commend this to the consideration of those responsible for the present situation.

Moreover, idle vehicle mileage—which is only another name for the bad load factor of an idle ton-mileage—must be largely restricted for the future. The travelling public will have to journey in better loaded trains with less elbow room, and fewer tramcars will run during the quieter hours of the day. In the household and in the factory, in the power station and on the railway, the general public will effect economies lessening the demand for coal, and by a reduction of the waste of fuel for purely competitive purposes the community will perhaps unconsciously, but indubitably, take its full vengeance on those who have so wantonly held it to ransom.



## PEAT FUEL. •

JUST in the nick of time, by a mere coincidence, comes Mr. Tomlinson's third dig of the spurs to the Irish landlord, the Irish Government, or the cosmopolitan capitalist, whomsoever of them is most likely to reap the benefit of his action.

Probably he will have to sharpen up his "spurrers" again and again, before the right people will listen to him; but the cause is so good, and its champion so valiant, that we hope he will proclaim his gauntlet thrown until the broad truth for which he is contending is demonstrated beyond cavil.

Mr. Tomlinson's scheme, of which we give an abstract elsewhere in this issue, requires nothing but rough labour, and as much patience as the builders of a railway require before they earn interest upon their outlay; but its very virtues are its bane. Experience has shown that capital can be got for peat schemes with the glitter of electricity and machinery about them, but it fights shy of the fustian of mere drainage.

Naturally enough, now that we are so accustomed to perform all manufacturing processes more cheaply by machinery than by hand labour, it is difficult to realise that there are yet one or two things which can be done more cheaply by a peasant than by an automatic machine; and it will be so difficult to persuade the non-technical and paying public that this is so, unless every member of it is taken to see a bog for himself, that a good case might be made for an educational experiment by the Government. We dislike resort on all occasions to the State, for we are sure that individual enterprise is productive invariably of better results, but the Irish people have been State-fed to such an extent that the backbone is nearly dissolved out of them, and whenever anyone wants to do anything, be it keeping a few hens or building a railway, the aid of the State is invoked immediately with prayer and blasphemy; so that nothing will be done in the bogs, except sink shareholders' money at fairly regular intervals, until the State demonstrates, regardless of expense in the usual way, that a bog can be drained in blocks and sections *à la* Tomlinson at such a cost that the cutting and transporting to the producers will not take the price beyond 4s. per ton of chemically dry (anhydrous) peat.

The Irish Board of Works is well suited for carrying through such an experiment. Its engineers are supposed to know a great deal about the drainage of large water-logged areas; they have at hand the records of various Commissions which investigated such matters during the nineteenth century; and, above all, they have the time to be patient.

The risk to the nation (let us not talk any more about the State) of loss by the experiment would be ridiculously small when compared to the ultimate benefits of success. Listen to Mr. Tomlinson:—Say a bog has an area of 1,000 acres and an average depth of 20 ft. If a purchaser can be found, the value *at present prices* will be £2,000 to £5,000. The bog contains 1,800,000 anhydrous tons of fuel. What is the bog worth to the owner?

Royalties at 3d. per ton	...	...	...	£22,500
Value of reclaimed land, say	...	...	...	10,000
" " fuel, say	...	...	...	180,000
Net value of sulphate	...	...	...	330,000
				£542,500

Half-a-million for the sporting owner who never thought of reclaiming anything from the bog except a few grouse, for which he pays about £1 a head. Our Socialists would look after him, and the nation would wake up gradually to the fact that there are 3,000 more of those 1,000-acre lots in Ireland, which Mr. Tomlinson estimates to be worth about twelve hundred million pounds. The Irish Parliament could get some grand taxes out of that!

In other words, Ireland can lay her hand on over eight hundred million H.P.-years, and all the artificial manure she will want for growing anything she likes on the reclaimed land, without going beyond her own shores for it.

Remember, now, that these fairy figures are good "if peat with 50 per cent. of water can be got *standing on the bog* for 2s. per anhydrous ton:" Mr. Tomlinson is under no delusions upon that point, and we must have a determining trial upon a large scale before we can be sure that magic will be wrought on the land.

This is the third paper by the same author, and it is interesting to notice that, while the second was a recantation of the first, this third paper, written after three years, which might have been occupied as before in changing his mind, is a repetition in stronger form of Mr. Tomlinson's second thought. What was done in Holland in the 17th century, and what those very Dutch offered to do for Ireland in 1700, can be done in the 20th century by Irish labour and by Irish brains unless the race has degenerated sadly. Politically, economically, and in the interests of the electrical industry, the burnt offering of 5,000 square miles of black peat would be magnificent. With the effect upon the soul of the country an electrical journal has no call to deal.

### Artistic (?) Lamp Standards.

We publish elsewhere in this issue an article on recent practice in American designs for street lamp columns, by an esteemed contributor, to show our readers the lines along which our trans-Atlantic friends are advancing. But we must confess that we are wholly unable to share the author's enthusiasm for the beauty of these designs, some of which, in fact, we should not hesitate to call atrocious—for example, figs. 7 and 10 on p. 480. Apart from the design of the columns, there is a monotony about the spherical globes, turned upwards towards the heavens, or drooping from their stiff supports, which to us is most unpleasing. There is not one of these designs that commends itself to us as suitable for lighting streets—from the æsthetic point of view. *Chacun à son goût*: we do not pose as arbiters of beauty, and others, like our contributor, may hold opposite opinions on this score, but on other grounds we may be bolder, and say that several of the designs illustrated are highly inefficient for street lighting. By using a sufficient number of the columns and expending sufficient energy on them, no doubt a brilliant effect can be secured; but where severe competition has to be met, and the streets must be adequately lighted at the minimum cost—the conditions which obtain in this country—hardly any of the designs shown can be seriously considered.

### Electricity in the Domestic Ménage.

ALMOST suddenly we find ourselves immersed in a campaign designed to bring about the more extended use of electricity in the household. Last week we drew attention to the investigation which has been set on foot by the I.E.E. to determine why the benefits of electricity have not been more fully realised by the consumer: this week we are able to describe the completely successful electric kitchen which is operating on a large commercial scale in Marylebone: and to-morrow, with the opening of the Smoke Abatement Exhibition, a vigorous propaganda will be set on foot, for, as will be seen from the list of electrical exhibitors elsewhere in this issue, a determined effort is to be made to bring home to the householder a knowledge of what can be done—and done best—with electricity. Moreover, we understand that an "At Home" will be given by the President of the Institution of Electrical Engineers at the Exhibition, and the admirable object lesson of an electrical restaurant in full swing—which was so earnestly wished for at Olympia—is bound to create a deep impression. The fact that some of the oldest firms engaged in the manufacture of steam and gas cooking apparatus have now begun to make electrical cooking apparatus clearly shows that its possibilities are being realised, and we hope to see a notable development in this branch of the industry in the early future.



## THE SUCCESSES AND FAILURES OF PROFIT-SHARING AND CO-PARTNERSHIP.

By FRANK BROADBENT, M.I.E.E.

DURING the miners' strike, considerable prominence has been given both in the public Press and in Parliament to the principles of co-partnership and profit-sharing, a large and increasing number of people being of opinion that, in some form or other, the co-partnership of labour and capital forms the solution, and the only solution, of the problem of industrial unrest. A petition signed by over 240 members of Parliament has just been presented to the Prime Minister asking for the appointment of a Royal Commission to inquire how far the principles of co-partnership could be applied to the industries of this country. An analysis of the signatures shows that the petition was signed by 157 Unionists, 72 Liberals, and *only two Labour Members*, viz., Mr. Crooks and Mr. Wardle. There is a widespread impression that the working classes hanker after the supposed huge profits made by capitalists, and it might, therefore, be thought that profit-sharing proposals would be welcomed by them: but those who have noted the attitude of the accredited Labour leaders, more particularly of those members of Parliament who are identified with Trade Unionism, cannot fail to have come to the conclusion that these men are bitterly opposed to profit-sharing in any and every form. One has but to turn to the records of the speeches made by these members at the time when Sir Christopher Furness (as he then was) propounded his system of co-partnership, to appreciate the fact that co-partnership has very little chance of success so long as the present leaders of Trade Unionist opinion retain their influence over organised labour.

The reason for this attitude is not far to seek: It is in the fear that the popularising of co-partnership would eventually destroy Trade Unionism. That it might do so is quite possible, if we regard Trade Unionism merely as a fighting organisation, which appears now to be its chief function; for in a true co-partnership business there would not be, as at present, the two opposing armies of capital and labour, and the only fighting that could take place would be due to mutiny among the co-partners. On the other hand, as showing that there is nothing inherently antagonistic in the principles of co-partnership and Trade Unionism, is the fact that most of the members of the workmen's co-partnership societies are Trade Unionists.

According to a recent Government return, there were in the year 1908 some 303 industrial and provident societies engaged in production and distribution in the United Kingdom. The number of members among whom the profits were shared was about 31,000, and the addition to wages was about 1s. in the £, or, say, 5 per cent. The number of workmen's co-partnership productive societies is about 110, embracing the following trades:—Textile, 19; agricultural, 17; boots and leather, 17; metal trades, 11; building and wood, 15; and printing, 15.

In the year 1910 the capital employed in these societies was about 2 millions, the trade or turnover about  $4\frac{1}{2}$  millions, and the profits (including interest on shares, but not on loans) was about £220,000. These amounts are very small in comparison with those for co-operative production as a whole, and are almost insignificant when compared with those for the whole of the manufacturing industry of the country. They serve to show, however, that the workers possess the ability of directing businesses of various kinds successfully. The conditions under which these workshops are conducted is worthy of mention, and it must be admitted that the standard set up is not inferior to those obtaining in the best-conducted company-owned works, and vastly superior to many. There are no hard and fast regulations laid down by any association for the purpose of defining the conditions of work in the co-partnership workshops, but the following conclusions have been arrived at as the result of inquiries made by the journal *Co-Partnership*, replies having been given by 23 societies in the boot and shoe, printing, and textile trades.

These conclusions are that (1) the hours worked are lower in co-partnership workshops than in others in the same

trades and districts; (2) That the wages are higher; (3) That women being shareholders gives them an opportunity of voicing matters affecting the welfare of women workers; (4) That regularity of work seems more assured; and (5) married women's labour is minimised to a degree that is unknown elsewhere, and is, in fact, practically prohibited.

In view of these facts, the antagonistic attitude of Trade Unionist leaders to all forms of profit-sharing seems hardly justifiable. The attitude is, no doubt, due in part to the suspicion that any co-partnership proposals emanating from the employers' side are a preliminary step to a general scheme to reduce the rate of wages. It may also be due to the knowledge that the employers' profits form but a small percentage on the amounts paid in wages, and that profit-sharing would not result in any considerable increase in the workmen's weekly earnings. That this is the case is evident from the results given above in connection with the existing co-partnership productive societies, where it was shown that the total profits over and above wages were only about 5 per cent., of which only about one-eighth was available for distribution as dividend to labour after paying interest on shares. It is obvious that, if the workers had voted themselves an increase in wages of, say, 1s. in the £, there would have been no available surplus to pay either interest on shares or dividend to labour. It is equally obvious that wages must be paid either out of profits or capital, so that every successful business concern is essentially a profit-sharing business, although wages are not generally recognised as a share of the profits.

Profit-sharing schemes in which the workers share in the available profits after wages and other charges have been paid, are not necessarily co-partnership systems. There are, in fact, a considerable number of profit-sharing systems in operation in this country, but apart from the gas-making industry there are few, if any, examples of co-partnership arrangements between capital and labour.

The attempts to establish either profit-sharing or co-partnership systems of production in the engineering and iron industries have not been, on the whole, very successful, the following representing the principal attempts:—

Fox, Head & Co., of Middlesbrough, in 1866 introduced a system in which the workers received half the profits over 10 per cent. This system was abandoned in 1874. In the year 1867 John & Henry Gwynne, of Hammersmith, gave the men a bonus equal to 10 per cent. on the profits. This was abandoned after a three years' trial. In this case the men had to be non-society men, a condition which may have contributed to the failure. J. Gimson, engineer, of Leicester, introduced in 1872 a system similar to that of Fox, Head and Co., but this was discontinued in 1879, when the profits fell below the minimum. In 1878 Sir Joseph Whitworth agreed to receive deposits from his employes and to pay them the same rate of interest as he received on his own capital. This system is still continued by the present company, Sir W. G. Armstrong, Whitworth & Co., Ltd., the workmen having upwards of £250,000 invested in the works. W. B. Massey & Co., of Openshaw, established in 1881 a system of profit-sharing by cash bonus, and in the year 1883 Tangyes, Ltd., of Birmingham, issued £50 bonds to their regular workmen, these bonds bearing interest at the same rate as the dividend paid to the shareholders. Six years later the practice was altered to that of paying a fixed rate of interest of 5 per cent. It is to be observed that the workmen did not subscribe to these bonds, which were current for one year only, and were renewed if the workman continued in the firm's employ, but were forfeited on leaving. In 1887 Ross and Duncan, of Govan, established a system by which a share of the profits was distributed either as a cash bonus or as a contribution to a provident fund, according to the votes of the majority of the employes. In 1890 the Thames Ironworks offered to share equally with the men any surplus profits over 10 per cent., but the scheme was rejected by the men after discussing it for three months. In the same year Willans & Robinson issued a limited amount of debenture stock to workmen, and Browett, Lindley & Co. offered to divide with the men one-fourth of the surplus profits, but the scheme was abandoned after one year's trial. Another abandoned scheme is that of Dobson & Barlow, of Bolton, who in 1891 established a system of paying a cash bonus to employes, but discontinued it in 1906.



Among electrical manufacturing companies who have attempted profit-sharing, or given the workers a financial interest in the business, are Crompton & Co., who in 1891 offered for subscription a number of £5 certificates, none of which were taken up by the workmen; and the Brush Co., who in 1893 set aside 10 per cent. of the dividend to be divided, half as cash and half as savings bank deposit, between such employes as "may be nominated as participants."

Robert Mushet & Co., of Bonnington Ironworks, tried a system of profit-sharing in 1892, but abandoned it as "not producing good results." These, with a few other cash bonus systems, are the principal recorded attempts at profit-sharing in the engineering trades. Similar systems have been tried and failed in connection with collieries; and the Furness scheme, as applied to shipbuilding, is one of the most recent attempts at profit-sharing, which, as is well-known, was abandoned after one year's trial, on the vote of the men, although the system did all that was claimed for it. This system, it will be remembered, aimed at being more than a profit-sharing system, the intention being to develop it into a real co-partnership business.

That the principles of co-partnership can be successfully applied to the competitive branches of the iron industries is proved by the remarkable success of the system in vogue at the Guise Ironfoundry, where after an unbroken record of 30 years of co-partnership the entire capital, about £200,000, is now owned by the workers who have received as profits over £277,000, in addition to their ordinary wages. The whole town is conducted on co-operative principles, practically everything being owned in common. Possibly, however, there is something in the French temperament which may account for this remarkable success, as a somewhat similar success was achieved in the business of Maison Leclaire.

In this country the greatest successes in co-partnership are connected with the gas-making industry, which is a non-competitive branch of manufacture. The Livesey scheme adopted by the South Metropolitan Gas Co. 21 years ago set an example which has been followed since by 31 gas companies in this country, representing a paid-up capital of over £47,000,000, out of a total of £86,500,000 for the whole of the gas companies in the United Kingdom. The employes now hold nearly £600,000 in the stock of the various companies, £88,000 being divided among them last year, about half this amount being represented by the South Metropolitan Gas Co.

Co-partnership is very much in the air just now, and whilst there are obvious difficulties in applying the principles fully in a competitive industry like electrical manufacturing, there is less difficulty as regards electrical generation and distribution, which, like the gas industry, is largely non-competitive. A considerable amount of literature has been published on the subject by the Labour Co-partnership Association, and this will repay the study of those interested in the question.

## PROPOSED ELECTRIFICATION OF THE CHILIAN STATE RAILWAYS.

[FROM A CORRESPONDENT AT SANTIAGO DE CHILE.]

AFTER considerable study, the Chilian Government decided in May, 1910, to electrify the first section of the railway down the Central Valley, from Valparaiso to Puerto Montt. This section of the Central line runs from Valparaiso to Santiago, a distance of 187 km., through mountainous country, to a height of 519 m. above the sea level. At present there is only a single line, over which the traffic is enormous, and as the cost of building a double track would be very great, the main object of the proposed scheme was to increase the carrying power of the line.

The Committee appointed to study the matter, however, reported that there would be an enormous annual saving in the cost of working, as the consumption of coal over the most difficult part of the track, that from Llai-Llai to Tilttil (Tabon), where the gradient is between 2 and 3 per cent., is very high. On this gradient the road rises, in a distance of 20 km., from 390 metres to 890 metres, on the Valparaiso

side, and on the Santiago side from 590 to 890 metres. From Tilttil to Santiago the road falls 71 metres in 50 km. to Santiago.

In accordance with the Committee's proposals, the Government asked for public estimates, in the *Diario Oficial*, dated May 27th, 1910, in which the conditions were published, the estimates to be opened on June 15th following. Estimates were sent in by the Westinghouse Co., backed by Messrs. Giros & Loncheur, French capitalists; and by Siemens-Schuckert, backed by the Deutsche Bank.

During the study of these estimates the Chilian Minister in London called the attention of the Government to the discussion going on in Europe with regard to the merits of the single-phase and three-phase systems, the result being that no decision was arrived at, as the proposing firms suggested different systems of working. It was, besides, pointed out to the Government that between May 27th and June 15th there was not time allowed for the matter to be studied in Europe by other firms, competent and prepared to estimate for the undertaking.

It was also well-known that the two firms who presented estimates had had their engineers on the spot for months studying the matter, and that the period of 20 days was deliberately suggested by them, in order to prevent other firms coming in, they being prepared to divide the undertaking between them.

The Committee itself is divided on the question of the single and three-phase systems, and places great importance on some articles recently published in the *Times*, translations of which have been forwarded to the Government by the Minister in London (Mr. Agustin Edwards). The matter has recently been given serious attention, and there is no doubt it will shortly be settled.

The *Diario Ilustrado* of February 14th states that the Minister of Public Works has decided to ask for new estimates, and to give sufficient time for contractors abroad to study the project, with which object the bases will, no doubt, be published in London, Paris, New York, and Berlin. A certain advantage will, no doubt, be gained by those firms who already have their engineers in the country; amongst them, we understand, is one American firm.

The Chilian Government, however, has such confidence in English undertakings that every facility would be given to representatives of English firms who would promptly take up the study of the undertaking, with the object of sending in an estimate.

The particulars necessary to a preliminary study of the subject would no doubt be found at the Chilian Legation in London, as the Minister, Senor Edwards, would undoubtedly give every assistance possible to firms wishing to go into the matter.

It is high time that British electrical engineers turned their attention to the field of development which is open in Chile, and which, up to the present, has been almost entirely worked by German capital. The State railways some few years ago placed a contract with the North British Locomotive Co. for engines, and these, in contrast to the German engines (Borsig), which had formerly been working on their roads, have given such good results that an English scheme would find the railway authorities already inclined in its favour.

**Copper.**—The steady hardening of the price of this metal is, naturally, a subject of comment in the leading financial journals. A writer in the *Financial News* for March 9th points out that, although there is still talk of selling combinations in the States, the difficulty of reconciling high-grade and low-grade ore mining interests, and the existence of rich deposits elsewhere (e.g., the French Congo), must militate against anything like a comprehensive association. The figures quoted for highest prices for the years 1902 to 1911 are interesting; they show a steady rise to 1906, a slow decline to 1910, and a more cheerful tone in 1911. An article in the *Times* of March 7th emphasises more strongly the decline in visible supplies, especially their falling-off since October last. It also draws attention to the increase in European consumption, and to the improvement in the situation now commencing to be felt in the U.S. The general enhancement of prices is, of course, dependent on the duration of the coal strike, but, as those countries where an intelligent direction of labour is still possible will naturally absorb the trade of those unfitted to retain it, the balance will probably remain in favour of the rise.



## FLUE-GAS EXPLOSIONS.

By EDW. INGHAM, A.M.I.M.E.

THERE is probably no subject bearing on the working of steam plant, about which so little has been written as that which forms the title of this article.

Explosions of gas in the flues of steam boilers are of pretty frequent occurrence, but as they are not usually attended with very serious results little is heard about them by the general public. The greatest danger to which a flue-gas explosion gives rise is that of burning the fireman. When an explosion occurs, there is a liability to blow open the furnace doors, and to drive the hot fuel on the furnace grates out across the stoke-hold, in which case, should the fireman happen to be in the line of fire, he is liable to be badly burned. Apart from this, there is no real danger, but a good deal of trouble and annoyance may be caused by these explosions in the shape of damaged brickwork and flues, and possibly straining and consequent leakage at the boiler seams. In a number of instances where explosions have occurred, a portion of the surrounding brickwork has been completely blown down, the boiler coverings have been lifted off the whole length of the boiler, and the tops of the economiser chambers, which chambers, by the way, are especially liable to flue-gas explosions, have also been blown away.

Although usually of a mild character, comparatively speaking, several disastrous explosions of vessels subjected to steam and water-pressure have been attributed to explosions of flue gases. One of the most notable of these was that which occurred in connection with a fuel economiser at the Agcroft Print Works, near Manchester, many years ago. In this particular instance, one of two economisers which were employed at the works was blown to pieces, many of the economiser pipes being projected to considerable distances; the brickwork covering and the back end of the boiler house were blown away, and the extent of the damage was estimated to be between £500 and £600. Although attributed to an explosion of gas in the economiser chamber, it is doubtful if such was the true cause of the accident. The fact that the safety valve of the economiser was found fast and inoperative after the accident would appear to show that the economiser itself exploded; the safety valve of the other economiser, which worked under precisely similar conditions, was in perfect working order.

Another notable explosion of an economiser was that which occurred at the Stanley Mill, near Oldham, in 1885. This explosion was a most disastrous one, inasmuch as it led to the death of four persons and injury to many others, not to speak of the damage to property which was incurred. At the Board of Trade inquiry which was subsequently held under the Boiler Explosions Acts, the Commissioners attributed the accident to an explosion of gas in the economiser chamber.

Here again, however, there is good reason for believing that such was not the true cause of the accident. An independent expert was called in by the coroner to report on the case, and after a very thorough investigation gave it as his opinion that the explosion was due to over-pressure brought about by an inoperative safety valve which had become frozen up. The jury accordingly gave a verdict to the effect that "the explosion was caused by excessive pressure of steam, generated within the economiser."

This explosion, and the differences of opinion which were entertained as to its true cause, led to considerable controversy at the time as to whether or not a flue-gas explosion could really be responsible for so much damage. At the present time the opinion is generally entertained by engineers that an explosion of gas is not likely to cause a vessel containing steam and water under pressure, such as an economiser or a steam boiler, to explode. Nevertheless, it is quite within reason to suppose that, in the case of a vessel which has become seriously weakened by internal and external corrosion, the shock resulting from an explosion of gas may be so severe as to cause failure of the vessel, and consequent explosion. Hence, where seriously-weakened steam boilers

and economisers are concerned, a flue-gas explosion may possibly be attended with disastrous results.

Fortunately, it is not difficult to prevent explosions of gas in boiler flues: a knowledge of the circumstances under which these usually occur will enable the fireman to adopt the means necessary to avoid such occurrences.

When coal is thrown into the furnaces the hydro-carbons it contains are rapidly distilled off. Under ordinary conditions of working, these hydro-carbons are intimately mixed at high temperature with a sufficient quantity of air, and are consequently burned to carbon dioxide ( $\text{CO}_2$ ). When, however, the fires are banked at stopping times, and the dampers closed, the above conditions, which are essential for proper combustion of the fuel, do not obtain. The air supply is restricted and the temperature of the distilled hydro-carbons is comparatively low; consequently, the latter pass along the flues unconsumed, and are thus liable to lodge in the flues, as their way to the chimney is barred because of the dampers being closed. Consider now what happens when the fireman restarts. The first thing he does, after seeing that the water level in the gauge glass is right, is to open the fire-doors for the purpose of breaking up the fires. The opening of the doors allows cold air to rush into the flues, and this air passes along and mixes with the unburnt hydro-carbons, unless, of course, the dampers have already been opened so as to allow the gases to escape. The air and the hydro-carbons together thus form an explosive mixture, and the flame produced by the breaking-up of the fires passes along the flues, ignites the mixture, and so causes an explosion.

This is the way in which flue explosions are usually brought about. It will be observed that before an explosion can occur the following conditions are apparently necessary: (1) Some of the hydro-carbons from the fuel must pass off unconsumed; (2) there must be a chamber or cavity in which the unconsumed hydro-carbons can accumulate; (3) a quantity of air must be admitted, sufficient to form, with the unconsumed hydro-carbons, an explosive mixture; (4) a flame is necessary to ignite the explosive mixture, and so produce an explosion.

By preventing the fulfilment of these conditions, flue explosions can, generally speaking, be avoided.

Thus, in ordinary working, and with efficient combustion of the fuel, neither of the conditions (1) and (2) would obtain, as the hydro-carbons would be mixed with a plentiful supply of air and would, therefore, be properly burned, whilst the dampers, being fully open, would allow all the gases to pass out of the flues and away up the chimney. In some instances, however, both of the above-mentioned conditions may be met with during working periods. When, for example, the fires are so heavily charged with fuel that the latter nearly reaches the furnace crown, the air supply is restricted, and consequently the combustion of the whole of the hydro-carbon gases cannot be properly effected, and the unburnt gases therefore pass along the flues; but if the flues have been built as they should be, and if the dampers are fully open, there is no place where the unburnt gases can collect, and these are therefore swept out of the flues. In many cases, however, overhead cavities exist in the flues: or, perhaps, the dampers are only partially opened. Under such circumstances, the hydro-carbons may rise and fill the cavities or the space above the damper openings, and thus remain lodged in the flues. All the conditions necessary for an explosion then exist, and an explosion is thus liable to occur.

It will be obvious, therefore, that in building the brickwork flues of steam boilers, economisers, &c., cavities, chambers, or any places in which it would be possible for gases to accumulate, should be avoided as far as practicable. When a lifting damper is only partly opened, a space is left above the damper opening, and for this reason, swivel dampers are to be preferred, inasmuch as these leave no overhead space when partly opened, but allow both the lighter and the heavier gases to escape.

In some cases cavities and collecting chambers cannot very well be avoided. Sometimes it is necessary to place the dampers low down at the end of a side flue, and this arrangement is a very favourable one for flue-gas explosions. Generally, where such arrangements exist, or where there are cavities in the flues, the risk of flue explosions may be



obviated by connecting the highest parts of the cavities with the chimney stack, so that there will be a way of escape for any gases which tend to collect.

Again, in the case of economisers, the chambers are very suitable for the collection of explosive mixtures; and hence, in order to minimise the shock which would result in the event of a gas explosion occurring, flap doors are sometimes fitted into the sides and top of the chamber. Similarly, loose blocks are sometimes provided in the side flue covers of Lancashire and Cornish boilers, so that should an explosion occur, it will find vent by blowing off these blocks, instead of, perhaps, blowing down a portion of the brickwork envelope.

In some instances, much trouble from flue explosions has resulted through the use of forced-draught arrangements on the boilers.

The use of forced-draught appliances is, in many cases, to be put down to the fact that the natural draught is defective. During the process of charging the fires, therefore, the whole of the hydro-carbons do not become consumed, owing to the absence of a good draught to provide an ample supply of air. Hence, if any cavities exist in the flues the unconsumed gases may accumulate therein, and may be ignited when the forced draught is turned on and the fires brightened up.

At some works where much wood-working is done, wood cuttings and shavings are sometimes used for firing the boilers, and at such places flue explosions occasionally occur. As in the case of heavily-charged fires, defective draught, &c., a restricted air supply is the fundamental cause of these explosions—the charred residue blocks up the spaces between the fire bars, and so chokes the supply of air entering the furnaces through the grates.

As already pointed out, flue explosions are most liable to occur when starting up the boilers after the fires have been banked. Before breaking up the fires, therefore, it is always advisable to open, and leave open, the dampers for a few minutes, so that any explosive mixtures which may have formed during the period of stoppage may be swept out of the flues before they can become ignited.

Where lifting dampers are employed, the risk of explosion may be minimised by drilling one or two holes at the upper parts of the dampers, or the latter may be left open for a considerable time after banking up or heavily charging the fires. The gases are, of course, most rapidly distilled off the fuel just after the fires have been charged, and by leaving open the dampers for some time after firing up, the distilled gases have a proper chance of escape before the dampers are more closely shut down.

## AN ELECTRIC MOTOR-CAR WITH EDISON STORAGE BATTERY.

A TYPE of motor-car which has been in service in the United States, and is made by Messrs. S. R. Bailey and Co., of Boston, is equipped with the Edison storage battery. It is claimed that this roadster, with a standard battery and motor equipment, can be run on one charge of the battery for 80 to 100 miles with an average speed of 20 miles per hour over ordinary roads, including hills, and that such a performance is not merely a top result, but a fair representation of everyday practice. The car is very light, but of strong construction, and has its centre of gravity fairly low, which lends itself to high speed and easy riding. The front end of the car is hung above and in the middle of a long cross spring extending almost the entire length of the front axle, and this point of support, at which there is a ball and socket joint, is well above the centre of gravity. This type of suspension produces a tendency for the car to lean inwards when going round a corner, instead of outwards, as is the case with other vehicles. The ball-and-socket joint allows the easy oscillation of the front axle when one wheel is raised in passing over an obstacle, the body being lifted only half as much as in the case of the usual suspension. The rear of the body or chassis is hung from two points at the top, upon two elliptic springs running parallel to the length of the

body and close to it. The frame is of wood construction, strongly braced with steel, and forms both the body and the battery compartment. By lifting hinged metal hoods, the motor, controller, all the driving mechanism, and every cell of the battery are open to easy inspection. The car has seating for two persons, with abundant carrying space in the rear of the seat for luggage.

The control includes a steering wheel with a controller lever mounted on the top of it similar to the throttle control on a petrol car, and easily moved by a finger of either hand. By the addition of a foot switch, eight speeds forward and four reverse speeds are obtained. The brakes are operated through foot levers.

The standard battery equipment is 50 cells, having an initial capacity of 225 ampere-hours or 13.5 kw.-hours. It appears from tests that the capacity can be maintained for over four years, and with use it increases 15 to 25 per cent. It is claimed that the Edison battery has an initial power capacity per pound more than 50 per cent. in excess of any other battery, while after about one year's service the capacity of the Edison cell is nearly twice that of any other battery used for an equal length of time. Moreover, this type of cell can be charged at very high rates, when necessary, without injury. It is not injured by being overworked, and it may be left standing in any state of charge for any length of time. The cells are light, and can be easily handled and the only attention required is to replace the electrolyte about once a year, and occasionally to supply a little distilled water. The motor is one especially designed by the General Electric Co., of America, and operates under severe conditions with high efficiency; it is rated at 48 volts and 40 amperes, and has a normal running speed of 1,200 R.P.M. The motor is suspended under the rear hood, driving a jack-shaft through a silent chain gear; from the shaft, the power is transmitted to the rear wheels by a double chain drive.

The Edison Electric Illuminating Co., of Boston, have seven of these cars in operation, and some figures may be given with regard to one of these roadsters equipped with a battery of 25 per cent. less capacity than the ordinary equipment, which was run on October 8th and 9th, 1911, between Boston and New York. In making this run no attempt was made to cover the distance with a minimum number of charges. A charge was taken at New Haven, where the night was passed, and short charges or "boosts" at Worcester, Springfield, and Stamford, where stops were made for meals. Mr. W. H. Francis, of the Boston Edison Illuminating Co., was one of the passengers and kept records, which he made public at the Convention of the Electric Vehicle Association of America, as follows:—

	Miles.	Hours.	Miles per hour.	Amp.-hours per mile.
Boston to Worcester ...	45	2'15	20'0	2'70
Worcester to Springfield ...	53	2'30	21'2	2'55
Springfield to New Haven ...	64	3'12	20'0	2'77
New Haven to Stamford ...	43	2'0	21'5	2'58
Stamford to New York ...	39	2'15	17'3	2'23
Totals ...	244	12'12	20'0	

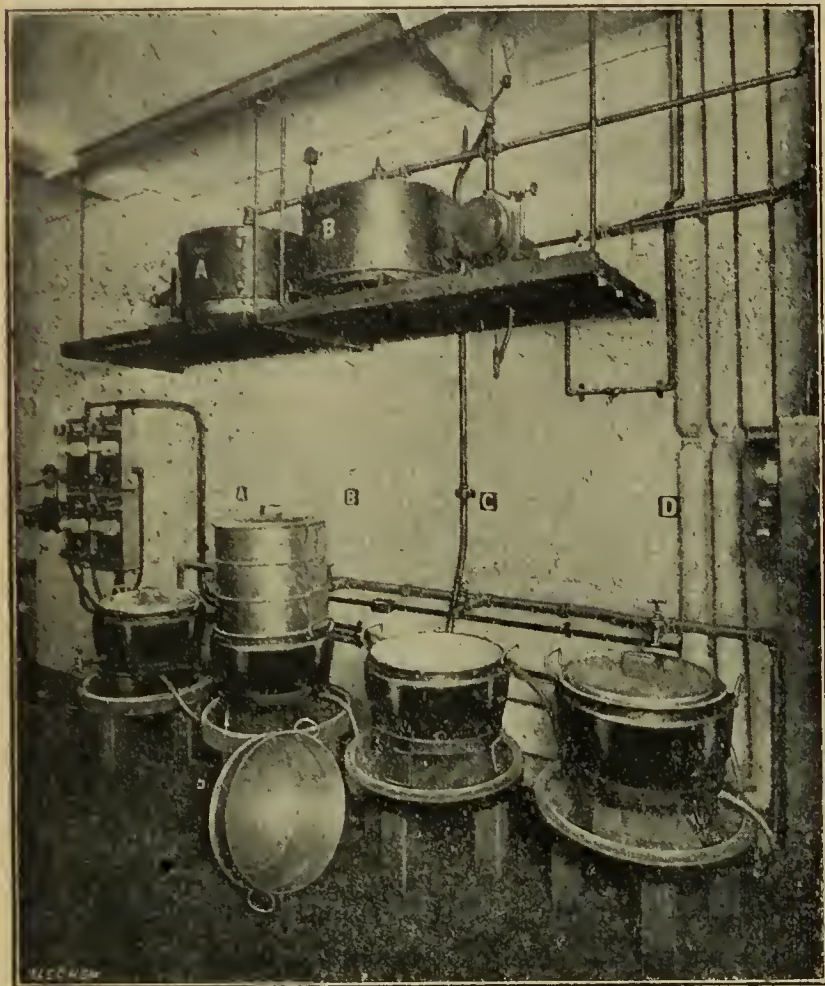
On examining the figures shown by this table, a very impressive testimony will be observed as to the efficiency of the electric motor-car, and it is to be sincerely hoped that before very long we shall see in Great Britain something analogous to this.

**Tool Steel Direct from the Ore.**—According to the *Journal of the Franklin Institute*, experiments have been made upon the direct production of steel from magnetite ores containing titanium and traces of vanadium, in a cylindrical furnace 18 in. high and 14 in. in diameter, with two lateral graphite electrodes 1 in. square. The maximum power used was 200 amperes at 110 volts. The slag and ore were first fused by an arc between the electrodes; then the electrodes were dipped in the bath. The ore contained 51.45 per cent. iron, 7.5 per cent. titanium, 0.12 per cent. nickel, and traces of vanadium and sulphur. The charge was 100 parts ore, 20 of limestone, and 18 of carbon formed into briquettes with molasses and water in the proportion of 10 : 16. No ferromanganese or other deoxidising agent was used before tapping, and sound ingots, 3 lb. in weight, were obtained. This could not be done with non-titaniferous ore. The metal was tool steel of good quality. The total cost of ore, coal, limestone, power, and electrodes is estimated at 2 cents per 1 lb. of steel.



## AN ELECTRIC KITCHEN IN MARYLEBONE.

ON Monday last, at the invitation of the St. Marylebone Electric Supply, we had the pleasure of inspecting one of the largest installations of electric cooking apparatus that has yet been carried out.



ELECTRIC STEAM BOILERS AND ELECTRIC BOILERS  
FOR PUDDINGS, &c.

This electric kitchen caters for the staff and employes of the "Marylebone Lane Power Factory"—which is not, as one might suppose at first sight, the electricity works of the Borough Council, but a large dress-making establishment—and provides for the supply of some 400 dinners and 500 teas daily. As a matter of fact, it could deal with a much larger output, but the accommodation available sets a limit to the number of customers. The whole of the operations are carried on electrically, with the exception of the hot-water supply, which is provided by an anthracite water-heater in the basement, at a temperature of about 150° F.

Emphasis must be laid upon the fact that this is not an experimental or tentative installation; it is a substantial commercial undertaking, which must be judged purely on merit. The question of working cost is here of first importance, for the kitchen cooks not for the general public, but for work-people, who are supplied with meals at a tariff so low that one wonders how it can possibly be done at the price. We shall return to the question of working cost later, after we have briefly described the installation.

This consists of the following items: Seven electric ovens, 24 in. × 26 in. high × 21 in. deep; two small hot cupboards, 19½ in. wide × 24½ in. high × 22 in. deep; one large hot cupboard, 9 ft. 6 in. long × 14 in. high × 21 in. deep; one hot cupboard in dining hall, with six shelves, for warming the dinners of those employes who prefer to bring their own food, each of the six spaces being 7 in. high × 26 in. wide × 15 in. deep; two hot cupboards 40 in. long × 23 in. high × 23 in. deep, in the serving room, with carving tables on top; three tea urns, 4 gallons capacity each; two electric steam boilers supplying steam to four large vegetable steamers at 15 lb. steam pressure, the steamers being capable of cooking 4 to 5 cwt. of potatoes per hour; four boilers for cooking meat puddings, vegetables, &c., also fitted with steaming tops for cooking with saturated steam; one boiling par is fitted with a heavy tinned-copper interior vessel to form a bain marie for cooking custards, sauces, &c.; one hot plate, 36 in. × 18 in. for boiling and simmering stews, gravies, custards, &c.

The whole of this plant was supplied by the British Promethens Co., of Birmingham, and installed and erected by the constructional staff of the St. Marylebone Electric Supply Department, which also supplies the electricity at ½d. a unit.

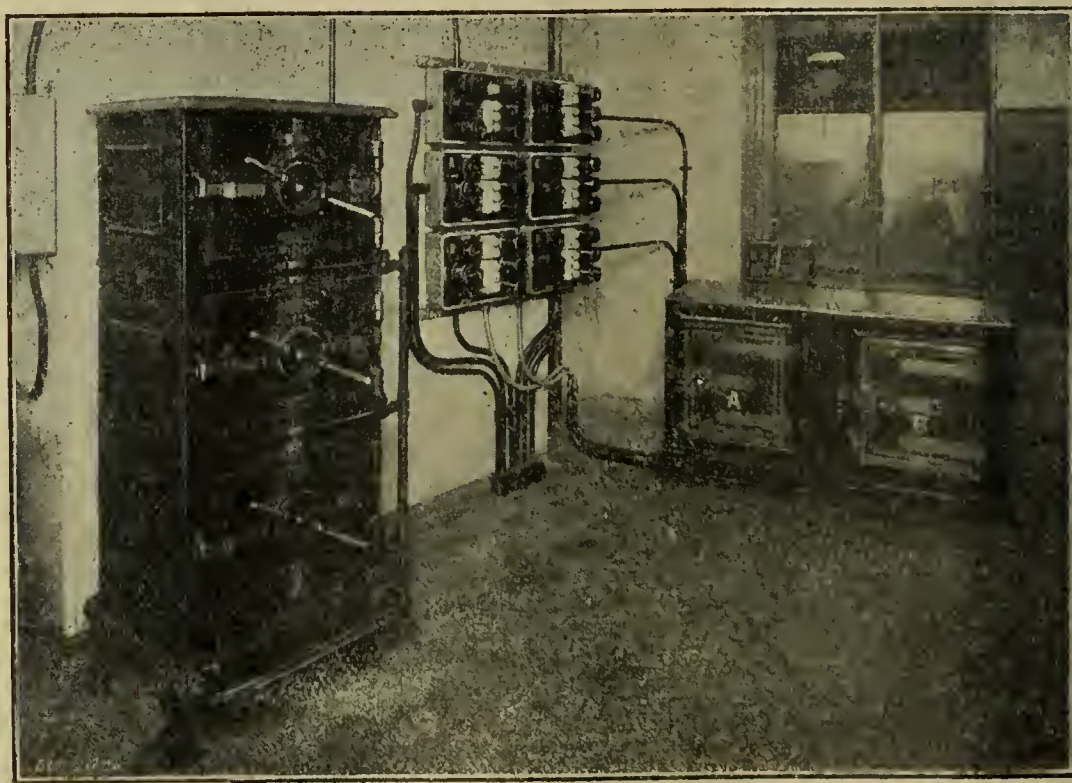
In addition to the plant just mentioned there are one electric grill, 23 in. × 12 in. cooking space, supplied by the General Electric Co., Ltd., and one large fish fryer, 24 in. × 24 in. and 4½ in. deep, capable of frying 300 to 400 pieces of fish per hour, which was supplied by Messrs. Purcell & Nobbs, of Cleveland Street, St. Marylebone.

Great credit is due to the staff of the Electricity Department, under Mr. A. H. Seabrook, for the admirable way in which the kitchen has been laid out and the apparatus installed. The supply is effected through a three-wire 240-240-volt service, and the building has been wired (by the department) in iron barrel, the job being exceptionally neat and workmanlike. The different classes of cooking apparatus are in this case fed separately through eight meters, for the purpose of obtaining precise data regarding the consumption of each—data which will be of the greatest value to the department in connection with future installations.

The ovens, boilers, &c., are of very substantial construction, resembling the cooking equipments with which the public are familiar, and embodying those features which experience has shown to be essential to success—for be it noted that while an electrical engineer can make an oven easily enough, experience in the manufacture of cooking apparatus is indispensable to the making of the best one. Two of the ovens are shown in one of the accompanying illustrations, as well as the steaming closet for cooking potatoes; between them will be seen the switchboard for five ovens and one of the boilers supplying the steamers. The switchboard is equipped with turn switches and "Dial" fuses, and a lamp in circuit with each of the heating elements, the lamp being fixed behind a red glass screen, and indicating by its ruddy glow the fact that the corresponding element is alive. The method of connecting the apparatus up is worthy of notice; flexible metallic tubing is used, with brass unions sweated on the ends, and the electrical connections are made with rubber-insulated conductors protected by these tubes. No plugs and sockets are used. The ovens, &c., can be moved about freely without breaking the connections, which are not touched by the kitchen staff at any time—the aim being to make the whole equipment fool-proof. Three other ovens, to the right of those illustrated, are built up with hot cupboards between them; and beyond these come two more, like those shown in the view.

The two electric boilers for supplying steam at 15 lb. pressure are to be seen in the other figure, mounted on a platform above the vegetable boilers; the latter stand on wooden trays, and can be used in a variety of ways, and in different combinations. The electric fish fryer is a novel feature; it provides a large pan for hot fat in which the fish are cooked, a grill on which they are drained, and a hot cupboard for keeping them warm.

We must now pass on to the working results, as described by Mr. Clinch, manager of The London Home Delicacies Association, whose firm, besides conducting the business indicated by its title, is one of the largest contractors for staff feeding in London, supplying meals for over 5,000 persons daily. Mr. Clinch, therefore, knows all that is worth knowing about the catering business; he undertook the contract to work the electric kitchen with interest, but with an open mind—a little doubtful, however, as to the reliability and cost of the system—and he reports as follows:—



VEGETABLE STEAMERS, ELECTRIC OVENS AND SWITCHBOARD.

"As to reliability: The apparatus has now been working for well over six months, and since it has been installed nothing whatever has happened to put a stop to cooking operations. The way the installation is fitted prevents such an occurrence, and we are satisfied that the apparatus is as reliable as anyone could wish."

As to cost: "We were informed that the cost would not exceed the cost of gas cooking for a similar installation, and our estimate



was made accordingly. The actual cost of electricity used in practice—and we have now had six months' steady working—proves to be lower than our estimate, even at the price of 1d. per unit, and we are satisfied that it would not be possible to work this kitchen, taking all things into consideration, at a less cost by using coal or gas as the heating agent."

That is for the actual cost of energy; but there are other advantages also:—"We can now state it, as a fact, that meat cooked in an electric oven does not shrink to nearly the same extent as meat cooked by other methods. It appears also that this saving in weight is accompanied by an advantage still more important: the meat cooked by electricity retains the juices important to digestion, and also presents a more appetising appearance, and certainly has a better flavour than if cooked in other ways. I should put the saving in weight at approximately 1 lb. in 12 lb. This saving, turned into £ s. d., represents quite an appreciable proportion of the cost of cooking."

"The apparatus is under perfect control by means of the switches provided. The indicating lamps (the lamps light up as each switch is put on) serve to constantly remind the cooks that the ovens are being used at certain temperatures. They, consequently, do not forget to lower the heat when required, with the result that the food cooked is very rarely spoilt by inattention at their hands."

Mr. Clinch goes on to express his appreciation of the great hygienic advantages of electric cooking—the temperature is low, the customary unappetising smell is absent, the electric kitchen is always clean, and the labour needed to keep an ordinary kitchen in a presentable condition is almost eliminated. "Those," he says, "who wish to be at the top of the modern catering business must see and read the writing on the wall: 'Electric Cooking.'"

We are thus enabled to state that the installation here described has proved itself able to meet every commercial, culinary, and hygienic requirement. We may add that it could to-day be purchased at a price no higher than that of its rivals. It will be clear from the report of Mr. Clinch that even at 1d. a unit the electrical system would afford a good margin of saving over the over-all running cost of a gas-heated kitchen, and probably it would be worth while to pay 1½d. per unit on the score of cost alone, while if all its points of superiority were allowed for, the par price might fairly be put at 1½d. per unit.

We heartily congratulate Mr. Seabrook and his staff, and the makers of the apparatus, on the striking success of this installation. Already there is a still larger electric kitchen connected to the mains of the St. Marylebone Electricity Department—that of the new London Polytechnic, Regent Street—which also was erected by the same staff. In due course we shall give particulars of this, and we hope that many other electric kitchens may be called into existence as the result of these examples.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Simplex Electric Toaster.

A new pattern of electric toaster has been introduced by MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, which embodies many improvements in design and construction. The base and frame are one casting, tastefully designed

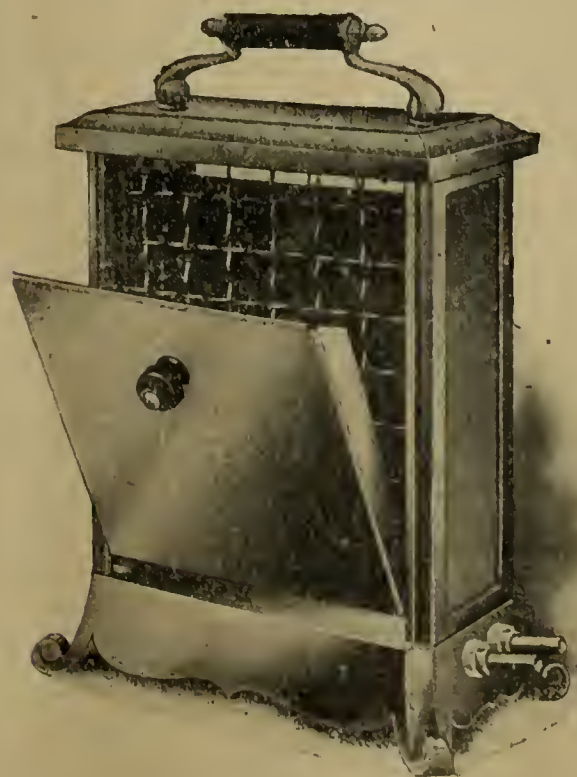


FIG. 1.—ELECTRIC TOASTER

in a style which the maker's experience in the manufacture of this class of apparatus has shown to be the most popular. The heating element consists of a highly efficient resistance

tape of special composition, spirally wound on thin rectangular mica strips which are supported one above the other on the frame. Two slices of bread can be toasted at the same time, and these are held in the correct position for toasting by two hinged sides which also serve to retain the heat. The current consumption is low, but the construction is such as to give very rapid toasting. The device is nickel-plated and is furnished with two pin terminals.

### "Zed" Fuse Distribution Boards.

We give below an illustration of a three-phase power distribution board fitted, with "Zed" fuses, for 500 volts, 60 amperes, per way, controlling induction motor circuits. This shows the design to which about 200 ironclad boards have recently been completed by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., for a large power installation. These boards varied in size from 25 amps. to 200 amps. per way, and from one to eight ways. A special feature of the design is the elimination of slate and marble, with the resulting advantage that risk of damage during transit is reduced

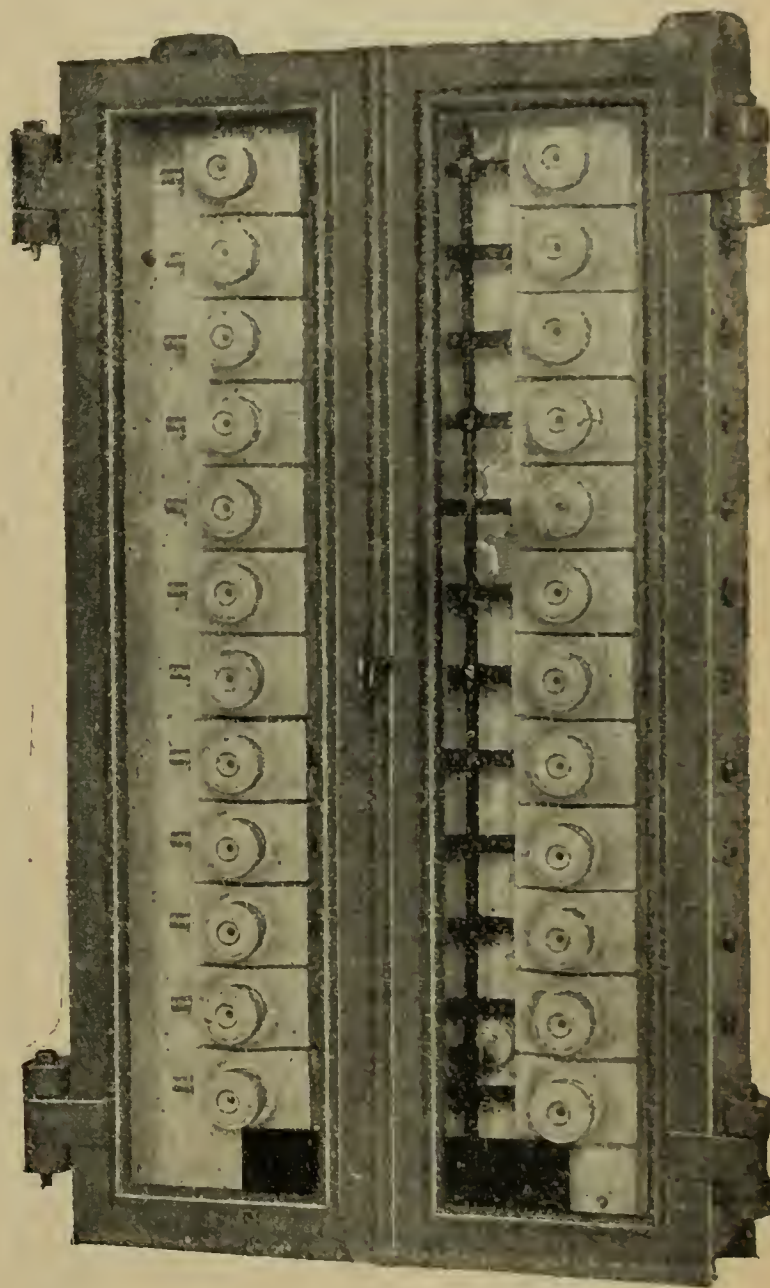


FIG. 2.—DISTRIBUTION BOARD FOR MOTOR CIRCUITS.

to a negligible quantity. The whole of the insulation of live parts is effected by means of vitreous porcelain, so that the insulation resistance is extremely high. The cases are castings, with fixing lugs arranged so that the backs of the boards themselves project sufficiently far from the wall to permit of conduit runs being taken straight through behind the board in any direction. The hinged doors are arranged so as to be weatherproof, and are provided with detachable hinge pins to facilitate ready removal.

Fuse boards of this class are particularly suitable for use in factories and workshops, especially in positions subject to explosive gases or a dust-laden atmosphere. In this connection we are reminded of the disastrous explosion which occurred some time ago in a Liverpool oil mill: it was stated at the inquest that the explosion might have been initiated by the blowing of a fuse, and in refitting the mill "Zed" fuses have been adopted throughout for the distribution boards.

### Alabaster Bowl Fittings.

MESSRS. BEST & LLOYD, LTD., of Cambray Works, Handsworth, Birmingham, are now supplying a new line of electric light fittings with alabaster bowls for the purpose of indirect lighting. The use of alabaster is claimed to avoid the ungracefulness of the metal dish and also the casting of shadows, while at the same time it gives a rich and artistic appearance to the fitting. The light is reflected from the ceiling, while a soft glow appears through the alabaster dish. Each dish is unique, no two pieces of alabaster being alike. The tints are variable—some almost pure white, others cream or ivory; some have reddish veins, and others green tints. For the lighting of drawing rooms, boudoirs, smoking rooms or lounges, these fittings with alabaster bowls are claimed to be



both agreeable and luxurious. Full particulars of these fittings are set forth, in four languages, in a catalogue that Messrs. Best & Lloyd have lately issued, a number of different types with different shapes



FIG. 3.—ONE-LIGHT PENDANT, WITH ALABASTER BOWL.

of bowls being illustrated therein. A typical example (No. 17,364) is shown in the accompanying fig. 3. It is a one-light polished or oxidised brass pendant, with a 9 $\frac{3}{4}$ -in. alabaster dish, its overall length being 30 in.

#### A Large Controller.

MESSRS. ELECTRIC CONTROL, LTD., of Bridgeton, Glasgow, have recently shipped a large automatic controller to Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-on-Tyne. This controller is for starting and stopping a 600-H.P. hydraulic pump, twice a minute if necessary. The pump is driven by two 300-H.P. induction motors supplied with three-phase current at 440 volts, 40 cycles. The motors are directly connected to the ends of the pump shaft, their stator and rotor windings being connected in parallel. The voltage between the slip-rings is approximately the same as the voltage applied to the stator, the starting current in both circuits being 900 amperes and the full-load current 750 amperes.

The controller consists of one triple-pole switch for the stator circuits, and five double-pole switches for cutting out the rotor resistances, thus giving six starting speeds, the time interval between steps being adjusted by means of vacuum dashpots.

Each switch unit on the panel is exactly the same, although the stator switch, the intermediate rotor switches and the short-circuiting rotor switch are all of different capacities. This is accomplished by taking a double-pole switch of 500-amperes capacity, continuous rating, and connecting the two poles in parallel, thus making it into a single-pole switch of 1,000-amperes capacity. Three of these switches are used to form the triple-pole stator switch, and two to form the last rotor switch. The five switches on the top half of the panel thus form one T.P. and one D.P. switch of 1,000-amperes capacity, and the remaining switches on the bottom half of the panel each form a D.P. switch of 500-amperes capacity, continuous rating, which is more than ample for the short time they are in circuit. Each switch is assembled on a 2-in. slate panel, and the panels are mounted on a heavy angle-iron frame.

The switches are built on the same principle as the A.C. patent controller standardised by this firm. The switch levers are fitted with laminated copper brushes and with auxiliary and main sparking-tips. The magnets are all operated by single-phase current from the main supply. When energised, they close the switches through a toggle mechanism, which is designed so that the magnet plunger is free of the mechanism in the "up" position, and thus it is impossible for any vibration to be produced at the switch contacts, which is the most essential feature to be obtained in A.C. magnet switches.

The controller itself is controlled by means of a tappet switch operated by two tappets on the hydraulic accumulator. When the

accumulator falls to its lowest level, the tappet switch is closed by one of the tappets; this closes the solenoid circuits of the three switches which form the stator switch. These immediately close, and thus start-up the motors with all the resistance in the rotor circuits, the other switches following in succession with a sufficient interval of time between them. When the short-circuiting rotor switch closes, the intermediate switches automatically open, and

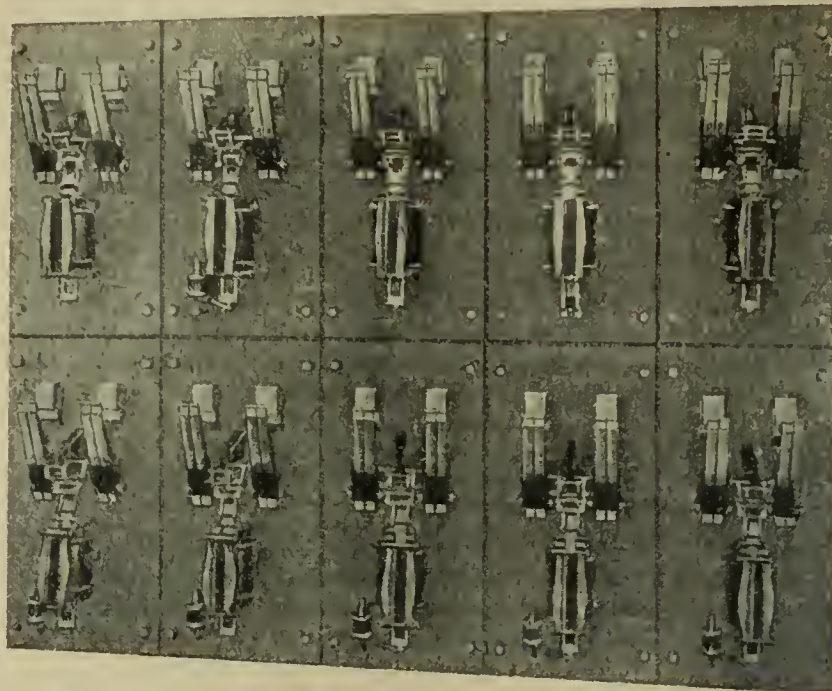


FIG. 4.—A.C. AUTOMATIC CONTROL GEAR FOR 600-H.P. PUMP MOTORS.

the motor runs at full speed with the stator and the rotor switches closed. When the accumulator rises to its highest level, the tappet switch is tripped open, and this opens the controller and so stops the motors, the main circuit always being broken on the stator switch.

A considerable amount of resistances is required for this controller. They are built up on three separate angle-iron frames. Each set is fitted with a slate panel with terminals and cable sockets, so that the connections between the resistance terminals and the terminals on the controller panel can be easily and quickly made. The resistances weigh altogether 4,000 lb., and the controller 3,000 lb. The dimensions of the controller are 7 ft. 6 in. wide by 6 ft. high, and each resistance frame is 5 ft. wide by 4 ft. 6 in. high.

This is probably the largest A.C. automatic controller installed in this country, the maximum capacity of the control panel, as shown in the illustration, being 900 H.P. at 440 volts.

#### "Vickers" Control Gear.

We are informed that our note last week was not quite correct: the wire-on-porcelain resistance unit is only used in their motor-starting gear by the ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., the resistances for their controllers being more often of the cast-iron grid type.

## LEGAL.

#### TRAMWAY ACCIDENT CLAIMS.

A SPECIAL jury sitting with Mr. Justice Phillimore, in the King's Bench Division, on 13th inst., awarded to the widow of a brewer's carman, compensation to the extent of £600, against the London County Council, as owners of the electric tramway system, and the London General Omnibus Co. for the loss of her husband. The plaintiff was Mrs. Elizabeth Shipcott, and her husband was engaged on September 11th last in delivering beer at "The Bell" in Shoreditch. A motor omnibus crossed the tram-line, and was in the act of passing the deceased, who was standing against his dray, when a tramcar, proceeding in the same direction, collided with the omnibus, driving it against the dray, and wedging the man between the two vehicles. The result was that the man received injuries which proved fatal. The case for the plaintiff was that the tramcar driver was negligent in not applying the brakes in time, and that the omnibus driver was also negligent in getting into the position which caused the accident. The defendants each sought to cast the blame upon the other, but the jury found a verdict against both, awarding damages as stated.

At Manchester Assizes on Tuesday, before Mr. Justice Bray, a claim for damages was heard in which the plaintiff was Mrs. Phoebe Shaw, of Barrow, and the defendants, the British Electric Traction Co., of Barrow-in-Furness.



PLAINTIFF stated that on February 8th of last year she was travelling by car to Dalton-in-Furness. She had to change cars, and met with an accident at a terminus in Barrow. She alleged that when the car stopped, and she was about to get off, the car suddenly jerked forward and threw her off.

The defence was that the plaintiff contributed to the accident by her own negligence.

A DOCTOR said the plaintiff was suffering from traumatic neurasthenia.

His LORDSHIP asked the doctor to put it into common English. WITNESS said authorities differed in defining it, but it was commonly known as "railway spine."

MR. RANKIN suggested to the witness that on the legal case pending, plaintiff being anxious about it, had been suffering from chronic lawsuit.

WITNESS: I call it chronic neurasthenia.

The jury returned a verdict for the plaintiff, awarding her £150. Judgment was entered accordingly.

#### BEAUMONT v. UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD.,

THIS case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Moulton and Buckley, upon the appeal of the company from the award of the Judge of the West Brompton County Court, sitting as the arbitrator under the provisions of the Workmen's Compensation Act, in favour of the administration of Allen Beaumont, who, before his death, was employed as the feed pump attendant at the company's generating station in Lot's Road, Chelsea.

MR. SHAKESPEARE, in support of the appeal, said it was based upon the ground that there was no evidence on which the County Court Judge could have come to the conclusion that Beaumont's death was occasioned by an injury or accident arising out of, and in the course of, his employment. The facts were these:—

Beaumont, the deceased man, in May, 1909, while in the service of the appellants, met with an admitted accident, but from the effects of that accident he entirely recovered. Beaumont afterwards developed valvular disease of the heart. On September 20th, 1910, when at work, he complained of a pain in his side, and left off work. He went to two hospitals, and afterwards died. The County Court Judge held that the man's work was too much for him, and that the heart disease was probably caused by a strain, but he (counsel) contended there was no evidence to justify any such finding.

MR. TURRELL, having supported the award of the County Court Judge on behalf of the respondent, their Lordships allowed the appeal, holding that there was not a particle of evidence to show that Beaumont's death was the result of an accident which arose out of and in the course of his employment.

Judgment was, therefore, entered for the company.

### COUNCIL OR COMPANY?

BY "CHANGE-OVER."

THERE is a certain time during the career of almost every central station engineer when he has to decide whether his own interests will best be served by joining the staff of a municipal undertaking or that of a similar works owned by a company. A change from one to the other should not be made without first carefully considering the difference in the general conditions which exist under the respective governing bodies. Many men have spoken in bitter tone after having changed appointments, when it is too late to turn back, and I put forward the following information, with a view to its proving useful to other engineers who may not yet have reached that stage in their career, which calls for a decision to take one road or the other. The step is an easy one to take, but a very difficult one to retrace. Change in a hurry; repent at leisure.

We all have complaints to make. Not one is satisfied with his lot in business; at least, a satisfied man is a rare exception, seldom met with in these days. But some complain of what is their own doing. The company man may complain of many matters appertaining to his work, for the major portion of which there may be some justification. In order to form an opinion, however, his privileges must be weighed against his grievances, and the balance judged accordingly. A company can usually be relied upon to deal fairly and squarely with their engineers. They fill responsible posts, and men of ability possessed of a ready power of initiative, who are quick to recognise advantages, and have the courage to suggest and inaugurate improved methods of working, in any of the various ways open to them, are usually able to

adopt them without interference from the directors. Naturally this kind of man is rewarded, as he should be, by suitable increase in salary, and, when occasion offers, additional responsibility. More economical working and improvements in organisation mean money to the company, and they give one a more or less free hand to carry out his duties along the best possible and most up-to-date lines. And they pay him according to his value to them.

The man of energy, providing his energy is real business energy, can make his opportunities and reap the benefits of his labours when employed by a company. The man works with a purpose, and is given to understand that constant attention to his work will surely bring reward in the shape of wages. The company receive more in the way of profit, consequently they can afford to pay the man who is chiefly responsible for the introduction of the money-making ideas, accordingly.

How widely different are the conditions of the municipal engineer. He also complains, and when his privileges are weighed against his disabilities, the balance is more often than not to be found on the wrong side. A municipality seldom treat their officers as they should. They bind him up in rules and regulations—red tape, if you like. Their engineers also have responsible duties to perform, but the man of ability and energy, instead of finding that his efforts for improvement and increased business are appreciated, discovers that there is no opportunity for making use of his talents. He is just one member of a large staff: an item of a big quantity, and opportunity seldom, if ever, comes for him to move ahead more quickly than the whole batch around him, be they slackers or workers. He has certain officers over him, and they in their turn have committees hovering over them, and his only chance of improving his position is by pushing the whole lot, or waiting for a dead man's shoes. The council engineer may be tearing his inside out to do his utmost for his employers: he is a worker, and naturally cannot remain idle: he wants to show how to save money for the department: he is itching to go ahead, to improve and alter, so as to bring in more profit; but he cannot move—his hands are tied. All alterations have to be made through his superiors, who in their turn must necessarily await instructions from committee. Result: much never reaches the committee stage, and the engineer in despair must needs scramble along in the groove made for him until such time as he is fortunate enough to obtain another situation, or is able to step up a pace through someone above him leaving, or growing business luckily favours him in the way of a better paid post. The engineer may work—a good man will always work, pay or no pay, it is his nature—but encouragement to do his best is lacking. Opportunities which he makes are not grasped, because he has not the power to grasp those opportunities. Committee meetings mean delays, and frequently delay means loss. The engineer sees the loss, and is powerless to prevent it. The committee are too busy with other matters to take action, even if they possessed the ability to recognise the opportunity.

The time spent in obtaining sanction for capital expenditure, with a Council undertaking, automatically puts a heavy brake upon its rapidly growing possibilities. Any new work entailing a cost of about £20 has usually to await the sanction of certain committees, who, in their turn, are forced to refer items of any value above that, to a general Council meeting, which often causes weeks of delay before the work can be proceeded with. Again, dealing with larger amounts, it is necessary to take up loans, or obtain tenders by public advertisement for goods and material, and several months will perhaps elapse before the work is well on its way to completion. In this manner a Council take months to carry out what a company would do in about a week. Imagine a prospective customer with a broken-down steam or gas engine, requesting an immediate supply of electricity for driving motors to replace his old plant; what a handicap a Council is to commence with. It is red tape all the time. Work cannot proceed without waiting to receive official sanction, and thereby business is lost, and business means money. Suppose a job offers, costing about £200, for main-laying, &c., with an estimated revenue of £150 a year guaranteed: a company would have the current on within a very short time after receipt of the application



for supply, but with a Council weeks will elapse before sanction is obtained for the work to proceed. When a company receive such an application as this, the applicants are marvelling at the smoothness of electric driving almost before they are aware of their gas being turned off, or of their obsolete steam plant being cold. This kind of consumer talks, which is the best advertisement possible, and many are the possible new consumers likely to come along through one smart piece of work of this kind.

Consumers naturally prefer a supply from the local authority where possible, because of the fact that charges for energy supplied by municipal undertakings are generally lower than in districts supplied by private enterprise. This rate depends largely upon the load factor and initial capital expenditure, which latter item is far higher in a company works than in a municipal undertaking. The tendency with a local authority is toward lower charges, as the works grow. The private companies have always their dividends to consider, and their districts, generally speaking, are not quite so favourable as the majority of Council areas.

In conclusion, I think the balance of advantage remains with the company service. There, when opportunities occur, they can be grasped and utilised to one's personal benefit in the end. With a municipality, it is just a question of waiting for a dead man's shoes. The man who has managed somehow to get placed on a scale where his salary automatically increases by small amounts annually, and who is satisfied to rub along without exerting himself too much, is better off in a Council station. On the other hand, a worker with a decent head on his shoulders, who wants to be paid for his ability, had far better stick to a company and use his abilities for his own betterment.

## BUSINESS NOTES.

**Lighting Plants Wanted for Canada.**—The Commissioner of the Commercial Bureau, Brandon, Manitoba, would like to hear from manufacturers of electric storage lighting plants that are suitable for farm-houses. Mr. Langdon states that if firms will send illustrations and all particulars to him, he will put them in the hands of an intending customer.

**Engine Foundations.**—From MESSRS. MITCHELLS, ASHWORTH, STANSFIELD & Co., LTD., 23 and 24, Old Bailey, London, E.C., we have received some lists relating to their "Mascolite" felts for reducing vibration and deadening sound. Amongst recent orders received by them is one for "Mascolite B.U.," 1 in. thick, for an engine foundation at the Belgravian Steam Works, Brewery Road, London, N., with Mascolite washers and bushings for the bolt holes in the engine bed. (Architects, Messrs. Taperell & Haase.) Another order is for "Mascolite B.U.S.P." (specially waterproof quality) 1 in. thick, for gas engine foundation 802 sq. ft., for Olympia Theatre, Coalville, near Leicester. (Electrical engineers, Messrs. Baughan & Co., London Street, Reading.) "Mascolite I.R." carriage body pads, 6 in.  $\times$  3 in.  $\times$  1½ in., quality F.H. (with two layers ½ in. rubber insertion) is being supplied for Ceylon Government railways. "Mascolite P.S.P." (specially waterproof) permanent-way pads ½ in. thick, for the State Railways of France (formerly Western) is to be used on a viaduct in the immediate neighbourhood of Poisey Station (Seine et Oise).

**White City Exhibitions.**—We have received from Sir Owen Phillips, the chairman of council of the Latin-British and South American Exhibition, 1912, the following figures regarding the increase in British exports to France and Japan since the Franco-British and Japan-British Exhibitions held at Shepherd's Bush. They are taken from the French official statistics recently published by the Administration Generale des Douanes (the French Custom House) and from a Japanese official source:

British exports to France.—In 1908 they were 790,363,000 fr.; in 1909 (the year following the Franco-British Exhibition) they reached 884,163,000 fr.; in 1910 they were 926,826,000 fr.; and in 1911 they were 1,020,827,000 fr.

British exports to Japan.—In 1909 the value amounted to 86,227,750 yen; in 1910 (the year of the Japan-British Exhibition), 94,700,911 yen; in 1911, 111,156,768 yen.

It is hoped that the forthcoming Exhibition will have, as one effect, the stimulation of export trade to France, Italy, Spain, Portugal and South and other Latin-American Republics.

**Osram Undaunted.**—We have received from the GENERAL ELECTRIC CO., LTD., a photographic reproduction showing the behaviour of an Osram lamp which met with a remarkable accident recently at Sunderland. The wire just above the holder fused, and, of course, the lamp and the heavy glass shade fell to the floor, a distance of 10 ft. The point of the lamp stuck in floor, and the lamp remained standing upright undamaged, whilst the glass shade was smashed to atoms.

**Electric Cookery Demonstration.**—A demonstration of electric cooking was recently given at Watford by the ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., in collaboration with MESSRS. A. COULDREY & Co., who demonstrated their Dreycol cookery bag, using an "Eclipse" electric cooker for that purpose. Mr. F. W. Purse, of the Watford U.D.C. Electricity Department, sent out a letter to his consumers, in which he drew their attention to the demonstrations, and pointed out that the "Eclipse" electric cooker was being used entirely for the cooking operations. Demonstrations were given twice daily, from February 26th to March 21st. The demonstrator was Mrs. Lewis, F.C.A., Gold Medallist, who had never before used an electric stove, and had only seen the "Eclipse" cooker for half an hour the previous week; yet within an hour of the stoves being connected up she commenced her first public demonstration, using electricity for cooking, with most successful results. The hall was crowded with people at each demonstration, and very keen interest was displayed in the electric ovens. Mr. Purse remarks that at the present time it is the duty of those connected with electricity supply to educate people up to the fact that cooking can be done better, more easily, and as cheaply with electricity as with gas; this having been accomplished, it will create the demand for cooking appliances without any hesitation on the part of the consumers.

**Condensing Plant.**—We have received a lengthy list of orders for steam condensing plant recently received by the Mirrlees Watson Company, Ltd., of Glasgow. These include the following:—

**BAROMETRIC JET PLANTS.**—Two sets for Messrs. D. Adamson & Co.; a number for sugar companies in East Africa, Formosa and elsewhere; some for Mexico; one set for Messrs. Babcock & Wilcox, Ltd.; one set for Houghton Main Colliery; one set for the Dominion Iron and Coal Co. (per The Canadian Boving Co.); one set for Oldham Corporation (per The Brush Electrical Engineering Co., Ltd.).

**SURFACE CONDENSING PLANTS.**—One set for the Powell Duffryn Coal Co.; one set for Denaby and Cadeby Main Collieries Ltd.; two sets for Liverpool Corporation (per The B.T.-H. Co.); two sets for Liverpool Corporation (per British Westinghouse Co., Ltd.); one set for Nova Scotia (per Messrs. Fraser and Chalmers, Ltd.); one set for Athens (per La Compagnie Francaise Thomson-Houston); one set for Messrs. F. Smith & Co., Salford (per B.T.-H. Co. Ltd.).

**LOW LEVEL JET CONDENSING PLANT.**—One set for Maltby Main Colliery (per B.T.-H. Co. Ltd.).

Also the following plant fitted with pumps of the Mirrlees-Leblanc Rotary Type:—

Three sets surface condensing plant for Port Said Tramways (per La Compagnie Francaise Thomson-Houston); two sets Mirrlees-Leblanc Multi-Jet Condensing Plant, for Nixon's Navigation Coal Co. (per Messrs. Belliss & Morcom Ltd.); one set surface condensing plant for Norwich Corporation (per Messrs. Jas. Howden & Co., Ltd.).

**Large Chain Drive Installations.**—Referring to a notice in our "Contracts Closed" column, that a recent order for chain drives aggregating 800 H.P., was thought to be the largest single order on record in this country, MESSRS. HANS RENOLD, LTD., inform us that they are just completing a single order aggregating 1,500 H.P., for chain drives for a woollen mill at Keighley. The consulting engineer, who is carrying out the electrification of this mill, decided to use chain drives from motors to line-shafts throughout, and a good many of these have now been installed. An order for chains and wheels for drives aggregating 1,200 H.P. for a single mill was followed by a duplicate repeat order by the same firm of engineers, and as far as installations, as distinct from single orders, are concerned, Messrs. Hans Renold know of many cases where even these figures have been exceeded. As showing the tremendous strides that this form of power transmission is making, they quote their own figures for the past three years:—1909, 48,104 H.P.; 1910, 67,360 H.P.; 1911, 99,642 H.P. These figures represent the horse-power that will be transmitted by the complete drives (wheels and chains) which they have supplied for engineering purposes during the years named.

**Book Notices.**—*Small Switches and their Circuits.* By W. Perren Maycock, M.I.E.E. 1911. London: S. Rentell and Co. Price 2s. 6d. net.—This book differs from the majority of new publications, inasmuch as it deals with one phase of electrical work, and views it from the standpoint of one particular firm. In an ordinary way this mode of proceeding would be unsatisfactory, but the name of Lundberg is so closely associated with small special switches that in this case the result justifies the experiment. It is now 30 years since the firm of Messrs. A. P. Lundberg & Son was established, and they have always been trying to improve their special designs. In thus limiting the scope of their activities they have been able to make this branch of work peculiarly their own, and their designs now cover practically every requirement of small multiple switch work. After explaining the importance of detail in electric wiring work, the author shows to how large an extent suitable switching arrangements affect the cost of electric lighting, and proceeds to describe Messrs. Lundberg's principal special designs of switches, wall plugs and ceiling roses. A number of diagrams follow, in which both "safe" and "dangerous" methods of wiring are shown, as well as the switches invented to permit of lamps being turned on or off from a number of points. Wiring problems, as they are often called, have for many of us a fascination somewhat akin to a chess problem, and to such persons the diagrams given in this book will be very welcome. They show how seemingly insoluble requirements can be easily met, and open out possibilities of arrangements of circuits which will prove of great value to a contractor advising a client as to the best positions of lamps, plugs and switches. The author has acquitted himself well in a difficult task, and we feel sure that many of our readers will derive much benefit from a study of the book.

The London Chamber of Commerce (Oxford Court, Cannon Street, E.C.) has issued a useful brochure regarding the Manufacturers' Section of the Chamber, with a full list of members of the Section, and giving in broad outline the character of the subjects which have occupied its attention from the year 1897 down to date. At the



end of the book, answers are given to a number of questions that are often asked regarding the organisation of the Chamber and its work internationally and legislatively, and the privileges of membership for the individual member.

"Journal of the Western Society of Engineers." Vol. XVI, No. 10. December, 1911. Chicago: The Society. Price 50 cents.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland." Glasgow: The Institution.

"L'Electricité Domestique." By Georges Mis. 1912. Paris: Dunod & Pinat. Price 2 fr. 50.

"Berechnung von Wechselstrom-Fernleitungen." By Dr. C. Brietfeld. 1912. Brunswick: Friedr. Vieweg & Sohn. Price M. 4.

"Journal of the American Society of Mechanical Engineers." Vol. XXXIV, No. 3. March, 1912. New York: The Society. Price 35 cents.

"Fortschritte der Elektrotechnik." 1911. Berlin: Julius Springer. Price M. 10.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXI, No. 3. March, 1912. New York: The Institute. Price \$1.

"Atti della Associazione Elettrotecnica Italiana." February, 1912. Milan: Stucchi, Ceretti e C.

"Papers and Reports Relating to Minerals and Mining." 1911. Wellington: The Government Printer.

"Boletín de Ingenieros." Vol. II, No. 6. February 16th, 1912. Mexico: Secretaria de Guerra.

**Catalogues and Lists.**—MESSRS. JULIUS SAX & CO., LTD., 24A., High Street, New Oxford Street, London, W.C.—New catalogue of 70 odd pages, divided into two sections, in the first of which are shown a variety of fittings for Holophane glass, while the second contains a variety of forms of Holophane glassware. The book is very fully illustrated, reflector bowl fittings, ceiling fittings, sphere fittings, pendant fittings, cluster bodies, bowl-type reflectors, ornamental reflectors, pendant and upright globes, Stiletto prism, and concentrating reflectors, &c., all being included.

MR. HARRY MOSS, 116, Horton Grange Road, Bradford.—Leaflet relating to, and samples of, "Moorit" jointing material for high-pressure steam piping, &c.

MR. A. T. MURRAY, 30, Great Charlotte Street, Liverpool.—List of "High Duty" twist drills, giving sizes, speeds, prices and other information. It is claimed that these drills will run at about double the speed of ordinary carbon drills.

MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, London, W.C.—Twenty-page list (No. 664), giving illustrated particulars and prices of their "Aston" electric pocket lamp cases, pocket lamps, lamp and torch batteries, small metal-filament lamps, portable lanterns, cycle lamps, travelling and inspection lamps, and other like manufactures—150 lines in all.

THE WESTERN ELECTRIC CO., LTD., North Woolwich.—Leaflet No. 11A, giving information relating to "Western" tape and its price. This is the material which was originally placed on the market as "Amazon" tape, the name only being altered.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Upper Thames Street, London, E.C.—New price list of six pages, illustrating the points of merits of the B.T.H. Edison carbon lamps. The new list gives tables of data and life and the various voltages, sizes, and efficiencies of both standard and radiator lamps. The traction type of Edison lamps is extensively employed by tramway companies. Copies of this list will be supplied in quantities on application.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—New catalogue of 16 pages, containing brief information, illustrations, and prices of a variety of electric heating, and cooking apparatus, including laundry and flat irons, glue pots, liquid heaters, kettles, geysers, hair dryers, water heaters, hot water urns, hot plates, electric convectors, luminous radiators, Bastian quartz heaters, &c. A number of simplified designs of cheap radiators are given in the list.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, N.E.—As a companion picture to the humorous cartoon entitled "Making the 'Onewatt' Lamp," recently issued by the firm, they have now produced a humorous cartoon on the subject of "Selling Tantalum Lamps." In this design the greatly overworked tantalum sales department is playfully depicted, while there is also an illustration of shipping tantalum lamps, showing barrels being tumbled over a parapet on to a steamer below; three instances of travellers' difficulties of a more or less imaginary, but humorous, character appear. One is entitled "Convincing the West," another "Delighting the East," and the third demonstrating the strength of tantalum lamps.

**For Sale.**—THE ST. PANCRAS B.C. has for disposal one 80-KW. Willans-Johnson & Phillips D.C. set and one Willans-Latimer Clark D.C. set. MESSRS. G. N. DIXON & CO. will, on March 27th and 28th, sell by auction, at Trefriw, N. Wales, a quantity of electrical mining, ore-dressing and contractors' plant. See our advertisement pages to-day.

**New Manufactures.**—MESSRS. JAMES BROS., of Leys Avenue, Letchworth, Herts, inform us that they have just put on the market new types of measuring instruments for A.C. and D.C., and a new valveless engine and dynamo for bioscope and country house work. The engines are low in first cost, and have only three moving parts. The firm are opening showrooms in London.

**A Million Magnetos.**—THE BOSCH MAGNETO CO. inform us that the millionth magneto manufactured by them has just been received at the London headquarters in Newman Street, W. This is a remarkable record, and serves to illustrate the important part played by the magneto in connection with the modern internal-combustion engine.

**The Coal Strike.**—A correspondent writes:—"THE BRITISH WESTINGHOUSE CO., Trafford Park, have intimated that they will have to close down at the week-end in the event of the coal dispute continuing. In normal times they employ about 7,500 people. About 1,000 of this number have been suspended from the beginning of the stoppage, but now the remaining 6,500 have received notice, and at the end of the present week it is expected that they also will be idle. The company have not taken this step because of the lack of coal. The prime reason is the impossibility of obtaining working material."

"At GLOVER'S CABLE WORKS, Trafford Park, the continuance of work depends on the length of time the electric power supply will hold out."

MR. H. D. BORET, 9, Billiter Square, E.C., London agent of the German-Australian Steamship Co., Hamburg, announces advances in rates of freight to Australia and New Zealand, "Owing to the enormous increase in cost of coal."

The *Times* states that the NATIONAL GAS ENGINE CO., LTD., Ashton-under-Lyne, which employed 2,000 workpeople, closed their works on Monday.

**Dissolutions and Liquidations.**—THE WESTERN ELECTRIC CO. (AUSTRALIA), LTD.—At a meeting held at Norfolk House, W.C., on February 28th, it was resolved to wind up voluntarily, with Mr. Duncan Campbell as liquidator. A meeting of creditors is called for April 1st.

OUUDSHOORN ELECTRIC LIGHT AND POWER CO., LTD.—This company is winding up voluntarily, with Mr. E. West, of 71A, Queen Victoria Street, E.C., as liquidator. Mr. West is authorised to divide among the contributories in specie any part of the assets. A meeting of creditors is called for April 3rd.

RAILOPHONES, LTD.—A meeting is called for April 22nd, at 20, Temple Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. E. Wilson.

BOLTON ELECTRICAL CO., electrical engineers, 12, Great Moor Street, Bolton.—Messrs. J. Whittle and J. R. Greenwood have dissolved partnership. Mr. Whittle will attend to debts and will continue the business under the same style.

BRITISH TRAMWAYS AND GENERAL CONSTRUCTION CO., LTD.—A meeting will be held at 83, Cannon Street, E.C., on April 18th, to hear an account of the winding up from the liquidators, Messrs. O. H. Smith and B. C. Molloy.

MESSRS. H. W. UMNEY and A. PECKETT (Umney & Peckett, consulting engineers and agents, 46, King William Street, E.C.) have dissolved partnership. Mr. Umney will continue the business.

**Trade Announcements.**—MESSRS. ROBERT BOWMAN and Co., LTD., of Newcastle-on-Tyne, have opened a branch in London, Nos. 21 and 22, Mark Lane, Station Buildings, E.C., where samples and particulars can be obtained of their specialities in white anti-friction metals for dynamo and motor bearings, turbines, reciprocating engines, &c. Flangite jointing paste, bitumen solution for the preservation of steel and ironwork, and for coating underground conduits, dynamo and motor-car cases and frames, pumping work, accumulator lugs, stands, trolley standards, &c.

LANGDON-DAVIES MOTOR CO.—With reference to the notice appearing in our last issue it is announced that all correspondence should be addressed to 110, Cannon Street, E.C.

MR. JOHN NEWBY, electrician, of 128, Grange Road, Ramsgate, has opened offices and a showroom at 105, High Street, Ramsgate.

Owing to increased business in Westinghouse-Morse Rucker-Joint silent chain drives for high-speed power transmission, the Westinghouse Brake Co., Ltd., of King's Cross, N., has opened a district office at Standard Buildings, City Square, Leeds, which will be in charge of Mr. G. W. Cosby.

MESSRS. E. BROOK, LTD., of Huddersfield, announce that owing to increasing business they have opened a branch at 178, Gray's Inn Road, London, W.C. (telephone No. "2642 Holborn"). This branch will be well stocked, for immediate delivery, with single, two and three-phase motors of both slip-ring and squirrel-cage rotor types suitable for all voltages and frequencies in and around the London area. It will be in charge Mr. Chas. H. Jessop, who until a few months ago was the representative of the Langdon-Davies Motor Co., Ltd. Mr. E. H. Smith, who has been in charge of Messrs. Brook's Leeds branch, will be his assistant.

## LIGHTING and POWER NOTES.

**Aberdare.**—The U.D.C. has applied to the L.G.B. for a loan of £5,000 for extending the electricity station and supplying energy for the tramways.

**Ashton-under-Lyne.**—The Electricity Committee proposes to visit a number of towns where a certain kind of turbo-alternators is in operation.

**Australia.**—The Mayor of Perth (W.A.) has announced the decision of the Lighting Committee to take over the Perth gas and electric lighting works immediately. The question of the terms of the purchase of this undertaking was the subject of considerable litigation, ending in an appeal to the Privy Council, which was heard last year, and decided in favour of the gas company. A few weeks ago the Council raised a loan of £525,000 on the London market for the purpose of completing the purchase.



**Barmouth.**—A scheme for lighting the town with electricity has been referred to the Works Committee of the U.D.C.

**Beaumaris.**—A scheme is under consideration for utilising the water power at Pwllfaunog, Anglesey, for the lighting of Beaumaris and district by electricity.

**Bredbury and Romiley.**—The U.D.C. has consented to the Stockport T.C. supplying current to the works of Messrs. Pollock & Macnab, engineers, of Bredbury, on the firm paying £1 per annum and Stockport Corporation 5s. per annum, as acknowledgements for the privilege. The Council has also empowered Stockport to canvass the district to ascertain what employers of labour are willing to take current.

**Brighton.**—The wiring scheme, referred to last week, has been revived by the Lighting Committee of the T.C., which now recommends the Corporation the scheme with the proviso that the Council reserves the right to refuse to supply current to premises more than 30 ft. from any distributing main, unless the cost of the service beyond the distance of 30 ft. is defrayed by the owners or occupiers of premises. If the scheme is now adopted, local wiring contractors will be invited to do the wiring and fitting, and receive 1d. per unit for current consumed.

**Burton-on-Trent.**—The Gas and Electricity Committee has decided to appropriate £1,000 from the electricity department in aid of the rates for the ensuing year.

**Cheltenham.**—An official inquiry will, on March 26th, be held into the application of the T.C. for an order to extend the lighting mains to rural parishes in the Cheltenham and Winchcombe R.D.C.'s areas. There is threatened opposition from the former body, the Gas Co., and elsewhere.

**Chile.**—Don Luis González Edwards has obtained a decree approving plans for the erection of an electric generating station in the town of San Antonio for lighting and power purposes.

**China.**—At the commencement of the present year the central station of the Compagnie de Tramway et Eclairage de Tientsin was supplying current to 28,065 lamps, an increase of 40 per cent. on the 12 months. Owing to the use of metal-filament lamps, however, the receipts are not showing a corresponding increase.

**Continental Notes.**—**AUSTRIA.**—The Oesterreichische Electricitäts Lieferungs Gesellschaft, of Vienna, is increasing its capital from £100,000 to £240,000 for the purpose of establishing a central electric lighting and power station in the town of Schatzlar.

**GERMANY.**—The dispute between the T.C. of Wilhelmshaven and the Thüringer Gaswerke, of Leipzig, regarding the right of the municipality to install an electric service, has been finally decided in the favour of the former by the Celle High Court. The path is now clear for the erection of a public service in the western parts of the city, while a beginning has already been made with the construction of the electric tramways network.—*Elek. u. Maschinenbau.*

**RUSSIA.**—With a view of meeting the increasing demand for current, a new Diesel engine and generator is to be put down at the central station of the Société d'Electricité de Radorn, in the town of Radorn.

**SPAIN.**—The joint stock society formed in October last to supply electric current to Barcelona, has placed an order with the Société de Mulhouse (Alsace) for two groups of turbo-alternators of 10,000 H.P. each, producing three-phase current at 11,000 volts. The groups will be installed in the society's station at San Adrian del Besos, and are expected to be working by December.—*Industria e Invenções.*

**Croydon.**—The B.C., on the recommendation of the Finance Committee, has appropriated a further sum of £3,500 from the electricity department towards the relief of the rates; and £8,000 from the tramways. These sums, in conjunction with other drastic measures, have saved an increase of the present rates of 7s. 2d. in the £. The chairman of the Finance Committee described the sum taken from the electricity department as 1 per cent. of the capital involved. Alderman Miller, chairman of the Electricity Committee, said that altogether the undertaking had provided £25,000 to the relief of the rates. The Finance Committee recommended that the Electricity Committee be required to present estimates of revenue and expenditure for 1912-13 before any further sums were expended out of revenue for works of a permanent nature, or any further reduction was made in the price of current. Alderman Miller declared that this would greatly hamper the committee; and his amendment that the recommendation be deleted was carried. Councillor Muggeridge said that according to his calculations, the capital expenditure in this department showed a return of 8½ per cent.

**Easington.**—A poll is to be taken here with reference to the obtaining of a Prov. Order, with a view to the parish being lit by electricity. The Northern Electric Supplies Co. has offered to install 42 lamps, poles, &c., at a cost of £450, payment to be extended over five years.

**Grantham.**—The Guardians were notified at their meeting on Monday, by the Urban Electric Supply Co., that if the coal strike continued on and after March 23rd, the price of electricity for heating and power would be raised from 2½d. to 4d. per unit.

**Gravesend.**—The T.C. has declined to give a supply of current to property at Meopham, which is outside the borough. Additional current for power purposes is to be supplied to the Imperial Paper Mills, and a loan is to be applied for for mains extensions, house services, &c.

**Great Yarmouth.**—The T.C. has entered into an agreement to supply current to the Royal Naval Hospital.

**Grimsby.**—In connection with its new Immingham Dock, the Great Central Railway Co. has erected a combined hydraulic and electric power station; the electric generating plant installed consists of two 250-KW. horizontal Curtis turbo-generators, one 500-KW. and one 1,500-KW. set of the same type, the largest set being under erection. Three 250-KW. rotaries are installed, and the three sub-stations on the Dock Estate, which convert the generated supply (6,600 volts three-phase) to 460 volts for distribution over a three-wire network, are to have a combined capacity of 1,500 KW. This plant, in addition to supplying lighting, pumping, &c., at Immingham, also supplies 1,200 KW. to Grimsby Docks, 9 miles away, and energy for operating the Grimsby District Light Railway, an overhead 500-volt D.C. trolley line of the Great Central Railway Co. The line is only 5 miles long, and is supplied through a sub-station equipped with two 250-KW. rotaries. The *Railway News* states that special steel under-frame cars to carry 64 passengers and 40 passengers, with two 50-H.P. motors and two 35-H.P. motors respectively, have been supplied by the Brush Co., the electrical equipments being by Messrs. Dick, Kerr.

**Govan.**—The T.C. has notified that from May 15th, 1912, the price per unit for lighting will be reduced to (a) 5d. per unit for the first 365 hours use per annum of the maximum demand, and 1d. per unit for extra units; (b) an optional flat rate of 2½d. per unit.

**Hazelgrove-cum-Bramall.**—The Stockport T.C., in the absence of consent from the U.D.C., having applied to the B. of T. for an order to enable it to supply current to premises in Hazelgrove, the B. of T. has asked for the Urban Council's reasons for refusing consent. The reply sent is to the effect that the Urban Council contemplates making application for a prov. order for E.L., and that under those circumstances it was not prepared to assent to electricity being supplied by any outside authority in the Council's area.

**Ipswich.**—A L.G.B. inquiry was held on March 14th into the T.C.'s application for sanction to a loan of £9,130 for extension of the electricity undertaking. In the course of the proceedings, Mr. Frank Ayton, the borough engineer, explained that in February last they received permission to borrow for a 1,000 KW. turbo-generator set, which was not yet finished; they were, however, working right up to their limit and would supply at least 1,600 KW. by next winter—their plant capacity at present being 1,611 KW. At the end of February last year the consumers numbered 866, while a year later they numbered 1,104; traction and power units accounted for about 70 per cent. of the supply. A revised application was drawn up, the items being as follows:—Turbine set, £5,865; switchboard, £540; boiler, &c., £2,400; water softening plant, &c., £325.

**Lancashire.**—We hear from a correspondent that the stocks of fuel held by many Electricity Committees in south-east Lancashire are now rapidly becoming depleted, and it was reported on Tuesday that in many cases the supply of electricity will have to be curtailed during the next few days. In Lancashire coal trade circles there is a feeling prevalent that the strike will not end until the close of the present month.

**London.**—It has been decided to install electric light throughout the whole of Westminster Abbey. The temporary installation carried out by the Office of Works for the Coronation has proved so satisfactory that it has been permanently adopted, and the service is now being extended to Henry VII's Chapel.

**MARYLEBONE.**—The Electric Supply Committee has adopted an estimate of £203,672 as the estimated expenditure on revenue account on the electricity undertaking for the year 1912-13. During this period the Committee estimates to sell 12,772,000 units, being an advance of 891,000 over the estimated sales for the current year. With regard to the average price likely to be realised, the Committee has assumed a further diminution of 5 per cent., viz., from 3'32d. to 3'16d.

**STEPNEY.**—The Finance Committee of the Borough Council has approved an estimate of a further sum of £500 to enable the Electricity Committee to supply to consumers on hire or hire purchase, apparatus, electrical fittings, &c. It has also been decided that the total liability of the Council to hirers in respect of the supply of fittings, meters, &c., on hire or hire purchase shall not, at any time, exceed £1,500 on capital account.

**FULHAM.**—The Finance Committee has received a letter from the Comptroller of the L.C.C., suggesting that the B.C. should make an arrangement with the L.C.C. to repay by installments (either annually, half-yearly, or quarterly) the electricity loans of the B.C., which are now repayable on the annuity system. Having fully considered the proposal, the Committee has decided to inform the L.C.C. that it does not see its way to make the alteration suggested.

**ISLINGTON.**—A L.T. distributing main is to be laid to Fitzwarren Gardens at an estimated cost of £287, and the thoroughfare mentioned is to be lighted by means of metal-filament lamps at an estimated cost of £61.



**ST. PANCRA.**—The Electricity Committee has decided to demolish 73, Pratt Street and Nos. 90 to 106, Great College Street in order that the site may be utilised for electricity purposes. The chief electrical engineer reports that owing to additional load he finds it necessary to increase the feeder mains in the Southern district at a cost of £4,323.

**HACKNEY.**—A special meeting of the B.C. was held on Tuesday last to consider the report and recommendations of the Electricity Committee in regard to the proposed scheme of extensions, which was detailed in our issue of March 1st. The work to be undertaken at once is estimated to cost £64,700, which includes buildings costing £25,000; one 3,000-KW. turbine set and two boilers, with economiser, draught fan, &c., switchgear, a 1,500-KW. motor-generator, &c.; some items, such as coal bunkers and conveyors, are, of course, such as will be required for the complete scheme. Probably until the load reaches 4,500-4,800 KW., the ring H.T. mains and sub-stations will not be proceeded with. As previously mentioned, the completed 9,000-KW. station is estimated to cost £12'89 per KW., including £2'89 per KW. for buildings; the first portion (3,000 KW.), £21'56 per KW., including £8'33 for buildings. The 6,000-KW. ring mains are estimated at £4'166 per KW., and the three sub-stations (four 500-KW. converters per sub-station), £5'375 per KW., including £'5 for land, £1'05 for buildings, and £3'8 for plant. The estimated cost of 24 ½-mile 5 C.C. sub-feeders from sub-stations (6,000 KW.) is £3'824 per KW. The Committee recommends the carrying out of the first part of the work, costing £64,700; that sites for sub-stations be obtained (£3,000), and that an architect and quantity surveyor be engaged to act with the borough electrical engineer in carrying out the work. The Finance Committee recommends that application be made to the L.C.C. for sanction to a loan to defray the estimated expenditure, £67,700.

**Loughborough.**—When news of the breakdown of the coal negotiations reached Loughborough, on Friday, notices were posted up at several large establishments intimating that they would close down or work short time. The most serious action was the closing of the greater part of the Brush Co.'s works, where about 900 men were suspended on Saturday. The firm is full up with contracts, and it is stated that work has not been so brisk for many years as it has been up to the present time. All-night power is cut off.

**Lowestoft.**—On March 13th a L.G.B. inquiry was held into the application of the T.C. for a loan of £4,500 for electricity purposes, some £2,000 of which has already been spent on urgent work. There was no opposition.

**Manchester.**—Such a heavy strain is being put upon the Manchester Corporation electricity undertaking by large firms of manufacturers and engineers, in consequence of the shortage of coal, that the department has issued a statement to big power users, intimating that although it has sufficient coal to maintain the electricity supply for at least another month, it is necessary that users shall exercise as much economy as possible.

**Norwich.**—The Electricity Committee of the T.C. has recommended that a loan of £3,000 be applied for for the erection of offices in Duke Street, and £3,000 for two boilers at the electricity works.

**Runcorn.**—The Mersey Power Co., Ltd., a subsidiary of the Salt Union, Weston Point, has given notice of its intention, under the Runcorn Electric Lighting Order, of applying to the B. of T. for consent to the erection of a H.T. line for the purpose of supplying energy at 6,300 volts between Runcorn and Helsby, the line crossing over Frodsham Marsh to a sub-station to be erected near the pumping station, Frodsham, thence to Helsby railway junction, and terminating at the works of the British Insulated and Helsby Cables, Ltd., Helsby.

The Chairman (Mr. G. H. Cox) presiding at the annual meeting of the Salt Union, Ltd., at Liverpool, on 15th inst., mentioned that there was an uncalled liability of £37,000, mainly on account of shares in the Mersey Power Co. The electrical power scheme, which was operated in conjunction with the Winsford vacuum plant, had worked well throughout the year. The delivery of the turbo-alternators had been greatly delayed, owing to pressure of work in the contractor's engineering department, and also to labour troubles. The power company had made further large and favourable contracts with various consumers in the district for the supply of electricity, and he believed that, before long, all the available power would be disposed of.

**South-West Africa.**—The Kolonial Bergbau Gesellschaft intend to erect a generating station for the working of their diamond fields, and also to supply current to the town and to the Imperial Telefunken station at Lüderitz Bay, German South-West Africa.

**Tasmania.**—According to the *Times* the contracts for the first 9,000-KW. unit for the Great Lake hydro-electric scheme have been awarded to the British Westinghouse Co. for the electric plant and transmission, and to Messrs. Jens Orten-Boving for the turbine and pipe line, &c.

**Torquay.**—The full amended tariff for current for power adopted by the T.C., and briefly referred to in the last issue of the ELECTRICAL REVIEW, is as under: Private consumers having a maximum demand of 1 KW. and over, using 725 units and above per KW. demanded per quarter, 1d. per unit net; between 625 and 724 units, 1½d.; between 550 and 624, 1½d.; between 450 and 549, 1½d.; between 350 and 449, 1½d.; between 200 and 349, 1½d.; below 200, 1½d., with a meter rent of 8d. per quarter.

**Wellingborough.**—The U.D.C. has under consideration the question of purchasing the undertaking of the electric supply company. In the meantime, information as to the working of such an undertaking in other towns is to be obtained by a deputation.

**Weymouth.**—The T.C. proposes to utilise electricity for working the pumps at the Westham pumping station in place of steam. The Electricity Committee has offered to take charge of the whole of the pumping at an annual cost of £567, thereby effecting a yearly saving of at least £600.

**Whitehaven.**—The T.C. has decided to leave in abeyance, pending the result of the I.M.E.A. Bill in Parliament, the assisted wiring scheme prepared by the electrical engineer.

## TRAMWAY and RAILWAY NOTES.

**Burnley.**—The reduction in the railway service has proved highly beneficial to the Corporation Tramways. Last week over 20,000 more passengers were carried than in the same week of last year, and the officials are looking forward to a record year.

**Colwyn Bay.**—The Llandudno and Colwyn Bay Electric Railway Co. has appointed a special committee to discuss with the Council all matters in dispute between the local authority and the tramway company, and hopes are entertained that terms will now be definitely settled upon with regard to the extension of the tramway to Old Colwyn. A deadlock had been reached in the negotiations between the two bodies owing to the company declining to comply with the request of the Council for a further payment towards road widening expenses, and the Council decided that, until the expenses in that respect was met by the company, it (the Council) would not be in a position to make further progress with the purchase of land for the construction of this section of the tramway from Llandudno.

**Continental Notes.**—**AUSTRIA.**—The electrification of the Salzkammergut Railway has been advanced an important stage by the Austrian Railway Administration's announced approval on technical grounds of the plans of Messrs. Stern & Hafferl, of Gmunden, for the electrical equipment, and of those for the distribution lines from the generating station at Gosau, owned by the Stern und Hefferl A.G.; also the lines crossing the tunnel network to supply the State main system. The Statthalterei, of Graz and Linz, have now been invited to open negotiations to arrange the political and compensation details.—*Der Elektrotechniker*.

**GERMANY.**—It is reported from Berlin that official approval of the North-South line has been accorded, the concession having a duration of 90 years. The line must be completed and opened for working by April 1st, 1916, failing which a penalty of 200,000 marks will become due. The Mayor, in anticipation of the official approval, has arranged fresh contracts with the Elektrischen Strassenbahn Gesellschaft, formerly Siemens and Halske.—*Elektro. Zeitschrift*.

**FRANCE.**—Plans in respect of a projected electric tramway between Vallorbe and Bellaigue (Doubs) are in course of preparation.

The provincial authorities of Loire-Inferieure have under consideration a scheme for the construction of an electric tramway between St. Nazaire and Pornichet.

**SWITZERLAND.**—A project for the construction of a narrow-gauge electric railway between Herzogenbuchsee, Koppigen and Utzendorf is at present under consideration. Messrs. Brown, Boveri & Co., of Baden, are interested in the scheme.

According to the *Standard*, 19 Swiss deputies representing all parts of the country have presented a motion to the Federal Council to examine the question of hastening the introduction of electric traction on all the State-owned railways. The matter is to be discussed in the Swiss parliament at an early date.

**SPAIN.**—The official trials of the electric trains on the converted section of the Southern railways between Santa Fe and Gergal have proved eminently successful, both as regards the stations and the trains. The line belongs to the Compania de los Caminos de hierro del Sur de Espana, which it is expected may extend electric traction to the rest of the system.—*Industria e Inveniones*.

**TURKEY.**—The Turkish Minister of Public Works has signed a contract with the railway engineering firm of Lenz & Co., Berlin, for the building and working of an electric railway at a cost of £4,000,000, which will have great results for the future of Constantinople. The line will start from the centre of Stamboul, near the Bagazid Mosque, from thence it will run to the High Porte and the Golden Horn. This latter will be spanned by a bridge to be built, and the line will then continue through Galata to Pera, and thence along the shores of the Bosphorous for 32 km. to the Black Sea. A period of three years is allowed for the completion of the first section, from Kara Koi to Sari Yer, and eight years for the whole of the line. The contractors are likewise pledged to make such street alterations at their own cost as the municipality may deem needful. The working concession covers a period of 75 years. The capital for the undertaking will be provided by a Turkish joint stock company to be formed, half of whose share capital must be subscribed by Turkish subjects.

**ITALY.**—Messrs. Brown, Boveri, & Co., acting in conjunction with the Brussels Chemins Economique have formed at Milan the Societa di Trazione e Imprese Mettriche whose object is the electrification of tramways in the province of Milan.—*Elektrotechnische Zeitschrift*.



**Dundee.**—It is intimated that there may be a slight delay in the delivery of the equipment for the Corporation's railless trolley system, owing to a strike of Messrs. Siemens's employes and on account of the coal trouble. The tramway manager explained to the Tramway Committee that there was a strike clause in the contract.

**Edinburgh.**—Mr. Harris, the tramway company's engineer, has devised a new safety guard for attachment to the cable cars. The guard works on the trigger principle. In front is what is described as a gate: any object touching it immediately sets a trigger in motion and the guard drops down close to the ground, preventing anything from going under the car. The mechanism necessitates an extension to the bogie of about 18 in., but this extension gives more room on the platform for passengers and also provides four additional seats at the top. The Tramway Committee of the T.C. paid a visit to the dépôt at Shrubhill and inspected the working of the new guard on a bogie, but it is intended to have another exhibition on a running car. The cost of transforming the old to the new arrangement is estimated at £30 per car.

**Greenock.**—The T.C. had under consideration at the last meeting the proposal of the Greenock and Port Glasgow Tramway Co. to run railless vehicles throughout the higher parts of the town. After discussion it was agreed to obtain information as to other municipal ventures of this kind, with a view to the Corporation taking up the proposal.

**Hastings.**—The Dolter system of tramways on the Hastings front is giving ground for loud complaints. The matter came before the T.C. a few days ago, when it was resolved that as repeated complaints made to the Tramway Co. as to the danger and annoyance caused by the unsatisfactory working of the cars had had no effect, a representation should be made to the B. of T. In the course of a long discussion strong allegations were made against the company, one being that it was endeavouring to force the erection of overhead wires in substitution for the Dolter system. It was also alleged that the system was worn out, and that the company had not done its best to make it work satisfactorily. The railless system was strongly advocated by one Councillor, but overhead wires, according to an Alderman, would effectively ruin the front. The decision to appeal to the B. of T. was carried by 28 votes to 2.

**Japan.**—Japanese railways underwent during the year 1910-11 a period of favourable development. Some of them increased their mileage, made new connections, or carried out other improvements. New lines were also constructed. In the summer of 1910 a short, but violent, railway building fever broke out. Some 30 companies were formed, with a nominal capital of 80,000,000 yen, to build railways in the neighbourhoods of Osaka, Kobe, and Kioto. Few reached the stage of realisation, as official sanction was withheld from the major part. Among the new undertakings may be mentioned that of the Kioto-Baba Electric Railway Co., whose line is 16 km. long, and the municipal electric tramway of Kioto of a length of 27 km. Both lines are under construction. With regard to extensions and improvements, the Kioto-Osaka Electric Railway has increased its capital to 3,500,000 yen, to provide for disbursements on improvements of the too-lightly constructed permanent way (1,334,249 yen); installation of an electric light and power station (560,000 yen), and augmentation of rolling stock (532,327 yen). The balance is to be spent on bridge building and other purposes. The Nankai Railway has carried out the electric conversion of 31 km. of the Osaka-Kaidzuka line, and the conversion of the entire 72 km. extent of the line was to be effected by November last. The steam locomotives will be used for goods traction only. To cover the second outlay a loan of 2,000,000 yen has been raised. Parallel to the railway, from Osaka to Saikai, a new electric line will be built, for which purpose the Hankai electric railway company has been launched. The municipal authorities of Osaka have extended their tramway network to 27 km. in length and purpose adding a further 27 km. by 1914. The cost of these works is estimated at 34,000,000 yen. New undertakings, whose completion is shortly expected, are the Okayama electric tramway; the Osaka-Nara electric railway, length about 40 km.; and the Kobe-Takanadzuka electric railway. The electric tramway in Kobe will be extended by an additional 6.4 km. Lastly, an agreement is spoken of between the four electric railways running between Baba and Akashi—the Keishin, Kaihan, Hanshin, and Hiogo companies—for the construction of junctions and the exchange of traffic. Some of the companies, in addition to buying the ground for their lines, have acquired considerable extents of land near their stations, with a view to letting houses and constructing gardens and pleasure resorts to attract the populations of the neighbouring large towns.

**London.**—The House of Commons Committee last week passed the Bill dealing with the extension of the Bakerloo tube line to Queen's Park in connection with the North-Western Co.'s electrification scheme; also the Edgware and Hampstead Bill, which provides for an extension from Golder's Green.

**Stretford.**—The U.D.C. has applied to the B. of T. for an extension of time for four years from June 15th next, for completing the railways authorised in the Light Railways Order of 1906, and railway No. 10 of the West Manchester Light Railways Order, 1906.

**Tasmania.**—The Hobart City Council has decided to purchase the tramways in the city and to offer £200,000 for the whole of the company's assets.

## TELEGRAPH and TELEPHONE NOTES.

**Belgium.**—Various improvements have lately been introduced into the Belgian telegraph and telephone service, and the Belgian Administration intends to make proposals to neighbouring countries—Germany, France, Holland and Great Britain—for the institution of cheaper international telephone rates.—*Der Elektrotechniker*.

**London Telephone Service.**—The Controller announces that "The Metropolitan Offices of the late National Telephone Co. (*sic*) at Salisbury House, London Wall, E.C., will after to-morrow be removed to 144A, Queen Victoria Street, E.C., where all communications with reference to the London telephone service should be sent. Subscribers may pay telephone accounts at any Post Office, or remittances may be sent to the above address. It will be noticed that the Telephone Co. is regarded by the Controller as dead already, but he will probably find that it still possesses a remarkable degree of vitality, when the arbitration proceedings commence.

**New Premises for Wireless Co.**—The L.C.C. has accepted an offer on the part of the Marconi Co. to take the building formerly known as the Gaiety Restaurant in the Strand, on a 99 years' lease, at £6,500 a year.

**New Telephone Exchanges in London.**—Three new exchanges, situated respectively in Notting Hill, Tottenham Court Road, and Clerkenwell, are in course of construction for the relief of exchanges which are heavily loaded.

**Wireless Telegraphy.**—Recently an operator on board the P. & O. liner *Mantua*, off Melbourne, clearly read signals that were being sent to a warship by an operator at the Government station at Jask, in the Persian Gulf. The distance traversed was 6,249 nautical miles, and the sending apparatus was of Marconi pattern; the receiver was the Marconi magnetic detector.

**Wireless Time.**—A society has been formed at Fulda to erect a wireless station for the supply of the correct time to the watch and clock makers throughout Germany. The tower which is to be built will be 100 metres high, and will be fitted with antennae. Every minute one of the three clocks at the station will close a circuit, the result of which will be the emission of waves. The receiving clocks will advance one minute at each reception. The receiving stations will only need to be fitted with a relatively small antenna; a flagstaff installed on the roof is enough. Each receiving clock can be made to control several hundred secondary clocks, so that an average sized town can be served by a single clock. The system is uninfluenced by stray waves and atmospheric disturbances.—*E.T.Z.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Accrington.**—March 23rd. Stores for the Tramways Committee for a year. H. Pilling, general manager.

**Australia.**—VICTORIA.—April 2nd. 250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 2nd.—10,000 metal-filament lamps, for the Melbourne City Council. See "Official Notices" March 15th.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" March 1st.

April 23rd.—2000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

April 24th. Power generating plant for the Federal Capital site. Secretary, Department of Home Affairs, Russell Street, Melbourne.

May 1st and 8th. Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors for Melbourne. See "Official Notices" to-day.

QUEENSLAND.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" March 15th.

April 3rd.—Insulators, binders, copper wire, &c., for P.M.G., Adelaide. See "Official Notices" to-day.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

**Austria-Hungary.**—BANJALUKA (BOSNIA).—April 10th. Tenders are invited for the erection complete of a hydro-electric station on the Urba River, for the supply of light and power to the city and suburbs. For further particulars see this column last week.



**Batley.**—March 25th. Twelve months' supply of general stores for the Electricity Department. Borough Electrical Engineer.

**Belfast.**—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

**Belgium.**—April 1st. La Direction du Service Special d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels, is inviting tenders for the mechanical and electrical equipment of ten pumping stations in connection with the Charleroi Canal.

**Birmingham.**—April 3rd. Electric motor and centrifugal pump for the Birmingham, Tame, and Lea District Board. J. D. Watson, engineer, Tyburn, Birmingham.

**Bristol.**—March 28th. Separate tenders for the following, for the Guardians, for Southmead Workhouse:—(2) Boilers, economisers, steam pipes, &c. (deposit £5); (3) electric light generating plant; (4) electric light wiring and fittings; (5) laundry machinery, motors and appliances. Deposits for 3, 4 and 5, £2 each. J. J. Simpson, Clerk to the Guardians, St. Peter's Hospital.

**Burma.**—March 29th. (a) Miscellaneous tools and stores; (b) electric generating plants for workshops, for the Burma Railways Co., Ltd. Specification (a) 20s., (b) 10s., not returnable. Managing director, 199, Gresham House, Old Broad Street, E.C.

**Canada.**—March 30th. One 1,500-KW. A.C. steam turbo-generating set, and one 500-KW. A.C. generator coupled to Diesel engine, for the City Commissioners of Moose Jaw, Saskatchewan. See "Official Notices" March 8th.

**Cape Town.**—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

**Edinburgh.**—March 23rd. Arc lamp globes, cast-iron pipes and pavement boxes, and underground conduits, for the Electricity Department. Deposit 10s. Mr. F. A. Newington, engineer.

**Gillingham.**—March 25th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" March 8th.

**Govan.**—March 26th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" March 15th.

**Greece.**—PIRÆUS.—March 31st. Three electric cranes of 10, 6 and 2 tons respectively for the Harbour Board. Com. Int. Dept., Board of Trade, London.

**Halifax.**—March 26th. Electrical fittings, for six months, for the Board of Guardians. A. T. Longbotham, clerk, Carlton Street.

**Kingston-upon-Hull.**—March 26th. Extra-high-tension three-phase switchboard, and 20-ton overhead travelling crane, for the Corporation. See "Official Notices" March 8th.

**London.**—L.C.C.—Tenders are to be invited for two new engines for driving the mechanical stokers, coal conveyors, &c., at the Crossness pumping station.

March 26th.—Electrical installation at the Morden Terrace School. See "Official Notices" March 15th.

KENSINGTON.—March 28th. Telephone installation at the Infirmary in Marloes Road. Clerk to Guardians, at the Infirmary.

H.M. OFFICE OF WORKS.—March 26th. Carbon and metal-filament lamps for one year. See "Official Notices" March 15th.

METROPOLITAN ASYLUMS BOARD.—April 10th. Two electrically controlled passenger lifts at Tooting Bec Asylum. See "Official Notices" to-day.

METROPOLITAN WATER BOARD.—April 12th. The Board is inviting tenders for 6 Diesel oil engines and two 10-ton overhead cranes for Cricklewood and Fortis Green pumping stations, also one Diesel engine and one 8-ton overhead crane for Green Street Green pumping station. Specifications and forms of tender from the Chief Engineer's Department, Savoy Court, Strand, W.C.

BETHNAL GREEN.—April 2nd. Telephone cables, for the B. of G. See "Official Notices" March 15th.

ST. PANCRAS.—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" to-day.

**Limerick.**—April 5th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Merthyr Tydfil.**—March 28th. Electrical installation at the Municipal Secondary School, Cyfarthfa Castle. See "Official Notices" March 8th.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Norway.**—April 1st. State Telegraph Department. Insulators, double-current wire, steel wire cables, and soldering tin. Tenders to Telegrafstyrelsens Kontor, Christiania. Local representation,—*Board of Trade Journal*.

**Nottingham.**—March 25th. Stores for a year, for the Corporation Electric Tramways Department.

**Partick.**—April 2nd. Stores and materials for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

**Rhodesia.**—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

**Rosslynlee.**—The Midlothian and Peebles District Asylum invites offers for supplies, including electric fittings. The Treasurer, 19, Heriot Row, Edinburgh.

**Shanghai.**—April 3rd. 945 single-phase A.C. house service meters, for the Municipal Council. See "Official Notices" to-day.

**Spain.**—The municipal authorities of Villabancz (province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

**Swinton (near Manchester).**—The U.D.C. has decided that tenders be invited for a motor-generator and electric wiring in connection with the lighting of the refuse destructor buildings and yard.

**Sweden.**—March 31st. The Electrotechnical Department of the Stockholm Municipality is inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). For further particulars, see this column for March 1st.

**West Hartlepool.**—April 2nd. (a) 300-KW. storage battery and booster (b) rotary converting plant, for the Corporation Electricity Department. See "Official Notices" March 15th.

**Wigan.**—March 25th. Stores and materials for the Corporation Electric Light and Tramways Departments. See "Official Notices" March 15th.

**York.**—April 12th. Two water-tube boilers, with superheaters, automatic stokers, economiser and pipework, for the City Electricity Department. See "Official Notices" to-day.

## CLOSED.

**Ashton-under-Lyne.**—The Borough Education Committee has accepted the tender of Mr. Robert Butterworth for the electric light installation at West End Schools.

**Bromley (Kent.).**—The T.C. has accepted the tender of Mr. R. E. Knight for the electric light installation at the library extension, at £67.

**Chesterfield.**—The T.C. has accepted the following tenders:—

Babcock & Wilcox, Ltd.—A boiler for the electricity works, at £750.  
British Westinghouse Co.—A Westinghouse-Le Blanc engine-driven condenser, at £497.

**Croydon.**—The following tenders have been accepted by the Corporation:—

Three high-tension switchboards.—Ferranti, Ltd., £3,612.  
Mixed-pressure turbine plant.—Belliss & Morcom, Ltd., £6,650.

**France.**—The French Post and Telegraph authorities in Paris have just placed a contract with Messrs. Geoffroy & Delore, of Clichy, Seine, for the supply of 100 km. of rubber and fireproof cotton-covered copper cables.

**Great Yarmouth.**—The T.C. has accepted the tender of Messrs. John Brown & Co., Ltd., for 40 steel tires for tramcars, at 34s. each.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

### WAR OFFICE.

Auto-converters.—Crompton & Co., Ltd.  
Electric cable and wire.—Siemens Bros. & Co., Ltd.  
Engines and dynamos.—L. Gardner & Sons, Ltd.  
Telephones.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Spagnoletti, Ltd.; West London Scientific Apparatus Co., Ltd.  
Installation of electric light, right wing of Duke of York's headquarters, Chelsea.—W. G. Heath & Co.

### GENERAL POST OFFICE.

Baudot apparatus.—Elliott Bros.  
Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.  
Telephonic apparatus, flexible cords.—London Electric Wire Co. and Smiths, Ltd.; British Insulated and Helsby Cables, Ltd.  
Indicators.—Phoenix Telephone and Electric Works, Ltd.  
Jacks.—Western Electric Co., Ltd.  
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.  
Aerial cable.—Johnson & Phillips, Ltd.  
Paper-core cable.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.  
S. and C.C. cable.—Western Electric Co., Ltd.; British Insulated and Helsby Cables, Ltd.  
Submarine cable.—Henley's Telegraph Works Co., Ltd.  
Desiccators.—Lacy-Hulbert & Co., Ltd.  
Electric light fittings.—General Electric Co., Ltd.  
Bronze wire.—British Insulated and Helsby Cables, Ltd.; T. Bolton and Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.  
Telephone exchange equipment, Sale, Manchester.—Peel Conner Telephone Works, Ltd.  
Ditto, Uxbridge.—Western Electric Co., Ltd.



**Hornsey.**—The B.C. has accepted the tender of the Bastian Meter Co., Ltd., for the supply of 5-ampere meters, and that of Messrs. Venner & Co. for C. & H. meters, for the coming year. The B.C. has also accepted the tender of the Reason Manufacturing Co., Ltd., for electrolytic meters for the year. Messrs. Venner & Co. have also received contracts from Worcester and Halifax.

**Keighley.**—The Keighley and Bingley Joint Hospital Board has accepted the tender of Mr. Hugh Spencer for electrician's work at the hospital.

**London.**—L.C.C.—The Highways Committee has this week issued a list of tenders accepted for the supply of tramway parts, equipment, &c., for 12 months:—

Motor and generator spares.—British Westinghouse Co. and Dick, Kerr and Co., Ltd.  
Controller, circuit-breaker and other switch, &c., details, and magnetic brake spares.—British Westinghouse Co.; Dick, Kerr & Co.; and Brecknell, Munro & Rogers.  
Contact fingers and parts, segments.—British Westinghouse Co.; Dyer and Young; E. Showell & Sons, Ltd.; and United Brass Founders and Engineers, Ltd.  
Pressed brass and steel articles.—British Westinghouse Co. and M. Mole and Son.  
Electric cable, fuse wire and cotton-covered copper wire.—British Insulated and Helsby Cables; General Electric Co.; London Electric Wire Co. and Smiths, Ltd.; and Siemens Bros. & Co., Ltd.  
Copper bonds.—R. R. Todd.  
Rubber details.—I.R., G.P. and T. Works Co.; J. G. Ingram & Son; Midland Rubber Co.; and North British Rubber Co.  
Moulded insulators (other than rubber).—British Westinghouse Co.; British Isola and Micanite Co.; Crystalate Manufacturing Co.; and Ebonestos Manufacturing Co.  
Fibre articles.—J. Burns, Ltd.; A. Cort & Co.; and Mosses & Mitchell.  
Mica and micanite articles.—Micanite and Insulators Co. and G. Schultz and Co.  
Track insulators.—Bullers, Ltd., and Doulton & Co., Ltd.  
Car furniture.—Brush Co.; G. D. Peters & Co.; Player & Mitchell; and E. Showell & Sons.  
Machined bronzed bearings.—Anti-Attrition Metal Co.  
Machine-finished articles (brass, gun-metal, &c.).—Anti-Attrition Metal Co.; Brecknell, Munro & Rogers; British Westinghouse Co.; Bryant, Symons & Co.; Davis & Timmins; Player & Mitchell; and E. Showell and Sons.  
Machine-finished articles (iron, steel, &c.).—Bayliss, Jones & Bayliss; Brecknell, Munro & Rogers; British Westinghouse Co.; Burton, Delingpole & Co.; F. W. Cotterill, Ltd.; Davis & Timmins; J. Holroyd and Co.; Horton & Son; F. W. Rowlands & Co.; and Wilkes, Ltd.  
Gear and pinion wheels, ratchets, worms.—British Hele-Shaw Patent Clutch Co.; J. Holroyd & Co.; and F. W. Rowlands & Co.  
Iron and steel drop forged stampings.—Armstrong, Stevens & Son; Charles Bunn, Ltd.; Low Moor Co.; Smethwick Stamping Co.; Vaughan Bros.; Wilkes, Ltd.; and Woodall & Co.  
Iron and steel forgings.—Bayliss, Jones & Bayliss; Brush Electrical Engineering Co.; Charles Bunn; East Ferry Road Engineering Works Co.; Hunter & English; Hurst, Nelson & Co.; Low Moor Co.; Male and Jordan; United Electric Car Co.; Warren & Sons; and Woodall and Co.  
Springs.—Lion Spring Co.; Smith Bros. & Hill; Steel & Sons; and West Bromwich Spring Co.  
Machined iron castings.—J. Holroyd & Co.; H. Newton Knights & Co.; J. Crowley & Co.; T. Summerson & Sons; Carron Co.; and P. Hooker.  
Special iron castings.—Brightside Foundry and Engineering Co.; S. Griffith; Rodney Foundry Co.; T. Smith & Co.; and Wilsons, Pease & Co.  
Machined malleable iron castings.—Brecknell, Munro & Rogers; Bullers, Ltd.; and Leys Malleable Castings Co.  
Malleable iron castings.—Bullers, Ltd.  
Steel castings.—E. Allen & Co.; Hadfield's Steel Foundry Co.; National Steel Foundry, Ltd.; and S. Peace & Sons.

The Highways Committee has ordered 5,800 coin testers for use in tramcars from Messrs. Hurst, Nelson & Co., for £74.

The Asylums Committee has accepted tenders from the following firms:—

Electrical sundries.—Siemens Bros. & Co.; General Electric Co.; Siemens Bros. Dynamo Works; Veritys; Edison & Swan Co.; B.T.H. Co.; Falk, Stadelmann & Co.; Cox Walkers; G. MacLellan & Co.  
Electric lamps.—B.T.H. Co. and Edison & Swan Co.

**FULHAM.**—The Electricity Committee has accepted the tender of W. T. Henley's Telegraph Works Co., at 5s. 3d. per yard run (the lowest price submitted) for cables (3,500 yd.) required for the supply to Earl's Court Exhibition. The British Electric Transformer Co., Ltd., are to supply ten transformers for the same service at £50 5s. each. In the list of tenders accepted for stores for the department for the year the following appear:—

Electrical goods.—Siemens Bros.; India-Rubber and Gutta-Percha Co., Ltd.; Plutte Scheele & Co., Ltd.; W. T. Henley's T.W., Ltd.; G. MacLellan & Co.; London Commercial Electrical Stores; British Westinghouse Co.; British Electric and Manufacturing Co.; British Insulated and Helsby Cables, Ltd.  
Frames and covers.—W. T. Henley's Telegraph Works, Ltd.  
House cut-outs and service boxes.—W. T. Henley's Telegraph Works, Ltd.; British Insulated and Helsby Cables, Ltd.  
Carbons.—The Electrical Co., Ltd.  
Glass globes.—Carl Quitman.

**SHOREDITCH.**—The Lighting Committee has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for lead-covered paper-insulated service cable as follows:—One mile '035 cable at £80 per mile; 1½ miles '022 cable, at £63 per mile.

**BERMONDSEY.**—The B.C. has placed contracts for annual supplies with the following firms:—

Morgan Crucible Co.—Dynamo and motor brushes.  
T. Wragg & Sons, Ltd.—Conduits.  
Siemens Bros. & Co., Ltd.—Conduits.  
E. H. Cripps.—Meter boards.  
Sykes & Sugden.—Street frames and covers, &c.  
B.I. and Helsby cables.—Joint and disconnecting boxes, &c.

**MARYLEBONE.**—The B.C. has accepted the tender of Messrs. Crompton & Co., at £1,160 (less 2½ per cent.), for a supply of converting plant.

**Southampton.**—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., for the supply of 170 tons of 7-in. tramway rails in 45-ft. lengths, at £7 5s. per ton, and 15s. per ton extra for 60-ft. lengths.

**Waterloo.**—The U.D.C. has accepted the tender of the Liverpool District Lighting Co., Ltd., for laying a service line to the Bowersdale Park Reading Room, and fixing meter, board and accessories.

**Whitehaven.**—The T.C. has accepted the following tenders:—

Metallic-filament electric lamps.—Falk, Stadelmann & Co., Ltd., and D. Burns & Co.  
Electricity meters.—Ferranti, Ltd., and the Bastian Meter Co., Ltd.  
Fuse boxes.—British Insulated and Helsby Cables, Ltd.  
Dynamo spindle oil.—A. Duckham & Co., Ltd.  
Bitumen.—Dussek Bitumen Co.  
Tapes.—W. T. Henley's Telegraph Works Co., Ltd.

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A 2,000-Frequency Alternator," by Mr. W. Duddell; "A New Method of Comparing Capacities," by Mr. A. Campbell; and "The Coefficients of Cubical Expansion of Fused Silica and Mercury," by Mr. H. Donaldson.

**Electro-Harmonic Society.**—Friday, March 22nd. At 8 p.m. At the Holborn Restaurant. Last smoking concert of the season.

**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, March 22nd. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-upon-Tyne. Further discussion on Mr. A. H. Finch's paper on "Some Considerations on the Choice of Auxiliary Plant for Power Stations."

**Association of Engineers-in-Charge.**—Saturday, March 23rd. At 6.30 p.m. At the Holborn Restaurant. Annual dinner.

**Royal Institution.**—Saturday, March 23rd.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture V.)

Friday, March 29th. At 9 p.m. Discourse on "Results of the Application of Positive Rays to the Study of Chemical Problems," by Prof. Sir J. J. Thomson.

Saturday, March 30th. At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture VI.)

**Institution of Electrical Engineers (Manchester Local Section).**—Tuesday, March 26th. At 7.30 p.m. At the University, Manchester. Paper on "Rail Corrugation," by Prof. A. Schwartz and Mr. R. G. Cunliffe.

**Institution of Electrical Engineers (Birmingham Local Section).**—Wednesday March 27th. At 7.30 p.m. At the Grand Hotel, Birmingham. Papers on "Some General Principles involved in the Electric Driving of Rolling Mills," by Mr. C. A. Ablett.

**Institution of Electrical Engineers (London).**—Thursday, March 28th. At 8 p.m. Paper on "The Power Factor and Conductivity of Dielectrics when Tested with Alternating Electric Currents of Telephonic Frequency at Various Temperatures," by Dr. J. A. Fleming and Mr. G. B. Dyke.

**Junior Institution of Engineers.**—Friday, March 29th. At 8 p.m. At the Criterion Restaurant, Piccadilly Circus. Smoking concert.

**Smoke Abatement Exhibition.**—Saturday, March 23rd and daily to April 4th, inclusive. At the Royal Agricultural Hall, London. Opening ceremony by Sir W. Richmond on Saturday at 12.30 p.m.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 25th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Tuesday, March 26th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.

Thursday, March 28th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.

Friday, March 29th.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.

Saturday, March 30th.—Easter Camp at Dover. Party will parade at headquarters for the issue of arms, etc., at 12.30 p.m. Kit bags and necessaries for Camp to be packed and properly labelled with owner's regimental number, name and destination on the outside of same, and to be brought to headquarters before the time ordered for the parade.

(Signed) P. H. S. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

**Radium in Hot Springs at Bath.**—Investigations which have been carried on by Sir W. Ramsay show that appreciable quantities of radium are present in the Bath mineral waters, and that niton, the emanation from radium, is present in large amounts compared with the Buxton waters. As niton is always being given off from the surface of the waters, patients taking baths inhale it, and probably some is absorbed by way of the skin. The latter process can be accelerated, Sir William Ramsay believes, by connecting the bather with the negative pole of a battery at 100 volts or more, the positive pole being connected to the water; the niton being positively charged by its discharge of electrons will then be attracted to the body and be quickly absorbed. Similarly the administration of stronger doses could be effected by the use of a spraying machine, fed with the natural gas under pressure; the gas being strongly charged with niton, its effect should be 20 times as great as that of the water as at present used.



## NOTES.

**Electric Heating and Cooking.**—We have received the following letter from Mr. Percy Good:—

"I have received from Mr. Meares a courteous reply to my letter which appeared in your journal. He contends that the public do not know of the things I talked about.

"This, Sir, is neither your fault nor mine. I devised a simple and very cheap system for the satisfactory solution of the hot-water problem. I used it for 12 months and described it fully, and you were courteous enough to give it full publicity—in fact, you paid for the opportunity. There is no patent or registration about the apparatus. What more could you do? (The article appeared March 17th, 1911.)

"I saw one leading London supply company soon afterwards, and they said they would write to me again, but I heard no more. Having my bread and butter to earn, could I be expected to do any more?

"PERCY GOOD.

"London, S.E., March 11th, 1912."

**"Northampton" Past Students.**—The Association of Past Day Students of the Northampton Institute is just completing the fourth year of its existence; it is claimed that no other Old Students' society can boast keener members, and it may soon be also affirmed that none can show a longer membership roll. A Bohemian concert is being held under the auspices of the Association on Friday, March 29th, as a wind-up to a most successful season, and it is hoped that all old "Northampton" students, with their friends, will make an effort to be present. The function will be held at the Food Reform Restaurant, Fumival Street, Holborn, at 7.30 p.m., and ladies are specially invited. Tickets (1s. 6d. each) can be obtained from the hon. secretary, Mr. J. C. Rennie, 28, Oxford Road, Putney.

**Publicity Literature.**—We have received from the Electric Supply Publicity Committee a further batch of its publications, dealing particularly with electric cooking. These include a small illustrated pamphlet and cards, some with monthly calendars on them, suitable for enclosure with letters, accounts, &c. A leaflet referring to the use of electric fans, and the benefit of keeping the air in workrooms in motion, is also enclosed. The Committee is issuing a larger booklet embodying a number of lectures by Mrs. Cross, 1st Class Diplôme, National Training School of Cookery, and freely illustrated with line drawings, which will, no doubt, be appreciated by those who have adopted electric cooking.

**Electro-Harmonic Society.**—The last smoking concert of the season will be held to-night at 8 o'clock at the Holborn Restaurant (King's Hall). Mr. Philip Dawson will be in the chair. The artistes are as follows:—Vocalists, Mr. Charles Saunders (tenor), Mr. Peter Dawson (baritone). Solo clarinet, Mr. Charles Draper. Conjuror and juggler, Mr. Stanley Collins. Scotch versatile comedian, Mr. Jock Walker. Humorists, Mr. Fred Wildon and Mr. James Campbell. Character entertainer, Mr. Thornley-Dodge. Sketch at piano, Mr. Ernest Hastings. Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

**Electrical Trades Benevolent Institution.**—The annual general meeting of this Institution will be held at the Institution of Electrical Engineers, Victoria Embankment, London, W.C., on Wednesday, March 27th, at 2.30 p.m. The meeting will receive the report of the committee and the accounts for the year 1911, after which it will proceed to consider and, if approved, pass the alterations which have been made to the rules of the Institution, and to fix the date of the general meeting to confirm them. The following members of the committee of management retire by rotation, and are eligible for re-election: Messrs. H. H. Berry, H. Bevis, Guy Burney, E. J. Clark, Sir J. Irving Courtenay, W. Davenport, B. Longbottom, and S. D. White. The meeting will also elect auditors in accordance with Rule 16. We understand that the new rules which are to be submitted contain alterations of an important character, inasmuch as they create a membership. Anyone who is qualified under the usual definition of the Institution will be able, if these rules are passed, to become a member on payment of a minimum subscription of 10s. per annum. Such subscription can be paid in instalments. The main object of this alteration is to bring in the rank and file of the staffs of the electrical industry. Various details, such as arrangements for collectors, &c., are also covered by the rules, which thus place the Institution on a broader basis. There are, of course, many electrical firms which are not large enough to have sick funds of their own, and it is to the members of the staffs of such as these that this new scheme will specially appeal.

**Cable Suspension in a Coal Mine.**—A colliery electrician writes to say that he is about to put down the pit a two-core 19/16 cable, double armoured, 1,000 yards long. It has to be suspended from end to end along a level which is fairly wet, and wooded all the way both sides and roof. Information regarding the best means of suspending the cable from roof or sides will be greatly appreciated by him.

**International Congress of Applied Chemistry.**—We have received Announcement No. 3 of this Congress, which is to be held at Washington and New York, September 4th to 13th, 1912. Early application should be made by those who propose to attend it.

**Smoke Abatement Exhibition.**—This exhibition will be opened to-morrow, at 12.30 p.m., at the Agricultural Hall, Islington. The Electric Supply Publicity Committee and the B.E.A.M.A. have combined to make an electric show in the King Edward's Hall, the principal part of which will be an electric restaurant, where full-course meals will be served, cooked in full view of the visitors; ordinary refreshments will also be supplied. Expert cooks are being obtained from the National Training School of Cookery, and the London Home Delicacies Association have been retained as caterers for the restaurant. Everything in the restaurant will, of course, be electrical. There will be an electric vacuum-cleaning exhibit, an electric laundry and electric heating. The Electric Supply Publicity Committee will have an information bureau at the entrance from the main hall. The Russian Balalaika Orchestra, under the direction of Prince Tschagadaeff, has been retained by arrangement with Mr. Clifford Essex. The exceptional interest in this Exhibition which is manifested by the electrical trades may be appreciated from the following list of exhibitors:—

Sun Electrical Co.—Electric signs, hair dryers and oven.  
Mabbott & Co.—Vegetable peeling and paring machines, knife cleaners, plate washers.  
Dowsing.—Radiators, solarium bath, vibrators.  
Purcell & Nobbs.—Radiators, heaters, foot warmers, humidifier, wall and window heaters, cookers, carving table, hot cupboard, coffee percolator, fish fryer.  
Causton.—Moving signs.  
B. T. H. Co.—Radiators.  
Ferranti, Ltd.—Electric fires, cooking outfits, grills and utensils.  
General Electric Co., Ltd.—Radiators and heating apparatus, ovens, urns, kettles, cooking utensils, cigar lighters, glue pot.  
Edison & Swan United E. L. Co.—Radiators and heating apparatus.  
Drake & Gorham.—Heaters.  
Berry, Skinner & Co.—Heaters.  
Siemens Bros.—Irons, convectors and radiators.  
Electric and Ordnance Accessories, Ltd.—Heaters, cookers, urns, &c.  
City of London E. L. Co.—"Bankside" water heater.  
Adnil Co.—Fans.  
Berry Co. ("Tricity").—Cooker, hot plates, utensils.  
Benson.—Plate warmer.  
Jacksons.—Cookers and utensils.  
Mavor & Coulson.—Vacuum cleaner.  
Armorduct Co.—Vacuum cleaner.  
Metropolitan Electric Supply Co.—Towel dryers.  
Spagnoletti.—"Therol" water heaters and accelerators.  
Synchronome Clock Co.—Electric clock.  
Bertram Thomas.—Cooker and utensils.

The following are among the papers which will be submitted for consideration by the Conferences:—

Dr. S. Rideal, D.Sc., F.I.C., "Effects of Town Air on Metal Work."  
Mr. Ruston, B.Sc., of Leeds University, "An account of investigations into the effect of Smoke."  
Dr. J. S. Owens, M.D., A.M.I.C.E., "Wasteful Power Production."  
Dr. R. Lessing, Ph.D., F.C.S., "The Economic aspect of Smoke Abatement."  
Bailie W. Smith, of Glasgow, "Smoke Abatement in Scotland."  
Mr. J. B. C. Kershaw, F.I.C., F.S.S., "Notes on Recent Progress in the Campaign against Black Smoke in this country."  
Mr. L. A. Willard (Boston), "Smoke Problem in the U.S.A."  
Commander W. F. Caborne, C.B., R.N.R., "Stoking."  
Mr. W. Nicholson (Chief Smoke Inspector for the City of Sheffield), "Smoke Abatement from the Inspector's Point of View."  
Herr Ingenieur Nies (Chief Engineer, Hamburg Smoke Abatement Society), "Progress of the Smoke Abatement Movement in Germany."  
Mr. W. D. Scott-Moncrieff, "Solid Smokeless Fuels."  
Mr. Julian S. Corbett, LL.M., F.S.A., "Smoke Abatement Laws in Other Countries."  
Principal Graham (President of the Smoke Abatement League), "The League's Proposed Smoke Abatement Bill."  
Mr. Frank Bailey, M.I.C.E. (Engineer and Joint Managing Director, City of London Electric Lighting Co., Ltd.), lecture on "Electricity, Lighting, Heating and Power."

**Walking Race.**—We are informed that a large number of cyclists have offered their services as competitors' attendants for the Open London-to-Southend Amateur Walking Race on April 6th, and the Committee will now be able to provide each competitor with at least one cyclist attendant. Arrangements are being made for refreshments to be supplied gratis to competitors at certain points en route, whilst a motor-car may also follow the race to supply the wants of the walkers in this direction. In addition to three prizes for the scratch race and three for the sealed handicap, a special prize will be offered to the first man (not otherwise a prize winner) to finish who is engaged in the electrical trade, provided at least eight electrical trades employés start. There will be a stroll over the course on Sunday, March 24th, and all those who would care to join for the whole or part distance should communicate with the race hon. secretary, Mr. A. R. Edwards, 303, Amhurst Road, London, N. A prospective Southend competitor desires to know if other Southend competitors would join in the provision of a motor-car to look after Southend competitors exclusively. The Committee still needs the loan of a couple of motor-cars to convey officials on the day of the race and any gentlemen willing to lend the same would greatly oblige by communicating with the hon. sec. as above.



**Fatalities.**—The *Sydney Herald* reports an inquest upon Bernard Jones, who was killed on January 25th, whilst engaged in drilling rock in a tunnel for a new sewer at Long Bay. The deceased man's mate said it was his first experience with an electric drill, and no instructions were given him by the contractors. Witness was in front, cleaning out the back hole, when he heard the deceased utter two sharp cries. Looking round, he saw him hanging over the back of the machine, his feet resting on the wood, and his hand clutching the handle of the drilling instrument. He rushed to the switch to cut off the current, but was hurled back by the shock. He then attempted to pull the deceased off the board. He was thrown back, however, and could not release him. The whole place was in darkness; the candles used had been extinguished. Davies next made a dash for the bottom of the shaft, and succeeded in shutting off the current; deceased had then fallen clear of the machine. Four minutes at the most had elapsed between the time of the accident and his arrival back from the switch.

William Corin, chief electrical engineer in the Public Works Department, and consulting engineer to the Mines Department, stated that the machine was not strictly an electrical drill; it consisted of an electric motor, driving an air compressor. His theory was that the deceased had his right foot on the machine and his right hand on the handle of the drill; or the deceased might have received the current through a faulty controller. In either case, the current would pass through his body to his right hand, which would be "earthed." The machine was not properly earthed. At present no regulation insists upon the earthing of portable motors. There should be such a regulation introduced. He thought there was a lack of knowledge apparent at Long Bay, and a want of the appreciation of danger.

The Coroner delivered a verdict of death from the effects of shock, accidentally received by the deceased while working with a rock drill, the driving motor of which was not properly earthed. In view of the evidence on the case, he added, it seemed of vital necessity that all persons engaged in any such work should, on engagement, receive electrical instruction.

The same paper, of February 1st, contains a report of an inquest on the death of Basil Wood, who was killed in the boiler-room of a timber yard at Pymont.

P. J. Day stated that deceased was cleaning the boilers, and was using a flexible portable extension electric light, which had been in use in the works from November 18th of last year. MacFarlane, the other fireman, attached the lamp and used it for about half an hour before handing it to witness, who used it for some time before giving it to MacFarlane again. Wood finished the boilers and asked MacFarlane to hand him the lamp. MacFarlane did so, and immediately deceased took the lamp he cried out and fell. Witness and MacFarlane ran to the switches to turn off the current. When deceased took hold the wire of the lamp, it was wet, and he was standing on a wet iron plate.

William Corin, electrical engineer to the Department of Public Works, stated that the lamp in question was attached to a switch-panel, which he could not examine with safety. He examined the cord (produced), and found the rubber insulator to be of medium quality, such as would give fair service if used for a simple pendant light in a position where it would not be liable to abrasion, and where the atmosphere was normally dry; the class of cord, however, would be quite unsuitable for use in any position where moisture would be frequently present, as in a boiler house. He made a test of the insulation, and found that, to say the least, it was low, and when the wire was damp, very low. It would be possible for the deceased to get a shock while holding the cord. In Sydney it was not the custom to earth the extension lights, but in England it was, and he thought that the Department of Trades and Labour should pass a similar regulation.

The Coroner returned a verdict of "Accidental death."

An inquiry was held on the 12th inst. at Walker-on-Tyne into an unusual fatality that had occurred on the previous day at Messrs. Dobson's shipyard. The victim was a youth named Harold Doughty (16). The evidence was to the effect that as Doughty and a lad named Hatcliffe were playing football with an orange, the orange was kicked over the wall, and Doughty climbed over the wall after it. While Doughty was creeping along on his hands and knees, he fell over, and a little later was heard shouting out. Doughty's companion got on to the wall and saw Doughty lying on the roof of a shed as if he were dead. The affair was reported at the yard, but when Doughty was reached he was dead. William Maidman, an electrician at Messrs. Dobson's shipyard, said that 3 ft. from the top of the wall there were wires which carried 440-volt electric current to the machinery in that part of the yard. When the accident was reported he cut the current off and went to the shed on to the top of which Doughty had fallen. The latter had come into contact with the live wires. In answer to the Coroner, witness said that it was customary for exposed wires to be used in some shipyards because they carried a higher voltage than insulated ones. There was no notice up, but it was intended to post them both inside and outside the yard. A verdict that deceased had been accidentally killed was returned.

**Social Events.**—The annual staff ball of Messrs. Bruce Peebles & Co., Ltd., was held at the North British Station Hotel, Edinburgh, on Friday last. About 200 ladies and gentlemen were present, including a number of the directors, branch managers, and agents of the firm with their wives, and the event was very successful. A reception by the general manager and his wife (Mr. and Mrs. Lee Murray) preceded the first portion of the dancing programme. Supper followed, after which the remainder of the dancing programme was carried through with zest. At the supper, which was laid in the large supper room of the hotel,

the tables were beautifully decorated with red and yellow flowers, the colours of the firm. The general manager presided in his usual genial way, and after proposing the toast of "The King," called on the Works Manager (Mr. W. A. Scott) to propose the firm. This toast was responded to by Mr. A. W. Tait, C.A. (director). The toast of "Our Guests" was proposed by Mr. A. B. Anderson (director), and responded to by Mr. James Watt, W.S. Indicative of the good feeling existing between the management and the staff, was the enthusiasm with which the toast of "The Chairman" was received. Reference was made to the results achieved by the firm in 1911, and the optimism was expressed by all the speakers.

The Perth Corporation Tramway employes held their annual social gathering last Friday evening, when Councillor Moncrief presided. An enjoyable dance followed the musical programme.

**Electric Smelting of Iron.**—Trials made from September 3rd to 9th last, at Trollhattan, with the electric manufacture of iron gave the following results:—

Consumption of ore, in tons	...	...	192.5
" " lime "	...	...	7.7
" " charcoal "	...	...	44.2
" " energy, KW.-hours	...	...	226,000
Average load, KW.	...	...	1,357
Iron produced, in tons...	...	...	131.4
Slags	...	...	22.1
Charcoal per ton of iron, in kg.	...	...	336
Iron, per KW. and per year, in tons	...	...	5.5
Iron, per H.P.	...	...	3.79
KW.-hours per ton of iron	...	...	1,736

At the end of 1911 there were in working in Scandinavia four similar furnaces—one of 1,500 KW. at Domnarfvet, in Sweden; one of 2,000 KW. at Tyssan, in Denmark; and two of 2,000 and 2,200 KW. respectively, at Hagfors, in Sweden.—*Industrie Electrique*.

The *Board of Trade Journal* states with regard to the electric iron smelting works at Tinfos, in Telemarken, that work will be begun in May next with three blast furnaces and a reserve furnace, provided that a concession is granted in the near future for laying wires for conducting electricity at high pressure to the works.

**Northampton Institute Dinner.**—The tenth annual dinner of the Northampton Institute (Engineering) Day Students took place at 7.30 p.m. on Saturday, March 16th, 1912, at the Holborn Restaurant, Mr. E. L. M. Emtage in the chair. After the toast of "His Majesty the King" had been duly honoured, an excellent musical programme was gone through. The events of the evening were, as usual, the topical song sung by Mr. Emtage and the distribution of the Eng. Soc. Premiums, for papers read during the past session, by Dr. Walmsley. The standard of papers read before the Society this session has been very high. Representatives of the Finsbury, University, and Central Technical Colleges were present. The function was in every way a record success.

**The Mortier System of Telegraphing Pictures.**—The Mortier system of telegraphic transmission of pictures requires no special electrical apparatus, and is capable of use in conjunction with any ordinary telegraph line. The picture to be transmitted is resolved into a number of tiny sections, the relative brightness of which is observed and telegraphed in a predetermined order and according to a predetermined code. According to instructions thus received, the picture is recomposed, at the receiving station, by "microtype."

Since the eye is incapable of estimating brightness differences with accuracy sufficient for the above purpose, the original is photographed through a special screen composed of ten transparent sheets, marked out in equal squares, but variously filled in with different geometrical patterns. The reproduction appears divided into a number of "fields," each containing a certain number of points and lines to which various brightness figures can be attached by observation. The prepared picture is mounted in a frame, over which the observing apparatus can be run to and fro. The eye piece of the latter allows about 20 of the "cells" (as Mortier calls the fields of the picture) to be observed at once, and the operator simply dictates, in a definite order, the various brightness figures of the picture. On receipt of the code message, which may be variously arranged to lessen the cost of transmission, the picture is set up with microtype, the thickness of the lines and the size of the dots of which reproduce the desired apparent brightness of the various parts of the picture.

At first sight the process appears crude, but the results attainable by its use are said to be very satisfactory, and certainly the simplicity of the apparatus required is a great point in its favour. Working with six degrees of brightness, results quite good enough for newspaper and similar work can be obtained. An average small picture is divided into about 3,900 points, and the brightness data are transmitted by 880 pairs of figures which may, for cheapness, be sent as 440 words. The preparation of the original, the transmission of the brightness figures, and the setting up of the microtype for such a picture may occupy about  $\frac{1}{2}$  hour each—1  $\frac{1}{2}$  hours in all. Under the most unfavourable conditions, it is possible to have a block ready for printing within two or three hours after taking the original photograph at any place within reasonably direct telegraphic communication.

**Electric Stamp-Cancelling.**—The German Postal Department are making use of an electric apparatus to cancel the stamps on letters, &c. The letters are made up into packets and a little india-rubber wheel carries them one by one under the apparatus. With letters of the same size, 900 cancels per minute



are done; uniform sized postcards are cancelled at the rate of 1,000 per minute; and those of various sizes at 600 per minute. By hand, an expert operator can only do this work at the rate of 100 per minute. Hardly 1 per cent. of the letters are missed, and at most 5 per cent. when the objects are of different sizes. The apparatus is driven by a motor of a capacity of  $\frac{1}{4}$  or  $\frac{1}{2}$  K.W.—E.T.Z.

**Appointments Vacant.**—Junior assistant engineers, for the Yorkshire Electrical Power Co. (15s.); meter reader, tester, and fixer, for the Stoke-on-Trent Borough Electricity Department (27s. 6d.); two switchboard attendants (25s.), also a cable jointer (30s.), for the Dundalk U.D.C.; junior assistant engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd. See our advertisement pages to-day.

**National Physical Laboratory.**—On Friday last the annual inspection of the Laboratory took place, and the Report for the year 1911 was issued. The Executive Committee, in presenting the latter, express their sympathy with the Director, Dr. Glazebrook, who is now recovering from his very severe illness, and record their high appreciation of the energy and devotion which he has given to the service of the Laboratory. During the year the new Metallurgy building, provided through the generosity of Sir Julius Wernher, was completed and occupied, and the contract for the Administration and Optics buildings was let. The Froude Tank was opened by Lord Rayleigh, and was brought into use. Progress was made with the Lorenz apparatus and the international specification for the silver voltameter, 13 new mercury standards of resistance were constructed, and the work on mutual inductance was advanced. Tests of total energy and hysteresis loss in iron sheet were made, and the establishment of sets of sub-standards for the photometry of electric glow lamps, experiments on induction meters, researches on insulating materials, and tests on dry cells, &c., were conducted, besides many other investigations less intimately associated with the electrical industry. The electrical measurements made in the Physics Department showed a considerable increase, from 172 to 269. The bulk of the increase was in connection with hysteresis and eddy-current measurements, which together numbered 109. Electrotechnical measurements rose to 2,203, as against 1,810 in 1910 (but 2,328 in 1909); a steady increase took place each year in the tests of resistance coils, ammeters and voltmeters, but supply meters fell off in numbers. Dielectric strength tests jumped up from 86 to 252, while fuses fell from 777 in 1909 to 21 in 1910, and nil in 1911. Primary cells also were 200 in 1909, 93 in 1910, and 78 in 1911. Evidently these matters are controlled by wide-spreading influences. In photometry, the tests of glow lamps, which had fallen from 895 in 1909, to 440 in 1910, rose again to 886, the total number of tests of all kinds being 920.

The income of the laboratory rose from £28,077 in 1910, to £30,337 in 1911, mainly due to increased receipts for work done (from £15,363 to £17,398). The total expenditure for the year was £30,572, or £235 more than the receipts.

We shall deal with the technical features of the report more fully in a later issue.

**The Strike.**—The Electrical Apparatus Co., Ltd., ask us to state that they have not been in any way inconvenienced by the coal strike.

**The Electric Driving of Textile Machinery.**—The *Indian Textile Journal* recently contained an interesting article on the irregular driving of cotton machinery, and the marked advantages resulting from the individual electric drive. The trouble is attributed to the variations in the torsion angle of shafts, and to the use of inferior leather belting, which is said to be a common fault in Indian mills. Data are quoted from Lancashire practice showing that the electric individual drive increased the output of looms by 10 per cent. above that of looms driven from shafting, in spite of the fact that the latter was electrically driven. There is also a saving of 10 per cent. in power, and various other economies.

**Institution and Lecture Notes.**—BIRMINGHAM ASSOCIATION OF MECHANICAL ENGINEERS.—A paper on "The Application of Electricity to Industrial Purposes" was read by Messrs. F. J. Moffett and N. B. Rosher on March 14th. The authors stated that for the manufacture of nitrates from the air, carried on chiefly in Norway, the power installed approximated to 180,000 H.P., and was expected to rise to 300,000 H.P. in the next few years. In the manufacture of calcium carbide 60,000 H.P. was already employed. Much had been done to utilise waste gases on the North-East Coast, where the available surplus power had been estimated at 61,000 H.P. continuously; but very little had been done in the South Staffordshire and Worcestershire districts, where 21,000 H.P. was available. In dealing with rolling mills, it was stated that 80,000 to 90,000 H.P. was now used in the electrical driving of continuous and reversing mills in this country. Electric furnaces and their applications were described, and interesting curves were given of the cost of combustion and electric heat; in the case of the former the cost for low temperatures was quite small, but as the temperature rose the cost rose much more rapidly, until a point was reached at which no increase in expenditure could produce any increase in temperature, the reason being that the volume of gases in the blast became so great that the gases carried off the heat as quickly as the fuel supplied it. The maximum temperature for combustion heat was 1,500°-1,900° C., and for the electric arc furnace 3,500°-4,000° C. The cost of hardening 100 millers, each weighing 12 lb., was given as being £2 18s. 11d. with a gas furnace and gas at 1s. 6d. per 1,000 cb. ft., as against £1 8s. 6d. with an electric furnace and energy at 1'2d. per unit.

Mr. C. D. Taite read a paper before the MANCHESTER GEOLOGICAL AND MINING SOCIETY on Tuesday, upon "The Lancashire Electric

Power Co.'s System, and Its Application to Lancashire Collieries." The aggregate horse-power supplied to collieries in Lancashire by the company, he said, was at present about 3,000 H.P., and this would shortly be increased to about 4,000. The present annual consumption by these collieries was about 4,000,000 units. For some reason Lancashire had been slower to adopt electrical methods than other colliery districts. In the Newcastle district electrical energy at the rate of 55,000,000 units per annum was being supplied for colliery purposes; in South Wales 12,500 H.P. was being taken, and a further 3,500 H.P. was contracted for; in the Clyde Valley district, 8,500 H.P. was connected or contracted for; and in Yorkshire 6,000 H.P. was at present connected or contracted for. There could be no doubt that where coal was most difficult to win, the most modern methods of working were essential in order that the cost of dealing with the coal might be kept at the lowest possible figure.

**INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).**—On Saturday last the eighth annual dinner of the Students' Section was held at the Trocadero Restaurant; Mr. E. F. Hetherington was in the chair, and there was a fair attendance of members and guests. After the toast of "The King," Mr. D. Betts proposed the health of "The Institution and the Hon. Treasurer"; he regretted that Mr. Ferranti had been prevented from attending, but took the opportunity of urging the question of "abstracts" upon the attention of the treasurer. Mr. R. Hammond, in the course of his reply, pointed out the valuable achievements of electrical engineering as evidenced during the present strike, and the importance of economising coal by generating power on a large scale at a central station. He then, in the absence of Mr. W. M. Mordey, proposed "The Students' Section," which he said numbered over 1,200; he drew attention to the great advantages derived by the Students from their connection with the Institution, at a very small cost. Mr. Hetherington, in reply, said that good progress had been made since last year, and emphasised the benefits to be derived from attending the meetings, preparing papers, and taking part in the discussions. They still hoped, he said, that the Institution would consent to have abstracts of the Students' papers printed for circulation before the meetings. They were also anxious for information regarding future policy in connection with the proposed examinations. He hoped that greater solidarity would be brought about between the London and provincial students.

Mr. E. W. Moss proposed "The Colleges," and remarked that whereas the Students' Section was formerly practically run by the colleges, the latter now did not take so active a part in their affairs as could be wished. With regard to the new Articles, he could not see what was to become of men over 23 and under 25 years of age, if the class of Licentiate was not established; and he pointed out that students who obtained their technical training by means of scholarships were not able to maintain themselves during works training—could not the Institution afford assistance to such men? In reply, Mr. Hammond urged the Students never to take anything for granted, but to master every point their teachers placed before them.

Proposing "The Guests," Mr. J. B. Sparks expressed the indebtedness of the Students to the Secretary of the Institution, Mr. P. F. Rowell, and to Mr. Tree; and the Chairman of the Graduates' Association of the Institution of Mechanical Engineers acknowledged the toast. An excellent programme was provided for the entertainment of the diners by Mr. Nadaud, and the function proved very enjoyable.

On Thursday, last week, at the INSTITUTION OF ELECTRICAL ENGINEERS, a lantern lecture was delivered by Mr. T. Stevens, who took as his subject an avalanche which occurred on the Wellington (U.S.A.) tunnel electric railway. The tunnel in question runs through a peak of the Cascade Mountains, and is operated by the Great Northern Railway, on the three-phase system, being the only three-phase railway electrification in the States. According to the lecturer the annual snow fall in the neighbourhood varies from 25 ft. to 75 ft., and up to 20 ft. of snow is found on the level. The speaker described one of a series of snow slides, which swept an accumulation of rolling stock which was snowed up in the Wellington yard, and the overhead trolley lines, &c., into the valley below the railway. Some two months elapsed before the electrical equipment was repaired. Indeed, it required 300 men and 28 snow ploughs working two days to open up  $\frac{1}{2}$  mile of track, the snow, to the depth of 30 ft., being first loosened by blowing it up with gunpowder. Needless to add, some unique lantern slides were shown, illustrating conditions which even a Highland railway official might envy.

**INSTITUTION OF CIVIL ENGINEERS (STUDENTS' MEETING).**—At the Students' meeting held on March 15th, a paper was read by Mr. A. E. Gladwyn, Student Inst.C.E., on "The Heat Value of Fuels."

**ROYAL INSTITUTION.**—The following arrangements are announced:—April 19th.—At 9 p.m. Mr. A. A. C. Swinton, on "Electricity Supply: Past, Present and Future."

May 17th.—At 9 p.m. Mr. W. Duddell, F.R.S., on "High Frequency Currents."

April 18th and 25th.—At 3 p.m. Prof. A. W. Crossley, F.R.S., on "Synthetic Ammonia and Nitric Acid from the Atmosphere."

May 30th and June 6th.—At 3 p.m. Prof. J. H. Poynting, F.R.S., on "The Pressure of Waves."

At the UNIVERSITY COLLEGE, Nottingham, on Friday last, Mr. S. H. Piper, B.Sc., concluded a series of popular experimental lectures on electrons, radio-activity, and Röntgen rays.

**INSTITUTION OF CIVIL ENGINEERS.**—The 20th "James Forrest" Lecture will be delivered on April 19th by Mr. H. R. A. Mallock, F.R.S., his subject being "Aerial Flight."



On Tuesday a paper was read by Mr. Justus Eck before the ILLUMINATING ENGINEERS' SOCIETY on "The Illumination of Printing Works by Electricity," illustrated by a unique series of lantern slides from photographs taken at night in the works of the principal London papers and magazines.

**JUNIOR INSTITUTION OF ENGINEERS.**—At a recent meeting a paper was read on the subject of "Railless Electric Traction," by Mr. Bertram D. Fox, B.A. On Wednesday, April 17th, Mr. E. Kilburn Scott will read a paper on "Dynamo Design."

**ELECTRICITY IN COTTON MILLS.**—Mr. S. J. A. Mills, a consulting electrical engineer of Blackburn, recently gave an address before the Blackburn Managers' Mutual Association on the subject of "Power for Mills and Workshops."

A lecture on the "Origin of Radium" was delivered at the ROYAL INSTITUTION on Saturday last by Mr. Frederick Soddy.

**The Johannesburg Gas Plant Litigation.**—SETTLEMENT.—According to the *Evening Standard* it was stated on Wednesday in the Court of Session, Edinburgh, that a settlement had been reached in the action by the Municipal Council of Johannesburg, Transvaal, against Messrs. D. Stewart (1902), Ltd., and Mr. William Beardmore, for the payment of sums amounting to over £400,000, in respect of the abandonment of contracts for the installation of gas and electrical plant at Johannesburg. Of the sums claimed, £115,134 was the amount in a bond by Mr. Beardmore and others for the performance of the contract by Messrs. Stewart. The litigation commenced in 1908, and passed through various preliminary stages, including an appeal to the House of Lords. In the terms of the settlement, the plaintiffs have accepted £100,000, and are allowed to keep the plant, each side to pay its own expenses.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The St. Helens electric power station staff have presented a suit case to Mr. F. J. HELSBY on his appointment as chief clerk at the Wrexham electricity works.

Mr. W. H. HARTNELL, mains superintendent at the Cheltenham electricity works, who is leaving for Canada, has been presented by the staff with a silver-mounted calabash pipe and case.

At Blackpool last week Mr. JAMES ANDERSON, electrical engineer, was the recipient (at the Golden Ball Hotel, Poulton,) of a watch presented as a token of good fellowship and esteem from friends at Poulton on his departure for Winnipeg, where he has accepted an appointment as electrical engineer.

The Barnes Council have decided to grant an immediate increase of £25 to the salary of the electrical engineer, and subsequent biennial increases of £25 each until his salary reaches £600.

At a meeting of the Sunderland T.C. on 13th inst. on the recommendation of the Electricity and Lighting Committee, the salary of Mr. WILFRED YORKE, superintendent at the Hylton Road electricity works, was advanced from £200 to £225, to be further increased at the end of 12 months to £250 per annum.

Mr. C. F. W. SEDGWICK has resigned his position in the Sunderland Corporation Electricity Department, having been appointed electrical engineer at Messrs. S. Pearson & Son's Oil Refinery, Mexico.

Mr. K. F. BISHOP has been appointed shift engineer at Warrington, near Darlington, as stated in our last issue. We regret the mistake.

**Tramway Officials.**—At a meeting of the Sunderland T.C. on 13th inst., Mr. New moved the adoption of the report of the Tramways Committee recommending the advance of the salary of the tramways manager, Mr. A. R. DAYSON, from £500 to £600 per annum by four annual increments of £25. He said that Mr. Dayson was appointed in 1904, at a salary of £400, and he had given complete satisfaction. The recommendation was adopted.

Mr. CHIVERS has been appointed to succeed Mr. Smith as manager of the Peterborough Tramway Co.

**General.**—His Majesty the King has appointed Sir J. J. THOMSON, D.Sc., F.R.S., to the Order of Merit. We tender our hearty congratulations to the distinguished Cavendish Professor of Experimental Physics at Cambridge.

Mr. HAROLD SMITH, of South Shore, Blackpool, has just returned from Canada to accept an offer from Messrs. Mather and Platt, of Park Works, Newton Heath, with whom he was originally apprenticed, and for whom he was superintendent of the electrical department for some time. While in Canada Mr. Smith was for 2½ years with the Montreal Light, Heat, and Power Co. (with a capital of 5½ millions), as superintendent of their repair and manufacturing shops. Later Mr. Smith accepted a more lucrative position as production engineer to the Canada Foundry Co., at Toronto, and he had been there a year when Messrs. Mather and Platt's invitation reached him.

Mr. FREDERIC H. TAYLOR, consulting engineer, has removed from 14, Victoria Street, to new offices at 19, Old Queen Street, Westminster. Telephone No. "Victoria 1,457."

## NEW COMPANIES REGISTERED.

**British Arc Welding Co. (Mersey), Ltd. (120,724).**—This company was registered on March 8th, with a capital of £20,000 in £1 shares, to take over and work a process for electrical welding under a grant or licence given by the British Arc Welding Co., Ltd., to H. & C. Grayson, Ltd., under an agreement dated February 16th, 1912. The subscribers (with one share each) are:—T. G. McKay, 171, Hornby Road, Bootle, Liverpool, engineer; G. S. Johnson, 18, Chambres Road, Southport, engineer. Private company. The number of directors is not to be less than two or more than six; the first are to be appointed by the subscribers, subject to the right of the British Arc Welding Co., Ltd., to nominate one director; qualification, 200 shares; remuneration as fixed by the company. Registered by Walker, Son & Field, 61, Carey Street, W.C.

**Collings-Bishop, Ltd. (120,674).**—This company was registered on March 6th, with a capital of £5,000 in £1 shares (2,500 preference), to carry on the business of electricians, contractors, engineers, manufacturers of electrical apparatus, &c., and to adopt an agreement with H. C. Bishop. The subscribers (with 10 shares each) are:—P. H. P. Wells, 48, Belsize Square, Hampstead, N.W., gentleman; J. A. Hart, Blenheim, Eagle Road, Wembley, N.W., gentleman. Private company. The number of directors is not to be less than three or more than nine; the first are H. C. Bishop, P. H. P. Wells and J. A. Hart; holders of a majority of preference shares may appoint two directors, and holders of a majority of ordinary shares, one director; qualification, 10 shares. Registered office: 19, High Street, Cardiff.

**Brompton and Kensington Accessories Co., Ltd. (120,670).**—This company was registered on March 6th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, mechanical and electrical engineers and contractors, manufacturers of, and dealers in, electric supplies and accessories of all kinds, &c., and to adopt an agreement with the Brompton and Kensington Electricity Supply Co., Ltd. The subscribers (with one share each) are:—R. S. Downe, 254, Earl's Court Road, S.W., electrical engineer; T. J. Owens, 254, Earl's Court Road, S.W., secretary. Private company. The directors for the time being of the Brompton and Kensington Electricity Supply Co., Ltd., shall be the directors of this company. Registered by Linklater, Addison & Brown, 2, Bond Court, Walbrook, E.C.

**Foreign Construction Syndicate, Ltd. (120,768).**—Registered March 11th, with capital £10,000 in £1 shares, to carry on the business of constructors and workers of tramways, railways and public works, capitalists, financiers, promoters, concessionaires, &c. The subscribers (with one share each) are: R. C. Howley, 11, St. Anne's Road, Leytonstone, Essex, clerk; P. M. Cullen, Revidge, Blandford Road, St. Albans, clerk. Private company. Table "A" mainly applies. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

**Hallamshire Electric Co., Ltd. (120,873).**—This company was registered on March 15th, with a capital of £2,000 in £1 shares, to carry on the business of electrical and mechanical engineers, suppliers of electricity, motive power and light, &c. The subscribers (with one share each) are:—H. D. B. How, 96, Banner Cross Road, Ecclesall, Sheffield, engineer; H. Clarke, 61, Meersbrook Road, Sheffield, traveller. Private company. The number of directors is not to be less than two or more than three; the first are H. D. B. How and H. Clarke; qualification, £100. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**S. Bill & Co., Ltd. (120,830).**—This company was registered on March 13th, with a capital of £4,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electrical accessories, dealers in electrical articles and appliances, manufacturers of motor-car fittings, electrical cases and cabinets, stampers and piercers, &c. The subscribers (with one share each) are:—S. Bill, 162, Rolfe Street, Smethwick, Birmingham, manufacturer; J. Richards, Vicarage Road, Handsworth, Birmingham, manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are S. Bill, J. Richards and R. W. Bill; qualification, 200 shares. Registered office, 388, Park Road, Hockley, Birmingham.

**Electric Lamp Regenerators, Ltd. (120,796).**—Registered March 12th, by Romer & Skan, 4, Copthall Chambers, E.C. Capital £50,000 in £1 shares. Objects:—To carry on the business of manufacturers and repairers of, and dealers in, electric lamps, reflectors, lenses, and other articles, opticians, glass blowers, engineers, manufacturers of globes, films, shades, burners, meters, galvanometers, ammeters, voltmeters, carbons, switches, accumulators, motors, batteries, wires, insulators, &c., to acquire an invention relating to electric and other lamps or any lenses, reflectors, and component parts, together with Patent No. 16,230 of 1911, for an improved method of and apparatus for regenerating burnt-out carbon and metal-filament electric lamps; and to adopt an agreement with L. H. Keep. The signatories (with one share each) are:—P. H. Brashier, 45, Lessar Avenue, Clapham Common, S.W., gentleman; H. J. Sheppard, 20, Adamsville Road, Sydenham, clerk; F. Romer, 4, Copthall Chambers, E.C., solicitor; H. E. Skan, 7, Grittleton Road, Elgin Avenue, Maida Vale, W., clerk; A. H. Skan, 4, Copthall Chambers, E.C., solicitor; E. Edwards, 11, Halley Street, Limehouse, E., clerk; F. W. Beard, 32, Winchester Avenue, Brondesbury, N.W., secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are J. H. Keep, Abbots Langley, Herts.; W. A. Lageson, 17, Avenue Mansions, Hampstead, N.W.; and F. P. Albrecht, 8, Draper's Gardens, E.C.; qualification (except first directors) 500 shares; remuneration as fixed by the company. Registered office, Salisbury House, London Wall, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Cantic Switch Co., Ltd.**—Debenture dated February 23rd, 1912, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: E. G. Phillips, Heatherbrae, Woodborough Road, Nottingham; and W. F. Cox, Tavistock Chambers, Market Place, Nottingham.

**Fletcher Jackson & Co., Ltd. (119,942).**—Particulars of not more than £1,000 debentures, created February 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £800. Property charged: The company's undertaking and property present and future, including uncalled capital. No trustees.

**Auxiliary Electrical Co., Ltd.**—Return dated December 31st, 1910, filed March 29th, 1911. Capital, £70,000 in £5 shares. All shares taken up; 2 guineas called up on each share; £29,400 paid, in addition to £1,965 12s. 7d. received in anticipation of calls. Mortgages and charges: Nil.



**Paignton Electric Light and Power Co., Ltd. (98,487).—**Agreement for loan, dated December 20th, 1911, to secure £3,000, charged on company's assets. Holders: W. J. Ham and others, all of Paignton. (Registered March 4th, 1912, pursuant to Order of Court).

**Nairobi Electric Power and Lighting Co., Ltd.—**Issue on July 27th, 1910, of £800 debentures, part of a series of which particulars have already been filed. (Notified March 5th, 1912.).

**Church Stretton Electric Supply Co., Ltd. (80,857).—**Further charge on freehold hereditaments at Crossways, Church Stretton, and company's other assets, dated March 7th, 1912, to secure £100. Holder: E. Bond, 43, Thurloe Square, S.W.

**Londonderry Moville Electric Railway Syndicate, Ltd. (75,455).—**Return dated January 12th, filed January 19th, 1912. Capital £10,000 in £1 shares. 6,507 shares taken up. £1 per share called up on 1,507. £1,425 5s. paid, leaving £81 15s. in arrears. £5,000 considered as paid on 5,000 shares. Mortgages and charges: Nil.

**Kent Electric Power Syndicate, Ltd. (72,742).—**Return dated January 13th, 1912. Capital £15,030 in 1,500 ordinary shares of £10 and 600 deferred shares of 1s. each. All shares taken up. £10 per share called up on 1,500 ordinary and 1s. per share on 600 deferred. £15,022 19s. paid, leaving £7 1s. in arrears. Mortgages and charges: £1,039.

**India-Rubber, Gutta-Percha, and Telegraph Works, Ltd. (1,122c).—**Return dated January 2nd, 1912. Capital £812,000 in 50,000 ordinary and 25,000 preference shares of £10 each and £62,000 unissued capital; 50,000 preference and 25,000 ordinary shares taken up; £750,000 paid. Mortgages and charges: £400,000.

**Rangoon Electric and Supply Co., Ltd.—**A memorandum of satisfaction to the extent of £1,600 on February 20th, 1912, and to the extent of £977 on March 5th, 1912, of debenture stock dated February 1st, 1906, and December 22nd, 1908, securing £250,000, has been filed.

## CITY NOTES.

### Newcastle and District Electric Lighting Co., Ltd.

THE directors' report for 1911 states that the number of units sold during the year was 13,599,294, as against 12,234,106 sold in 1910, being an increase of 11.16 per cent. for the year. The result of the year's working is as follows:—Gross profit at Newcastle Works as per profit and loss account, £25,699; gross profit at Lemington and Newburn Works as per profit and loss account, £3,067; transfer fees, £5 = £28,771, plus balance brought forward (£4,807), making £33,578; less interest on debenture stock, temporary loans, &c., £13,363; directors', trustees', and auditors' fees, income-tax, leasehold redemption fund, &c., £1,920; and less interim dividend paid August 31st, 1911, £4,198, leaving an available balance of £14,097. The directors recommend a dividend at the rate of 3 per cent. per annum (less income-tax) for the half-year ended December 31st last, absorbing £4,199, and making with the interim dividend paid in August 3 per cent. for the year, leaving a balance of £9,898 to be carried forward, as against £4,807 brought forward from 1910. The improved results foreshadowed in the directors' report for 1910 have been realised during the past year, the profit having been considerably increased; but, owing to the present disturbed state of the labour market, the directors do not think it advisable to recommend an increase in the dividend. Favourable contracts for the supply of coal over the whole of this year have been made, and the directors have reason to anticipate a further increase of profit during the year. The company have arranged with the Corporation of Newcastle-upon-Tyne to supply for a period of 10 years from the date of their commencing to work, all the electrical energy required for the Newburn Tramways sanctioned by Act of Parliament last year; and at the end of that term negotiations may be entered into for a renewal of the contract. The efficiency and economy associated with the use of the metal-filament lamps has led to a large increase in the number of consumers, and as the applications for current show no sign of falling off, these high efficiency lamps should eventually prove a great advantage in the development of the company's business. As in previous years, the whole of the plant and machinery, together with buildings, &c., owned by the company have been maintained in a complete state of efficiency out of revenue during the year.

The meeting is called for March 28th.

### Oxford Electric Co., Ltd.

SIR HENRY MANCE presided at the annual meeting, held on March 8th, and in moving the adoption of the report (see ELECTRICAL REVIEW, p. 355), he said that mains extensions had been carried out to new localities, and services given to 181 new customers. They had replaced a considerable number of unsuitable and condemned meters, many of which had been in use for 20 years. He could hardly bring himself to believe the extent to which economy in electric light could be carried. In time he hoped they would educate their consumers to use it more freely. The capital account had been increased by the issue of 2,000 preference shares. They were, as usual, very much over-applied for. The lighting receipts were slightly less than in 1910, partly owing to the reductions made in charges to some of the largest consumers, but also owing to the use of high efficiency lamps. There had been several causes which had operated unfavourably for them in 1911, but, on the whole, they had done very well. The year was a record one for sunshine, and people stayed out of doors as long as possible, and practically there was very little light required during the June and September quarters. Luckily, the first and last quarters were more satisfactory and made up the difference. They also had a very satisfactory income from power, cooking and heating, but they

suffered greatly from the metal lamps, and would do so until the last limit of efficiency was reached. He hoped that in the future they would increase the revenue more proportionately to the number of lamps. They had a little additional revenue from the Coronation, but the amount received from that in no way compensated them for the loss of one week of term at that period. In regard to the coal strike, this was the third or fourth occasion within recent years that they had had to provide for the contingency of a strike. On one occasion they provided increased accommodation for coal, on another they were threatened with a shortage of Welsh coal, and made certain modifications in their boilers to enable them to use Midland coal. Now they had a national strike they had decided to resort to oil, and they had adopted the Diesel engine, which would to some extent make them independent of coal. They could keep running for two or three months, and by that time, if nothing went wrong, they would have the new engine in position. The fuel for it was now beginning to arrive. It was a three cylinder engine of 650 B.H.P., and it would only occupy the same space as an 80-kw. engine and dynamo, which was now on sale. The chairman went on to allude to the improvements that were taking place in cooking and heating apparatus, to the lack of progress in regard to the local tramway question, and to the enormous progress made in the States with electric vehicles as compared to that observed in this country.

SIR ROBERT BUCKELL seconded, and the report was adopted.

### Newcastle-upon-Tyne Electric Supply Co., Ltd.

THE directors' report for 1911 states that the connections to the company's system at the end of the year amounted to 151,627 H.P., which, compared with the previous year's figure of 139,776 H.P., show an increase of 11,851 H.P. The profit for the year is £114,838 (£107,779 for 1910), plus £2,050 brought forward, making £116,888, as compared with £110,702, against which has been charged interest on debentures, loans, &c., amounting to £81,968, leaving an available balance of £34,920 (£78,925 for 1910), which the directors recommend should be appropriated as follows:—Dividend of 5 per cent. for the year on the preference shares (of this an interim dividend of 2½ per cent. was paid in July, amounting to £17,187, £34,375; a dividend of 4½ per cent. for the year on the ordinary shares (of this an interim dividend of 2 per cent. was paid in July, amounting to £13,750), £30,937 (4 per cent. in 1910. £27,500); transfer to depreciation account, £15,000, the same as for 1910; carrying forward £4,608. The reserve account at December 31st, 1910, stood at £6,994, to which has been added £8,054 (being the amount received from the Newcastle Corporation for acquiring the right to supply their tramways in Walker, less Parliamentary and other costs), thereby increasing the reserve account to £15,049. The depreciation account which, at the end of 1910, stood at £115,000 will, when increased by the proposed transfer of £15,000, stand at £130,000. In addition to this, as stated in former reports, the sum of £150,000 was written off in 1906 in reduction of capital expenditure. The expenditure on capital account for the year amounted to £76,950, which has been mainly incurred in completing the new power station at Dunston, and in developing the distribution system, more particularly in the colliery districts served by the company. The development of waste heat generating stations continues. That of the Bankfoot Power Co. at Bankfoot is being doubled in capacity, and the same company are also erecting a waste heat generating station at Bowden Close, near Crook. Agreements for operating these stations, and for taking a supply of the surplus current therefrom, have been entered into by the company. The unconverted balance of first and second mortgage debentures, which at December 31st last amounted to £67,800, has since been exchanged for 4½ per cent. consolidated first mortgage debenture stock, or paid off, and replaced by a corresponding amount of that stock.

The annual meeting is called for March 27th.

### Melton Mowbray Electric Light Co., Ltd. — Mr.

W. J. New presided at the annual meeting held on March 13th at the works. He moved the adoption of the report, which showed that the lamps connected had increased from 19,889 to 21,063. The revenue, including the balance of £60 brought forward, amounted to £2,342, and after providing for £1,000 debenture interest, there remained £1,342 for distribution. After paying a dividend of 2½ per cent. per annum, and placing £600 to reserve for plant renewal, £242 is carried forward. The chairman said that the future prospects were favourable. But for the coal strike they might have declared more than 2½ per cent. dividend. The company's stock of fuel would last well over six weeks, but the trouble would probably result in an increase in the price of fuel for some months to come. It would have been an unsatisfactory procedure to increase their dividend this year and then to have to reduce it next year. The report was adopted.

**Continental.—BELGIUM.**—The balance-sheet of La Société Bruxelloise d'Electricité for the last financial year shows a profit of £5,170, as compared with £4,520 in the preceding 12 months.

**AUSTRIA.**—The report of the Kabelfabrik und Drahtindustrie Gesellschaft, of Vienna, for the last financial year shows a net profit of £41,396, as compared with only £33,338 in the preceding 12 months. A dividend of 11 per cent is again being declared.

**FRANCE.**—The balance-sheet of La Société d'Electro-metallurgie de Dives for the last financial year shows a net profit of £75,580, as compared with only £58,188 in the preceding 12 months.



### Madras Electric Tramways (1904), Ltd.

MR. W. S. B. McLAREN, M.P., presided on Thursday, last week, at the eighth annual meeting held at Dashwood House, E.C.

The CHAIRMAN, in moving the adoption of the report, said the accounts again showed a considerable improvement upon those of the preceding year. Their revenue had been earned entirely on the old lines, and although they thought that their maximum earning power had been reached in 1910, there was an increase in traffic receipts in 1911 of £2,786, or 8.49 per cent. The number of passengers carried was 14,656,611, being an increase of 8.44 per cent. The expenditure in Madras had not been increased, and, therefore, the whole of the improvement in gross receipts was brought in to the credit of the profit and loss account. They had increased the contribution to the depreciation and renewal fund from £5,000 to £7,000. The net result for the year was a profit of £4,846 plus £854 brought forward. The directors recommended a dividend at the rate of 6 per cent. per annum on the preference shares, and a dividend of 2 per cent. on the ordinary shares. Those dividends would absorb £4,595 and leave £1,104 to be carried forward. Turning to the balance-sheet, the usual contribution to the debenture stock sinking fund had been provided out of revenue, and the reserve arising therefrom now amounted to £3,830. They had made temporary arrangements for financing the two extensions which were being carried out, and, as soon as the lines had been opened, they intended to repay the loans out of an issue of debenture stock and shares. In terms of the trust deed for securing the debenture stock, they were entitled to create further stock at the rate of £3,500 per mile of extension. The exact form of the issue had not been settled by the board, but an opportunity would be given to present debenture-holders and shareholders to subscribe. The renewals and improvements during the year, amounting to £5,161, had been debited to the depreciation and renewals account, and there remained at the credit of the fund, including the amount brought forward from last year, the sum of £5,653. In addition to the amount spent in renewals and improvements, there was expended during the year on ordinary maintenance the sum of £3,972. The shareholders would, therefore, recognise that they were steadily improving the condition of the undertaking and, in the course of a couple of years, they hoped to have raised it to the standard of any up-to-date tramway. The additions to the property account include a large double-bogie car which had proved so successful that four similar cars were now being built; and part of the outlay on the extensions to Washermanpet and Royapuram. The former extension was practically completed, and the latter was being pushed on as rapidly as possible. Having been in India in the latter part of last year, he took the opportunity of inspecting the tramway and of making himself conversant with the organisation generally. He considered the latter to be highly efficient and to reflect great credit upon the management. There was still a good deal to be done to the permanent way and rolling stock, but, as he had already said, the next few years would show a great improvement in that respect. He inspected the various parts of the city which had no tramway service, and he was satisfied that there was still plenty of scope for extensions if a concession could be obtained on reasonable terms. Negotiations were now proceeding for a diversion of their lines along Mount Road—the principal business thoroughfare in the city, which would prove a very useful extension. Unfortunately obstacles as to the cost of widening the roads and bridges had prevented a settlement being reached. He had, however, an interview with the Secretary to the Government (local and municipal), and was hopeful that a proposition which he submitted, and which was now under consideration, might prove helpful.

MR. J. GRAY seconded the motion, and the report was adopted.

### Bournemouth and Poole Electricity Supply Co., Ltd.

THE annual general meeting was held on Thursday last week at Moorgate Court, Moorgate Street, E.C., Mr. A. H. Sanderson presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 397), said that the reserve for depreciation amounted to £31,383. The capital expenditure showed a net increase of £7,749, after allowing for machinery written off during the year. That expenditure was less than in the previous year, when it was £9,256. The bulk of that expenditure had been for mains extension. Of the remaining items in capital account, £993 was in respect of meters, which were revenue-earning, and, as they were bought for new consumers, they formed a good and sound indication of the progress of the business. A further sum of £2,300 under the head of investments had been advanced to the Richmond (Surrey) Electric Light and Power Co., Ltd. Revenue from sale of current and rental of meters and indicators amounted to £52,228, as against £50,777 in 1910—an increase of £1,451 as compared with an advance of £570 in 1910. There was an increase of £120 in interest and dividends receivable, due to an enlarged return on their holding in the Richmond company. Trading account had been debited with much greater standing charges this year than before. Apart from its profits, which would certainly increase, that department was instrumental in many ways in developing the business. It was not the object of the directors to make large profits on trading account by cutting prices or competing unfairly with local electrical engineers and contractors, but to exhibit to the public the most artistic and efficient fittings and heating and cooking apparatus, and to afford reliable information, their primary objects being to develop the business and increase the number of consumers. The accounts showed an increase in rates and taxes which included an estimated amount

to provide for the Christchurch reassessment lately made. Since the report was issued there had been a readjustment which released £120 under that head, and the actual amount carried forward would be increased by that sum from the figure shown in the report. Turning to net revenue account, interest in debenture stock and temporary loans had increased by £269, through the enlargement of the loan from the bankers. Out of revenue they had written off £1,696 in respect of leasehold and special redemption funds, £637 from suspense account, and £5,000 for depreciation, a total of £7,334. Regarding the progress of the undertaking, the applications received during the year were equivalent to 535 KW., as compared with 402 in 1910, and the number of consumers connected with the company's mains at December 31st was 5,738, an increase of 449. The units sold showed a fair increase, and the division of the output was as follows:—Ordinary lighting, 52.5 per cent.; slot-meter supply, 2.8 per cent.; public lamps at Christchurch, 0.7 per cent.; heat and power, 10.3; traction 33.7 per cent. The revenue from supply of electrical energy to the Bournemouth Corporation tramways during the year had been disappointing, and showed a considerable decrease due to economies effected by the Corporation, and probably to improvements in the running conditions in relation to a large portion of the permanent way. The revenue from lighting showed an increase of £2,418. Income from heat and power was £2,674, or 17 per cent. more than in the previous year. The reduction of the heating rate by 25 per cent., or 1½d. per unit, had been much appreciated, and had doubtless been instrumental in bringing about the increase under this head. The use of the metallic-filament lamps had turned out to be a good friend in disguise, and he believed the time had passed when it could have any but a most beneficial effect on the revenue. As time went on he was sure it would more and more popularise electric lighting by cheapening its cost. The Richmond Co. had had a very satisfactory year, its revenue increasing by 10 per cent., while the applications for lamps showed an increase of 40 per cent. on the previous year. In the case of the Bournemouth and Poole Co., the undertaking had progressed steadily during the year, and its prospects for the coming year were most encouraging. In the year 1912 applications had so far been received amounting to 106 KW., an increase over the corresponding period of 1911 of 21 per cent.; the units sold were 727,055, an increase of 8 per cent.; the gross revenue receivable was £13,346, an increase of 9 per cent.; and the net revenue £7,952, an increase of 9 per cent. With regard to the coal strike, while it was impossible to say how long the strike might last, the general opinion was that it would not extend beyond a month or six weeks, and in that event the company had a sufficient stock of coal to carry it through without dislocation of its business.

DR. J. ATKINSON HOSKER seconded the motion, which was unanimously adopted without discussion.

Subsequently a resolution was unanimously agreed to increasing the remuneration of the directors from £1,000 to £1,050.

### Brompton and Kensington Electricity Supply Co., Ltd.

THE annual meeting was held on Thursday last at Winchester House, E.C., Mr. H. M. Beeton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 431), said he was pleased to say that the normal growth of their lighting business continued satisfactory. The number of additional consumers connected was above the average, though the number of lamps connected per consumer was naturally smaller than in the earlier years of the business. There was a tendency in Kensington, as elsewhere in London, for many large houses to be sub-divided into flats with the result that more people resided on the same site, and for a longer period of the year, thereby increasing the productivity of their area. The metal lamp continued to supersede the carbon lamp, though at a diminishing rate, and whilst the effect of that was to largely reduce the consumption of current per candle-power, the standard of illumination, encouraged by the more economic lamp, had been raised, and experience justified the assurance that that tendency would continue. On the other hand the demand for artificial light during the past year was restricted by more sunshine in summer, and less fog in winter than usual. The most satisfactory development, because the most promising, was the growth of the accessory demand for cooking and heating, which was largely attributable to the establishment of their showrooms and demonstration kitchen. They had had the benefit of the custom of the Earl's Court Exhibition during the past year, which was lost to them during 1910, and they hoped to continue to enjoy that in the current and subsequent years. The limited participation in the benefit derived from the metal lamp secured by the slight increase in charge for the smaller quantity of current required to furnish the same amount of illumination, had enabled the company to more than maintain its average price, notwithstanding the greater number of low-priced units supplied for cooking and heating. The combined effect of those various factors had been to secure an increased revenue of upwards of £4,000 during the past year. Turning to the expenditure side of the account, although they had sold upwards of 208,000 additional units the increase in expenses amounted to only £121, the cost per unit sold being reduced by 15d. That was in spite of a slightly higher price per ton paid for coal, and was due to the smaller fuel consumption attributable to the introduction of the turbine, of which they had had a limited benefit during the last half of the year. They proposed extending that type of plant to the point of re-modelling their station, in consequence of which their works cost in future



would more closely approximate to that of stations more favourably situated. The balance of net revenue for the year amounted to £30,700, which approximated closely to the record years of 1906 and 1907. The total capital expenditure during the year amounted to £2,565, after scrapping machinery of the net value of upwards of £6,000, caused by the replacement of three old and inefficient units of plant by the turbine plant to which he had referred. The effect of that policy, which they hoped to still further pursue, would be, so far as they could see, not only to enable them to accommodate in their existing station all the plant required to meet any possible demand which might be made upon them during their tenure, but to ensure an added value to their station and secure a larger capital return in the event of purchase. In that connection it was to be noted that the latest engineering practice went to show that the economies of very large and distant generating units were more than counteracted by the losses on transmission and transformation, and he was disposed to think that the time when a centrally situated station in a limited distribution area, such as they possessed, would be economically superseded, was indefinitely remote. If that anticipation should prove well founded, the result to their shareholders, who, with an unexpired tenure of 19 years, already possessed reserves equal to nearly 60 per cent. of their subscribed capital, was one which would be highly gratifying. How far that outlook might be justified was to form the subject of inquiry by a special committee of the L.C.C., which had been recently appointed to inquire into the situation arising out of the provision of the Electric Supply Acts of 1908 and 1910. Whatever other conclusions that committee might reach, it was safe to predict that it would demonstrate that the resistance of the companies to Brodingtonian power schemes, much as it cost them, was in the best interests of the public.

Referring to the coal strike, the CHAIRMAN said that that affected their business directly by raising the cost of their raw material, and indirectly by impairing the purchasing power of their consumers, and any prospects which could be predicted to-day must be largely subject to the course of events which the future might have in store for them in this regard. The directors, of course, foresaw the lamentable contingency, and they had on hand a stock of coal which should last them for any likely extension of the stoppage. Their supplies on the reopening of the mines would be secured under their current contracts. They enjoyed the services of a contented and devoted staff, with which they had been long associated, and if intimidation arising out of a general strike should ever deprive them of their services, they had made complete arrangements to carry on the business. Subject to exceptional misfortune, the progress of the business since the close of the accounts presented, encouraged him to anticipate sufficiently satisfactory results for the current year.

MR. W. R. DAVIES seconded the motion, and the report was adopted.

### South London Electric Supply Corporation, Ltd.

THE annual meeting of this company was held on Tuesday at the Cannon Street Hotel, E.C., Mr. J. Atherton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 431), said that during last year the number of lamps added to the circuits was the equivalent of 18,542 35-watt lamps, and the total lamp connections at the end of the year amounted to the equivalent of over a quarter of a million 35-watt lamps, the actual figure being 250,721 and the total units sold amounted to 4,479,487, as compared with 4,101,539 for the previous year, an increase of 377,948 units or 9·2 per cent., producing an increased revenue of £3,356. The costs of production had increased by just over £1,582, so that the gross profit has risen by nearly £1,774. The largest increase in expenditure had been in respect of rates owing to the assessment of the property having been increased at the last re-valuation. They had spent some £350 more than during the previous year on repairs to plant, due to the thorough over-hauling of one of the main engines. All other items of expenditure were about the same as for the previous year, but despite the increased cost per ton of coal, and the fact that they had sold nearly 400,000 units more, the increased cost was only £320, or two-tenths of a penny per additional unit sold. Adding together all the items of expenditure under the revenue account, the amount totalled £19,272, which worked out at 1·03d. per unit sold, or precisely the same cost per unit as in the previous year, and which figure was still one of the lowest attained by any of the companies supplying electricity in the Metropolis. The units sold last year were almost equally divided between the sales for lighting and for power purposes, and although the greater part of the increased output last year was for power purposes, the output for purely lighting purposes was now on the up grade, both as regarded the quantity consumed and the revenue obtained, so that he thought he might safely say that the influence of the metal-filament lamp in depressing their lighting revenue had now been overcome, and that they could confidently look forward to steady progress in sales of lighting units. With regard to the power supply side of the company's business, they last year sold nearly 2½ million units for this purpose, the horse-power of motors installed having increased by 550 during the year, making the total horse-power connected to the mains 4,000; since the end of last year, many new power consumers had been obtained, and negotiations were in progress with other power users to whom they hoped to supply large quantities of electrical energy in the near future, and in order to provide for this continual increase, more especially for power, they decided after careful consideration of an exhaustive report submitted to them by their engineer and manager to install a further turbine, complete

with condensing plant and auxiliaries, but instead of this extension being on the single-phase system to correspond with the whole of the Company's other generating plant, they had decided to change the system of generation from single to two-phase by re-winding some of the existing alternators and providing additional switchgear and cables. The cost of the whole of this work, including extension plant would be approximately £13,000, and they felt sure that when this system of supply was available, it would be readily taken advantage of by many of the larger manufacturers situated in various parts of their area of supply. The contract for the additional plant was let at the end of last year, and unless any unforeseen circumstances arose it would be ready for operation in the first week of September next, and the two-phase supply would then be immediately available for distribution. The capital expenditure during the past year amounted to £7,768, the greater part of which had been expended for extension of mains and for additional transformers and meters to meet the continuously increasing demand for supply. They had last year reconstructed their showroom at the generating station and reorganised their sales department, and the results so far had been satisfactory; the profit on the sale of goods during the year amounting to nearly £700, although the new department was only really at work for nine months of the year. The vital point in their undertaking was, of course, a ready supply of coal, a considerable stock of which they had accumulated, with the result, that although the strike had been in progress nearly three weeks, they were still in the satisfactory position of being able to maintain an undiminished supply from their generating station for several weeks to come, and, in fact, they considered they had taken such precautions that their stock of coal would outlast the strike. The total amount available for distribution was £26,245, and out of this sum they had provided £6,000 for depreciation on plant and machinery. The item for renewals on the other side of the depreciation account amounted to £3,238, and was for the replacement of one of their original wooden cooling towers, and for a complete new high-tension switchboard of the most modern construction to take the place of the original switchboard erected in 1899. This year they would still have to provide a further large amount for writing off the value of the first generating set which was installed in 1898. This plant had been dismantled and sold to make room for the new 2,000-kw. two-phase turbo-alternator; although this plant was only capable of an output of 250 kw., the advance in the construction of electrical generating plant had been so rapid, that in the room of the original set they would be able to easily install the 2,000-kw. turbo-alternator—that was to say, a generator eight times the output of the original plant.

COL. TATHAM, a shareholder, seconded the motion, which was adopted after a short discussion.

### South Wales Electrical Power Distribution Co.—

The directors' report states that the whole of the working expenses in connection with the company's undertaking being now borne by the Treforest Electrical Consumers Co., Ltd., there is, for the time being, no revenue account to be submitted. The directors report that, notwithstanding the disturbance and restriction of trade caused by strikes and labour troubles in South Wales during the past year, the result of the year's working to December 31st shows a material improvement over that of the previous year. The units sold (says the *Financier*) were 2,822,320 in excess of those sold in 1910, and after payment of all working expenses and interest on prior lien debenture stock, and making due provision for depreciation on new plant, there is a small surplus which, under the terms of the agreement with the debenture agent and the Treforest Co., has been added to the suspense account, which is being accumulated for the discharge of certain obligations to the members of the Treforest Co., particulars of which have been given in previous reports. The £30,000 prior lien debenture stock offered for subscription to the share and debenture stockholders of the company on March 23rd last was fully subscribed on the terms set out in the circular letter of that date, and this amount, together with the further capital which is being subscribed by the shareholders of the Treforest Co., is being called up from time to time as required, and utilised in extending the company's system and plant.

### London Underground Electric Railways Co.—

An adjourned meeting of the holders of 6 per cent. income bonds was held last week, when resolutions were submitted embodying acceptance of the scheme for the acquisition of the ordinary stock of the L.G.O. Co., and approving the draft supplemental trust deed for securing the creation of further income bonds. The chairman, Sir Algernon West, stated that over 90 per cent. of the stockholders of the L.G.O. had agreed to the scheme. The L.G.O. would within 10 days convene a meeting for the purpose of confirming the alteration to their articles of association, and by the end of the present month they hoped to be able to announce that the scheme had become binding.

### Winnipeg Electric Railway Co.—

The directors' report states, says the *Financier*, that the accounts for the year to December 31st show net earnings of \$1,110,573, after providing for all operating expenses, taxes, the City of Winnipeg's proportion of earnings, and other fixed charges. Out of these net earnings the directors declared four quarterly dividends amounting to \$690,000, leaving a surplus of \$420,573, which has been transferred to the credit of profit and loss account, making a total credit to this account at December 31st of \$1,616,773.

The directors have declared a quarterly dividend at the rate of 12 per cent. per annum, payable April 1st.



### City of London Electric Lighting Co., Ltd.

THE annual meeting was held on Wednesday last week at Winchester House, Old Broad Street, Mr. J. B. Braithwaite presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 395), said that the capital expenditure for the year was £45,814, compared with £50,338 in 1910. The continuous-current turbine mentioned at the last general meeting had been completed and put to work with the most satisfactory results. A third alternating-current turbine was now on order, in pursuance of the board's policy of replacing the old reciprocating plant by generators of the turbine type, and this new machine would be completed in time for next winter's requirements. The second portion of the economiser had been completed, and had had a marked effect on the working costs during the past winter. The duplication of the suction and discharge pipes in the river was proceeding satisfactorily, and would be completed shortly. The remainder of the year's capital expenditure was, of course, due to the normal extension of mains and meters required for the service to new customers and the additional demands of existing customers. The capital value of works demolished during the year was £47,274, as compared with £44,270. As he had stated, the company was deliberately pursuing the policy of replacing the old generating plant by turbines, and as each old generating set was removed its entire original cost was struck out of the capital account. Modern plant was cheaper to buy, and consequently, although the generating capacity of the station had been increased, and the value of the station as revenue-earning works greatly improved, the asset from the point of view of capital expenditure only had diminished. For these reasons the net capital expenditure at the end of 1911 showed a shrinkage of £1,460. The total reserves in hand had been increased by £6,471, notwithstanding the larger amount written off. The gross revenue had increased by £9,455, of which they had been able to retain £5,111 as net profit, the additional expenditure having amounted to £4,344. There had actually been a smaller expenditure upon generation and distribution, which fact reflected the greatest credit upon their technical staff. They had produced 1,500,000 more units than last year, and the cost of generating had gone down by £1,317. They had decided to raise the dividend on the ordinary shares from 7 to 8 per cent., and he was glad to say there was every prospect of that increase being maintained. Besides increasing the dividend, they had put £50,000 to reserve, and they were carrying forward considerably over £20,000. The most satisfactory feature of the year was the increase in the business, which was considerably more than in the previous year. There was, he was satisfied, still room for a considerable expansion, as he felt sure that electricity would continue to make its way in public favour for power, lighting and heating purposes. The coal strike was inducing many people to look to the possibilities of electricity for those purposes, and those persons who were using electricity at the present time were, no doubt, congratulating themselves that they were not affected by the coal strike. They had got sufficient coal to last them for a very long time, stored at their dépôt at Bankside.

MR. F. W. REYNOLDS seconded the motion, which was adopted.

### Metropolitan Electric Supply Co., Ltd.

THE annual meeting was held on Tuesday, at Winchester House, E.C., Mr. W. Harrison Cripps presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 433), said that at the end of 1910 the capital expenditure had amounted to £1,936,000 odd; it now amounted to £1,989,000, or an increase of £53,000 during the year. The revenue in 1910 was £172,000; last year it was £182,000, an increase of £9,800. The costs in 1910 were £78,200; last year they were £88,000, or an increase of £9,700. If they deducted the working costs from the income there was £94,600 left. The directors proposed this year to put by £17,000 to depreciation, which left a net revenue of £77,610. To that must be added interest on their various investments, which brought up the amount to £88,412. From that had to be deducted the debenture interest, the interest on the preference shares, and the interest on loans. After those deductions a balance was left of £42,356, which was available for ordinary dividend. Of that amount £20,000 was paid last August, and the directors proposed to pay a similar amount now, that was, at the rate of 4 per cent., carrying forward £2,356. As regarded the capital expenditure last year, it was somewhat more than the average of the past few years. It had been partly spent upon the development of their old district, but chiefly in the development of their new areas of Hanwell, Southall, Brentford, and to some small extent in Acton. Capital spent upon new districts could not expect to fructify immediately, it must require time, but he considered that the results from that capital were already good, and that they had got prospects of a good return upon it in the future. The capital required last year was obtained by the sale of £43,000 worth of their 3½ per cent. debentures, and they still had £146,000 of that issue left to draw upon from time to time if necessary. The gross revenue increased by £10,000 odd in the year. That in itself was, of course, satisfactory; but it was practically wiped out by the increase in their costs. That required some explanation. First of all, the coal cost was considerably more than in 1910. Then, again, when they opened a new district—Southall and Hanwell were opened last year—there was a considerable amount of standing charges which had to be made and provided for before any units were sold and

provided for. Naturally for the first few months they got no return at all. They were working that new district by a system which was entirely new to this country. It seemed to be an admirable system, and was introduced by Mr. Highfield, their engineer. It was started about nine months ago, and he could say, without any reservation, that it had worked without any hitch or hindrance day or night since the day it was started. That result, of course, was not obtained without a great deal of thought and a good deal of experimental work before it was got into condition. It was the high-tension direct-current system, and they had laid a cable, the copper in which was very thin, and which was capable of carrying the enormous voltage of 100,000 volts. When they first started a district there was, of course, comparatively little demand, but instead of using 100,000 volts, they began by working at a pressure of 2,000 or 3,000 volts; then as the load increased they could use 4,000, and so on, but as months ran on into years they could gradually work up to the full 100,000 volts; and at 100,000 volts the cable was capable of supplying 13,000-H.P., which was about 25 times the amount that was supplied to-day. They had got the cable laid and it would do 20 or 25 times the amount of work that was required of it at present. Turning to the rates, they had increased during the year by between £2,000 and £3,000, although the Company had had a diminished net income. The sting about the rates was not so much in the actual amount they had to pay, but the great costs which were involved in getting the rates diminished. Their mains ran through seven or eight different rating districts with the result that they had to fight each assessment separately, and much of the money which they eventually saved on the rates was spent in getting them down. A more unjust system could not be conceived. What ought to be done was to establish a single tribunal which should hear the case and adjust the whole matter. It was, however, extremely difficult to get anyone to take up this rating question. It would surprise them to learn that for every £8 they received in dividend the rating authorities received £3—something more than one-third. The shareholders ran all the risks, but they were absolutely unrepresented in the spending of the money. They knew a great deal of it was wasted, and the only person who represented their interests was the hall porter. A few words about their coal supply would be interesting. Early last year there was some threatened trouble in the coal districts, and at that time they laid in a considerable quantity of coal. They usually kept a fortnight's or three weeks' supply, but they then laid in a sufficient supply for six weeks. But as the strike became more within measurable distance, they still further increased the quantity, and when the day of the strike arrived on March 1st, they had, on a most careful estimate, sufficient to supply their customers without restrictions of any sort for 10 weeks. They thought that was a sufficient margin. If the strike should last beyond that time, it was quite obvious that it would no longer be a question of companies or individuals, but that it would be a vast national question, over which, as a company, they would have no control. They had increased the reserve fund this year by £2,000, and in one sense they had increased it at the other end by not taking out of it any of the undivided part of the Marylebone award, which they had put by as a nest egg for the equalisation of dividends. They thought it better to do this and pay only 4 per cent., and so put their reserve into a better condition. They were also carrying forward something like £1,500 more. The reserve fund now amounted to £277,000, which was a very handsome reserve. In conclusion, the Chairman paid a tribute to the staff, especially Mr. Highfield, the engineer, and the secretary, for their services, and to the workmen who, he said, were thoroughly loyal and contented.

SIR J. PENDER, Bt., seconded the motion.

The CHAIRMAN, replying to questions, said he did not like to prophesy, but he thought their future was extremely hopeful. In the year 1910 the increase in their connections was equivalent to 43,000 lamps. If the business was not progressive, they would have expected that to have remained stationary or to have diminished, but the actual improvement last year was 66,000 lamps, which included a large number in the new districts which had not yet become remunerative. With regard to the public lighting at Holborn, they now supplied half the district, and the gas company supplied the other half, which was a better arrangement than if each had tried to cut out the other by tendering at cost price. As to their concession, it ran in perpetuity. Nobody could touch a penny that they had spent at Willesden, and in their new areas they had got a 42 years' agreement. It was only after careful thought and deliberation that the board had come to the conclusion that in this particular year it would be better to advise the shareholders to accept a 4 per cent. dividend instead of a 5 per cent. and put part of the difference to the reserve fund.

The report was adopted.

**Huelva Gas and Electricity Co.**—The directors report that the net profit for the year 1911 amounts to £2,612, plus £3,125 brought forward. The directors recommend a dividend of 4 per cent., free of tax, and that there be written off for depreciation of gas and electric plant £1,300, leaving £825 to be carried forward, subject to directors' and auditor's fees. According to the *Financier*:—"In view of the miners' strike the directors considered postponing the declaration of any dividend out of the profits of last year, but decided that the year 1911 should be kept by itself. Coal has had to be bought, however, for present shipment to Huelva, at prices which will seriously affect the results of the current year, and the directors think it well to give this intimation to the shareholders."



**Guildford Electricity Supply Co., Ltd.**

THE directors' report for the year ending December 31st, 1911, states that the company again made very satisfactory progress, the gross receipts being £8,679, as compared with £7,885 for the year 1910, thus showing an increased revenue of £794. The accounts show that there is a balance on the revenue account of £3,303 (after crediting depreciation fund account with £1,000) as compared with a balance of £3,445 (after crediting depreciation fund account with a like amount) on the revenue account for 1910. After making due provision for debenture interest, dividend on preference shares, &c., and the placing of £400 to the credit of reserve fund account, the net revenue account shows a balance of £988 for distribution. Out of this sum the directors recommend the payment of a dividend at the rate of 5 per cent., less tax, for the past year on the ordinary share capital of the company, which will absorb £701, thereby leaving a balance of £286 to be carried forward. The following table shows the progress of the company's business during the past three years:—

Year.	No. of connections.	Total revenue.	Total costs.	Gross profit.
1909 ..	744	£7,490	£3,198	£4,292
1910 ..	807	£7,885	£3,441	£4,444
1911 ..	874	£8,679	£4,376	£4,303

	1911.	1910.
Units sold—Lighting ..	295,930	275,160
Power and heating ..	256,515	201,276
Total sold ..	552,445	476,436
H.P. of motors connected ..	553	469
Total number of connections	874	807

Mr. C. W. Dixon was elected a director in December last to fill the vacancy caused by the retirement of Mr. E. E. Pullman.

**Salisbury Electric Light and Supply Co., Ltd.**

THE directors' report for the year ended December 31st, 1911, states that the generating plant was sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £325 brought forward from last account, amounted to £6,340, and after paying £1,390 interest on debentures and an interim dividend at the rate of 4 per cent. for the half year, amounting to £700, there remained a balance of £4,249. The directors recommended that a further dividend at the rate of 8 per cent. for the half year be paid, making with the interim dividend, 6 per cent. for the year, and that £2,400 be carried to reserve, leaving £449 to be carried forward. The annual meeting was held on March 12th, when the report was adopted and the dividend declared.

	1909.	1910.	1911.
Units generated ..	630,618	651,548	684,297
Quantity sold—Public lamps ..	10,200	10,200	6,120
Private consumers by meter ..	513,843	529,958	559,832
Total ..	524,043	540,158	565,952
Used on works ..	53,848	57,480	61,704
Total used ..	577,891	597,638	627,656
Expended in distribution ..	52,727	53,910	56,551
Public lamps ..	33	33	33
Total maximum supply demanded ..	332 kw.	321 kw.	318 kw.

**Diesel Engine Co., Ltd.**—The following circular has been issued by the secretary to the shareholders: "With a view to the enlargement of the scope of this company's business and the enhancement of the value thereof, the board have, for some time past, had on hand important negotiations, which are expected to eventuate in a few days in a completed scheme. With this in view it has been necessary to have the company's assets examined, and expert advice has been taken of their value. On the basis of the figures furnished by the experts it would appear that the value of the shares is—including current dividends—preference shares par, and ordinary shares 3s. 4d. each. My board has thought it right to inform you of this, and to intimate the negotiations on hand, and I am directed to state that the shareholders will be called together at the earliest possible date to consider the proposed new arrangement, which, in the opinion of my board, there can be no doubt will be highly satisfactory and beneficial to the shareholders."

**Newmarket Electric Light Co., Ltd.**—The directors' report for the year ended December 31st, 1911, states that the equivalent of 1,051 33-watt lamps have been connected to the mains, making the total at the end of 1911 27,039 lamps. Applications for a further 224 lamps have been received this year. The whole of the works have been maintained in perfect working order. The profit on the year's working, added to £58 brought forward from the last account, amounts to £2,480, which, after providing for debenture and other interest, £757, leaves a balance of £1,723. The directors recommend the payment of a dividend of 4 per cent.; that £650 be carried to reserve for renewal of plant, and that the balance be carried forward. The directors regret the death of their chairman, Mr. G. H. Verrall, last year. Mr. H. J. Garrod was elected chairman in his place for the remainder of the year, and Mr. George Blackwell, of Newmarket, was elected a director.

**Isle of Wight Electric Light and Power Co., Ltd.**—The directors after paying interest on debentures and loans, also the preference dividend (5 per cent.), recommend that the remaining £7,614 be disposed of as follows:—1 per cent. dividend on the ordinary shares, £3,500 to renewal fund account, £1,000 to reserve, carrying forward £2,115.

**British Insulated and Helsby Cables, Ltd.**

THE directors' report for the year ended December 31st, 1911, states that the profit for the year amounts to £188,259, plus the balance brought forward, £42,320, making £230,579. From this have to be deducted directors' and debenture trustees' fees, and remuneration to Works Committee, £5,316; interest on first debenture stock, £22,500; interest on second debenture stock, £8,112; depreciation on buildings, plant, machinery, &c., £20,000; transfer to reserve account, £10,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; balance of commission on issue of second debenture stock, £7,500; dividend on preference shares to December 31st, 1911, £30,000; interim dividend on ordinary shares to June 30th, 1911, £20,000, leaving available for dividend a balance of £93,651. The directors recommend the payment of a further dividend of 6s. per share on the ordinary shares, making, with the interim dividend already paid, a total of 10 per cent. for the year ended 31st December, 1911, £30,000, carrying forward £63,651. There has been an increased turnover during the year, owing in large measure to better trade conditions, and this has resulted in £44,954 more profit being earned than in the previous year. A sum of £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £10,000 to reserve account, £20,000 applied to depreciation on buildings, plant and machinery, and £7,500 (the balance outstanding) written off commission on issue of second mortgage debenture stock, the amount carried forward being £63,651. The company's Liverpool works and business were sold at the end of last year to a new company named the Automatic Telephone Manufacturing Co., Ltd. From the prospectus (a copy of which was posted to each shareholder when issued in November last), it would be seen that this company had guaranteed the payment of the dividend on the 200,000 preference shares of that company, which guarantee will continue until the general reserve fund of the Automatic Telephone Co. amounts to £100,000.

The meeting is called for March 25th.

**County of Durham Electrical Power Distribution Co., Ltd.**

THE directors' report for 1911 shows that the total connections to the company's system at the end of the year (including the connections of its associated Parliamentary company, the County of Durham Electric Power Supply Co.) amounted to 43,525 H.P., which, compared with the previous year's figure of 39,070 H.P., show an increase 4,455 H.P. The profit for the year amounts to £32,031 (an improvement over the previous year of £3,325), plus £158 brought forward, making £32,189, against which has been charged interest on loans and debenture stock, £13,527, leaving an available balance of £18,662. A dividend of 5 per cent. for the year on the preference shares absorbs £12,500; there is transferred to depreciation account £6,000, and carried forward £162. The expenditure on capital works during the year has been £12,597, of which £5,004 represents the outlay on the company's account, and £7,594, the outlay on behalf of this company's associated company, the County of Durham Electric Power Supply Co., for which this company receives shares therein.

The meeting is called for March 27th.

**Galloways, Ltd.**—According to a financial contemporary the directors report that, after transferring £5,182 to depreciation, the profit for 1911 was £1,606. Debenture interest and special non-recurrent loss entailed a net deficiency of £6,070, increasing the debit at profit and loss to £26,138.

**Liverpool District Lighting Co., Ltd.**—The directors have declared a dividend at the rate of 4 per cent. per annum for the half-year ended December, 1911.

**Prospectus.**—*County of London Electric Supply Co., Ltd.*—The list opened yesterday, and is to close to-day, in an issue of 19,000 ordinary shares of £10 each. We understand that the entire amount will be taken up by existing holders.

**STOCKS AND SHARES.**

Tuesday Evening.

THE feature this week in the markets with which we deal is the series of rises amongst London Electric Lighting Companies' shares. It is an ill wind that profits nobody, and the coal strike—the cause of so much misery, unhappiness and inconvenience to the community—has, at all events, been one ostensible reason why these electric lighting shares have risen so substantially. Another noticeable feature is the remarkable rise in Central London Railway stocks, the Deferred especially being favoured, while Undergrounds, as a whole, continue in high favour.

The lead to the Lighting market was supplied by City of London Ordinary, the price mounting to 19 on Friday last, against 15 a few days previously, the latter price in itself representing a material improvement since the beginning of the year. To justify this jump, the story was re-affirmed to the effect that the Corporation of London intended to buy out the City of London Electric Lighting Company, a rumour which we referred to, of course, last week.



Denial has been as strenuous as re-affirmation, and colour is lent to the suggestion by the fact that if the Corporation takes no steps in 1914, the London County Council can come in as the purchasing authority in 1931. As brotherly love between these two bodies is at a heavy discount, it is maintained by some people that the Corporation is certain to exercise its right—and perhaps even earlier than in 1914. The price of 18 is, it must be admitted, a fairly tall one in any circumstances: though if the Corporation were intent upon buying at all costs, conceivably the current quotation would be found warranted by the course of events. Even this (Tuesday) afternoon a single line of 250 shares changed hands at 18.

Another important consideration, however, in connection with these London companies is that some manufacturers are said to be changing—or thinking of changing—their plant from steam to electrically-driven machinery. There can be little doubt that the coal strike will make steam-users look round for some other motive power upon which they can fall back if coal fails them, and so the report just mentioned gained a ready hearing, if not entire credence. At any rate, it proved quite broad enough base upon which to ground further optimism in respect of lighting shares; and although in good quarters this security for the rise is considered very sketchy, the Stock Exchange market is more buoyant than it has been for a long time past.

County of London shares proved a good second to Cities, and the price of the Ordinary is up 30s. on the week, allowing for deduction of the dividends. If, says rumour, the City Company is going to be taken over by the Corporation, efforts may possibly be made to acquire portions, at all events, of the County Company and the Charing Cross Company, and on the strength of these suppositions quotations have been raised in each case. The market, however, is a difficult one, in illustration of which we may cite the fact that a broker had an order a day or two ago to buy 100 Charing Cross, and he was not able to get more than quarter of his shares, dealers simply refusing to offer them at all. Westminster rose £1 to 9½, but this price tempted sellers, and it fell back to 9. St. James's put on ½. Chelseas recovered the dividend. Metropolitan and London Preference both gained ½, and the market all round has been strong. It would be a little remarkable, in these circumstances, if some of the companies were able to resist the temptation to offer fresh capital to their shareholders, for they have had little chance of doing so during the past few years, and no doubt several of them can do with extra money for extensions and so forth. Indeed, it is quite probable that the County of London Company will be in the field with a fairly large issue within the next day or two, and other companies are likely to follow its example. Apart from the reasons given above for the animation in these London shares, it is, of course, a fact (which readers of these notes will readily appreciate) that prices fell to an unduly low level, from which a reaction was certainly to be expected; but whether the recognition of this has not been carried far enough during the rise of the last week or two can best be judged by those in closer touch with the industry itself than a mere writer of financial notes can be.

Central London Deferred has risen no less than 17 points. The Ordinary gained 9 and the Preferred 1, buying having been stimulated by reports that the company is about to be included in the Underground fusion of interests, while another report declared the London and South-Western Railway to be making overtures to the Central London in respect of the Thames Valley extensions contemplated by both companies. Considering that it takes a modicum of buying or selling to cause big movements in the prices of the stocks, the rises are, perhaps, less extraordinary than they appear on the surface. But official statements are eagerly awaited, and, in the meantime, some people are taking advantage of the rise to clear out of stock which they bought much more cheaply. City and South London Ordinary regained its three-point fall of last week, and has spurred to 38 again; while Metropolitan at 58½, and Districts at 37 both show good rises. Underground Electric Railway shares put on ½ and the income bonds gained 5. In view of the excellent services which the Underground have managed to maintain up to the present, no doubt public imagination has been attracted by reason of the contrast afforded by the steam lines. British Electric Traction Preferred stocks are a little easier.

Telegraph stocks and shares are still a little bit fearful of the Marconi competition, and although in one or two cases there are slight recoveries, the market on the whole is dull. Marconis themselves are without nominal change on the week at the time of writing, but Canadian Marconis, in which the special settlement is taking place, have jumped up from 27s. 6d. to 33s. 3d. Spanish Marconis have been somewhat neglected at 1½. West India and Panama shares have steadied to 4½, and Anglo "A" fell ½ again. Amongst Telephone issues, American Telephone capital stock rose 2, National Telephone Deferred lost 1½, and United River Plate Telephones are ½ higher. Business in this department, however, is very quiet.

The Manufacturing group is almost equally quiet. Babcocks are nominally easier, but Castner-Kellners hardened to 3½; and Callenders Cable braced up 10s. to 9½. On the other hand, Willans and Robinson Preference lost their recent rise, and fell back to 20s.

Amongst the Latin-Canadian issues, the news from Mexico is still very mixed, but there seems to be an impression that the worst is over and that the revolutionaries will soon settle down. Consequently, Mexico Trams regained 2, and recoveries have occurred in Mexican Light and Power issues and Mexico Electric Lighting bonds. The feature perhaps in this section is a rise of 4 points in Shawinigan Water on dividend prospects. Calcutta Trams are a good market with a ½ rise, and Sao Paulo, ex their dividend, are up to 200. The market is very steady, and there is a good demand for most of the bonds.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen .. ..	Mar. 3	2,627	+ 54	41	60,909	+ 3,459	14.4	..
Ayr .. ..	" 16	389	+ 19	44	13,103	+ 160	8	..
Bath .. ..	" 16	1,398	+ 66	11	7,407	+ 307	14.75	..
Birkenhead .. ..	" 17	2,178	+ 174	50	57,187	+ 2,228	13.68	..
Birmingham Corp.	" 9	20,891	+ 6,516	49	412,023	+ 101,818	56.4	..
Blackburn .. ..	" 18	1,942	+ 54	50½	57,367	+ 4,512	14.62	..
Blackpool Corp. ..	" 14	820	— 65	..	63,213	+ 7,771	11.87	..
Blackpool-Fleetw'd	" 16	610	+ 128	10	2,936	+ 247	8	..
Bournemouth .. ..	" 13	3,076	+ 317	50	87,705	+ 1,429	21.95	..
Bradford .. ..	" 9	9,968	— 10	49	266,839	+ 15,421	56	1.2
Brighton .. ..	" 17	1,540	+ 49	33	50,537	+ 2,742	9.5	..
Bristol .. ..	" 15	12,046	+ 1,212	11	66,142	+ 6,063	30.5	..
Brit. Elec. Trac. Co.								
Airdrie .. ..	" 8	563	+ 130	10	2,654	+ 592	3.65	..
Barnsley .. ..	" 8	337	— 23	..	1,760	+ 117	..	..
Barrow .. ..	" 8	661	+ 164	..	2,971	+ 750	5.87	..
Devonport .. ..	" 8	1,008	+ 133	..	4,766	+ 646	8.85	..
Gateshead .. ..	" 8	2,039	+ 21	..	9,771	+ 135	11.25	..
Gravesend .. ..	" 8	389	+ 24	..	1,890	+ 191	6.5	..
Greenock .. ..	" 8	1,502	+ 227	..	6,707	+ 932	7.25	..
Hartlepool .. ..	" 8	478	+ 48	..	2,250	+ 220	6.72	..
Kidderminster .. ..	" 8	190	+ 17	..	874	+ 75	..	..
Leamington .. ..	" 8	272	+ 3	..	1,374	+ 77	..	..
Merthyr .. ..	" 8	335	+ 1	..	1,855	+ 79	2.9	..
Metropolitan .. ..	" 8	16,984	+ 914	..	79,389	+ 6,264	22	..
Middleton .. ..	" 8	595	+ 11	..	2,654	— 43	8.5	..
Mid. Joint Com'tee	" 8	6,228	+ 281	..	28,412	+ 823	..	..
Oldham—Ashton ..	" 8	1,122	+ 50	..	5,248	+ 266	9.13	..
Peterborough .. ..	" 8	238	+ 30	..	1,104	+ 155	6.31	..
Potteries .. ..	" 8	3,764	— 142	..	18,777	+ 648	29	..
Rothsay .. ..	" 8	10.	+ 14	..	485	+ 64	2.75	..
Southport .. ..	" 8	497	+ 35	..	2,217	+ 22	8.17	..
S. Metropolitan ..	" 8	1,461	+ 37	..	6,636	+ 137	..	..
Swansea .. ..	" 8	2,253	+ 122	..	10,616	+ 552	12.5	..
Tynemouth .. ..	" 8	306	— 6	..	1,328	— 92	3.75	..
Weston-s-Mare .. ..	" 8	51	+ 16	..	252	+ 88	3	..
Worcester .. ..	" 8	496	+ 10	..	2,286	+ 62	5.75	..
Wrexham .. ..	" 8	192	+ 11	..	897	+ 59	..	..
Yorks. Wool. Dist.	" 8	2,092	+ 131	..	9,931	+ 350	17	..
Miscellaneous .. ..	" 8	428	+ 38	..	1,985	+ 93	..	..
Burnley .. ..	" 16	2,785	+ 868	..	..	..	11.73	..
Burton-on-Trent ..	" 17	520	+ 45	50	14,306	+ 764	6.6	..
Bury .. ..	" 17	2,502	+ 281	50½	63,615	+ 4,863	22.5	..
Cardiff .. ..	" 16	4,360	— 12	50	121,604	+ 8,543	17.35	..
Chatham and Dist.	" 7	1,694	+ 32	10	7,309	— 5	14.98	..
Cork .. ..	" 14	1,080	+ 46	11	4,529	+ 10	9.89	..
Croydon .. ..	" 1	1,682	+ 107	48	85,236	+ 5,539	11.6	75
Darlington .. ..	" 16	420	+ 25	51	11,225	+ 1,027	4.87	..
Darwen .. ..	" 15	602	+ 54	50	13,247	+ 873	4.36	..
Dover .. ..	" 9	391	+ 43	49	12,190	+ 1,591	4.75	..
Dublin .. ..	" 15	10,705	+ 612	..	56,283	+ 3,449	54.25	..
East Ham .. ..	" 16	2,164	+ 209	50	55,235	+ 3,677	7.87	..
Exeter .. ..	" 15	547	+ 24	50	16,682	+ 1,051	5.5	..
Glasgow .. ..	" 16	57,676	+ 1,779	..	780,122	+ 42,074	98	25
Hastings .. ..	" 14	1,512	+ 35	..	..	+ 271	19.3	..
Huddersfield .. ..	" 16	3,710	+ 217	44	95,622	+ 8,028	29.5	1
Hull .. ..	" 16	5,871	+ 339	50	147,747	+ 8,435	14.5	..
Ilkeston .. ..	" 14	204	— 33	50	6,486	+ 114	3.8	..
Ipswich .. ..	" 16	695	+ 30	50	21,626	+ 1,127	10.5	..
Kilmarnock .. ..	" 9	289	+ 8	43	6,984	+ 468	4.25	..
Lancashire United	" 13	2,847	— 101	11	12,674	+ 135	39	..
Leeds .. ..	" 16	14,117	+ 838	50	376,779	+ 24,838	57.5	..
Leicester .. ..	" 16	5,000	+ 511	..	..	..	20	..
Leith .. ..	" 9	604	+ 38	42½	27,559	+ 2,128	8.72	..
Liverpool .. ..	" 9	23,270	+ 790	9½	113,464	+ 6,382	116	..
L.C.C. .. ..	" 6	86,401	+ 2,443	..	2,128,585	+ 104,037	139.5	3
London United ..	" 16	11,058	+ 184	11	58,129	+ 980	..	..
Lowestoft .. ..	" 16	259	— 2	24	3,823	+ 35	8.5	..
Manchester .. ..	" 16	33,303	+ 3,230	50	813,845	+ 44,698	105	..
Newcastle .. ..	" 16	8,367	+ 376	..	214,799	+ 15,669	31.3	..
Newport .. ..	" 9	1,336	+ 15	49	34,540	+ 1,143	7.25	..
Oldham .. ..	" 17	3,925	+ 223	51	98,419	+ 4,458	23	..
Pontypridd .. ..	" 16	673	— 107	50	20,611	— 90	5.5	..
Portsmouth .. ..	" 16	3,460	+ 182	50	107,289	+ 7,384	15.25	..
Preston .. ..	" 13	1,443	— 12	50	38,814	+ 2,623	10	..
Rotherham .. ..	" 14	1,210	— 79	45½	31,312	+ 2,467	12	..
Salford .. ..	" 18	9,551	+ 706	50½	244,537	+ 10,267	41	..
Sheffield .. ..	" 19	12,221	+ 141	51	330,847	+ 20,181	40	..
Southampton .. ..	" 13	2,182	+ 212	50	61,104	+ 7,093	11	..
Southend-on-Sea ..	" 13	1,030	+ 148	50	33,067	+ 5,208	7	..
South Shields .. ..	" 16	1,101	+ 55	50	31,025	+ 3,175	10.25	..
Swindon .. ..	" 13	883	+ 82	11	4,373	+ 250	11	..
Tyneside .. ..	" 16	2,243	+ 377	50½	54,747	+ 6,719	8.72	..
Wallasey .. ..	" 16	1,341	+ 108	50	36,862	+ 2,286	9	..
Walthamstow .. ..	" 7	2,598	+ 152	49	132,901	+ 11,509	15.25	..
West Ham .. ..	" 13	1,883	+ 111	50	49,078	+ 2,277	13.75	..
Wolverhampton ..								
Cen. London Rly. ..	" 16	9,723	— 1,041	11	55,628	— 3,750	6.82	..
City & S. Lon. Rly.	" 17	6,594	— 249	11	87,249	— 1,012	7.26	..
Dublin-Lucan Rly. ..	" 15	293	+ 1	11	1,118	+ 1	7	..
G.N. and City Rly. ..	" 16	8,856	+ 163	11	18,778	+ 1,205	3.5	..
L'pool Overh'd Rly. ..	" 17	2,918	+ 191	11	16,260	+ 1,155	6.6	..
Llandudno-Col. Bay	" 15	298	+ 20	15½	2,057	+ 189	6.5	..
Lond. Elec. Ry. Co. ..	" 16	28,795	+ 255	11	163,395	+ 7,115	21.25	..
Mersey Railway .. ..	" 16	8,991	— 128	11	22,710	+ 864	4.5	..
Metropolitan Rly. ..	" 17	81,499	— 1,783	11	186,032	— 166	25.75	..
Met. District Rly. ..	" 18	25,099	+ 597	11	189,561	+ 7,189	25	..
Anglo-Argentine ..	" 11	111,453	+ 9,899	10	513,878	+ 21,874	..	..
Amekland .. ..	Feb. 9	17,810	+ 1,294	..	137,109	+ 11,043	23.8	..
Bombay (B.E.T.) ..	Mar. 16	6,873	+ 452	7	20,568	+ 1,773	..	..
Brisbane .. ..	Feb.	6,700	— 1,975	8	23,734	— 1,101	..	..
Brit. Columbia Rly. ..	..	..	..	..	..	..	..	..
Calcutta .. ..	Mar. 16	8,008	+ 800	..	..	+ 5,814	..	..
Cape Electric T.Ld. ..	..	..	..	..	..	..	..	..
Kaloorlie, W.A. ...	Feb.	2,684	..	8	5,568	..	20.5	..
Lisbon .. ..	..	..	..	..	..	..	..	..
Madras .. ..	Mar. 15	1,581	— 141	10	7,738	+ 190	..	..
Montevideo .. ..	Feb.	85,621	+ 5,224	4	125,833	+ 13,837	..	..
Perth (W.A.) .. ..	Mar. 15	3,751	+ 506	11	20,718	+ 3,091	29	..

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 19th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations March 19th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	8½—9½	..	5 18 11	Kensington & Knightsbridge, Ord	5	9	9	6½—7½ xd	..	6 6 4
Do. 4½ % Pref. ...	10	4½	4½	8½—9½	..	4 14 9	Do. 4 % Deb. ...	Stock	4	4	92—95	..	4 4 3
Do. Second 6 % Pref. ...	10	6	6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ...	Stock	4½	4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½	4½	10½—102	..	4 8 3	London Electric, Ord. ...	8	2	2½	1½—2	+ ½	2 15 0
Brompton & Kensington, Ord...	5	10	9½	8½—9	..	5 11 1	Do. 6 % Pref. ...	5	6	6	4½—5½	+ ½	5 14 8
Do. 7 % Cum. Pref. ...	5	7	7	7½—8½	..	4 4 10	Do. 4 % First Mort. Deb. ...	Stock	4	4	90—93	..	4 6 0
Central Electric Supply, 4 %	100	4	4	98—101	..	8 19 3	Metropolitan ...	5	5	4½	3½—4	+ ½	6 5 0
Quar. Deb. }							Do. 4½ % Cum. Pref. ...	5	4½	4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5	5	4½—4½ xd	+ ½	5 8 1	Do. 4½ % First Mort. Deb. ...	Stock	4½	4½	99—104	..	4 6 7
Do. 4½ % Cum. Pref. ...	5	4½	4½	4½—4½	..	5 0 0	Do. 8½ % Mort. Deb. ...	Stock	3½	3½	84—87	..	4 0 6
Do. " City Undertaking "	5	4½	4½	8½—4½	+ ½	5 2 10	Midland Electric Corporation	100	4½	4½	96—98	..	4 11 10
4½ % Cum. Pref. }							4½ % First Mort. Deb. }						
Do. Do. 4 % Deb. ...	100	4	4	93—96	..	4 3 4	Newcastle-on-Tyne ...	5	4	4½	8½—4	..	5 0 0
Chelsea, Ord. ...	5	5	5	4½—5 xd	+ ½	5 0 0	Do. 5 % Pref., Non-Cum. ...	5	5	5	4—4½	..	5 11 1
Do. 4½ % Deb. ...	Stock	4½	4½	98—101	..	4 9 1	North Metropolitan Power Sup-	100	5	5	99—102	..	4 13 0
City of London, Ord. ...	10	7	8	17—19 xd	+ 3½	4 4 3	ply, 5 % Mortgages (Red.) }						
Do. 6 % Cum. Pref. ...	10	6	6	13½—15½ xd	+ 2½	3 19 2	Notting Hill, 6 % Non-Cum.	10	..	..	10—11	..	5 9 1
Do. 5 % Deb. ...	Stock	5	5	117—121	..	4 2 8	Pref. }						
Do. 4½ % Second Deb. ...	100	4½	4½	100—103	..	4 7 5	Oxford ...	5	7½	7½	5½—6½ xd	..	5 13 9
County of Durham, 5 % First	Stock	5	5	87—89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10	10	8½—8½	+ ½	5 13 0
Mort. Deb. }							Do. 7 % Pref. ...	5	7	7	6½—7½	..	4 16 7
Connty of London, Ord. ...	10	5	6	10½—11½ xd	+ 1½	5 4 4	Do. 8½ % Deb. ...	100	8½	8½	85—87	..	4 0 6
Do. 6 % Pref. ...	10	6	6	11½—11½ xd	+ ½	5 2 2	Smithfield Markets, Ord. ...	5	Nil	2	1½—1½	..	..
Do. 4½ % Deb. ...	Stock	4½	4½	107—109	..	4 2 7	South London, Ord. ...	4	5	5	2½—9½	..	6 3 1
Do. 4½ % Second Deb. ...	Stock	4½	4½	101—104	..	4 6 7	Do. 5 % First Mort. Deb. ...	100	5	5	99—102	..	4 13 0
Edmundson's, Ord. ...	5	Nil	Nil	3½—8	..	Nil	South Metropolitan, 7 % Pref. ...	1	7	7	1—1½	..	6 4 5
Do. 6 % Cum. Pref. ...	5	Nil	Nil	2½—3½	..	Nil	Do. 4½ % First Mort. Stock ...	100	4½	4½	97—100	..	4 10 0
Do. 4½ % First Mort. Deb. ...	100	4½	4½	86—89	—1	5 1 2	Urban, Ord. ...	5	5	..	1½—3	..	..
Folkestone ...	5	6	6½	4½—5	..	6 0 0	Do. 5 % Cum. Pref. ...	5	5	..	2½—3½	..	..
Do. 5 % Cum. Pref. ...	5	5	5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb. ...	100	4½	4½	87—89	..	5 1 2
Do. 4½ % First Deb. ...	100	4½	4½	93—96	..	4 13 9	Westminster, Ord. ...	5	10	10	8½—9½	+ ½	5 5 3
Hove ...	5	9	9	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref. ...	5	4½	4½	5—5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ...	5	6	6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5	5	88—90	..	5 11 1
Calcutta, Ord. ...	5	8½	7½	6½—7	..	6 1 5	5 % 1st Mort. Deb. }						
Do. 5 % Pref. ...	5	5	5	5—5½	+ ½	4 15 3	Montreal, Lt., H. and Power ...	\$100	7	8	192—197	..	3 11 1
Calgary Power, 1st Mort. Bds.	100	5	5	92½—94½	..	5 5 8	Northern, Lt., Power and Coal, }	\$500	5	..	39—41	..	12 3 10
Canadian Gen. El. Com. ...	\$100	7	7½	115—119	+ 1	5 17 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. ...	\$100	7	7	116—120	..	5 16 8	River Plate, Ord. ...	Stock	10	..	248—258	..	3 17 6
Cordoba Lt., Power and T., Ord.	1	3	3½	8—1	..	3 0 0	Do. 6 % Non-Cum. Pref. ...	Do.	6	6	110—115	..	5 4 4
Do. 5 % Deb. ...	100	5	..	96—99	..	5 1 0	Do. 5 % Deb. Stock ...	Do.	5	5	101½—103½	..	4 16 7
Elec. Lt. and P. of Cochabamba, }	100	6	6	92—94	..	6 7 8	Roy. Elec. Co., Montreal, 4½ % }	100	4½	4½	101—103	..	4 7 5
6 % Bonds }							1st Mort. Deb. }						
Elec. Supply Victoria, 5 % 1st	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital ...	\$100	4	5½	133—135	+ 4	3 14 1
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	108—110	+ 1	4 11 0
Elec. Dev. Ontario, 5 % 1st	\$500	5	5	93—95	+ ½	5 5 3	Do. 4½ % Per. Deb. ...	Stock	4½	4½	103½—105½	..	4 5 4
Mort. Bonds }							Toronto Power, 4½ % Deb. ...	Do.	4½	4½	99½—101½	..	4 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1½—1½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ...	1	6	6	1½—1½	..	8 0 0	1st Mort. Deb. }						
Kaministiquia Power, 5 % G. Bs.	\$500	5	5	108—110	..	4 11 0	Victoria Falls Power, Pref. ...	1	Nil	11½d.	1½—1½	..	..
Madras, Ord. ...	5	..	..	2½—3½	..	..	West Kootenay Power and Lt., }	100	6	6	104½—106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102—105	..	4 15 3	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84½—86½	+ ½	5 15 7							
Mexican Lt. & Power, Common	\$100	4	4½	84—86	+ 2	4 13 0							
Do. 7 % Cum. Pref. ...	\$100	7	7	105—107	+ 1	6 10 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½—96½	+ ½	5 3 8							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ...	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ...	1	6	6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ...	Stock	5	5	97½—99½	..	5 0 6	Do. 5 % Pref. ...	1	5	5	1½—1½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8½	150—152	+ 2	5 5 3	National Telephone, Pref. ...	Stock	6	6½	99½—102½	..	5 17 1
Do. Collat. Trust ...	\$1000	4	4	94—96	..	4 3 4	Do. Def. ...	Do.	6	6½	125½—127½	—1½	4 14 1
Anglo-American Telegraph ...	Stock	3½	8	66—68	..	4 3 6	Do. 6 % Cum. 1st Pref. ...	10	6	6	9½—10	..	6 0 0
Do. 6 % Pref. ...	Do.	6	6	116½—111½	+ ½	5 7 10	Do. 6 % Cum. 2nd Pref. ...	10	6	6	..	..	6 0 0
Do. Def. ...	Do.	30/-	80/-	25½—25½	— ½	5 16 6	Do. 5 % Non-cum. 3rd Pref. ...	5	5	5	5½—5½	..	4 15 3
Anglo-Portuguese Tel., 5 % }	100	5	5	100—102	..	4 18 0	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	— ½	4 6 9
Mort. Deb. }							Oriental Telep. and Elec. ...	1	8	..	1½—1½	..	4 11 5
Chili Telephone ...	5	7	..	7½—7½	..	4 13 4	Do. 6 % Cum. Pref. ...	1	6	6	1½—1½	..	4 16 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86—88	..	4 10 11	Do. 4 % Red. Deb. ...	Stock	4	4	87½—89½	..	4 9 5
Cuba Telegraph ...	10	6	6½	9½—10½	— ½	5 11 7	Pacific and European Tel., 4 % }	Do.	4	4	98½—100½	..	3 19 7
Do. 10 % Pref. ...	10	10	10	17—18	..	5 11 1	Guar. Debs. }						
Direct Spanish Telegraph, Ord.	5	4	4½	3½—3½	..	5 6 8	Reuter's ...	8	5	5½	10½—11½	..	3 10 11
Do. 10 % Cum. Pref. ...	5	10	10	8—8½	..	5 17 8	Submarine Cables Trust ...	Cert.	6	6	130—133	..	4 10 3
Do. 4½ % Debs. ...	50	4½	4½	99—101	..	4 9 1	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	99—101	..	4 9 1
Direct United States Cable	10	4½	..	7½—7½	+ ½	5 14 3	Deb. Red. }						
Direct W. India Cable, 4½ % }	100	4½	4½	99—101	..	4 9 1	United River Plate Telephone	5	8	8	7½—7½	+ ½	5 3 3
Reg. Deb. }							Do. 5 % Cum. Pref. ...	5	5	5	5½—5½	..	4 8 11
Eastern Telegraph, Ord. Stock	Stock	7	5½	128—132	—1	5 6 1	West Coast of America ...	2½	2½	2½	1½—1½	..	3 11 5
Do. 8½ % Pref. Stock ..	Do.	8½	8½	81½—83½	—1	4 3 7	Do. 4 % Debs., 1 to 1,500	100	4	4	97½—99½	..	4 0 5
Do. 4 % Mort. Deb. ...	Do.	4	4	100½—102½	..	3 18 1	guar. by Braz. Sub. Tel. }						
Eastern Extension ...	10	7	5½	12½—13	— ½	5 7 1	West India and Panama Teleg.	10	1½	1½	4½—4½	..	..
Do. 4 % Deb. ...	Stock	4	4	9½—101½	..	3 18 10	Do. 6 % Cum. 1st Pref. ...	10	6	6	10½—11½	..	5 6 4
East and S. Africa Tel. 4 % }	25	4	4	99—101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ...	10	6	6	9½—10½	..	5 6 8
Mt. Db. Mauritius Sub. }							Do. 5 % Debs. ...	100	5	5	102—104	..	4 16 2
Globe Telegraph and Trust ...	10	5½	6½	10½—11	— ½	5 9 1	Western Telegraph, Ltd. ...	10	7	6½	13½—13½	— ½	5 2 7
Do. 6 % Pref. ...	10	6	6	12½—13½	..	4 10 7	Do. 4 % Deb. ...	Stock	4	4	99—101	..	3 19 3
Great Northern Telegraph ...	10	18	5½	8½—8½	..	6 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106—106	..	3 13 5
Indo-European Telegraph ...	25	13	5½	56½—58½	..	5 10 3	Do. 4½ % Fdg. Bonds ..	\$1000	4½	4½	102—105	..	4 5 9
Mackay Companies Common ...	\$100	5	5½	82—85 xd	..	5 17 8							
Do. 4 % Cum. Pref. ...	\$100	4	4	73—75 xd	— 2	5 6 8							
Marconi's Wireless Telegraph	1	5	..	4½—4½	..	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	4½—4½	..	..							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 19th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 19th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	12 1/2	58 1/2—59	+2	3 3 6
Do. 5 % Pref. ..	1	5	5		6 13 4	Do. Surplus Lands ..	100	2 1/2	68—70		3 18 7
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 5 11	Do. 8 1/2 % Deb. ..	100	8 1/2	84—91		3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100					Do. 8 1/2 % Pref. ..	100	8 1/2	85—87		4 0 6
Do. Do. Deferred ..	100					Do. 8 1/2 % Con. Pref. ..	100	8 1/2	84—86		4 1 5
Do. Do. 6 % Cum. Pr'f. ..	100					Metropolitan District Ord. ..	100	Nil	36 1/2—37 1/2	+1 1/2	Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100					Do. 6 % Deb. ..	100	6	144—146		4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5	5		5 1 0	Do. 4 % Deb. ..	100	4	96—98		4 1 8
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2		5 7 2	Do. 4 % Prior Lien ..	100	4	100—102		8 18 5
Central London Railway, Ord.	100	8	8		3 11 5	Do. 4 1/2 % First Pref. ..	100	8 1/2	83—91		4 18 11
Do. Pref. ..	100	4	4		4 12 0	Do. 8 1/2 % Gtd. ..	100	8 1/2	76—78		4 9 9
Do. Def. ..	100	2	2		2 10 8	Metropolitan Elec. Trams, Ord.	1	5 1/2	27—28 1/2		6 13 6
Do. 4 % Deb. ..	100	4	4		3 18 5	Do. Def. ..	1	Nil	27—28 1/2		Nil
City & South London, Ord.	100	1 1/2	1 1/2		4 3 4	Do. 5 % Pref. ..	1	5	27—28 1/2		5 10 2
Do. 5 % Pref., 1891 ..	100	5	5		4 11 9	Do. 4 1/2 % Deb. ..	100	4 1/2	99—101		4 9 1
Do. Do. 1896 ..	100	5	5		4 16 2	Do. 5 % Deb. ..	100	5	100 1/2—102 1/2		4 17 7
Do. Do. 1901 ..	100	5	5		4 17 1	Potteries, Ord. ..	1	2	132—133 1/2		
Do. Do. 1903 ..	100	5	5		3 17 8	Do. 5 % Pref. ..	1	5	132—133 1/2		6 19 3
Do. 4 % Deb. ..	100	4	4		5 2 2	Do. 4 1/2 % Deb. ..	100	4 1/2	89—92		4 17 10
Dublin United Trams, 6 % Pref.	10	6	6		Nil	South Metro. Trams, 6 % Pref.	1	6	72—77		6 17 2
Great Northern & City, Pr'f. Ord	10	Nil				Do. 4 % Deb. ..	100	4	72—77		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2			Underground Elec. Railways	10		23—3	+ 1/2	
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 15 5	Do. 4 1/2 % Bonds ..	100	4 1/2	99—101		4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2		4 6 11	Do. 6 % Income ..	100	1	83—85	+5	
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil	1—3 1/2		Nil
Lancashire United, 5 % Deb. ..	100	5	5		5 19 1	Do. 6 % Pref. ..	5	Nil	2 1/2—3 1/2		Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4		4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	81—85		5 5 11
London United Trams, 5 % Pref.	10	Nil									
Do. 4 % Deb. ..	100	4	4		5 1 11						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2—5 1/2		5 3 6	La Plata Elec. Trms, Ord. ..	1			2 1/2—2 1/2		
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2—5 1/2		5 3 6	Do. Pref. ..	1	6	6	2 1/2—1		6 0 0
Do. 4 % Deb. ..	100	4	4	9 1/2—95		4 4 3	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	1—1 1/2		4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	102—104	+ 1/2	4 6 7	Do. 6 % Pref. ..	1	6	6	1—1 1/2		4 16 0
Do. 5 % Deb. ..	100	5	5	103 1/2—105 1/2		4 14 9	Do. 5 % Deb. ..	100	5	5	99 1/2—97 1/2		5 2 7
Auckland Trams, 5 % Deb. ..	100	5	5	102—105		4 15 3	Madras Elec. Tr. (1904), Deb. ..	100	5	5	95 1/2—97 1/2		5 2 7
Bombay Elec. S. & Trams, Pref.	10	6	6	103—11 1/2		5 6 8	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93—96		5 4 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98—100		4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	99 1/2—101 1/2		4 18 6
Do. 5 % 2nd Deb. ..	100	5	5	98—100		5 0 0	Mexico Trams Com. ..	\$100	7	7 1/2	119—121	+2	5 15 8
Brisbane Trams Invt., Ord. ..	5	8	8 1/2	9 1/2—9		4 8 11	Do. Gen. Con. 5 % Bonds ..		5	5	97—99	+ 1/2	5 1 0
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2		4 15 3	Do. 6 % Bonds ..	100	6	6	100 1/2—102 1/2	+ 1/2	6 17 1
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103		4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 1/2—7 1/2		7 0 4
B. Colum. la Elec. Rly., Def. ..	100	8	8 1/2	134—139	—1	5 15 1	Do. 6 % Pref. ..	5	6	6	5—5 1/2		7 0 4
Do. Pref. Ord. ..	100	6	6	118—122		4 18 4	Do. 5 % 1st Deb. ..	100	5	5	97 1/2—99 1/2		5 0 6
Do. 5 % Pref. ..	100	5	5	110—113	+ 1/2	4 8 6	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2		1 1/2—1 1/2		1 18 1
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	100—103		4 7 5	Do. 5 % 1st Deb. ..	100	5	5	101—104		4 16 2
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	103—105	+1	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5—5 1/2		5 9 1
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102—104 xd		4 6 7	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	98—101		4 9 1
Calcutta Trams, Ord. ..	5	6		5 1/2—5 1/2	+ 1/2	5 1 3	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	119 1/2—120 1/2	+ 1/2	4 3 2
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2		4 16 5	Do. 1st Mort. 5 % Bonds ..		5	5	102 1/2—103 1/2		4 16 5
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99—102		4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	99 1/2—100 1/2	+ 1/2	4 19 9
Cape Electric Trams ..	1	Nil	2 1/2				Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	193 1/2—200 1/2 xd		4 19 9
City Buenos Aires Trams (1904)	5	5	5	5 1/2—5 1/2		4 6 0	Do. 5 % 1st Deb. ..	\$500	5	5	104—106	+2	4 14 4
Do. 4 % Deb. ..	100	5	5	101—103		4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	81—84		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98		5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95		5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100—103		4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2—5 1/2		6 1 9
Kalgoorlie Elec. Trams ..	1	Nil				Nil	Do. 6 % Pref. ..	5	6	6	5 1/2—5 1/2		6 11 7
Do. 5 % A Deb. ..	100	5	5	91—94		5 6 5	Do. 5 % 1st Deb. ..	100	5	5	100—103		4 17 1
Do. 6 % B Deb. ..	100	5	6 1/2	66—60		10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	103—105 xd		4 5 9

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6				Dick, Kerr ..	1	5		2 1/2—2 1/2		5 3 1
Do. 6 % Pref. ..	1	9	6			7 2 2	Do. Pref. ..	1	6	6	2 1/2—1 1/2		5 9 9
Babcock & Wilcox ..	1	26	24 1/2			3 15 7	Do. Deb. ..	100	4 1/2	4 1/2	97—100		4 10 0
Do. Pref. ..	1	6	6			3 13 10	Edison & Swan, A, £3 paid	5	Nil		1 1/2—1 1/2		Nil
B.I. & Helsby Cables ..	5	10	10 1/2			6 17 11	Do. fully paid ..	5	Nil		1 1/2—2 1/2		Nil
Do. Pref. ..	5	6	6			4 16 0	Do. 4 % Deb. ..	100	4	4	71—75		5 6 8
Do. Deb. ..	100	4 1/2	4 1/2			4 7 5	Do. 5 % Second Deb. ..	100	5	5	77—80		6 5 0
British Thomson-Houston, Deb.	100	4 1/2	4 1/2			4 13 9	Electric Construction ..	2	Nil	2 1/2	2—1		
British Westinghouse, Pref. ..	3	Nil				Nil	Do. Pref. ..	2	7	7	1 1/2—1 1/2		7 9 4
Do. Deb. ..	100	4	4			6 7 0	Greenwood & Batley, Pref.	10	7	7	7 1/2—8 1/2		8 5 8
Do. 6 % Prior Lien ..	100	6	6			5 14 3	Do. Deb. ..	100	5	5	94—96		5 4 2
Browett, Lindley, Ord. ..	1	Nil				Nil	General Electric, Pref. ..	10	5	5	9—9 1/2		5 5 3
Do. Pref. ..	1	Nil				Nil	Do. Deb. ..	100	4	4	87—92		4 7 0
Brush, Ord. ..	2	Nil				Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2—12 1/2 xd		6 0 0
Do. 7 % Pref. ..	2	Nil				Nil	Do. Pref. ..	5	4 1/2	4 1/2	5—5 1/2		4 5 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2			7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	104—106		4 4 11
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2			10 14 4	India-Rubber, G. & T. ..	10	10		9 1/2—10 1/2		
Callender's Cable ..	5	15	10 1/2			7 10 0	Do. Pref. ..	10	5	5	9 1/2—10 1/2		4 17 7
Do. Pref. ..	5	5	5			4 15 3	Telegraph Construction ..	12	20	10 1/2	84—86 xd		6 7 0
Do. Deb. ..	100	4 1/2	4 1/2			4 9 7	Do. Deb. ..	100	4	4	99 1/2—101 1/2		4 9 0
Castner-Kellner ..	1	17 1/2	20			5 9 11	Willans & Robinson ..	1	Nil		2 1/2—2 1/2		Nil
Do. Deb. ..	100	4 1/2	4 1/2			4 10 7	Do. Pref. ..	5	Nil		2 1/2—1 1/2		Nil
Crompton & Co. ..	3	Nil	Nil			Nil	Do. Deb. ..	100	4	4	61—64		6 5 9
Do. Deb. ..	100	5	5			7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/2 per cent., February 8th, 1912.



## ARTISTIC STREET LAMP STANDARDS.

[CONTRIBUTED.]

A BY no means unimportant factor in the fierce inter-city competition which has raged between various towns in North America during recent years has been the increasing attention paid to scientific and artistic street lighting—high illumination and attractive standards and fittings being both considered.

In the strenuous campaign for fresh citizens, as in the competition between different quarters of one town, it has been realised that brilliant street illumination from fixtures presenting a handsome appearance by day and by night is one of the easiest means whereby a town or a street may attract more attention than its neighbours. Once the pioneering difficulties were surmounted—and these, in such a matter, probably offer less obstruction in America than in any other country—progress was rapid. Where municipalities could not or cannot, for any reason, embark on a

FIG. 2.

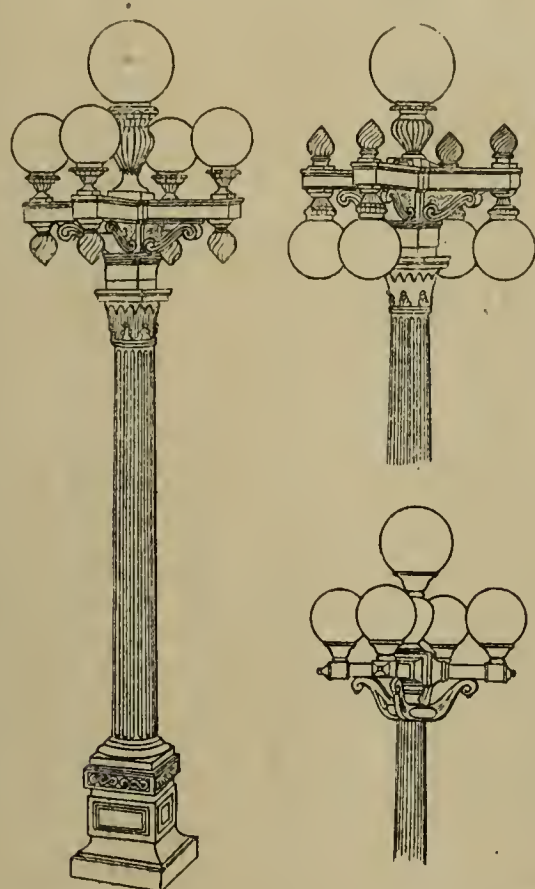


FIG. 1.

FIG. 3.

sufficiently ambitious scheme of electric street lighting there were formed, or are being formed, energetic committees of business men, all more or less interested in the proposals in hand, and all prepared to go to considerable personal expense and trouble to ensure their unqualified success. Such movements naturally receive hearty support from central station engineers, long-hour street lighting forming an admirable evening load.

Contrast these conditions and methods with the confirmed attitude of *laissez glisser*, or the spasmodic "ratepayers' agitation" (say, for six-flame arcs in a certain street), to be found in the majority of English towns, where street lighting matters are concerned, and it is not surprising to find that in the very materials employed we are much behind denizens of Canada and the States.

The drawn-tungsten filament lamp had been boomed, tested and discussed for months in America before it commenced to attract attention on this side, and, in the manufacturing and stocking of innumerable useful types of globes, reflectors and lamp fittings in general, we are undoubtedly behind America, though fully maintaining our position in Europe.

Confining our present attention mainly to the artistic appearance of a street lighting equipment, we find that one opalescent globe much resembles another; the globe supports or "lantern" framework lend a certain character to the equipment as a whole, but it is the bracket and standard which attaches an air of stability, dignity and beauty or of ugliness, insignificance or downright meanness to the entire installation. Prime cost is, of course, an important matter in determining the selection of a type of lamp standard, but

therein can lay no adequate excuse for many of the hideous or merely unimaginative patterns adopted in the average English town. In view of the vast number of lamp and trolley poles now in use in this country, and bearing in mind the great effect, for good or evil, which these exert on the appearance of a town or street—and even in an "old" country the relative beauty of towns has appreciable effect on their prosperity and development, while the appearance of shopping quarters is of uncontrovertible importance—allowing for all these considerations, it certainly appears that insufficient attention has hitherto been paid to the design of street lighting and trolley poles in this country.

In the hope that wider attention will be called to the matter, the writer ventures to illustrate a number of novel designs which are striking and beautiful without being bizarre or excessively costly. Originality in English designs has been very largely confined to variations in the surface mouldings of the pedestals and shafts of poles, and to variations in the scroll work which, though mainly decorative, is often relied upon to strengthen considerably the main members. These improvements are, in most cases, excellent, but they are in matters of detail and, at a short distance, their individuality largely disappears. To show the intrinsic merits of entirely different styles of construction, to illustrate the general appearance of the poles as viewed from a short distance, and to omit those details of finish which can easily be varied to taste without appreciably affecting the general appearance of the structure, the poles illustrated herewith are shown for the most part in simple outline. After indicating their general construction, their technical merits from the illuminating standpoint will be briefly considered, and, in conclusion, will be presented typical data as to dimensions and costs.

*Styles.*—Standards modelled according to Corinthian designs have proved enormously popular in American cities. The great strength and beauty of this pattern is well illustrated by fig. 1—a five-globe standard patented by the Flour City Iron Works. By simply inverting the four lower lamp brackets, as shown in fig. 2, considerable change is effected in the general appearance of the standard, and the latter becomes, by its low-pendant globes and concentrated light distribution, more suitable for interior illumination than the pattern of fig. 1, which is specially adapted to street work. A plainer and lighter, but equally handsome, design, enabling the same lamp arrangement as shown in fig. 1, is

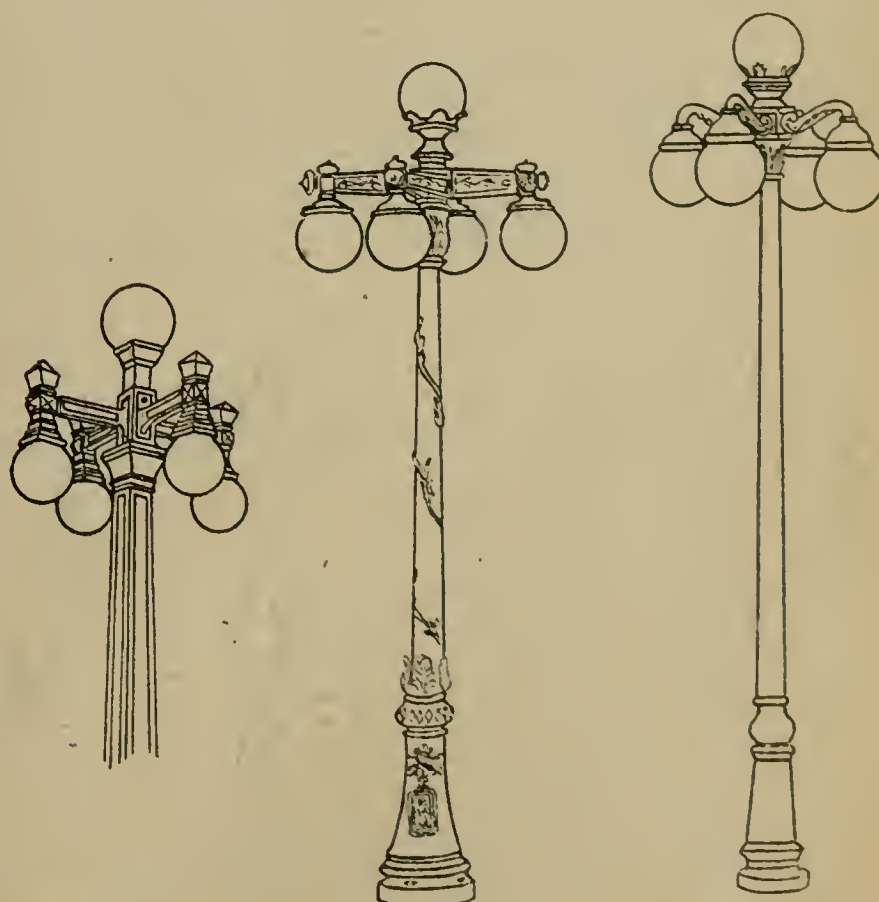


FIG. 4.

FIG. 5.

FIG. 6.

provided by the standard illustrated in fig. 3. Following the same general design but employing bolder lines, a square shaft and inverted lower lamps, we arrive at the style shown in fig. 4, also much employed in America.

Fig. 5 represents a less rugged pole, otherwise similar to that illustrated in fig. 4, and one which presents a most



handsome appearance when lightly decorated as indicated (Cutter's patent). The design shown in fig. 6 sets the lower lamps considerably closer together, and, while increasing the obstruction, one globe with another, and yielding less widespread illumination than most of the preceding standards is, in the writer's opinion, of much less striking and pleasing design. However, *chacun à son gout!*—the result is still charming.

The highly ornamented, massive pillar illustrated in fig. 7 might, at first sight appear ungainly, but this, and even heavier patterns have proved very popular in high class



FIG. 7.



FIG. 8.

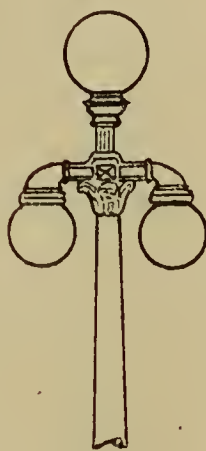


FIG. 9.



FIG. 10.



FIG. 13.

street lighting, and especially in illuminating entrances and frontages to which the pole design and finish is suited. (The particular standard illustrated is one of a number in use round the Gotham Hotel, New York).

Where only one lamp per standard is required, the design shown in fig. 8 is at once aesthetic and strong, but, by the injudicious addition of side globes (as in fig. 9), the whole effect may be destroyed. A single globe standard of rare beauty is shown in fig. 10. This pole is of great strength in those parts liable to mechanical damage, and, as compared with the type shown in fig. 8, it possesses the advantage of giving better illumination immediately below the lamp, though, on the other hand, there will now be a certain shadow cast by the main column.

Turning to designs more nearly resembling those in use in the more fortunate of English towns, fig. 11 shows an elegant

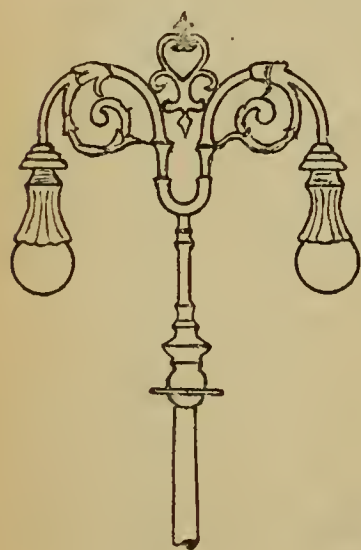


FIG. 11.

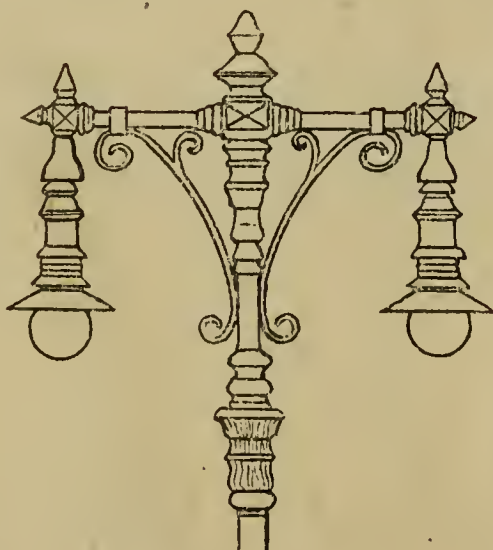


FIG. 12.

pole-head equally suitable for arc lamps or metallic-filament lamp clusters. On bolder lines, fig. 12 represents a good design (Morris Iron Co.), and the three-globe standard shown in section in fig. 13 uses steel piping and sleeves, and is very light and strong while enabling excellent light distribution. The design is decorated and strengthened by scrolls of beaten ironwork in the angles in the ordinary manner.

A salient feature of the American designs illustrated is their "clean" build and highly artistic appearance, whether light or heavy, bold or smooth. Many less pleasing designs are, of course, in extensive use, and in a number of patterns we find an objectionable mixture of styles and over-ornamentation; it has naturally been the writer's aim to call attention to those forms most likely to find favour in this country, excluding all excessive styles.

Space forbids specific mention and illustration of the many combined traction and lighting, telegraph and lighting, or power transmission and lighting standards now on the

American market. The best of these possess those artistic merits admired above, in addition to such constructional features as convenient bracket attachments, telescopic bracket arms (for use where outstanding lamps are to be kept collinear, though the standard columns be out of line), and so on. An exceptionally elaborate combined arc and incandescent lamp standard has recently been designed by the Buda-Pesth General Electric Co. for use in the streets of that city.

Where fire alarms, time switches, call boxes, and so on, have to be attached to street standards, we might with advantage imitate the practice of certain American manufacturers in opening out the main centre column, for a suitable distance, into a rectangular frame within which the required attachment is fixed without the unsightly and annoying projections otherwise unavoidable.

The Flour City Co., already noted, have co-operated with the Police and Fire Departments in a number of cities by equipping standards at various street crossings with "night signals." Red, violet or blue globes of the same external appearance as the iron "acorns" on the Corinthian pillars (figs. 1 and 2), are substituted for one of these parts on poles at the signal points, and incandescent lamps, for flash-signalling purposes from headquarters, are placed within these distinctive globes.

*Illuminating Value.*—The placing of individual lamps or clusters in three, five or more globes per standard, completely avoids the heavy shadow which would otherwise be cast by most of the pillars illustrated above. The longer the bracket arms, the more uniform the illumination obtained, and the less the mutual obstruction between globes. The "angle of obstruction" of the globe supporting caps varies from 50° to 80° in the types illustrated, but whatever shadow is cast by one bracket arm and globe cap is rendered quite unnoticeable by illumination from the remaining globes. The large opalescent globes usually employed, naturally result in a certain absorption loss, but this is fully compensated for by their handsome and attractive appearance by day, and by the equally beautiful "snowball" effect at night. Readers of the American electrical Press will remember a number of photographs showing the striking night appearance of "White Ways" illuminated on this system.



Three or five globe standards are usually placed 60—90 ft. apart along each side of the street, and, for combined beauty and efficiency, probably provide the cheapest street illumination yet evolved.

**Materials, Dimensions, &c.**—Cast-iron is naturally the usual material employed in the manufacture of these standards, but cast-steel or steel tubing is widely used where a slender design is desired, or where weight is a consideration. For specially high-class work and for standards to be used in shop or hotel frontage schemes, bronze is sometimes employed, but it may be doubted whether the additional cost is justified by the improved appearance attained.

With the class of standard illustrated in figs. 1—10 (usually carrying 1, 3, or 5 globes), 14 in. is a suitable diameter for the top globe, and 12 in. for the lower globes, if any, and whether upright or inverted. By this slight difference in diameters, the appearance of the completed standard is greatly improved. The angle subtended by the globe cap at the centre of the globe is usually between  $50^\circ$  and  $60^\circ$ , but occasionally rises to  $70^\circ$  or  $90^\circ$ ; the lower range should be adhered to whenever possible.

At the ground line, the standard base is from 15 in. to 20 in. in diameter, and the height of the lower globe holder from ground level ranges from 10 to 12.5 ft. (figs. 1—10), up to 15—30 ft. (figs. 11—13). The "spread" of the bracket arms, from the centre of the main column to the centre of the lamp supports, varies from 1 ft. to 2 ft. in the types shown in figs. 1—10, and from 2.5 to 4.5 ft. in specially lofty single or double-bracket standards.

The weight and cost of the various styles illustrated depend essentially on the column diameter and on the degree of ornamentation employed. Single-globe standards, such as shown in fig. 4, may weigh from 250 to 450 lb. and cost from £2 15s. to £3 15s. apiece, while five-globe standards of similar style may weigh from 320 to 530 lb., and cost from £3 10s. to £4 10s. apiece. On the other hand, these figures may be doubled, or made yet greater, by the adoption of heavier columns and brackets, and more elaborate ornamentation. Standards such as shown in figs. 11 and 12 may weigh 1,000—1,500 lb. and cost £15—£20 each.

It need hardly be mentioned that in American, as in home designs, absurdly large structures often carry a ludicrously small lighting equipment. Thus a certain large maker provides a standard, 14 ft. from ground to bracket (16 ft. overall), 15 in. in base diameter, and with a 5-ft. bracket to carry—a single incandescent lamp! In all such cases, a simple span-wire with a self-levelling hanging lantern had better be employed. Span arches present a better appearance, but are very liable—as in the case of the Forth Bridge—to require an enormous amount of metal to carry their own weight.

An apology can hardly be needed for these notes. The matter with which they deal concerns every citizen, and certainly there is an ample field in this country for the application of the principles, methods and apparatus described.

## VOLUME CHANGES IN ACCUMULATOR ELECTRODES.

By C. TOONE.

ONE of the most familiar phenomena of lead accumulators is the growth of the positive and the shrinking of the negative electrode, and it is a very common belief that the positive plate expands solely during charging and particularly during over-charging. This, however, occurs only during the first charging, the so-called "forming," when metallic lead or lead oxide is converted to lead-peroxide (the highest known oxide of lead) a change which is accompanied by an increase in weight and volume. On discharge, lead sulphate is formed on both plates, with an increase in weight and volume of the latter. If both electrodes were initially of the same paste, say, red lead, spread on precisely similar grids, they would initially have exactly equal porosities; but, during formation, the positive plate would become denser

by the absorption of oxygen and the negative plate would become more porous, by the liberation of oxygen. For this reason, all changes during charge and discharge occur more readily and with less loss in the negative than in the positive plate. For some time past, accumulator manufacturers have realised the importance of securing maximum porosity in

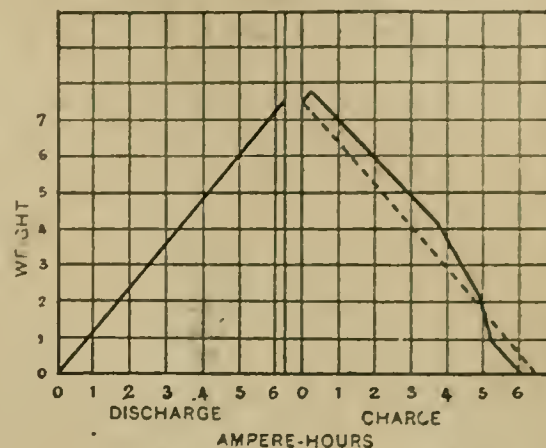


FIG. 1.

their plates and have prepared positives and negatives by different processes, each suited to the working conditions to be met; the positives with large active surfaces and the negatives with much spongy lead.

Schoop, in his work "Ein Beitrag zur Kenntnis der Diffusionvorgänge an Akkumulatorenelektroden," has described a means whereby the weight changes in accumulator plates on charge and discharge may be studied directly by the aid of a balance. Theoretically, 3.85 gm. of spongy lead on the negative plate is converted to 5.64 gm. of lead sulphate per ampere-hour, and, in the positive plate, 4.44 gm. of lead peroxide yields 5.64 gm. of lead sulphate; fig. 1, shows the increase and decrease in weight of a spongy lead plate on discharge and charge respectively (as determined by Schoop's method). During discharge the weight increases practically

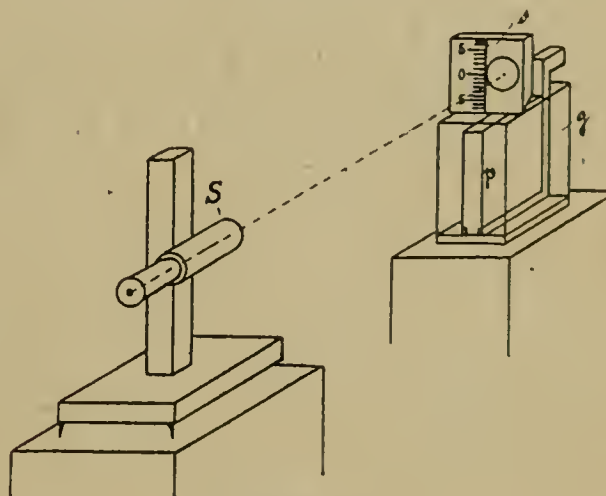


FIG. 2.

linearly with the ampere-hours, but, during charging, the curve shows a marked deviation due to the collection of hydrogen bubbles in the pores of the spongy lead.

H. Hobel, writing in the *Elektrotechnischer Anzeiger*, describes an adaptation of the Poggendorf-Gauss mirror method to the direct observation of the working changes in volume of accumulator plates by determining their change in height. The spongy plate *p* (fig. 3) consisted of a pasted block 84 mm. high, 60 mm. wide and 8 mm. thick; the hard lead rim was removed from one side and the top edge to permit free expansion of the spongy material. The electrode was fixed to the base of the containing vessel *g* by sealing wax, and its upper edge was provided with the glass cone *k* bearing on the block attached to the back of the mirror *s* (fig. 2). The lower edge of the actual mirror block *s*, being chamfered and resting on the edge of the containing vessel, acts as the fulcrum about which the rise and fall of *k* tilts the moving system.

The spongy plate stands between two lead sheets (not shown), which act as positive electrodes, but on which no measurements are required. The complete cell stands on a rigid masonry column, and a cathetometer *s* is mounted on a neighbouring rigid foundation: the arm of action of the cone *k* being very small, and the distance from *s* to *s* being 2 or 3 metres, there is no difficulty in securing a magnification of 1,000; i.e., in accurately observing 1 mm. displace-



ment of  $s$  in the telescope—corresponding to  $\frac{1}{1000}$  mm. movement of  $k$ . In fig. 4 the scale displacements are taken as directly proportional to the plate movement, and from the conditions of the measurement, it will be seen that the error in the assumption is small.

Referring to fig. 4, curve  $a$  shows the increase in electrode height during a discharge at 1.18 amps. for 7.5 hours. The scale deflection at the end of this period (11.0 mm.) increased to 12 mm. during a rest period of 15.5 hours

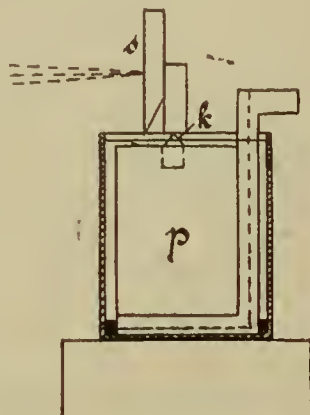


FIG. 3.

(dotted curve). After this, a further discharge period of one hour at 1.18 amperes increased the scale deflection to 15 mm. During charging (curve  $b$  and lower time scale), for 9.25 hours at 1.18 amperes, the decrease in height followed the solid curve  $b$ , while, during the dotted rest-period, the total decrease attained 22 mm. below the starting zero-line. It is clear that during the discharging and charging cycle, the negative plate has undergone a permanent change (a shrinkage), otherwise the curve  $b$  would close on the beginning of  $a$ , and, charge and discharge being followed by no structural alteration—within the limits of elasticity—the plate would be of practically constant capacity for a very long time in service. Unfortunately, in pasted plates of the above description, the shrinkage cannot be prevented. The above method affords a very rapid and sufficiently accurate examination of the shrinkage characteristics of

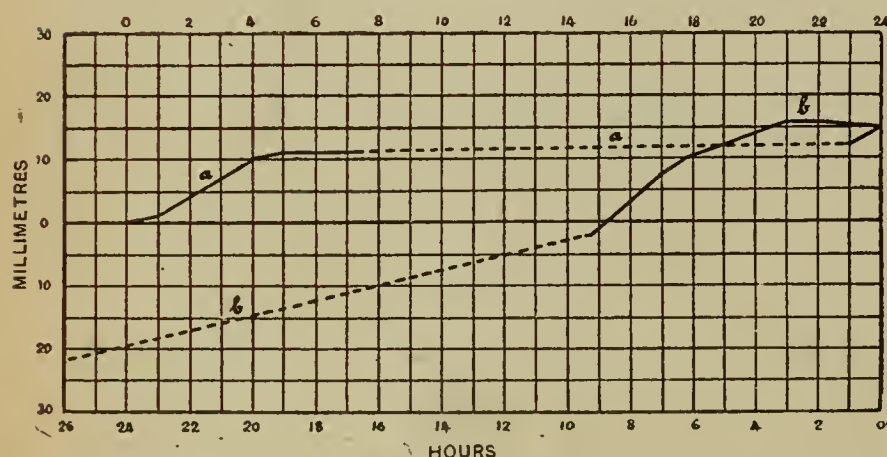


FIG. 4.

any new pasting mixture and is, of course, at once applicable to any type of plate, positive or negative. The apparently paradoxical rise of the curve  $b$  over  $a$  during the first hours of the charge is due to the rising temperature of the cell, and such secondary action can easily be avoided by maintaining the test-cell at constant temperature.

The mirror method is applicable to the comparison of pasting and "forming" methods, and appears to be quite suitable for the rapid testing of new types of accumulators. The present tests applied to the latter are both tedious and costly and, if carried out at exceptionally high currents, in order to save time, the results obtained cannot safely be taken as indicative of the actual service performance of the cells; but according as the volume changes of the electrodes of a cell, determined as above, show a tendency, during several successive charges and discharges, to become constant or continue varying, the degree to which the capacity of the cell may be expected to decay in service can be accurately prophesied.

## TRADE STATISTICS OF BRITISH INDIA.

THE following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1911, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1910, are added for purposes of comparison, and notes of any increases or decreases are given:—

15 rupees = £1.

	1909-10. Rupees.	1910-11. Rupees.	Increase or decrease. Rupees.
<i>Lampware.—</i>			
From Great Britain ...	9.10.000	10.49.000	+ 1.39.000
" Germany ...	5.84.000	8.80.000	+ 2.96.000
" Austria ...	5.34.000	6.59.000	+ 1.25.000
" United States ...	5.79.000	5.60.000	— 19.000
" Other countries ...	1.70.000	2.55.000	+ 85.000
Total ...	27.77.000	34.03.000	+ 6.26.000
<i>Other hardware, except enamelled ware.—</i>			
From Great Britain ...	1.26.61.000	1.31.69.000	+ 5.08.000
" Germany ...	23.74.000	30.81.000	+ 7.07.000
" Belgium ...	8.99.000	14.85.000	+ 5.86.000
" Austria ...	2.79.000	3.94.000	+ 1.15.000
" United States ...	7.85.000	10.42.000	+ 2.57.000
" Other countries ...	6.82.000	10.74.000	+ 3.92.000
Total ...	1.76.80.000	2.02.45.000	+ 25.65.000
<i>Brass, wrought.—</i>			
From Great Britain ...	5.41.000	5.80.000	+ 39.000
" Germany ...	49.000	66.000	+ 17.000
" Austria ...	48.000	1.01.000	+ 53.000
" Other countries ...	2.95.000	3.02.000	+ 7.000
Total ...	9.33.000	10.49.000	+ 1.16.000
<i>Copper and copper ware.—</i>			
From Great Britain ...	1.49.82.000	2.07.90.000	+ 58.08.000
" Germany ...	59.82.000	75.57.000	+ 15.75.000
" Belgium ...	19.78.000	35.65.000	+ 15.87.000
" Italy ...	3.64.000	4.59.000	+ 95.000
" Austria ...	1.77.000	2.82.000	+ 1.05.000
" Japan ...	28.40.000	42.83.000	+ 14.43.000
" Other countries ...	1.12.000	1.60.000	+ 48.000
Total ...	2.64.35.000	3.70.96.000	+ 1.06.61.000
<i>Iron wire.—</i>			
From Great Britain ...	95.000	1.41.000	+ 46.000
" Germany ...	13.000	7.000	— 6.000
" Belgium ...	3.12.000	4.94.000	+ 1.82.000
" Other countries ...	1.52.000	2.06.000	+ 54.000
Total ...	5.72.000	8.48.000	+ 2.76.000
<i>Steel plates and sheets.—</i>			
From Great Britain ...	76.71.000	93.85.000	+ 17.14.000
" Germany ...	18.18.000	11.30.000	— 6.88.000
" Belgium ...	25.28.000	23.93.000	— 1.35.000
" Other countries ...	57.000	55.000	— 2.000
Total ...	1.20.74.000	1.29.63.000	+ 8.89.000
<i>Steam engines (except locomotives).—</i>			
From Great Britain ...	73.45.000	69.66.000	— 3.79.000
" Belgium ...	36.000	2.21.000	+ 1.85.000
" United States ...	1.75.000	2.28.000	+ 53.000
" Other countries ...	1.15.000	1.57.000	+ 42.000
Total ...	76.71.000	75.72.000	— 99.000
<i>Electrical machinery.—</i>			
From Great Britain ...	26.57.000	26.64.000	+ 7.000
" Germany ...	27.000	3.24.000	+ 2.97.000
" Belgium ...	49.000	5.11.000	+ 4.62.000
" Italy ...	1.99.000	1.82.000	— 17.000
" United States ...	2.28.000	2.34.000	+ 6.000
" Other countries ...	15.000	44.000	+ 29.000
Total ...	31.75.000	39.59.000	+ 7.84.000
<i>Mining machinery.—</i>			
From Great Britain ...	4.81.000	7.20.000	+ 2.39.000
" Germany ...	—	3.000	+ 3.000
" United States ...	2.19.000	6.42.000	+ 4.23.000
" Other countries ...	37.000	18.000	— 19.000
Total ...	7.37.000	13.83.000	+ 6.46.000
<i>Machinery, other (except textile and agricultural).—</i>			
From Great Britain ...	1.51.00.000	1.39.83.000	— 11.17.000
" Germany ...	4.87.000	8.78.000	+ 3.91.000
" Belgium ...	2.29.000	7.36.000	+ 5.07.000
" United States ...	8.69.000	14.71.000	+ 6.02.000
" Other countries ...	2.30.000	2.17.000	— 13.000
Total ...	1.69.15.000	1.72.85.000	+ 3.70.000



	1909-10.	1910-11.	Increase or decrease.
	Rupees.	Rupees.	Rupees.
<i>Railway carriages, &amp;c.—</i>			
From Great Britain ...	2,28,46,000	1,45,38,000	—83,08,000
„ Belgium ...	94,000	4,52,000	+ 3,58,000
„ Other countries ...	44,000	46,000	+ 2,000
Total ...	2,29,84,000	1,50,36,000	—79,48,000
<i>Locomotives and tenders, and parts thereof.—</i>			
From Great Britain ...	87,06,000	73,52,000	—13,54,000
„ Germany ...	13,000	48,000	+ 35,000
„ Other countries ...	62,000	—	— 62,000
Total ...	87,81,000	74,00,000	—13,81,000
<i>Rails and fishplates.—</i>			
From Great Britain ...	88,86,000	72,61,000	—16,25,000
„ Belgium ...	2,68,000	1,38,000	— 1,30,000
„ Other countries ...	3,93,000	—	— 3,93,000
Total ...	95,47,000	73,99,000	—21,48,000
<i>Glass lampware.—</i>			
From Great Britain ...	1,38,000	1,33,000	— 5,000
„ Germany ...	3,25,000	4,49,000	+ 1,24,000
„ Austria ...	2,75,000	4,10,000	+ 1,35,000
„ Other countries ...	1,34,000	2,32,000	+ 98,000
Total ...	8,72,000	12,24,000	+ 3,52,000
<i>Electrical instruments, apparatus, &amp;c.—</i>			
From Great Britain ...	39,40,000	43,99,000	+ 4,59,000
„ Germany ...	1,80,000	3,74,000	+ 1,94,000
„ Belgium ...	49,000	1,87,000	+ 1,38,000
„ Austria ...	10,000	76,000	+ 66,000
„ United States ...	1,29,000	66,000	— 63,000
„ Other countries ...	39,000	49,000	+ 10,000
Total ...	43,47,000	51,51,000	+ 8,04,000
<i>Scientific, &amp;c., instruments.—</i>			
From Great Britain ...	12,15,000	13,48,000	+ 1,33,000
„ Germany ...	74,000	74,000	—
„ Belgium ...	32,000	84,000	+ 52,000
„ United States ...	40,000	38,000	— 2,000
„ Other countries ...	50,000	55,000	+ 5,000
Total ...	14,11,000	15,99,000	+ 1,88,000
<i>Telegraph construction materials.—</i>			
From Great Britain ...	1,20,000	32,000	— 88,000
In addition to the foregoing, the following were imported as Government stores :—			
	1909-10.	1910-11.	Increase or decrease.
	Rupees.	Rupees.	Rupees.
<i>Instruments, apparatus, &amp;c. (except musical).—</i>			
From Great Britain ...	15,47,000	13,80,000	— 1,67,000
„ Germany ...	4,000	1,000	— 3,000
„ United States ...	72,000	1,000	— 71,000
„ Other countries ...	6,000	4,000	— 2,000
Total ...	16,29,000	13,86,000	— 2,43,000
<i>Machinery.—</i>			
From Great Britain ...	27,53,000	24,81,000	— 2,72,000
„ Germany ...	2,000	6,000	+ 4,000
„ United States ...	14,000	1,000	— 13,000
„ Other countries ...	4,000	1,000	— 3,000
Total ...	27,73,000	24,89,000	— 2,84,000
<i>Iron wire.—</i>			
From Great Britain ...	1,56,000	3,54,000	+ 1,98,000
<i>Steel plates and sheets.—</i>			
From Great Britain ...	6,67,000	6,35,000	— 32,000
„ United States ...	1,000	—	— 1,000
Total ...	6,68,000	6,35,000	— 33,000
<i>Railway carriages.—</i>			
From Great Britain ...	96,77,000	49,22,000	—47,55,000
„ Other countries ...	1,56,000	69,000	— 87,000
Total ...	98,33,000	49,91,000	—48,42,000
<i>Locomotives.—</i>			
From Great Britain ...	87,56,000	48,40,000	—39,16,000
<i>Rails and fishplates.—</i>			
From Great Britain ...	59,83,000	67,68,000	+ 7,85,000
„ Belgium ...	—	11,000	+ 11,000
Total ...	59,83,000	67,79,000	+ 7,96,000

	1909-10.	1910-11.	Increase or decrease.
	Rupees.	Rupees.	Rupees.
<i>Telegraph construction materials.—</i>			
From Great Britain ...	6,28,000	10,56,000	+ 1,28,000
„ Belgium ...	3,000	—	— 3,000
„ United States ...	13,000	—	— 13,000
„ Other countries ...	9,000	4,000	— 5,000
Total ...	9,53,000	10,60,000	+ 1,07,000

PROCEEDINGS OF INSTITUTIONS.

Peat as Engine Fuel.

By T. TOMLINSON, B.A.I., M.I.E.E., M.I.C.E.I.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Dublin, March 14th, 1912).

THIS paper is a continuation of two previous papers in which the author has dealt with the subject of peat.

In 1907 two things were doubtful: (1) Could peat in Ireland be used on a practical scale for the production of power? (2) Could peat be got in Ireland at a price allowing of its use for power production with electrical distribution commercially on a very large scale?

At this date the first has been decisively settled in the affirmative by power undertakings on a large scale—as we shall see later; the second is not settled, nor is it likely to be settled till a determined effort is made to do so.

The present state of the problem may be concisely stated thus:—The problem is solved as to the economical generation of power from peat, it is not solved as to the getting of peat in Ireland continuously in large quantities and at such a definite known and low price as to make the success of a large enterprise certain.

It will, doubtless, be news to most that there is one instance of complete success on an enormously large scale, depending on no elaborate machinery and on no fancy patents, but simply upon sane engineering continuously and purposefully applied, much as the author pleaded for in his paper before the Institution of Civil Engineers of Ireland.

The author came upon the record of the success in an old book, and as the facts are unknown to most people, the author proposes to give a summary with a running commentary:—

The author, Mr. M'Meadows, had partly originated, and had been a member of a then recent Irish Peat Fuel Commission which had carried out certain investigations upon the Continent, and in this pamphlet he gives his own conclusions.

Evidently the main work of the Commission was the examination of the claims of certain then new methods of machine treating peat for the production of dense peat fuel.

The author goes on to demonstrate (1) that only the top layers of the deep Irish bogs require machine treatment; (2) that machine-made peat costs more than hand-cut peat; (3) that the Dutch had, by hand labour, transformed whole provinces from barren bogland into valuable agricultural land teeming with plenty, and this at a time when English and German coal was cheaper in Amsterdam and Rotterdam than in Dublin, Cork, or Limerick.

His general conclusion is best given in his own words:—"It is most wise and proper to mature the best mechanical arrangements for making dense turf out of fibrous peat; but, at the same time, most unwise and improper to neglect the utilisation of the large resources, in the shape of comparatively unfibrous peat, that are open to us at once, and which, instead of steam engines and mace-rating mills, require only the strong arms and tough-handled slanes of good Irish turf cutters, for yielding supplies of excellent fuel."

The fact that only a small proportion of a deep Irish bog needs any treatment other than drainage to make excellent fuel has been and is still too often overlooked. Our author is emphatic on this point:—"In almost all our bogs we have facilities for drainage, which are entirely wanting in those peat districts of Holland, in which the peat has to be dredged up from under water. To subject such black peat as is capable of being drained in Irish bogs, to any mixing or tearing process, would be simply a waste of time and money."

The fact that hand-getting is cheaper than machine-getting is as true now as it was 36 years ago. All the supposed improvements in peat-getting have not altered this fact. The very figures which the author gave in 1873—6s. for hand-getting and 8s. to 9s. for machine-getting per anhydrous ton—are those deduced by me from the figures given by Mr. Nystrom's Report to the Canadian Government in 1908. If these two facts had been borne in mind, most of the failures, which have brought projects of peat utilisation into well-deserved disrepute, would have been avoided.

The most interesting and suggestive part of the pamphlet is that in which the author—to enforce his contention as to the feasibility of a hand-worked peat industry with reclamation—instances its success in Holland and the Netherlands.

The work apparently began about 1628, when desolate, marshy districts were disposed of in lots to colonists by whom the winning of the peat and the reclamation of the land was begun. In spite of obstacles and temporary suspensions, the work went on, in stolid Dutch fashion, and so successfully that, about 1700, a Dutch



colony offered to colonise the Bog of Allen and to turn it into a meadow.

The working of the peat fields in the Netherlands, regarded as a principal of industrial and agricultural wealth, has created entire provinces; it has supplied, and still supplies, employment for the needy classes, and it has transformed houseless wanderers into owners of the soil. We thus see what the Netherlands owe to peat.

During the period in which the use of turf so largely increased in the Netherlands, the price of coal did not average more than 25s. per ton at any of the Dutch ports.

The use of the peat for power-production on the bog is a commercial possibility now, as it was not in 1873, and its utilisation in this way has two very important advantages over its use as fuel off the bog:—(1) The peat so used need not have the water reduced below 60 per cent.; (2) the recovery of sulphate of ammonia in the process of gasifying the peat is commercially profitable under favourable conditions.

The importance of the first point is that the difficulty of extracting water from peat and the time taken to do it increases very rapidly as the proportion of water to peat decreases, so that the possibility of using it with so high a percentage of water decreases the cost of production and makes possible continuity of supply without expensive storage and double handling.

The importance of the second point is that, under favourable conditions, the cost of the fuel would be covered by the value of the sulphate of ammonia.

Very favourable conditions would be a demand for power of 2,000 H.P. or over, worked day or night, a high percentage of nitrogen in the peat, a total cost of peat of 4s. or less per anhydrous ton, with a certainty of continuous production.

The first and most obvious improvement is thorough drainage; the effect of this upon reducing the labour cost per ton of anhydrous peat is shown by the following figures:—

"In a bog newly drained, 15 cb. yards contain 1 ton of anhydrous peat." "One year drained, 12 cb. yards contain 1 ton of anhydrous peat." "Two years drained, 9 cb. yards contain 1 ton of anhydrous peat."

Here is a possible saving in labour of getting of 40 per cent. by drainage.

The cost of the surface drainage is very high. A very much cheaper and more effective method of realising the saving in labour due to drainage before cutting would be thorough bottom drainage of a portion of the bog cut off from the main bog, with local surface drainage of the cut-off part.

That bog, thoroughly surface and bottom drained, will continually lose water at first by drainage, and then by evaporation and capillary attraction, is obvious.

Relying on drainage and evaporation, with protection from rain, I believe it to be certainly possible (1) to improve enormously the existing hand-cut peat industry; (2) to provide continuously and at low cost, fuel for industrial purposes.

A very simple experiment, and a very cheap one if made on a suitable bog, would establish the facts that the bulk of the water can be got rid of, slowly, it is true, but inexpensively; that the best peat, now unworked, can be made available; and that the land ultimately reclaimed is much more valuable for agricultural purposes than the undrained cut-away bog as left under the present conditions of working.

The owner of a large bog area—and there are many such—might consider the following figures:—Say the bog has an area of 1,000 acres and an average depth of 20 ft. The present value of such a bog will be £2,000 to £5,000 if a purchaser can be found. The actual contents of the bog in anhydrous peat is about 2,400,000 tons, or, allowing one-fourth to be left as soil for the unclaimed area, say 1,800,000 tons (anhydrous), available as fuel. This is certainly worth at least 3d. per ton royalty for electro-chemical power purposes if it can be shown that peat with 50 per cent. water can be got standing on the bog for 2s. per anhydrous ton. This amounts to £22,500, and the reclaimed land will be worth at least £10,000, or a total value of £32,500, say £30,000. The value of the peat as fuel is about £180,000. The gross value of the sulphate of ammonia is about £660,000, the net value about £330,000. The fuel would supply 2,000 H.P. day and night for 140 years.

Let me give a quotation from Mr. Nystrom's Report to the Canadian Government, "Peat and Lignite," 1908:—"In Holland the bogs are very expensive. A bog, 6 to 7 ft. deep, sells for \$486 (£97) per acre.

Remembering that in Ireland a bog, 20 to 30 ft. deep, sells for £2 to £5 per acre, there was evidently sound commercial sense in that offer of the Dutch to colonise the Bog of Allen.

The essential difference between the Dutch success and the Irish failure is that the Dutch cut out the whole bog and so got both the fuel value and the reclaimed land value, while the Irish simply cut off the top peat of little fuel value and then reclaimed the top surface of the waterlogged underlying peat of great fuel and little agricultural value.

The peat belt of Ireland—as to six-sevenths of the total area of peat deposit—lies "between a line drawn from Wicklow Head to Galway and another drawn from Howth Head to Sligo." The area of peat land is one-seventh of that of Ireland, equal to 3,000,000 acres, or 4,600 sq. miles. There is no part of Ireland which is beyond reach of power derived from this area.

It is not necessary to insist upon the vast economic difference to Ireland between supplying the power, light, and to a steadily increasing extent the heat required, from her own peat resources, with recovery of agricultural land, as against the supply of these demands by means of imported coal.

Every country with large peat areas but Ireland has a special department to deal with its utilisation; here, unfortunately, the

matter is left to private initiative, and capital has been frightened away by failure after failure.

In face of an honest and alert public department such exploitations of the credulity of the investing public would be impossible.

It may be worth while, before leaving this part of the paper, to make an estimate of the value of the bogs. These cover one-seventh of the area of Ireland, and extend over 4,600 sq. miles, or 2,000,000 acres. If we assume them to be on the average of the same value as the Dutch bogs, 6 ft. deep, as before given, namely, £100 per acre, we have a total value of £300,000,000.

As a matter of fact, I estimate the gross value of the peat and bog products and reclaimed land as £1,200,000,000.

The value to the country politically of the solution of the problem of bog utilisation, in the increase of employment, in the increased industry, and, above all, in the calling of the city slum-dwellers back to countryside, is not measurable in cash terms.

So much for the peat winning side of the problem. Now as to its application when won. Here we are on sure ground. (Then follows a report of a test of peat gas plant lately put down at Portadown, as recently published in the ELECTRICAL REVIEW.)

This installation proves, on the facts given, that peat can be substituted for anthracite at 32s. 6d. per ton under favourable conditions as to proximity to the bog, good weather, and small demand, with a decided saving.

The cost of peat, 6s. per ton, with 20 per cent. moisture, i.e., 7s. 6d. per ton anhydrous is too high for the wide scheme of utilisation I am advocating as possible, and shows that this—the most important side of the problem—has been quite untouched and still lies open for solution.

The Power Gas Corporation claim to have developed a means of mechanically drying peat from 80 per cent. moisture to 50 per cent. moisture, independent of the weather conditions, at a total cost, including excavating, manufacturing, drying and all handling, of about 3s. per anhydrous ton.

The ideal to be aimed at, in my opinion, is 10,000 tons of peat (reckoned on its anhydrous contents) standing dried *in situ* on the bog, 10,000 tons less dry but drying, and the certainty of this supply being available year after year—coupled with such improvements in the producers as shall allow of the use of the peat in big amorphous lumps, not neatly-cut sods, so that the peat could be rather quarried than cut, and transported direct to the producers—with, say, 1,000 tons under cover for emergencies.

It may appear that this is a rather large order. As a matter of fact, based on the recorded price per cubic yard of excavating the narrow intensive drains with the Dolberg Dowbrowsky cutter (6d. per cubic yard) the labour cost of the drains (18,000 cubic yards) would be only £450, and would be offset by the value of the 1,350 tons of anhydrous peat cut in the process, as well as the 30,000 tons exposed to intensive drainage and air drying *in situ*.

On a suitable bog I estimate that the first 30,000 tons would cost £2,000 to £3,000, and it would be about five years before the first 10,000 tons were available *in situ*—thereafter an increasing annual supply would be available at a gradually decreasing cost as the bog dried out and electric power became available. I should expect in the long run to get the peat at the producers at 2s. per anhydrous ton.

### Flashing-over in Commutator Machines.

By W. W. FRITH, M.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Newcastle, March 11th, 1912.)

By the term flashing-over is meant the formation of an arc with explosive violence between the brushes of a commutator machine subjected to abnormal conditions of load. In every case the flash-over appears to be associated with high current density in the brushes and excessive sparking. The arc forms a low-resistance path between the brushes, and the machine is virtually short-circuited as long as the arc exists. The arc is carried away from the commutator surface chiefly by the magnetic action of the leakage flux, and is finally broken at the outer portions of the brush-gear. In motor or converter cases, however, the circuit-breaker may operate, and the arc is then extinguished by the withdrawal of the power.

Of all machines, the converter is most subject to flashing-over, the usual cause being a short-circuit on the direct-current side. It also occurs frequently in motors subjected to excessive overloads or to accidental breaking of the field circuit; it seldom occurs in generators, probably for the reason that armature reaction on short-circuit greatly reduces the voltage across the segments.

In multipolar machines the flash sometimes extends around the circumference of the commutator, but as a rule is confined to certain pairs of brushes, a reason for which is suggested later. Flashing-over is a source of considerable anxiety to engineers because of the danger to attendants and the damage which usually results to the machine itself. A brush-gear is generally badly damaged, and often the machine is put out of commission for repair. A remarkable feature of the phenomenon is that the commutator is seldom, if ever, in the slightest degree injured, in spite of the fact that the flash starts at its surface.

A valuable clue to the cause of flashing-over is afforded by a fact previously mentioned, that it is always associated with heavy initial sparking at the brushes. This may occur at any load, and depends upon the setting of the brushes: a machine set to run sparklessly at full load will probably not flash-over at full load, but will do so on light load if a short-circuit develops in either case.

There are only two possible reasons for an arc forming between



the brushes; either an abnormal rise of voltage or a decrease of resistance; the former is very unlikely to happen, and there is left only the second alternative, namely, the establishment of a conducting path between the brushes. The path may consist (a) of carbon particles liberated from the brushes by excessive sparking or (b) of a series of local arcs across the segments.

It is likely that both agencies are concerned—imperfect commutation as a primary cause and carbon dust as a secondary one; probably the function of the dust is to reduce the resistance of the arcs over the mica insulation. That carbon dust has some influence in producing flash-over is supported by observations on a 7½-H.P. 430-volt Westinghouse motor loaded with a direct-coupled

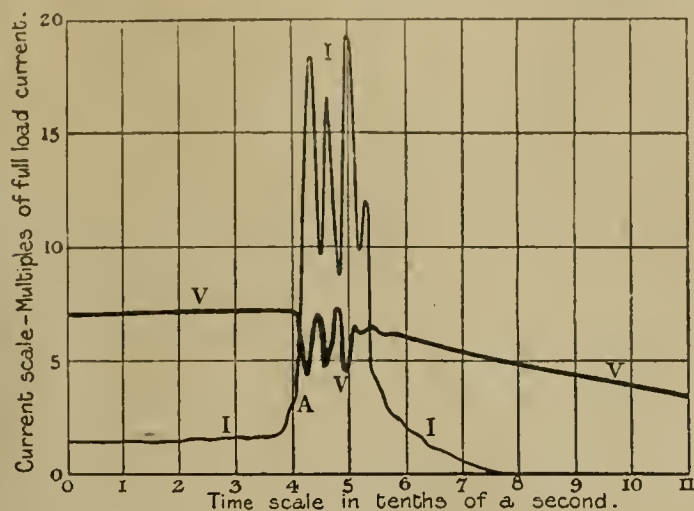


FIG. 1.

100-volt 50-ampere generator. Flash-over could be produced when desired by short-circuiting the fully-loaded generator through a 40-ampere fuse. The flash was always present at the upper surface of the commutator where the carbon dust is held on by gravity, but none was observed on the lower surface, where the carbon dust can fall clear. Further evidence is that when the commutator and brushes had been well cleaned, flashing-over could not be produced until the machine had run for some time afterwards.

Fig. 1 is a copy of a photographic record of current and voltage to the motor at the time of flash-over, from which it is quite clear that the flash is not started by a voltage rise, and is therefore due to the second cause—viz., a fall of resistance across the surface of the commutator. The establishment of such a conducting path between terminals across which a voltage of 480 is maintained is quite sufficient to start a current which instantaneously develops into a short-circuit. The arc is then blown out by the leakage

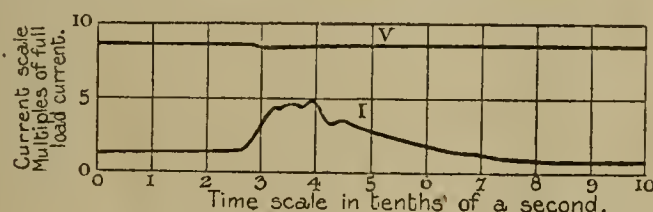


FIG. 2.

flux, but another one is at once started unless the short-circuit has cleared; a succession of flashes occurs so long as the short-circuit lasts.

In the voltage record of fig. 1 there are large fluctuations below the normal voltage terminated by a falling line as the machine comes to rest, the main fuse of the motor having blown during the short-circuit.

A distinct change in the slope of the current curve will be noticed at A, which point probably represents the instant of flash-over; it is of importance to the theory of progressive short-circuit to note that the time measured on the oscillogram from the bottom bend up to A closely corresponds with that required for a segment to move from one brush to the next.

Until the fuse blows, the arc is maintained by the supply mains, and afterwards by the energy stored in the revolving armatures. The maximum current recorded on fig. 1 is 19 times full-load current, and the energy absorbed is about 7,500 ft.-lb.; the total time of flash-over measured on fig. 1 is 0.4 second. The ripples in both voltage and current appear to be due to the varying length of the arc as it passes over the irregularities of brush-gear and horns.

The real solution of the problem of flashing-over is in the design of machines with good commutation, and with an ample allowance of insulation between the segments, in machines which are subject to the trouble.

A most effective preventive of flashing-over has been found by the author in the use of asbestos-faced wipers placed between the brushes and extending the full length of the commutator. With these wipers in position it was found to be impossible to produce a flash-over under the most extreme conditions of load and sparking. On short-circuiting the loaded generator a shower of flashes starting from the brush-tip, travelled over the surface of the commutator to the wipers, where they were instantly quenched. Fig. 2 is an oscillogram taken under these conditions, from which it will be seen that the maximum current reached is about five times that at full load.

A further advantage in the use of the wipers is that the surface of the commutator is kept quite clean and normal sparking reduced

to a minimum. The only drawback to their use is that they retain the carbon dust, and after a time become dirty. This results in some slight sparking under the wipers, particularly if set, as in this experiment, in the central position where the segments are carrying their maximum voltage. This points to the advantage of using thin wipers set close to the trailing tips of the brushes, and arranging them so that they may be easily cleaned or renewed.

The arrangement now used is to make the brush box double, the second compartment carrying the wiper. On the heaviest short-circuit, sparking is confined to the narrow space between the brush and the wiper.

#### DISCUSSION.

DR. W. M. THORNTON said that at one time he had held the theory that flashing-over was due to a rise in voltage, but Mr. Firth had clearly shown that the true cause was the maintenance of a true arc between the segments, and this result was contributed to by the disintegration of the brushes due to the initial sparking.

PROF. ROBERTSON, Bristol (communicated) did not think that disintegration of the brushes was at all necessary in order to produce flashing-over, as the small arcs drawn out between the segments and the brushes were sufficient in themselves.

MR. G. STONEY said that flashing-over was liable to occur in a machine in which the voltage per segment was high and where the pole-tips were of the wrong design. It could be reduced by the use of compensating windings and the other devices which were employed to improve the sparking constants. The use of thicker mica between the segments had also a beneficial effect. He had found that turbine machines fitted with carbon brushes were less liable to give trouble, as were also two-pole machines as compared with four-pole ones. Wipers had been tried 10 or 12 years ago and abandoned, and he did not think that they were practicable in commercial work.

MR. W. BAXTER agreed that the leakage flux had a good deal to do with carrying the arc away from the commutator, and also in finally extinguishing it altogether. He thought that the fact that generators were generally designed with better sparking constants than were motors was the true explanation of the lesser liability of the former to flashing-over. He could not agree that any one pair of brushes were more liable to go over than any other pair; and with regard to the suggestion that the particles were held on the top surface by gravity, he pointed out that in the machine tested the centrifugal force was 193 times the force of gravity, so that the difference between the top and bottom sides was only about 1 per cent. He thought that the best plan was to design machines which would stand 100 per cent. overload without sparking, and in any case it would be difficult to sell machines fitted with wipers.

MR. J. SCHUIL said that the whole question resolved itself into one of obtaining sparkless commutation. Some Brown-Boveri machines for 1,750 volts D.C. with 52 volts between segments worked perfectly, simply because perfect commutation was provided for. The reason why a commutating pole machine cleared itself after a flash-over was that the inter-poles automatically provided a stronger reversing field in that event.

MR. BURGESS said that the wipers were sure to give trouble when they became dirty, and he could hardly imagine these on, say, a 600-volt traction motor. The solution did not lie in the use of wipers, but in the correct design of the machine for its work. He thought that it should be possible to utilise condensers to take up any spark which might occur.

MR. FIRTH, in reply, did not think that the centrifugal force would be so great as had been stated, because it was not at all certain that the particles were travelling at the same speed as the commutator. He could not see why wipers should not be used commercially; they were cheap, easily renewed, and did not add appreciably to the cost of the machine.

#### The Röntgen Society.

THE meeting of the Röntgen Society on March 5th was held, by special invitation of Prof. Silvanus Thompson, at the City and Guilds Technical College, Finsbury, where the members had an opportunity of putting to a personal test the discovery of Prof. Thompson that an alternating magnetic field produces certain physiological effects, chiefly visual. Prof. Thompson said that he was induced to take up the subject on reading in Lord Kelvin's papers that some years ago Lord Lindsay, now the Earl of Crawford, had constructed a large electro-magnet capable of producing a powerful magnetic field, but that on placing his head between the poles of the magnet no effect whatever was observed. Thereupon the speaker caused to be manufactured two large copper coils, each of them weighing rather more than a hundredweight, and containing 10,000 magnetic lines per square centimetre. It was arranged to have one of these at each side of the head and to excite them by means of an alternating current generated on the spot. The effect was to produce a certain flicker, colourless, or of a slight bluish tint—other speakers subsequently described it as golden yellow—not well defined over the whole region of vision, and rather brighter at the periphery than in the centre. The effect was best seen in the dark, but the flicker persisted in the ordinarily lighted room, and seemed to superimpose itself over the visible objects. The effect differed in intensity according to the direction in which the head was placed between the coils. It was greater if the coils were at the temples than if the magnetic influence had to pass from the front to the back of the head. The only other effects produced were some nausea and vertigo after a long continued



experience, and, in some cases, a slight taste in the teeth. It was possible that the nerves of hearing were stimulated equally with the nerves of sight, but if this were so the noise in the generating room "drowned out" any such subjective effect. Two people among the large number who had made the experiment were unable to see anything unusual. In a *résumé* of the work, most of it negative, previously done upon this subject, Prof. Thompson referred to a statement by Prof. Birkeland that the workmen engaged in the nitrate works at Notodden, Norway, were able to see lights at night over some of their magnetic machinery, and also to some similar statements of psychologists in this country. It might be that "sensitives" were able in the dark to see flames standing above permanent magnets, but he pointed out that so far as his own investigations were concerned, the effect was bound up with the alternating current, and nothing unusual was observed at all with the continuous steady current. In a verbal communication to the Société de Biologie, of Paris, D'Arsonval stated that an intense magnetic field—110 volts, 30 amperes, 42 periods per second—gave rise when the head was plunged into it to "phosphenes" or appearances of light in the eye. In Prof. Thompson's opinion the effect was due to electric currents induced by magnetism, and existed in proportion to the degree of magnetism produced.

### The Electric Driving of Rolling Mills.

A SPECIAL meeting of the NEWCASTLE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS was held at Darlington on February 26th. The works of the Darlington Forge Co. was visited, as was also the Municipal electricity works, where the members were entertained to tea by the Corporation.

In the evening the paper on "The Electric Driving of Rolling Mills,"\* by MR. C. A. ABLETT, was read by Mr. L. Rothera, in the absence of the author, and the following discussion took place:—

MR. G. STONEY said that their unavoidable time-lag seemed to be the drawback of all automatic regulators. He did not think that three or four mills would be sufficient to equalise the load on a central station, as on a tramway system, with 50 or 60 cars running, variations up to 200 per cent. above normal were observed.

DR. W. M. THORNTON thought that the moving parts of automatic regulators were usually made too heavy. Even if they were perfectly balanced, it was still necessary to put the parts into motion, and this occupied an appreciable time. With regard to rope losses, he thought that with 10 per cent. as given in the paper, it would be difficult to keep the ropes from charring.

MR. A. H. MARSHALL regretted that everyday figures for the consumption in units per ton rolled had not been given for the sake of comparison with direct driving by steam. In the Middlesbrough district there were seven electrically-driven mills of over 1,000 H.P., all supplied by the local Electric Supply Co., with 2,750 volts 40 cycles three-phase current, and, so far as he knew, there had been only one instance of trouble of an electrical character, and even that was not serious. The costs given in the paper for a supply under the maximum-demand system were rather misleading, as instantaneous peaks were not recorded by the demand meters, the usual basis being a half-hour one.

MR. J. INGHAM did not agree with the figures given in the paper for rope losses. With a well-designed drive, the loss should not exceed  $2\frac{1}{2}$ —3 per cent. He agreed that the rope loss remained constant for wide variations of the power transmitted, and consequently it was important that the ropes should be worked at or near full load. His own practice was to design the ropes for 80 to 90 per cent. of the normal power of the motor. Taking the case of a 500-H.P. motor, he would use 12 2-in. ropes running at 3,200 ft. per min., giving a loss of  $3\frac{1}{2}$  per cent. at full load and  $5\frac{3}{4}$  per cent. at average load. The life of the ropes would be about two years, working 120 hours per week. Assuming 60-ft. centres, the ropes would cost about £10 each, and the total annual cost for renewals would be £60. Comparing this with a similar drive but with 16 ropes, which would probably last three years, the extra cost was only £7 per annum. Against this there would be an increase in efficiency equal to 9.6 H.P., which, at 3d. per H.P.-hour, would effect a saving of £75 per annum, thus showing a net saving of £68 due to using the smaller number of ropes.

MR. ROTHERA (in reply) said that he thought that it would be false economy to install ropes capable of transmitting only 80 per cent. of the normal power of the motor, and as peaks equal to twice the normal would have to be dealt with frequently, he did not think that the ropes would last very long. The efficiency of the Ilgner system varied from 60 to 70 per cent., but the increased output more than compensated for this somewhat low figure. When they saw steam-driven mills with as many as 10 sets of gear wheels, it was obvious that an enormous amount of power was being wasted, and anything which would eliminate this waste would be an advantage.

**A Dutch Electrical Exhibition.**—The Maatschappij van Nyverheid, or Dutch Industrial Union, intend to hold an Electrical Exhibition from June 3rd to 23rd next in the rooms of the Zoological Garden at the Hague. The object is the popularising of electric appliances and processes. Engineer J. C. Boot, Frederik Hendrik-laan 12, The Hague, is the Secretary.—*Elek. u. Maschinenbau.*

## PARLIAMENTARY.

### London Electric Railways Bill.

LAST week a Select Committee, under the chairmanship of Sir Luke White, considered this Bill, which proposes to authorise the company to construct a railway joining up with the present authorised extension of the Baker Street and Waterloo line to Paddington on to Queen's Park, Willesden, where a junction will be made with the London and North-Western Railway line. It also provides for the construction of a moving staircase at Oxford Circus Station and subways at Southwark. It also amalgamates with the company the Edgware and Hampstead Railway Co., which has powers to construct a railway from Golder's Green to Edgware. The Bill also contained powers for the London and North-Western Railway Co. to raise £1,000,000 for the various works set out; for the London Electric Railway Co. to raise £750,000 4 per cent. preference stock, and for the company to supply electricity to the North London Railway Co. and to the Richmond Electric Supply Co.

MR. J. D. FITZGERALD, K.C., opened the case for the promoters, and said the principal object was to enable a new line to be made from Paddington to Queen's Park, which would mean running through a thickly populated district not at present provided with direct railway communication to the centre of London. At Queen's Park the new line would form a junction with the London and North-Western Railway's line to Watford, which was now in course of being electrified, and the result would be that passengers would be able to travel direct from Watford to the Elephant and Castle. So convinced were the London and North-Western Railway of the success of the proposal, that they were willing to advance £1,000,000 for the construction and equipment of the new line. A further object was the amalgamation of the Edgware and Hampstead Railway with the company. This company obtained powers in 1902 to construct a line from Golder's Green to Edgware, but owing to the promoters being unable to raise the necessary capital it had not been constructed. It would, however, be a valuable extension for the London Electric Railway Co., and they and the Underground Co. would find the necessary capital.

MR. STANLEY, managing director of the company, gave formal evidence. The estimated cost of constructing and equipping the line from Paddington to Queen's Park was £918,600.

The only petitions against the Bill were those of the Westminster City Council and the London County Council, and as the objections were not pressed the Committee passed the preamble of the Bill.

### Brighton Tramway Proposals.

ON Thursday, February 14th, a Select Committee of the House of Lords, presided over by Lord Newton, commenced the consideration of the group of Bills being promoted for tramway powers in Brighton and District. The first Bill taken was that of the Brighton Corporation. Mr. H. Lloyd, K.C., Mr. G. J. Talbot, and Mr. Clode appeared for the Brighton Corporation; Mr. Balfour Browne, K.C., Mr. J. W. Fitzgerald, K.C., and Mr. Tyldesley Jones for the Hove Corporation; Mr. Freeman, K.C., for the East and West Sussex County Councils; Mr. C. C. Hutchinson and Mr. Lyndon Macassey for the British Electric Traction Co., and there were several local authorities and gas companies also represented.

MR. H. LLOYD, K.C., in opening the case for the Brighton Corporation, said the proposal was to install a trackless trolley system of tramways on various roads within the borough, and also in Hove and the districts of Portslade, Southwick, and Shoreham. The Hove Corporation were promoting a Bill to run a similar service in Hove, Portslade, Southwick, and Shoreham, and the British Electric Traction Co. proposed to resuscitate the tramway which at present existed in Hove and in the districts West of Hove. Practically the proposal of the Brighton Corporation was to install a through east and west route from the eastern boundary, through Hove to the districts beyond. The Brighton Corporation were an existing tramway authority, but so far they had never seen fit to put down tramways near the sea front for the reason that they considered the roads unsuitable, although there could be little doubt that such a service would prove far more lucrative than the existing routes. For the past few years, however, the Corporation had been attracted with the idea of a railless system along this route, although it was true that now there was a derelict tramway along part of the proposed route, and also a service of motor-buses. The existing tramways in Hove were authorised in 1888, and they had fallen into the hands of the British Electric Traction Co. In 1903 the company were authorised to extend the line to Worthing, but nothing had been done in the matter. Then, as the result of action taken by the Hove Corporation to deal with the tramway, the company in 1910 brought forward a Bill to extend the tramways at either end, so as to go to Worthing and Brighton, but owing to opposition of all the three Corporations affected, it fell through. Last year the Brighton and Hove Omnibus Co. promoted a Bill for trackless tramways, but all the power they got was to install a system from Brighton to Rottingdean. The Omnibus Co. had promoted a Bill this year, but the Brighton Corporation had come to terms with the promoters. The effect of the provisional agreement was that if the present Bill of the Brighton Corporation were carried, the Omnibus Co. would transfer to the Corporation the powers they obtained last session for a cash payment. With regard to Hove, if the Hove Corporation really wanted a trackless trolley system, he would undertake to construct the portion of the system within

\* For abstract, see ELECTRICAL REVIEW, February 9th, 1912.



Brighton, and leave it to the Hove Corporation to construct the portion within Hove. What it came to was, that if it was agreed that such a system was desirable, there would be no difficulty about Brighton and Hove each respectively taking their powers and finally regulating how these things should be constructed. As to the opposition of the Tramway Co., he contended that it was merely an attempt to try and resuscitate a tramway which was derelict, and he submitted that it was against the public interests that this should be allowed. He understood that the local authorities were desirous of better facilities, but they held the view that only one system should be allowed. In regard to the Gas Co.'s opposition, he would not trouble the Committee with the clause giving the Brighton Corporation power to supply electricity in outside districts by consent, and would say at once that all Brighton now asked for was power to supply the electric energy required for running the proposed service of trolley vehicles.

MR. ALDERMAN GEERE, Deputy Mayor of Brighton, was called, and bore out counsel's opening statement. A deputation from the Corporation had visited Leeds and Bradford to inspect the railless system there. The Omnibus Co. had both petrol and electric 'buses, and the effect of the agreement provisionally entered into was that the Corporation would acquire the electric 'buses and the charging stations and leave the company with the petrol 'buses.

Cross-examined by MR. BALFOUR BROWNE, WITNESS admitted that the Corporation last year opposed the Bill of the Omnibus Co., which contained practically similar proposals to those in the present Bill; but their reason for doing it was because the Corporation were the tramway authority. He admitted that they had received a letter from the Board of Trade, pointing out that some of the roads were too narrow for the proposed system, but they did not intend to widen them.

Questioned by MR. HUTCHINSON, WITNESS said the intention was to do away with the present tramways owned by counsel's clients, but they were not asking for that power in the present Bill.

WITNESS was examined at great length by other petitioners regarding the question of depreciation of property, &c.

ALDERMAN F. T. WILSON (chairman of the Brighton Corporation Tramways Committee) also gave evidence, and pointed out that at present the existing tramways were handicapped by having to serve only hilly routes; but in spite of this, since 1903-4 the tramways had, with small exceptions, paid their way. He understood that the expense of running the trackless system would be less than that of running 'buses. He saw no reason to object to the overhead equipment, because the route to be served was chiefly through commercial streets.

After further local evidence had been given,

MR. J. B. HAMILTON, general manager of the Leeds City Tramways, gave evidence, and said he considered Brighton a suitable town for a trackless trolley system. There was no reason why a trackless trolley vehicle could not pass with absolute safety wherever a motor-'bus went, because it would be about 6 in. narrower than the 'bus. A trolley vehicle would also be a ton or 30 cwt. lighter than an electric motor-'bus. He had gone into the figures in the estimates and considered they would show a profit.

On cross-examination, WITNESS admitted that the Leeds system was an extension from the centre to the outside districts. Exclusive of overhead equipment, the cost of working trolley vehicles was 6d. to 6½d. a mile, but he was not aware that the cost of motor-'buses was not more than 7½d. Motor-'buses carried 34 passengers, and the proposed trolley vehicles 28, but he did not know whether that number would be final. He did not know any place where double-decked cars were worked on the trolley system, but he considered it a perfectly safe proposition. He did not agree that the system was at present in an experimental stage, although it was in a stage of evolution.

(To be continued.)

**Edgware and Hampstead Railway Bill.**—This Bill came before Sir Luke White's Select Committee last week, the object being to allow of a deviation of the authorised line at Hendon and to give an extension of time for completion. The only opposition was that of Sir J. Blundell Maple's Trustees with regard to the acquisition of some land at Burnt Oak, and the Committee found the preamble proved.

**Southall, Hounslow and Twickenham Railless Traction Bill.**—It is reported that the petition for this Bill has been withdrawn. It will be remembered that the promoters failed to satisfy the Examiner that Standing Orders had been complied with.

**Annual Dinner.**—Electrical Installations, Ltd., held their Fifth Annual Staff Dinner on 9th inst., at the Crown and Cushion, London Wall, E.C., when some 60 members of the staff were present, with Mr. H. F. Simon, manager of the company, in the chair. Mr. Simon, in his speech, alluded to the very satisfactory progress which the company had made in the past year, and with a view to showing the management's appreciation of the staff's valuable services, presented, on behalf of the directors, a donation to the recently founded "Electrical Installations, Ltd., Athletic Club," which, in the first season of its existence, had done so well in the football field as to reach the final tie for the "Davis" Football Challenge Cup, open to teams of firms in the electrical industries. After the dinner a smoking concert was held, various musical items being contributed by members of the staff.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**BRAZIL.**—The new Brazilian Budget recently introduced provides, amongst other things, for the following new rates of duty:—

Manufactures of cast-iron or steel not specially mentioned in the Customs Tariff, enamelled... 1,200 reis per kg.  
Electrodes, electric machines, electric turbines, electric furnaces, put together or not; iron plates coated with tin or lead, necessary for the installation and working of manufactories of carbide of calcium established in Brazil ... 8 % ad val.

It is also laid down that all machinery and material destined for the first public installation of light, power, water supply, drainage, and imported directly by States and Municipalities, excluding that destined for private houses, are to be dutiable at the rate of 8 per cent. *ad valorem*. The same duty is to be levied on screws, rivets, tubes of copper or glass, and other articles, even if they are separately specified in the Tariff, which are imported with machines adapted thereto, and in quantities strictly necessary for the working of the same.

The undermentioned articles, when imported by "railway companies and by manufactories of china, fine stoneware, porcelain, or vitrified tiles for pavements," are to be allowed the following special rates:—

Physical apparatus, and articles or instruments adapted for electrical power and light installations... 8 % ad val.

N.B.—35 per cent. of the amount of duty is leviable in gold at the rate of 1,000 reis = 2s. 3d.; the remainder in currency at 1,000 reis = 1s. 3½d.

A surtax of 2 per cent. of the duty is also levied.

The Budget Law also provided that Consular invoices for shipments of merchandise to Brazil shall be presented in triplicate to the Brazilian Consul or Consular Agent, who, after authenticating them, shall send the original direct, together with the ship's papers, to the Custom house of the port or place of destination. (Hitherto, the original has been handed by the Consul to the shipper to be forwarded to the consignee for presentation to the Customs on clearance of the goods.) The two copies of the invoice are to be exempt from stamp duty. The value of the goods for Customs clearance is to be based on the original invoice as transmitted to Brazil by a Consul of that country.

In case the examination of the goods in Brazil shows that divergences exist between the Consular invoice and the contents of the packages, the owner or consignee of the goods shall be liable to a fine of twice the amount of the duties (whatever such amount may be) arising through the difference in question, whether resulting from a difference in quality, quantity, weight, lower rate of duty, or value. The declaration in the invoice of the gross weight of the merchandise, when it is subject to payment of duty on the net weight, or *vice versa*, shall be included amongst the divergences giving rise to the penalty mentioned above.

These new Consular invoices are to come into force on April 1st.

**ROUMANIA.**—A bill has recently been laid before the Chamber by the Roumanian Government which proposes to modify the existing Roumanian Customs tariff. The following proposed alterations will be of interest to readers of the ELECTRICAL REVIEW:—

	Present duty.	Proposed new duty.
	Lei per 100 kg.	
Copper wire less than 1 mm. thick ... ..	30	20
Cables for the transmission of electric current, and insulated wire for electrical conduits—		
(a) With covering or casing of sheet iron, iron wire or iron bands ... ..	12	6
(b) Without metallic casing, but insulated with paper, asbestos, or other materials, not specially mentioned ... ..	20	10
(c) Insulated with india-rubber or gutta-percha ... ..	30	15
(d) Insulated with textile thread other than silk, even combined with other materials ... ..	50	25
(e) Insulated with silk thread ... ..	100	50

It is also proposed that parts and accessories of machines and apparatus specified in Nos. 735 to 744 (*i.e.* all machines *except* electrical) imported separately or as reserve pieces, are to be dutiable as wares of which they are made. Machines specified in Nos. 735, 736, 740, 744 and 745 (*i.e.* engines, machine tools, printing machines, machines and apparatus not specially mentioned, dynamo electric machinery, electric motors, converters, transformers and distributors) if imported by the Ministry of Public Works, by the Railway Administration and by State industrial establishments for their own needs shall be exempt from import duty with the authorisation of the Ministry of Finance, and in so far as they are not manufactured in the country.

**NORWAY.**—Wireless telegraphic apparatus being widely installed on Norwegian shipping, the Government have issued an order declaring all such apparatus duty free until further notice.—*Elek. u. Maschinenbau.*



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 5,415. "Metal-vapour alternating-current rectifiers and similar apparatus." HARTMANN & BRAUN AKT.-GES. (Convention date, March 2nd, 1911, Germany.) March 4th. (Complete.)
- 5,416. "Electrolysis of metal solutions." F. HODGSON. March 4th.
- 5,492. "Method of automatically igniting gas lamps and the like." E. W. ASHTON and T. M. SPURGE. March 4th.
- 5,434. "Apparatus for charging accumulators." K. VON DREGER. (Convention date, March 3rd, 1911, Germany.) March 4th. (Complete.)
- 5,446. "Brush-holders for magneto-machines for electric ignition." A. G. BLOXAM (firm of R. Bosch, Germany.) March 4th. (Complete.)
- 5,447. "Speed control of direct-current motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, March 6th, 1911, Germany.) March 4th. (Complete.)
- 5,462. "Electrical tumblerswitches and the like." A. WYNNE. March 5th.
- 5,467. "Electric lamps, electroliers, and the like." PEYTON & PEYTON, LTD., and H. B. BONN. March 5th.
- 5,469. "Trolley collectors for electrically-driven tramway cars or road motor vehicles." E. P. B. ESTLER. March 5th.
- 5,534. "Electric signal or indicator for taximeter cabs or other similar public vehicles." P. T. HILLMAN. March 5th. (Complete.)
- 5,542. "Automatic mechanism for operating electric switches, valves, and the like." R. C. GRIESBACH and VENNER TIME SWITCHES, LTD. March 5th.
- 5,544. "Electrically-driven planing machines and similar reciprocating tools." VICKERS, LTD., and A. D. WILLIAMSON. March 5th.
- 5,545. "Process of manufacturing negative electrodes for alkaline accumulators." SVENSKA AKKUMULATOR AKTIEBOLAGET JUNGNER. (Convention date, March 7th, 1911, Sweden.) March 5th. (Complete.)
- 5,551. "Generation of alternating currents." K. ZICKLER and R. CZEPEK. (Convention date, March 19th, 1911, Austria.) March 5th. (Complete.)
- 5,554. "Apparatus for connecting conducting wires, cables, and the like." A. FODOR. March 5th. (Complete.)
- 5,559. "Electric block-signalling systems." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) March 5th. (Complete.)
- 5,560. "Holders for electric lamps." C. C. REGNART. March 5th.
- 5,562. "Electrical switches." S. L. PRICE. March 5th.
- 5,575. "Couplings for electric conductors." BRITISH THOMSON-HOUSTON Co., LTD., H. N. SPORROR and A. S. CURITT. March 5th.
- 5,576. "Electro-magnetically-operated switches." BRITISH THOMSON-HOUSTON Co., LTD., and E. GARTON. March 5th.
- 5,584. "Wireless telegraphy." C. H. GULLIVER. March 5th.
- 5,590. "Telegraph and like cable conductors." W. E. HITCH. March 6th.
- 5,629. "Magnetos used with internal-combustion engines." E. E. BENTALL and G. C. BINGHAM. March 6th.
- 5,630. "Electrical resistances." ELECTRICAL APPARATUS Co., LTD., and G. FARQUHAR. March 6th.
- 5,635. "Process for treating water or other liquids by means of ultra-violet rays produced in a quartz lamp and apparatus therefor." C. KNIPS. (Convention date, March 6th, 1911, Germany.) March 6th. (Complete.)
- 5,636. "Device for attaching overhead line wires to insulators." G. K. PATON. March 6th.
- 5,651. "Calculating typewriting and other machines." E. C. R. MARKS (McCasky Electric Calculator Co.) (Divided application on 9,563/1911, April 19th.) March 6th. (Complete.)
- 5,655. "Telegraph systems." H. H. HARRISON, G. W. MOORE and J. SAVIN. March 6th.
- 5,692. "Electrical engine or machinery tell-tale." J. C. CLARKE and CHADBURN (SHIP) TELEGRAPH Co., LTD. March 6th.
- 5,703. "Switch-throwing mechanism for electric railways and the like." R. V. COLLINS. (Convention date, November 10th, 1911, United States.) (Complete.)
- 5,717. "Electro-magnetic apparatus for automatically discharging liquids from vessels in which the pressure can be either above or below the atmosphere." C. D. BURTON and GARNER, TELFORD & HARDMAN, LTD. March 7th.
- 5,719. "Automatic switch and relay." E. F. KENT. March 7th.
- 5,720. "Application of electricity to a lock designed for giving an alarm signal and the application of an insulating material to a key for the said lock." E. E. ALEXANDER. (J. H. Preston, Canada.) March 7th.
- 5,723. "Means for transforming electrical energy into heat energy particularly applicable to hair-drying apparatus." LONDON ELECTRICAL TRADING Co., LTD., and C. O. BASTIAN. March 7th.
- 5,741. "Electric bell switches." A. B. EBBS. March 7th.
- 5,774. "Production of luminous radium effects." GEBR. JUNGHANS AKT.-GES. (Convention date, February 15th, 1912, Germany.) March 7th. (Complete.)
- 5,775. "Method of mounting and driving dynamos on railway and similar vehicles." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., and J. ETCHILLS. March 7th.
- 5,796. "Electric relays." E. MÖLLER. (Convention date, March 8th, 1911, Sweden.) March 7th. (Complete.)
- 5,803. "Electric motor-control systems." ALLGEMEINE ELEKTRICITÄT Ges. (Convention date, March 7th, 1911, Germany.) March 7th. (Complete.)
- 5,810. "Combination of an electric switch and fuse." A. H. MAYES. March 7th.
- 5,814. "Switch arrangement for pocket, torch, cycle, hand and motor lamps." J. F. SMITH. March 8th.
- 5,850. "Mechanical and electrical machine for a train to put to danger its signal after passing it." W. G. MELLOR. March 8th.
- 5,853. "Bath for the electrolysis of iron." G. TISCHENKO. March 8th. (Complete.)
- 5,854. "Electrolysis of iron." G. TISCHENKO. March 8th. (Complete.)
- 5,855. "Process and apparatus for the electrolytic refining of ores." G. TISCHENKO. March 8th. (Complete.)
- 5,856. "Electrical insulating means." H. W. TURNER. March 8th.
- 5,862. "Electric switches." BRITISH THOMSON-HOUSTON Co., LTD., and E. B. WEDMORE. March 8th.
- 5,871. "Power producing apparatus." F. V. W. SWANTON. March 8th.
- 5,876. "Telephone exchange systems." P. JENSEN (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) March 8th. (Complete.)
- 5,877. "Telephone exchange systems." P. JENSEN. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) March 8th. (Complete.)
- 5,887. "Supports for lamps." E. I. PARKES. March 8th.
- 5,888. "Construction of branched electric fittings." E. I. PARKES. March 8th.
- 5,889. "Control device for electrically-operated hot-air douches." E. I. PARKES. March 8th.
- 5,902. "Apparatus for electrically-indicating the available seating accommodation in theatres, halls or other public places." TYLER APPARATUS Co., LTD. March 8th.

5,904. "Apparatus for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., J. E. COCHRANE and R. D. BAROAY. March 8th.

5,907. "Conductors or lugs for electric conductors." J. E. M. ROSA and J. SHAW. March 8th.

5,919. "Means of making contact of operating electric signals for use principally in mines." M. FRYAR. March 9th.

5,924. "Apparatus for transmitting orders or the like, indications specially applicable for ships' telegraphing apparatus." P. R. KERRIE and H. M. R. MADDICK. March 9th.

5,962. "Apparatus for electric welding of tubes." Ges. FÜR ELEKTRO-TECHNISCHE INDUSTRIE M.B.H. (Convention date, March 9th, 1911, Germany.) March 9th. (Complete.)

5,971. "Speed control circuits for series-wound motors for cranes and the like." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, March 10th, 1911, Germany.) March 9th. (Complete.)

5,972. "Telephone metering systems." A. J. BOULT. (International Telechronometer Co., United States.) March 9th. (Complete.)

5,985. "Time-controlled mechanism for electric switches." R. HADDAN. (Copeman Electric Stove Co., United States.) (Divided application 22,001, 1911, October 5th.) March 9th. (Complete.)

5,986. "Electrically-heated ovens." R. HADDAN. (Copeman Electric Stove Co., United States.) (Divided application on 22,001, 1911, October 5th.) March 9th. (Complete.)

5,987. "Controlling means for electric cooking apparatus." H. HADDAN. (Copeman Electric Stove Co., United States.) (Divided application on 22,001, 1911, October 5th.) March 9th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1910.

ELECTROMAGNETIC DEVICE. B. Soldatencow. 14,658. June 17th. (January 11th, 1911.)

## 1911.

LIGHTING AND REGULATING OF ELECTRIC ARC LAMPS. Harlé et Cie. 25,133. November 4th. (November 12th, 1910.)

ELECTRICALLY ACTUATED AND CONTROLLED APPARATUS FOR OPERATING RAILWAY SEMAPHORE SIGNALS. O'Donnell and British Pneumatic Railway Signal Co. 25,345. February 4th. (Divided application on No. 2,887 of 1911, February 4th.)

ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 29,368. December 30th. (February 18th, 1911.)

ELECTRICAL HEATING APPARATUS. A. F. Berry. 1,074. January 14th.

ELECTRIC CONTROLLERS FOR LIFTS AND THE LIKE. Easton Lift Co. and W. J. Huggett. 3,258. February 8th.

UNDERGROUND ELECTRIC CABLE TROUGHING. O. V. Thomas. 3,446. February 10th.

ELECTRIC INCANDESCENCE LAMPS. E. G. Royer. 3,541. February 11th. (February 12th, 1910.)

PUSH-BUTTON CIRCUITS FOR ELECTRIC CONTROLLERS. T. Barnard and C. Edwards. 4,191. February 18th.

ELECTROMAGNETICALLY CONTROLLED PERFORATING MECHANISM. M. Kotyra. 4,498. February 22nd.

HOLDERS FOR ELECTRIC LAMPS. G. H. Cottam. 5,594. March 6th.

SPARK GENERATOR FOR WIRELESS TELEGRAPHY. S. Walker. 7,582. March 27th.

STORAGE BATTERY PLATES. H. Lake. (United States Light and Heating Co.) 8,521. April 8th.

APPARATUS FOR STERILISING LIQUIDS BY THE ACTION OF THE ULTRA-VIOLET RAYS. T. Nogier. 9,660. April 20th. (December 22nd, 1910. Patent of Addition not granted.)

ELECTRIC JACQUARD APPARATUS. A. Regal. 10,363. April 28th. (May 17th, 1910.)

ELECTRICALLY INSULATED FISH-JOINTS FOR RAILWAY RAILS. W. R. Sykes Interlocking Signal Co. and G. H. Sykes. 11,711. May 15th.

REGENERATION OF THE HITHERTO WASTE PRODUCTS OF GALVANIC CELLS OR BATTERIES. Chemische Fabrik Griesheim Elektron. 12,040. May 18th. (June 3rd, 1910.)

AUTOMATIC STARTING DEVICES FOR ELECTRIC MOTORS. H. J. Haddan. (Whittingham.) 12,587. May 24th.

METALLIC ARMOURING FOR INSULATED ELECTRIC CABLES. A. H. Howard. 13,750. June 9th.

ELECTRIC ARC LAMPS FOR CINEMATOGRAPH PROJECTION AND THE LIKE. A. Cole and F. Wilson. 15,794. July 7th.

ELECTRIC INCANDESCENT LAMP. O. Schaller. 16,195. July 13th. (July 13th, 1910.)

SPEED REGULATION OF DYNAMO-ELECTRIC MACHINERY. H. Pieper. 17,675. August 3rd. (August 6th, 1910.)

METHODS AND APPARATUS FOR SHAPING FILAMENTS FOR ELECTRIC LAMPS AND THE LIKE. R. W. Suman. 19,047. August 24th. (May 31st, 1911.)

SINGLE-PHASE COMMUTATOR MOTORS. British Thomson-Houston Co. (Allgemeine Elektrizitäts Ges.) 20,829. September 20th.

SPARKING-PLUGS FOR INTERNAL-COMBUSTION ENGINES. The Firm of Robert Bosch. 20,899. September 21st. (December 3rd, 1910.)

ELECTRIC SEARCHLIGHTS. L. Pasqualini. 22,429. October 11th.

COMMON-BATTERY TELEPHONE SYSTEMS. Aktiebolaget L. M. Ericsson & Co. 23,823. October 27th. (November 9th, 1910. Addition to No. 21,924 of 1911.)

ATTACHMENT OR DEVICE FOR USE IN CONNECTION WITH TELEPHONES. H. S. Bryant and Third Hand Patents, Ltd. 23,957. October 28th.

CABLES FOR ELECTRIC CURRENT DISTRIBUTING SYSTEMS. C. H. Merz and R. V. Hunter. 26,857. November 30th. (Divided application on No. 4,004 of 1911. February 16th.)

**Long Non-Stop Diesel Engine Test.**—It is reported that Messrs. Barclay, Curle & Co., of Glasgow, who are building a sister ship to the *Selandia*, described in our issue of March 8th, have recently completed a 30-day non-stop (night and day) full-load trial of one of the 1,500-H.P. eight-cylinder Diesel engines for their vessel. The machinery ran without hitch, and was in perfect condition when opened up. This is said to be the longest reliability trial of Diesel plant on record. Scotch shale oil fuel was used, the consumption averaging 35 lb. per I.H.P.-hour (according to report).



# THE ELECTRICAL REVIEW.

Vol. LXX.

MARCH 29, 1912.

No. 1,792.

## ELECTRICAL REVIEW.

## SOME COAL STRIKE EFFECTS.

Vol. LXX.]	CONTENTS: March 29, 1912.	[No. 1792.	Page
Some Coal Strike Effects ...	...	...	489
Popularising Electricity ...	...	...	490
Large Turbines ...	...	...	490
The Domestic Consumer ...	...	...	490
Payment of Dividend out of Capital ...	...	...	491
Electrifying the World ...	...	...	491
Railless Traction at Leeds and Bradford ( <i>illus.</i> ) ...	...	...	492
International Smoke Abatement Exhibition ...	...	...	495
Electrical Law in the British Dominions ( <i>continued</i> ) ...	...	...	496
Correspondence:—			
Diesel Engine Trials ...	...	...	498
Earthing Mains ...	...	...	498
Large Currents at High Frequency ...	...	...	498
Constantinople Telephone System ...	...	...	498
Parliamentary ...	...	...	498
Legal ...	...	...	499
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	...	500
Colonial References... ..	...	...	501
Depreciation ...	...	...	502
Business Notes ...	...	...	504
Notes ...	...	...	510
City Notes ...	...	...	513
Stocks and Shares ...	...	...	516
Market Quotations ...	...	...	516
Share List of Electrical Companies ...	...	...	517
Exports and Imports of Electrical Goods during Feb., 1912	...	...	519
Reviews ...	...	...	520
Proceedings of Institutions:—			
Tariffs for Electrical Energy ...	...	...	522
Our Legal Query Column ...	...	...	525
Notes on Cleaning Babcock & Wilcox Boilers ( <i>illus.</i> ) ...	...	...	526
Petroleum in England ...	...	...	527
Foreign and Colonial Tariffs on Electrical Goods ...	...	...	527
New Patents Applied For, 1912 ...	...	...	528
Abstracts of Published Specifications ...	...	...	528
Contractors' Column ...	Advertisement pages xxii and xxiv		

MANAGERS of electricity works in many instances are to be commended for the foresight which they displayed in securing large stores of coal in readiness for the strike. Frequently during the months preceding the throwing down of tools we published information showing that the strike was almost inevitable; but notwithstanding the strong determination shown on both sides, most of us hoped that something would happen to prevent matters reaching such a pass that there would be a strike still in progress after four weeks, which would so calamitously disorganise the industries of the nation. Whatever the effects of the struggle may be in other directions, we may single out two reflections on the situation for comment at the moment. One of these is that we believe that the country will require some strong legislative action to be taken which will in future prevent the wholesale holding up of industry by one class of workers. What is the use of all our social reform legislation, our efforts to improve trade and industry and to prevent unemployment, our setting up of Labour Exchanges, our establishment of relief works, if by other legislation we are to permit one class of the workers in whose interests we adopt progressive legislation, to plunge the nation into such a state of chaos that poverty and distress are present on an appalling scale? Thousands of families will be brought permanently lower as the result of this war on capital. For them, at any rate, all the benefits accruing from the social legislation of the past generation are thrown away. Surely the past month has impressed all who have their country's interests at heart with the folly of legislating for the bringing in of a "new heaven and a new earth," and simultaneously arming a section of the people who are to be the residents of that blissful abode with weapons which will at the first opportunity be turned upon their fellows.

The other reflection that must have occurred to most of our readers as the price of coal has risen, and as the advantageous position of electricity supply works and users has been made so plain, has been the necessity for taking advantage of this electrical opportunity to the full. Many managers of electricity works are already turning the occasion to account, and others should do the same, by an active propaganda among the users of power, and particularly among those who have had to shut down their steam-driven works through the want of coal. Many stations in industrial areas have been experiencing a great increase in the demand for power supplies, in order not only to secure the economy and special advantages of electricity, but the freedom from dependence upon coal or gas.

Publicity and sales departments can do great things to keep this movement going. Now is the time to circulate freely practical information as to all the advantages of the electric motor, and in towns where they are already driving the machinery in local factories electrically, to publish the

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris:

BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



results of the working, in the form of testimonials from those who have had the good fortune to adopt the system, for there is no better method of business-getting than the evidence of those who have been taught by experience, and whose testimony cannot be attributed to any self-interested motives.

The practical difficulties in the way of changing over from the old methods of steam and gas-driven machinery to the electric motor have to be met, and this is done where necessary by the supply of the electric plant on a hire-purchase system, so as to relieve, as far as practicable, the question of capital expenditure, by utilising the future savings in working for paying the cost of the alteration.

The prices charged for electricity are so moderate that apart from all the other advantages obtained from its use, it is the most economical source of power, but even if it cost the same as steam, gas or oil, per horse-power generated, the convenience of being able to limit the consumption to the actual power usefully employed, constitutes a considerable percentage of saving.

When the other items are considered, such as interest on capital invested in plant, wear and tear, depreciation and obsolescence, rental of space, cleanliness, saving in wages of engine-drivers, &c., the savings by adopting electric driving from a supply company's mains are obvious.

At this moment, when the business-getting experts should be making a raid upon the power-users who are suffering from the want of coal, it is well to speak freely of the obvious benefits derived from the electric motor.

### Popularising Electricity.

A VISIT to the Electricity Hall at the International Smoke Abatement Exhibition can be cordially recommended to our readers; ladies especially are sure to be interested in what they see, for the electric cooking section is by far the most comprehensive and varied that has yet been organised, and every facility is given for visitors to make themselves familiar with the construction and working of the apparatus, and to satisfy themselves as to the excellence of their products by the proverbial method. The hall is tastefully decorated and comfortably lighted; it is not overcrowded, but nevertheless is well filled; the music is neither too loud nor too faint—in fact, we find nothing to criticise adversely, except that the Hall is hardly large enough, and we are all the more pleased to be able to offer our sincere congratulations to the Electric Supply Publicity Committee when we remember that, but a few months ago, we were obliged to comment severely upon its total failure at Olympia. The contrast could hardly be more complete; we can almost say that everything that was done by the Committee at Olympia has wisely been avoided at Islington, and nothing that has been done at Islington was done at Olympia.

Some allowance must be made for the lack of counter-attractions, for it must be admitted that there is no other exhibit at the Agricultural Hall that can be classed in the same category as the Electricity Hall, from the point of view of the ordinary householder; but even had it been set down in the Electrical Exhibition, it would have held its own. Its situation is admirably chosen, for the visitor is attracted both on entering and on leaving the Exhibition, and as the sensible plan has been adopted of charging only for tickets actually presented at the turnstile, the supply authorities and exhibitors are distributing tickets

broadcast. Some of the former are sending them in pairs, and this is undoubtedly a wise proceeding, which will greatly increase the attendance.

A visit to the lecture hall and restaurant of the gas companies at the other end of the Main Hall only adds to the gratification of the electrical enthusiast, for the enclosure is by no means attractive, and the restaurant, for obvious reasons, is *not* in the same room as the gas cookers. There is, however, a large collective exhibit of gas cooking and heating apparatus in the Main Hall. The gas companies have been freely circularising their customers with regard to the Smoke Abatement Exhibition; that is so much the better for the electrical suppliers, for the impressions left on the mind of the visitor by the respective displays cannot fail to be heavily in favour of the Electricity Hall.

A feature of the exhibits, the significance of which should not be overlooked, is the fact that several firms, whose names are literally household words in connection with coal and gas heated cooking apparatus, have found it desirable to establish departments for the construction of electric cookers. Their vast experience in connection with the culinary art cannot fail to make itself felt in this comparatively new line, and we look for material improvements in the design of electric cookers as a result of their entry into the business. Electrical engineers have tackled the subject with a courage deserving of the highest praise, but it was not humanly possible for them intuitively to recognise all the niceties and needs of the art of cooking: consequently they have had to tread the painful path called "learning by experience." But they have proved apt pupils, and with the aid of their knowledge thus acquired, and that of the newcomers into the business, they will soon be able to produce designs combining all the best features of the various models now available, and thus hasten the general adoption of electricity for cooking.

### Large Turbines.

ELSEWHERE we record an event which we may fairly regard as marking an epoch in the triumphant progress of the steam turbo-generator—the placing of an order for a set of 25,000 kw. continuous output. Those of us who remember the time—as it were yesterday—when we exhibited complacent pride in the successful construction of a dynamo of 250 kw., and earnestly discussed the relative advantages of two-pole field magnets and of the multipolar designs which were then forcing their way to the front, are perhaps in a better position to appreciate the extraordinary progress that has been made in this department of electrical engineering than our younger colleagues. In those days we were only recently emancipated from the conditions graphically described by Mr. Swinburne as the sealing-wax and postage-stamp edging stage of development: the smooth-core armature still successfully held its own against the slotted drum, and carbon brushes were hardly known. Indeed, the litigation regarding the patent rights over the self-exciting compound-wound dynamo was still in progress—a sure indication that we were in the earliest stages of the art; and we thought a 250-kw. dynamo a very fine achievement.

Now, we hear without surprise of a machine with an output 100 times as large; we all knew it would come before long. As a matter of fact, we hardly realise exactly what 25,000 kw. really means; the figures convey little definite information to our minds. But we cannot fail to recognise the importance of the event, and we are glad to know that the firm of Sir Charles Parsons, to whose genius we owe the reaction turbine, will have the pleasure of constructing the first machine of this great output.

### The Domestic Consumer.

JUDGING by the full attendance and extended list of speakers—many of whom did not get the chance to speak—at the informal meeting of the Institution of Electrical Engineers last week, it is quite evident that that body has taken the



cause of the domestic electrical consumer very much to heart.

An informal discussion is somewhat of an innovation at the Institution; this method of procedure has, however, met with much success in other directions, and the meeting on Thursday week more than justified the Institution authorities in making the departure.

In view of the avowed aim of the meeting, and the various factors which determine the success or otherwise of the movement to extend domestic electricity supply, it may be interesting roughly to analyse the speakers on that occasion. For instance, the consumer was ably represented by several speakers, although the opinions expressed on his behalf were certainly not more striking than many which have appeared in our own pages. Then, again, the views of the supply engineer were fully given: but they are well known, more particularly as regards the municipal engineer's sphere of labour.

The electrical manufacturer, on whom so much depends in this connection, took no appreciable part in the proceedings save for an endeavour to saddle the supply engineer with responsibility in the matter of cheaper units.

This was a disappointing feature of the discussion, in which the comparatively costly nature of electrical cooking apparatus was admitted, as well as the lack of up-to-date commercial facilities for obtaining it on hire. It seems obvious that, however efficient and economical in subsequent use a piece of apparatus may be, comparatively high first cost is the most certain thing to hinder its general adoption. In the interests of the industry, it might even pay at the present time to sacrifice some portion of this subsequent economy—which the average purchaser cares very little about—if this will enable us to manufacture on standard lines at a reasonable and competitive figure.

We are afraid that the manufacturers, like certain supply undertakings, are content to skim off the cream of the domestic consumers' business, deferring indefinitely the day of the small consumer—the class above all others which has made the gas industry what it is to-day.

#### Payment of Dividend out of Capital.

DIVIDENDS presuppose profits of some sort, but the word profit is by no means free from ambiguity. The law is more accurately expressed by saying that dividends cannot be paid out of capital, than by saying that they can only be paid out of profits. The last expression leads to the inference that the capital must always be kept up and be represented by assets, which if sold would produce it; and this is more than is required by law. Perhaps the shortest way of expressing the distinction is to say that fixed capital may be sunk and lost, and yet that the excess of current receipts over current payments may be divided: but that floating or circulating capital must be kept up, as otherwise it will enter into and form parts of such excess, in which case to divide such excess without deducting the capital which forms part of it, would be contrary to law. There is no law which compels limited companies in all cases to recoup losses shown by the capital account out of the receipts shown in the profit and loss account, although care must be taken not to treat capital as if it were profit. There is nothing in the Acts which prevents a company which has lost part of its capital from continuing to carry on business and declaring and paying dividends.

There is no law which prevents a company from sinking its capital in the purchase or production of a money-making property or undertaking, and from dividing the money annually yielded by it, without preserving the capital sunk, so as to be able to reproduce it intact either before or after the winding up of the company. When it is said that dividends are not to be paid out of capital, the word capital

means the money subscribed pursuant to the memorandum of association or what is represented by that money. Accretions to that capital may be realised and turned into money which may be divided among the shareholders, as was decided in *Lubbock v. British Bank of South America*.

Economic and legal profits have always been, and will always be, irreconcilable, and there is as much difference between them as there is between an axiom and a fallacy, or as there is between truth and falsehood.

Economically there is no doubt that large sums are paid away every year as divisible profits or dividends out of capital.

The legal *obiter dictum* which we have noticed is vividly brought before us in a recent case of the compulsory liquidation of a company which was only incorporated in 1910, and which in August last paid an interim dividend of 25 per cent. per annum, which the Official Receiver states in his report was paid out of capital.

#### Electrifying the World.

THE electrification of the world is proceeding at a gratifying pace. To our mind, nothing can stay the progress of this development. The movement, once well begun, does not call for the same degree of effort to sustain it as was the case a few years ago. Facts and experience cannot conceal themselves in these days, therefore the advantages accruing from the success of electrical service, of whatever kind, make imitation and advance inevitable. We attach great importance to the testimony of a satisfied user in encouraging the domestic and industrial applications in any authorised area at Home; in a larger sense it is the selfsame influence which will compel extended electrical service in the vast areas abroad. The satisfied investor, too, anxious to repeat his experiences, may also be reckoned upon to render indispensable aid. In no awakening or developing country can progress proceed along the comparatively slow and difficult way that characterised foreign and colonial forward movements of earlier days. Electricity has altered all that. The pace is quickened and the way simplified. Water-power utilisation, telephonic and wireless telegraph communication, the automobile, are among the friends of the pioneer of the twentieth century.

In most places electricity has in the past been brought in, as scientific and engineering achievements have rendered it possible, to supersede some other agent. To-day it is recognised as *par excellence* the great handmaiden of the pioneer, and when we talk of the opening-up of great territories it is impossible to ignore the value of the assistance she can give. To the electrical mind these truths are patent enough; they are rapidly becoming common knowledge among general engineers, and to the financier the electrical way makes its irresistible appeal. Let the reader imagine, if he can, how much more advanced the present-day world would have been had electricity thirty years ago entered the field the full-grown servant that it is to-day. How vastly different must the progress have been in certain respects, and how much more rapid its speed! We mention the point as one of interest to everybody who is concerned with the grand work of peopling the great expanse of North America and utilising its natural resources, and to those who seriously consider the probabilities of the future in South America, in Africa, in Australia, in India, in China, whither the eyes of so many are wonderingly turning, desiring a greater scope for their own abilities and better opportunities for their sons, as well as a profitable sphere for their investments. The theme is one of fascinating interest: and while the practical observer is able to say what electricity has done and is doing to-day in supersession of other forces, it requires the fine imagination of a Ferranti to draw back the curtain and allure the secrets from the opening vista revealing the place that electrical application is destined to fill in practically every phase of life in countries where it begins with the beginner, and has not to compete with and rout methods and means that are already in possession.



## RAILLESS TRACTION AT LEEDS AND BRADFORD.

RAILLESS trolley 'buses have now been in service for nearly nine months in Leeds and Bradford, and, though we must wait little longer for complete financial accounts of the results of their working, various interesting results and changes in practice have followed from the experience already gained. By the courtesy of Mr. J. B. Hamilton, manager and engineer of the Leeds Tramways, and of Mr. C. J. Spencer, manager and engineer of the Bradford Tramways, our representative was recently enabled to collect the following

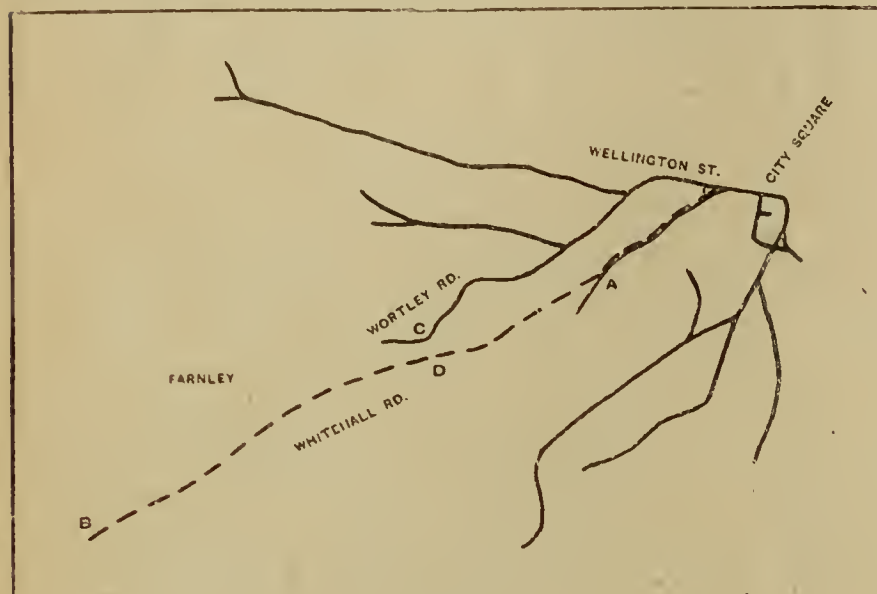


FIG. 1.

information concerning constructional developments, the past working of the trolley 'buses in these two cities and the future prospects of the system in each case.

In our issue of July 7th, 1911 (pages 22-23), we described and illustrated the chief features of the Leeds and Bradford installations. It will be remembered that the Leeds route, about 4 miles long, reaches from City Square to Moor Top, *via* Lower Wortley and Farnley (fig. 1), while the Bradford route is only 1.25 miles in length, and connects Dudley Hill with Laisterdyke, *via* Sticker Lane. Geographically both routes are easy, the most serious grades

that the 15-ft. right or left deviation from the trolley wires, allowed by the 17-ft. trolley booms, is amply sufficient.

From a traffic standpoint, the districts served are barren. The Leeds route traverses poor quarters inhabited mainly by workers in the adjacent ironworks. There are rural sections on the route and near the authorised extension of the latter to the city boundary, so that the improved travel facilities now provided will doubtless lead to a certain development of the neighbourhood, but there is no hope of a radical amelioration of the latter. The existing population is poor, and except on Saturdays there is little traffic to be handled. The Bradford route operates under yet more unfavourable conditions. Though it undoubtedly meets a need by cross-connecting two radial tramway routes out of Bradford, it traverses a very poor district, and is of such short length that little regular traffic can be depended upon.

The running costs on each route may be regarded as typical, but the revenue obtainable is exceptionally low in both cases, so that, financially, the trial of the system is exceptionally severe.

Four 'buses are at present in service in Leeds and two in Bradford; all are by the Railless Electric Traction Co., and are equipped with Siemens motors and controllers. An average schedule speed of 8 M.P.H. is maintained on the Bradford route, while in Leeds, the double journey (8.5 miles), is performed in one hour, including all stoppages *en route* and the schedule stop of 5 min. at each terminus; the maximum running speed attained by the Leeds 'buses is 16 M.P.H., and the average schedule speed is from  $\frac{1}{2}$  to 1 M.P.H. higher than that of the trolley tramcars.

The Leeds railless vehicles maintain a regular service from 8 a.m. to 10.30 p.m.; on Saturdays, three 'buses are in use (20 min. service), but, on other days, one 'bus runs till noon and two thereafter (1 hour and half-hour services respectively). On the Bradford route, only one 'bus is normally in service, maintaining a half-hour service from 5 a.m. to 11.30 p.m. On Saturday, both 'buses run, thus providing a quarter-hour service.

Up to and including December 31st, 1911, the Leeds 'buses ran 36,699 revenue miles, and the total number of passengers carried during this period was 149,333. During the same period, the Bradford vehicles ran approximately 18,000 miles, but full statistics are not yet available. The Leeds 'buses carry meters, but in Bradford the trackless trolley wires are fed through special meters located in street

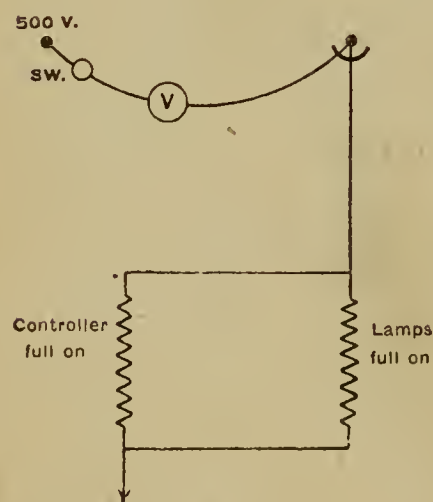


FIG. 2.



FIG. 3.—VIEW SHOWING FRONT AND REAR OF LEEDS TROLLEY 'BUSES.

being  $\frac{1}{15}$  in Bradford and  $\frac{1}{20}$  in Leeds. By far the sharpest curve negotiated is at the acute junction of Wellington Street and Whitehall Road (Leeds), where the 'buses turn at a radius varying from 14.5 to 19.5 ft. The width of the streets traversed averages 33-35 ft. in both cities, so

pillars at the two ends of the route. Whereas the energy consumption has averaged 0.87 unit per 'bus-mile (measured on the Leeds vehicles in dry weather), the Bradford 'buses have averaged 1.20 units per 'bus-mile (measured at the street feeder boxes).



The Leeds vehicles as originally placed in service were undoubtedly under-tired (4.5 in. and 8.5 in. tires being used), with the result that tire maintenance exceeded 2d. per 'bus-mile for some time. Heavier tires (5 in. and 9 in.), are now in use, and several well-known firms are willing to contract for tire maintenance at 1.5d. per 'bus-mile. Tenders for the contract maintenance of the Bradford 'bus tires range from 1d. to 2d. per 'bus-mile.

The overall running costs in both cities have been approximately 6.5d. per 'bus-mile, and as experience in working the vehicles enables correction of defects in the original construction, it is hoped to reach a yet lower figure.

Originally the through fare on the Leeds-Moor Top route was 3d., but this has lately been reduced to 2d. (an average of 1/2d. per mile, which is lower than all but "privilege" tram fares). A maximum revenue of 8.3d. per 'bus-mile has been reached under the old fares, but during the

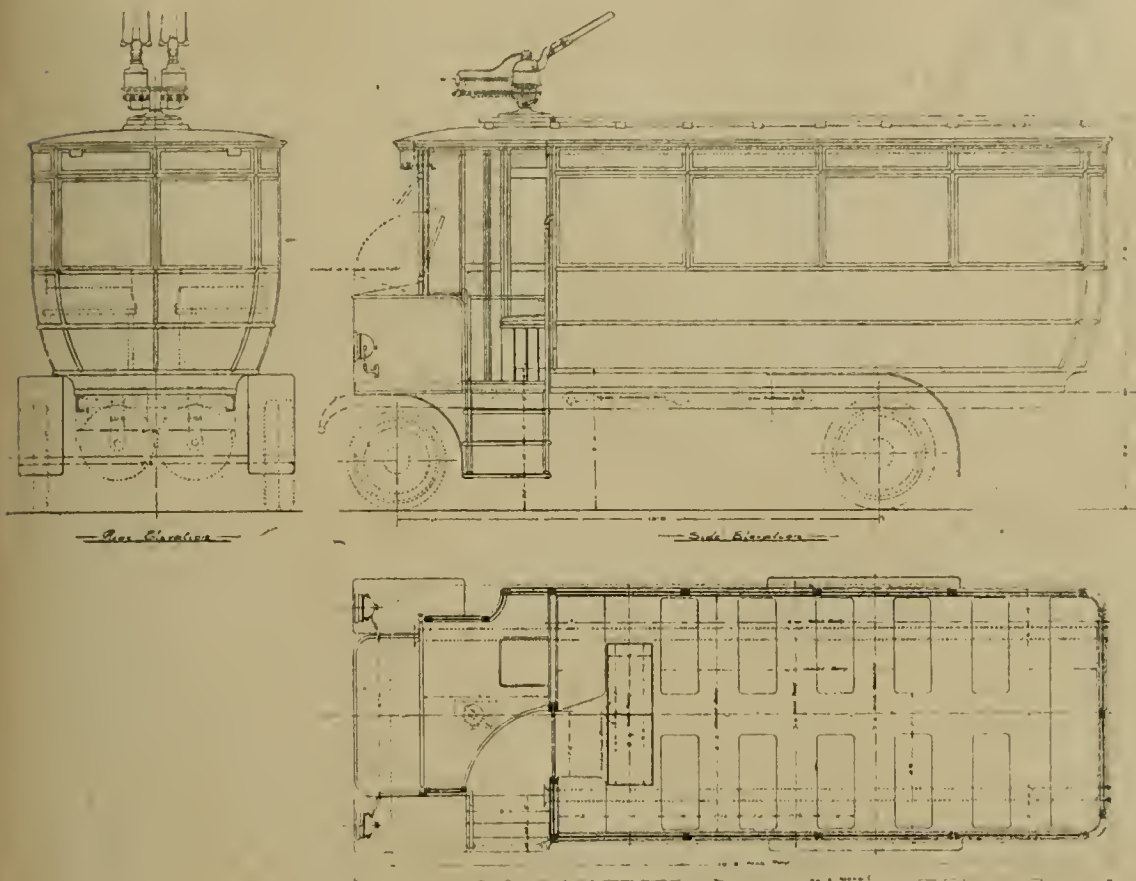


FIG. 4.—LATEST DESIGN, LEEDS TROLLEY 'BUS.

Christmas holiday week (new fares then in operation), the average receipts = 7.02d. per 'bus-mile, and, at more normal times, now fluctuate between 5.5d. and 6.5d. per 'bus-mile. In Bradford the fare for the 1.25 mile route is 1d., and an average revenue of 8.5d. per 'bus-mile has lately been secured (rising to 9.5d. and 10d. per mile during the Christmas week).

In both cities the running costs have been as low as was expected, and so long as increased traffic does not raise the working costs by an amount approaching the additional revenue—a contingency which there is no reason to fear—the economic stability of the trolley-'bus is well established.

*Life Data, Constructional Defects, &c.*—It is yet too early to advance any definite opinion as to the mileage life of tires on trolley-'buses (though the above maintenance tenders give an approximate indication on this point). After nearly 40,000 and 20,000 'bus-miles respectively, it has not yet been necessary to take down any bearings on either the Leeds or the Bradford vehicles. The high gear ratio of 10 : 1, from the motor shaft to the road wheels, is obtained by an oil-immersed steel worm driving a phosphor-bronze worm-wheel, from the extended shaft of which a second reduction is obtained by an enclosed sprocket and chain drive. With the exception of a twisted worm shaft, broken during the recent snowy weather at Bradford, there has been no gear trouble reported, but in both systems considerable difficulty has been encountered with the chains. At Leeds, the spirally wound strips forming the roller bushes on the chains used, have been found to crack after a short time in service, and more serious damage then naturally follows. At Bradford 1 1/8-in. roller chains have been employed, and have been too light for the work, so that breakages have been very frequent. The remedy is, fortunately, simple, a heavier chain being all that is required.

The steering gear of railless trolley-'buses is, of course, practically identical with that of petrol-driven vehicles, but at Leeds several weaknesses in the original design have appeared. The pin-holes in the rods have worn badly, a trouble which will be rectified by fitting hard steel bushes. In two cases steering rods have broken, fortunately without serious result; in one case the 'bus was under immediate control, while, in the other instance, the front wheels slewed round and the chassis sank forward till it touched ground.

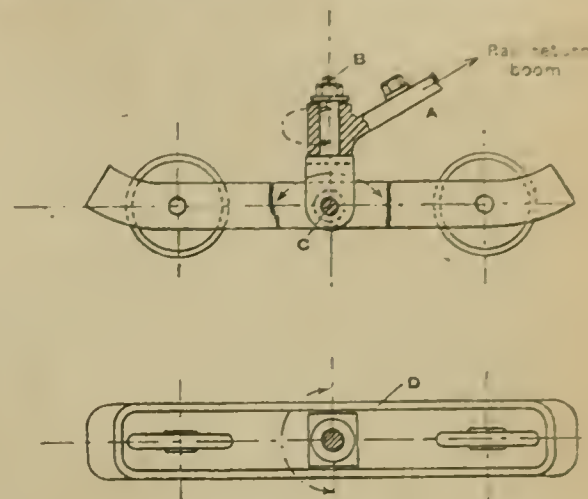


FIG. 5.

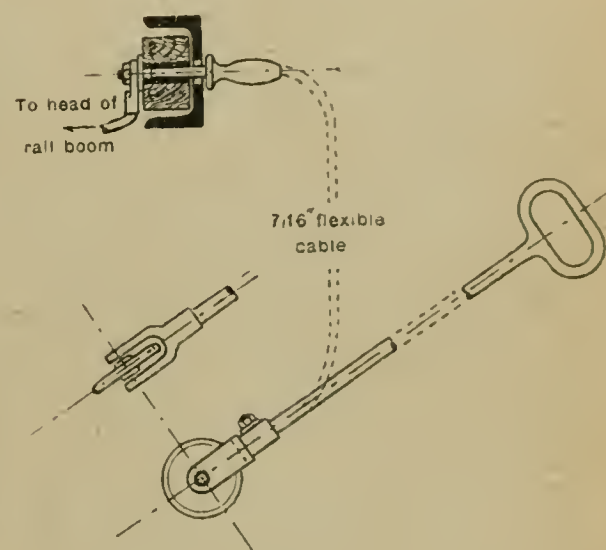


FIG. 6.

The only electrical mishap has been a short-circuit in the base of the trolley-boom of one of the Bradford 'buses. The motors (of the Siemens totally enclosed, shunted-field traction type), have given excellent results. On both systems, the insulation of the whole of the electrical equipment is tested daily, the method employed at Leeds being as indicated in fig. 2. The trolley wheel is placed on a length of specially erected, insulated trolley wire connected to the running trolley line through a voltmeter  $v$ , the reading  $v$  of which is related to the insulation resistance of the 'bus-circuits (controller and lamps full "on") by the following equation:—

$$R = \frac{(500 - v) \cdot r}{v} = \frac{500 \cdot r}{v} \text{ (approximately).}$$

where  $r$  = voltmeter resistance;  $v$  = reading of  $v$  in volts. This method of testing is simple and effective, and even with a dead short to the frame of the 'bus no damage can occur during testing (but  $v$  would then = 500 volts).

The insulation resistance of the Leeds 'buses (at 500 volts) was about 4 megohms when the vehicles were first placed in service. The best result now obtainable is about 2 megohms, and in wet weather the insulation falls to 500,000 or 250,000 ohms. The latter is the minimum at which the 'buses are allowed to remain in service, and corresponds to an earth current of 2 milliamperes. No shock can be felt at 500 volts through such a resistance.

*Technical Notes: Constructional Improvements.*—The Leeds trolley-'bus route follows the Whitehall Road tramway for about 1 mile, and then diverges, as shown in fig. 1. The remaining 3 miles of trolley-'bus route is fed entirely from the junction A, where also the negative wires are connected to the tramway track and to a negative feeder. The drop in the length A B of the trolley line averages 30 to 35



volts (two 'buses running), and rises to 38 or 40 volts as a maximum. The minimum line voltage available (at B) thus averages 430 volts at present, but it is proposed to increase this by running a negative feeder from the 'bus route to an adjacent tramway route near Lower Wortley (C D, fig 1).

The Bradford railless system is fed through 300-ampere Chamberlain and Hookham meters and double-pole switches and fuses in street boxes from the tramway feeders at each end of the 'bus route. The negative lines are similarly connected to the track return at each end of the route, and the

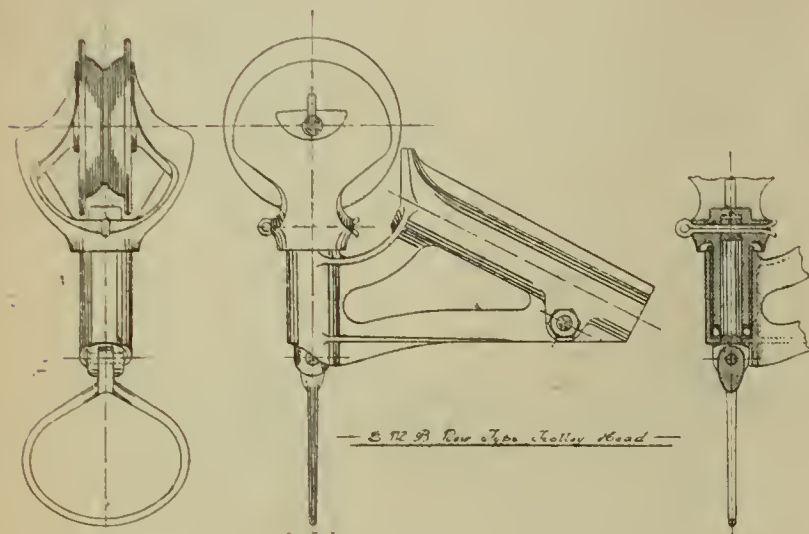


FIG. 7.

conditions, therefore, approximate the  $\frac{1}{2}$ -mile sections usual in tramway practice. Recent tests showed 3.8 volts drop in the trolley line.

With the exception of the passengers' entrance, the general appearance of the 'buses on both systems is very similar. The Leeds vehicles, by their front entrance (see fig. 3) are certainly more handsome and snugger to ride in; the driver is able to see when passengers have finished alighting, and, in case of need, the 'buses could be managed by one man. Fig. 4 shows the general arrangement of the latest Leeds design, in which a number of small alterations have been introduced.

The Leeds cars have ordinary semi-elliptical plate springs; but in Bradford lever-spring shock absorbers have been fitted. Over frosty roads, both types of vehicle are fairly noisy in running, but in this respect and in general smoothness of riding, the advantage lies with the Leeds 'buses—mainly owing to the better road surface available. In neither case is any difficulty experienced in using high-voltage metallic-filament lamps for lighting the 'buses. It is important to note that the low centre of gravity of the vehicles, together with the twin back tires, has resulted in entire freedom from side-slip. Indeed, tests at Bradford, on greasy roads, showed it to be practically impossible to make the 'buses skid.

There have been some complaints of excessive mud-splashing at Bradford, which is hardly surprising, considering the weight and speed of the vehicles and the wretched nature of the road surface. Various patent splash-preventers have been tried without success, and the most practicable and satisfactory remedy appears to be a thin sheet of metal plate, hung vertically from the outside rim of the ordinary mudguard and provided along its bottom edge with a leather apron.

Both the Leeds and Bradford vehicles are at present heavier than is desirable, but by lightening the car body, the trolley boom, the motor shell (for the present  $\frac{3}{4}$  in. cast-iron shell is to be substituted a  $\frac{5}{16}$  in. cast-steel shell), the rail skate and various minor parts, no difficulty is anticipated in reducing the weight of the 'buses to 4.25 tons, without unduly sacrificing strength. The tare weight of the Leeds

vehicles is distributed between the front and back axles in the ratio 1 : 1.51.

The rail skates which are at present fitted to the Leeds 'buses to enable the latter to run on tramway routes, using the track return, are unsatisfactory in practice. Their design is complex, involving, as it does, a scraper, a metal brush, a guide wheel and a 20 lb. copper contact block. Though the skate boom enables a transverse movement of the 'bus 5 ft. on either side of the centre of the track, the "skate" is easily jerked out of the rail, and is specially liable to take the wrong route at points. The leading features of a new design by the Leeds Tramway Department are shown in the accompanying sketch (fig. 5). The boom A is free to swing round the vertical pin B which, in turn, can rock on the horizontal shaft C, carried in the frame of a small two-wheel bogie. The new contactor will weigh about half as much as the present model, and will ride the rails and points more securely.

During movements of the trolley-'buses in the car sheds, it is frequently necessary to work from a single trolley wire (using rail return), and it is then inconvenient to use the ordinary rail-skate (new or old design), with which it is difficult to move across rails. It is, therefore, proposed to use a portable rail skate for such work in the Leeds sheds. An insulated handle and stem (fig. 6) will carry a contact wheel, which may be placed on any track rail, and readily shifted as often as necessary. The U-frame carrying this wheel is to be connected by  $\frac{7}{16}$  in. flexible cable to a plug fitting a socket mounted on the 'bus body as indicated. This socket will be connected to the head of the rail boom, ordinarily employed for track return purposes, and is covered-in when not in use.

A special type of trolley-head is now used exclusively on the Leeds railless cars (and to a considerable extent on the tramcars). As shown in fig. 7, the improvement consists in fitting a tail-piece and ring to the fork carrying the trolley-wheel, a small change which is, however, of great practical importance. The conductor's trolley-pole can be readily engaged in the ring on the trolley-head when lowering the boom (see fig. 8), and a simple means is provided for turning the trolley-wheel should this be displaced perpendicularly to the line. Hitherto there has been no definite means\* whereby a displaced wheel could be turned round its pivot, and the



FIG. 8.—MANIPULATING THE NEW TROLLEY HEADS, LEEDS RAILLESS 'BUSES.

time saved by the new device in this respect alone fully justifies its adoption. The ease with which hand poles can be hooked into the trolley-head rings makes this operation quite as expeditious as the use of permanently attached guide-ropes (such as are used at Bradford); if the least slack is

\* Other than bumping the wheel against the trolley wire and attempting impossible marksmanship with a pliable 20-ft. pole.



allowed in the latter they constitute a serious menace to passing traffic.

The special line crossing, illustrated in figs. 9 and 10, has proved a simple but efficacious solution to a difficult problem. Proposals originally suggested involved 6 ft. cross-lengths of "dead" trolley-wire across which the 'buses were to coast. This necessity was specially objectionable, since the vehicles here enter a busy street. To provide for the not unlikely



FIG. 9.—VIEW OF SPECIAL OVERHEAD CROSSING.

contingency of a 'bus being pulled up with its trolley wheels on the dead line, the latter was to be so arranged that it could be made "live" temporarily, from an adjacent street box. This scheme was very unsatisfactory, and is far surpassed by the present arrangement, which gives continuous supply, except at the section points shown.

On the accompanying diagram (fig. 10) ordinary solid cross-overs and frogs are employed, but, at the points A, their ends are built up as in section-insulator frames, and suitable lengths of fibre are held between two such ends or between one of the latter and half a standard section insulator, as the case may be. At this crossing, the standard spacing of the trolley wires (13.5 in. + to - and 9 in. + to +), is somewhat increased to make room for the special attachments required. Throughout the route, standard trolley poles with 16 to 18-ft. bracket arms are employed, and, on account of the greater number of lines carried, these are placed 35 yards apart (instead of 40 yards).

*General and Extension Prospects.*—So far as may be at present judged, the trolley 'bus has justified its adoption in both Leeds and Bradford. Further extensions are in immediate prospect in both cities, and neighbouring districts (e.g., Rotherham), are erecting trial sections of railless route which, if satisfactory, will lead to rapid and

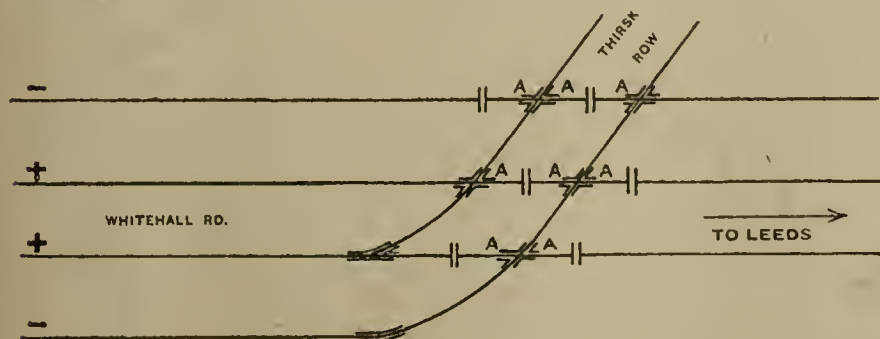


FIG. 10.

wide extensions. As compared with motor-'buses in the Leeds and Keighley districts, where running costs as high as 14d. per 'bus-mile are reached, the trolley-'bus is far more economical. Though it is only fair to state that these petrol vehicles are of old design, it appears that the trolley-'bus can compete favourably with the latest petrol-'buses, and has great advantages in smooth starting and speed changing (a factor which has great influence on tire maintenance costs). The roadside at regular stopping places

on petrol-'bus routes soon becomes saturated with oil, which is most injurious to rubber tires.

A short motor-'bus route in Leeds, running outwards from the Headingley tramway terminus, is soon to be converted to railless electric traction, and the 12 miles of railless extensions embraced by the present Bradford proposals cover several radial routes to districts at present unserved by tramways (but in which the latter should soon be justified by the developments caused by trolley-'buses) and a number of link routes between existing tramway lines radiating from Bradford.

## INTERNATIONAL SMOKE ABATEMENT EXHIBITION.

On Saturday last this Exhibition was formally opened by the Duke of Argyll, president of the Coal Smoke Abatement Society, at the Royal Agricultural Hall, Islington. The Duke referred to the fact that the coal strike was in progress as emphasising the need for economy of fuel, and adding to the interest of the Exhibition, which would do good service in demonstrating the methods by which that object could be achieved and the combustion of coal rendered less harmful to the public. Incidentally he praised the efforts of the Society to reduce the production of smoke, and pointed out that London had become almost free from fog during recent years, a result which was largely due to the operations of the Society.

A luncheon followed, at which Sir W. Richmond presided. Proposing "Success to the Exhibition," Sir W. Ramsay suggested that the work of the Society would be greatly simplified if no coal were burned at all. He proposed that gas should be generated in the bowels of the earth, by setting the coal on fire *in situ*, and blowing air down through boreholes to form, in contact with the hot coal, carbon monoxide gas, or air and steam to form water gas: the gas thus generated could be collected by means of concentric tubes and used to feed gas engines on the surface. These engines would drive generators which would produce electricity, and the latter could then be distributed to all parts of the country for lighting, heating, and power purposes. This system would utilise 30 per cent. of the energy of the coal, or twice as much as the steam engine, and the cost of electricity might be brought down even to one-hundredth of a penny per unit! Then there would be no need for miners, and the latter had better take care what they were doing, or they might lose their employment altogether. Sir W. Richmond, in responding, welcomed the suggestion, which, he said, illustrated the great truth that when the politician failed, the man of science must be called in to attack the question from a non-party but progressive point of view. The manufacturers were formerly blamed for the smoke nuisance, but the domestic fire was responsible for a great deal of it, and they must enlist the public in support of their movement. He rendered thanks to Mr. Bridges, the organising manager of the Exhibition, and Mr. Lawrence Chubb, secretary of the Society, for the successful promotion of the Exhibition.

Proposing "The Visitors," Dr. H. A. Des Voeux laid stress on the great improvement that had been effected in London during the past 30 years; but still, he said, 25 to 30 lb. of soot was deposited in London per inhabitant per annum, and it would be a very different place if that could be abolished. In his reply, Dr. W. N. Shaw, director of the Meteorological Office, stated that it had recently been found that sulphur compounds in the atmosphere were acted upon by sunlight, giving rise to haze and fog. Dr. Gough referred to the work done by the L.C.C. in the direction of smoke abatement, and Dr. Hill also responded. In proposing the health of the chairman, Prof. Meldola paid a well-deserved tribute to his efforts in the cause.

The Exhibition will be open daily from 10 a.m. to 10 p.m. until April 4th, and during this week a programme of conferences and lectures has been carried on in connection with it, at which many interesting papers and addresses have been read.



Apart from the special exhibit of the Electric Supply Publicity Committee, there is not a great deal of interest to electrical men in the Exhibition. Messrs. Bilbie, Hobson and Co. are showing their Hornsby Stockport gas engines. The Carron Co., whose cooking and heating apparatus are of world-wide reputation, have embarked upon the manufacture of electrical cookers, radiators, &c., and show on their stand an electric range which presents some interesting features. Mr. W. Whittaker shows coking stokers and a sprinkling stoker, and Messrs. Babcock & Wilcox, Ltd., exhibit their chain-grate stoker. The Union Electric Co., Ltd., show a model shop window lighted by the "Union" Ideal Shop Window Lighting System." Messrs. Ozonair, Ltd., have a stand devoted to their apparatus for generating ozone: both fixed and portable types are shown, suitable for a variety of applications. Messrs. Edward Bennis & Co., Ltd., show no fewer than five "smoke abatement" exhibits, comprising two types of mechanical stokers (coking and chain-grate), with a bucket elevator and bunker and ash remover. Bean's Bunsen Smokeless Furnaces Co., Ltd., have an exhibit of their furnace, and Messrs. James Hodgkinson (Salford), Ltd., show an automatic coking stoker. Messrs. John Ruscoe & Co., Ltd., also show their "Tuto" mechanical stoker and elevator. Mr. Hjalmar Lofquist, of Stockholm, exhibits an electric automatic apparatus for heating water, in operation. Messrs. J. & P. Hill show the "Galloway-Hill" patent furnace.

The centre of interest at the Exhibition, however, is the "Electricity Hall" organised by the Electric Supply Publicity Committee. This has been tastefully decorated with mauve and white hanging drapery, palms, &c., and is well advertised by prominent electric signs; being close to the entrance of the Exhibition it cannot be overlooked, and hardly a single visitor can escape paying it a visit. The Electricity Hall is not divided up into separate stands; it is, however, classified into sections under the heads of cooking (and eating—there is a daintily furnished restaurant), heating, laundry and miscellaneous, of which the first-named is by far the most important. Here are collected electric cookers, boilers, hot-plates and other utensils representing the products of all the leading makers: Messrs. Purcell & Nobbs, the British Prometheus Co., Ltd., the Sun Electrical Co., Ltd., Messrs. Ferranti, Ltd., the General Electric Co., Ltd., Electric and Ordnance Accessories Co., Ltd., the Berry Construction Co., Ltd., Messrs. Benson, Messrs. Mabbott & Co., Messrs. Jackson, Mr. Bertram Thomas—all these firms have more or less apparatus on show, most of it being in use. The collection is unique, and of the greatest interest. Next comes the heating section, in which, as well as in the former, we find many of the above-named firms represented; here also are the Dowsing Radiant Heat Co., Ltd., the British Thomson-Houston Co., Ltd., the Edison & Swan United E.L. Co., Ltd., Messrs. Drake & Gorham, Messrs. Berry, Skinner, & Co., Messrs. Siemens Bros. & Co., the Metropolitan Electric Supply Co., Messrs. Spagnoletti & Co., and the City of London E.L. Co. The main feature of the laundry is the electric iron; and in the miscellaneous section we must add the names of Messrs. Causton, the Adnil Electric Co., Messrs. Mavor & Coulson, the Armorduct Co., and the Synchronome Co. to those given above.

The Hall is admirably arranged; at the entrance is the stall of the Committee, at which numerous booklets, brochures, pamphlets, *et hoc genus omne*, can be obtained. Beyond this on one side is the restaurant, with its inviting little tables, and at the end of the room the scullery, where some interesting electrical machines for peeling potatoes, cleaning knives, &c., are to be seen in use. Returning on the other side of the hall, we find the electric kitchen facing the restaurant, behind a counter on which are displayed various appetising dainties. The apparatus shown in this section was connected up by the Marylebone Electric Supply Department on the excellent system already mentioned in a recent issue, and includes cookers mainly suitable for ordinary households, as well as auxiliary apparatus such as hot cupboards, water boilers, &c. A large space is allotted to this exhibit, and visitors are welcome to examine the ovens, &c., which are operated by a staff of lady cooks who have been taught the use of the electrical appliances within the last fortnight. Needless to say, there are no nauseous

odours, no suffocating fumes, in the neighbourhood of this *cuisine*; nor is the temperature high. Perfect comfort reigns, and hence it is possible to place the restaurant and the kitchen close together in the same room.

The heating section comes next, well filled with radiators and convectors of all sorts and sizes; and, lastly, the model laundry and miscellaneous sections close the circuit. There is also a tuneful but unobtrusive band—the Russian Balaika Orchestra—in a corner, whose performance, without preventing conversation, is soothing and appropriate.

The lighting of the Electricity Hall is effectively carried out with metallic-filament lamps in bowls, and in Holographane cut-glass shades, close to the ceiling: the Union Electric Co.'s Excello flame arc lamps are used in the corridor and the main hall.

It should be added that demonstrations of the uses of the various electrical devices go on all day, and all the refreshments consumed in the restaurant are cooked by electricity, in view of the purchasers. Free tickets of admission can be obtained from the various electricity supply authorities, and it is to be hoped that there will be a very large attendance.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(Continued from page 331.)

10. *Ontario*.—The revised statutes of Ontario which were published in 1897, contain "an Act respecting companies for supplying steam, heat, electricity, or natural gas, for heat, light, power." This Act provides (by Sec. 1) that any five or more persons who desire to form a company for supplying (*inter alia*) electricity in any city or municipality, may become incorporated under the Ontario Companies Act. Every such company may construct works for the production of electricity, and may conduct the same by any means through, under, and along the streets, highways and public places of the city, town, or other municipality; but as to such streets, highways and public places, only upon and subject to such agreement in respect thereof as shall be made between the company and the municipality, and under and subject to any by-law of the Council of the municipality passed in pursuance thereof. By Sec. 5 it is provided that no company shall be entitled by virtue of the Act, to take possession, or make use of, private property, or to do any work thereon under the compulsory powers of the company in that behalf, until the amount to be paid for or in respect of such property is ascertained by arbitration or otherwise, as the case may be, and is paid or tendered to the parties entitled thereto, or is paid into Court for their benefit. An electric light company may also lease their machinery when it is not in use, and they may lease the land which they use for the purpose of their undertaking.

Another Statute (Cap. 208 of the Revised Statutes of 1897) entitled, "An Act Respecting Street Railways," provides, by Sec. 18, that where a street tramway is operated by electricity, and wires are suspended overhead, guard wires must be placed and maintained in such a way as to prevent telegraph or telephone wires from falling upon the naked conductors. It is also enacted that the company when operating any portion of its line by means of electricity shall use such means and appliances as may, as far as may be reasonably possible, prevent water pipes, &c., placed underground from being damaged by the escape or discharge of electricity into the ground. For this purpose the rails must be properly bonded.

By the Municipal Act of 1897 (Cap. 223), it is provided that the local authorities may make by-laws for regulating the erection and maintenance of electric light, telegraph, and telephone poles and wires, within their limits.

By Sec. 566 of the same Act, it is provided that the Councils of the municipalities may make by-laws to authorise any gas or water company to lay down pipes or conduits for the conveyance of water or gas under streets or



public squares, subject to such regulations as the Council see fit; and by an amending Act which was passed in 1902 (The Municipal Amendment Act, 1902, 2 Edward VII, c. 29), similar provision was made in the case of electrical supply. It may be observed, in passing, that these Acts contain provisions which ensure that a supply shall be given to each consumer on equally favourable terms. It is also competent for those who provide the supply to demand security for its continuance from the consumer.

The Government of Ontario early became alive to the fact that they had in their great rivers which run through the colony immense stores of power, and that it was essential that the use of that power should be controlled by the Legislature. Accordingly in 1906 by "an Act to provide for the Transmission of Electrical Power to Municipalities," a body entitled the Hydro-Electric Power Commission of Ontario, was brought into being. While this Act, generally speaking, enabled the Commission to grant powers to municipalities, an Act which was passed last year (The Power Commission Act, 1911, Cap. 14), provides that any one or more of ratepayers in a municipality, the Corporation of which has not entered into a contract with the Commission under the Power Commission Act, may apply to the Corporation to obtain from the Commission a supply of electrical power and energy for the use of such ratepayer or ratepayers for lighting, heating, and power purposes, or for any of such purposes. Upon such request the Commission furnishes to the Corporation an estimate of the maximum cost per horse-power at which the electrical power or energy will be supplied and an estimate of the cost of providing and constructing transmission lines. The process of obtaining a supply of power is much simplified by the procedure under this Act. Thus, under a former Act a poll of ratepayers was necessary, but this may now be dispensed with.

11. *Quebec*.—There does not appear to be any special Act or Ordinance relating to the supply of electric light in the Province of Quebec. However, by an Act assented to on January 12th, 1895, it was provided that the provisions of the law concerning the organisation of gas and water companies should govern the organisation of electric light and water companies. It would thus seem that those who have power to legislate in Quebec have fallen into the error of legislating by reference, a procedure which has done so much to arrest the progress of electrical development nearer home. Turning to the ordinances so incorporated, it will be found that by Sec. 6 of Cap. III of the Revised Quebec Statutes (1888), provisions are set out under which gas and water companies may commence business. It is provided that any five or more persons who desire to form a company for supplying any city, town, incorporated village, parish, township or other municipality with electricity or water, or with both electricity and water, may make and sign a statement or declaration in writing in which shall be set forth:—

(1) The corporate name of the company; (2) the object for which the same is formed; (3) the amount of the capital stock of the company, which shall be divided into shares of \$20 each. The company so incorporated may sell or hire out meters and fittings. They may break up streets for the purpose of laying mains and pipes, and may even pass through or under the property of one person to reach that of another, provided, of course, that in this, as in other cases, they make satisfaction for all damage which may be done. Their works must also be carried on with due regard to public safety. With regard to the laying of cables, the company has powers similar to those which are conferred upon telegraph companies. Thus, "it may construct the lines of telegraph designated in its certificate, upon any lands purchased by it, or the right to carry its line over which has been conceded to it by the parties having a right to make such a concession, and along any and upon any of the public roads and highways, or across any of the waters within this province by the erection of the necessary fixtures, including posts, piers or abutments, for sustaining the cords or wires of such lines, provided the same are so constructed as not to incommode the public use of such roads or highways, or to impede the free access to any house or other building erected in the vicinity of the same, or to interrupt the navigation of such water."

12. *Nova Scotia*.—The Nova Scotian Government, in the

matter of electric lighting, have apparently contented themselves with placing a restriction on prices. Thus, by "an Act to Regulate the Prices of Electric Light and Energy, 1907 (7 Edw. VII, c. 40)," every person, firm and company, and every city or town carrying on the business of furnishing electric light or energy, must file in the office of the Provincial Secretary a schedule of the prices charged for electric light and energy. The Governor may, upon application, alter, reduce, or modify the charges. To take or collect charges higher than those contained on the file is an offence for which a person is liable to a penalty of not less than \$50.

13. *Cape Colony*.—The only Act in force in Cape Colony on the subject under discussion is an "Act for Regulating the Employment of Electricity for the Purposes of Electric Lighting and Power Generally," which was passed in 1893. The provisions of that Act apply to every local authority, company or person, supplying or employing electricity for any public purpose, within any area, who may be authorised by an Act of Parliament, or to any company or person who may, with the consent of any local authority, and the approval of the Governor, be empowered to supply or employ electricity for any public purpose within any area, and shall apply to every undertaking so to supply or employ electricity.

Sec. 2 provides that "the Governor may from time to time make such regulations in accordance with the regulations for the time being of the Board of Trade of the United Kingdom, subject to such modifications as he may think expedient, but in no case more stringent, for securing the safety of the public from personal injury, or from fire or otherwise, and for minimising, as far as may be reasonable, any interference with the electric wires and apparatus, and lines of the Government or any other authority, company or person, and from time to time rescind, alter or repeal such regulations.

Sec. 8 provides that any local authority duly authorised thereto, and any company or person having received the necessary consents intending to apply for statutory powers to enable them to supply electricity for any public purpose, or use it as a motive power in connection with tramways, shall give three months' notice of such intention to the Government, and must also advertise the fact of their application in the papers.

14. *Ceylon*.—In 1895 the Government of Ceylon passed an Electricity Ordinance to provide for the protection of persons and property from the risks incidental to the supply and use of electricity for lighting and for other purposes.

The Ordinance of 1895 was repealed in 1906 by the Electricity Ordinance (No. 26) of 1906, which, by Sec. 5 (1), provides that no person shall supply energy for electric traction or to the public for any purpose, except under and in accordance with the terms and conditions of (a) a licence granted by the Governor; or (b) a licence or concession granted by a municipal council and authorised by the Governor, with the advice of the Executive Council. There is a proviso exempting those affected by contracts in force when the Act came into operation. The section goes on to provide that no person shall for any purpose in any street, alley, or lane, or in any vessel, factory or public place use energy which is not supplied to him under a licence as aforesaid without giving seven clear days' notice to the local authority. By Sec. 6 (1) the Governor may license any person to supply energy for any purpose in any specified local area, and also to lay down electric supply lines for the conveyance and transmission of energy from a generating station situated outside such specified local area to the boundary of such area in any case in which the energy to be supplied is to be generated outside the local area. The Governor may cancel a licence or place the licensee upon further conditions and restrictions in case he is guilty of a breach of the conditions of his licence; becomes bankrupt or insolvent; or where the licensee shows the Governor that the undertaking cannot be carried on except at a loss. The law is apparently rigorously enforced, for by Sec. 10 if a person supplies energy either to the public or for traction without obtaining a licence or concession as required by Sec. 5 (1), or uses energy supplied otherwise than under the provisions of Sec. 5 (1), without giving notice required by Sec. 5 (2), he is punishable with a fine which may extend to 500 rupees.



15. *Jamaica*.—The supply of electricity in Jamaica is controlled by a law which was passed in 1890, *sub. tit.* "The Electric Lighting Law, 1890." This measure seems to be founded on the English Electric Lighting Acts. It provides (by Clause 2) that the Governor in Privy Council may from time to time license any local authority as defined by the law, or any company or person, to supply electricity under this law for any public or private purposes within any area, subject to certain provisions. The "local authority" means the parochial board of the parish within which the licence is sought to be obtained. The consent of every local authority having jurisdiction within the area, or any part of the area, within which the supply is to be licensed to be furnished, is required as a condition precedent to the application for a licence. The local authority are authorised to give such consent, subject to the approval of the Governor in Council. In addition to the by-laws which the Governor may make for the purpose of carrying the Act into effect and securing the safety of the public, the local authority may make by-laws and provide penalties for their breach.

There is a provision for compulsory purchase of any undertaking by the local authority upon terms precisely similar to those of the Electric Lighting Act, 1888.

(To be concluded.)

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Diesel Engine Trials.

We note that in your issue of March 22nd, it is suggested in reference to the trial made by Messrs. Barclay, Curle & Co., of Glasgow, on the Diesel engine made by them, which trial consisted of a 30 days' non-stop run, that this is the longest reliability trial of Diesel plant on record.

In reference to this point, we would say that a trial of this duration on Diesel engines is by no means exceptional, and not only is this the case as regards trials, but also many of our engines have run regularly for similar periods in actual service.

I might quote one instance of this, viz., the engine we supplied to the Birkdale Electricity Works close upon five years ago. This engine runs regularly for a month, and is then shut down for a few hours for cleaning, &c. Mr. Bentham, the engineer, recently presented a report to his directors, in which he gave the number of hours this engine had actually run in service since it was installed, and the figures showed that the engine had worked on load for an average of  $23\frac{3}{4}$  hours out of every 24 since it was first started.

We do not bring up this point with any desire to depreciate the excellent performance of the Barclay-Curle engine, but merely to show that runs of 30 days' duration are not without precedent with Diesel engines, but in fact occur in regular practice.

Mirrlees, Bickerton & Day, Ltd.

CHAS. DAY, *Managing Director*.

Hazel Grove, March 25th, 1912.

[It should be remembered that the engine in question was of 1,500 B.H.P.—EDS. E.R.]

### Earthing Mains.

In your note below my letter *re* the above, you state that the earthing regulation of the Board of Trade applies only to the neutral of a three-wire system. In Messrs. Dick and Fernie's new book on distributing systems they give an instance to show that it is advisable to earth the outer of a L.T. single-phase network fed from transformers, and in a note at the foot of page 195 they state that, according to the B. of T. regulations, the outer conductor of a concentric low-tension network should be *earthed* at the transformer.

Suppose outers were not earthed, a slight defect, such as the inner or + lead touching tubing, in the wiring of a house, would cause the inner of a distributing main to be at earth

potential, and full voltage of supply to be between the outer and earth. The insulation between the outer and lead covering of concentric cables is usually not so high as between the inner and outer conductors, so that this reversal of the inner and outer would not be desirable.

Inquirer.

### Large Currents at High Frequency.

To produce currents at high frequency—say, 2,000 per second—very high speeds and a large number of poles are used. The winding might be a single turn arranged zigzag. In such cases might not artificial cooling be adopted, where larger currents are required? In the case of a simple winding like that referred to, it might be in the form of a copper tube, and oil or air might be applied as the cooling media; this would probably multiply the output, as ordinarily obtained, many times.

W. H. F. Murdoch.

London, March 23rd, 1912.

### Constantinople Telephone System.

In your "Telegraph and Telephone Notes" last week, referring to the telephone installation at Constantinople, there are one or two errors which I think it perhaps might be advisable to set right.

The rates themselves are not as stated in your Notes, but are as follows:—For private houses, £T5 for 500 conversations; for business exchanges, £T5.50 for 550 conversations.

The total cost of the works that are being installed will be nearer £250,000 sterling than the £125,000 you mention, and it is hoped that the exchange system will be opened and ready for use in about 18 months from now.

S. J. Goddard.

London, E.C., March 21st, 1912.

[We regret the errors pointed out by our correspondent; the Note, as indicated at the time, was derived from a French journal.—EDS. E.R.]

## PARLIAMENTARY.

### Brighton Tramway Proposals.

(Concluded from page 437.)

AT the resumed sittings of the Committee, MR. C. J. SPENCER, general manager of the Bradford Corporation Tramways, gave evidence in support of the scheme, and said that, having regard to his experience at Bradford, he considered that the estimates of the proposed Brighton system were reasonable. He corroborated the evidence of Mr. Hamilton to the effect that, wherever motor-buses could operate, so could trolley vehicles. In cross-examination, witness said a five-minutes service would be needed to carry the estimated traffic. Answering the CHAIRMAN as to whether he thought that railless traction would one day supersede tramways altogether, witness said he did not think that would be the case on broad roads, but it was an excellent substitute where the roads were too narrow for a tramway. On broad roads, he thought the tramway would always hold its own. Replying to further questions, witness said that the system at Bradford was installed as an experiment, but, being satisfied with it, they proposed extending it.

MR. J. M. McELROY (general manager of the Manchester Corporation Tramways) expressed the opinion that there ought to be a through route between Rottingdean and Shoreham, operated by one authority. He considered the outside local authorities should own the system which was within their own districts, but that the Brighton Corporation should operate the whole.

MR. R. W. BARNETT, who represented a large number of property owners, addressed the Committee on their behalf, and urged that powers should not be granted in respect of Western Road.

A number of WITNESSES were afterwards called in support of the contention that property would be depreciated if the system was allowed in certain roads.

COLONEL YORKE, who was in attendance on behalf of the Board of Trade, was asked by the Chairman to give advice, and said the Board of Trade were of opinion that the circumstances concerning parts of the Western Road, North Street, St. James' Street, Upper St. James' Street, Bristol Road and St. George's Road, were such as to render the Board adverse to seeing any system of trackless trolley traction along the route. Answering Mr. Balfour Browne, Witness said the Board considered double-decked cars more dangerous than single decked, but there was no experience either in this country or on the Continent to guide them with regard to this. The double deck would increase the weight, and the Board had decided from the first that the weight of a car should not exceed  $3\frac{1}{2}$  tons un-



loaded or 5 tons loaded. Questioned by Mr. Lloyd, Witness said there was ground for objecting to a single-decked trolley car which would not apply to a motor-bus, but he did not say there was a physical reason why the one should be more objectionable than the other.

MR. BALFOUR BROWNE, K.C., then opened the case for the Hove Corporation Bill, which proposed to lay down a system of railless traction in the Borough of Hove and in the western districts beyond. He explained that neither the Corporation or the majority of the ratepayers desired to have such a system, but they were bound to admit there was a necessity for better communication through Hove into Brighton. They brought their Bill forward in self-defence, not only for power to run 'buses—which they wanted—but for the trackless system, in case the committee should consider that system was the right thing. Their contention was that the extra facilities required should be met by motor-buses.

MR. BARNETT MARKS (Mayor of Hove) was called and said they considered it would be most detrimental to Hove to have a trackless trolley system. If, however, the Committee decided there should be such a through system, then the Corporation wanted to be master in their own house, and hence they were seeking the power to provide the system from Shoreham to the Brighton western boundary. In that case there would be no difficulty in working with Brighton.

A large number of local witnesses were called, chiefly on the question of property depreciation.

MR. W. H. DAWSON, of Bradford, who had assisted Mr. Scott, the surveyor of Hove, in the preparation of the estimate, expressed the opinion that these were sufficient.

MR. A. R. FEARNLEY (general manager of the Sheffield Corporation Tramways) said that his Corporation were now promoting a Bill for trackless trolley tramways. They had not many roads in Sheffield which would compare favourably with those of Hove. In cross-examination, Witness said if Hove preferred a motor-bus service, he did not see why they should not have it.

MR. A. C. SWINTON, M.I.C.E., expressed the opinion that Western Road was unsuitable for a railless system, and he advocated motor-buses in preference to the proposed system.

MR. F. W. KEEN addressed the Committee for the Portslade U.D.C. He said his clients were opposed to railless traction, and asked the Committee to reject the Bill of the Brighton Corporation, which he submitted was only brought forward to prevent the Tramway Co. getting the powers they were asking for. The introduction of the trackless cars would not be to the interests of the district, and the scheme presented two germs of self-destruction, viz., the narrow roads and the double-deck cars. The present 'bus service might not be perfect, but it was better than posts and wires on these narrow roads. He believed the 'Bus Co., if left alone, would improve its service to meet the needs of the district.

Evidence was then called in support of the position taken up by Portslade U.D.C.

MR. R. HARKER, who represented the Shoreham U.D.C., said that, after careful consideration, the local authority had come to the conclusion that a service of electric tramways would best meet their needs.

MR. J. FLOWERS, on behalf of the Southwick U.D.C., opposed the Bills of the Brighton and Hove Corporations.

MR. WEDDERBURN, K.C., addressed the Committee for the Omnibus Co., and said that if the Bill of the Brighton Corporation was going to be granted, his clients had nothing to say, as the Brighton Corporation had treated them fairly in the matter, but if the Hove Corporation were to be given powers to run motor-buses in Hove, then he contended there should be some recognition of the 'bus company. Hove ought to give an undertaking to grant a lease to the company for a number of years.

MR. HUTCHINSON opened the case for the Brighton and District Tramway Bill, and said that the reason why the tramway was in its present condition was simply because every effort made on its behalf had been thwarted by the local authorities. The British Electric Traction Co. acquired the tramway with the intention of equipping it electrically and extending it to meet modern needs, but at every step Brighton and Hove had opposed them. The promoters of the present Bill were gentlemen of very large experience in tramway undertakings, and if the Bill was passed they intended to form a company and to transfer the tramway to that company. The terms of the agreement by which the tramway could be acquired from the British Electric Traction Co. and handed over to the new company would be laid before the Committee and evidence given that the necessary capital would be forthcoming.

MR. STEPHEN SELLON gave evidence in support of this scheme, and detailed the various attempts which had been made in the past to get Parliamentary powers to reconstruct and extend the existing tramways. He admitted that for certain purposes railless traction was useful, but in the case before them he considered it ill advised, and that it would involve a great loss to the Brighton and Hove ratepayers. To make an income of £16,500 a year in Hove, the railless cars would have to cover 744,000 miles a year, and that he estimated would mean a loss on the working of £4,650, to which interest and sinking fund and depreciation would have to be added. The proposal in the Hove Bill to remove the tramway he considered most unfair.

In cross-examination witness said the company had power to electrify the present line, but they were deterred from doing it because they could not get a satisfactory agreement with Hove regarding the purchasing period.

Questioned by LORD ASHTON, witness said he did not think it was possible to run trackless trolleys over the same line as a tramway for any distance. In Leeds the railless trolley system started where there was a tramway and went over it for some way and then branched off.

MR. GEO. BALFOUR, one of the promoters of the Company's Bill was called, and pledged himself to electrify the line if the Bill was passed. He had no doubt that the necessary capital would be forthcoming.

MR. FREEMAN, K.C., addressing the Committee on behalf of the East and West Sussex County Councils, said that there was objection to either of the Bills proposed and he asked the Committee if they were absolutely satisfied that any new developments were necessary, or were the whole needs to be met by leaving things in the hands of the present persons with a strong intention that the service must be improved. Whatever the Committee decided, however, he asked that there should be some contribution made to the cost of keeping up the roads affected.

Counsel appearing for the Hove and Brighton Bills also addressed the Committee in reply.

The Committee having adjourned to consider the matter, the CHAIRMAN announced that they had decided not to approve of the preamble of the Bill of the Tramway Co. With regard to the other two Bills, they considered it a matter for regret that the two Corporations had found themselves unable to promote a joint scheme. The Committee approved of the principle of the system of a continuous railless traction route under one management between Brighton and the western boundary of Hove. They approved the preamble of the Brighton Corporation Bill, with regard to that portion within their own boundary, and also the preamble of the Hove Bill, so far as it was within their own boundary, and they hoped it would be possible for the parties to arrive at some satisfactory arrangement.

MR. BALFOUR BROWNE said he had no doubt after the intimation from the Committee some arrangement would be made between the parties.

The further consideration of the Bills was adjourned to allow of the necessary adjustments being made before the clauses were considered.

**Metropolitan District Railway Bill.**—Last week a Select Committee of the House of Commons, presided over by Sir Luke White, considered this Bill, which gives power to the L. & S.W. Railway Co. to widen their existing Wimbledon and Fulham Railway, and to enter into arrangements by which the District Co. will have the exclusive right of running over the widened lines when completed. There were also clauses relative to the constitution of the Power House Working Committee, which was set up under powers obtained last session. Evidence having been given, the Bill was reported for third reading.

**Second Reading.**—In the House of Lords on March 20th, the Loch Erich Water and Electric Power Bill was read a second time.

## LEGAL.

SCHWARTZ v. THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD.

THIS case, heard in the Court of Appeal by the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley on an appeal from an award of the Judge of the Woolwich County Court, raised a novel and interesting point in relation to the operation of the Workmen's Compensation Act, and decided the question as to whether, for the purposes of the Act, employment on board a British ship at sea could be regarded as employment within Great Britain.

From the statement of counsel, MR. KNOCKER, who appeared for the applicant, a widow, who sought compensation for the loss of her husband, it appeared that the deceased, who was an electrical engineer, had been in the employ of the respondents, and, amongst other things, it was his duty to lay electric cables. In December, 1910, he was ordered to go to Tenerife to lay cables there, and the ship in which he went was lost with all hands in the Bay of Biscay, and the question was whether the employment of a man on a British ship brought him within the operation of the Workmen's Compensation Act. There was no question that the accident was one which arose out of the employment, and the sole point was whether British territory included British ships, and if so, did it enable a man killed on such a ship to come within the Compensation Act. According to the authorities, a man on board a British ship was held to be on British territory, and if it were not so, there would be no law at all for the man whose employment took him to sea on such a ship.

LORD JUSTICE FLETCHER MOULTON said that from Section 7 of the Act it was clear that it was not intended to include ships as part of the ambit of the Act, and the Court had to construe the Act as a whole.

LORD JUSTICE BUCKLEY said that Section 7 had special reference to seamen who, but for that Section, would be outside the Act altogether. Section 7 said that a seaman might recover notwithstanding that he was at sea on a British ship.

MR. KNOCKER said that if a British ship was, for criminal purposes, British territory, in the absence of Sec. 7, the Act would apply to this case. This case had nothing to do with Sec. 7, which was only introduced for the benefit of seamen. The deceased was a workman who happened in the course of his employment to be on a piece of British Territory which brought him within the General Statute law.



LORD JUSTICE FLETCHER MOULTON: The ship went down with all hands, and we don't know anything about the death.

MR. KNOCKER said that a number of facts had been agreed, and the finding of the Board of Trade inquiry had been accepted. The deceased man was not a seaman, and Sec. 7 did not apply to him.

LORD JUSTICE BUCKLEY said that Sec. 7 said that a seaman was entitled to recover compensation for accident, and the deceased not being a seaman was not entitled to recover.

MR. KNOCKER said that Sec. 7 simply extended the ambit of the Act. It was an extending and widening section and was unfairly used as an excluding section.

LORD JUSTICE FLETCHER MOULTON said he did not remember any case under that Act or any other Act in respect of which a claim was made for accident on board a British ship.

MR. KNOCKER said he agreed that there was no such case.

LORD JUSTICE BUCKLEY said that British ships were not included in the territorial limits for the purposes of the Act.

MR. KNOCKER said that the law of contract or the Sale of Goods Act would apply to British ships.

The MASTER OF THE ROLLS said that the deceased man was in the service of the respondents as electrician, and was sent out by them to take part in the laying of a cable to be paid so much per month while at sea, and so much a month while engaged in the work. There, therefore, was no question as to his having been employed by them at the time he lost his life, and his widow now said that she had a right to compensation under the Act. The accident was admitted and the employment was admitted and it might be assumed the accident occurred in the course of the employment. The applicant, however, was met by the difficulty that the case did not come within the provisions of the Act. Section 7 was not a provision for every one on board a ship, but only for seamen—the crew of the ship. It was impossible to hold that because a special section of the Act conferred upon a certain class certain rights, that every man who was injured on board a ship was entitled to claim compensation. Having regard to Section 7 of the Act he could come to no other conclusion than that the view taken by the County Court judge was right and that the appeal must be dismissed.

LORD JUSTICE FLETCHER MOULTON agreed, and LORD JUSTICE BUCKLEY also concurred, observing that in his opinion a British ship for the purposes of the Act did not come within the territorial limits.

The appeal was accordingly dismissed with costs.

#### STREET ACCIDENT CLAIM.

At Leigh County Court, last Friday, the hearing was continued on the action brought by George Gorse, who claimed £100 from the South Lancashire Tramways Co. for personal injuries. The plaintiff, who was a spinner at the Howe Bridge (Atherton) Mills, at half-past nine on the evening of June 15th last, it then being dark, was going along Leigh Road, Atherton, when he caught his foot on a manhole and fell heavily on his right hand, and his arm become practically paralysed. Mr. Acton submitted that the company were not liable. The work was done under the superintendence of the Atherton District Council, and approved and passed by the Council's surveyor. That was the limit of the Tramways Company's obligation, and if there was any actionable negligence the persons responsible were the District Council. His Honour reserved judgment.

#### THE POSTMASTER-GENERAL AND THE NATIONAL TELEPHONE CO.

The National Telephone Co. applied to the Railway and Canal Commission, composed of Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne-Hardy, and Sir J. Woodhouse, to fix a date for the hearing of the arbitration provided for under the agreement between them and the Postmaster-General, by which the Post Office acquired the company's undertaking.

SIR ALFRED CRIPPS, K.C., who made the application, said that the matter was a very heavy one, and many millions sterling were involved. The hearing must take a considerable time. The company were preparing certain particulars of their claim, and they would give the Postmaster-General as much information as they could. They had agreed to give him not only the items of their actual claims, but also the original figures on which the discounts had been made. He had had the opportunity of consulting with the Attorney-General (Sir Rufus Isaacs, K.C.), and they were agreed that the case should be taken immediately after the Whitsuntide recess, so that it might be finished before the Long Vacation.

The ATTORNEY-GENERAL, who represented the Postmaster-General, suggested June 10th as a convenient day for commencing the hearing, and MR. CRIPPS assented to that date.

MR. JUSTICE LAWRENCE asked whether counsel could give him any idea of the possible length of the case?

SIR ALFRED CRIPPS said that the company would compress their case as much as possible, but he did not think that it could take less than three weeks or a month.

The ATTORNEY-GENERAL said it would seem that they had to face a stupendous undertaking, and it was very difficult to say how long it would take to complete.

SIR J. WOODHOUSE.—So far as you can see it looks like lasting until the end of the sittings?—The ATTORNEY-GENERAL said that was so.

SIR ALFRED CRIPPS said they proposed to take the case with regard to the plant first, the claim in respect of which amounted to between £15,000,000 and £16,000,000.

MR. JUSTICE LAWRENCE remarked that if they had to ascertain the value of items amounting to £15,000,000 or £16,000,000, it looked as if the arbitration would last nearer a year than two months.

SIR ALFRED CRIPPS said he should be misleading the Court if he said the case would take less than two months. Besides the plant there were a number of other items and, he believed, some 60 or 70 compensation cases.

The ATTORNEY-GENERAL said he hoped the Court would see its way to commence the hearing on June 10th and sit *de die in diem* until it was concluded.

MR. JUSTICE LAWRENCE said that it would be necessary for him to consult the Lord Chief Justice, as he had arranged to go on circuit in June, but the case should be commenced on June 10th if he could cancel his circuit arrangements.

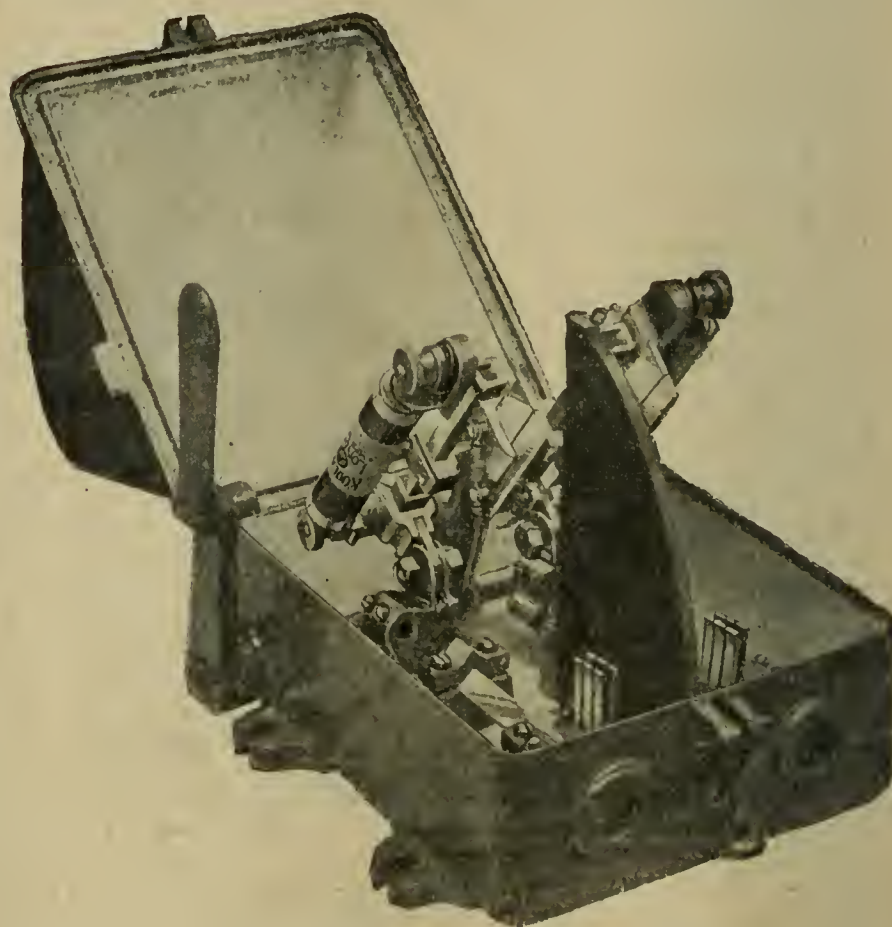
#### COAL MINES REGULATIONS ACT.

WM. ROBERTSON, pit fireman, 15, Park Street, Crosshill, was convicted on evidence in Dunfermline Sheriff Court, of having, in the Mary Pit, Lochore, used an electric cable which was less than 20 yards in length for the purpose of firing a charge, contrary to the Coal Mines Regulations Act, in consequence whereof he was injured by some of the material dislodged when the charge exploded. It was stated that Robertson had been entirely incapacitated for work since the accident in December last, and that a penalty was not desired, the case being brought into Court in order to enforce an important part of the Statute. As the man had already suffered so much, the Sheriff imposed no penalty.

### NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

#### E.A.C. Switch-Fuses.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.E., have just introduced a switch-fuse for heavy currents somewhat on the lines of their smaller design, but insulated throughout with mica, all live parts being clamped on to



E.A.C. SWITCH-FUSE (50-AMPERE SIZE).

substantial mica-insulated steel bars. The switch has a quick break, and is interlocked so that the cover cannot be opened when the switch is closed. No combustible or hygroscopic materials are used, and the rating is liberal throughout. "Koolark" fuses are used. The interior of the switch is shown above.

**The Coal Strike.**—MESSRS. W. H. BAILEY & CO., LTD., of Salford, issued a notice last week stating that they were well stocked with coal and most of the materials required for their works and foundries, so that there would be no stoppage.



## COLONIAL REFERENCES.\*

BY COLONIAL.

MANY engineers who have been in the Colonies have found, no doubt, on their return to England that the experience they have obtained abroad has not much weight at home, and also that engineers trained in the Colonies are not considered as good as men trained in the old country or on the Continent.

This is rather an interesting point, and there is much to be said on both sides; at the same time, it is an important question now that so many of our Colonies are going ahead in engineering matters, in some cases manufacturing their own goods. Many an engineer goes abroad for a few years, with the intention of ultimately returning to England, so that this matter is one which he must consider, in order that he may understand what his standing will be when he returns home.

One of our Colonies which is advancing apace in matters electrical, and opens tremendous possibilities for the electrical engineer, is United South Africa; a short description of the conditions and status of the engineer there may not be out of place, and will serve to show why Colonial experience does not count for much.

The root of the matter is that many Colonial engineers do not know their work, and are, in fact, only half-trained men, in some cases being absolutely untrained, merely self-taught, and not entitled to be called professional men at all; some such men are chief engineers and managers of engineering works, and as they control the work of those under them, it follows that the latter do not see things done in the manner in which they should be done, and consequently get into slack ways themselves, and get no up-to-date experience.

Many of these managers, borough electrical engineers, &c., are men who came to the Colony many years ago, and having absolutely no idea of modern methods, they run their works in the style that they were run in England, 10 or 15 years ago; this especially applies to central stations, some of which are an absolute disgrace to those in charge of them.

What chance, then, does a central-station engineer in South Africa have of obtaining experience which will be useful to him on his return to England? Can it be wondered that his Colonial experience is belittled? It can safely be said that one of these engineers, having been, say, five or seven years in the Colony, would be rather "at sea" in a modern central station, run on up-to-date lines.

It is not intended to imply that *all* the central stations in South Africa are obsolete, in fact many of them are quite modern; for instance, many of the new stations in the Transvaal have the very latest machinery, but it cannot be denied that things are often run in a very slipshod manner, with an entire absence of discipline, and many of the engineers in charge of the plant do not understand or appreciate it.

Another reason for the non-recognition of Colonial experience, is the fact that the Colonial engineers do not in any way endeavour to maintain their status; they will be shift engineers to-day, and switchmen or glorified wiremen to-morrow, if they can get better salaries as the latter; it naturally results that the wireman class are shift engineers, &c., in time. How, then, can it be expected that the home engineers will attach importance to an engineer's Colonial references? He may be one of the glorified wireman type, in spite of his good references as an engineer.

It is no idle talk to say that there are many men in South Africa, glorying in the title of "Electrical Engineer," boasting of their A.M.I.E.E. (how they ever get it, Heaven knows), who, if the truth were known, are only wiremen or drivers, and have received no training whatsoever; in spite of this, they are, to all intents and purposes, electrical engineers, and are classed as such, even in some cases by

the Government. These men, then, come home with their papers, the same as *bona fide* men; can it be wondered at that they are looked at askance? The genuine must suffer with the rest, since no weight can be placed on their papers, and there is no doubt that "paper experience" counts nowadays.

It must be admitted that many men who, on account of their poor qualifications, could never get a good position in England go abroad and manage to get what they cannot get at home. This must prove that the quality of the engineer in the Colonies is not up to the standard of the man at home.

These few points will serve to show why Colonial references do not avail much in England; what, then, is the remedy?

This question can be answered in a few words: "Raise the tone and status of the electrical profession in the Colonies."

How can this be done? In many ways; a few may be mentioned. First, the help of the Government must be obtained; they must define the term "electrical engineer," and institute a State Board examination, which will take the form of an ordinary examination in electrical and mechanical engineering—the mechanical section alone would weed out scores; they must also make genuine enquiries as to the candidate's training and experience, and pass an Act forbidding anyone to be employed in a position of responsibility who has not successfully passed the State Board; in fact, they must follow the example of the mining electrical engineers in the Transvaal.

Under these conditions, Colonial references, backed up by the State certificate, would be of value in England, and gradually the stigma attaching to them would disappear.

This would stop engineers from lowering their status by going as switchmen, wiremen, &c., for, naturally, an employer would look askance at an electrical engineer in possession of his certificate who had lowered himself and his profession in this way; whereas, at present nothing is thought of it, as many of the so-called engineers are in reality wiremen and electricians, and consequently dropping back to their real trade is lightly regarded.

Cases are come across where men are employed as shift engineers who never before saw a boiler in their lives; is this right, when so much damage and loss of life may be occasioned by their ignorance? The crux of the whole matter is that those who are in charge and who employ these men as shift engineers are not themselves capable; in fact, many of them would not be competent to take the post they are offering to others.

Municipalities are the worst in this respect: the councillors do not, of course, know anything about engineering, and get hold of men as their borough electrical engineers who are quite incapable of managing the department efficiently. It stands to reason that if good men are to get recognition, their chief must himself be a good engineer, so that he can appreciate their value and differentiate between them and the half-trained men.

The only way to impress upon municipalities the importance of choosing well-trained men to manage their electric supply departments is through the medium of the Press—in fact, a regular campaign is needed in all the leading newspapers, pointing out the advantages to themselves and the towns and cities generally.

There are many central stations which, run on up-to-date methods, could be made to pay, and pay well, instead of being a burden on the ratepayers. With prices ranging from about 6d. to 1s. per kW.-hour for lighting, 2d. to 3d. for power, and 1d. to 1½d. for traction, many works could be turned into veritable gold mines; whereas some of them make only small profits, or next to none, and in some cases they are run at a loss, simply because the chief knows nothing, either from an engineering or a business point of view.

Some municipal supplies do *nothing* in the way of publicity, and many people in the towns hardly know that a power station is in existence.

It may appear that all this is away from the point, but these facts are mentioned to show that the central-station industry is rotten to the core, especially those owned by the municipalities, and consequently the profession must suffer. If the concerns are not financial successes, then they cannot afford to pay good men; consequently the half-trained men are taken on and considered cheap! Then the confusing of the engineer with the "amateur" begins. All this

\* This article has been sent us by a young engineer who has acquired experience in central stations, both in South Africa and at home. While we disclaim responsibility for the views expressed, we believe they will be of interest to our readers. Probably there is another side to the question, and we shall be glad to receive communications from those acquainted with it.—EDS. E.R.



can be traced to the incompetency of the chief. If a few statistics of some of these stations were looked at, the figures would be appalling to the home engineer—12 to 14 lb. coal per kw.-hour, &c.; the chiefs take no steps to alter it, and the Councils do not know any better.

It may be asked why the engineers concerned do not remedy matters: the answer is easy—they cannot. They say their plant is out-of-date; in many instances it is, but it could easily be improved upon and “modernised,” or, better still, replaced by up-to-date machinery. They will say that their committees will not sanction the expenditure—why? because the engineer is unable to prove to them the advantages, and consequent saving; it is beyond him. And so things go on in the same old way, and the chief bluffs the Council and keeps his post!

In some parts they are waking up somewhat, and importing men from home, in some cases with success, but very often the wrong men are brought out, simply because the chief does not know a good man. The log books of some stations would form an excellent “funny book” for Home engineers; thousands of figures may be seen, but what they are there for, no one knows: if they were asked how many lbs. of water they consumed per kw.-hour, or boiler-hour, or their kw.-hours per boiler-hour, &c., they would look puzzled, and shrug their shoulders.

Ask them to show cards from their engines, the results of boiler and engine tests, their coal analyses—few could do so; their coal is cheap (?), that is about all they know. May be, some engineer, a little more enlightened than his brothers, reads that turbines are more economical than his ancient reciprocating sets, or he thinks they would be; he decides to recommend his Council to sanction the necessary expenditure: he knows nothing about them, probably has had nothing to do with them, but still decides to install them without taking the trouble of going into the matter and estimating the saving, taking capital charges, sale of old plant, installing of superheaters, extra vacuum required, &c., into account, and probably ends up by being in a worse state than before.

Before installing them, his experience consists of taking an assistant with him and *seeing* someone else's plant running. This will show what stamp of men some of the chiefs are in South Africa, and the consequent class of men under them. Can it, then, be wondered at that Colonial engineers' papers are of little avail in England when the profession is in this state?

There are many good engineers in South Africa, but what can they do under chiefs of the stamp outlined? They must keep quiet and say nothing, whereas, were their advice taken, great improvement would result.

Engineering is a great and important profession, and the electrical section will be of the utmost importance to South Africa, and in the development of the country; so let each member of it do what he can to raise the status of all connected with it.

The South African Institute of Electrical Engineers has done yeoman service for the mining section and obtained at least some recognition for the electrical engineer at the mines; but there is yet a far wider field open for it in the raising of the standing of the electrical engineer all over South Africa and getting him to realise his own responsibility in the matter—not to allow himself to be classed among the wireman-engineer type, and to refuse to accept a position beneath his status because it happens to be more lucrative. The engineers must stand together to retrieve their position before it is too late, and then, and only then, will their Colonial references carry any weight at home.

---

**Prices Advance.**—THE WESTERN ELECTRIC CO., LTD., announce that, in view of the increase in the cost of raw materials, the prices of batteries and parts, battery material, bells, indicators, galvanometers, pushes (all classes), were advanced 10 per cent. on March 25th.

THE GENERAL ELECTRIC CO., LTD., have also issued notice of 10 per cent. advance on all prices shown in sections L of their catalogue.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., have likewise issued a notice of a 10 per cent. advance in prices appearing in the Bell Section of their catalogue (all items listed under initial letter “S”), with the exception of wires, insulators, ironwork and medical coils.

## DEPRECIATION.

[COMMUNICATED.]

THE necessity for, and importance of, making systematic and adequate provision for depreciation or renewals is being increasingly forced upon the attention of the administrators of electrical and other industrial undertakings.

We have only to look at the huge sums under construction and equipment and other nomenclature, representing expenditure in cash and paper, and incorporating in many instances goodwill and other descriptions of outlay, and to observe here and there the scant reparation for the perpetual loss which is ever in evidence, to obtain some idea of the vast primary importance of making due allowance therefor.

It is a mere truism to state that no profit can be deemed a true profit without giving effect to all losses applicable to the period for which the account of profit and loss is drawn; and as depreciation, wear and tear, or other synonymous idiomatic nomenclature is indicative of a certain loss, it should, as far as it can be approximated, form a debit against revenue, and should never be shown as an appropriation of so-called net profits, unless it be a provision in advance of the loss that has arisen and that will require to be sustained.

So-called net profits are in themselves merely estimated profits more or less, and to the extent that they are estimated, having regard to the intended continuous nature of industrial and other commercial ventures, it is sometimes stated that there is no such thing as net profit.

Now, if we take the assets side of an electrical or any other industrial balance-sheet, we shall find that the expenditure is of a diversified nature, from which we may comprehensively draw the following general characteristics from a disintegration and classification of its component parts.

In the first place, capital is usually held to mean anything which affords production or revenue, or which is a source of income.

Assumably the (1) legal capital of a company is that contributed to it by its proprietors, whilst economic capital of a company is the product of the use of the capital as represented by the assets and expenditure shown on the assets side of the balance sheet. Capital from an income-tax point of view is so full of anomalies as to be incapable of any satisfactory interpretation.

Broadly, capital expenditure is either of a fixed or circulating character. Fixed capital is that from the use of which arises revenue or production without change of owners, and circulating capital is that from which is derived revenue or production by parting with it or changing it.

These terms, though they may be ambiguous, merely serve the purpose of expressing what expenditure is of a fixed capital nature, and what expenditure is of a circulating capital nature. Their use does not imply that the sums which they represent are continuously fixed or circulating, as the case may be. We therefore have:—

1. Assets and expenditure employed in the service of earning revenue for the undertaking, and therefore of a live or active and producing character.

2. Expenditure which *per se* possesses neither present nor future value, and which, considered even in conjunction with or in the light of the context of the business, may be credited in many cases with a precarious tangibility.

Such expenditure should be afforded merely a temporary reception in the balance sheet because of the inequity that would arise if it were incorporated or sunk in the profit and loss account at one time, it being convenient to apportion the extinction in money of such book values over a course of years.

3. Expenditure unrepresented at present by any assets, physically or otherwise, which should be treated in a manner similar to that indicated in (2).

We are told that from a legal point of view all assets of a circulating capital nature must be efficiently maintained; but that, as regards assets of a fixed capital nature, there is at any rate a certain amount of toleration.

What are the divisible profits of an undertaking, is a question which is closely allied with what is the capital of a company, the former, for a correct solution being subsidiary to the latter.

Reverting to Section 1 of our classification, it follows from what we have said that all expenditure on the assets side of a balance sheet in which there occurs a loss, or in which there appears a reduction of value due to any cause, is, to the extent of such a loss or depreciation, a kind of prepayment in practice on account of revenue, because all such losses should find their way into the revenue account. For example, machinery is purchased for £9,000 for the purpose of performing certain work with a view to obtaining revenue. At the end of the first year's use there is a loss for wear and tear, and this continues, it may be, until the employment of the machine becomes an expensive earning medium of revenue, or until it has to be renewed. Now, if the residual value is estimated at, say, £500, and the life at 10 years, it means that revenue must be charged with £850 each year, representing the average yearly amount of its increasing inefficiency or loss of life; and if depreciation be provided in some such manner as presented, the whole of the asset, when dead and renewed, has been paid for out of the earning capacity of the undertaking, because revenue has discharged its obligation to capital by repaying it the amount which it paid for the machine which is now *non est*, and the machine which takes its place may, with propriety, be charged to capital.

We may, therefore, regard the £9,000 (minus £500) as being only temporarily capitalised, because of its perpetual wasting and declining character, in spite of the assistance rendered to it by



efficient repairs and maintenance, which, as it occurs, should be extinguished over subsequent revenue accounts, according to the duration of its serviceable use or its accepted and recognised life as an efficient factor in the work assigned to it for producing revenue, which is the object of all commercialism.

No one reading the balance-sheet would be led to suppose that £9,000 was anything else than the mere book value of the machine after, say, five years, and it is not even worth £9,000 *per se* to the undertaking as a going concern. All assets of the nature to which we are referring must be reduced by the depreciation reserve, if any, and even in that event will be found generally to be totally inadequate.

Depreciation, renewal, or reserve for depreciation, whatever we may term it, should, to the extent that it has occurred, be shown strictly as a deduction from the assets concerned; but it is customary to raise a special account therefor, debiting profit and loss, some showing it erroneously as an appropriation of profit.

There are various methods in vogue of arriving at the amount of depreciation, many of a mixed nature, some based upon the life of the assets concerned, whilst in the electric tramway industry we sometimes find the provision expressed in terms of a rate per car-mile run; but, speaking generally, the amount appropriated to that purpose is of a haphazard character, depending upon what the credit balance of the profit and loss account is, after providing for the usual charges, including debenture interest, if any, and the share capital requirements. The result is that in many cases, owing to the comparatively narrow margin, the profit and loss account is so enfeebled as to be incapable of rendering but scant respect to loss occasioned by wear and tear.

In noticing the following methods it would seem, as a general statement, that for depreciation requirements a decreasing annual sum is preferable to an equal annual instalment having regard to the increasing charges emanating from repairs and maintenance.

Diminishing or Written Down Balance System.—

Machinery standing at	...	...	£800
Estimated residual value, realisable value, or value in use at end of estimated term	...	...	100

£700, amount to be written off in 10 years.

Let A = present value, B = residual value, and n = time, it may be easily shown that—

$100 \left\{ 1 - \left( \frac{100}{A} \right)^{\frac{1}{n}} \right\}$  = the rate at which the asset should be written down from £800 to £100.

We have, therefore—

$100 \left\{ 1 - \left( \frac{100}{800} \right)^{\frac{1}{10}} \right\} =$

$100 \left\{ 1 - \left( \cdot 125 \right)^{\frac{1}{10}} \right\} =$

Log. of  $\cdot 125 = \overline{1} \cdot 0969100 \div 10$   
 $= \overline{1} \cdot 0969100$   
 $\overline{9}$

$\overline{10} \cdot 0969100$   
 $\overline{9}$

$\overline{19} \cdot 0969100 \div 10 = \overline{1} \cdot 9096910,$

which is the log. of  $\cdot 812252$ . Now,  $1 - \cdot 812252 = \cdot 187747$  upon 1, or, say, 18·77 upon 100, the rate per cent. :

Value to be depreciated	...	...	£800
1st year. Charge to profit and loss	...	...	150·160
			£649·840
2nd year.	"	"	121·974
			£527·866
3rd year.	"	"	99·081
			£428·785
4th year.	"	"	80·483
			£348·302
5th year.	"	"	65·377
			£282·925
6th year.	"	"	53·111
			£229·814
7th year.	"	"	43·140
			£186·674
8th year.	"	"	35·040
			£151·634
9th year.	"	"	28·470
			£123·164
10th year.	"	"	23·120

Written down value ... £100·044

which is near enough for all practical purposes.

When debentures or debenture stocks secured by a trust deed on lands, buildings, machinery and other assets are to be redeemed under certain conditions within a stated period, and a sinking fund is created, the amounts credited thereto and debited to profit and loss or profit and loss appropriation, as the case may be, form in themselves a contribution to the depreciation or loss arising on the assets to which the expenditure relates. If they are regarded as contributions towards depreciation, then they are strictly charges against profit and loss, and not an appropriation of it.

The following table shows the redemption in five years of £50,000 debentures, assuming a 5 per cent. rate both for the debenture interest and the sinking fund, to curtail the use of figures—sinking funds are, of course, usually calculated at from 2 per cent. to 3 per cent.

Years.	Debentures to be redeemed.	Annual interest payable.	Annual amount required for redemption.	Amount outstanding.
(1)	(2)	(3)	(4)	(5)
1	50,000	2,500	9,048·7399	40,951·2600
2	40,951·2600	2,047·5630	9,501·1769	31,450·0830
3	31,450·0830	1,572·5041	9,976·2358	21,473·8471
4	21,473·8471	1,073·6923	10,475·0475	10,998·7995
5	10,998·7995	549·9399	10,998·8600	

If so provided, the amounts standing in column 4 would be debited to profit and loss and credited to the sinking fund.

Annuity method.—

£10,000 in 10 years at 3 per cent.

$\frac{1}{s_{\overline{10}|3\%}} = \cdot 117230 \times 10,000 = 1,172·30$ , annual instalment.

\* The present value of £1 per annum for 10 years at 3 per cent.

The question resolves itself into one of calculating what annual instalment will repay, with interest at 3 per cent., £10,000.

Years.	Annual instalment to be charged to Profit and Loss.	Principal outstanding at beginning of each year.	Interest on amounts in col. 2 at 3%, to be credited to Profit and Loss acct.	Total of columns 3 and 4.	Net amount charged to Profit and Loss acct. (col. 2 - col. 4).	Balance of principal at end of year—i.e., (3 + 4 - 2).
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1,172·30	10,000	300	10,300	872·30	9,127·70
2	1,172·30	9,127·70	273·8310	9,401·5310	898·4690	8,229·2310
3	1,172·30	8,229·2310	246·8769	8,476·1079	925·4231	7,303·8079
4	1,172·30	7,303·8079	219·1142	7,522·9221	953·1858	6,350·6221
5	1,172·30	6,350·6221	190·5186	6,541·1407	981·7814	5,368·8407
6	1,172·30	5,368·8407	161·0652	5,529·9059	1,010·2348	4,357·6059
7	1,172·30	4,357·6059	130·7281	4,488·3340	1,040·5719	3,316·0340
8	1,172·30	3,316·0340	99·4810	3,415·5150	1,072·8190	2,243·2150
9	1,172·30	2,243·2150	67·2964	2,310·5114	1,105·0036	1,138·2114
10	1,172·30	1,138·2114	34·1463	1,172·3577	1,138·1537	†
	11,723					

† The balance here should be nil. There is, however, a balance of ·0577, owing to the annual instalment not being carried to further decimal places.

The actual instalment is 1,172·3054.  
Now,  $1,172·3054 \times 10 = 11,723·0540$   
and  $1,172·30 \times 10 = 11,723$

and ·0577 — ·0540 = ·0037, which would be the difference with the new instalment, and which may be neglected.

The instalment in the table is sufficiently near for our purpose.

Sinking Fund.—

£10,000 of lost or exhausted outlay in 10 years at 3 per cent.

This resolves itself into calculating what annual sum or sinking fund is required to be invested at 3 per cent. to amount to £10,000 at the end of an estimated 10 years' life.

P = the principal.

$A_n$  = the amount of £1 per annum for 10 years at 3 per cent.  
 $= 11·46388$ .

Therefore,  $10,000/11·46388 = 872·30501$ , sinking fund instalment.

OPERATION OF FUND.

Years.	Amount of fund at beginning of year.	Interest thereon at end of year.	Instalment payable at end of year.	Amount of fund at end of year.	Total of cols. 3 and 4, which equals the amount of capital loss to be borne annually by the undertaking.
(1)	(2)	(3)	(4)	(5)	(6)
1	—	—	872·30501	872·30501	872·30501
2	872·30501	26·16915	872·30501	1,770·77917	898·47416
3	1,770·77917	53·12337	872·30501	2,696·20755	925·42838
4	2,696·20755	80·88622	872·30501	3,649·39878	953·19123
5	3,649·39878	109·48196	872·30501	4,631·18575	981·78697
6	4,631·18575	138·93557	872·30501	5,642·42633	1,011·24058
7	5,642·42633	169·27278	872·30501	6,684·00412	1,041·57779
8	6,684·00412	200·52012	872·30501	7,756·82925	1,072·82513
9	7,756·82925	232·70487	872·30501	8,861·83913	1,105·00988
10	8,861·83913	265·85517	872·30501	10,000	1,138·16018

† On the supposition that the "want" of the use of the instalments does not cost the undertaking more.

In some instances it may be advantageous to take out a sinking fund or capital redemption policy. For example, supposing the



accumulation of £100 in 10 complete years may be accomplished by an annual payment of £8 9s. 5d., or by a single payment or premium of £74 8s. 3d., which a little calculation will show is at the rate of 3 per cent. The amount of £1 per annum for 11 years at 3 per cent. =  $12 \cdot 80780 - 1 = 11 \cdot 80780$ , and—

$$1/11 \cdot 80780 \times 100 = \text{£}8 \text{ 9s. 5d.}$$

The single premium is  $1/(1 \cdot 03)^{10} \times 100 = \text{£}74 \text{ 8s. 3d.}$

We may show in a statement the working of the transaction for the period, making the payment at the beginning of each year, and adding thereto, with the subsequent accumulation, interest at the end of the year at 3 per cent., and it will be found that in 10 complete years the amount will be £100. In the event of a single premium, of course, the interest only is added.

There are certain equitable conditions attaching to such policies, which we need not pursue here, and the policies possess surrender values if it be found inconvenient or impossible to continue them.

With regard to the incidence of income-tax, it has been suggested that all depreciation of inherently wasting assets which form a component part of the expense of earning revenue should be allowed as a deduction from taxable profits. Some concessions in that direction have been made by the authorities.

Assets and capital expenditure from the point of view of income-tax may be divided into—

1. Capital invested in the purchase of temporary sources of profit, such as buildings, plant, machinery and ships, furniture and fixtures: natural raw materials, including coal, minerals, stone, gravel, earths, oil, nitrate, and, when intended for sale, land; shaft-sinking, and development undertaken to obtain access to all such raw materials; purchased terminable annuities, and capital invested in terminable foreign concessions which, if they had remained in the hands of the seller, would not have been subject to British income-tax.

The source of profit in all these instances may be looked upon as temporary, from the point of view that such origins of profit cannot be maintained or cannot live without the process of inherent wear and tear, or, as it may be expressed in other terms, that such assets afford production only with the concomitant of waste, and that they cease to yield revenue when they become exhausted.

2. Capital invested in the purchase of a temporary interest in a permanent source of profit—i.e., capital invested in forms of assets other than those we have described in 1, such as goodwill, leaseholds, copyrights, patent rights, terminable concessions within the United Kingdom. No allowance, as at present, should be made, inasmuch (*inter alia*) as they are not represented by a corpus or fund, being of the nature of purchased rights to future income.

Depreciation is not allowed by the income-tax authorities as a deduction from revenue for the purpose of arriving at the taxable profits of the year; but certain measures of relief and allowances at specific percentage rates, or expressed in terms of an agreed unit, on written-down values, have been afforded, the amount allowed being deducted from the average profits for three years for assessment.

Among other things, the authorities have made the following considerations in regard to the permanent-way of electric tramway companies:—

The life of the permanent-way is to be taken as 12, 14 or 16 years, according to the traffic thereon. The classification is to be based on the average car-mileage per mile of track per annum, viz.:

1. Not exceeding 50,000 car-miles per mile of track, 16 years.
2. Over 50,000 and not exceeding 75,000 miles, 14 years.
3. Over 75,000 and not exceeding 125,000 miles, 12 years.
4. Over 125,000 car-miles per mile of track, special consideration.

Where there are special circumstances, such as exceptional gradients and the compulsory use of wood paving, tending to show that the car-mileage does not fairly represent the wear and tear of the track, each such case is entitled to special consideration.

The cost of renewals, including setts or other paving, but excluding concrete foundations, is to be taken at £4,400 per mile of single track until the general renewal of the track takes place.

No allowance is to be made in computing the assessable profits in respect of any expenditure on repairs or maintenance of the permanent-way, but the allowance for depreciation is to be computed at such a sum per annum as will in the aggregate over the determined life of the permanent-way be equal to the cost of renewal as above fixed, plus the estimated repairs for that period.

Cost of renewal per mile as above	...	...	£4,400
Add for example—Estimated cost of repairs at £100 per mile per annum for an undertaking with a life of 16 years	...	...	1,600
			£6,000
Amount to be allowed per annum in lieu of depreciation, one-sixteenth	...	...	£375

The amount to be added in respect of ordinary repairs is to be determined by taking the actual average expenditure as shown in the accounts of the undertaking for the last three years or less period that the company may have been operating.

Repairs under this head are understood to include renewals of special track work at junctions and cross-overs, which occur at frequent intervals.

Lastly, we have the incidence of the purchasing powers of local authorities of tramway and electric lighting undertakings, the various agreements that have been entered into between Councils and companies, in many of which grave questions arising out of the subject of depreciation are involved. These questions are a theme in themselves, and cannot be adequately noticed on the present occasion.

## BUSINESS NOTES.

**Our Next Issue.**—Next Friday being Good Friday, the ELECTRICAL REVIEW for that date will be published two days earlier, appearing on the morning of Wednesday, April 3rd. This being so, we shall be glad if contributors and advertisers will take special note of the necessity for sending in matter, &c., for that issue immediately.

Correspondence for publication should reach us by first post on Monday at latest. News matter should be received in the course of that day.

Our Advertisement Department announce that new advertisement copy and alterations to existing displayed advertisements should be in their hands not later than to-morrow (Saturday) morning; but Official Notices and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday next, April 2nd.

**Private Meeting.**—GROSSMITH & Co. (William Hugh Smith trading as), 3, Marmion Road, Southsea, and Daniel Street, Portsea, electrical, gas, and water engineers.—A meeting was held in this case on March 18th at the offices of Messrs. Howard, Morris, and Crocker, accountants, Pearl Buildings, Portsmouth, when a statement of affairs presented showed liabilities unsecured £4,254 and gross assets of £1,831. From this latter figure had to be deducted preferential claims of £248, leaving net assets of £1,582, and disclosing a deficiency of £2,671. The liabilities were made up of unsecured trade creditors, £2,314; unsecured cash creditors, £1,327; partly secured cash creditors, £757; less value of security (a second charge on reversion), £144—£613. Fully secured cash creditors consisted of G. T. Aylen £315, value of security £371, surplus to contra £56; Jones £1,021, value of security £1,165; surplus to partly-secured creditors, £144; W. Stanner £1,127, value of security £1,300, surplus to second mortgagee £172. The assets consisted of cash in hand, £28; stock, estimated, £600; plant and machinery, £207; office furniture and shop fittings, £60; household furniture, £95; book debts estimated to produce £540; value of work done on uncompleted jobs, £243; surplus from fully-secured creditors, £56. The chair was taken by Mr. A. W. Bartlett (Evered & Co., Ltd.), and there were present or represented at the meeting trade creditors for over £1,800. It was resolved that the deed of assignment executed to Mr. H. B. Morris, be confirmed, and that a Committee of Inspection, consisting of Messrs. A. W. Bartlett, W. J. Potter (W. T. Henley's Telegraph Works Co., Ltd.), A. R. Holbrook (Holbrook & Son, Ltd.), H. V. Morris (F. & C. Osler, Ltd.), and G. W. Scholey (Corfield & Cripwell), be appointed to assist the Trustee in realisation. The following are the creditors:—

Adnil Electric Co. .. ..	£24	Henley's Telg. Works Co. ..	£190
Bergthell & Young .. ..	61	Osler, F. & Co. .. ..	117
Bland Light Syndicate ..	52	Pritchetts & Gold .. ..	49
Bonnella & Son .. ..	22	Round, J. & Sons .. ..	36
B.T.H. Co., Ltd. .. ..	51	Sanders, W., & Co. .. ..	101
Cryselco, Ltd. .. ..	35	Siemens Bros. & Co. .. ..	33
Edison & Swan U. E. L. Co.	77	Simplex Conduits .. ..	79
Evered & Co. .. ..	245	Smith, E., Ltd. .. ..	60
Falk, Stadelmann & Co. ..	42	Stearn Electric Lamp Co. ..	154
Frankenberg & Sons .. ..	49	Veritys, Ltd. .. ..	40
General Electric Co. .. ..	35		

**The Union Co. at Johannesburg.**—Our Durban correspondent writes as follows:—"Messrs. H. Barder & Co., of Johannesburg, selling agents to the Union Electric Co., Ltd., have recently carried out a very complete electrical installation for lighting, heating and power at the new premises of the *Rand Daily Mail*, Johannesburg, current being taken by duplicate feeders from the municipal supply. The lighting installation consists of approximately 500 incandescent lamps and 10 arc lamps; the heating installation provides for 100 kW. throughout the different offices, consisting of Union Electric Co. convectors of from 5 kW. to 2 kW. each. The power installation totals 120 H.P., the principal motors being of 45 H.P. each, used for the large printing machines. These motors are of the interpole D.C. type, 460-500 volts, and are designed for a speed regulation from 100 to 1,200 R.P.M. Speeds from 100 to 600 are obtained by means of series resistance in the armature circuit and the higher speeds by resistance in the shunt. The output of the two printing machines is 50,000 newspapers per hour between them. The controllers are of the tramway pattern, and they are fitted with no-voltage release. Other motors of 5 H.P. are used for the linoes, and other auxiliary machinery. Altogether some 10 miles of wire have been used in the wiring of the building. Among other contracts recently carried out by the Union Electric Co., of which Mr. H. W. Curling is the Johannesburg manager, is a motor-driven centrifugal pump for the Rand Water Board. The motor was of the Union Co.'s make, giving 130 H.P. on 2,000 volts 50 cycle three-phase, and included a liquid starter and H.T. control panel. The pump was by the Pulsometer Co., England. The Union Co. have also in hand the contract for the arc lighting of Messrs. Chudleigh Bros., drapery establishment in Johannesburg, consisting of 96 lamps, 48 being of the Excello pattern, rated for 10 amperes, and burning four in series on 230 volts. The remaining 48 are of the open type, rated for 8 amperes, also burning four in series. All the lamps are fitted with the Union Co.'s 'Kandem' coupler for purposes of lowering the lamps, by which ropes, winches and pulleys are eliminated. An order has just been placed with this company for 100-s.p. double quick-break switches of special design for the Johannesburg Municipality feeder boxes. Further installations by this company are of large three-phase motors for the Johannesburg Brick and Pottery Co., and three-phase motors for the City and Suburban Gold Mines, also single-phase motors for the Johannesburg Municipal Sewage Pumping Station."



**Trade Announcements.**—THE LANGDON - DAVIES MOTOR CO., LTD., are now in occupation of their new premises, Eastdown Works, Dermody Road, Lewisham, S.E., where all goods should be forwarded.

MR. DONALD SMEATON MUNRO, A.M.I.E.E., having acquired the Edinburgh business of Messrs. Anderson & Munro, will now trade under his own name as electrical engineer and contractor, at 11, Randolph Place, Edinburgh.

THE VISCOSÉ DEVELOPMENT CO., LTD., have transferred their City office to their works, and all communications should in future be addressed to them at Semreh Works, Pembroke Road, Bromley, Kent.

THE MIDGET ELECTRIC LAMP MANUFACTURING CO., LTD., Bothwell Street, Fulham Palace Road, Hammersmith, W., have, by a special resolution and with the approval of the Board of Trade, changed their name to the Midget Lamp Co., Ltd.

MR. JOHN NOBLE, electrician of 10, North Street, Peterborough, has disposed of his business to Mr. Arthur Bull.

**Catalogues and Lists.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., 38 and 39, Upper Thames Street, E.C.—A folding price-list of "Glossup" electric irons for domestic and laundry service has been issued by the firm. These irons are finished in polished nickel plate on copper. A number of copies of the list can be had with distributors' name and address printed thereon.

MESSRS. T. FRANCIS & SONS, 41, Hampden Street, Bolton.—Twenty-page illustrated catalogue of electrical theatrical accessories, &c. Prices and brief notes are given of the Francis hand-feed arc, standard pattern and box pattern resistances, square and circular type stage boxes, proscenium lamps, "Rheo" resistance wire, cable and flex, lacquers, and many details.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, S.E.—Eight-page pamphlet (No. 112) containing brief descriptive matter, and a number of neat illustrations, relating to electric driving of grinding machinery.

THE ADNIL ELECTRIC CO., LTD., London, E.C.—Illustrated and priced leaflet (No. 69E) relating to their automatic switch for lighting staircases, &c.

MESSRS. CHAS. JOYNER & CO., LTD., Icknield Square, Birmingham.—Illustrated priced leaflets showing electric table standards with winding gear; the "Trolley Light" comprising a ceiling plate and swinging arm, and a pulley or trolley running thereon, for drawing offices, workshops, hospitals, &c.; and spring-drum ceiling roses.

MR. E. C. BERRIDGE, 46, Queen Victoria Street, London, E.C.—Circulars describing the Liberty Heavy Duty turbine cleaner, and Merrill's patent "twin" strainers for purifying water supply.

THE JANDUS ARC LAMP AND ELECTRIC CO., LTD., of Hartham Road, Holloway, London, have sent us a charming lithographed drawing of a lady's bust, in similar style to that of the one received last year. Incidentally, in the right hand bottom corner of the large mount, there is a calendar for 1912.

MESSRS. ELECTRIC CONTROL, LTD., 177, Reid Street, Bridgeton, Glasgow.—Booklet of between 30 and 40 pages containing illustrated descriptions of the more important applications of their patent automatic control gear for direct and alternating current. The following will indicate the contents:—"Empire" automatic controllers for D.C. (single solenoid and multiple unit types), for A.C. (small and large size), remote control for D.C. and A.C., automatic control of pumps for D.C. and A.C., hydraulic accumulators, air compressors, capstans, plate-edge planing machines, "Empire" printing press control, and lift control.

**Dissolutions and Liquidations.**—IMESON, FINCH AND CO., LTD., Bridge Road, Stockton-on-Tees.—In announcing a first and final dividend of 1s. in the £ for the unsecured creditors, Mr. T. R. G. Rowland, the liquidator, has issued a statement of realisation and disbursements as at March 14th, 1912, as follows: Realisations—Purchase price of assets sold, £1,945; balance of receiver's receipts above expenses, £31—£1,976. The disbursements were: Preferential creditors, rent, rates and wages, £86; first mortgage debentures and interest, £1,687; administration expenses, £115; dividend at 1s. in the £, £87.

DE FOREST WIRELESS TELEGRAPH SYNDICATE, LTD.—A meeting is to be held on April 24th at 147, Leadenhall Street, E.C., to hear an account of the winding up from the liquidator (Mr. S. J. Ashby).

BEAUMONT AND STILL COLONIAL AND FOREIGN TRAIN LIGHTING CO., LTD.—A meeting will be held at 29, Charles Street, Hatton Garden, E.C., on April 29th, to hear an account of the winding up from the liquidator (Mr. C. T. Burke). A similar meeting of the Beaumont and Still Train Lighting Co., Ltd., will be held on the same day.

**Lamp Contracts.**—A contract from Messrs. Balfour, Beatty & Co. for the supply of tantalum traction lamps for 12 months, and one for the supply of tantalum traction lamps for ship lighting for the White Star Line Co., have been placed with MESSRS. SIEMENS BROS. DYNAMO WORKS CO., LTD.

**Wotan Lamps.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, are about to introduce 10 and 16-C.P. high-voltage lamps. They believe the 10-C.P. lamp to be the first metal lamp of this C.P. to be made in this or any other country with a filament of pure drawn tungsten wire. The makers expect to obtain an average life of 1,000 hours with this lamp. According to present expectations the maximum power consumption will be 11 watts. The bulb will be extremely small, and it is considered that there will now be no case in which the use of carbon lamps will be economical. The firm will shortly be ready to accept orders for the new 10 and 16-C.P. lamps, and they are now accumulating

stocks. We are informed that they have further "Wotan" lamp developments in hand, and that they intend to maintain their priority. The firm also announce that they have now decided to supply "Wotan" lamps for series burning without the extra charge of 5 per cent. which has hitherto been made. Many consumers are still using low-voltage metal lamps in series, having wired their premises accordingly, and there is on this account a very large demand for series burning "Wotan" lamps.

**Book Notices.**—"Official Gazette of the United States Patent Office." Vol. 176, No. 2. March 12th, 1912. Washington: Government Printing Office.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 3. March, 1912. Philadelphia, Pa.: The Institute.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVIII, Part 1. March, 1912. Newcastle-on-Tyne: The Institution.

"The Electrical Properties of Flames and of Incandescent Solids." By Harold A. Wilson. 1912. London: Hodder and Stoughton. Price 6s. net.

"Elementary Internal Combustion Engines." By J. W. Kershaw. 1912. London: Longmans, Green, & Co. Price 2s. 6d. net.

"Yellow Sands." By A. Gowans Whyte. 1912. Edinburgh: Wm. Blackwood & Sons. Price 6s.

"Irrwege der Naturlehre." By Johannes Zacharias. 1912. Hamburg: Hephaestos-Verlag. Price 1 M.

"International Electrotechnical Commission. Report of Turin Meeting, 1911." London: From the General Secretary. Price 1s. 2d.

**Mexico.**—A company has just been formed in Berlin with a capital of £100,000, and the title Die A.E.G. Mexicanische Electricitäts Gesellschaft, to represent the A.E.G. interests in Mexico and Central America.

**Easter Holidays.**—THE WALSHALL ELECTRICAL CO., LTD., announce that their works will be closed from Thursday evening next, April 4th, until Wednesday morning, April 10th. A small staff will attend to urgent correspondence, &c.

**For Sale.**—The Sheffield Corporation has for disposal a quantity of steam-raising plant, comprising boilers, oil separators, superheaters, &c., at Kelham Island tramways power station. See our advertisement pages to-day.

## LIGHTING and POWER NOTES.

**Argentina.**—The Buenos Ayres Municipality has created a special office to fiscalise the carrying out of the contract of the Compania Alemana Transatlantica de Electricidad. Engineer B. Laurel has been placed in charge of same.—*Review of the River Plate.*

**Baldock.**—Messrs. J. B. Saunders & Co., Ltd., have approached the U.D.C. with reference to an electric lighting scheme, offering, under certain conditions, to find the necessary capital to carry out the work. The Council has decided to take no action in the matter.

**Birmingham.**—The Corporation Electricity Supply Committee proposes to borrow £10,000 for "wiring" in connection with installations for electric lighting, to be paid for by tenants on the hiring system. The chairman of the Committee stated that it is proposed that the tenant shall pay the cost of the "wiring" by a payment of 10 per cent. down, the other payments to be spread over a period of two or three years. The work of installation is to be done by private firms.

**Bootle.**—According to the financial statement submitted to the T.C. on March 22nd, the electricity supply account showed that the approximate net surplus for the current year would be considerably below the estimate, and compared very unfavourably with the results in recent years. There had been a slight decline in the income from sales, and the cost of production had been exceptionally heavy, due, principally, to increased coal consumption, higher rating assessment, law costs, and fees to rating and electrical experts. The gross profit would amount to approximately £8,438, or 7.3 per cent. of the average capital expenditure, compared with £10,157, or 8.83 per cent. in the previous year. The net surplus would amount to £1,720, or £1,030 less than the estimate. It was assumed that no additional revenue would accrue during the ensuing year, as a result of the new extension scheme, and the capital charges would be increased in consequence thereof.

**Burnham (Somerset).**—The U.D.C. has sealed the agreement with Dr. Purves for the electric lighting scheme for the district. The maximum price of current for lighting has been altered from 8d. to 6d. per unit, and Berrow has been struck out of the scheme.

**Chatham.**—Experimental lighting by electricity is being carried out in High Street by the T.C. in conjunction with the Kent Electric Power Co., which has erected four lamps.

**Continental Notes.**—DENMARK.—According to the statistics of Danish electricity undertakings in 1910, all Danish towns of 5,000 inhabitants and above are furnished with electric installations. Of towns having between 5,000 and 3,000 inhabitants only



three are without electric services. Copenhagen possesses the largest equipments, having three generating stations of an aggregate capacity of 26,340 H.P., and an output during 1910 for light, power, and tramways of 8,621,000, 8,549,000, and 8,815,000 kw.-hours respectively. The total cable length was 521.99 km. At the moment, Denmark possesses only one installation, which may be regarded as an "überlandcentral"—namely, that at Skovshoved, near Copenhagen. This generates 10,000-volt three-phase current, and supplies by means of a distributing network of 131.5 km. extent, almost the entire suburbs of the capital, with light and power. At the same time, this station supplies direct current to the tramways to Hellerup and Klampenborg. The aggregate station output totalled for the year 2,290,000 kw.-hours. Several of the towns equipped with direct-current installations supply the neighbouring rural districts with H.P. three-phase current. The greatest pressure thus employed is 10,000 volts. Some of the stations lately built are wholly three-phase without batteries. Apart from the largest installations in the cities, the power plants erected are driven by Diesel motors, built mostly by Burmeister & Wain, of Copenhagen. The Diesel motor of this form has also found its way in recent years into the large municipal stations, where it works in parallel with the existing steam plants.—*Elektrotechnische Zeitschrift*.

**PORTUGAL.**—The *Diario* of March 9th publishes a notice approving a contract between the municipal authorities of Penafiel and Sr. Luis Nunes Borges Madureira de Carvalho, whereby the latter is authorised to set up a central electric generating station for the purpose of supplying electric light to the town of Penafiel.

**FRANCE.**—The plans are under consideration for the establishment of a distribution network, having its source at Vire and intended to serve at first the most important Communes, and eventually the greater number of the villages in the arrondissement. The aim of the scheme is principally to supply motive power for agricultural users, and for the minor industries. Construction works will shortly be begun.

Plans have been drafted by MM. Harlé, Blondel and Mähl for the utilisation of the water-powers of the Upper Rhone. It is intended to construct a dam 70 m. high near Génissiat. The Rhone waters will be dammed up from here to near the Swiss frontier, and, a fall of between 67 and 69 m. obtained, a 60-m. wide canal leading to the power house, which will be equipped with 24 turbo-dynamos of 10,000-kw. capacity each. The site of the dam is geologically favourable, as rock is met with at 40 m. below the surface of the water. Interference with navigation will be obviated, either by the construction of a number of locks or of a single ship lift near the dam. According to the observations made, the available water-power the year throughout never sinks below 78,000 H.P.—*Zeitschrift für Turbinenwesen*.

**Cuba.**—Sr. Francisco Diego Madrazo, President of the Manzanillo Water and Light Co., is to establish, with the consent of the municipal authorities of Manzanillo, a central electric generating station, for the purpose of supplying electric light to that town.—*Board of Trade Journal*.

**Dendraeth.**—The Rural Council has announced that a syndicate has been formed to establish electric lighting schemes at Harlech and Llanbedr; these places are now lighted by oil lamps.

**Dundee.**—The Corporation has completed negotiations for a supply of current to some large motor installations. At a foundry in the Blackness district over 700-H.P. of motors are being installed, ranging from 10 H.P. for small blowers, to 200 H.P. for main drives. A 200-H.P. motor and some smaller ones are now working. A calender works in the centre of the city, after a successful trial with motors, have decided to abandon their steam plant in favour of a complete electric drive, which will amount to over 240 H.P.

**Finchley.**—At the last meeting of the U.D.C., it was reported that the assessment of the electricity undertaking had been reduced to £3,345 gross and £1,400 rateable.

**Farnborough.**—The U.D.C. has passed plans for an electric generating station in Farnborough Road for the Aldershot Gas, Water and District Lighting Co.

**Farnworth.**—A L.G.B. inquiry was held on the 19th inst. into the D.C.'s application for sanction to borrow £3,000 for purposes of the electricity undertaking, and for additional loans for public offices and in respect of the refuse destructor. In regard to the electricity works, the clerk stated that they were established under a provisional order in 1897 and commenced actual working in 1901. Since then the loss on the works had been £1,667, an average of £185 yearly, but they were confidently hoping for better things in the near future, and they had at present 391 consumers, which was a record. Since the inception of the works they had paid £20,474 for principal and interest, and of that £10,564 represented loan capital repaid. There was no opposition.

**Golborne.**—The B. of T. has revoked the 1905 E.L. order.

**Great Missenden.**—The P.C. has decided to hold a parish meeting to discuss and consider an electric lighting scheme initiated by Mr. G. White, on behalf of a company which is prepared to supply current at a most reasonable rate.

**Greenock.**—Negotiations are still proceeding between the Corporation and Port Glasgow T.C. in connection with the scheme under which Greenock is to supply shipbuilders and others

in Port Glasgow with electricity. The proceedings have been conducted in private, but it is believed that Greenock desires Port Glasgow T.C. to give a guarantee that neither the Corporation nor any other company will be allowed to supply electricity to Port Glasgow for 30 years, the time required to pay off the capital expenditure of £25,000 by Greenock.

**London.**—**HACKNEY.**—The Electricity Committee of the B.C. reports that it has received a request from the Stoke Newington B.C. asking Hackney to assist it, owing to the possibility of the North Metropolitan Electric Supply Co. being unable to supply it if the coal strike continues. After carefully considering the matter, the Committee decided that affording a supply would make very little difference to the period during which it would be able to continue giving a supply from the large stock of coal which it has in hand, and it has instructed the borough electrical engineer to make an offer on the following terms, subject to the approval of the B. of T.:—(1) The supply to be taken from the network at Amhurst Road and Cazenove Road to such an extent as may be possible without unduly lowering the pressure of supply; (2) The charge for the supply to be at the same rate as the Stoke Newington Council pay the North Metropolitan Co., viz., £1 per quarter per kw. demanded, plus, per unit—First 5,000 units per annum, '96d. per unit; 5,000 to 25,000, '65d.; 25,000 to 50,000, '55d.; 50,000 to 75,000, '45d.; above 75,000, '35d.; (3) The whole of these terms to be subject to the addition of 12 per cent., as in the case of this supply the cost of transformation and conversion will not be incurred.

**Merthyr Tydfil.**—The Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for consent to erect overhead lines for the transmission of energy at a pressure of 460 volts from the Taff Vale goods yard to Brandy Bridge Junction for the purposes of supply, under the E.L. order, 1899.

**Oldham.**—The Chamber of Commerce has sent a letter to the Electricity Committee of the T.C. calling attention to the fact that the department continues to supply motors and undertake repairs to them, despite the assurance given some time ago that it would not do so. The letter also directed attention to injunctions which had been granted in other towns against this trading in motors. When the matter came before the Committee, Mr. Newington said no such assurance, as stated, had been given. The Committee said it would not push these things, but if people came to it in preference to other contractors, it would supply them; everyone who came were asked if they had been to contractors. No profit was made on the business; the profit was in the energy supplied. It was decided to ascertain what the Committee actually promised.

**Peterborough.**—The T.C. has instructed its engineer (Mr. J. C. Gill) to purchase 24 automatic time switches to control the public lamps.

The G.N. Railway Co. has applied for a supply of electricity for power purposes at its works in Priestgate. The request has been complied with, an extension of the Corporation mains being involved.

**Rawtenstall.**—The T.C. is having a scheme prepared for lighting by electricity the main roads in the borough so far as they are co-extensive with the tramway routes.

**South Africa.**—According to the East Rand Proprietary Mines report, the erection of the last 6,000-kw. turbine set in their power house was completed in March last, and it has run satisfactorily during the year. The monthly output of the station at present exceeds 4,700,000 units, as compared with 3,500,000 units at the end of 1910. This increase in power has been chiefly utilised to run the Comet and Driefontein Mills, the former electrically driven since May, and the latter since October.

Permission has been granted to the Transvaal Gold Mining Estates, Ltd., and to Glynn's Lydenburg, Ltd., to supply electric power to consumers in the mining district of Pilgrim's Rest.

**Southend-on-Sea.**—The T.C. has sanctioned mains extensions at a cost of £755. If the Education Committee pays half the cost (£64) of extending the mains, current will be supplied to the Westborough schools, which are already wired.

**Sunderland.**—The *Daily Mail* states that the Corporation, which supplies electric current to the whole of the ship-building yards and engineering works on Wearside, has given notice that the supply will cease next week, owing to the lack of fuel.

**Watford.**—Mr. Goodrich, in moving the adoption of the various recommendations of the Electricity Committee, at the last meeting of the Council, said that it would not be necessary to install new plant except in time for the winter of 1913. The cost per kw. of plant installed was £53, but under the new extension, the figure would be reduced to £47. During the past five years the undertaking had contributed £2,201 in relief of the rates, and to this sum is to be added £850, the contribution for the present financial year. With regard to private lighting, they were making an all-round reduction of ½d. per unit.

**Whitefield.**—Messrs. Nelson & Greenhalgh, who are building a new shed of 400 looms, have engaged Mr. E. M. Lacey, consulting engineer, to design the electrical equipment for an inclusive fee of 250 guineas.



## TRAMWAY and RAILWAY NOTES.

**Acton.**—At the last meeting of the Council, the accountant reported that the London United Electric Tramways Co. had had its assessment reduced, and had sent in a cheque for an amount equal to one-fourth of the rateable value. He had written to the company, stating that the cheque would be accepted if it would give an undertaking to repay the balance of the amount claimed in the event of the decision of the Courts being reversed by the House of Lords, to which the matter is to be taken. This, however, the company refuses to do. The difference between the amount claimed and paid is about £20. The matter was left in the hands of the accountant.

**Australia.**—The electrification of the Newcastle (N.S.W.) tramway service, which is owned by the Government, has been talked about for some years past, but the proposal seems to have hung fire owing to financial considerations. Recently a conference of representatives of the Newcastle Council and the suburban Councils was held, when it was decided to send a deputation to the Premier to urge upon him the necessity for the immediate electrification of the tramway system.

Many schemes have been put forward and many suggestions made for relieving the pressure of the Sydney traffic both by electric tramways to the various suburbs and by ferry boats to the northern suburbs: but no definite proposal has emanated from the Government. With this object in view, the Government has now decided to obtain the services of the highest British engineering authority on city traffic, and Mr David Hay is to go to Sydney and make the necessary report.

**Barking.**—The Tramways Sub-Committee reports having considered the advisability of removing the tramcar sheds from Beckton to the rear of the Town Yard. The cost of this, the surveyor estimates as follows:—Brickwork car-sheds sufficient to house 12 cars, £3,000; stores and workshops, £533; demolition and re-erection of old car-shed on new site as paint and workshops, £250; tramway track and overhead equipment, £1,717. By this removal the engineer estimates that an annual saving of £189 will be effected. In view, however, of the proposed large expenditure on capital account by the electricity department, and in view of the proposed through running arrangements between Loxford Bridge and Aldgate, the Sub-Committee has decided to defer the consideration of the matter for a period of six months.

**Belfast.**—The motormen and conductors of the Corporation tramway have been put on their notice to terminate the weekly engagement *pro tem.*, and from next week will be on a daily engagement in consequence of the coal strike. At the generating station preparations are being made to put in boiler equipments to use oil fuel. It was reported that there were four weeks' supply of coal on hand for electrical supply.

**Blackpool.**—The Corporation tramways at North Shore and along Lytham Road are to be re-opened for Easter week. The work of relaying the latter track will be completed, but that from Queen's Square to the Gynn will only be used up to the Thursday in Easter week, and then the work of completion will be proceeded with as quickly as possible.

The most interesting item in reports submitted to the Blackpool Tramways Committee on March 21st was the fact that the receipts from April 1st to March 14th show a net increase of £7,772 over last year, the figures being £63,213 and £55,441. Passengers increased 1,334,314, making the receipts 2d. per car-mile more, whilst the car-mileage has been reduced by 5,461.

**Bradford.**—The city is exceptionally fortunate in its supplies of coal for electrical as well as for other purposes. The city electrical engineer, Mr. T. Roles, announces that his department can hold out comfortably until Easter without any curtailment. There has not been, and it is anticipated will not be, any curtailment of cars on the tramway service; indeed, it is stated that extra current has been used recently, because the slackening of the railway services has led to a greater demand for tramway facilities. A factor in the situation which is of aid to the Corporation has been the lessened energy consumption owing to the closing of many works, although this is counter-balanced to a great extent by the large increases in the installation of electric radiators in place of fires in private houses. The dull weather, also, has acted adversely. The tramway receipts for the week ending March 16th were £5,602, showing an increase of £716 over those of the corresponding week of last year. Leeds, on the other hand, has found it necessary to withdraw 40 of the 200 cars which daily run in the city.

The Corporation Tramways Committee proposes to make an important change regarding workmen's fares. At present a general penny fare is charged for any distance on the route up to 8 o'clock in the morning. It is proposed to abolish this, and make all ordinary penny stages halfpenny ones up to 9 o'clock. Those travelling one stage will thus be  $\frac{1}{2}$ d. better off, and those travelling three, a  $\frac{1}{2}$ d. worse off. The department stands to lose £11,000 by these changes, unless traffic increases. It is also proposed to allow children working to travel at half the ordinary fare, the same as school children.

**Bury.**—The manager of the local tramways has drawn the attention of the Tramways Committee to an important alteration in the interpretation of the law in relation to the rating of tramways, which will now be assessed at one-quarter only of the annual value instead of at the full annual value. In Bury the department will have to pay £455 less in rates, and the profit to the

borough fund may be expected to increase by that amount. In the case of the tramways outside the borough, the department will have to pay £230 less in rates.

**Canada.**—According to the *Standard* negotiations have been completed for the sale of the Winnipeg Electric Railway and its allied interests to a New York syndicate.

**Chile.**—The Government has granted a concession to Mr. A. Cousino for an electric railway from Quintero to Nogales, Province of Valparaiso. The capital to be employed amounts to \$2,500,000 gold.—*Review of the River Plate.*

**Continental Notes.**—**FRANCE.**—A scheme is at present under consideration for the construction of an electric railway to give communication between the Cantons of Quillan and Belcaire, on the one hand, with those of Querigat (Ariege) and Mont Louis (Pyrenées Orientales) on the other.

A new company has lately been formed in Paris, with the title La Société de Tramways Nord de Marseilles, and with a capital of £240,000 to construct and work an electric tramway between Marseilles and Salon.

**AUSTRIA.**—The municipal authorities of Schonberg, Tyrol, are considering a scheme to put down a plant to utilise certain available water-power to supply the electrical energy necessary for the projected electric tramway between Patsch and Schonberg.

**East Kent.**—The Light Railway Commissioners last week held an inquiry at Sandwich into the application of the East Kent Light Railways Co. for two extensions to their previously sanctioned lines, intended to serve two projected collieries at Wickhambreaux and Great Mongeham. The only objection raised was with reference to level crossings, and the order applied for was granted.

**Huddersfield.**—It is proposed to extend the tramways on the railless trolley system to Brighouse, Marsden, Mirfield, Elland, Holmfirth, Dalton, and Golcar. The manager of the tramways has been instructed to report upon the probable cost, working expenses, and revenue.

**Ilkeston.**—In consequence of the coal strike the electric tramway service has been entirely suspended, owing to the inability of the local electricity department to supply power. It is expected that another week will suffice to stop the factories using electricity.

**L. and Y. Railway.**—According to the *Times*, Messrs. Dick, Kerr are to electrify this company's Bury-Holcombe Brook line on the H.T. direct-current system, using an overhead conductor at 3,500 volts.

**Liverpool.**—The annual report of Mr. C. W. Mallins, the Corporation Tramways manager, for 1911, shows that there has been an all-round increase in mileage, receipts, and passengers carried, the increase in the passengers being 2.5 per cent. and the receipts 3.2 per cent. A gross profit was made of £224,343, net £114,731, an increase (net) of £16,465 over 1910. Of the profits, £38,244 is allotted as a contribution in relief of rates, an amount which is £5,488 in excess of the sum devoted to rates in 1910; £50,109 is apportioned to interest; £59,502 to sinking fund and repayment of loans; and £76,488 to reserve, renewal, and depreciation account.

Experiments are to be made with two new types of tramcar, designed by Mr. Mallins, and if they are successful it is proposed to put them on the Liverpool routes. One is a bogie car, with an over-all length of 36 ft. and seating accommodation for 84 passengers, with a double staircase inside the body of the car, at the centre affording separate entrance and exit to the upper deck, which also provides separate entrance and exit for the lower deck. The leading feature of this car lies in its central platform, the two outside portions of which are used as exits, and the larger or centre portion as an entrance. By this means all passengers boarding or leaving the car are brought to a focus under the control of the conductor. The object is to enable the car to load and empty simultaneously, avoiding confusion and loss of time. As the platform has ample standing space, the car can be started without delay, and the conductor can collect fares before the passengers disperse to the different compartments. The other experimental car is a single truck coach, 31 ft. long, carrying 74 passengers. This also has double staircases at each end, and the fares can either be collected when passengers are entering the car or at any time of the journey. On this car there is to be tried a signalling arrangement which, independent of the conductor, will let the passengers know the car is about to start. The Corporation is to have the unrestricted right for all time in manufacturing, acquiring, and using these cars, staircase, platform, barrier, and automatic signalling apparatus, on payment of the patent fees and Mr. Mallins's out-of-pocket expenses.

**London.**—According to the *Daily Telegraph*, the Central London Railway Co. is at present relaying its track, which has been in use since 1900. About 50 ft. of track is being relaid nightly, with cross sleepers instead of the old longitudinal sleepers, the work also including the taking up of the concrete sleeper bed and provision of a fresh bed.

The Highways Committee of the L.C.C., with the Improvements Committee, has decided to submit further proposals in regard to the construction of tramways over the new St. Paul's Bridge, terminating underground near Cheapside.

**Manchester.**—A special meeting of the Tramway and Vehicle Workers' Association was held on Sunday, when a new programme of working conditions was formulated. The new demands include a farthing per hour advance for all motormen and guards;



an eight-hours day for Sundays : overtime at the rate of time and a half for all hours over nine each day ; and a minimum wage of 26s. per week for all men employed in the traffic department.

**Newcastle.**—The Tramway Committee last week decided to make a grant of £12,000 to the relief of the rates. It also resolved to try for three months an experiment of ½d. fares on the inward stage near the centre of the city, from Northumberland Street to the railway station.

**Perth.**—The artistic tastes of certain citizens having been offended by the letting out of the tramway standards for advertisement purposes at £100 a year, the T.C. communicated with the contractors with the view of cancelling the bargain. The reply received was to the effect that while the contractors would be sorry to lose the advertisements, they might manage to get their clients to countermand the shields on payment of £600. The Tramways Committee has agreed to let the matter rest, although it was jocularly observed that the signatories to the petition sent to the Council might be willing to pay £1 per head to get the advertisements removed.

**Rawtenstall.**—The Secretary of the B. of T. has written to the Corporation on the subject of the recent accident at Accrington to one of the Corporation cars, and the Board notes with satisfaction that it has been decided to convert the Corporation car equipments to the ordinary controller type. The Corporation has decided to advertise for tenders for the extension of the electricity works.

**Rothsay.**—The tramway accounts for 1911, after providing for renewals and depreciation, show an available sum, including £232 brought forward, of £1,265, from which £200 has been placed to depreciation and reserve, and the full dividend of 5 per cent. paid on the preference shares, leaving £165 to be carried forward.

**Usworth (Co. Durham).**—At a parish meeting it was decided to communicate with the Gateshead Tramway Co., with a view to obtaining, if possible, a system of railless cars to connect the Usworth district with the Wrekenton and Heworth systems.

**West Bromwich.**—Mr. H. Jackson, the electrical engineer to the Corporation, has outlined a scheme for the use of railless cars along a 27-mile route, using 30 cars with a 15-minute service. The estimated capital cost is £76,000, against £331,000 for tramways.

## TELEGRAPH and TELEPHONE NOTES.

**Admiralty Wireless Stations.**—Replying to a question in Parliament last week, Mr. Churchill said the wireless messages from the *Delhi* were taken in by His Majesty's ships at Gibraltar, and it was not the fact that the news of the wreck was first received by the naval authorities through the wireless station at Cadiz. The International Wireless Convention provided for the differentiation between commercial and naval wave lengths. Whenever a sufficient number of men-of-war were in company, a look-out was kept by one of them on a commercial wave length. Naval shore stations, however, had to look out on naval wave lengths, and consequently commercial ship or shore stations would not ordinarily be able to communicate with them. This differentiation was necessary, and he did not propose to alter it.

**Australia.**—The *Australian Mining Standard* of February 22nd states that the Marconi Wireless Telegraph Co. has issued a writ asking for an injunction against the use by the Commonwealth Government of the plaintiff company's system, and damages for alleged infringement of the patent rights of the company for each of the six States of the Commonwealth. Action had previously been taken by the company against the Australian Wireless Co. of Melbourne.

**Marconi Patents Upheld in U.S.A.**—The Marconi Wireless Telegraph Co., of America, have succeeded in their action in New York, against the United Wireless Telegraph Co. and Clyde Steamship Co. In this action, which was brought for infringement of the Marconi Co.'s American patent, corresponding to their well-known English Patent No. 7,777 of 1900 (the master patent covering the principle of syntonisation and selectivity), and which was already part heard, both the defendants acknowledged the validity and scope of the patent, admitted their infringement, and submitted to judgment and a permanent injunction in favour of the Marconi Co. The 500 ship installations and the 70 land stations which have been erected and worked by the United Wireless Telegraph Co. pass into the hands of the Marconi Co. The parent company, Marconi's Wireless Telegraph Co., Ltd., have an action pending in this country against the United Wireless Telegraph Co. for infringement of Letters Patent Nos. 12,326, of 1898, and 7,777, of 1900, by the installation of the United Wireless system on various British boats, and the defendants are about to consent to judgment in this action also. As a result the installations on the ships carrying the British flag and fitted with the United Wireless system will pass into the possession of the Marconi Co. The effect of this decision is to confirm the judgment of Mr. Justice Parker, given last year in the action brought by Marconi's

Wireless Telegraph Co., Ltd., against the British Radio-Telegraph and Telephone Co., Ltd., upholding Patent No. 7,777 of 1900, and also to give the same value and importance to the corresponding American Marconi patent.

**Japan.**—It is reported from Tokio that some successful trials have just been made with a system of wireless telephony invented by Mr. Kitamura, a mechanical engineer connected with the Japanese Department of Communications.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—The Board of Guardians is to invite tenders for the electric lighting of the workhouse, as the present gas-fittings are worn out.

**Australia.**—VICTORIA.—April 23rd. 2,000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

April 24th.—Power generating plant for the Federal Capital site. Secretary, Department of Home Affairs, Russell Street, Melbourne.

May 1st and 8th.—Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—One electric motor-car, two electric motor-wagons. Mr. John Clayton, Town Clerk, Melbourne.—*Australian Mining Standard*.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard.

QUEENSLAND.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

SOUTH AUSTRALIA.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" March 15th.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

**Belfast.**—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

**Birmingham.**—April 3rd. Electric motor and centrifugal pump for the Birmingham, Tame, and Lea District Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

**Brazil.**—PERNAMBUCO.—April 18th. Concession for the establishment and working of several lines of electric tramways. Preliminary deposit, 20,000 milreis ; final deposit, 80,000 milreis. Particulars, Direction Générale des Travaux Publics, Pernambuco.

**Bulgaria.**—SOPHIA.—April 11th. Supply of 71,100 No. 2 and 10,100 No. 3 phosphor insulators. Particulars, on receipt of stamp-tax of 20 centimes per copy and 50 centimes per drawing, from the Post and Telegraph Administration, Sophia.

**Caerphilly.**—April 2nd. Complete electric light installation at the Energlyn Isolation Hospital, for the U.D.C. Mr. A. O. Harpur, engineer and surveyor, Council offices (returnable deposit of 10s. 6d.).

**Cape Town.**—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

**Dublin.**—April 15th. Flame arc lamps and suspension gear, for the Corporation. See "Official Notices" to-day.

**France.**—ROUEN.—Six 4,000-kg. capacity and four 2,500-kg. capacity electric cranes, with automatic driving machinery, for the harbour. Particulars, Président de la Chambre de Commerce, Rouen.

**Hungary.**—NAGYSOMKUT.—April 10th. Concession (50 years) for erection of a generating station and supply of lighting. Deposit 400 kronen. Particulars, Grossgemeinde Nagysomkut, Szatmar County, Hungary.

**Krakau.**—April 15th. For the railway workshops at Neu Sandez. One electric drilling machine for 20-mm. holes, one electric exhaustor, one portable electric boring machine for 50-mm. holes, one electric circular saw (for wood), two turning lathes of 200/1,000 mm. and 150/750 mm. respectively, one pneumatic riveting hammer, one 1-H.P. continuous-current motor, and one 2½ H.P. three-phase-current motor, &c. Deposit, 5 per cent. of cost. Particulars, K.K. Staatsbahndirektion, Krakau.



**London.**—L.C.C.—April 16th. Supply, during twelve months, of 484 tons of rolled-steel bar, special section, for magnetic brakes of electric cars. Chief Officer of Tramways, 62, Finsbury Pavement, E.C.

April 16th.—Electrical installation at the Lyham Road School. See "Official Notices" to-day.

**METROPOLITAN ASYLUMS BOARD.**—April 10th. Two electrically controlled passenger lifts at Tooting Bec Asylum. See "Official Notices" March 22nd.

**METROPOLITAN WATER BOARD.**—April 12th. The Board is inviting tenders for 6 Diesel oil engines and two 10-ton overhead cranes for Cricklewood and Fortis Green pumping stations, also one Diesel engine and one 8-ton overhead crane for Green Street Green pumping station. Specifications and forms of tender from the Chief Engineer's Department, Savoy Court, Strand, W.C.

**BETHNAL GREEN.**—April 2nd. Telephone cables, for the B. of G. See "Official Notices" March 15th.

**ST. PANCRAS.**—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" March 22nd.

**H.M. OFFICE OF WORKS.**—April 17th. Conduit boxes for two years. See "Official Notices" to-day.

**Limerick.**—April 5th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" March 22nd.

**Manchester.**—April 4th. (a) Atmospheric pipe; (b) electric capstan; for the Corporation Electricity Committee. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Partick.**—April 2nd. Stores and materials for a year, for the Burgh Electricity Department. See "Official Notices" March 22nd.

**Pilsen.**—April 15th. Sundry machine tools with electric driving. Particulars from the K.K. Staatsbahndirektion, Pilsen.

**Prague.**—April 9th. Supply of electric machine tools for the local railway workshop. Particulars, K.K. Staatseisenbahndirektion, Abteilung IV, Prague.

**Rawtenstall.**—April 9th. Extensions to the generating station at Hareholme, near Waterfoot, for the T.C. Mr. C. L. E. Stewart, borough electrical engineer (returnable deposit of £2 2s.).

**Rhodesia.**—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

**Shanghai.**—April 3rd. 945 single-phase A.C. house service meters, for the Municipal Council. See "Official Notices" March 22nd.

**Spain.**—April 3rd. The General Direccion de Correos y Telegrafos, in Madrid, are inviting tenders for the concession for the establishment and working, during a period of 20 years, of a telephone exchange in the town of Villafranca del Panndes (province of Barcelona).

**Vienna.**—April 15th. The Imperial and Royal State Railways Direction invite tenders for some 50 machine tools of various kinds, with electric driving equipment (including boring, shaping, riveting and leather-sewing machines, metal and wood circular saws, electric fans, portable electric dust-exhausters, eight cranes, &c.). Particulars, K.K. Direktion der Staatseisenbahnen, Schwartzbergplatz 3, Vienna I.

**Walsall.**—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" to-day.

**West Hartlepool.**—April 2nd. (a) 300-KW. storage battery and booster (b) rotary converting plant, for the Corporation Electricity Department. See "Official Notices" March 15th.

April 15th.—High and low-tension switchgear, for the Corporation Electricity Department. See "Official Notices" to-day.

**York.**—April 12th. Two water-tube boilers, with super-heaters, automatic stokers, economiser and pipework, for the City Electricity Department. See "Official Notices" March 22nd.

## CLOSED.

**Aberdare.**—The U.D.C. Electricity Department has placed the contracts for service material for the coming year as under:—

Cables.—Union Cable Co., Ltd., £106.  
Meters and current limiters.—Siemens Bros., Ltd., £157.  
Joint boxes, &c.—W. Lucy & Co., Ltd., £185.

**Australia.**—NEW SOUTH WALES.—The *Australian Mining Standard* records the placing of the following contracts:—

Telephone switchboard cable, and a large variety of telephone accessories.—Western Electric Co. (Australia), Ltd.  
Various telephones, switchboards, apparatus and accessories.—James Paton & Co.  
Coppers, leads, zincs, bells, electric lamps, binders, tapes, wire, &c.—Lawrence & Hanson Electrical Co., Ltd.  
Glass tubes, detectors, instruments, staples, carbons, &c.—I.P., G.P. and T. Works, Ltd.  
Condensers, resistance boxes, sounders, tapes, wire, &c.—B.I. and Helsby Cables, Ltd.  
Galvanised iron wire, copper wire.—R. Johnson, Clapham & Morris, Ltd.  
470 telephones.—British G.E.C. Co., Ltd.  
14,000 connectors, resistance boxes, tape, &c.—Siemens Bros. Dynamo Works, Ltd.  
14,000 Leclanché cells, earpieces, mouthpieces, &c.—W. G. Watson and Co., Ltd.  
Salammoniac, &c.—J. Bartram & Sons Pty., Ltd.  
Sulphate of magnesia, sleeves, &c.—Theodore Zwicker & Co.  
Various wires (10, 2, 106 and 120 miles).—W. T. Henley's Telegraph Works Co., Ltd.  
Brackets, shackles, switches, iron wire, &c.—Noyes Bros. (Sydney), Ltd.  
4,500 dry cells.—British Ever-Ready Electrical Co., Ltd.  
Postmaster-General's Department.—119,000 porcelain insulators, pattern "A," at 4½d. each.—Dalgety & Co., Ltd., Melbourne.  
1,000 stay rods, ½ in., at 1s. 9d. each; 7,000 spindles, galvanised iron, swan neck, 3 in., at 5½d. each.—British and Foreign Indent Co., Sydney.  
75,000 binders, copper, for 300-lb. copper wire and pattern "A" insulator, at £2 18s. per 1,000; 75,000 copper tapes, for 3.0-lb. wire, at £2 4 per 1,000.—British Insulated and Helsby Cables, Ltd., Melbourne.  
7,000 sleeves, jointing, for use with hard-drawn copper wire of maximum diameter of 123 mils, at 11s. 8d. per 100; 2,700 sleeves, jointing, for use with galvanised iron line wire 0.141 in. in diameter, at £1 2s. 9d. per 100.—Theodore Zwicker & Co., Melbourne.  
206 tons hard-drawn copper wire, 300 lb. per mile, at £69 14s. per ton.—R. Johnson, Clapham & Morris, Ltd., Sydney.

**SYDNEY.**—City Council.—Direct-current meters, Ferranti, Ltd., for all sizes except the 5-ampere size, already accepted from W. G. Watson & Co.; the Australian General Electric Co., for all A.C. meters, with the exception of the various four-wire meters.—*Australian Mining Standard*.

**Croydon.**—The B. of G. has accepted the tender of Mr. W. Huntsman, of Islington, for electrical fittings.

**Halifax.**—The Council has accepted the tender of the Reason Manufacturing Co., Ltd., for the supply of electrolytic meters for the year.

**Leeds.**—The City Tramways Committee has accepted the tender of the Corona Lampworks, Ltd., London, for 10,000 Corona 1912 type annealed tungsten wire lamps.

**London.**—The tender of W. J. Fryer & Co., at £79, has been accepted by the Metropolitan Asylums Board, for carrying out supplementary electric lighting for staff cubicles at the Brock Hospital.

**SOUTHWARK.**—The B.C. has accepted the tender of the Electrical Engineering and Equipment Co., Ltd., at £961, for the supply of 560 yards of 5 × 2 × 5 sq. in., 440 yards of 3 × 3 × 125 sq. in., and 880 yards of 2 × 2 × 075 sq. in. copper cable. Fourteen tenders were received at prices ranging from that accepted to £1,166.

**WOOLWICH.**—The B.C. has accepted the tenders of W. T. Henley's Telegraph Works Co., Ltd., and Siemens Bros. & Co., Ltd., at £1,394 and £1,848, respectively, for cable.

The electric light, power and telephone installation for new works of Zoetrochrome, Ltd., film manufacturers, at Tooting, has been awarded to Mr. H. J. Whitehead, of Wandsworth.

**Merthyr Tydfil.**—The B. of G. has accepted the tender of the Merthyr Electric Traction and Lighting Co. for electrical accessories.

**Southend-on-Sea.**—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for three bogie tramcars, at £596 each, and four single truck cars, at £535 each, with a carrying capacity of 70 and 55 persons respectively. All will be fitted with Brush motor equipments.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, April 1st.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.  
Tuesday, April 2nd.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.  
Thursday, April 4th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.  
Friday, April 5th.—Headquarters will be closed.  
Saturday, April 6th.—Headquarters will be opened for the transaction of regimental business till 12 noon.

(Signed) P. H. S. CAMPBELL, Capt. R.E. and Adj.,  
For Officer commanding L.E.E.



## FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Friday, March 29th. At 8 p.m. At the Criterion Restaurant, Piccadilly Circus. Smoking concert.

**Royal Institution.**—Saturday, March 30th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture VI.)

**North-East Coast Institution of Engineers and Shipbuilders.**—Monday, April 1st. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-upon-Tyne. Discussion on "Relative Possibilities of the Diesel Oil Engine, Geared Turbine and Suction Gas Engine, as compared with the Reciprocating Engine, for Marine Propulsion," to be introduced by Mr. E. L. Orde (Diesel Oil Engine), the Hon. Sir Charles Parsons and Mr. R. J. Walker (Geared Turbine), and Mr. A. C. Holzapfel (Suction Gas Engine).

**Smoke Abatement Exhibition.**—Until April 4th, inclusive. At the Royal Agricultural Hall, London.

## NOTES.

**Social Events.**—The first annual dinner of the Screw Machine and Drill Press Departments of the Western Electric Co., Ltd., was held at the Crown and Cushion Hotel, London Wall, E.C., on Saturday, the 16th inst., when about 35 representatives of the departments were present. The chair was taken by Mr. Pendar (foreman of the Screw Machine Department), assisted by Mr. Nye and Mr. Cooper, and after the dinner, a very successful smoking concert was given by the various members.

The fourth annual staff dinner of the South Metropolitan Electric Light and Power Co., was held in the Nelson room of the Trafalgar Hotel, East Greenwich, on the 20th inst. The chair was taken by the managing director and engineer-in-chief, Mr. H. W. Bowden, who, in proposing the toast of "The Company," remarked that the staff were to be congratulated on the improved position of the company, which this year's working had shown. It was gratifying to him to note the increased number who were able to be present, the attendance being over 50, which compared very favourably with previous years' figures. After dinner, the evening was devoted to a concert and whist drive.

Mr. A. C. Cramb (Borough Electrical Engineer) presided at the staff dinner of the Croydon Corporation Electricity Works, which was attended by the Mayor (Ald. J. Trumble), and many members of the Council and officials. The chairman claimed that electric current was supplied in Croydon at charges comparing very favourably with those of towns where coal was much cheaper. If they kept their capital charges down he did not see why further reductions should not be made. At the same time he believed that Parliament, in granting to municipalities powers for electric supply, had in mind the production of current as cheaply as possible, and he felt that before long the Legislature would prevent municipal electricity undertakings being drained for the relief of the rates in the manner they had been in the past. The principle of municipal trading was that the best quality commodity should be supplied at the lowest possible price. The Mayor believed the time would come when more could be done for the consumers, but it would not be at the expense of the employés. Proposing "The Lighting and Electricity Committee," Mr. Cramb said that as a rule there was not the close personal interest evinced in a municipal trading concern that there was in a public company; but in Croydon they approached very nearly, if not quite, to that level. Alderman D. B. Miller (Chairman of the Committee), in replying, said he was certainly opposed to the principle that municipal undertakings should be run primarily to aid the rates. He agreed with Mr. Cramb's desire to see more industries established in Croydon. Their engineer-in-chief was the best they had ever had, and the department owed its great success to him, with the co-operation of a loyal staff.

The British Westinghouse Engineers' Club held their sixth annual dinner at the Midland Hotel, Manchester, on Friday, March 22nd. Mr. J. H. Tearle occupied the chair, being supported by Mr. Ph. A. Large and Mr. W. W. Blunt. After an enjoyable repast and the loyal toast, telegrams from several absent members were read. The toast of "The Company" was proposed by Mr. A. E. Soanes, who dealt with the position and future of the company. In reply, Mr. Lange remarked on the effect of the coal strike, and also assured the members of the club of the interest of the directors in their project for new headquarters. Mr. Lange also read an interesting letter which Mr. E. M. Herr, president of the American Co., issued to all the employés of that company when he assumed office. Mr. H. Mensforth next proposed the toast of "The Commercial Departments," on behalf of which Mr. Blunt replied. "The Engineers' Club and Foremen's Association" were proposed by Mr. J. C. Whitmoyer, and replied to by Messrs. Tearle and F. Swann. The proceedings were enlivened by several musical items by the following members of the company:—Messrs. F. A. Broadhurst, E. M. Johnson, T. M. Kirkby, E. H. Muller, and R. H. Thistlethwaite. Mr. D. Jenkins gave his services at the piano.

The employés of Messrs. Elliott Bros., Century Works, Lewisham, held their annual social gathering on March 23rd. The Blackheath Concert Hall, which is the largest hall available in the neighbourhood, was filled to its utmost capacity—over 600 being present—and a most enjoyable evening was spent. As on previous occasions, a number of local residents kindly contributed to the entertainment, which consisted of "The Pom-Pom Pierrots" for the first part, and the well-known farce in three acts, "The Arabian Nights," for the second part. During the interval refreshments

were served, and throughout the evening the works orchestra performed selections of music. All the arrangements were carried through without a hitch under the supervision of the "Amusements Committee," which is a permanent institution to supervise all matters of welfare among the employés.

On Thursday last week the annual staff supper and dance of the Greenock Corporation Electricity Department was held, Mr. J. A. Robertson, burgh electrical engineer, presiding. The toast of "The Electricity Department" was proposed by Mr. W. Nicoll and responded to by ex-Bailie J. W. Bailey, convener of the electricity department. In the course of the speeches many things were said appreciative of Mr. Robertson, and one speaker let drop a whisper "That Mr. Robertson was leaving Greenock."

**Copper.**—Up to the date of issue of Messrs. Merton's last statistical circular, the influence of the general depression on the metal markets had not been severe. From the figures given we find that visible supplies fell 579 tons during the first fortnight in March, this being due to withdrawals from English stock, and lower Australian shipments.

Supplies, on the whole, are fairly brisk at 22,082 tons, deliveries for half-month being 22,661. North American exports to Europe show average, Spain and Portugal low, Chile shipments low, and Australian rather below average. The above are on mid-monthly figures only; a slight falling-off would be expected after the heavy deliveries of last month.

The American visible supplies are beginning to show reduction, being at 28,098 tons for end of March, a withdrawal of 1,491 tons during the month. The world's visible supply stands at little over half what it was last February, when the price was £54 15s.

Rotterdam stocks show 100 tons less than for end of March, and Hamburg (estimated) 300 tons less.

**The Australian Electrical Wages Board.**—The *Australian Mining Standard* publishes the first portion of the award of the Victorian Wages Board appointed to fix the rates of pay for men employed on electrical installation work. The award was to come into force on March 11th. It fixes the following rates for a week of 48 hours:—

"Electrical mechanics or wiremen and linesmen, 63s.

"Cable-joiners, 69s.

"Electrical fitters, engaged in electrical work mainly carried out in a workshop, including making or repairing electrical instruments or apparatus of all kinds, 66s.

"Patrol men, engaged in patrolling and effecting repairs to external electric supply or transmission mains, 63s.

"Persons attending to consumers' complaints regarding faults on installation and private arc circuits, or effecting temporary repairs, 54s.

"Leading hands in the above cases respectively, *i.e.*, journeymen (a) who are placed in charge of two or more journeymen; (b) who, where three or more journeymen are employed, receive orders from an officer, or from a foreman, who may not be continually on the works, to direct the work generally, in the absence of such officer or foreman, 1s. per day, in addition to the rate specified.

"Electrical labourers, *i.e.*, persons engaged in any work (not requiring knowledge of electricity) carried out under the direct supervision or direction of an electrical mechanic, 54s.

"Boys of 14 or 15 years of age (not being apprentices or improvers) engaged in waiting on workmen, cleaning tools, &c.:—First six months' experience, 5s.; second, 7s. 6d.; third, 10s.; fourth, 12s. 6d.

"The number of apprentices who may be employed is fixed at one to every three workers, or fraction of three workers, receiving 54s. per week, or earning at piecework rate not less than that wage.

"The employment of improvers is limited to one to one, two or three journeymen, and thereafter one improver to every three journeymen receiving not less than 63s. The wages of apprentices range from 5s. in the first year to 45s. in the fifth. The rates for improvers rise from 7s. 6d. to 48s. Special rates are fixed for overtime and for holiday work."

**Illegally Abstracting Electricity.**—A Farnworth tradesman was fined 5s. and costs at Bolton Police Court on Monday for illegally abstracting electricity from the District Council mains. It was stated that the District Council's engineer visited his premises on February 27th and found electric lights burning in the kitchen. When the current was switched off next door the light disappeared. It was afterwards found that while the defendant was taking supplies for power a sub-connection had been made whereby he was able to get current for lighting without its passing through the meter. Even if it had been allowed to pass through the power meter the man would still have been defrauding the Council, inasmuch as there was a difference of 2d. per unit in the cost of electricity for lighting and for power. The defendant stated that he had not offended "with any wrong intention." He was aware that he was getting light for nothing.

**Alleged Damage to Tramway Track.**—Greenock and Port Glasgow Tramways Co. recently sought to interdict two local firms from using certain streets for the cartage of heavy boilers and machinery, particularly over those portions where the tramlines pass. Damages were also claimed for alleged destruction of the causeway setts along the track by what was termed extraordinary traffic. Sheriff Welsh on Monday refused interdict, holding that it had not been proved that the passage of defenders' traction engines of themselves caused the damage complained of, nor had it been proved that the loads exceeded the limits allowed by Sec. 4 of the Locomotive Act, 1865. Pursuers were found liable to defenders in expenses.



**Electrical Trades Benevolent Institution.**—The annual report and accounts of the Committee for the year ended December 31st, 1911, were adopted at the meeting held at the I.E.E., Victoria Embankment on Wednesday.

It is stated that the year was one of the most successful in the records of the Institution, this being largely due to the Gustav Byng bequest and the receipt of the balance of the surplus proceeds from the 1905 Electrical Exhibition at Olympia. The amount of the annual subscriptions also increased from £49 to £82, with a large increase in the number of subscribers. As a result of the year's work £920 has been expended beneficially in furthering the objects of the Institution, £885 being carried to the balance-sheet and £35 expended in grants for temporary relief. £1,000 of Western Australia 3½ per cent. inscribed stock was purchased, and the amount of the investments has been thereby raised from £2,285 to £3,248. Five grants for temporary relief were made, and employment was found for three of these applicants. Grants were made to every applicant who was eligible, but the Committee remark that it is surprising that so few applications were made. They consider that it is of vital importance to secure sufficient invested funds to produce a revenue from which pensions can be paid, rather than to increase the amount given in grants for temporary relief. We make the following extracts from the report on one or two interesting points:—

"Your committee lay it down as a rule that under no circumstances should pensions be promised or granted excepting when their payment can be made out of the revenue from invested funds. This gives the institution a stability which it cannot otherwise have, and when such stability is fully realised, benevolent persons will give it greater support.

"The invested funds, although growing steadily, are not increasing with the rapidity which is essential, in view of the demand for pensions which may be expected in the near future, and the granting of pensions must undoubtedly be the primary object of the institution.

"The Committee trust that this institution will be remembered by the wealthy members of the industry when making testamentary distribution of their property.

"A sub-committee was appointed to consider the revision of the rules, and also to consider arrangements for collections in offices. In order to carry out in a thorough manner the objects to be attained, the Secretary interviewed several of the secretaries of similar institutions, and also obtained copies of the rules of a large number of such institutions.

"The new rules," which were confirmed at the annual general meeting will, it is believed, "have an important effect on the success of the Institution, embodying as they do a definite membership, while for the first time provision has been made for systematic collection from small contributors as well as for a scheme of life assurance, under which members will be able to obtain special terms and privileges.

"Some of the actual subscribers, and others who are possible subscribers to this Institution, have unfortunately had the impression that its benefits would be unnecessary in view of those which may accrue under the new National Insurance Act. Such is, however, not the case, for there are but few who are included in the list of those eligible for pensions who would be eligible for benefits under the Insurance Act. The benefits are, moreover, of a very different scope and character."

The meeting proceeded with the election of the Committee of Management. We shall publish the alterations later. Messrs. Price, Waterhouse & Co., were elected auditors to the Institution.

**Cookery Demonstrations.**—In addition to the exhibits at the Smoke Abatement Exhibition, an independent display of electric cooking has been in progress in Islington during this week. The demonstration has been organised by the Lighting Committee of the borough, with the collaboration of the Berry Construction Co., Ltd., at the Central Library, Holloway Road, and was opened on Tuesday by the Mayor. The concluding demonstrations will be given to-day at 3.30 and 7.30 p.m.

The Berry Construction Co. has also established a public electric kitchen at the "London Louvre," in Oxford Street—that is, a complete installation of "Tricity" cooking apparatus, on which demonstrations are given practically throughout the day by a special staff, with a view to educating the public to the advantages and excellences of electric cooking. The kitchen is admirably situated to a large show window, in which its appetising products are displayed, and visitors are welcomed, the whole object of the installation being to explain to them individually the distinguishing features of the system. A showcase at the other entrance of "The Louvre" is kept stocked with joints, cakes, &c., cooked in the "Modern Kitchen," as it is called, which are changed daily. We understand that already visitors have manifested great interest in the demonstrations and the latter will form a permanent show, maintained at a heavy cost by the company.

We must congratulate Mr. Berry upon the courage and enterprise with which he has embarked upon this costly venture—though the fact that 4,000 "Tricity" ovens have already been sold, no doubt justifies his confidence. As the demonstrations will continue after the Smoke Abatement Exhibition is over, and are open to all comers, they will prove extremely useful to central-station managers, who will, no doubt, find it greatly to their advantage to send their prospective clients to "Modern Kitchens" to see for themselves how it is done.

**Annual Dinners.**—THE ASSOCIATION OF ENGINEERS-IN-CHARGE held its annual dinner last Saturday evening at the

Holborn Restaurant. About 250 persons were present, and the President, Mr. W. H. Maw, was supported by such representative men as Dr. W. C. Unwin, the President of the Institution of Civil Engineers, his Honour Judge Rentoul, K.C., Capt. Sankey, R.E., Mr. H. Hirst, Mr. Henry Adam, Mr. Arthur Davey, Sir Ernest Shackleton, C.V.O., Mr. A. E. Renn, Mr. Alexander Siemens, Dr. H. S. Hele-Shaw, &c.

After the usual loyal toasts, Dr. Unwin proposed the toast of "The Association." He pointed out that he understood that the Society had been formed to help engineers to do their work better. He fully appreciated the importance of the duties of the engineer-in-charge of the plant of a large institution or industrial establishment, and realised that a considerable amount of knowledge was absolutely necessary. No one ever succeeded on his own experience alone; he was bound to rely to a large extent on that of others, therefore the discussions which took place at their meetings was good, and he especially commended their custom of holding special meetings where they retailed to one another their experiences with the plant under their charge. Dr. Unwin then touched upon the importance of thoroughly understanding the reason why things happened, and urged all to cultivate the habit of clear thinking. He illustrated his meaning by referring to the subject of superheated steam. First brought to the front in this country, failures in using it caused its practical abandonment. Continental engineers studied the matter, were convinced of its advantages, and its use became general in Alsace before British engineers tried it again. It was the same in other directions. Unless we did more clear thinking and worked intelligently, we should find our competitors forging ahead of us. The society existed to prevent this, and he heartily wished it success. The President (Mr. Maw) in replying, pointed out that the society had a well-defined sphere of operation, and was trying to successfully fill it. Large sums of money were lost every year because valuable plant was not used to the best advantage. Their province was to train those in charge of such plant so that they could make the very best use of the machinery under their care. In view of the practical value of many of their discussions, he thought the time was fast coming when they should get the various speeches reported for the benefit of members not able to attend.

The toast of "Kindred Institutions" was proposed by Mr. A. Davey, and responded to by Captain Sankey, and Sir Ernest Shackleton. Captain Sankey pointed out the uselessness of good plant unless intelligently used, and Sir Ernest Shackleton referred to the invaluable help the engineer gave to the explorer. Mr. Capsey, the late hon. secretary, proposed the toast of "The Guests," which was acknowledged by Mr. H. Hirst, and his Honour Judge Rentoul.

An excellent musical programme interspersed the speeches, and great credit is due to Mr. Singleton (the new hon. secretary) for the care with which the various arrangements had been made.

The annual dinner of the NOTTINGHAM SOCIETY OF ENGINEERS, held at the Victoria Station Hotel, Nottingham, on Friday evening, was attended by a company numbering 150. The President (Mr. F. W. Davis) occupied the chair. The toast of "The Imperial Forces" was proposed by Col. Sir L. Rolleston, who spoke on the question of compulsory service. Col. G. M. Jackson (Clay Cross) responded, and urged on employers the wisdom of giving every facility to their workmen for joining the Territorials. "The Civic Toast," proposed by the Rev. F. W. Paul, was acknowledged by the Mayor and Sheriff, the former speaking of the work of the civil engineering staff in connection with the Derwent Valley water scheme. Councillor Foulds proposed "The Toast of the Society," the chairman responding, and Mr. Crawford (president elect) submitted the toast of "Kindred Societies." A capital musical programme was provided.

Mr. W. A. Baxter presided at the fifth annual dinner of the Birmingham Branch of the ELECTRICAL CONTRACTORS' ASSOCIATION, held at the Imperial Hotel, Birmingham, last week. The toast of "The Electrical Industry," was proposed by Mr. N. B. Rosher. Mr. Foulds (secretary of the Birmingham Electricity Department), in replying to the toast, said the electricity department, in spite of the strike, were in a very fortunate position, for they had more coal now than at the beginning of the strike, and they could go on for at least two months.

**Inquiry.**—A correspondent sends the following query:—

"For certain apparatus which has been planned it is necessary to have an electric potential sufficiently high to give a 'cold' (i.e., one that does not produce any considerable heating of the electrodes) oscillatory spark several inches in length. There are three requirements of the apparatus: (1) the induction coil or transformer must be light, not weighing more than 30 or 40 lb.; (2) it must be able to run continuously for weeks or months at a time; (3) the current consumption should not be more than 1 or 2 amperes at 110 volts.

"The difficulty met in the case of induction coils is that the interrupter will get out of order, and requires considerable attention. Transformers are too heavy if they give sufficient voltage. The discharge is usually of a flammatory character, and produces heating of the electrodes. If capacity is inserted in the circuit the sparking distance is greatly reduced.

"Could you advise the use of any kind of apparatus that fulfils some, or all, of the above conditions? Would any kind of induction coil that you know of give a sufficiently long spark if run on 220 A.C. with incandescent lamp resistance in series in the primary, no interrupter being used?"

**Will.**—Mr. John Nevin, chairman of the Electrical Distribution of Yorkshire, Ltd., left £54,617 gross, with net personalty £47,422.



**Smoke Abatement Exhibition.**—On Wednesday a conversation was held in connection with the Electrical Section at the Exhibition: the President and Mrs. Ferranti received the guests in the Exhibition Reception Room, and afternoon tea was served. The President then made an inspection of the Electricity Hall, and at 5.30 p.m. he gave a short address in the Berners Hall, which was followed by an illustrated lecture delivered by Mr. Frank Bailey, on "Electricity—Lighting, Heating and Power." The function was well attended and very successful.

**Chilean Railway Electrification.**—With reference to the article on page 453 of our last issue, the following has come to hand at the moment of going to press from the Legacion de Chile, 48, Grosvenor Square, W.:—

"I am directed by the Chilean Minister to inform you in regard to a publication made in your issue of the 22nd inst. that this Legation has not received from the Chilean Government any instructions whatsoever concerning the proposed electrification of the Chilean State Railways. Kindly correct this misstatement in your next issue and oblige, yours faithfully,

"ENRIQUE CUEVAS, *First Secretary*.

"March 27th, 1912."

**Appointments Vacant.**—Junior shift engineer, for the Corporation electricity works, St. Helens (32s.); commercial assistant, for the Borough electric light and power department, Gillingham (£100); telegraph construction foreman, for the Ceylon Government (£250). See our advertisement pages to-day.

**Marconi Extensions in the U.S.A.**—A correspondent of the *Times* reports that the Marconi Wireless Telegraph Co., of America, is going to increase its capital to two millions sterling, and will erect a powerful station near New York City, which will be able to communicate with the one to be erected near London.

**Institution and Lecture Notes.**—INSTITUTION OF CIVIL ENGINEERS.—The annual dinner of the Institution was held last week at Lincoln's Inn Hall. Dr. W. C. Unwin, F.R.S., the President, occupied the chair, and in proposing the toast of "The Universities and Applied Science," said that the divorce between science and practice had ended, and now they had engineering schools in every University in the United Kingdom. They were making rapid strides in their attempt to overtake the German engineering schools. Sir William Ramsay, who responded, said that nothing was impossible to the constructional engineer; the question which they had to consider was, not whether the thing could be done, but whether it would pay.

**Justice to Ireland.**—A correspondent in County Dublin (Mr. E. N. Allan, A.M.I.E.E.), whose letter reached us after our "Correspondence" column had been closed, complains bitterly of some expressions in our leader on "Peat Fuel," which, he considers, contain reflections upon the Irish character. The remarks in question were not intended to be taken seriously, but we agree that if they are so taken, they are offensive, and we regret that they were allowed to appear in our pages. Our correspondent goes on to say that many years ago the cultivation of reclaimed bogland was tried in Ireland, but the soil was found to be so useless that nothing would grow on it except a kind of grass of no value whatever. The Dutch, he thinks, must have been particularly fortunate: but it does not follow that, because they offered to reclaim bogland in Ireland, they would have successfully carried it out.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—The following alterations in salaries in the Hackney B.C. Electricity Department are recommended:—MR. T. DALBY, works superintendent, to be advanced from £200 by annual increments of £12 10s. up to £250 maximum. MR. E. MATHEWS, testing engineer, to be advanced from £130 per annum, by annual increments of £10 to £180. MR. E. WILKINSON, deputy generating engineer, to be advanced from £117 per annum to £130. MR. C. LILL, sales engineer, to be advanced from £150 per annum by annual increments of £10 to £200. MR. J. H. HEATHMAN, senior general clerk, is now to be designated Chief Clerk to the Electricity Department.

The Swansea Council will increase the salary of the electrical engineer, Mr. C. A. L. PRUSMANN, by £50 per annum.

The Carlisle T.C. has adopted the recommendation of the Electricity Committee increasing the salary of Mr. BARHAM, station superintendent, from £120 to £130, rising by £5 a year to £150.

The Rawtenstall T.C. has amended the duties of the borough electrical and tramways engineer (MR. C. L. E. STEWART) from April 1st, so as to include all services which may in future be required of him by the Council and all its Committees and special Sub-Committees, including the street lighting, education, and all other departments. The salary has been increased, as from April 1st, to £300, rising to £400 by £25 a year, on condition that Mr. Stewart agrees to stay with the Council for four years from April 1st.

**Tramway Officials.**—MR. H. WILSON, assistant traffic superintendent of the Sheffield tramways, has been presented with a case of cutlery by the members of the Tramway Employés Club, in recognition of eight years' service as trustee.

**General.**—The King has given authority to MR. JOSEPH MACNAMARA, chief electrical engineer in the Egyptian Railway department, to accept and wear the Insignia of the Fourth Class of the Imperial Ottoman Order of the Osmanieh conferred upon him by the Sultan of Turkey in recognition of valuable services rendered by him.

MR. A. S. DUNCAN and MR. A. PODMORE, members of the National Telephone Co.'s engineering staff, who were transferred to the Post Office, have been appointed assistant electrician and assistant engineer respectively to the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople), and they will shortly proceed to Constantinople to take up their duties.

MESSRS. R. D. McCARTER and JAMES KERR BOCK, have removed from Finsbury Pavement, E.C., to Donnington House, Norfolk Street, W.C.

THE RIGHT HON. LORD AMPHILL, G.C.I.E., G.C.S.I., F.R.G.S., etc., has accepted the Presidency of the British Electrical and Allied Manufacturers' Association (Incorporated).

The *Australian Mining Standard* says it is rumoured in electrical circles in Melbourne that Mr. G. G. Balsillie, the Commonwealth wireless expert, appointed but a few months ago, and under whose direction the new stations are being erected, has been approached by the Marconi Wireless Telegraph Co., with a view to his taking up the management of that company's affairs in Australasia.

MR. WM. ANTHONY BROWN, of Messrs. Hooghwinkel, Anthony Brown & Partners, is leaving by the R.M.S.P. Co.'s steamer *Aron* on 29th inst., for South America in connection with various engineering works in which his firm are interested.

MR. W. STONE, electrical expert for the Victorian railways, left Sydney on February 11th by the *Makura* for America, and he will proceed to London, to confer with Mr. Merz on the electrification of the railway services.

**Obituary.**—ANTONIO PACINOTTI.—We deeply regret to record the death at the age of 71 of Signor Antonio Pacinotti, who, for many years, had been renowned as the Professor of Physics at the University of Pisa, the city of his birth. It was in the year 1860, when he was only 19 years of age, that Pacinotti constructed, at the expense of the Cabinet of Technological Physics of the above University, the chief of the machines which established his reputation as a pioneer in dynamo-electrical machine design. This machine, which preceded Gramme's dynamo by some 11 years, had a ring armature wound upon a core with projecting teeth, and it was an immense advance upon previous inventions, for it embodied the main principles of present-day continuous-current motors. Pacinotti was assisted in the construction of this machine by Guiseppe Paggioli. This, with other pieces of apparatus, was sent by Pacinotti to the International Exhibition of Electricity in Paris in 1881. The 1860 machine was produced there as evidence of Pacinotti's priority as against Gramme, in the construction of field magnets transverse to the ring, and in their use, both for obtaining mechanical work from the electric current and for obtaining a continuous induced current from mechanical work. In 1873 Pacinotti constructed a magneto-electric machine. In 1878 at Cagliari, in the Doghio workshop, Pacinotti constructed a magneto-electric machine with a transverse ring, the first attempts at which he had made at Pisa three years previously. Another of his exhibits at Paris in 1881 was a pair of discs for the study of the electricity developed by molecular attraction. Pacinotti's work was very fully described in the pages of this journal (the *TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW*) in 1881, at the time of the Paris Exhibition, as well as in earlier issues.

## CITY NOTES.

### North of Scotland Electric Light and Power Co., Ltd.

THE directors' report for the year ended December 31st, 1911, records satisfactory progress. The gross profit, including £773 brought forward from last year, is £6,554, and after meeting interest paid on debentures and loans, amounting to £2,861, and writing off £31 balance of street-lighting alterations and £10 loss on meters destroyed by fire, there remains a net profit of £3,653. It is proposed to carry £2,000 to the renewal reserve account, and the balance of £1,653 forward. £11,115 of debenture stock has been issued during the year.

	Montrose.	Brechin.	Inverness.
Units generated .. ..	276,528	189,938	530,240
Units sold—			
Public lamps .. ..	60,050	30,178	—
Private consumers .. ..	162,054	108,677	443,654
Used on works .. ..	45,418	41,031	65,403
Total accounted for .. ..	267,522	179,886	509,057
Not accounted for .. ..	9,006	10,052	21,183
Number of public lamps ..	Aios, 20; 50-c.p. M.F., 245; 16-c.p., 62; S.C.P., 20.	50-c.p. M.F., 134; 10-c.p., 121; 16-c.p., 3.	—
Total maximum supply demanded .. ..	163 kw.	101.6 kw.	324 kw.
Year of working .. ..	Tenth	Tenth	Sixth
Lamps connected Jan. 1st	22,175	18,076	25,846
Lamps connected Dec. 31st	23,892	18,990	29,000



**Gateshead District Tramways Co., Ltd.**

THE annual general meeting was held on Thursday last week at the Electrical Federation Offices, W.C., Mr. C. R. Greene presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 435), the CHAIRMAN said the traffic receipts had increased by £2,850, and that extra traffic, representing 643,928 passengers, was dealt with, at an increased cost in power and running of only £77. The expenditure on repairs and maintenance was £1,020 larger than in 1910. Many of the cars had been in service for 12 years, and now required a considerable expenditure on the bodies and equipments. That work was being continued, and they must naturally expect the cost under that head to be heavy during the next few years. During the latter part of the year the company had installed meters on the tramcars. The results during the period under review were satisfactory, and it was hoped that during the current year still more favourable results would be obtained. The question of the wages of employes received the attention of the directors, and increases were given to drivers and conductors, and certain concessions to other employes, which resulted in an immediate addition to the wages bill of about £325 per annum. The results for the year's working had been most satisfactory, the net profit being the highest in the history of the company. Trade in the district throughout the period under review was excellent, and the strike of railway employes in August last in no way interfered with the traffics. On the contrary, throughout the period an increase in the receipts were shown. After providing for the usual dividends on the 5 per cent. and 6 per cent. preference shares, a dividend was paid at the rate of 6 per cent. per annum for the year on the ordinary shares, and £1,878, equal to nearly 1½ per cent. dividend on the ordinary shares, was carried forward. The amount carried forward was large, but in view of the present unrest in the industrial world the directors considered it advisable to preserve the resources of the company. Gateshead, with all other towns in the district, was seriously affected by the coal strike, but he was pleased to say that their traffic receipts had, so far, shown only a small decrease. As stated in the report, after the appropriations had been made to the reserve, renewal and sinking funds, the total of those accounts would amount to £51,932. The investments, which were all in trustee securities, amounted to £19,039, and interest amounted to £697 on those investments, and had been carried direct to the renewal and reserve accounts instead of being taken into the profit and loss accounts as in previous years. Arrangements had been made with the "P.A.Y.E." London Syndicate for the conversion experimentally of nine cars operating on the Bensham and Saltwell routes to the "Pay-as-you-enter" system. The platforms of the cars were now being extended so as to provide separate and distinct entrance and exits. The conductor remained upon the rear platform and collected the fares as the passenger passed into the car. By the adoption of that type of car the company expected to provide a better service with greater safety and comfort and convenience to the passengers. The operation of the cars was intended to accomplish four important results. First the prevention of accidents through the starting of cars while passengers were in the act of boarding and alighting; second, facilitating the collection of fares and enabling the conductor to give more complete attention to the operating of his car; third, increasing the comfort of the passenger by doing away with the necessity of conductors at busy times having to struggle past passengers in the body of the car while collecting fares; and fourth, to assist in giving a better and quicker service to the public by reducing the total time taken by the loading and unloading of cars.

Mr. H. DAY seconded the resolution, and the report was adopted.

**Victoria Falls Co.'s New Capital.**—It is reported from Berlin that the quotations on the Exchange for the debentures of the Victoria Falls and Transvaal Power Co., of which an extensive holding is in German ownership, have recently experienced a slow decline. A Berlin newspaper learns from quarters closely associated with the company that the fall in price is connected with the circumstance that consideration is being given to the question as to whether the company's new capital requirements are to be met by the issue of second debentures or new shares. It is added, however, that neither of the securities would be intended for the Berlin Stock Exchange.

**Wemyss and District Tramways Co., Ltd.**—In the sixth annual report, it is stated that the traffic receipts for the year amounted to £13,925, an increase of £349 as compared with the previous year. The total income was £14,209, and the balance at credit £2,763, after paying the interest on mortgage debenture stock and writing off £1,004 against the special expenditure incurred in 1909. A dividend of 6 per cent. on the ordinary shares is recommended.

**Salisbury Electric Light and Supply Co., Ltd.**—At the annual meeting, the chairman said that the plant, as stated in the report, was kept up in every possible way. It was in good working order, and capable of dealing with a considerably increased demand, and it was satisfactory to find that, although perhaps the improvement was not large, the position improved year by year, in spite of opposition and different adverse causes.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the five weeks ended March 1st, 1912, was 324,351, compared with 669,936 units in the corresponding five weeks of 1911.

**Direct Spanish Telegraph Co., Ltd.**

SIR J. DENISON PENDER, K.C.M.G., presided at Electra House, Finsbury Pavement, E.C., on March 20th, at the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 434), he first referred to the death of the Marquis of Tweeddale, and to the election of Sir Albert Leppoe Cappel to the board. The traffic receipts for the year showed an increase of £194, which in view of the fact that they compared with a substantial increase in 1910 over 1909, was very satisfactory. The working expenses showed an increase of £144, but the increase would have been considerably higher but for the fact that they had been able to make savings under several heads. Repairs and maintenance of instruments, &c., had decreased by £131, due to the fact that the expenditure necessary in 1910 on the repair of overhead lines did not recur. Having referred to the expenditure on drainage necessitated on the renewal of the company's Gracechurch Street premises, the Chairman called attention to the fact that to commemorate the Coronation of the King every employe with over a year's service had received a bonus of a month's wages. The board were very pleased to confer this benefit to mark their appreciation of the loyal services rendered by the staff. The Bilbao cable again became interrupted on June 28th, but it was quickly repaired at a cost of £4,124, which had been paid out of revenue. It would be within their recollection that the Bilbao cable had been frequently interrupted in the last few years, and had necessitated a heavy expenditure for repairs. Therefore, the directors had considered carefully the question of the renewal, and decided to carry this out, and the work was done in September and October of last year. The cost of the operations came to the very considerable sum of £33,000, and it was intended to gradually repay this sum out of the reserve fund. At the last meeting it was explained that owing to the general deterioration of the company's underground line between Falmouth and the Lizard, which had been used since 1881, it had been thought advisable to transfer the company's telegraph station from Falmouth to Kuggar, which was about a quarter of a mile from the landing place. The overhead wire from London, which was leased by the company from the Post Office, had now been extended from Falmouth to Kuggar, this being considered more reliable, as well as cheaper. The company's old underground line between Falmouth and the Lizard, laid in 1881, having been taken out of circuit, the original cost of the line, viz., £2,710, had been deducted from the capital expenditure account, and the cost of the land purchased by the company at Kuggar, and the new telegraph station erected thereon, had been added to that account. The actual cost of the renewal was about £1,225. The reserve fund on December 31st amounted to £65,880 at cost price, but the securities showed a depreciation of 13 per cent., this being practically the same figure as at December, 1910. The result of their operations was that after paying the sum necessary for interest, and the redemption of debentures, and transferring £5,000 to reserve, they were able, in addition, to pay 10 per cent. on the preference shares, and the usual 4 per cent. on the ordinary shares, leaving £35 to be carried forward.

Mr. F. A. JOHNSTON seconded the motion, and the report was adopted without discussion.

**Urban Electric Supply Co., Ltd.**—A special meeting of the preference shareholders was held on Thursday last week at Salisbury House, E.C., and in the absence of Mr. Tuckett, Mr. F. E. Gripper presided, and proposed a resolution sanctioning the alterations and modifications of the rights of the holders of the preference shares effected by the resolutions passed recently at an extraordinary general meeting. Mr. Charrington seconded the resolution, and it was adopted.

**Rothsay Tramways Co., Ltd.**—The report for 1911 states that after providing for renewals and depreciation the accounts show an available sum of £1,265. £200 has been placed to depreciation and reserve, and 5 per cent. paid on the preference shares, £165 being carried forward.

**Airdrie and Coatbridge Tramways Co.**—The directors' report states that the accounts for the year to December 31st show a profit, including £296 brought forward of £2,950. The directors have placed £600 to depreciation and reserve, and recommend a dividend of 4 per cent. £463 is to be carried forward.

**Commonwealth Edison Co.**—The report states (says the *Financier*) that the accounts for the 15 months to December 31st show a total income of \$6,617,552, and, after providing for bond interest, placing \$680,000 to depreciation reserve and setting aside \$2,712,315 for dividends, there remains a surplus of \$1,305,293 increasing the credit to profit and loss to \$4,330,701.

**Mexican Light and Power Co., Ltd.**—The directors announce a dividend of 1 per cent. for the quarter to March 31st.

**Rio de Janeiro Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent.

**Robey & Co., Ltd.**—The directors announce a dividend of 6s. per share on the ordinary shares for 1911.



Folkestone Electricity Supply Co., Ltd.

THE directors report that the company continues to make satisfactory progress. Up to December 31st, 1911, the equivalent of 124,149 S.C.P. lamps was being supplied, being an increase of the equivalent of 6,100 S.C.P. lamps over those connected at December 31st, 1910. Including the receipts from hired installations, the profit on the revenue accounts for the three undertakings amounts to £16,242. This amount, with the sum of £349 brought forward and interest and installation profits, and after allowing for interest on debenture stock and dividend on preference shares, shows a balance of £9,913. Out of this an interim dividend at the rate of 6 per cent. per annum has been paid on the ordinary shares, and £6,058 has been carried to the depreciation fund, making this fund now £23,803 net, the sum of £500 to the reserve fund, making this fund now £4,100; and they recommend the payment of a dividend at the rate of 6 per cent. per annum (less income-tax) on the ordinary shares for the half-year (making 6 per cent. for the year), which will require £1,500, thus leaving £355 to be carried forward. The whole of the company's debenture stock has now been issued, and the balance of this stock has been taken up with practically no expense to the company. The directors report the death of Mr. C. J. Pursey, who had been a director of the company since its incorporation. Mr. Loftus Banks, of Folkestone, has been elected to the board.

Units generated .. .. .	1,903,749
Quantity sold—Public lamps .. .. .	76,100
By contract .. .. .	419,678
Private consumers by meter .. .. .	1,041,892
Total sold .. .. .	1,537,670
Used on works .. .. .	31,900
Total accounted for .. .. .	1,568,870
Not accounted for .. .. .	334,879
Public lamps .. .. .	Arcs 88, incan. 455 (M.F.)
Maximum supply demanded, kw. .. .. .	1,211

The meeting is to be held to-morrow, Saturday.

Bromley (Kent) Electric Light and Power Co., Ltd.

—The directors' report for 1911 states that the lamp connections have increased from 95,307 to 101,276. The sale of current has increased from £15,865 to £16,418. The works have been maintained in good order and repair. The result of the year's trading, including £185 brought forward from last year, shows a profit of £12,683, and after payment of debenture interest and trustees' fees, amounting to £3,139, and writing off one-third of the cost of motor-car, there is a balance of £9,463. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 8 per cent. per annum, making a total dividend of 6 per cent. for the year. £1,260 is to be placed to reserve account for renewal of plant, and £3,000 to general reserve fund, leaving a balance of £703 to be carried forward.

**Vickers, Ltd.**—The directors report for 1911 a substantial improvement over 1910. All the chief departments were working at full time throughout the year. Further important orders were secured, and a considerable proportion of them were derived from foreign countries. Before arriving at the profits depreciation has been provided for on a liberal scale. The directors have applied £100,000 to writing off goodwill and patents, and this item now disappears from the balance-sheet. After meeting preference dividend, the total ordinary dividend is 10 per cent. for the year, and there is carried forward £205,031.

**Puebla Tramway Light and Power Co.**—The directors' report states that the net profits in Mexico for 1911 were £67,039, as against £61,677 for 1910, £48,677 for 1909, and £27,354 for 1908. After meeting expenses and bond and interest charges, there remains a balance of profit of £7,329. The gross and net receipts of the light and tramway business show satisfactory increases, but, says the *Financial News*, little improvement is noticeable in the power section, due principally to the unsettled state of the country. The directors, having obtained the consent of the holders of more than two-thirds of the first mortgage gold bonds, created an issue of \$6,000,000 prior lien 50-year 5 per cent. gold bonds, secured under trust deed in favour of National Trust Co., Ltd., of Toronto, and of this issue they sold \$3,000,000 in December last. Out of the proceeds of this sale the directors have completed the purchase of the whole issued bond and share capital of the San Agustin Co., and have repaid the moneys borrowed and used for capital purposes. The partial development of the Tuxpango Fall is now being actively carried out, and it is anticipated that the work, which will be sufficient to provide 17,000 H.P. at the turbines, will be completed in about two years. As the company is incorporated under the laws of Canada, the annual general meetings must be held in the Dominion. The board, however, with the exception of one director, are resident in England. The directors have, therefore, decided that in future a meeting of shareholders shall be held annually in London. This meeting was held in London yesterday.

**Prospectus.**—*Western Canada Power Co., Ltd.*—The list closed yesterday in an issue of £205,400 5 per cent. first mortgage bonds at £93 per cent. The company has a large demand for hydro-electric power. Contracts have already been signed for over 14,000 H.P. Power was being supplied continuously, at December last, from the plant to Vancouver New Westminster and Mission. It is expected that the company will have sold the entire present development of 25,000 H.P. before the end of 1912.

Metropolitan Electric Tramways, Ltd.

THE directors' report for 1911 states that the revenue, including £31,500, the dividend and bonus receivable upon the company's investment in the North Metropolitan Electric Power Supply Co., amounted to £501,667. After deducting all expenses chargeable to revenue, including an addition of £27,170 to the reconstruction and renewals reserve, and writing down preliminary expenses by £3,000, there is a surplus of £57,855, making, with £2,822 brought forward, an available total of £60,677. Out of this amount of £60,677 there was paid during the year £12,500 dividend for the half-year ended June 30th, 1911, on the preference shares and £9,896 interim dividend at the rate of 2½ per cent. on the ordinary shares, leaving £38,281, which the directors recommend should be appropriated as follows:—To reserve account, £10,000; dividend on the preference shares for the December half-year, £12,500; final dividend on the ordinary shares, at the rate of 3½ per cent. (making a total of 6 per cent. for the year), £13,854; carrying forward £1,927.

In response to the offer contained in the last report of the directors, 4,495 ordinary shares were taken up at par by the shareholders in April last, and have since been paid in full: £8,342 4½ per cent. debenture stock was bought and cancelled last year under the provisions of the trust deed. The premiums paid upon the purchases have been charged direct to profit and loss account. The expenditure on capital account during 1911, including £31,347 on additions to rolling stock, amounted to £45,791. At December 31st last the issued debenture and share capital was:—£571,096 in 4½ per cent. debenture stock, £250,000 in 5 per cent. debenture stock, £500,000 in 5 per cent. cumulative preference shares of £1 each fully paid, £395,832 in ordinary shares of £1 each fully paid, and £314,016 in deferred shares of £1 each fully paid.

The traffic receipts, which amounted to £460,544, show an increase over the previous year of £66,675. Working expenses and payments to local authorities for interest and rent have increased by £42,747 and £16,591 respectively. Thirty new cars were purchased early last year to provide for the increasing requirements of the system, and, in view of the steady expansion of traffic, orders have recently been placed for twenty further cars, to be delivered before the coming summer. Owing to these additions to the rolling stock, the directors have decided to extend the carsheds at Stonebridge Park and Finchley, and to secure a site for a new dépôt in the Enfield district. The Metropolitan Electric Tramways Act, 1911, the provisions of which were summarized in the last report, received the Royal Assent in August last. In view of increasing competition from motor omnibuses, the Company has, since the closing of the books, taken a participation in the capital of the Tramways (M.E.T.) Omnibus Company, Limited, which has been formed for the purpose of operating services of up-to-date motor omnibuses, primarily as feeders to, and in connection with, the system worked by the Company. It is anticipated that the new services will be in operation in the course of the coming summer. Reference was made in the last report to the impending purchase by the London County Council of the Company's tramway situated in Seven Sisters Road between the Finsbury Park Terminus and Manor House. With a view to securing a permanent link between the northern portions of the Company's system and the important traffic centre at Finsbury Park, the Company, at the request of the Middlesex County Council, deposited a Bill in the present session of Parliament to sanction the construction of a new tramway running parallel with the tramway to be purchased, but situate in Finsbury Park, and for this purpose to authorise the purchase of a narrow strip of the park where it abuts on the Seven Sisters Road. The Bill has now been withdrawn on the understanding that the London County Council will negotiate with the Company for through running over their respective systems.

The directors of the North Metropolitan Electric Power Supply Co., in which the company hold 30,000 fully paid, and 10,000 £5 paid, ordinary shares of £10 each, have declared a 6 per cent. dividend upon the ordinary shares, together with a bonus at the rate of 6s. per fully-paid share. The business of the Power Supply Co. is increasing satisfactorily, the total number of units sold during 1911 amounted to 26,454,492, an increase of 23·5 per cent. over the preceding year's figures. A supply of energy was commenced in April last under the Southgate Electric Lighting Order, 1904. The North Metropolitan Electrical Power Distribution Co., Ltd., shows satisfactory results from its undertakings at Barnet, Enfield, Hertford and St. Albans, and for the past year has paid a dividend upon its ordinary share capital at the rate of 5 per cent.

	1910.	1911.
Mileage .. .. .	55·375	56·750
Passengers carried .. .. .	76,460,980	89,908,677
Car miles run .. .. .	8,761,837	10,433,113
Average receipts per car-mile .. .. .	10·78d.	10·59d.
Average receipts per passenger .. .. .	1·23d.	1·23d.
Cars in stock .. .. .	262	292

The meeting is called for April 3rd at Electrical Federation Offices, London, W.C.

**Continental.**—**FRANCE.**—The report of the Société de l'Energie Electrique du Nord de la France for the last financial year shows a profit of £29,889, as compared with £20,107 in the preceding 12 months.

The Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, of Paris, reports a net profit of £183,326 for the last financial year, as compared with only £155,126 in the preceding 12 months.

**GERMANY.**—The balance-sheet of the Deutsche Kabelwerk Gesellschaft, of Berlin, for the last financial year show a net profit of £24,813, as compared with £19,894 in the preceding 12 months. A dividend of 7 per cent. is being declared.



### German Electrical Companies.

**THE Treuhandbank für die Elektrische Industrie, of Berlin**, which is one of the electrical banks, and is associated with the A.E.G., realised a net income of £11,400 from interest in 1911, on a nominal share capital of £1,250,000, of which one-fourth has been paid. The net receipts from interest in the previous year were £11,900. It is proposed to pay a dividend at the rate of 3½ per cent. for the past year.

The directors of the *Elektrotechnische Fabrik Rheymt, Max Schorch & Co., of Rheymt*, state that the company was well employed in 1911, particularly in the second half, although delays in delivery took place in consequence of a three months' strike. An extension of the works has been carried out in order to largely increase the production. After making provision for depreciation to the extent of £4,000, as compared with £3,400 in 1910, the accounts indicate net profits of £9,800, as against £10,100 in 1910. It is intended to distribute 8 per cent. on the share capital of £87,500, being the same rate as in the preceding year.

The report of the *Kabelwerke Duisburg* states that the turnover in 1911 considerably increased as compared with the preceding year, and all departments were satisfactorily and regularly employed. The buildings destroyed by fire in 1910 were rebuilt simultaneously with an extension in working. The augmentation in the share capital which was decided upon last April had been carried into effect, and the premium of £9,300 realised on the new issue of £37,500 had been placed to the reserve fund. After allocating £23,000 to depreciation, as against £44,000 in 1910, when the fire necessitated a larger provision for this purpose, the accounts show net profits of £23,000, as compared with £9,600. A dividend at the rate of 14 per cent. has been declared on share capital of £75,000, and 7 per cent. on £37,500, as against 10 per cent. on the former capital in 1910. It was mentioned at the recent meeting that the orders on hand at the beginning of the year had experienced a further increase, and the degree of activity had so far been satisfactory.

**Rand Mines Power Supply Co.**—The Hon. L. W. Bagot, D.S.O., presided at the meeting of this Company held at the end of February. According to a report in the *South African Mining Journal* he said that the accounts showed for the last eight months of the financial year a profit of £32,710 after providing for interest on loan during the revenue-earning period. This was satisfactory in view of the fact that the whole of the period was occupied in starting up huge items of generating plant. Initial difficulties must be expected in starting up a scheme of such magnitude, and minor troubles had to be overcome at Rosherville. Only one difficulty of any importance, was experienced, namely, the failure of certain large transformers, which the engineers said was entirely due to defective workmanship on the electrical windings. This failure had handicapped their operations considerably. There was every reason to believe that all risk of a recurrence would be avoided by the alterations now being carried out. But for the transformer trouble the plant generally had done excellently, especially the compressed air scheme. The erection of the new generating station at Vereeniging was unavoidably delayed pending the issue of a licence to the company under the terms of the Power Act, 1910, which licence was not granted until November, 1910. These works are now well in hand, and unless there should be delay in the delivery of material it is anticipated that the two first turbo-generators in this station will be in service shortly after the middle of 1912. Two additional generating sets of a similar capacity to those at Rosherville are under construction for this station, and this plant will enable the company to meet the increased supply demanded by its consumers.

**Evered & Co., Ltd.**—The directors report that the trading for the year 1911 has resulted, after the provision of £1,410 for debenture interest and £48 for income-tax, in a net profit of £6,539, which, with £1,320 brought forward, leaves £7,858 to be dealt with. They propose to pay a dividend of 2½ per cent. absorbing £4,269; to write off plant £1,500; and to carry forward £2,090. In considering the disposal of the available balance it should be borne in mind that the buildings have been provided for by the lease redemption policies taken out last year at an annual total premium of £297. A satisfactory increase in the company's turnover during the year under revision has to be recorded, and this increase has, so far, been maintained; but, in view of the serious outlook with regard to labour troubles, a forecast of the future is impossible. All stocks have been valued at the lowest prices generally ruling during 1911, and certain goods which have become obsolete owing to change of fashion have been written off. Machinery, plant, and buildings have been maintained in fully efficient condition. It is intended to subdivide the shares, and the articles of association are to be altered.

**Lymington Electric Light Co., Ltd.**—Mr. Keppel Pulteney presided over the annual meeting of this company, held on March 20th. The directors in their report stated that the company continues to make satisfactory progress, the total proceeds from the sale of current having been increased from £2,269 to £2,366. The result of the year's trading, including £32 brought forward, shows a profit to the credit of the net revenue account of £1,821, and after paying interest on debentures amounting to £500, there was a balance of £1,321. The directors recommended that £800 be placed to reserve account, and a dividend at the rate of 5 per cent. per annum be paid on the preference shares, amounting to £321, leaving a balance of £200 to be carried forward. The report was adopted.

**Stock Exchange Notices.**—The Committee has appointed special settling days as under:—

Thursday, March 28th.—Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—£750,000 5 per cent. first mortgage gold bonds of £20 each, Nos. 1 to 37,500.

Tuesday, April 2nd.—Spanish and General Wireless Trust, Ltd.—249,007 shares of £1 each fully paid, Nos. 1 to 249,007.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British L. M. Ericsson Manufacturing Co., Ltd.—99,990 cumulative 5 per cent. preference shares of £1 each, 10s. paid.

And to allow the following securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 37,586 5 per cent. cumulative preference shares of £5 each, fully paid (Nos. 160,371 to 197,956).

Pennsylvania Water and Power Co.—Further issue of \$100,000 first mortgage sinking fund 5 per cent. gold bonds of \$1,000 each (Nos. 7,521 to 7,680).

**Potteries Electric Traction Co., Ltd.**—The directors report that the total receipts for 1911 were £119,420. The traffic receipts show an increase of £5,598 over the previous highest receipts recorded—viz., in 1907. Up till the end of February this year, the receipts again showed a marked improvement. The working expenses show an increase of £447. After deducting all expenses chargeable to revenue, including £11,704 for debenture and other interest, there remains £35,099, as compared with £26,333. The directors recommend as follows:—Depreciation, reserve account, £2,000; renewals account, £12,000; dividend, 5 per cent. per annum on preference shares, £12,250; dividend at the rate of 3½ per cent. per annum on the ordinary shares, £8,575; carrying forward £681. The depreciation and reserve account will then stand at £19,000, and there will be a credit balance on the renewals account of £10,577. During the year £18,040, as compared with £10,521 in 1910, has been expended on the improvement, renewal, and repair of the permanent way, of which £7,617 has been charged against the year's revenue and £10,423 to the renewals account.

**British Aluminium Co., Ltd.**—The directors' report for 1911 states (according to the *Times*) that the trading profit, together with interest and dividend on investments and deposits, and the revenue derived from the Kinlochleven and Foyers Estates and transfer fees, amounted to £152,901, which has been dealt with as follows:—Provision for legal expenses, bad and doubtful debts, depreciation of furniture, and proportion of profits payable to directors, £13,407; prior lien debenture interest, £40,000; debenture stock service fund, £43,224; reserve for depreciation, £35,000; carried to reserve account, £17,269; leaving £4,001 to be carried forward. The reserve account to December 31st, including the amount added out of profits for the year, amounted to £50,000. The sum allocated to reserve account in respect of the year to December 31st, 1910, has been invested in securities outside the company's business; and it is the intention similarly to apply the amount allocated out of profits for the year to December 31st, 1911. The output and the sales for the year were larger than in any previous year.

**Vera Cruz Electric Light & Power Co.**—The directors' report for 1911 states that the net profits in Mexico amount to £27,884, as compared with £24,107 for 1910, an increase of £3,777. After providing for London office expenses, and bond and other interests, there remains, says the *Financial News*, a balance of profit for the year of £13,220, to which should be added the balance brought forward from last year of £10,294 and deducted the transfer to depreciation and general reserve account of £15,000, leaving £8,514, which the directors propose to apply as follows: To dividend on share capital for 1911 at the rate of 2 per cent., £7,000, carrying forward £1,514. The directors have practically settled, on satisfactory terms, a contract with the Puebla Tramway, Light and Power Co. for the supply of a large amount of power from that company's new installation at Tuxpango, which contract will not involve any capital expenditure on the part of this company. This power will, it is hoped, be available in about two years' time. Meantime, the temporary steam plant has been completed, and is now ready for use.

**Browett, Lindley & Co., Ltd.**—The report, as abstracted in the *Financier*, states that the accounts show a gross profit of £9,924 upon work completed during the year 1911. After deducting £2,101 for bank, debenture and loan interest, and writing off £4,890 for depreciation, there remains a net profit of £2,943 to be deducted from the loss shown in the last balance-sheet. This result is an improvement of £5,106 over the previous year's working. During the year there was a considerable increase in the volume of orders received, but the prices obtained were the lowest on record. The strike of the transport workers in the summer caused considerable disorganisation and delays in the company's works; in addition, the boiler feed-water supply was curtailed by the Manchester Corporation, owing to the exceptionally dry summer. These causes restricted the output over a certain portion of the year, and, owing to getting behind with deliveries, it was necessary, in the latter half of the year, to start overtime and nightshifts, which has increased the cost of production, and consequently reduced profits.

**Mexican Light and Power Co., Ltd.**—The directors have declared a dividend of 3½ per cent. for the six months to April 30th on the preference shares and a dividend of 1 per cent. for the quarter to March 31st on the ordinary shares.



MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 27th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. per lb.	23/-	..
a " Oxalic .. .. per lb.	23d.	..
a " Sulphuric .. .. per cwt.	5/6	..
a Ammoniac Sal .. ..	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. ..	£5 10	..
a Bisulphide of Carbon .. ..	£18	..
a Borax .. ..	£16 10	..
a Copper Sulphate .. ..	£22 15	5/- dec.
a Lead, Nitrate .. ..	£25	..
a " White Sugar .. ..	£25	..
a " Peroxide .. ..	£32	..
c Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	33d.	..
a Potash, Caustic (80/82 %) .. per ton	£20 5	..
a " Chlorate .. .. per lb.	33d.	..
a " Perchlorate .. ..	43d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	74d.	..
a Shellac .. .. per cwt.	68/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ..	£6 10	..
a " Recovered .. ..	£5 10	..
a " Lump .. ..	£5 5	..
a Soda, Caustic (white 70/72 %) ..	£10 5	..
a " Chlorate .. .. per lb.	33d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£67	£2 inc.
b " Wire, in ton lots .. ..	£102	..
b " Sheet, in ton lots .. ..	£120	..
p Babbitt's metal ingots .. ..	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	8½d.	3d. inc.
c " Tube (brazed) .. ..	10½d.	1d. inc.
c " (solid drawn) .. ..	8½d.	3d. inc.
c " Wire, basis .. ..	8½d.	3d. inc.
c Copper Tubes (brazed) .. ..	11½d.	1d. inc.
c " (solid drawn) .. ..	10½d.	1d. inc.
g " Bars (best selected) .. per ton	£84	£4 inc.
g " Sheet .. ..	£84	£4 inc.
g " Rod .. ..	£84	£4 inc.
d " (Electrolytic) Bars .. ..	£71	£2 15 inc.
d " Sheets .. ..	£88	£2 15 inc.
d " Rods .. ..	£76	£2 15 inc.
d " H.C. Wire per lb.	9d.	1d. inc.
f Ebonite Rod .. ..	5/3	..
f " Sheet .. ..	4/9	..
n German Silver Wire .. ..	1/11	..
h Gutta-percha, fine .. ..	5/0½	2d. inc.
h India-rubber, Para fine .. ..	51/8	1½d. inc.
i Iron Pig (Cleveland warrants) .. per ton	£14	..
l " Wire, galv. No. 8, P.O. qual.	£16 10	5/- inc.
g Lead, English Pig .. ..	6/6	..
m Manganin Wire No. 28 .. per lb.	£8 12 6	5/- inc.
g Mercury .. .. per bot.	6d. to 2s.	..
e Mica (in original cases) small .. per lb.	2/6 to 4/-	..
e " " medium .. ..	4/6 to 8/6	..
e " " large .. ..	11d.	..
p Phosphor Bronze, plain castings ..	1/0½	..
p " " rolled bars & rods ..	1/1	..
p " " rolled strip & sheet ..	185/-	..
o Platinum .. .. per oz.	10d.	3d. inc.
d Silicon Bronze Wire .. .. per lb.	£55	..
r Steel Magnet, in bars .. .. per ton	£200 to £201	£6 inc.
g Tin, Block (English) .. ..	2/4	3d. inc.
n " Wire, Nos. 1 to 16 .. .. per lb.	£45 to £150	..
p White Anti-friction Metals .. per ton	£28 15	£1 dec.
k Zinc, Sh't (Vieille Montagne bnd.)	..	..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p W. F. Dennis & Co.
h Edward Till & Co.	

STOCKS AND SHARES.

Tuesday Evening.

ALL things considered, the markets in the Stock Exchange are by no means bad. The coal strike continues to be the factor of greatest uncertainty, and many people wonder how it is that quotations of domestic issues, such as Home Rails, maintain their prices with the hardihood that they exhibit. The reason, no doubt, lies in the feeling that, after all, the dispute must be settled before long, and that when this happy consummation is reached, markets and prices will go ahead gaily once more.

Central London stocks are the special features of the Home Railway market. The Deferred stock followed up its rise of 17 points last week with another amounting to 9 during the past few days, while the Ordinary capped its jump of 9 with a further advance of 4, and even the Preferred and 4 per cent. Debenture stocks rose 1 each. Various rumours are afloat to account for the boomlet. To some we have already referred; but another one of interesting

complexion came into force last week, it being stated that the South-Western, the Great Western, and the Great Eastern were about to guarantee a 4½ per cent. dividend on Central London stocks. Though this was promptly denied, and the prices fell, the latter picked up again readily enough, and the report is merely scotched and not killed. The incursion of the Central London into the Thames Valley district is at any rate held to be a bull point for the company, and the rise, great as it has been, failed to dislodge any particular amount of stock.

City and South London Ordinary rose no less than 4½, Metropolitan jumped up 2, and Districts 1½, these being the principal changes in the other Undergrounds. The shares of the Underground Electric Railways Company, however, spurted 12s. 6d., and the 6 per cent. Income bonds rose another 5 points upon what was characterised as good buying. In good quarters the price is talked quite confidently to par. On the other hand, Metropolitan Electric Tramways eased off a trifle, and London United Tramways Debenture fell ½, the latter movement being associated with the suggested extension into the Thames Valley of the Central London Railway already mentioned. British Electric Traction issues are weaker. Bath Trams Ordinary rose 1½, and the Preference improved to the same extent upon a small amount of buying that came from the West of England.

The new issue of County of London Electric Supply Ordinary shares is pronounced to have been a distinct success. The price at first was about ½ premium, receding later to ¼ premium for the allotment letters, a good many of which came to market. The old Ordinary shares are steady at about 10½, while the Preference eased off ½. This time there has been little selling of the old shares in order to take up the new, though in the ordinary way this is what usually happens in the case of a new issue. In Cities there is still an excited market, and the price shows a further jump of 25s., making fully £5 rise within a fortnight, after allowing for the dividend deduction. The columns of the financial papers have been filled day by day with much discussion as to what is likely, or not likely, to happen in respect of the City Company. In some quarters the view is put forward that it was not the City Corporation itself which stumbled upon the idea that it would be well to buy out the City Company now; but that, having had this aspect of the case presented to them, the Corporation authorities were attracted by the chance which it afforded them for administering a rap over the knuckles to the London County Council.

Other London shares are firm, with rises at ¼ in St. James' and Metropolitan, and of ½ in Kensingtons and South London Ordinary. Some surprise is expressed that Charing Cross shares should have moved so little, because the argument runs that if the City company is taken over by the Corporation, similar treatment might conceivably be meted out to its colleague the Charing Cross, as regards the City part of the company's undertaking.

The Latin-Canadian group is unusually quiet, although this does not mean that prices are any less firm. Indeed, British Columbia Deferred is up 1, and the Preferred put on 3. Mexican Light and Power gained 1, and other Mexican issues have not moved, in spite of most contradictory rumours from the theatre of the revolutionary trouble. Montreal stock at 200 has a rise of 4½ to its credit on the week. River Plate Debenture is 1 higher. La Platas have gone back 3½, and United Electric Trams of Monte-Video Debenture rose 1. Calcutta Trams at 6½ continue their improvement. Madras Ordinary shed ½, but Madras Tramways Debenture stock at 97½ is 1 up. Victoria Falls Power Preference shares at 1½ are better on the progress which the company is declared to be making, while a substantial rise in the price of British South Africa shares has also helped the market.

In the Telegraph section the bulk of the excitement has centred round Marconis. The old Ordinary shares have been taken up to nearly 6, the Preference rising 22s. 6d. in sympathy. Canadian Marconis, which made up at 33s. at their special settlement last week, touched 40s. later on, but came back to 36s.; while Spanish Marconis ran up from 1½ to 2½ before reacting. Rumours have been busy with the name of the American Marconi Company, which is said to be on the eve of issue, but which, according to the latest information, is to be postponed for a little while. The market has developed into a wild and highly speculative one, but buyers seem to have the courage of their convictions, and are undaunted by daily rises in the prices of the shares.

In the American group, Anglo Deferred and Preferred have both fallen a little, and Direct United States are also easier, while the two Mackay issues are both lower. West India and Panama shares have sobered down, the price remaining at 4½, while the Second Preference eased off to 10. In the Eastern group, nervousness still remains with regard to the possibilities of the harm that Marconi competition may do to these companies, but Eastern Ordinary managed to regain a point, although Eastern Extensions are ¼ lower. A new issue of Reuter's shares is in contemplation, and the price at which they will be offered to shareholders is £11 5s. National Telephone Deferred fell back ½, then went ahead with a smart advance. In other Telephone issues there is no special change, save for a rise of 1 in American Telephone and Telegraph Capital stock.

The Manufacturing division is marked by rises in Callender's Ordinary and Preference, the Ordinary putting on a further 10s. after its rise of a similar amount last week, while the Preference rose 1½. Henley's Ordinary, however, are ¼ lower. Castner-Kellners eased off 1½, and Babcock & Wilcox fell ½. There are no other changes of special interest. The price of raw rubber is still on the up grade, but in the share market there is not much notice taken of this, public attention being concentrated too much on other things at the moment for it to pay much heed to the rubber shares. The new Consolidated Diesel Engine prospectus is on the point of issue.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 26th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 26th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½ 5½	8½—9½	+ ½	5 15 9	Kensington & Knightsbridge, Ord	5	9 9	6½—7½ xd	+ ½	6 4 2
Do. 4½ % Pref.	10	4½ 4½	8½—9½	..	4 14 9	Do. 4 % Deb.	Stock	4 4	92—95	..	4 4 3
Do. Second 6 % Pref.	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb.	Stock	4½ 4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock	Stock	4½ 4½	100—102	..	4 8 3	London Electric, Ord.	3	2 2½	1½—2	..	3 15 0
Brompton & Kensington, Ord.	5	10 9½	8½—9	..	5 11 1	Do. 6 % Pref.	5	6 6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref.	5	7 7	7½—8½	..	4 4 10	Do. 4 % First Mort. Deb.	Stock	4 4	90—93	..	4 5 0
Central Electric Supply, 4 %	100	4 4	98—101	..	8 13 3	Metropolitan	5	5 4½	3½—4½	+ ½	5 17 5
Guar. Deb.						Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5 5	4½—4½ xd	..	5 8 1	Do. 4½ % First Mort. Deb.	Stock	4½ 4½	89—104	..	4 6 7
Do. 4½ % Cum. Pref.	5	4½ 4½	4½—4½	..	5 0 0	Do. 3½ % Mort. Deb.	Stock	3½ 3½	81—87	..	4 0 6
Do. "City Undertaking"	5	4½ 4½	9½—4½	..	5 2 10	Midland Electric Corporation	100	4½ 4½	96—98	..	4 11 10
Do. 4½ % Cum. Pref.	100	4 4	93—96	..	4 3 4	4½ % First Mort. Deb.					
Do. 4 % Deb.	100	4 4	11½—11½ xd	..	5 0 0	Newcastle-on-Tyne	5	4 4½	3½—4	..	5 0 0
Chelsea, Ord.	5	5 5	4½—5 xd	..	5 0 0	Do. 5 % Pref., Non-Cum.	5	5 5	4—4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½ 4½	98—101	..	4 9 1	North Metropolitan Power Sup-	100	5 5	99—102	..	4 18 0
City of London, Ord.	10	7 8	18½—20 xd	+ 1½	4 3 2	ply, 5 % Mortgages (Red.)					
Do. 6 % Cum. Pref.	10	6 6	14—16 xd	+ ½	4 0 0	Notting Hill, 5 % Non-Cum.	10	..	10—11	..	5 9 1
Do. 5 % Deb.	Stock	5 5	117—121	..	4 2 8	Pref.					
Do. 4½ % Second Deb.	100	4½ 4½	100—103	..	4 7 5	Oxford	5	7½ 7½	5½—6½ xd	..	5 13 9
County of Durham, 5 % First	Stock	5 5	87—89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10 10	8½—8½	+ ½	5 12 8
Mort. Deb.						Do. 7 % Pref.	5	7 7	6½—7½	..	4 16 7
County of London, Ord.	10	5 6	10½—11½ xd	..	5 4 4	Do. 8½ % Deb.	100	3½ 3½	85—87	..	4 0 6
Do. 6 % Pref.	10	6 6	11½—11½ xd	..	5 3 0	Smithfield Markets, Ord.	5	Nil 2	12—14	..	..
Do. 4½ % Deb.	Stock	4½ 4½	107—109	..	4 2 7	South London, Ord.	4	5 5	2½—2½	+ ½	5 18 4
Do. 4½ % Second Deb.	Stock	4½ 4½	101—104	..	4 6 7	Do. 5 % First Mort. Deb.	100	5 5	99—102	..	4 18 0
Edmundson's, Ord.	5	Nil Nil	3—5	..	Nil	South Metropolitan, 7 % Pref.	1	7 7	1—1½	..	6 4 5
Do. 6 % Cum. Pref.	5	Nil Nil	2½—3½	..	Nil	Do. 4½ % First Deb. Stock	100	4½ 4½	97—100	..	4 10 0
Do. 4½ % First Mort. Deb.	100	4½ 4½	86—89	..	5 1 2	Urban, Ord.	5	..	2½—3½	..	..
Folkestone	5	6 6	4½—5	..	6 0 0	Do. 5 % Cum. Pref.	5	5	2½—3½	..	..
Do. 5 % Cum. Pref.	5	5 5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb.	100	4½ 4½	87—89	..	5 1 2
Do. 4½ % First Deb.	100	4½ 4½	93—96	..	4 18 9	Westminster, Ord.	5	10 10	8½—9½	..	5 5 3
Hove	5	9 9	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref.	5	4½ 4½	5—5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6 6	5½—5½	..	5 2 2	Monterey Rly. Light & Power,	100	5 5	88—90	..	5 11 1
Calcutta, Ord.	5	8½ 7½	6½—7	..	6 1 5	5 % 1st Mort. Deb.					
Do. 5 % Pref.	5	5 5	5—5½	..	4 15 3	Montreal, Lt., H. and Power	\$100	7 8	198—202	+ 5½	8 19 3
Calgary Power, 1st Mort. Bds.	100	5 5	92½—94½	..	5 5 3	Northern, Lt., Power and Coal,	\$500	5	39—41	..	12 3 10
Canadian Gen. El. Com.	\$100	7 7½	115—119	..	5 17 8	5 % 1st Mort. Bonds					
Do. 7 % Pref.	\$100	7 7	116—120	..	5 16 8	River Plate, Ord.	Stock	10	248—253	..	3 17 6
Cordoba Lt., Power and T., Ord.	1	3 3½	3½—1½	+ ½	2 18 3	Do. 6 % Non-Cum. Pref.	Do.	6 6	110—115	..	5 4 4
Do. 5 % Deb.	100	5	96—99	..	5 1 0	Do. 5 % Deb. Stock	Do.	5 5	102½—104½	+ 1	4 15 8
Elec. Lt. and P. of Cochabamba,	100	6 6	92—94	..	6 7 8	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	101—103	..	4 7 5
6 % Bonds						1st Mort. Deb.					
Elec. Supply Victoria, 5 % 1st	100	5 5	88—86	..	5 16 3	Shawinigan Water, Capital	\$100	4 5½	133—135	..	8 14 1
Mort. Deb.						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108—110	..	4 11 0
Elec. Dev. Ontario, 5 % 1st	\$500	5 5	92½—94½	..	5 5 10	Do. 4½ % Per. Deb.	Stock	4½ 4½	103½—105½	..	4 5 4
Mort. Bonds						Toronto Power, 4½ % Deb.	Do.	4½ 4½	99½—101½	..	4 8 8
Kaloorlie Elec. P. and L., Ord.	10/-	Nil	3—5	..	Nil	Vera Cruz Lt., P. and T., 5 %	100	5 5	92½—94½	..	5 5 10
Do. 6 % Pref.	1	6 6	3—5	..	8 0 0	1st Mort. Deb.					
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	108—110	..	4 11 0	Victoria Falls Power, Pref.	1	Nil 11½d.	1—1	+ ½	..
Madras, Ord.	5	..	2½—3	..	..	West Kootenay Power and Lt.,	100	6 6	104½—106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5 5	102—105	..	4 15 3	1st Mort. 6 % Gold					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	84½—85½	..	5 15 7						
Mexican Lt. & Power, Common	\$100	4 4½	85—87	+ 1	4 13 0						
Do. 7 % Cum. Pref.	\$100	7 7	105—107	..	6 10 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	94½—96½	..	5 3 8						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4½ 7½	..	..	Monte Video Telephone, Ord.	1	6 6	1—1½	..	5 6 3
Do. 5 % Deb. Red.	Stock	5 5	97½—99½	..	5 0 6	Do. 5 % Pref.	1	5 5	8½—8½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8 8½	151½—15½	+ 1½	5 4 3	National Telephone, Pref.	Stock	6 6½	99½—102½	..	5 17 1
Do. Collat. Trust	\$1000	4 4	94—16	..	4 3 4	Do. Def.	Do.	6 6½	128½—130½	+ 3	4 12 0
Anglo-American Telegraph	Stock	3½ 3	66—68	..	4 8 6	Do. 6 % Cum. 2nd Pref.	10	6 6	9½—10	..	6 0 0
Do. 6 % Pref.	Do.	6 6	110—111	..	5 8 1	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½—5½	..	4 15 3
Do. Def.	Do.	30/- 30/-	25—25½	..	5 17 8	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	102½—103½	..	4 6 9
Anglo-Portuguese Tel., 5 %	100	5 5	100—102	..	4 18 0	Oriental Telep. and Elec.	1	8	12—12½	..	4 11 5
Mort. Deb.						Do. 6 % Cum. Pref.	1	6 6	12½—12½	..	4 16 10
Chili Telephone	5	7	7½—7½	..	4 13 4	Do. 4 % Red. Deb.	Stock	4 4	87½—89½	..	4 9 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	86—88	..	4 10 11	Pacific and European Tel., 4 %	Do.	4 4	98½—100½	..	8 19 7
Cuba Telegraph	10	6 6½	9½—10½	..	5 11 7	Guar. Debs.					
Do. 10 % Pref.	10	10 10	17—18	..	5 11 1	Reuter's	3	5 5½	12—12½	+ 1½	3 5 4
Direct Spanish Telegraph, Ord.	5	4 4½	3½—3½	..	5 6 8	Submarine Cables Trust	Cert.	6 6	130—133	..	4 10 8
Do. 10 % Cum. Pref.	5	10 10	8—8½	..	5 17 8	Telephone Co. of Egypt, 4½ %	Stock	4½ 4½	99—101	..	4 9 1
Do. 4½ % Debs.	50	4½ 4½	99—101	..	4 9 1	Deb. Red.					
Direct United States Cable	10	4½	7½—8	+ ½	5 12 6	United River Plate Telephone	5	8 8	7½—7½	..	5 8 3
Direct W. India Cable, 4½ %	100	4½ 4½	99—101	..	4 9 1	Do. 5 % Cum. Pref.	5	5 5	5½—5½	..	4 8 11
Reg. Deb.						West Coast of America	2½	2½ 2½	1½—1½	..	3 11 5
Eastern Telegraph, Ord. Stock	Stock	7 5½	129—131	+ 1	5 5 3	Do. 4 % Debs., 1 to 1,500	100	4 4	97½—99½	..	4 0 5
Do. 8½ % Pref. Stock	Do.	9½ 3½	80—82	..	4 5 4	guar. by Braz. Sub. Tel.					
Do. 4 % Mort. Deb.	Do.	4 4	100½—10½	..	3 18 1	West India and Panama Teleg.	10	1½ 1½	4½—4½	..	..
Eastern Extension	10	7 5½	12½—1½	..	5 9 10	Do. 6 % Cum. 1st Pref.	10	6 6	10—11½	..	5 6 8
Do. 4 % Deb.	Stock	4 4	98½—101½	..	8 18 10	Do. 6 % Cum. 2nd Pref.	10	6 6	4½—10½	..	5 17 1
East and S. Africa Tel. 4 %	25	4 4	99—101	..	8 19 3	Do. 5 % Debs.	100	5 5	102—101	..	4 16 2
Mt. Db. Mauritius Sub.						Western Telegraph, Ltd.	10	7 6½	13½—13½	..	5 2 7
Globe Telegraph and Trust	10	5½ 6½	10½—11	..	5 9 1	Do. 4 % Deb.	Stock	4 4	19—101	..	3 19 3
Do. 6 % Pref.	10	6 6	12½—12½	+ ½	4 9 9	Western Union Tel., 4 % Bnds. A	\$1000	4 4	100—103	..	3 13 5
Great Northern Telegraph	10	18 5½	34—83	..	5 9 1	Do. 4½ % Fdg. Bonds	\$1000	4½ 4½	102—105	..	4 5 9
Indo-European Telegraph	25	18 5½	56½—58½	..	5 10 2						
Mackay Companies Common	\$100	5 5½	81—84 xd	..	5 10 1						
Do. 4 % Cum. Pref.	\$100	4 4	70—73 xd	..	5 9 7						
Marconi's Wireless Telegraph	1	5	5½—6	+ 1½	..						
Do. 7 % Cum. Partio. Pref.	1	1½	5½—5½	+ 1½	..						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 26th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations March 26th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil	50 — 50	+ 1 1/2	Nil	Metropolitan Railway Consol. ..	100	12 1/2	12 1/2	60 1/2 — 61	+ 2	3 1 6
Do. 5 % Pref. ..	1	5	5	6 13 — 6 13	+ 1 1/2	6 13 4	Do. Surplus Lands ..	100	2 3/4	2 3/4	67 — 69	- 1	4 3 4
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	80 — 85	..	5 5 11	Do. 8 1/2 % Deb. ..	100	3 1/2	3 1/2	84 — 91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	- 1	..	Do. 8 1/2 % Pref. ..	100	3 1/2	3 1/2	85 — 87	..	4 0 6
Do. Do. Deferred ..	100	..	..	8 — 10	..	..	Do. 3 1/2 % Con. Pref. ..	100	8 1/2	8 1/2	84 — 86	..	4 1 5
Do. Do. 6 % Cum. Pr'f. ..	100	..	..	90 1/2 — 92 1/2	- 1	..	Metropolitan District Ord. ..	100	Nil	..	38 1/2 — 39	+ 3	Nil
Do. 7 % Non-Cum. Pr'f. ..	100	..	..	36 — 39	- 2	..	Do. 6 % Deb. ..	100	6	6	144 — 146	..	4 2 2
Do. 5 % Perp. Deb. ..	100	5	5	96 — 99	..	5 1 0	Do. 4 % Deb. ..	100	4	4	96 — 98	..	4 1 8
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2	50 — 84	..	5 7 2	Do. 4 % Prior Lien ..	100	4	4	100 — 102	..	3 18 5
Central London Railway, Ord.	100	8	8	86 — 88	+ 4	8 8 2	Do. 4 1/2 % First Pref. ..	100	8 1/2	4 1/2	89 — 91	..	4 18 11
Do. Pref. ..	100	4	4	86 — 88	+ 1	4 10 11	Do. 8 1/2 % Gtd. ..	100	8 1/2	8 1/2	76 — 78	..	4 9 9
Do. Def. ..	100	2	2	86 — 88	+ 9	2 5 5	Metropolitan Elec. Trams, Ord.	1	5 1/2	5 1/2	37 — 38 1/2	..	5 13 6
Do. 4 % Deb. ..	100	4	4	101 — 100	+ 1	4 0 0	Do. Def. ..	1	Nil	..	37 — 38 1/2	..	Nil
City & South London, Ord.	100	1 1/2	1 1/2	42 — 43	+ 4 1/2	3 15 7	Do. 5 % Pref. ..	1	5	5	—	- 3 1/2	5 14 3
Do. 5 % Pref., 1891 ..	100	5	5	107 — 109	..	4 11 9	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99 — 101	..	4 9 1
Do. Do. 1896 ..	100	5	5	102 — 104	..	4 16 2	Do. 5 % Deb. ..	100	5	5	100 1/2 — 102 1/2	..	4 17 7
Do. Do. 1901 ..	100	5	5	101 — 108	..	4 17 1	Potteries, Ord. ..	1	2	..	33 — 34 1/2	..	..
Do. Do. 1903 ..	100	5	5	101 — 108	..	4 17 1	Do. 5 % Pref. ..	1	5	5	33 — 34 1/2	..	6 19 8
Do. 4 % Deb. ..	100	4	4	101 — 103	..	8 17 8	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	89 — 92	..	4 17 10
Dublin United Trams, 6 % Pref.	10	6	6	102 — 11 3/4	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6	..	3 — 7	..	6 17 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1 1/2 — 1 1/2	..	Nil	Do. 4 % Deb. ..	100	4	4	72 — 77	..	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2	3 — 3	..	..	Underground Elec. Railways	10	..	..	32 — 33	+ 1/2	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	73 — 78	..	5 15 5	Do. 4 1/2 % Bonds ..	100	4 1/2	4 1/2	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2	28 — 27 1/2	..	4 6 11	Do. 6 % Income ..	100	1	1 1/2	88 — 90	+ 5	..
Do. 4 % Deb. ..	100	4	4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil	..	1 — 2	..	Nil
Lancashire United, 5 % Deb. ..	100	5	5	82 — 84	..	5 19 1	Do. 6 % Pref. ..	5	Nil	..	2 1/2 — 3 1/2	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	80 — 84	- 1	5 7 2
London United Trams, 5 % Pref.	10	Nil	..	8 1/2 — 4	- 1 1/2	..							
Do. 4 % Deb. ..	100	4	4	75 — 78	- 1 1/2	5 2 7							

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2—5 1/2	..	5 3 6	La Plata Elec. Trms, Ord.	1	..	..	5—5 1/2	- 1/2	..
Do. 2nd Pref. ..	5	5	5 1/2	5 1/2—5 1/2	..	5 3 6	Do. Pref. ..	1	6	6	5 1/2—1	..	6 0 0
Do. 4 % Deb. ..	100	4	4	9 1/2—95	..	4 4 3	Lisbon Elec. Trams, Ord.	1	5 1/2	6 1/2	1—1 1/2	..	4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	102—104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	1—1 1/2	..	4 16 0
Do. 5 % Deb. ..	100	5	5	103—105	- 1/2	4 15 3	Do. 5 % Deb. ..	100	5	5	95—97	+1 1/2	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	102—105	..	4 15 8	Madras Elec. Tr. (1904), Deb.	100	5	5	96 1/2—98 1/2	+1	5 1 6
Bombay Elec. S. & Trams, Pref.	10	6	6	103—11 1/2	..	5 6 8	Manaos Trams & Lt., 1st Deb.	100	5	5	93—96	..	5 4 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98—100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	99 1/2—101 1/2	..	4 18 6
Do. 5 % 2nd Deb. ..	100	5	5	98—100	..	5 0 0	Mexico Trams Com.	\$100	7	7 1/2	119—121	..	5 15 8
Brisbane Trams Inv't., Ord.	5	8	8 1/2	98—9 1/2	+ 1/2	4 7 8	Do. Gen. Con. 5 % Bonds	..	5	5	96 1/2—98 1/2	- 1/2	5 1 6
Do. 5 % Pref. ..	5	5	5	47—5 1/2	..	4 15 3	Do. 6 % Bonds ..	100	6	6	100 1/2—102 1/2	..	5 17 1
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103	..	4 7 5	Para Elec. Rlys. & Lt., Ord.	5	10	10	6 1/2—7 1/2	..	7 0 4
B. Columbia Elec. Rly., Def.	100	8	8 1/2	135—140	+1	5 14 4	Do. 6 % Pref. ..	5	6	6	5—5 1/2	..	7 0 4
Do. Pref. Ord. ..	100	6	6	121—125	+3	4 2 9	Do. 5 % 1st Deb. ..	100	5	5	97 1/2—99 1/2	..	5 0 6
Do. 5 % Pref. ..	100	5	5	110—113	..	4 8 6	Perth (W.A.) Elec. Tr., Ord.	1	2 1/2	..	1 1/2—1 1/2	..	1 18 1
Do. 4 1/2 % 1st Mort. Deb.	40	4 1/2	4 1/2	100—103	..	4 7 5	Do. 5 % 1st Deb. ..	100	5	5	101—104	..	4 16 2
Do. 4 1/2 % Vancouver Deb.	100	4 1/2	4 1/2	103—105	..	4 5 9	Rangoon El. Tr. & Sup., Pref.	5	6	6	5—5 1/2	..	5 9 1
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102—104 xd	..	4 6 7	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	98—101	..	4 9 1
Calcutta Trams, Ord.	5	6	..	6—6 1/2	+ 1/2	4 16 0	Rio de Janeiro Trams	\$100	4 1/2	5 1/2	118 1/2—119 1/2	+ 1/2	4 3 6
Do. 5 % Pref. ..	5	5	5	47—5 1/2	..	4 16 5	Do. 1st Mort. 5 % Bonds	..	5	5	103—104	..	4 16 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99—102	..	4 8 3	Do. 5 % Mort. Bonds	100	5	5	99 1/2—100 1/2	..	4 19 9
Cape Electric Trams	1	Nil	2 1/2	..	..	..	Sao Paulo Tram, Lt. and P.	\$100	10	10 1/2	197 1/2—199 1/2 xd	..	5 0 3
City Buenos Aires Trams (1904)	5	5	5	5 1/2—5 1/2	..	4 6 0	Do. 5 % 1st Deb. ..	\$500	5	5	104—106	..	4 14 4
Do. 4 % Deb. ..	100	5	5	101—103	..	4 17 3	Singapore Trams, 5 % Deb.	100	5	5	81—84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100—103	..	4 17 1	Un. Elec. Trams Monte Video	5	6	7	5 1/2—5 1/2	..	6 1 9
Kaloorlie Elec. Trams ..	1	Nil	..	3 1/2—3 1/2	..	Nil	Do. 6 % Pref. ..	5	6	6	5 1/2—5 1/2	..	5 11 7
Do. 5 % A Deb. ..	100	5	5	91—94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	101—104	+1	4 16 2
Do. 6 % B Deb. ..	100	5	6 1/2	56—60	..	10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	103—105 xd	..	4 5 9

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	5—5 1/2	..	..	Dick, Kerr ..	1	5	..	27—34	..	5 8 1
Do. 6 % Pref. ..	1	9	6	2 1/2—2 1/2	..	7 2 2	Do. Pref. ..	1	6	6	3 1/2—1 1/2	..	5 9 9
Babcock & Wilcox ..	1	26	24 1/2	6 1/2—6 1/2	- 1/2	4 0 0	Do. Deb. ..	100	4 1/2	4 1/2	97—100	..	4 10 0
Do. Pref. ..	1	6	6	1 1/2—1 1/2	..	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	1 1/2—1 1/2	..	Nil
B.I. & Helsby Cables	5	10	10 1/2	6 1/2—7 1/2	..	6 17 11	Do. fully paid ..	5	Nil	..	1 1/2—2 1/2	..	..
Do. Pref. ..	5	6	6	5 1/2—6 1/2	..	4 16 0	Do. 4 % Deb. ..	100	4	4	71—75	..	5 6 8
Do. Deb. ..	100	4 1/2	4 1/2	101—103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	77—80	..	6 5 0
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	92—95	..	4 13 9	Electric Construction ..	2	Nil	2 1/2	3—1	..	..
British Westinghouse, Pref.	8	Nil	..	3—3	..	Nil	Do. Pref. ..	2	7	7	1 1/2—1 1/2	..	7 9 4
Do. Deb. ..	100	4	4	59—62	-1	6 9 1	Greenwood & Batley, Pref.	10	7	7	7 1/2—8 1/2	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	102—105	..	5 14 3	Do. Deb. ..	100	5	5	94—96	..	5 4 2
Browett, Lindley, Ord.	1	Nil	..	1/6—2/	..	Nil	General Electric, Pref.	10	5	5	9—9 1/2	..	5 5 3
Do. Pref. ..	1	Nil	..	5/—6/	..	Nil	Do. Deb. ..	100	4	4	87—92	..	4 7 0
Brush, Ord. ..	2	Nil	..	0—1	..	Nil	Henley's, Ord.	5	15	10 1/2	11 1/2—12 1/2 xd	- 1/2	6 2 6
Do. 7 % Pref. ..	2	Nil	..	0—1	..	Nil	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2—5 1/2	- 1/2	4 6 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	54—59	..	7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	104—106	- 1/2	4 4 11
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	87—92	..	10 14 4	India-Rubber, G. & T.	10	10	5	93—10 1/2	..	..
Callender's Cable ..	5	15	10 1/2	9 1/2—10 1/2	+ 1/2	7 2 10	Do. Pref. ..	10	5	5	94—10 1/2	..	4 17 7
Do. Pref. ..	5	5	5	5—5 1/2	..	4 15 3	Telegraph Construction ..	12	20	10 1/2	33—35	-1	6 15 2
Do. Deb. ..	100	4 1/2	4 1/2	98—100	- 1/2	4 10 0	Do. Deb. ..	100	4	4	99 1/2—101 1/2	..	4 9 0
Castner-Kellner ..	1	17 1/2	20	3 1/2—3 1/2	- 1/2	5 10 4	Willans & Robinson	1	Nil	..	1 1/2—1 1/2	..	Nil
Do. Deb. ..	100	4 1/2	4 1/2	105—109	..	4 10 7	Do. Pref. ..	5	Nil	..	1 1/2—1 1/2	..	Nil
Crompton & Co. ..	8	Nil	Nil	1—1	..	Nil	Do. Deb. ..	100	4	4	61—64	..	6 5 9
Do. Deb. ..	100	5	5	58—68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3 1/2 per cent., February 8th, 1912.



EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1912.

THE February returns of electrical exports and imports show that the former reached a total of £407,746, or some £60,000 less than in the preceding month, while the imports at £222,714, show a much smaller decrease in value, the January total being £228,245.

The re-exports total of £18,129 for the month was rather under the average obtaining in recent times.

During the month, machinery exports reached over £150,000 in value, while in the cable and telegraph export sections the totals were £67,229 and £56,926 respectively.

The importation of machinery and cables was practically the same

in extent as in the previous month, and the decreased import total for the month is traceable to decreased value of telegraphic and telephonic material entering this country.

During the month Japan was our best customer, with India, our Australian Colonies, Argentina, Canada, &c., also well represented. It is interesting to note that the last-named has appeared among the importers into this country during the past two months.

It will be noticed that the German contribution to the imports was rather higher than in January, and that a substantial increase in glow lamp imports is shown.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	£ 1,038	£ 393	£ 485	£ 15	£ 479	£ 84	£ 4,070	£ 843	£ 760	£ ...	£ 7,635	£ 9,550	£ 25,352
Germany ...	1,050	38	6	350	538	42	1,390	...	185	...	...	222	3,821
Netherlands, Java and Dutch Indies ...	683	874	102	41	18	21	1,290	100	37	...	50	173	3,389
Belgium ...	387	557	192	...	334	68	1,309	1,474	4	29	1,401	...	5,755
France ...	2,263	...	523	...	...	40	6,422	242	6	10	286	17,578	27,370
Portugal ...	56	42	166	122	...	103	176	...	80	...	54	...	799
Spain, Canary Isles and Spanish N. Africa...	209	...	176	...	19	219	1,320	181	...	...	8	1,097	3,229
Switzerland, Italy and Austria-Hungary ...	392	2,720	34	200	196	38	2,532	...	5	...	155	2,183	8,455
Greece, Bulgaria, Roumania and Turkey ...	245	107	57	58	...	...	536	...	174	...	33	453	1,663
Channel Isles, Gibraltar, Malta and Cyprus...	122	85	117	63	10	126	1,153	23	6	29	...	806	2,540
U.S.A., Philippines and Cuba ...	247	229	30	550	...	108	747	...	...	...	14	266	2,191
Canada and Newfoundland ...	682	2,533	111	3,097	80	3,504	11,231	2,193	123	...	30	1,053	24,637
British West Indies, British Honduras and Guiana ...	342	94	646	84	...	...	755	...	15	10	113	12	2,071
Mexico and Central America ...	73	163	62	...	...	...	304	...	32	...	...	21	655
Peru, Uruguay and Paraguay ...	89	...	65	103	195	...	404	...	169	...	7	30	1,062
Chile ...	1,063	131	136	1,291	25	121	2,398	166	1,649	62	151	123	7,316
Brazil ...	1,193	941	115	276	90	111	3,543	1,278	115	29	419	1,461	9,571
Argentina ...	3,491	7,296	533	679	269	999	4,718	5,328	3,993	212	2,649	1,522	31,689
Colombia, Venezuela and Bolivia ...	...	...	92	72	...	...	1,758	5	...	...	112	...	2,039
Egypt, Persia and N. Africa...	1,700	926	159	82	159	8	2,065	32	91	...	133	1,691	7,046
British West Africa ...	65	723	41	10	...	42	638	41	18	...	55	138	1,771
Rhodesia, O.R.C. and Transvaal ...	1,810	1,038	405	2,176	115	249	3,471	...	1,003	129	394	1,062	11,852
Cape of Good Hope ...	1,247	3,058	230	512	...	391	905	215	156	45	249	153	7,161
Natal ...	1,558	7,306	785	496	34	...	4,498	2,606	402	...	25	2	17,712
Zanzibar, Brit. E. Africa, Mauritius & Aden	98	21	73	75	...	35	32	...	3	...	79	120	536
Azores, Madeira and Portuguese Africa ...	55	1,152	46	26	...	72	601	...	21	...	18	213	2,204
French African Colonies and Madagascar ...	...	...	...	...	...	...	13	18	...	16	...	...	47
China and Siam ...	901	847	539	318	156	...	3,028	46	30	211	7	85	6,168
Japan and Korea ...	1,080	4,720	204	1,451	...	2,892	18,666	4,749	3,258	...	290	12,343	49,653
India ...	3,843	4,920	2,475	1,330	208	981	14,434	1,995	1,125	646	294	178	32,429
Ceylon ...	366	307	176	106	108	640	320	36	3	93	100	...	2,255
Straits Settlements and Fed. Malay States...	912	626	270	11	...	10	2,015	94	5	...	69	56	4,068
Hong Kong and Wei Hai Wei ...	790	144	79	216	...	14	617	75	19	...	36	721	2,711
West Australia ...	658	230	154	28	28	380	726	...	422	...	779	283	3,688
South Australia ...	569	1,146	494	243	...	380	1,019	...	...	...	869	160	4,880
Victoria ...	2,886	6,883	433	1,873	...	88	3,802	212	1,233	...	7,913	50	25,373
New South Wales ...	5,281	10,746	616	1,110	33	135	9,742	1,174	921	...	1,094	870	31,722
Queensland ...	277	2,490	59	27	...	272	4,074	4,450	41	...	486	...	12,176
Tasmania ...	...	704	5	115	...	...	...	...	...	...	...	...	824
New Zealand and Fiji Islands ...	1,856	3,039	712	524	33	406	10,159	260	214	...	412	2,251	19,866
Total, £	39,577	67,229	11,603	17,730	3,127	12,579	126,881	27,836	16,318	1,521	26,419	56,926	407,746

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	563	35	42	83	...	...	3,531	2,429	450	...	7,195	14,328
Germany ...	2,651	2,707	2,176	30,160	6,587	1,867	55,385	75	1,040	8,651	30,669	141,368
Holland ...	...	10	2	3,270	513	...	133	4	...	58	...	3,990
Belgium ...	481	1,007	26	10	70	165	761	...	367	417	6,457	9,761
France ...	132	...	983	846	2,232	875	192	1,000	2,154	3,051	908	12,373
Switzerland ...	1,516	1,156	...	40	...	117	1,461	...	...	29	...	4,319
Italy ...	...	412	...	...	...	...	1,426	...	...	...	3,237	5,075
Austria-Hungary ...	...	783	...	899	100	...	75	...	...	330	410	2,597
United States ...	2,509	50	486	2,578	4,145	461	6,885	10,048	171	369	608	28,310
Canada ...	102	...	50	...	136	...	...	...	...	...	...	288
Total, £	7,954	6,160	3,765	37,886	13,783	3,485	69,849	13,556	4,182	12,305	49,484	222,409

Additional imports : Spain, carbons, £305.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	7,889	669	...	3,473	304	...	4,879	...	308	607	...
----------------------------------------	-------	-----	-----	-------	-----	-----	-------	-----	-----	-----	-----

TOTAL EXPORTS : £407,746.

TOTAL RE-EXPORTS : £18,129.

TOTAL IMPORTS : £222,714.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.



## REVIEWS.

*Electric Traction for Railway Trains.* By E. P. BURCH. 1911. London: Hill Publishing Co. Price 21s. net.

From the designation of this volume, one would expect a treatise covering complete engineering details of the electrification of railway trains. The purchaser will, however, in this respect find himself disappointed, for, on perusal of the volume, he will find little reference to purely engineering questions; but as he progresses his disappointment will give way to pleasure at the mass of information collected together and put into a concise form on the operation and financial sides of electrical traction as applied to railway trains. A better title for the volume would perhaps have been "Capital and Operating Costs of Electric Railway Trains."

The early history of the application of electric power to propulsion is gone into in detail in Chapter I, but exception must be taken to the following paragraph under the heading of "Discarded Ideas in Electric Traction":—(1) Long-distance transmission of direct-current power: (2) Control of motor speeds by weakening the field.

With regard to (1) it should be stated that the "Thury" system has not received the consideration it deserves; now, however, a progressive concern in this country controls the system, and is installing it on an extensive railway system abroad. The direct-current high-voltage system is making enormous headway, and at the time of writing it is announced that the Westinghouse Co. will electrify 150 miles of railway with direct current at 1,500 volts for the Piedmont Traction Co.

With regard to (2), the shunting of the fields for high-speed operation, both on the series and parallel positions, is again coming to the fore; in interpole motors no trouble is experienced from bad commutation. Messrs. Siemens give with one of their railway motors an extra running position on the series connections with the field weakened 50 per cent., and two extra running positions on parallel connections, viz., 33 per cent. and 50 per cent. weakened field.

American steam locomotives are described and discussed in Chapter II. There is little doubt that "nosing," caused by the large outside cylinders of these monsters, is very detrimental to the track, causing loosening of spikes and consequent spreading of rails. It is notable, however, that the original New York Central and other electric locomotives have not been altogether free from this defect.

Firebrick arches, which are quite common on English locomotives, seem to be the exception in American. The 2-8-2 Illinois "Mikado" monsters just built are without arches.

Chapter III describes in a very clear way the gains which take place when electric traction is substituted for steam haulage. These gains are not theoretical, but actual, and are borne out by figures supplied by officers of existing electrified lines. There is no doubt that the steam locomotive has reached its limit, and with the heavier trains and higher speeds called for by present-day practice, only one conclusion can be come to—viz., that electric haulage will supersede steam.

Under the heading "Trunk Lines in Freight Service," we are told that expenses per train-mile amount to from 50 to 60 cents, exclusive of fixed charges, office and general expenses, so that on a 100-mile division with 10 trains per day, the yearly train-miles are 3,650,000, and expenses \$1,825,000. These figures should read 365,000 train-miles, and expenses \$182,500. The saving on the electric locomotive, owing to the power being transmitted to the axles with minimum friction, is, in the case of the locomotive, probably more apparent than real. Take, for instance, the Oerlikon Bernese Alps locomotive; the armature shaft is geared to the jack shaft, the jack shaft driving on to the leading and trailing wheels. Again, the weight of the rods is neutralised by counter-balances, as in the steam locomotive, so that the electric locomotive of this type cannot be said to be very much better as regards track pounding than its rival. It will, no doubt, come as a shock to many who regard electricity as only in its infancy to read that on the New York, New Haven and Hartford Railroad the average

mileage per detention is some two or three times better than with steam locomotives, while on the Manhattan Elevated the delays to traffic are 40 per cent. less with electric power than when steam power was used. The New York Central records for 1909 give an average detention of 12 seconds per train, a record unrivalled in the history of railways.

The systems available for electric traction are briefly discussed in Chapter IV. It should be noted, however, that 25-cycle rotary converters are now designed with 1,200 volts across their commutators, so that it is no longer necessary to use two converters in series. Moreover, railway motors are designed for 2,000 volts across their commutators, and tests on the manufacturers' private lines indicate that no trouble should be experienced from this voltage, either to the motors or equipment. As is pointed out, the best system is that which is adapted to the electrification of an entire railway. This question of the system to be adopted is one of vital importance, and therefore the question must be thoroughly investigated by unbiased and level-headed men. The time is drawing nearer and nearer when electrification will have to be seriously considered by all main roads, and as through running is most essential, it is of paramount importance that the system adopted shall be universally applicable to all the railways in the country. The battle of the gauges must not be forgotten.

Chapter 5 deals with the selection of motors for railway service. The advantages and disadvantages of direct-current series-wound, three-phase, and single-phase motors are discussed. It is worth while repeating the words of Dr. Steinmetz in 1908 in the discussion on the electrification of the New York, New Haven Road, viz.:—"This, I believe, establishes the single-phase alternating-current motor as one of the pieces of apparatus by which the future electrification of our country's railway system will be accomplished."

In discussing forced draught for the cooling of motors, we are told that the rating is increased by not more than 10 per cent. during the first hour's run; yet the Pennsylvania Railroad motors have a one-hour rating of 215 H.P., but this is raised by means of forced draught to about 250 H.P., which is an increase of 16 per cent. Surely there is something wrong in the figures given for the New Haven freight locomotive motors, where the continuous to the one-hour rating is given as 89 per cent. In speaking of motor suspensions, it is stated that "Nose suspension is the simplest and it has superseded all others," which appears to contradict the statement that "Nose suspension is an unsatisfactory plan." In classifying speed-torque characteristics of motors, the following sentence occurs: "Torque of direct-current motors is proportional to the number of lines of force threading the armature, the number of turns or conductors on the armature; the current in the armature. It is independent of the motor voltage. The lever arm extends through the crank, gear and drivers." The last sentence appears to be somewhat misplaced, as it has nothing whatever to do with the speed-torque characteristics of the motor.

Chapter VI confines itself to motor-car trains: descriptions of practically all trains operating on this system are reviewed, and tables giving the cost per car-mile, weight of trains, &c., are profusely provided. The characteristics of electric locomotives are ably discussed in Chapter VII. Electric locomotives are stated to be simply energy collecting machines; a better name would have been energy-converting machines, as opposed to the steam loco. being an energy-generating machine. Mr. J. J. Hill's words regarding steam locomotives before the Kansas City Commercial Club are worth repeating:—"The men in charge of the railways of this country have struggled for 15 years with the greatest problem of our times—how to move a load whose weight increases 10 per cent. a year with a steam locomotive whose power increases but 2½ per cent. a year. The limit of safe, speedy and reasonable service with existing facilities has been reached." In the table comparing the weight of motive power with the weight of the train for steam and electric trains, the weight of the motive power for a New York Central eight-coach motor train is given as 68.7 per cent. Taking the train as previously given, made up of five motor and three coaches, the motor



coach weighing 53 tons and the ordinary coach 41 tons, the weight of motive power to total weight is about 16·5 per cent., which compares favourably with the figures of 24·5 and 19·5 per cent. for six and eight-coach trains hauled by locomotives. One can quite believe that the energy stored up in the rotating armatures of some of the locomotives requires more powerful brakes, larger brake shoes and ties; take, for instance, the Pennsylvania locomotive. The armatures are 56 in. in diameter, and at 60 M.P.H., the armature runs at 280 R.P.M., and weighs nearly 11,000 lb. If the locomotive makes frequent stops, would not some form of friction clutch be worth considering, more especially in the case of single-phase motors, since, in all probability, the armature would not come to rest if the stop were short, and, consequently, the transformer action, which is a maximum at starting, would be partially eliminated? A description of practically all direct-current locomotives is given in Chapter VIII. The table giving the modifications in the New York Central locomotive design refers to these as being either of the 2-6-2 or the 4-6-4 class. The lithograph, however, shows them to be of the 2-8-2 and 4-8-4 class.

Chapter IX describes all the three-phase locomotives which have been built. These are practically all Swiss or Italian. The only road using three-phase motors in the United States of America is the Great Northern, for the Cascade Tunnel. In the description of the Simplon Tunnel locos. it is stated that the absolute torque is raised by regulating the voltage impressed on the rotor. This should read "on the stator."

Chapter X covers a description of all single-phase locomotives in operation, a large portion of the chapter dealing with the New Haven Road. The reference to the lithograph of the Oranienburg 1906 locomotive gives fig. 196; it should be 156.

The power required for trains is discussed in an elementary way in Chapter XI. The expression for a 1,000-ton train at the summit of a 4,000-ft. grade running down in two hours neglecting friction is given as  $8 \times 10^9/550/7,200$ . This should be  $8 \times 10^9/550 \times 7,200 = 2,000$  H.P. Armstrong's formula for the tractive resistance is given as—

$$\frac{5 \cdot 0}{\sqrt{T}} + 0 \cdot 3 v + \left( \frac{0 \cdot 002 A v^2}{T} \right) \left( 1 + \frac{N - 1}{10} \right).$$

Surely the first term should be  $50/\sqrt{T}$ , and some limit must be given to the term. The tables giving the average input with varying stops per mile are incomplete, as nothing is given regarding the schedule speed, maximum speed, length of stop, &c. In the example under the heading "Regeneration of Energy," a 1,200-ton train is specified, but only a 1,000-ton train is figured on. It is stated that the Swiss Federal Railway Commission agreed on the basis of a tractive resistance in express service of 11 to 12·4 lb. per 2,000 tons. This should read 2,000 lb.

Chapter XII treats of transmission and contact lines, but only in a very meagre way. This important section deserves more than the space allocated to it. Modification is necessary to the statement that Lord Kelvin's law governs transmissions; in many cases the governing factor is the voltage drop, or, in other words, the  $I^2R$  losses are well within the limit imposed by the law, or *vice versa*. In view of what is stated regarding the third rail and snow in mountain districts, it is noteworthy to remark that during the heavy winter of 1909-1910, the Spokane and Inland Empire 11,000-volt line was the only one in the district which maintained its normal schedule.

Chapter XIII is devoted to power plants for railway train service, and deals with the subject only in a general way. Under the heading of load factor for railway loads, the power factor is spoken of in error. The statement that it is obviously cheaper to transmit the energy from coal by wires than to transport the coal itself on freight cars needs considerable qualification; in fact, generally speaking, the reverse is the case. The cases cited are concerned with peat and lignite fuels of comparatively low calorific value, which is a problem of a different aspect entirely.

The power house operating costs for the Twin City Rapid Transit Co. are given in one table at ·66 cent, and on the opposite page at ·62 cent, a difference of some 6½ per cent.

Chapter XIV details Procedure in Railroad Electrification, and covers such points as essential considerations, cost of electrification, &c., while the volume concludes with a chapter on work done in railroad electrification.

The volume is of American origin, and consequently deals chiefly with American conditions. These conditions differ, in some cases, considerably from those existing in this country; but, at the same time, a careful perusal of the volume will be of great interest to the English engineer in showing the enormous amount of work that has been done on the other side of the Atlantic, and in indicating the energetic way in which the various problems have been attacked and pushed to successful conclusions. The book being American, the new spelling is only to be expected. It is curious to note, however, that what little is gained in space by this spelling is lost several times over by the reiteration and want of conciseness in explanation. The volume abounds in minor errors, which shows great carelessness in the reading of the proofs. The following are a few instances:—Atkinson for Acheson; Manhattan for Manhatta; Odgen for Ogden; derceased for decreased; subrbana for suburban; techical for technical; singe for single; whoels for wheels. The name of Mr. Aspinall, of the L. and Y. Railway, is spelt throughout the book as Aspinwall, while Mr. Slichter's name is spelt Slieter. Some of the wording is very lax; for example: "The speed of rotation depends upon the frequency of the cycles of the generator, which is practically constant. When the motor is rotating at maximum speed it is at synchronous speed." In spite of the blemishes mentioned, the volume is certainly one that should be in the hands of all who are interested in electric traction, more especially of those whose duty it is to advise their boards on the commercial and financial side of the problem. The book is well printed in good clear type, and is provided with an excellent index. It contains some 600 pages, and is very heavy, making it very tiring to hold in a convenient position for reading.—S. W.

**Electric Smelting of Tin.**—The experiments on a large scale in the electric smelting of tin carried out in Cornwall during the past summer by Mr. J. Harden, for the Gröndal Kjellin Co., Ltd., of London, are the complement of the researches of Mr. J. F. Maclaren, initiated in London in 1909, and later of Dr. Walmsley, at the Northampton Institute. Although they used inadequate and extemporised appliances, the results of the experiments of these two gentlemen sufficiently attested the technical and economic feasibility of electric smelting, which has since been abundantly confirmed by Mr. Harden's more extended operations. The novel lines of the blast furnace used have not been divulged; the only detail which has transpired is that it is fitted with three carbon electrodes, 203 × 203 mm. and 1·5 m. in length, with corresponding holders and regulating arrangements. The results of the process are briefly as follows:—The yield of pure tin is with the electric furnace continuous from the beginning; no skilled labour is required, as with the ordinary process; the creation of "hard slag" is avoided, and the output is greater—up to as much, in some cases, as 99·75 per cent. Experiments begun on a small scale, and gradually enlarged, showed that with a purity standard of 96 per cent. of tin the weekly average consumption of energy was about 2,200 kw.-hours, and in single instances only 1,700 kw.-hours, per ton of tin, which might even be lessened, by special arrangements, to 1,400 kw.-hours. The current used was three-phase 50 cycles at 650-670 volts, stepped down to 30, 40, 50 and 60 volts.—E.T.Z.

**Electrical Method of Cultivation.**—A British immigrant to Canada who is taking up a farm at Chatham, Ont., proposes to use electricity for the cultivation of his produce. The electrical system which he is going to put into operation is already producing splendid returns, he says, in the South of England and in France. Briefly, it is to heat the soil by means of underground wires. These, carrying electricity and generating heat, are laid at 5 ft. apart and 1 ft. underground, 25 miles of wire being required for 20 acres of ground. The heat thus diffused is carefully regulated, and its effect is to force an astonishing growth of vegetables and fruit. It is far more effective for forcing, he declares, than the glass-house system, and invariably enables garden produce to be ready for the market from one to three weeks earlier than by any other means, ensuring good prices. The cost of the electric power is small, and in Ontario, in the regions covered by the service of the Hydro-Electric Commission, it is, no doubt, smaller than in most places.—*Glasgow Daily Herald*.

**Darwen Electric Lighting.**—The L.G.B. has sanctioned the application of the Corporation to borrow money for electrical extensions. The application was for £7,600, but the loan sanctioned is only £6,500.



PROCEEDINGS OF INSTITUTIONS.

Tariffs for Electrical Energy.  
By W. W. LACKIE, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Edinburgh, February 13th; Manchester, February 27th; and London, March 7th, 1912.)

THE accounts of electrical undertakings are frequently adversely criticised by non-technical financial journals which do not acknowledge the principles underlying the maximum-demand system of charging. For this reason I hero put forward the accounts of two consumers, A and B, under three differing sets of conditions, viz. :—

- 1. With an equal number of units used by each.
  - 2. With an equal annual bill paid by each.
  - 3. With an equal maximum demand made by each.
- A takes a supply for 200 hours per annum, and B takes a supply for 2,000 hours per annum, the rate of charge being 730 hours' use of the maximum-demand quantity at 3½d. per unit, and all energy in excess of this at ¾d. per unit.
- It is clear from the figures here given that to charge A and B the same average rate would be unfair. It is difficult to persuade the consumer who takes energy for less than one hour per day and who pays 3½d. per unit, that he is not being overcharged. He

—	Units.	Plant required.	Capital cost.	Amount of account.	Average price.	Interest, sinking fund, and depreciation, at 8 per cent.
I. EQUAL UNITS.						
A	1,460	H.P. 10	£ 400	£ s. d. 21 5 10	3½	32 0 0
B	1,460	1	40	10 16 8	1·78	3 6 0
Minimum loss on A ... .. £10 14 2						
Gain on B ... .. 7 10 0						
II. EQUAL BILLS.						
A	686	10	400	10 0 0	3½	32 0 0
B	1,194	1	40	10 0 0	2·01	3 6 0
Loss on A ... .. £22 0 0						
Gain on B ... .. 6 14 0						
III. EQUAL MAXIMUM DEMANDS						
A	1,500	10	400	21 17 6	3½	32 0 0
B	15,000	10	400	109 12 3	1·75	32 0 0
Loss on A ... .. £10 2 6						
Gain on B ... .. 77 12 3						

knows that the average rate received by the supply authority is, say, 1½d. per unit, and he imagines that he is taxed to contribute to this result. This, of course, is a fallacy. Were it not for the consumer who gets his power units at 1·7d. per unit, the charge would need to be increased from 3½d. to a much higher figure.

The cost per unit of supplying electrical energy depends—

- 1. Upon the maximum rate at which the supply is demanded.
- 2. Upon the number of Board of Trade units taken.
- 3. Upon the time of day at which the demand is made.
- 4. Upon whether the supply is taken regularly over the year, or in the winter months only, for a few hours a day, and
- 5. On the number of consumers being supplied.

The city about which I know most has many huge tenement blocks of offices with load factors of 5 or 6 per cent., but there are also other offices having large basements with a load factor of over 20 per cent. The probability is that the only extra capital expenditure entailed in supplying consumers who take a supply for less than one hour per day is expenditure on plant. The consumer who uses the supply for only 200 hours per annum should not be charged the same rate of depreciation as those who use it for a longer time. Electric lighting undertakings have suffered in the past not so much from plant being depreciated as from plant becoming antiquated. Interest and sinking fund must be charged on the basis of the maximum demand.

If, therefore, those 1-hour consumers are debited with only half the capital expenditure per KW. (*i.e.*, on plant only), and have a reduced rate of depreciation allocated against them, they will not present such a deplorable balance-sheet.

The tabulation annexed to this paper shows the necessity for the maximum-demand system of charging in large cities, and it further shows where a reduction may be made with any surplus. There is no necessity for supplying electrical energy for less than 3d. per unit for lighting in a town or district where the price of gas is 2s. per 1,000 cb. ft. or more, even though such lighting is used only between 7 p.m. and 5 a.m.

Few persons who have looked closely into the subject will say that the maximum-demand system of charging is unsound. Several prominent engineers have stated that it does not take into account the actual time of day when the maximum demand is made. This is not accurate. The amount of plant to be installed to supply any given total number of consumers connected is decreased in proportion to the extent to which the maximum demands of these consumers do not occur at the same 'ime; and this means that the standing charges, represented by interest and depreciation, are

reduced; so that the maximum-demand system takes cognisance of the time when the maximum demands occur by reducing the charges to all the consumers. The system is equitable and fair because of this very fact. Any flat rate, or even an approach to a flat rate, must have as its basis the maximum-demand system of charging if it is to be equitable. For instance, against a rate of 3½d. per unit for lighting, a charge of 1½d. per unit for power is fair, because the power supply will be used for at least three times as many hours per day or per annum as the lighting supply is used.

In the table on p. 523 an analysis is given of over 20,000 consumers' accounts. In this an extreme view has been taken, *i.e.*, all charges except coal and carting (for the removal of ashes) have been divided among the consumers in proportion to their maximum demand, and coal and carting have been taken as just under one-fifth of a penny per unit. This was the average cost for 1910 in Glasgow.

This analysis shows that it is necessary to get a revenue of £9 per KW. of maximum demand, including coal and carting. This is made up of £7 17s. per KW. of standing charges, and 0·191d. per unit for coal and carting, the average cost for coal and for carting being £1 3s. per KW. A figure to be noted is that the plant required is stated at 27·475 KW., whereas the maximum load on the station was 23,524 KW., or 16 per cent. less KW. than the summation of the individual maximum demands of the consumers. The difference between these two figures is of course accounted for by the diversity factor amongst the maximum demands of the consumers. Theatres, halls, and schools are seldom lit between the hours of 3.30 and 6 p.m., and the maximum demand in residential districts is an hour later than the industrial or business maximum demand. The opposite extreme to that given in the table annexed is to make the running cost ¾d. per unit, and this would enable the standing charges to be reduced to £4 10s. per KW. In all business premises maximum-demand indicators are erected except where it is known that the supply will not be used for anything like 2 hours per day. In theatres and large works recording ammeters are used to get a fair maximum demand, but in domestic premises the maximum-demand quantity has been arrived at by a maximum-demand indicator or recording ammeter connected in the feeder or main supplying a hundred or more tenement consumers at one time. The maximum demand against domestic consumers given in the analysis, therefore, already allows for a diversity factor. It is also agreed that if the consumers who take their supply for one hour and under were not connected, some of the standing charges, at present allocated against them, would have to be made up by the other consumers. The analysis shows that any of the following rates would give the same financial result :—

Per kw. per annum.	Per unit.
£7 17 0	0·191d.
7 8 0	0·250d.
6 0 0	0·500d.
4 10 0	0·750d.
3 0 0	1·000d.

Increasing the running charges from 0·19d. to 1·0d. per unit is out of the question, as our total generation, distribution, and management charges were under 0·5d. per unit. It is of interest to note that the actual cost of the additional units shown as an increase over each previous year during the past 10 years is just under 1d. per unit.

As I believe the supply of electrical energy to domestic consumers is of vital importance in all large cities which are at present faced with the smoke problem, and are striving to bring about a purer atmosphere, I should like to draw attention to what has been done in Glasgow to encourage the use of electricity by domestic consumers for purposes other than lighting.

The rates of charge for lighting purposes in Glasgow up till 1901 for business premises and for domestic consumers were 6d. per unit for the first 365 hours' use of the maximum demand, and 1d. per unit for all further quantities. At that date an analysis of the accounts of all our consumers showed that the only class which used the supply for the same length of time throughout the year were the domestic consumers, it being found that they used their supply for fully two hours per day or 730 hours per annum. It therefore became a simple matter to convert the charge of 6d. per unit for the first 365 hours' use, and 1d. thereafter, into a flat rate of 3½d. per unit. This was done. The domestic flat rate has since been lowered to 3d. per unit for lighting.

The return of the accounts now given on the annexed table shows that the domestic consumers use their supply for nearly three hours per day. Since 1901 a large number of smaller houses and tenement flats have been connected to our mains, and such houses have a better load factor than large private residences, for the reason probably that they are unable to take full advantage of the hours of daylight. It is probable also that the average number of hours per day has been increased as the smaller domestic consumer has realised that electric lighting is not prohibitive with regard to cost, and therefore that there is no need for any undue economy in the use of it.

With the problem of black smoke and atmospheric pollution in one's mind, it was incumbent to devise a scheme which would enable the domestic consumer to get a supply of electricity for heating, cooking, &c., at a lower rate, without being put to the expense of separate wiring, with a separate meter, &c. Having ascertained that domestic consumers' premises, similarly situated, and of the same size, were practically consistent from month to month, in the nature and extent of their consumption for lighting, it was a simple matter to devise an adaptation of the maximum-demand system which would meet their case. As their average use of the lighting maximum demand was 800 hours per annum,



and the charge was 3d. per unit, it was suggested that all current consumed over this quantity should be charged at 1d. per unit. In order to enable the consumers to realise that they were getting their extra units at the lower rate, a proportionate number of lighting units was allocated to each of the two-monthly bills, and whatever number of units might be consumed over this minimum in each two months were to be charged at 1d. per unit. The division of the 800 hours' use of the maximum demand over the six periods into which the year is divided was as follows:—

					Hours' use of maximum demand at 8d.
June-July	...	...	...	...	40
August-September	...	...	...	...	60
October-November	...	...	...	...	200
December-January	...	...	...	...	300
February-March	...	...	...	...	160
April-May	...	...	...	...	40
Total					800

All further units at 1d.

The number of hours given corresponds to the hours of darkness from sundown to 10 p.m. each two months, and it was found that the domestic consumers' accounts also gave approximately this result.

The average account of the domestic consumers is shown to be £2 16s. per annum.

In formulating this system of charging, the data allow for the domestic consumers being absent from the city for one or two months per annum. The fact that each two-monthly bill shows its own proportion of 1d. units tends to encourage domestic consumers to use radiators, irons, vacuum-cleaners, &c., without hesitation. This is a case where expediency in charging is preferable to rigid adherence to a fixed principle.

This system of charging for further units at 1d. to domestic consumers has now been in use for one year. Over 500 consumers have installed electrical apparatus of some kind. One hundred of these domestic consumers' accounts, examined at random in different parts of the city, show an increased consumption of 21 per cent. as compared with the corresponding period of the previous year. This represents 7 per cent. increased revenue. If the domestic rate for lighting had simply been reduced, the probability is that the bills examined would have been less, instead of greater, than the corresponding bills for the previous year.

If different persons, in similar houses, have, in a few cases, a different consumption, that is not a sufficient reason for stopping a movement which will simplify the tariff for the general supply. The tariff may make those odd persons, whose bills seem unduly

3d., if there is any known reason, such as abnormal increase or decrease in the lighting demand. It is not difficult to see from a recording ammeter chart what energy is used for lighting and what energy is used for "other purposes." This method has been adopted in fixing the lighting demand in the larger houses; it has also been used to ascertain the maximum demand in engineering works, where the consumer, having previously generated his own current, has not the wiring for lighting and for power on separate circuits.

Date of period.	1 R & K.		2 R & K.		3 R & K.		4 R & K.		5 R & K.		6 R & K.	
	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.
June-July	2	0 6	4	1 0	6	1 6	10	2 6	12	3 0	13	3 3
Aug.-Sept.	4	1 0	6	1 6	10	2 6	15	3 9	17	4 3	20	5 0
Oct.-Nov.	13	3 3	18	4 6	30	7 6	50	12 6	57	14 3	65	16 3
Dec.-Jan.	19	4 9	24	6 0	44	11 0	75	18 9	86	21 6	97	21 7
Feb.-March	10	2 6	14	3 6	24	6 0	40	10 0	46	11 6	52	13 0
April-May	2	0 6	4	1 0	6	1 6	10	2 6	12	3 0	13	3 3
50		12 6	70	17 6	120	30 0	200	50 0	330	57 6	400	65 0

R = room. K = kitchen. U = units.

It is easy to see from a recording ammeter chart, even in the winter months, what the lighting demand is, and this can be confirmed by comparing the winter chart with the summer chart. The rate of charge or maximum-demand quantity has been increased proportionately to make up for the lighting demand, and all energy is charged at power rates, or a fixed annual sum is charged to cover the difference between lighting and power rates.

To abide rigorously by the Hopkinson method, which means charging, say, £5 per kW. plus 3d. per unit, has disadvantages. It was tried in Glasgow and consumers objected to it. Their bills were very much the same the whole year through, and we had serious complaints from people who got in a bill for electricity either when their house was shut up or when they were not consuming any current. The objections now stated to the Hopkinson system and other systems which are based on dividing the standing charges equally over the year, do not apply to power consumers' accounts, as their consumption is, as a rule, regular and consistent from month to month.

As already indicated, each two-monthly period is allowed to stand by itself; and if a domestic consumer is absent from his house during the whole of any one two-monthly period, he is not asked to make up the units allocated against that period. On the average, the quantities payable at 3d. per unit for the different houses are shown in the accompanying table (above).

The following table gives the cost of generation, distribution, &c., during 1910-11; the capital outlay involved and return thereon, by different classes of consumers, based upon the units sold:—

Class of consumer.	Number of meters.	Units consumed as recorded by meter.	Price per unit.	Average price received per unit in pence.	Average use per day of max. demand in hours.	Amount of plant required in kW.	Standing charges on proportion of plant ex. depn. per unit in pence.	Total cost including depn. per unit in pence.	Profit or loss per unit in pence.	Capital outlay.	Gross return per cent. on capital outlay.	Net profit or loss per cent. on capital outlay.
1 hour and under	3,716	778,538	3½d.	3'500	566	4,297	8'316	10'649	-7'149	£294,548	3'854	-7'874
1 hour and under 2 hours	2,962	2,504,041	3½d. and 3d.	3'497	1'495	4,735	2'845	3'774	-2'277	324,572	11'244	-888
2 hours and under 3 hours	1,661	2,187,929	Do.	3'002	2'442	2,339	1'611	2'217	+7'855	160,332	17'073	+4'468
3 " " 4 "	791	1,476,868	Do.	2'335	3'468	1,194	1'218	1'723	+6'12	81,846	17'552	+4'596
4 " " 5 "	348	1,203,799	Do.	1'975	4'486	734	919	1'346	+6'29	50,314	19'689	+6'265
5 hours and over	396	2,484,040	Do.	1'571	6'676	1,042	632	986	+5'85	71,426	22'767	+8'480
Domestic	6,548	1,466,381	3d.	2'995	2'784	1,443	1'483	2'056	+9'39	98,914	18'500	+5'801
Churches	347	191,082	3d.	2'991	1'272	456	3'596	4'712	-1'721	31,258	7'618	-438
Theatres, halls, & schools	308	1,246,228	3½d. and 3d.	2'579	1'724	2,132	2'573	3'432	-8'53	146,143	9'162	-3'035
Power and heating	3,519	23,809,939	1½d. to 3d.; 1d.	888	8'299	7,860	497	816	+7'02	538,783	16'358	+1'320
Special agreements	124	1,714,695	1½d.	1'512	5'274	876	770	1'159	+3'53	60,047	17'987	+4'195
Total meter consumption	20,720	39,063,540	—	1'528	4'068	27,108	1'046	1'506	-1'95 +2'18	£1,858,183	13'387	-1'716 +1'909

Cost of coal and carting in each case = 191d. per unit.

low, light up their premises to a larger extent than they otherwise would have done; whereas those whose bills seem higher than the average, can either economise or, alternatively, they may be entitled to have their extra units at a lower rate.

It is now admitted that the domestic chimney is mainly responsible for atmospheric pollution. Municipalities must, therefore, as a branch of their activities in connection with the general movement towards public health, recognise the importance of nursing their electrical undertakings by encouraging the use of electrical energy for all domestic purposes. I submit that it would be an enlightened policy on the part of the local authorities and of the nation to encourage the use of electrical energy for domestic purposes by educating the public regarding the possibilities of electrical apparatus, and giving energy at the lowest possible rate. To this end the recently developed policy of taking the surplus revenue from electrical undertakings for the reduction of city rates should be condemned and at once abandoned; and not only so, but I think electricity supply concerns, both municipal and private, might reasonably ask to be relieved from paying rates, if it could be shown that, to this extent, they were lowering their prices to domestic consumers.

The system of charging now advocated leaves it quite open either to add to or deduct from the number of units chargeable at

DISCUSSION AT MANCHESTER.

Mr. S. J. WATSON said that the large number of tariffs in use up and down the country was extraordinary. This condition of affairs was not good for the industry, and there should be some attempt to reduce the tariffs to a common basis which would be clearly understood by everybody who used an electrical supply. The figures which the author gave showed the enormous differences which existed in the charge per unit to different classes of consumers. Taking the one-hour and under consumers, the average amount charged per kW. was about £2 3s., whilst for five hours the average amount charged exceeded £16 per kW. Obviously there was an enormous loss on one or an enormous gain on the other. The author stated that the average account of domestic consumers was £2 16s. per annum. The question of domestic supplies was one of the most important, and he doubted whether with such a small income per service the supply could be profitably given, not on account of the generating costs but on account of the distributing cost including capital charges on mains, repairs, meter reading and accounts. They should do their utmost to encourage the domestic use of sundry apparatus to increase the revenue per service from small users. The existing systems of charging on flat rates per unit made it difficult to give reductions by comparatively small increments. At



present if it was desired to reduce from 3d. per unit, it was necessary to jump to 2½d. or 2¼d., which was equal to 9 per cent. or 17 per cent. If the flat rates were maintained, he would suggest that the rate should be 10 units for 2s. 6d., and the reduction could then be made in penny stages.

MR. MILES WALKER could not understand why to-day, within 10 miles of Manchester, they should be paying 6d. per unit. Perhaps if they lived in Glasgow, they would be paying 3d. and 1d. per unit after so many years. He thought that where large power users were considered, a good deal of difference should be made in the charges for good and bad power factors. When a consumer could see that by using a better power factor he would be charged a better rate, they would get better power factors.

MR. ALDERMAN WALKER said one of the principal objects to be borne in mind in obtaining an increased use of domestic apparatus was that no separate wiring should be required. In trying to get lighting consumers now on the Manchester system to install radiators, &c., immediately they were told that it was necessary to incur extra capital expenditure, they would not listen any further and refused to adopt electric aids in their domestic economy, yet they were the type of consumer who would be the most advantageous to the department if they could be obtained.

MR. COOPER said the author had stated there was no necessity for additional wiring for radiators. That might be so if the installations were originally wired for carbon lamps. Mr. Watson mentioned the difficulty of reducing the price of electricity by even ½d. as being too big a jump. He thought the best plan would be to work by a system of discounts, say, 2½, 5, or 10 per cent. for prompt payment and at the same time get the money in sooner.

MR. C. C. AITCHISON agreed that the question of power factor was a serious one for station engineers. Double wiring was a thing to get rid of if it could possibly be done, but it was very necessary to see that additional load by the connection of radiators, &c., was not growing out of all proportion to the original wiring. He agreed with the suggestion Mr. Watson made with regard to charging in larger units. He did not agree with discounts based on the number of units consumed; discounts on the amount of the bill were better. He would be pleased to see all his consumers gradually adopt the flat rate.

MR. H. T. WILKINSON thought the author had done quite right in devising so simple a tariff. He had often wondered why, in the case of flats, blocks of small houses, offices, &c., a flickering device should not be installed in each consumers' premises, and a charge made on the demand at which the flicker operated without any unit charge; it would practically amount to a rate such as was charged for water. This system would considerably reduce the capital cost, first, by keeping down the maximum demand on the station, and secondly, in the consumers' premises by eliminating the meter, except one for the whole building. It would also reduce the running expenses in reading meters and maintaining them, which Mr. Lackie mentioned amounted to 12½ per cent. of the cost of supply to the domestic consumer. They would also get a very good load factor and save work in the accounts department, as the accounts could be made out for some time ahead quite accurately, instead of there being a rush at the end of each quarter. The scheme would not be feasible where heating and cooking apparatus was installed, and separate circuits would have to be provided. In the case of large power users it was a question of getting the best price they could. He had known cases where consumers had been charged quite in their own language as it were—such as a weaving shed at so much per loom per annum. In a certain case where a consumer had ridiculed the price of 0.9d. per unit, a much better price was obtained by an annual charge based on the horse-power hours which he was firmly convinced would be consumed on suction gas at 0.1d. each.

MR. W. CRAMP said there was the question of limit of supply area. It seemed rather unfair that a consumer who was 5 miles from a centre of supply should get a rate like that of the man in the centre of the city. In Mr. Lackie's table special agreements were mentioned for a consumption of 1,714,693 units at 1½d. per unit. It was quite clear from this that the large consumer was not in Glasgow encouraged to the same extent as in some municipalities. When both electricity and gas were obtainable at reasonable prices for domestic purposes, the amount of smoke in the neighbourhood would be much reduced, and it was high time that Manchester made a move in this direction. Mr. Lackie had apparently discovered the constancy of load factor for domestic purposes; it was on this that his tariff was based. He agreed entirely that separate wiring for power and light must be abandoned.

MR. LACKIE, in the course of his reply, said that while it was true that certain consumers gave a return of only £2 16s. per KW., and others paid £12 per KW. The consumer who paid £12 and got his energy at 1½d. per unit, did not complain of excessive rates; it was the consumer who gave the smaller return, and was charged at 3½d. per unit, who found fault with their methods of charging. Alternatively to reducing the rate per unit from 3½d. to 3¼d., or charging a rate per 10 units, they might reduce the number of hours' use from 730 hours' use at 3½d. to some such figure as 700 or 600. It was quite true that the consumer having a bad power factor should pay a higher rate per unit, but if it was difficult to explain the meaning of the load factor to the ordinary customer, it would be far more difficult to acquaint him with the significance of the power factor. The Glasgow Corporation had never taken profits from the Electricity Department for the relief of the rates. It was obviously impossible to have a fixed price for electrical energy all over the country when one found coal varying in price from 4s. to 24s. per ton, interest varying from 2½ to 4 per cent., and sinking fund from 1 to 3½ per cent. He doubted whether even a fixed principle could be laid down, owing to the varying nature of

the supply in different districts and the varying diversity factor in the case of different classes of consumers. With reference to special agreements, the analysis given in the paper showed that it was immaterial whether a consumer paid for 730 hours' use at 3½d., and all further units at ¼d., or merely paid the flat rate of 1½d. quoted.

#### DISCUSSION IN LONDON.

In opening this meeting, the PRESIDENT mentioned that this paper and the preceding one on the subject of electricity tariffs were part of a scheme being carried out by the Institution to promote the much wider adoption of electricity for domestic purposes. [As our London readers are aware, an informal meeting was held on the 22nd inst. to discuss the matter generally.]

MR. A. K. SCOTT MONCRIEFF said that theory was not such a certain support as fact in such a matter as that dealt with in the paper; he thought that a graphic chart of the station loads, comparable with the tabulated matter in the paper, would show more clearly their relative values. Diversity factor was an important feature, and it was not so useful as regards the mains as it was on the generating plant; he (the speaker) could not agree with the reduction of 16 per cent. on the maximum demand to meet the 16 per cent. diversity factor of the total load, since the long-hour consumer contributed little to diversity factor. It was interesting to note that at Portsmouth the load factor had remained almost constant during the last ten years—about 14 per cent.—yet the total costs had dropped from 2½d. to 1½d. per unit, and the output had increased to four times as much. The maximum demand had to be paid for, but with diversity factor one got something for nothing.

MR. E. T. RUTHVEN MURRAY said that it seemed that by the author's tariff, although there was a balance to the good on the whole, there was a loss on 7,000 consumers out of a total of 21,000. He questioned whether the tariff was so simple as was suggested; how did the author arrive at the maximum demand of the smaller consumers and proportion of 3d. units? It appeared that recording ammeters were used to get the demands of some consumers, while some consumers' demands were estimated after inspection. The latter method was apt to be unreliable. In considering the factors bearing on the cost of supply, the size of the consumer was a very important feature which influenced the cost of supplying him individually. He had found that the cost of reading and inspecting meters, and rendering accounts amounted in many cases to 24s. per consumer, or even higher, and it was obvious that this would not pay in the case of a small consumer. These "consumer" costs could not fairly be averaged over a number of consumers; the small man must be charged more than the large one, and it seemed that a graded scale based on this must be the only fair arrangement.

MR. A. H. SEABROOK said it was practically impossible to charge the small consumer what it cost to supply him. The author's scheme was somewhat indefinite, but it was satisfactory if it brought business. He did not see how one could go to a prospective consumer with the author's tariff without assessing the maximum demand, and it would be interesting to know how that was done.

MR. L. E. BUCKELL asked how the author arrived at the demand for each individual consumer; if by means of the demand indicator, the capital cost would be increased; if by assessment it would be interesting to know how it was done. The question of mains was very important; load factor only concerned the station and did not affect mains, office expenses, &c.; the amount of revenue was quite as important as the load factor, and it was an ordinary commercial factor which controlled the supply of electricity as of other things. In Newcastle they considered that they had got from 10 to 15 per cent. of the possible domestic load, and this showed the large margin for extended business. Maintenance of the meter was usually covered by the meter rent.

MR. A. J. CRIDGE said the profit on the domestic consumer was out of all proportion high as compared with the power consumer.

The cost of meter reading ran out at about 9d. or 10d. a day, and there was a good margin left to make up the 7s. mentioned by the author.

MR. W. E. BURNAND (partly communicated) said that he felt strongly that unsuitable tariffs and restrictions were at the present time holding back the industry from a great expansion. The great fault was that they did not sufficiently coincide with the cost of production. He agreed that the principle outlined by Mr. Arthur Wright was the correct one, but he did not see how a much more incorrect system could have been developed than that employing maximum-demand indicators on consumers' premises and basing the high-rate charge on monthly readings of these indicators. The broad objection to it was, that for every unprofitable unit that was choked off, probably a hundred or more profitable ones were choked off, in addition to the difficulties of getting customers to appreciate a system usually not understood by the suppliers. A chart based on data placed at his disposal by Mr. Fedden, showed what load had been carried by a large generating system supplying an industrial town (Sheffield), and the total length of time the load had been above or below any given value during the year. This showed in a striking manner the large proportion of time during which much of the plant was standing, and the serious handicap of having to carry a lot of spare plant as a sort of insurance against trouble with extraordinary peaks that occurred only once or twice a year, with a margin for a specially long, heavy fog, that might or might not occur at all. The curve represented the output over quite a normal year (1911-12). Over 95 per cent. of the revenue-producing load lay below the point marked X, and if they



could have been sure that the load would not exceed this, the plant need not have been extended beyond the line *N*. All the plant indicated by the distance *N* to *C* was needed to cope with the almost insignificant (as regards revenue) part of the curve above *X*. In view of this, it was quite evident that the top part of the curve was of no use to the producer, and it appeared doubtful whether this would pay at even 10s. a unit. Control must be obtained over this peak, so that it would be avoided, if the supply was to be cheap. The greater part of the normal peaks lay below the point *X*, and this showed where the demand indicator system failed badly. It might reduce the curve above *X*, but this did not compensate for the reduction below this point, and the extra peak was not due to half the consumers having doubled their maximum demand, but was the result rather of normal maximum demands abnormally overlapping, which the indicators took no account of. Additional load at any point of the curve below *X*, even peak load, was almost equally profitable, provided it did not increase the load above *X*. The whole of the output below *X* could be equitably dealt with by means of a fixed charge based on the actual fixed costs of the service, plus a low rate per unit. The fixed charge should be practically equal to the net cost to the suppliers, and the profit should come on the rate per unit. The part of the curve above *X* should, in his opinion, be done away

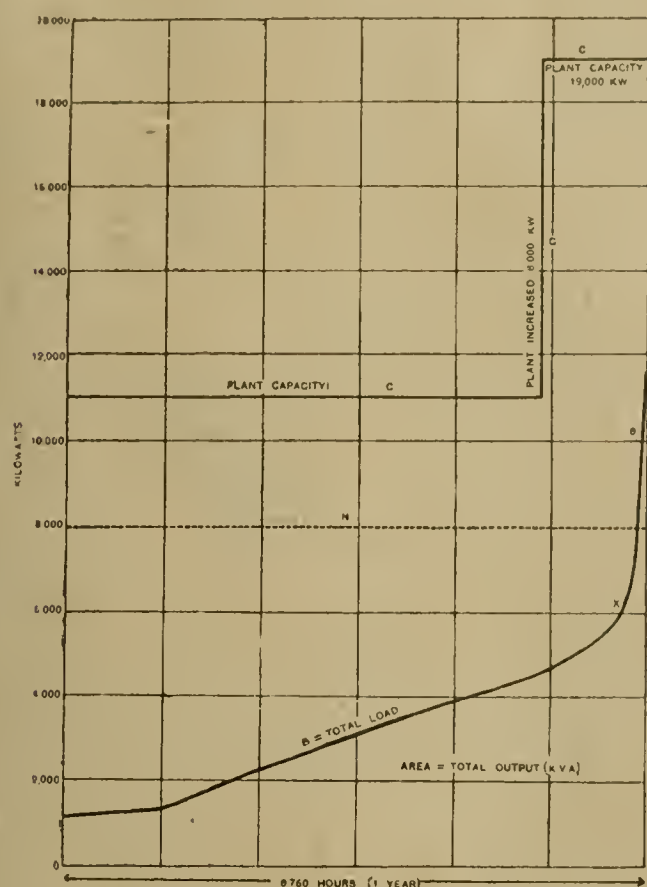


DIAGRAM SHOWING THE RELATION OF STATION LOAD AND TIME AT SHEFFIELD.

with by bringing this under the control of the suppliers, and he thought the way to do this was when the load approached a fixed ratio of load to plant capacity, say 25 per cent. of plant capacity *N*, to put an extra 3d. to 5d. per unit on all load, and let the consumers know it was on. This left it open to the customer to leave on any vital load, whilst taking off load that could be readily spared for the hour needed to get over the abnormal hump, thus having the effect of keeping this down with the minimum of inconvenience, not comparable with the reduction in cost made available by this arrangement. An additional dial might be added to existing meters to register the additional high rate charge, this dial being made to register only at and above a fixed ratio of total load to plant capacity. The best method to adopt to work this indicator and mechanism remained to be proved, but it was quite certain that it could be done. This system was the only one that restricted the use of current at the time when required, and encouraged full use at all other times, thus combining lowest costs with maximum convenience to both users and suppliers. The bills rendered under this system would be very simple, comprising a fixed charge and units at low rate, and occasionally units at high rate. This system was obviously applicable to all classes of service.

MR. J. F. C. SNELL, from an analysis of the tabulated results, concluded that the one-hour consumer should be charged at a higher rate. Many supply undertakings were beginning to feel the effects of cooking and heating appliances. He had himself made some heating tests and found that, at 2d. per unit, there was a saving over the use of gas. Given energetic pushing of domestic electricity, he believed there would be great developments in that line and that the tariff would take care of itself, everything tending to bring the cost of supply lower. There was a great lack of information as to individual loads, which must be analysed and understood before the tariff question could be settled.

MR. W. A. CHAMEN referred to the supply conditions in South Wales, where, owing to the Eight Hours Act, the power load came on at 6 a.m., and fell away at 2 or 3 p.m., with a peak at 10 or 11 a.m., the conditions being inverse to those in large towns. There was scope for electric lighting in many villages where oil lamps

were now used, but the difficulty was the wiring, which his company were now undertaking. They used overhead mains, and the street lighting was controlled by clock meters, and it seemed possible that "collier" consumers could be supplied through the same switches and cut off during the day. The idea was to charge, say 1s. a week all the year round and collect the revenue in advance giving a ticket (similar to a tramway ticket) as receipt. The disadvantage of this was that it did not provide for day use of electricity, and he was undecided, for that reason, as to its adoption.

MR. ARTHUR WRIGHT mentioned the life of the concession as an important factor in the cost of supply in the case of companies. This particularly applied in London, and until some definite knowledge of the course of events in 1931 were obtained, we could not expect low rates for lighting. The size of the generating plant was another factor of importance; with modern plant additions costs of supply were decreasing, and it seemed that any consumer whom it actually did not cost more to supply than the amount of his bill, was worth keeping. He was not an absolute loss. Events might lead to a great decrease in cost of production in a few years, and it was inadvisable to drive the present-day unproductive consumer away in view of that.

MR. MORDEV questioned whether there was such a loss as appeared from the supply to churches, theatres, &c., as people who attended those places cut down their lighting at home, and merely transferred their load.

MR. W. W. LACKIE, in reply, said that an analysis of Edinburgh consumers showed agreement with the figures he had prepared for Glasgow. To assess the consumer's maximum demand the simplest way was to take the last year's consumption and divide it by 800, or a demand indicator could be installed. At Glasgow there were a number of flats where five or six floors were served by one service, which reduced the cost of the latter. Actually the average number of consumers per service over the whole city was 3.3, while in the residential parts it was 7. The new consumer was assessed like similar consumers in the same district. Since the system had been introduced in Glasgow, some 900 electrical appliances had been connected.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"MELDELP" writes:—"Is it necessary for me, as engineer for the above company, without any powers, to make any return to the Board of Trade? It is a private company, and the supply is not solely for the town. We use the power for our own factories as well, and we have not any competition."

"J. J. C. S. B. N." writes:—"I shall feel extremely obliged if you will place the following query in your 'Legal Query Column':—Is it necessary for a private limited liability company, supplying electricity for lighting and power purposes, to make any return to the Board of Trade? The objects of the company are not primarily the supply of electricity."

\* \* \* These two queries may be conveniently answered together. There is nothing in any Act of Parliament relating to the supply of electricity which places any liability of this kind upon a person who is privately supplying electricity on his own account. Indeed, he is subject to no interference at the hands of any Government department unless he runs wires "in, over, along, across or under any street" (having regard to the objects of the company). Nor can he be interfered with in any way by any local authority by virtue of Sec. 23 of the Electric Lighting and Power Act, 1909.

**The Largest Turbines in the World.**—The Commonwealth Edison Co., Chicago, which is probably the most important electric supply authority in the world, has decided to carry out some further extensions in connection with its Fisk Street station. This station at present contains 10 turbo-generators of 14,000 kw. each. The proposed extensions will consist of four turbo units of 25,000 kw. maximum continuous load and 20,000 kw. economical load. The order for the first machine has been placed with Messrs. C. A. Parsons & Co., and it will be built at their works at Heaton-Tyne. The machine will generate three-phase current at 25 cycles and 9,000 volts, and will run at 750 R.P.M. In accordance with Messrs. Merz & McLellan's recent practice in ordering turbines of the reaction type, the turbine will be of the two-cylinder type, the high-pressure cylinder being a single-flow turbine and the low-pressure cylinder being a double-flow turbine; the high-pressure cylinder body will be of steel. The exciter will be direct-coupled to the end of the alternator shaft. The alternator will actually generate current at 4,500 volts, the current being stepped up to double this pressure by an auto-transformer to be supplied by the General Electric Co. in America. The specified steam conditions are 200 lb. steam pressure, 200° F. superheat, 29 in. vacuum. We shall hope at a later stage to be able to give some particulars of the consumption of this machine. The Commonwealth Co.'s extensions and the design of these turbo-generators are being carried out by Messrs. Sergeant & Lundy, the engineers of the company, in conjunction with Messrs. Merz & McLellan, of Westminster.



## NOTES ON CLEANING BABCOCK AND WILCOX BOILERS.

By JOHN S. LEESE.

ALTHOUGH Babcock and Wilcox water-tube boilers are very widely used in this country, it is probable that there are still many engineers whose experience with them is not of sufficiently long duration to preclude the possibility of some slight instruction being obtained from the following practical notes on cleaning this type of boiler, with which the writer has had an extensive practical acquaintance.

When a boiler is layed off for cleaning, the first operation which should be carried out is that of clearing out the grates, ash pit and combustion chamber, at the same time removing the soot and dust from the caps and tubes. This may be partially accomplished when the boiler is still under steam by the use of a suitable steam jet through the opening in the side of the brickwork setting, but it will not be found possible to clean all the soot off thoroughly by this means. As soon, therefore, as the boiler has cooled off enough, the operator should enter each compartment and push his steam jet down between the rows of tubes, when, if he uses an ell piece on the end of the jet pipe, he will be able to make a clean job of all the caps and tubes and scour all the dust and soot from the corners and crevices also. Whilst the operator is inside the setting he should make a careful examination of the brickwork, firebrick lining, baffles, dampers, grates, &c., making notes of all such repairs as may be necessary.

To clean the internal parts of the boiler itself the first step is to open the blow-off until the water has fallen away from the upper drums. The manholes on these may then be removed and the inside of the drum flushed out with a hose-pipe, using the best pressure of water available. The drums may then be entered and examined for pitting, scale, and oil. All scale and oily deposits must be carefully scraped and cleaned off, after which it will be found beneficial to paint any places which appear to have been subject to pitting and corrosion with a coat of white lead. If there is no particular hurry about getting the boiler into commission again, it will also pay to give the internal surface of the drum a light coating of paint up to a point a little above the normal water line.

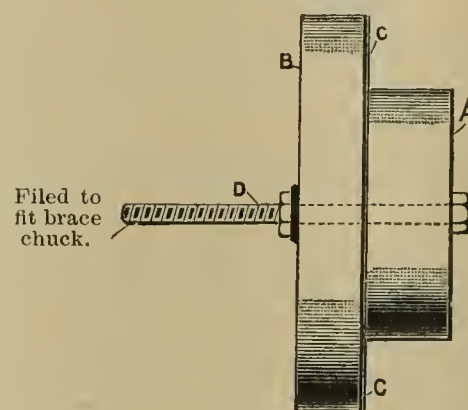
The blow-off cock may now be opened again and the water completely drained off from the boiler. The tube hand-hole caps may next be removed from both headers, and should be placed, together with their nuts and bolts, in a receptacle containing water, in order that any scale which may be upon them will not become hard, and thus hinder its easy removal. Some sorts of scale will be more readily removed if a little paraffin is placed in the water as well.

The tubes may next be cleaned internally, and this process should be started before the tubes have had time to drain dry. It is a long and very tedious job to tackle the tubes with a hand cleaner, and a turbine or other form of mechanical cleaner should always be found in a plant where Babcock & Wilcox boilers are installed. The cuts which it is permissible to take with a turbine cleaner naturally depend upon the thickness and character of the scale. For scale  $\frac{1}{4}$  in thick, for instance, two sets of cutters should be used, but for  $\frac{1}{8}$  or  $\frac{1}{16}$  in. of scale it will be only necessary to use the finishing cutter unless the scale is of an exceptionally hard variety. Great care should be taken not to stop the feed of the cutter through the tube, but if for any reason such stoppage is unavoidable the turbine must be stopped at once or else damage to the tube is likely to occur. The time taken to clean a tube also depends upon the thickness and hardness of the scale. The cutter should be kept well up against its work, but should not be heavily fed into the scale. A little practice will soon teach the operator how to handle the mechanical cleaner. If there is no means by which the water can be carried away from the rear header, the tube caps will have to be left on at this end whilst the cleaning is in progress, and in this case care must be exercised so that the turbine is not fed clear through the tubes and on to the rear head caps so as to damage the latter.

The probability is that the plant—unless it be a large one—will only boast one mechanical cleaner, so that whilst

the senior operator is scaling the tubes, the rest of the help can go ahead with the caps, bolts and nuts. These must be completely cleaned of scale and carefully dried, when the faces and backs of the caps will require polishing, as also will the faces of the nuts. No. 1 emery cloth mounted on a wooden disc which, in turn, is secured to a wooden belt pulley and is rotated at about 800 revolutions per minute, will be found to be an excellent polishing medium. The caps and nuts must be held quite square against the emery cloth in polishing in order to avoid leaky joints after the caps are re-assembled. Each polished surface should be wiped with a greasy rag after it has been thus ground, in order to protect it against the insidious inroads of oxidisation. The nuts should be run up the bolts with a mixture of graphite and boiled linseed oil, or graphite alone, but an excess of either is undesirable. Graphite is the easiest to apply, it being lightly brushed on to the bolt threads.

When the tubes have been scaled the header surfaces must be polished around the handholes and a useful device for accomplishing this may be made as shown in the accompanying sketch. A is a circular wooden plug of such a



diameter as just to fit inside the handhole openings in the header, whilst B is another wooden plug of about 2 in. larger diameter. C is a piece of No. 1 emery cloth, which is placed against the plug B, and is clamped between the two plugs by means of the central bolt D, a nut and washer being run up the bolt behind the disk B, as shown. The end of the bolt is filed up to fit the chuck of a carpenter's brace, by means of which the emery may be rotated, and at the same time pressed hard up against the surface which it is desired to polish, the plug A acting as a guide in the handhole opening. The latter will be cleaned and polished by a few revolutions of the brace.

The cleaning process is now finished, and the re-assembling of the caps may be commenced. This part of the job requires the utmost cleanliness, and the application of a mixture of boiled linseed oil and graphite to the polished and ground surfaces of the caps and nuts should not be omitted on any account. Every possible precaution should be taken to eliminate the presence of the slightest trace of grit or dirt on the polished surfaces of the handholes or caps. One single speck of emery remaining upon the surface of a cap will unfailingly be the cause of a leakage, which, although in itself it may not be of any account, will engender the corrosion of the header and cap to a greater or less extent, so that the grinding-in process for that cap at the next cleaning will be an extremely tedious undertaking. The tightening up of the nuts should be very carefully undertaken. The application of too much strength will easily fracture the claws, and in using the wrench it should be remembered that the joint which is being operated upon is a metal to metal one, and that there is no soft packing to pull against.

When all the caps and manhole plates are again in position the boiler should be filled with water and any leaks marked with chalk for attention. If none of the leaks are excessive, the water pressure should be pumped up to between 50 and 100 lb. per sq. in., when any additional leak must be marked. Next relieve the pressure, slacken back the nut of any leaking cap slightly—that is to say, not enough to loosen the cap, but enough to allow of giving it a slight twist. Then tap the cap back and forth sideways with a hammer, giving it a slight twisting grinding movement, and tighten thenut up again. In the great majority of cases this attention



will make the joint tight, and will avoid emptying all the water out of the boiler again. If, however, the cap still leaks, the water should be emptied out and the cap properly attended to and corrected, irrespective of the language of the assistants.

The use of compounds in Babcock & Wilcox boilers is, in the writer's opinion, detrimental, and should not be encouraged when it is at all possible to introduce any necessary purifying agents into the water before it reaches the boiler.

## PETROLEUM IN ENGLAND.

By W. H. BOOTH.

It has been known to a few for some weeks that petroleum had been discovered in England at two spots at least. The facts have now got into the daily Press, and considerable interest has been aroused. Last year, as the result of my study of the geology of the London area in connection with artesian work, the conclusion was more than ordinarily forced under my observation that the disturbed stratification shown over the South-East of England, the numerous faults on the Weald, and the evidences of folding, all had their origin at some considerable depth below surface.

The many attempts, chiefly fruitless, to find the lower greensand formation in, and around, London, proved practically conclusively that during the geological period embracing this stratum and the one above it—viz., the gault clay, the sea level was from 600 to 1,000 ft. lower relatively to the shore than it is to-day; that the land was in turn rising and falling, and that between these two stratifications what land there was consisted of rocks of the age of those in the West Country.

My successful boring to the lower greensand near Woking, where the sand was found at 1,571 ft. deep, or just about the mean of my limit estimates of 1,550-1,600, confirmed the conclusions arrived at by coinciding so closely with the estimate. As a result, in the new edition of "Liquid Fuel" I anticipated oil being found in England. Now it has been found.

The conclusions to be drawn from the results of the borings made during the past 40 or 50 years are that modern England was laid down on a very ancient foundation, and that since the modern or recent rocks were deposited there has been a great disturbance of this old foundation.

There is great probability that oil may have an inorganic origin, though personally I have had a leaning towards the organic origin. The disturbances alluded to would, however, tend towards conditions favourable to oil production, and our surface indications of deep-seated contortions, and the facts disclosed by deep boreholes appear quite to justify the expectation of oil. So far, of course, not much has been found, but a fairly plentiful supply at one place and actual oil, though small in quantities, at Willesden, are scarcely likely to have been casually dropped upon by the drill, unless there is a fairly wide spread of petroliferous ground.

Even in proved copiously-yielding countries, the location of a borehole is a factor of some importance: usually one drills upon the crest or on the upper slopes of an anticlinal fold, for the superior gravity of water enables it to displace oil in the synclinal folds. So much is this the case, that in some places a line of derricks may be seen to occupy a very narrow tract of land over the syncline, each well indicating the depths and assisting to keep the line.

Really copious boreholes yet remain to be developed in England, and the best localities for future boring must be found. Assuming that they will be found, and that petroleum will be found in large quantities, it is impossible to forecast the future. With our coal supplies becoming more difficult to mine, with much of our coal being actually thrown away by the strike disturbances, and the drowning of pits that will not again be unwatered, the presence and aid of oil would be a great boon to this country, and particularly welcome for the Navy.

Nor need it cause much wonder that there is oil on this side the North Sea, for it is found as near as Hanover.

The depth here is great, but not excessive. The wells cannot be called shallow wells, but there are many of greater depth.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

SWEDEN.—The Board of Trade point out that in Group 13B of the Swedish Customs Tariff (electrical machines and apparatus), under which stators, rotors, current collectors, magnet poles, brush-holders and hanks (hårfvor) imported separately, are dutiable as electrical machines with a surtax of 50 per cent., it is provided that this surtax shall not be levied in the case of an article which is proved to be imported as a substitute for a worn-out or otherwise useless part of a machine imported previously.

A recent Swedish Royal Decree prescribes that importers who desire to avail themselves of this concession must deliver to the Customs Administration an assurance on their word of honour that the imported parts are intended to replace a worn-out or otherwise useless part of a machine of foreign manufacture on which full import duty was paid. The accuracy of such assurance must be attested by two responsible persons, and it must contain particulars as to the date of importation of the part which has become unfit for use.

The same Royal Decree lays down the following general regulations as regards imports of machinery into Sweden:—If an importer fails to supply the description, specification or drawing referred to in Note 1 to Section 13A of the Tariff\* or if the documents furnished do not afford a satisfactory basis for assessing duty, the necessary particulars must be ascertained by experts summoned by the Customs Administration at the expense of the importer. If the Customs consider it necessary, the person declaring the goods for payment of duty or for warehousing must either himself furnish a written assurance on his word of honour that the consignment does not contain portions of other machines or spare parts of the imported machines other than such portions as go to make up the machine itself, or in case he is not himself the purchaser of the article, he must produce an assurance to this effect from the purchaser. If such assurance is not supplied or there is reasonable ground for assuming that the assurance supplied is not in accordance with the facts, the Customs Administration may summon experts to furnish the necessary particulars. In the latter case the cost must be borne by the importer if he has failed to supply the assurance required, or if the assurance he furnished is not in accordance with the facts; in other cases, it shall be borne by the Customs.

When machines are imported in parts, or other causes render it difficult for the Customs official concerned to ascertain the nature of the machine in question, the Customs Office may deliver it on deposit of duty at the highest rate which might be applicable to the goods, after such suitable parts have been marked by lead seals or otherwise, so far as may be considered necessary in order to identify them and to determine the nature of the machine when it has been erected. The expenses of this supplementary inspection shall be borne by the importer in accordance with the scale of fees laid down for the clearance of goods in premises belonging to private persons.

If a machine is imported in parts which arrive on different occasions or by different methods of conveyance, and the importer requests that the rate of duty leviable on the machine as a whole shall be applied, such request shall be notified on the declaration for the consignment which arrives first, and it shall be binding as regards subsequent assessment of duty. Importation of the various parts must take place at one and the same Customs Office, and the importer must furnish sufficient proof when the first importation takes place that all the parts will together form one machine, and he must supply drawings and specifications as to the parts imported on each separate occasion of passing them through the Customs. Proof of payment of duty shall not be issued until all the parts have arrived, but the importer shall be allowed to take possession of the parts as imported on depositing duty at the highest rate applicable to each separate consignment.

The same Royal Decree lays down regulations respecting the proof required of the declared value of imported goods.

\* This Note provides that:—

The rates stated are applicable, unless otherwise stated, to machines, whole or in parts, even if any subordinate component parts are missing.

In declaring machines which are imported in a "knocked down" state (i.e., taken to pieces) for clearance or warehousing, the owner must supply an explanatory statement and specification of the parts, together with a drawing showing that the parts together form a machine—so far as these may be required for the guidance of the Customs.



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co.,  
Electrical Patent Agents, 235, High Holborn, London, W.C., and at  
Liverpool and Bradford, to whom all inquiries should be addressed.

- 5,992. "Insulator-carrying brackets or arms of telegraph and like poles." BULLERS, LTD., and E. H. CHAMBERS. March 11th.
- 6,047. "Electric generators." E. F. BRENNER and J. W. HEWAT. March 11th.
- 6,049. "Electrical step-by-step translating devices." L. M. POTTS. March 11th. (Complete.)
- 6,050. "Electrical signalling apparatus." L. M. POTTS. (Convention date, November 18th, 1911, United States.) March 11th. (Complete.)
- 6,052. "Electrical conduit fittings." L. G. BYNG and T. TAYLOR. March 11th.
- 6,061. "Means for decreasing the injurious effects due to capacity in electric conductors." F. A. BECKER. (Convention date, March 11th, 1911, Germany.) March 11th. (Complete.)
- 6,062. "Sparking plugs." I. KOUTRINE. March 11th. (Complete.)
- 6,076. "Igniters." L. D. VAUGHAN and T. MILLER. March 11th. (Complete.)
- 6,077. "Automatic spark timing mechanism for internal combustion engines." T. TOWNSON. March 11th. (Complete.)
- 6,078. "Time switches." F. SCHMID. (Convention date, August 10th, 1911, United States.) March 11th. (Complete.)
- 6,099. "Dynamoes." M. M. FOUQUE and C. H. RUELE. March 11th. (Complete.)
- 6,101. "Method of regulating the output of dynamos for motor-cars and the like." W. H. FRITZ. March 11th.
- 6,112. "Manually operated electric switches with automatic releasing mechanism." E. T. R. MURRAY. March 11th. (Complete.)
- 6,116. "Drivers' brake valves for electrically and pneumatically controlled compressed-air brakes." W. HILDEBRAND and KNORR-BREMSE AKT.-GES. March 11th. (Complete.)
- 6,139. "Magnetic chucks." H. HUMPHREYS. March 12th.
- 6,146. "Coupling up conduits and fittings for electrical wiring purposes." F. L. YATES. March 12th.
- 6,155. "Terminal connections for dynamo-electric machines." H. W. BOSWORTH and H. C. SIDDELEY. March 12th.
- 6,182. "Electric heating devices." FERRANTI, LTD., and J. ROTHMAN. March 12th. (Complete.)
- 6,189. "Variable speed dynamos for use in starting internal combustion engines and the like." H. LEITNER. March 12th.
- 6,212. "Systems of electrical distribution." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 12th.
- 6,248. "Means for connecting electrodes." GEER. SIEMENS & Co. (Convention date, March 28th, 1911, Germany.) March 13th. (Complete.)
- 6,261. "Electrolysis of liquids." J. G. PAULIN. March 13th. (Complete.)
- 6,262. "Acoustic tubes applicable for use with telephone receivers." L. A. L. STRUXIANO. March 13th.
- 6,269. "Control of variable speed dynamos such as those employed for train lighting." ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., J. ETCHells and E. W. PRICE. (Addition to 6611/1911.) March 13th. (Complete.)
- 6,275. "Telegraphy." S. G. BROWN. March 13th.
- 6,286. "Electric insulators." BULLERS, LTD., and G. V. TWISS. March 13th.
- 6,287. "Electric insulators." BULLERS, LTD., and G. V. TWISS. March 13th.
- 6,295. "Preparation or forming of metallic-filaments for use in incandescent electric lamps." E. A. GIMINGHAM. March 13th.
- 6,304. "Electrically-controlled lifts or elevators." A. ROZIER. March 13th. (Complete.)
- 6,305. "Automatic telephone systems." M. BAUM. (Convention date, March 13th, 1911, Germany.) March 13th. (Complete.)
- 6,392. "Method of and apparatus for regulating electric currents." J. S. GOODWIN, J. A. J. HASLOP and T. H. BROWN. March 14th.
- 6,393. "Telephonic transmitters." L. A. L. STRUXIANO. (Convention date, March 14th, 1911, Belgium.) March 14th. (Complete.)
- 6,395. "Holders for electric lamps, electric switches, ceiling roses, blocks and the like." A. R. MULLER. March 14th.
- 6,396. "Holder for telephones." J. B. POTTER. March 14th.
- 6,398. "Electric ignition of internal combustion engines." L. REVAULT. (Convention date, March 18th, 1911, France.) March 14th. (Complete.)
- 6,441. "Means for the transmission of signals, telegraphic and other communications over high-tension transmission lines." F. GIRAUD-TEULON. March 15th. (Complete.)
- 6,473. "Insulating supports for the conductor rails of electric railways." E. T. BROOK. March 15th.
- 6,486. "Means for producing electro-magnetic waves of high group frequency and the application thereof to wireless telephony." W. T. DITCHAM, H. G. MATTHEWS and GRINDALL MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. March 15th.
- 6,487. "Electric incandescent lamps." A. C. HYDE. March 15th.
- 6,496. "Electric motor for transmitting angular movements, with an auxiliary motor which controls the successive displacements for it." R. GIARDELLI. (Convention date, March 15th, 1911, Italy.) March 15th. (Complete.)
- 6,498. "Internal combustion engines." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and R. H. WHITE. March 15th.
- 6,500. "Electrodes." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 15th. (Complete.)
- 6,517. "Electrically operated valve-controlling devices." J. KEITH and G. KEITH. March 16th.
- 6,528. "Electric fittings." W. S. HALLIWELL. March 16th.
- 6,550. "Transformation of direct currents." AKT.-GES. BROWN, BOVERI ET CIE. (Convention date, March 17th, 1911, Germany.) March 16th. (Complete.)
- 6,555. "Electric signal for use on locomotives." R. G. J. WRIGHTMAN. March 16th.
- 6,557. "Electrically heated culinary apparatus." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD. (Westinghouse Electric and Manufacturing Co., United States.) March 16th. (Complete.)
- 6,562. "Device for supporting conduits, pipes or the like for electric conductors or other uses." J. B. BLAKE and W. KILBURN. March 16th.
- 6,580. "Combined intercommunication and party line telephone systems and the like." STERLING TELEPHONE AND ELECTRIC CO., LTD. (Telephono Fabrik Akt.-Ges. vorm. G. Berliner, Germany.) March 16th.
- 6,596. "Electric welding of metals." E. H. JONES. March 16th.
- 6,599. "Automatic apparatus for operating electric starting switches and the like." W. A. CLATWORTHY. March 16th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 235, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

- PROCESSES OF SEPARATION BY AID OF ELECTRO-OSMOSIS. V. B. SCHWERIN. 27,931. December 12th. (January 25th, 1911. Addition to No. 3,364 of 1911.)
- TELEPHONIC TRANSMITTERS. W. J. MARCHANT. 29,195. (Addition to No. 24,390 of 1910.)
- ELECTRICALLY-CONTROLLED FLASHLIGHT APPARATUS. W. Bale and L. H. Hopkins. 1,360. January 18th.
- ELECTRIC CURRENT DISTRIBUTING SYSTEMS. G. H. Merz and P. V. Hunter. 4,004. February 16th. (Cognate application, No. 5,189 of 1911.)
- ELECTRIC CONNECTIONS AND SWITCH CONTROL. H. F. JOEL. 4,019. February 17th.
- APPARATUS FOR PERFORATING THE SIGNAL-CONTROLLING TAPE TO BE USED WITH AUTOMATIC TELEGRAPH TRANSMITTERS. W. Judd, A. Fraser and Eastern Telegraph Co. 4,050. February 17th.
- VAPOUR ELECTRIC APPARATUS. M. A. F. Leblanc. 4,266. February 20th.
- ELECTRIC BELLS, GONGS AND THE LIKE. E. R. GROTE. 4,414. February 21st.
- CONTROL OF ELECTRIC REGULATORS. AKT.-GES. BROWN, BOVERI ET CIE. 4,915. February 27th. (February 25th, 1910.)
- ELECTRIC WALL-PLUGS. S. W. MARTYN. 5,986. March 29th.
- ELECTRIC IMITATION CANDLE LAMPS. V. CURTIS. 7,306. March 23rd.
- ELECTRIC HEATERS. J. F. MONNITT. 8,023. March 30th. (Convention date not granted.)
- DIRECT-CURRENT ELECTRIC MACHINES. J. H. CARRICK and Greenwood & Batley, Ltd. 8,589. April 6th.
- MECHANISM FOR TIMING ELECTRO-MAGNETO MACHINES FOR EXPLOSION MOTORS. Soc. Rene Gillet et Cie. 9,948. April 24th. (November 29th, 1910.)
- ELECTRIC HAIR-COMB. J. T. NIBLETT and W. H. CADMAN. 10,436. April 29th.
- MEANS FOR ELECTRICALLY INDICATING OR RECORDING THE POSITION, TIME AND SPEED OF TRAINS ON RAILWAYS. N. T. JONES-MILLER. 11,195. May 9th.
- ELECTRIC SWITCHES. British Thomson-Houston Co. and J. M. WALLACE. 12,919. May 29th.
- ARC LAMP ELECTRODES. British Thomson-Houston Co. (General Electric Co.) 13,124. May 31st.
- CONTROL OF ELECTRIC RAILWAY TROLLEYS OR CARS HAVING ELECTRIC HOISTING GEAR. M. A. BLEICHERT and M. P. BLEICHERT. 13,573. June 6th.
- ELECTRO PLATING OR COATING OF CYLINDRICAL OR LIKE REVOLUBLE ARTICLES. A. WALKER. 14,140. June 14th.
- ELECTRIC MOTOR CONTROL SYSTEMS AND APPARATUS THEREFOR. British Thomson-Houston Co., Ltd. (General Electric Co.) 15,322. June 30th.
- PORTABLE ELECTRIC FUSE-WIRE CARRIER. S. CHASE. 15,564. July 4th.
- CLOCK HAVING ELECTRICAL WINDING MECHANISM. N. GERDES. 15,684. July 6th.
- EARTHING DEVICES FOR ELECTRICAL CIRCUITS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 16,907. July 24th.
- TELEPHONE INSTRUMENTS ESPECIALLY APPLICABLE TO RECEIVERS. E. C. R. MARKS. (G. R. Webb.) 16,954. July 24th.
- SAFETY DEVICE FOR ELECTRIC CABLES. Siemens-Schuckertwerke Ges. 17,046. July 25th. (July 25th, 1910.)
- TERMINALS FOR ELECTRIC STORAGE BATTERIES. O. OLDHAM. 17,612. August 2nd.
- RECEIVING APPARATUS FOR ELECTRIC TRANSMISSION OF SIGNALS. H. A. SCHEPCLER. 17,975. August 8th. (August 5th, 1910.)
- TRANSMITTER FOR WIRELESS TELEGRAPHY. W. T. DITCHAM. 18,271. August 12th.
- DIAPHRAGMS AND LIKE SOUND RECEIVING AND TRANSMITTING SURFACES FOR TELEPHONES, GRAMAPHONES AND OTHER APPARATUS. O. REINHARDT. 18,355. August 14th. (March 1st, 1911.)
- DIRECT-CURRENT MOTORS. F. VLAMINCK. 20,298. September 13th.
- CIRCUITS FOR AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 21,164. September 25th.
- STORAGE BATTERY ELECTRODES. H. C. HUBBELL. 21,692. October 2nd.
- PROCESS OF MAKING METAL-FOIL APPLICABLE FOR USE IN STORAGE BATTERY ELECTRODES. H. C. HUBBELL. 21,734. October 3rd.
- MACHINE FOR MAKING PERFORATED STRIPS WITH CHECK IMPRESSIONS IN TYPE, OR FOR ELECTRICALLY TRANSLATING PERFORATED STRIPS INTO TYPEWRITING, OR FOR OPERATING TYPE SETTING, CASTING AND IMPRESSION MACHINES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 22,068. October 6th.
- LOUD-SPEAKING TELEPHONIC APPARATUS. E. A. GRAHAM. 22,356. October 10th.
- ALTERNATING-CURRENT ELECTROMAGNETS. R. A. BARBOUR. 24,977. November 9th.

## 1912.

- MANUFACTURE OF ELECTRIC ACCUMULATOR ELECTRODES. S. PAPE. 728. January 8th. (Divided application on No. 12,019 of 1911. May 18th.)

**German Enterprise in France.**—The position of the Compagnie Générale d'Electricité of Creil is referred to by the Paris correspondent of a Frankfort newspaper, who represents the matter from the point of view of French interests. It appears from statements made by the French directors at the recent meeting that the company was formed in 1898 with the co-operation of the Schuckert Co., for the working of the latter's patents, to which were added the patents of the Siemens and Halske Co. when a close association was established between those two German firms. The French company was alternately under French and German management without, however, becoming prosperous and it had to be reconstructed. A new French director succeeded in bringing the undertaking into a better position, but the correspondent declares that German interests counteracted this movement and finally entered into arrangements with the French Creusot Works for the production of Siemens-Schuckert plant for the conversion of railways to electric traction. As a consequence of this measure the four French directors tendered their resignation and the German group, which owns the majority of the shares, appointed two new members to the board. The Frankfort newspaper remarks that the Siemens-Schuckert Works will now probably express an opinion on the French representation of the situation of affairs.

**Skegness Lighting.**—A Sub-Committee of the U.D.C. is visiting Skegness to obtain information in regard to the electric lighting system in vogue there.



THE

ELECTRICAL REVIEW.

Vol. LXX.

APRIL 5, 1912.

No. 1,793.

ELECTRICAL REVIEW.

Vol. LXX.]	CONTENTS: April 5, 1912.	[No. 1793.	Page
Natural Sources of Energy	...	...	529
The German Electrical Industry in 1911	...	...	530
Copper	...	...	530
The Patents Report, 1911	...	...	531
Municipal Trading in Canada	...	...	531
The Inter-Relation of Capacity in Three-Phase Three-Core Cables ( <i>illus.</i> )	...	...	532
Fraudulent Tests	...	...	533
Proceedings of Institutions:—			
The Supply and Transmission of Power in Self-Contained Road Vehicles and Locomotives ( <i>illus.</i> )	...	...	535
The Ignition of Coal Dust by Electric Flashes	...	...	537
Electric Haulages in Mines	...	...	537
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	...	538
Correspondence:—			
Gas Tar as Fuel	...	...	540
Tariffs for Electrical Energy	...	...	540
The Central Station Engineer	...	...	540
Business Notes	...	...	541
Notes	...	...	546
Some Recent Böving Water-Turbine Plants ( <i>illus.</i> )	...	...	547
A Novel Electrical Steel Furnace ( <i>illus.</i> )	...	...	549
City Notes	...	...	553
Stocks and Shares	...	...	557
Electric Tramway and Railway Traffic Returns	...	...	558
Share List of Electrical Companies	...	...	559
Reviews	...	...	561
Electrical Law in the British Dominions ( <i>continued</i> )	...	...	562
Trans-Atlantic Telegraphy	...	...	563
Wireless Telegraphy in Horology, Navigation and Cartography ( <i>illus.</i> )	...	...	564
Metal Market.—Fluctuations in March	...	...	567
Legal	...	...	567
Foreign and Colonial Tariffs on Electrical Goods	...	...	568
New Patents Applied For, 1912	...	...	568
Abstracts of Published Specifications	...	...	568
Contractors' Column	...	Advertisement page xxii	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY,

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION

READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

NATURAL SOURCES OF ENERGY.

At the present time, everyone's attention has been very forcibly drawn to the question of the conservation of our national supply of coal, and to the desirability of supplementing this source of energy by others, even if only for reasons concerned with the labour problem.

This, then, is a very opportune moment for the British Science Guild to issue a preliminary Report of the Committee appointed by the Guild to consider the subject of our Natural Sources of Energy.

Sir William Ramsay is the chairman of the Committee, and the present publication contains the following reports from various members:—

Sources of Energy depending on Atomic Transformation, by Sir William Ramsay, K.C.B., F.R.S. ;

The Internal Heat of the Earth as a possible Source of Energy, by Prof. the Hon. R. J. Strutt, F.R.S. ;

Present and Prospective Supplies of Petroleum and Shale Oil available for use as a Source of Power, by Sir Boverton Redwood, Bart. ;

The Coal Resources of Great Britain, by Dr. G. T. Beilby, F.R.S. ;

The Effect of Temperature in the Carbonisation of Coal, and its bearing upon the Conservation of our Coal Supplies, by Prof. Vivian B. Lewes ;

The Thermal Efficiency of Internal Combustion Engines, by Mr. Dugald Clerk, F.R.S. ;

Efficiency in Steam Engines, by the Hon. Sir Charles A. Parsons, K.C.B., F.R.S. ;

The Conservation of Water Power, by Mr. Walter F. Reid ;

and there is a concluding note by the chairman.

Sir William Ramsay in his own Report, which is concerned with atomic transformation, repeats the statement which he made in his Presidential Address to the British Association, which address we considered at some length in our issue of September 1st, 1911.\*

Nowadays, he says, the question is not—Can it be done? but, Will it pay to do it? And, so far as the production of energy from radium or any similar substance is concerned, the answer is emphatically in the negative. Perhaps radium will now take its true place as a natural marvel of problematical value. It has been represented up to now as a combination of the elixir of life, the philosopher's stone, and the source of all power, including the internal heat of the earth.

Prof. R. J. Strutt considers the possibility of pumping cold water into the hot interior of the earth, at places where this hot interior is accessible, and pumping it out again at a temperature suitable for use as a driving agency. This would involve the installation of iron pipes in molten rock, and Prof. Strutt ingeniously remarks that the engineering difficulties would be very great: with which opinion we think our readers will find themselves in agreement.

The question of the supply of petroleum, and of the distillation of petroliferous shale, is of more serious importance. Sir Boverton Redwood deals with this matter, and goes into

\*ELECTRICAL REVIEW, Vol. 69, pp. 328, 329.



considerable detail, showing the output of crude petroleum from the various sources, and the possibilities of increased supplies. It is satisfactory to note that some considerable increase in the amount of petroleum produced within the limits of the British Empire may be looked for. In this connection Mr. W. H. Booth's article on page 527 of our issue of last week, in which he states that he has actually determined the presence of oil-bearing strata in England itself, is of special interest.

The sections contributed by Dr. Beilby, Prof. Lewes, Mr. Clerk, Sir Charles Parsons and Mr. Reid, remind us of two Presidential Addresses to the Institution of Electrical Engineers. Mr. James Swinburne, in 1902, considered the limits bearing upon various electrical engineering problems, amongst which were the tides—a report on wave power is to be expected from the British Science Guild later on—water-power, the steam engine, and the gas engine. Concerning this last, he noted that there was at that time considerable prejudice against the Diesel engine, because it was novel, and, from the condemnation it was receiving, he concluded that it was very good, which prophecy is now being proved correct. In 1910 our present President, Mr. Ferranti (who is also a member of this Committee), spoke upon the question of coal conservation, and made his famous "all-electric" proposition.

Briefly, the contributions concerned with coal, by Dr. Beilby and Prof. Lewes, tell us that we should extract the gas from coal, and use it for generating electricity, which could be cheaply transmitted from the pit mouth to the place where it was to be used. Prof. Lewes makes a great point of the advisability of using low temperatures in the coke ovens. The gas is richer, and could be diluted with water gas, which is much cheaper than coal gas. The coke left behind is better for burning, and there is more tar. Both writers insist strongly on the necessity for using recovery ovens, and doing away with those of the beehive type.

Mr. Dugald Clerk prophesied nearly 30 years ago that the internal combustion engine was coming, and he reminds us of this prediction in his Report. The Diesel engine is certainly coming very much to the front, together with other prime-movers consuming oil, and there seems very little doubt that when this kind of engine has been rendered more perfect, it will be largely used for the driving of electrical machinery. Mr. Clerk touches on the question of enforcing by law the use of gas power, but he thinks that even apart from vested interests, such action would be of doubtful benefit.

Sir Charles Parsons writes on the subject of large turbines and their efficiencies, pointing out that in such machines it is possible to convert 70 per cent. of the steam energy—not the heat energy—into work, while in small reciprocating units this efficiency may be halved.

Mr. Walter Reid writes an interesting note on water power, dealing also to some extent with afforestation.

The project lately put forward by Sir William Ramsay, of burning the coal at the pit bottom instead of at the top, opens up vast possibilities. We shall, however, postpone comment on this subject for the moment. We understand that experiments in this direction are to be undertaken.

The trend of thought among scientists of all professions is : (1) Burn your fuel economically ; (2) Burn it centrally ; and (3) Transmit by electricity. Thus we see that the prolongation of the industrial life of this country rests largely with electrical engineers, and we have no doubt that they will prove equal to the occasion.

### The German Electrical Industry in 1911.

THE situation of the electrical industry in Germany in 1911, exclusive of the business transacted by the four large firms, is discussed in the report issued by the Association of Electrotechnical Special Works, which is claimed to represent several hundreds of the smaller establishments. In general the year is characterised as having been favourable, as the special works succeeded in obtaining an increased turnover both at home and abroad, although the export trade advanced to a somewhat less extent than in 1910. It is now more difficult for the works to retain the foreign markets, as electrical manufacturers in other countries are becoming stronger under the protection of high import duties, and the circumstance that the exports of electrical products, which were formerly very considerable, will largely decline in the future—as, for instance, to Sweden—will have to be reckoned with. Notwithstanding the better condition of trade, prices further receded, although it was to some extent possible to equalise the decrease by improved manufacturing methods and the increased turnover. On the question of labour, the report remarks that the conditions were considerably more unfavourable than in 1910, since a large number of establishments were disturbed through partial strikes and through the lock-out of metal workers, especially in Berlin and Saxony, whilst at the same time a scarcity of skilled workers generally, was manifested.

The makers of electrical machinery, the report proceeds to state, were very well employed in general, although under-selling by the large firms in the open market was specially perceptible. In the case of electric cables and insulated wires the works were also well occupied, but over-production still prevailed in the manufacture of lead cables, and this was also very largely the case in other countries. Although a syndicate for cables exists in the home market, all attempts hitherto made to establish a similar combination for insulated wires have failed. The branches concerned with the production of apparatus for heavy currents and of installation materials were likewise well employed, and in these cases also the larger volume of business and more rational methods of manufacturing, enabled the works to partly recoup themselves for the further fall in sale prices. On the other hand, the glow-lamp department was unsatisfactory, and the fresh reduction in the prices of metal-filament lamps last October scarcely permitted of the realisation of any profits. The arc lamp branch suffered from the tax imposed on lighting apparatus, and a similar observation also applies to the carbon department. Measuring instruments and meters afforded good employment, although prices became still more unfavourable. The makers of artificial insulating materials were well occupied, but the advent of fresh competition caused prices to be depressed. Business in insulating tubes in particular was brisk, although makers suffered from the establishment of new competitive works abroad.

The report, in conclusion, refers to the efforts made by the Governments of various of the Federal States to prevent the further creation of monopolies in installation work and materials. It is, however, considered that these endeavours can only be regarded as small remedies and as fragmentary work, seeing that the majority of the State and communal authorities, who have to place orders for plant and works to an increasing extent, entrust the contracts as a whole to the large firms without any division, and thereby exclude free competition in the trade.

### Copper.

THE upward tendency of copper prices, at the same time as tin is rising, is remarked upon by a writer in the *Financier* of March 25th. As he points out, the price has continued to rise in face of the labour deadlock. This is attributed to a degree of co-operation and regulation of output in advance of former conditions, as well as to shrinking stocks, and the existence of a bear account. The steady increase in the world's consumption is noted : it has risen from 720,000 tons in 1907 to 851,000 tons in 1910, and is estimated at 875,000 tons for last year. A factor in this is the large increase in consumption in Germany and France ; for while in 1910 the German consumption was 117,169 tons, last year it rose to 135,487 tons, and that of France rose from a normal value



of 65,486 tons to 80,837 tons. In America the demand fell off by 13,891 tons, and in England it was stationary, though at a high figure, namely, 97,192 tons. The leading copper shares have, as is natural, participated in the rise, but not to the extent which would be expected. The American mines appear to be firmest in this respect.

Messrs. Merton's statistical circular, giving the whole production for last year, contains interesting statistics bearing upon the above. From these we find that Africa and Argentina show a good increase on last year, and Australia an appreciable production of 41,840 tons (nearly equalled, however, in 1907); Bolivia, Canada and Chile show a distinct falling-off in production. Cuba appears to be coming on, now showing 44,550 tons, whereas five years ago she did not figure in the statistics. Germany's output at 22,010 tons is good (for Europe), though only one-fifth of her consumption. Japan shows especially strong with 55,000 tons, an increase of 6,000 tons on her previous record (1907). Mexico, like so many of the countries of that hemisphere, shows smaller production, while Norway seems to have, for the present, reached the limit of her output at 9,400 tons. Peru and Russia have both increased, and show up well on past figures. Spain and Portugal show a small increase for Rio Tinto, whose production, however, is still 1,000 tons below the best, and a satisfactory return for the whole country of 52,045 tons. The United States shows an increase of 7,715 tons on 1910, and still maintains an increase, though the leading producing States have all fallen off except Arizona.

A note in the *Financial News*, quoting from the annual report of Messrs. A. Hirsch & Son, gives the German production of copper for last year (1911) at 37,500 tons, a quantity considerably higher than given in previous reports. The home consumption amounted to 238,745 tons, against 212,268 tons in 1910, the increase being due mainly to the growing development of the electrical industry, which absorbed 110,000 tons in 1911. Germany at 208,826 tons (consumption minus production) with England (159,736 tons) and France (106,408 tons) together consumed 501,129 tons, a quantity considerably in excess of the United States' 316,791 tons.

The continued rise in price is commented upon in the *Times* with reference to the possibilities of increased output with the newer producers. In this respect Australia shows an excellent record, putting out only 6,500 tons 20 years ago, and 42,000 tons last year. Japan, at 55,000 tons, was considerably in advance of Australia in 1892, then producing 18,000. Peru has risen from 7,580 tons in 1902 to 25,445 in 1911.

#### The Patents Report, 1911.

THE twenty-ninth annual report of the Comptroller-General of Patents, Designs and Trade Marks shows a decrease of 4.2 per cent. (from 39,873 to 38,186), in the total number of specifications received during 1911, as compared with 1910. The number of applications accompanied by provisional specifications decreased 6 per cent., while those accompanied by complete specifications increased 2.2 per cent. and reached the record total of 9,829. The number of applications from persons residing in the United Kingdom decreased approximately 6.5 per cent., while the number granted to residents in most foreign countries showed increases, with the exception of the U.S.A. (decrease, 5.25 per cent.). A total of 16,452 patents have been granted on 30,603 applications received in 1909, and among 16,269 patents granted in the United Kingdom in 1910, 42.5 per cent. were to persons non-resident on British soil. Corresponding percentages are: U.S.A., 10.5 per cent.; Germany, 30.6 per cent.; France, 53.9 per cent.; Switzerland, 58 per cent.; Austria, 66.6 per cent.

The subjects of the applications continue to form a reliable index to the progress of industry and its conditions, but events of temporary interest give rise to abnormal numbers of more or less relevant patents; thus the Hawes Junction and Pontypridd disasters led to numerous applications covering automatic railway signalling devices. The ever-increasing importance of means of locomotion, and apparatus auxiliary thereto, is demonstrated by the high percentage of applications filed *re* road wheels, variable-speed gearing, clutches, and so on. Internal combustion engines have claimed much attention from inventors, particularly in connection with

revolving cylinder and "valveless" types. A large proportion of the aeronautical patents refer to the use of aeroplanes as naval auxiliaries, and hence to the question of rising from and landing on battleship decks. Increasing attention is being given to applications of the gyroscope, *e.g.*, as a substitute for the magnetic compass, and as an anti-skidding and stabilising device for vehicles.

The total receipts of the department amount to £319,711, as compared with £314,024 in 1910, and the surplus of receipts over expenditure is £114,731—an increase of £15,662 on the 1910 figure. During last year, 6,283 volumes were added to the library, making the present total, exclusive of duplicates, 136,000 (44,300 works). The total number of readers registered was 155,091, as against 153,707 in 1910.

An examination of 17,039 complete specifications accepted in 1910 showed 1,181 to be wholly anticipated, 10,352 partly anticipated, and 5,506 not anticipated. Of those anticipated, 10,363 were amended without a hearing and 740 after a decision. The expiry of 15,539 patents in 1911 and the sealing of 17,164, increased the number in force by 1,625. Out of 13,452 patents sealed on applications made in 1898, only 3.9 per cent. were maintained for the full period of 14 years. The Hart, McCulloch, and Lodge patents (extended beyond the normal maximum) expire in 1914, 1918, and 1918 respectively.

During the last 10 years the number of hearings upon oppositions to the grant of patents was 1,316, and among 198 appeals heard by the law officer the decision of the Comptroller was supported in 118, varied in 55, and reversed in 25 instances. In 18 appeals against the results of 72 hearings upon opposition to specification amendments, the Comptroller's decision was twice varied and twice reversed. During the same decade there were 1,217 hearings under Sec. 73 of the 1907 Act, and only one reversal in 26 appeals. Last year there were 36 hearings *re* restoration of lapsed patents, and 4,360 hearings were fixed under Sec. 7 (4), 1907; 1 (6), 1902; and Patents Rule 33, 1908, but 2,381 of these were abandoned or settled by amendment of the specifications.

#### Municipal Trading in Canada.

WE often have something to learn from our Colonial brethren in relation to the supply of electricity. This means of distributing power has naturally found favour in a country where energy can be had for the asking, and where its supply is not, as here, dependent upon the sweet will of the miner, egged on by the leathern-lunged agitator who has to oiate for his living. It is satisfactory to find, however, that although the supply of electricity in some of the Dominions is recognised as a public or municipal affair, there is a body of opinion that the supply of fittings, &c., should be reserved for private enterprise.

For instance, the *Hamilton Herald* has recently warned the municipal Corporations against going into the retail business. In the course of its warning it says:—

It is natural and right that municipal corporations should have power to supply electric power and light to private consumers on a commercial basis, for the distribution of electric current is in the nature of a natural monopoly, and all natural monopolies should be publicly owned and controlled. The distribution of water is no more a natural monopoly than the distribution of electric current. But the vending of electric fixtures and supplies is not a natural monopoly. We do not think it would be prudent for the municipal corporation to go into business as a vendor of water-taps and washers, of sinks and bath-tubs and other fixtures and furniture in connection with which water is used. And the same is true of electric supplies and fixtures. These things are articles of commerce not subject to monopoly—at least it is not natural that either the production and distribution of them should be monopolised. If the municipal corporation were to go into business as a vendor of such supplies, it would have to compete with merchants and plumbers, and the competition would be unfair.

Admit that the municipal corporation may properly buy and sell goods of this sort, and you will find it exceedingly difficult to set bounds to municipal commercial enterprise.

We might say, with reference to this expression of opinion: "We agree, and have nothing to add."

The journal in question indicates one justification for this form of municipal trading. It expresses the view that if local vendors of fittings made any attempt to refuse to handle electric fixtures and supplies adapted to the kind of power supplied by the municipality, the municipality might then take up the trade for its own protection.



# THE INTER-RELATION OF CAPACITY IN THREE-PHASE THREE-CORE CABLES.

By A. B. CLARK.

WHEN people make capacity tests on three-phase three-core cables they do not always connect up the cores in the same combination: it is not unusual to hear of widely different values of the capacity given for what is really the same cable.

In what follows it is shown how from two capacity measurements, each of a different method of connecting



FIG. 1.

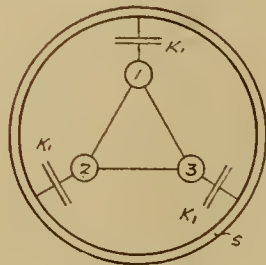


FIG. 3.

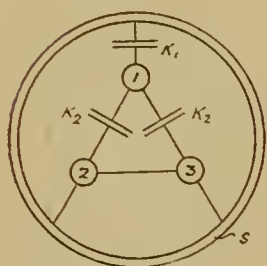


FIG. 2.

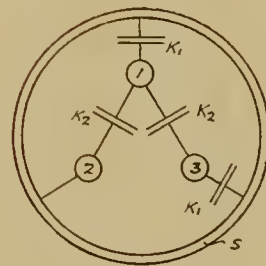


FIG. 4.

up the cores of the cable, all the other combinations can be calculated: thus tests made in various ways can be reduced to a common basis for comparison.

Let fig. 1 represent the section of a three-phase three-core cable, 1, 2, 3 being the cores and S the lead sheath. These cores may be considered as being without capacity, but connected to each other and the lead sheath by means of condensers  $K_1$  and  $K_2$ .

It is convenient to make the two capacity tests as follows, but any combination will do:—

1. Make a capacity measurement between core 1 and the other cores 2 and 3 connected to the sheath S: this we will represent by  $1||2.3.S$ . This is shown diagrammatically in fig. 2: call this  $x$ .

2. Make a capacity measurement between the three cores connected together, and the sheath S: this is called  $1.2.3||S$ , and is shown in fig. 3: call the value of this  $y$ .

Now the capacity measurement  $x$  is equal to the three capacities,  $K_1$  and twice  $K_2$ , in parallel. That is—

$$x = K_1 + 2K_2 \quad \dots \quad (1)$$

The capacity measurement  $y$  is equal to the three capacities  $K_1$  in parallel. Then we have—

$$y = 3K_1 \quad \dots \quad (2)$$

It follows that  $K_1 = y/3$ : and substituting this value of  $K_1$  in equation (1) we have—

$$\begin{aligned} x &= y/3 + 2K_2 \\ \therefore K_2 &= x/2 - y/6 \\ &= \frac{1}{6}(3x - y) \quad \dots \quad (3) \end{aligned}$$

As an example from practice, the following test on an 11,000-volt three-phase cable is given:—

Capacity  $1||2.3.S = .269$  microfarad per mile.

„  $1.2.3||S = .494$  „ „ „

$K_1 = .494/3 = .1646$  microfarad per mile.

$K_2 = \frac{1}{6}(3 \times .269 - .494) = .0521$  microfarad per mile.

Having obtained  $K_1$  and  $K_2$  other combinations may be considered.

Fig. 5 represents the conditions of the capacity of 1 core to the lead sheath; denoted by  $1||S$ , cores 2 and 3 being insulated.

It will be seen that core 1 is joined to the lead sheath by capacity  $K_1$ ; also by way of cores 2 and 3 by means of capacities  $K_2$  and  $K_1$  in series.

Call the capacity of  $K_2$  and  $K_1$  in series =  $K$ . Then—

$$1/K = 1/K_1 + 1/K_2$$

$$\therefore K = K_1 K_2 / (K_1 + K_2).$$

Therefore—

$$\text{Capacity } 1||S = K_1 + 2K_1 K_2 / (K_1 + K_2). \quad (4)$$

Taking the previous example—

$$\text{Capacity } 1||S = .1646 + 2 \left( \frac{.1646 \times .0521}{.1646 + .0521} \right) = .2438 \text{ microfarad per mile.}$$

The capacity obtained for this combination of  $1||S$  experimentally on the same cable was .248 microfarad per mile, which is in close agreement with the calculated value.

The combination shown in fig. 6 is that of the capacity between any two cores, denoted by  $1||2$ ; the third core being insulated. In this connection there are three paths between the two cores 1 and 2:—

1. By means of  $K_1$  to the sheath.
2. „ „  $K_2$  between cores 1 and 2.
3. „ „  $K$  and core 3.

Therefore, by the ordinary rule for the grouping of condensers the capacity of the combination is—

$$\begin{aligned} 1||2 &= K_2 + K_2/2 + K_1/2, \\ &= \frac{1}{2}(3K_2 + K_1) \quad \dots \quad (5) \end{aligned}$$

Taking the actual test case as above for the example, we have—

Capacity  $1||2 = \frac{1}{2}(3 \times .052 + .1646) = .1604$  microfarad per mile. The actual experimental value for this cable and combination was .166 microfarad per mile; again in reasonably close agreement.

Fig. 7 represents the combination denoted by  $1||2.3$ : that is, the capacity between core 1 and the cores 2 and 3 in parallel.

In this case we have two of the capacities  $K_1$  in parallel, and these are in series with the remaining capacity  $K_1$ ; also the two capacities  $K_2$  in parallel. The value of the two capacities  $K_1$  in parallel is  $2K_1$ , and if the value of  $2K_1$  in series with  $K_1$  is  $K$ , then—

$$1/K = 1/2K_1 + 1/K_1.$$

Therefore,  $K = \frac{2}{3}K_1$ .

Therefore the capacity of this combination is—

$$1||2.3 = \frac{2}{3}K_1 + 2K_2 \quad \dots \quad (6)$$



FIG. 5.

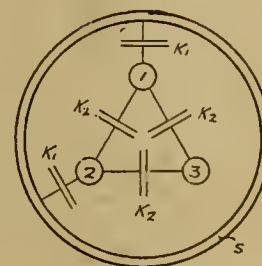


FIG. 6.

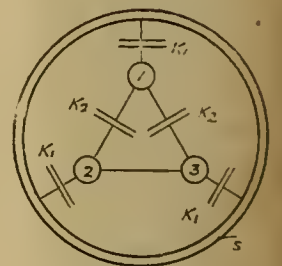


FIG. 7.

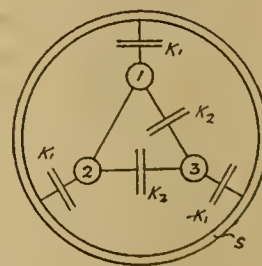


FIG. 8.

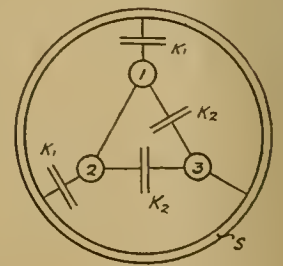


FIG. 9.

Illustrating by means of the example as before—

$$\text{Capacity } 1||2.3 = \frac{2}{3} \times .1646 + 2 \times .0521 = .214 \text{ microfarad per mile.}$$

The observed value of this combination of cores was found to be .221.

Fig. 4 shows the combination denoted by  $1||2.S$ ; that is, the capacity between core 1 and core 2 connected to the



sheath, core 3 being left insulated. In this case there are three paths—

1. By means of  $K_1$  to the sheath from core 1.
2. By means of  $K_2$  between cores 1 and 2.
3. By means of  $K_1$  and  $K_2$  in series to the sheath by way of core 3.

Therefore, from what has been said previously, the capacity of this combination is—

$$1||2.s = K_1 + K_2 + K_1 K_2 / (K_1 + K_2) \dots (7)$$

To illustrate by means of the example as before, we have—

$$\text{Capacity } 1||2.s = .1646 + .0521 + \frac{.1646 \times .0521}{.1646 + .0521} \\ = .2563 \text{ microfarad per mile.}$$

The actual value of this combination obtained by experiment was .258 microfarad per mile, showing closer agreement than the previous combination.

The last two combinations, shown in figs. 8 and 9, are similar in the fact that the two cores 1 and 2 are joined in parallel, and the calculations are made between these two cores and the sheath; but in fig. 9 the core 3 is joined to the sheath, and in fig. 8 it is insulated.

The condition shown in fig. 8 is denoted by 1.2||s; and without going into detail, it will be seen that this capacity is—

$$1.2||s = 2K_1 + 2K_2 K_1 / (K_1 + 2K_2).$$

Example as before—

$$\text{Capacity } 1.2||s = .1646 \times \frac{2 \times .0521 \times .1646}{.1646 + 2 \times .0521} \\ = .393 \text{ microfarad per mile.}$$

No experimental test of this combination was made.

Now, in fig. 9 the fact of connecting the core 3 to the sheath makes the expression for this combination, denoted by 1.2||3.s, a very simple one: it will be readily seen to be, with reference to fig. 9—

$$1.2||3.s = 2K_1 + 2K_2 \dots \dots (9)$$

Example:—Capacity  $1.2||3.s = 2 \times .1646 + 2 \times .0521 = .4334$  microfarad per mile. The experimental value for this combination was .435 microfarad per mile.

The experimental determinations of the capacity were made by the usual method of comparison with a standard condenser.

Below are tabulated a few comparisons between the calculated and observed values for various cables:—

Combinations	1  2.3.s.	1.2.3  s.	1  s.	1  2	1, 2.3.	1  2.s.	1.2  s.	1.2  3.s.	Size.
Capacity per mile.—									
Measured..	.269	.494	.248	.166	.221	.258	—	.435	37/15
Calculated	—	—	.243	.160	.214	.256	.393	.433	
Measured..	.255	.43	—	.150	.206	—	—	.390	37/15
Calculated	—	—	.223	.155	.206	.238	.348	.397	
Measured..	.28	.495	—	.168	.224	.268	—	.440	37/14
Calculated	—	—	.25	.168	.225	.265	.397	.445	
Measured..	.304	.528	.266	.184	.247	.304	.324	.474	37/13
Calculated	—	—	.269	.184	.245	.286	.374	.480	"

**Irish Electricians.**—In Parliament last week, Mr. Brady asked the Vice-President of the Department of Agriculture (Ireland) whether his attention had been called to the fact that his Department recently advertised for applicants for the position of electricians to the new Royal College of Science in Dublin, and if so, how many Irish electricians applied, and what was the nationality of the successful candidate?—Mr. Russell, in reply, said that there were 120 applicants for the post, and the candidate who received the appointment was an Irishman.

**A Copper Trade Forecast.**—According to a statement accompanying the statistics which have just been issued by the firm of Aron Hirsch & Son, of Halberstadt, the prospects of an increase in the European consumption of copper can be regarded as decidedly favourable, and the electrical industry of Germany in particular entertains good expectations in respect of the near future, especially in relation to the conversion of steam railways to electric traction. As far as the United States are concerned, the firm states that it seems as if great expectations of a thorough improvement in industrial branches in 1912 are still premature on account of the impending presidential election. But even if an increase in the stocks of copper should be observed in the current year, it should not be overlooked that this situation cannot last long, as the consumption should soon again exceed the production through the intervention of American industries. In general, the copper industry is held to be justified in good expectations for the early future.

## FRAUDULENT TESTS.

[CONTRIBUTED.]

As a contract for any kind of power plant machinery is rarely placed without definite guarantees as to performance and efficiency being demanded, it naturally follows that certain tests have to be carried out with the object of assuring the purchaser that all specified results have been obtained. Upon the satisfactory completion of such tests, usually dignified by the name of "official trials," payment for the plant depends, and as the earning of a bonus or the incurring of a penalty is frequently consequent upon the exact results, to say nothing of the credit of the manufacturer, it follows that the latter has every inducement to secure a favourable record upon the test sheet. The other party to the contract, however, has even more interest in the tests, because, not only will they probably constitute his one and only means of knowing what the efficiency of his plant really is, but any default in performance will be a source of loss or danger to him so long as the plant is in use.

Now, when competition is very keen amongst contractors to secure a particular order, there is an obvious temptation amongst the less scrupulous to claim an exceptionally high efficiency for their products, and to guarantee a better performance than they are likely to obtain, trusting to conceal the discrepancy when the tests are carried out. It is not, however, only in the case of firms giving high guarantees that fraudulent testing is met with, as there are others who habitually resort to such practice because they are incapable of obtaining results which, with better design and workmanship, should be easily secured.

It may be protested that the supervision of tests on behalf of the purchaser should be sufficient protection against deliberate and systematic fraud; but, unfortunately, this is by no means the case. The average inspector is a young man whose previous experience in some consultant's office or Government department has never initiated him into the secrets of the test-bed. Usually, also, the official test is conducted at the manufacturer's works, and the inspector is received with deference and hospitality, so that he does not like to show a suspicion which may be unfounded. Moreover, in many cases, particularly where Government work is concerned, he considers his duty accomplished when he has seen the plant running and noted a few figures before he hurries off to catch his train, relying on the promise that the full result of the trial, carefully worked out, shall be posted on to him that evening. The average Admiralty inspector is often very complaisant in this respect, and thus almost invites the fraud which his simplicity renders possible. If, however, an inspector takes his duties more seriously, he is, as a rule, hopelessly unequal to the wiles of the testing staff, who pride themselves on their ingenuity in deceiving him, and have everything in their favour, even to test-bed equipment specially designed for fraud.

The vast majority of manufacturers in Great Britain, and certainly the whole of the private buyers of plant, would welcome the elimination of fraudulent testing and its consequent evils. But those who know most of the subject rarely say much, either because they are interested in a continuation of the conditions, or because they have natural scruples about casting aspersions on the honesty of their competitors. Hence an exposure of some of the typical forms of test-bed fraud is desirable in the interests of the industry generally, and while it is hopeless to attempt to deal exhaustively with the innumerable methods of deception, a few of the common methods of obtaining official certificates of spurious figures from the unwary inspector will be indicated.

Before dealing with the tricks of the test-bed proper, a few remarks concerning tests of material will not be out of place, as tensile and other tests are frequently specified for important items. Test bars from castings have usually to be broken off from the main casting in the presence of the inspector, who stamps them in order to identify them after they are machined for testing. Even this precaution, however, is futile if the test bars have been previously cast independently of good metal, and by being placed in the moulds, are burned on to the body of the casting whose quality they are supposed to represent. One foundry at least has been credited with this practice, which is very



difficult to detect. A steel test piece has been known to be screwed into the body of the "parent" metal, from which an Admiralty inspector afterwards saw it cut in apparent good faith. The shaft thus gaining approval subsequently broke, with serious results.

Supposing, however, the test specimen to be genuine, the inspector should assure himself that it has not been treated in any way so as to alter its mechanical properties. It is well known, though often forgotten, that the elastic limit of a test bar can be materially raised by stretching the piece previously to its official test. This fraud is sometimes betrayed by the marks made by the grip of the machine at the preliminary stretching, but the artificial strengthening of gunmetal test pieces by annealing is not so well known nor so easily detected. If ordinary Admiralty gun-metal of composition 88 : 10 : 2 is annealed, it gives a higher tensile test, but becomes porous. Now, porosity does not matter in a test bar, so that this can be artificially raised in strength above that of the main casting, to which "heat-treatment" is inapplicable for the reason stated.

Assuming that the test bar is known to be genuine and unsophisticated, and the inspector has assured himself that it is of the dimensions specified, he has then to see that an unfairly high breaking stress is not obtained by a too rapid application of the load. It is unusual for the testing machine itself to be tampered with, though not impossible. Before leaving the subject of tensile tests, it may not be out of place to mention the advisability of inspectors insisting that a surplus article shall always be provided when the specification calls for a test to destruction on one article of a set, as is often done in the case of connecting rod bolts for high-speed engines. Thus, the inspector can choose a bolt to be tested, and leave the required number for the engine. Otherwise a new one has to be made, and it will probably be made of the handiest material, without regard to quality.

Hydraulic tests are specified for many castings, the object being to prove that the articles are not porous, and are capable of standing a stipulated internal pressure. Porosity in iron castings is usually concealed by rusting up the bad places with a solution of salammoniac. Sometimes a cored place is filled instead with an acid solution of copper sulphate, metallic copper being thus deposited on the iron surfaces. The deposit may be localised and thickened where desired by placing small pieces of zinc to serve as anodes. When the deposit is considered sufficient, the hydraulic test is applied, and the copper, being forced into the spongy iron, renders it quite watertight. Light peening with a hand hammer will often cure mild cases of porosity. In the case of bronze castings—such as those for pumps or air compressors—soft solder is frequently applied; but the use of boiled oil is quite as effective, and less easy of detection. The oil is forced into the metal by the test pump, and soon oxidises and hardens, making the casting perfectly able to withstand the water test. None of these ways of getting spongy castings through the hydraulic test is, however, so flagrant as the plan of blanking off the casting from the pump, so that while the gauge at the latter shows a high pressure, the interior of the casting is subjected to no pressure at all. Sometimes a blank flange across the pressure pipe, close to the casting, is used, but more often a small valve in this pipe is surreptitiously closed. A pressure gauge communicating with the interior of the casting is the best preventive of fraud of this kind. It is well to assure oneself that the gauge actually does communicate with the interior, as boiler tests have been conducted with a pipe inside the boiler connecting the gauge with the pump inlet. The boiler was full of water, so that had the manhole cover been removed, it is probable that no suspicion would have been aroused.

Coming now to tests of plant as a whole, it will be best, perhaps, to consider the tricks practised upon the inspector in the case of a particular plant, such, for example, as a high-speed engine direct coupled to a dynamo for electric lighting. It will be assumed that neither the engine nor dynamo could fairly obtain any one of the guarantees, and that the test-bed staff have instructions to get the plant through its tests with especial credit by any means in their power. We will consider first the six hours' full load test to determine the steam consumption of the engine and temperature rise of the dynamo. In testing Admiralty engines and commercial engines where saturated steam con-

ditions are specified, the steam consumption may be reduced by 10 or 15 per cent. by the use of quite a modest amount of superheat. A thermometer pocket at the stop valve is never specified for such engines, so that even if the inspector suspects superheat he has no means of verifying it, as a thermometer in contact with the outside of the pipe is not much good. A visit to the boiler house will not give him much information, as little must be inferred from the position of the lever of the superheater damper or the handle of the mixing valve. As a matter of fact, the Admiralty inspector never does suspect. The stipulation of a proper thermometer pocket at the stop valve is the best safeguard against surreptitious superheat. In engines, and particularly in turbines, built for superheated steam, where there is such a pocket, the ingenuity of the tester is often applied to the vacuum gauge. An inch, or even half an inch of vacuum, will make such a marked difference in steam consumption, that any test conducted with an apparently poor vacuum and "corrected" to the specified conditions may reasonably give grounds for suspicion. The inspector should rely on his own vacuum gauge, and should not accept the readings of any works recording aneroid barometer or "weather glass," as necessarily giving an accurate indication of the barometric pressure, as these may be adjusted with the greatest ease.

Besides "faking" the steam and the vacuum conditions, there are however numerous other ways in which the steam consumption can be made to come out on the right side of the guarantees. Neglecting such obvious but common expedients as running water out of the measuring tank during the test, we may mention the device of falsifying the ammeter readings by tampering with the shunt, or using leads of lower resistance than those with which it was calibrated, or otherwise. These methods, even if detected, can usually be explained away to the satisfaction of the average inspector. They have some popularity, since they have the advantage not only of reducing the apparent steam consumption per kW.-hour, but of easing the load on the engine and lessening the heating and sparking of the dynamo. Occasionally an engine is built which will not develop its rated load or overload with the stipulated steam pressure. In such a case, unless, unknown to the inspector, it can be supplied with steam at a higher pressure, there is every temptation for the testers to falsify the ammeter in order to get the plant through its test. After the inspector has left, the high-pressure slide valve is removed and some of the lap turned off, so as to get the requisite power, though at the expense of economy. To guard against falsified or specially calibrated instruments, the Admiralty inspector should bring his own portable testing set and connect it up himself. He should also never leave the plant unwatched, for while he is lunching with the heads of the firm during the six-hours' test, he may be sure that the load is off the machine, and that scouts are posted out to notify his return.

As regards temperature tests, there is little to be said. Temperatures are usually taken by the thermometer, and an experienced tester will have no difficulty in getting the machine through, even if the temperature has not been lowered by running at less than the rated load, as by any of the means previously indicated. Unless the inspector places the thermometers himself, and sees that they remain untouched until he himself reads them, he should distrust the figures given him. Moreover, he should see that the thermometer placed to measure the temperature of the surrounding air is not put "for convenience" on the top of the outboard bearing or near a hot steam pipe. He should also be conversant with the fact that there are in existence thermometers reading several degrees low, and that these are not unknown adjuncts to the equipment of a test bed.

Few tests are more difficult to conduct with accuracy than those of air-compressors, but the usual official trial makes no pretence to scientific exactitude. In general a machine is merely required to give evidence that it will deliver the guaranteed output. The output is tested either by noting the time taken to pump up a reservoir of known capacity to the stipulated pressure, or by requiring the compressor to maintain a given pressure when the air is escaping through a sharp-edged orifice of known size. In both cases the temperature of the air in the reservoir should be noted, and, it



is needless to say, this cannot be measured by holding a thermometer in the issuing jet, when the orifice method of test is used, although this is sometimes done by Government inspectors. When the reservoir test is being conducted, the usual method of fraud consists in having a quantity of water in the reservoir, thus reducing its capacity and shortening the time required to raise the air it contains to the specified pressure. The presence of water cannot easily be detected if the drain cock is fitted with an internal pipe terminating at a point above the bottom of the reservoir, so that air is always drawn from the cock when it is opened. Another method, largely practised when there are duplicate reservoirs, as in battleships, consists of slightly opening a junction valve for a few minutes and allowing air from another reservoir to enter the one to which the compressor is connected. By this means the compressor is helped to the desired extent, and if the trick is carried out unobserved, it is difficult of detection, as the gauge readings are not fine enough to make the transaction readily visible. When the output of a compressor is being ganged by the pressure maintained behind a sharp edged orifice, it is the duty of the inspector, not merely to measure the orifice, but to satisfy himself that there is no obstruction, temporary or otherwise, to the free flow of air to the orifice.

(To be concluded.)

## PROCEEDINGS OF INSTITUTIONS.

### The Supply and Transmission of Power in Self-Contained Road Vehicles and Locomotives.

By J. C. MACFARLANE, M.I.E.E., and H. BURGE, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, February 22nd, 1912.)

At the present time the popular means of driving heavy commercial vehicles in this country is by the petrol engine, and this is fairly satisfactory where long non-stop runs have to be made through level country. In large cities, however, the problem is entirely different. The inflexibility of the petrol engine makes it a difficult matter to design heavy vehicles to withstand the continual starting and stopping that is necessary in city traffic; this necessitates a large engine, three to four times the size that would be required to drive the vehicle on the level, which, when running at high speed and developing low power, must be very inefficient. Other disadvantages of the petrol engine for this service arise out of the multiplicity of parts liable to get out of order, and omnibus companies require a large night staff for continual observation and adjustment. As regards the petrol omnibus in London, the transmission gear is the most expensive item in the upkeep.

The authors have no doubt that the remedy lies in adopting secondary batteries as a source of power for heavy vehicles of all kinds for city traffic, more especially if complete regenerative control is adopted and the batteries are maintained by the makers.

The reasons for this are briefly as follows:—

1. The absence of shock and vibration greatly reducing the wear and tear.

2. The reduction of rates following on the supply of current for battery charging from municipal stations.

3. From the owner's point of view there are many advantages, some of which are: Lower cost of insurance and freedom from insurance limitations; instant readiness of vehicle and less depreciation, resulting in less time in the repair shop, so that a larger percentage of vehicles are kept running. This involves a reduction in capital, rates, rent and taxes, insurance, supervision and establishment charges. In the case of omnibuses, due to better lighting and other public advantages, the takings are bound to be considerably augmented, and further additions to revenue might be obtained from novel forms of advertisement and electric signs on the vehicles.

Even if the supply is cheap, the income to be derived by stations will be nearly all profit. Taking energy at  $\frac{1}{2}$ d. per unit, 1,500 electric 'buses running in a city, each consuming 1 unit per mile, and making 30,000 'bus-miles per year, would provide an income for the power station of £100,000 per annum, apart from the additions to the lighting load that would naturally accrue. Surely this is well worth fighting for, seeing that it is obtained with practically no outlay.

Hitherto traction batteries for a 6-ton vehicle have weighed about 2 tons (consuming energy at well over 1 unit per mile, i.e., 2 units per mile for charging purposes), and it was therefore impossible to construct omnibuses carrying a sufficient number of passengers to be remunerative. One of the objects of this paper is to describe a system which, to a great extent, removes the weaknesses of the battery and considerably strengthens the position of the battery vehicle from other points of view.

Most of the improvement has been obtained by raising the vehicle efficiency, with a consequent reduction in the size of the battery for a given mileage. Resulting from this, the initial and

upkeep costs are reduced in almost direct proportion to the reduction in the size of the battery, but more important still, the ratio of the live to the dead load has been increased almost as the square of the reduction in battery weight.

Some of the methods that the authors have adopted to bring about this result comprise:—

(a) Braking entirely by regeneration, the battery absorbing the energy returned.

(b) A controller in the shape of a very efficient rotary transformer or automatic electric valve (only transforming half the power supplied to the wheel motors) which automatically limits the current that can be drawn from or returned to the battery, displacing the usual series-parallel type of controller.

(c) A motor with special shunt field windings, having a torque-speed characteristic similar to a series motor.

The battery is used under very favourable conditions indeed, and the regenerative action of the motor comes into play whenever the driver reduces the speed or stops the vehicle.

The scheme as applied to the driving of heavy electric vehicles is shown in fig. 1. The automatic electric valve A B, used as a controller, possesses the further property of acting as a power-limiting device between the battery and the motor. The action of this machine under full-speed conditions is as follows:—

The upper half A of the armature acts as a motor, and is coupled directly across the battery. The lower half of the machine marked B acts as a generator, and is coupled in series with the driving motor C, so that the latter is receiving across its terminals twice the battery voltage. The motor C is provided with two shunt field windings, one of which D is connected across the battery, providing a constant excitation, and the other E across the terminals of B. The winding E is arranged so as to assist the winding D during the acceleration period, and to oppose D when running at full speed. The part B of the electric valve is provided with a variable and reversible excitation by the winding F and controlled by the regulator G. When the regulator arm is over to the right, say, B adds its voltage to that of the battery, but when

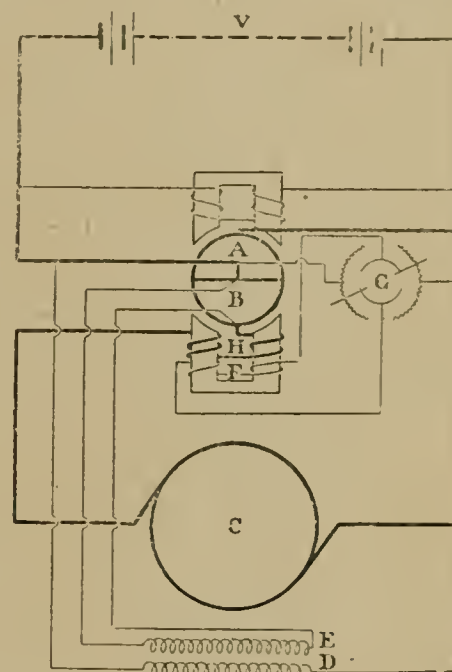


FIG. 1.—DIAGRAM OF CONNECTIONS. (BATTERY VEHICLE.)

the regulator arm is to the left, this voltage is subtracted from that of the battery. With the regulator arm in the mid-position, B is not excited. An additional winding H is also provided on the field of B in series with the driving motor C, which opposes the winding F when B is acting as a generator delivering power to C.

The advantages of this arrangement are as follows: During the period of negative acceleration, when the motor is returning energy, the field of the motor is strengthened so that the electrical braking tendency is largely increased, whereas when the motor is being accelerated and is rotating rapidly, its field strength is diminished so that acceleration is facilitated. The design of the motor is such that due to the action of the field winding E the torque produced is nearly proportional to the square of the current passing through the motor armature. Thus, when starting or hill-climbing, with the controller "full on," the torque is four times that on the level, with only  $2\frac{1}{2}$  times the normal current in the armature. Moreover, by means of the series winding on B the current to the motor C is always kept within safe limits when it is driving as well as when it is braking.

The entire control is carried out by means of a foot pedal and a single reversing lever, which is also employed to start up the machine A B. The pedal controls the reversing field regulator G, and when in the "off" position, the arm is over to the extreme left, and if it is allowed to come quickly to this position, a very powerful braking effect is produced, which continues even after the vehicle has been brought to rest. The latter effect is obtained by arranging the resistance of the regulator G so that B gives a back E.M.F. slightly in excess of the voltage of the battery, producing a negative current of no power through the armature of the driving motor, and giving a torque in the backward direction. This torque is arranged to be of such a magnitude that it holds the vehicle on a comparatively steep downward gradient, and yet has not sufficient power to cause the vehicle to start backwards on the level. If, however, the vehicle is facing uphill with the controller in the "off" position, it is necessary, in order to prevent



the vehicle from moving backwards, to depress the controller pedal slightly and give the driving motor a positive torque, tending to drive the vehicle uphill. This torque can be arranged to keep the vehicle stationary on the hill, thereby dispensing with the use of any mechanical brakes.

A vehicle equipped with such a system has the advantage that the speed is adjusted automatically to the gradient of the road. In fact, the speed is a definite function of the torque required to drive the vehicle. The above statement applies to all positions of the controller pedal, as indicated in fig. 2, where the dotted curves

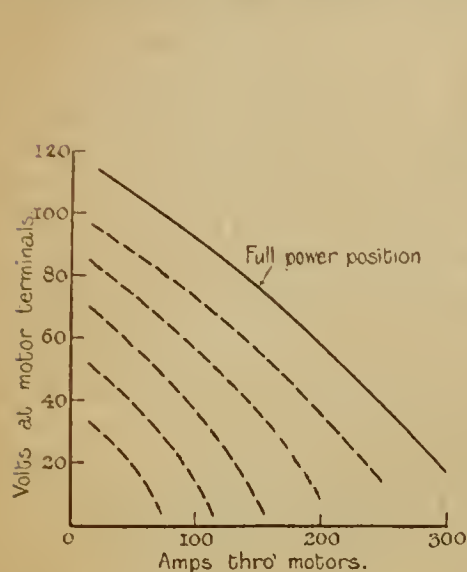


FIG. 2.—OUTPUT CHARACTERISTIC OF ROTARY TRANSFORMER FOR VARIOUS POSITIONS OF CONTROLLER PEDAL.

show the output to the motor for intermediate positions. Fig. 3 shows the electrical characteristics of the system for maximum power position of the controller as a function of the vehicle speed.

Due to economical acceleration, regeneration, high torque per ampere, and other causes, it is possible to obtain a higher efficiency, and therefore reduced battery weight and size (*i.e.*, about half the energy consumption and weight for the same number of passengers and mileage as on previous battery omnibuses).

Further, as the voltage of the battery is only half that of the motor, the number of cells can be reduced without additions to the weight of other parts. This admits of a further reduction in the weight, due to fewer cases and connections, less liquid, &c. Also, as the discharge rate of the battery is limited, the capacity is greater under working conditions, *i.e.*, the ampere-hour efficiency is high. Further, it is obviously not necessary to use two motors or a double-commutator driving motor to obtain economical speed control; therefore a further increase in the efficiency of the system is obtained.

Thus the energy, initial and upkeep costs are reduced, and the ratio of live to dead load is very much increased.

The control is very simple, the whole operation being effected with one foot-pedal. It is fool-proof, and any prearranged maximum battery currents are obtained for definite vehicle speeds. These values cannot be exceeded by any means within the power of the driver. Pressing down the pedal increases the speed; raising the pedal reduces the speed, and at the same time applies regenerative braking.

The acceleration or retardation is proportional to the rate of

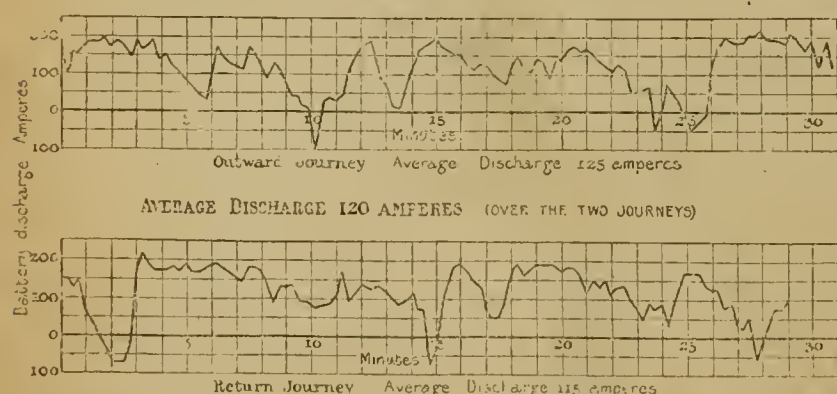


FIG. 5.—CHART OF DISCHARGING CURRENTS. (BATTERY VEHICLE.)

forcing down or raising the pedal, and these have been arranged as a maximum to get up speed from a standstill in about one and a half or two bus-lengths, and to brake to a standstill from full speed in the same distance. Any intermediate positions of the pedal give intermediate speeds, and continuous crawling can be done at the rate of one-hundredth of a mile per hour if required.

One brake can be dispensed with if police regulations permit, and it is not even necessary to use any mechanical brake when driving in the ordinary course.

The system of braking reduces the tendency to skid on greasy roads, and as the controller always returns to the braking position, this action brings the vehicle to a standstill if anything happens to the driver.

An omnibus constructed at Chelmsford and equipped with the system outlined above is now running in London, and conforms in all points with the Metropolitan Police Regulations, and when loaded it has a total weight of not more than 6 tons. It is fitted with a battery having a capacity of 500 ampere-hours on a 5-hour discharge rate. The battery of 28 cells weighs 19 cwt., and the battery case 2 cwt.; the electrical

equipment complete weighs 7 cwt.; the total dead weight is 73½ cwt., and the total live weight, with 34 passengers, driver and conductor, is 45 cwt., making in all 118½ cwt. The battery is mounted in front in the position usually occupied by the petrol engine, therefore no swinging bolts or clamps are required for its support. Ordinary apparatus in the way of cranes or blocks is all that is necessary to remove the battery and replace it by another. Further, in this position it is much freer from dust and dirt—a point affecting its life—and it is more easily inspected and repaired. In the previous omnibuses running in London the battery was suspended from under the frame and liable to get very dirty, and if any of the connectors on the cells under the chassis gave out in the middle of a journey, it was almost impossible to carry out repairs on the spot.

Fig. 4 shows the outline of the chassis of the latest design of omnibus, to which is fixed the automatic electric valve and motor, all in one case and marked A, B, C. The case is hung to the chassis frame by means of suspension hooks and eyes and is stayed to the sides of the chassis by rods. The motor drives direct through the cardan shaft to the worm-reduction gearing mounted on the usual

construction of live axle. The regulator G is fixed on one side of the electric valve, while the starter K is mounted on the other side. The foot-pedal L and the starting and reversing lever M are linked up to the regulator and starter respectively by means of rods, as shown.

The dimensions of the battery over cells when packed closely

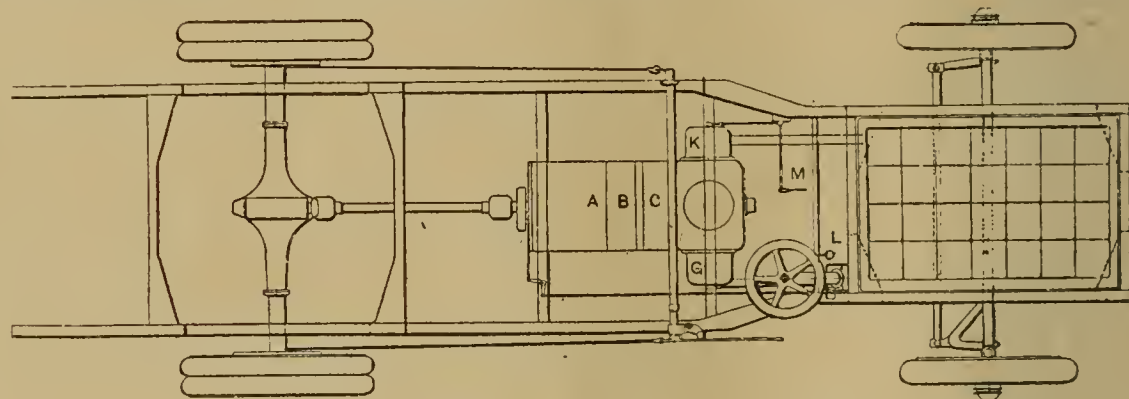


FIG. 4.—PLAN OF CHASSIS (BATTERY VEHICLE).

are 49 in. × 31 in. × 16½ in., making it of a convenient size for placing in front of the omnibus in the position usually occupied by the petrol engine.

The total weight of the equipment, excluding the battery, is extremely small, and compares very favourably indeed with an equipment of the series-parallel control type for the same speed and loaded weight.

Fig. 5 shows a chart of ¼-minute readings of the battery discharge taken on a loaded omnibus (6-ton weight) on a run from Chelmsford, a distance of six miles out and six miles home. There were one or two fairly steep hills to be negotiated, and an examination of the chart will show these, especially the down grades. The

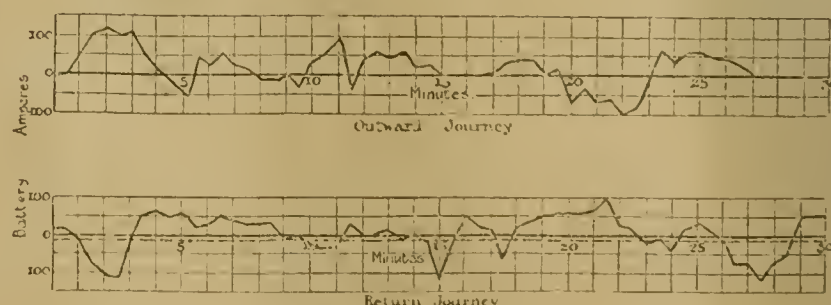


FIG. 6.—CHART OF BATTERY CHARGING AND DISCHARGING CURRENTS (PETROL-ELECTRIC VEHICLE).

readings were taken with the controller pedal on the "full on" position the whole of the time, the omnibus speed only varying due to the contour of the road. The average speed was just under 13 miles per hour, the average current consumption on the outward journey was 125 amperes and on the back journey 115 amperes, making a total average of 120 amperes. The ampere-hours per mile therefore work out at just under 10, and as there are 28 cells giving a discharge of 120 amperes at about 53 volts, the energy consumption per mile was equal to 0.7 of a unit, or, in



other words, 88 watt-hours per ton-mile, and the average horse-power required to drive the vehicle at a speed of 12½ miles per hour was just under 8½ H.P. It will therefore be seen that as the battery has an average capacity of 500 ampere-hours, the total range of the vehicle is 50 miles.

It would appear that the electrical omnibus can be run for at least 1d. per 'bus-mile less than the petrol, and the revenue per 'bus-mile should be greater.

The arguments in this section apply equally in many points to heavy commercial vehicles, especially where these are operating in city traffic on round journeys.

It is obvious that the electrical vehicle is unsuitable for travelling long distances or working in outlying districts, but it is suggested that the all-electric system modified by reducing the battery to one fifth the capacity, and by adding a 9-H.P. air-cooled engine, would meet the case. The engine is coupled to the electric valve, and takes the average load, the peaks being supplied by the battery, which also absorbs the energy returned during braking.

The engine runs practically at constant speed, and has only to supply the average power required to drive the vehicle. Air-cooling for the engine is possible, with its attendant advantages. A governor is used to keep the engine speed constant. The load factor being approximately 100 per cent., the consumption of petrol will not be more than half that of the ordinary petrol vehicle, the engine of which works on the average at only one-third full power.

Due to economical acceleration, high torque per ampere, and regeneration, the efficiency of the system is very high, and also one mechanical brake can be dispensed with. The weight is under that of the petrol omnibus.

Fig. 6 shows a chart of the charge and discharge of a buffer battery, and was obtained by fitting a petrol engine to the chassis of the electric 'bus described above, and running the vehicle over a road of average contour. The engine has supplied the average load of the omnibus throughout a 12-mile journey out and back, and the hills have been dealt with by the battery. The dotted straight lines gives the average value of the complete discharge that the battery obtained during the 6-mile inward run; this was about 17½ amperes, although the maximum went up in some cases to 110 amperes. The vehicle would travel approximately 14 miles with a gallon of petrol, making a cost of 0.75d. per mile for power, taking petrol at 10½d. per gallon.

It would appear that the petrol-electric vehicle, constructed on the above lines, would cost less to run than the present vehicle by at least 1½d. per mile.

Many railway companies have been looking into the question of electrifying their suburban lines, to meet more successfully the competition of tramcars and omnibuses. It is suggested that a self-contained electric train with complete regenerative braking would meet the case. The capital outlay apart from the cost of a generating station would only amount to approximately two-thirds of that required where the power has to be transmitted from generating stations and fed to the train by conducting rails.

The trains would be made up of any number of motor coaches and trailers on the multiple-unit system. The motor coach is equipped with a spirit or oil engine and electrically equipped similar to that described, but to provide in suburban trains the very large additional power required during acceleration, and to absorb the returnable energy, a larger proportion of battery is carried on the train.

Only a comparatively small engine is required, developing power sufficient to overcome all train friction, battery, and other losses, and running at constant speed and power throughout the whole journey.

So far as can be seen from estimates, the capital outlay would be reduced to approximately two-thirds and the cost of running to seven-eighths, reductions which should make the system proposed well worth consideration where capital is scarce and where there is likely to be a narrow margin between revenue and total working costs.

### The Ignition of Coal Dust by Electric Flashes.

By PROF. W. M. THORNTON, D.Sc., D.Eng.

(Abstract of paper read before the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, NORTH OF ENGLAND BRANCH).

THIS paper deals with an experimental investigation of the influence of the presence of firedamp on the ignition of clouds of coal dust by single electric flashes. Previous experiments dealt with the influence of small percentages of ordinary lighting gas upon the ignition of clouds of fine coal dust in air by single electric flashes. The degree of ignition was there found to depend very largely upon the manner of formation of the cloud.

Instead of the Ralph electrical device for indicating the percentage of coal gas present, which, though perfectly adapted for detecting coal gas, is not sensitive in methane, the desired strength of mixture was now obtained by introducing measured volumes of gas into the explosion vessel, the volume of which had been accurately determined. A blast was made by fitting the rubber bag of a motor-cycle horn to the dust bottle; the expanding jet of dust produced by it crossed the explosion box over the arc and impinged upon the closed end of the exit, forming in the box a dense cloud more uniformly distributed and with less movement than before. This new arrangement gave a marked increase in the sensitiveness of the cloud to ignition. No change was made in the electrical conditions, the arc being that caused by breaking 4.5 amperes of non-inductive direct-current at 480 volts as quickly as possible.

The first conclusion to be drawn from a comparison of the

figures obtained was that the presence of gas had a greater effect when the disturbance of dust and air was not violent. Again, in the former case, the transition from the low rate of change at very low percentages of gas to the linear rate of change obtained at values approaching 1.25 per cent., was more gradual and had a clear turning point at 1 per cent. In the present case the linear stage continued with both lighting and marsh gas down to 0.5 per cent. The slope of the curves at points corresponding to 1.5 per cent. of gas showed an increase in the former experiments of about 12.0 ignitions for unit percentage increase of gas, and in the present 11.5. The fact that the curves obtained by the two arrangements are parallel was a satisfactory confirmation of the experimental results, showing that the influence of the gas was the same in both cases, and that the difference was caused by the manner of forming the cloud of dust and the disturbance of the air in the box.

The influence of methane was uniformly less than that of lighting gas in the ratio 0.92.

### DISCUSSION.

MR. H. W. CLOTHIER said that this paper was intended as a reply to criticism which had been levelled at Dr. Thornton, because he had not tested the explosive properties of coal dust and methane.

MR. T. A. W. SMITH said he thought the question of temperature would be found to have considerable influence on the results obtained; it was a curious fact that fiery mines were always exceedingly hot.

MR. H. W. CLOTHIER said that although some of the figures given by Dr. Thornton might appear to be alarming (e.g., 60 per cent. of full ignitions could be obtained with 1 per cent. of fire-damp in a cloud of coal dust) it must not be forgotten that these were obtained with the utmost difficulty, and he thought that the chances of the same conditions occurring in a mine were exceedingly remote. It was, however, satisfactory to note that no coal dust explosion in a mine had ever been proved to be due to electricity.

### Electric Haulages in Mines.

By W. C. MOUNTAIN, M.I.E.E.

A LECTURE was given by Mr. W. C. Mountain on January 15th, 1912, before a joint meeting of the INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION), and the ASSOCIATION OF MINING ELECTRICAL ENGINEERS (NORTH OF ENGLAND BRANCH). The author explained that main-rope haulage consisted of a single drum, hauling the tubs up a single road, and was used in places where the gradient was sufficient to allow the empty tubs to run back and draw the rope with them. It was found that to operate such a system the gradient must be from 2 in. to 3 in. per yard. In main-and-tail haulage a main drum and its rope were used to draw out the train of tubs, a tail rope attached to the back of the tubs being drawn off the tail drum as the full train was hauled out-by. The train of empty tubs was then drawn in-by by means of a tail rope.

The endless-rope system was used in mines where the roads could be made wide enough to accommodate two lines of rails, the full tubs coming out-by along one line, and the empty tubs returning from the pit bottom or running in-by along the other line. In this system of haulage the rope wheel ran practically continuously, and the speed of haulage was usually about two miles per hour.

The great advantage in this system of haulage lay in the fact that the tubs were delivered in constant rotation to the pit bottom. The load was, therefore, practically constant. On account of its low speed, this system of haulage did not throw up the cloud of coal dust which was frequently the case when hauling at the high speed necessary with main-rope and main-and-tail systems. Less coal dust was also made in the tubs. The wear and tear of the ropes and the tubs was also much less.

There was a large field for the use of portable haulages of either type in collieries, where it was desired to dispense with horses and work as economically as possible with electricity. He had prepared two tables which he had found of very considerable value for ascertaining the horse-power necessary. These tables were based on the assumption that the frictional loss to overcome the friction due to the rope, tubs, guide pulleys, gearing, &c., also acceleration, was equivalent to hauling the load up an incline of about 2 in. to the yard. This figure he had found after many years' experience to be quite reliable and on the safe side, and this would explain what was meant in the tables by "actual" and "virtual" incline.

Table I dealt with the horse-power required by the main-and-tail haulage at 10 miles per hour. The horse-power did not involve any consideration for the length of road.

Table I.—H.P. required for Main-and-Tail Haulage at 10 Miles per Hour.

Actual incline in inches per yard.	Virtual incline in inches per yard.	Load in tons.				Output in lb. per minute.				
		5	10	15	20	200	400	600	800	1,000
0	2	16.7	33.3	50	66.6	1	2	3	4	5
2	4	33.4	67.5	100	134	2	4	6	8	10
4	6	50	100	150	200	3	6	9	12	15
6	8	66.3	133	200	267	4	8	12	16	20
8	10	83.5	166	250	333	5	10	15	20	25
10	12	100	200	300	400	6	12	18	24	30

Table II.—H.P. required for Endless-Rope Haulage on Road 1,000 yds. long.

In endless-rope haulage one had to consider the weight of coal only delivered per minute either to the pit bottom or landing, also



the length of road and average gradient. Table II had been prepared on the assumption that the road was 1,000 yds. long, and the horse-power would be proportionately reduced or increased as the road was longer or shorter.

In both systems it was desirable to add, say, 25 per cent. to the calculated power for contingencies, such as tubs coming off the road, abnormal friction, &c.

With regard to the construction of haulage gears, bedplates required to be very stiff, so that there would be no springing and consequent vibration. They were generally built of rolled-steel girders or channels placed back to back, the main girders being tied together by cross-girders with strong gusset plates at the corners. The bedplates must be constructed so that they could be taken to pieces for getting underground, and in-bye. Care must also be taken that the supporting girders were of such a length that they could be got down the shaft and round corners.

The main shafts should be of steel, and in all cases where machine-cut helical gearing was used, it was desirable that there should be a bearing on each side of the spur wheel and the pinion, otherwise any wear and tear upon the bearing brasses would throw the wheels out of gear and tend to cause noise and heavy wear and tear. The shafts required to be of very ample strength, particularly in main-and-tail haulage gears where the drums were necessarily some distance apart, giving a long distance between the bearings. It was preferable to avoid feathers in clutches. In the case of main-and-tail haulage gears the clutch should slide upon a square or hexagon, in preference to keys or feathers.

The drums of main-and-tail haulage gears should in all cases be in halves where the diameter of the drum exceeded 2 ft. 6 in.

The bushes for drums should be of gun-metal in halves, arranged so that by slackening the bolts the bushes could be drawn back and new bushes fitted without having to take off the drums themselves.

The brake rims should be preferably cast separate from the drums in large sizes, and should be fitted with renewable brake tracks, these usually being secured to the brake rim by countersunk bolts.

The most powerful brake was that known as the "post" type, consisting of two vertical posts working upon fulcrums below the drums. These posts were drawn together by means of a toggle joint, and adjusting screws must be provided to enable the wear and tear of the brake-blocks to be taken up. The brake-blocks were usually of cast-iron, and they could be lined, if required, with hard wood or with material known as "Ferodo," which had great lasting properties, and did not fire.

Double-helical machine-cut gear wheels were by far the best type of gear for transmitting the power from the motor to the main drum-shaft of either endless-rope or main-and-tail gear. With cut teeth double-helical gear would give a reduction of as much as 16 to 1, but a very good proportion was about 10 or 12 to 1. For haulage gears of, say, 100 to 300 H.P. a motor speed of 300 to 400 R.P.M. gave very satisfactory results.

In endless-rope haulage the rope wheel if above 4 ft. in diameter should be in halves with planed joints, and, if a fleeting wheel were used, the rim should be fitted with renewable chilled cast-iron "C" segments.

It was frequently desirable to convert existing haulage gears to electric driving, and in many cases they were not of modern design. Under such circumstances there was no doubt that a drive by ropes from the motor on to a rope wheel on the pinion shaft possessed considerable advantages, and the loss in friction on the ropes was exceedingly small. If the ropes were of proper diameter and sufficient in number, the life would be very long and the upkeep trifling.

In the early days before controllers were as reliable as they were to-day, he had used friction-clutches on both main-and-tail drums and endless-rope wheels. They were satisfactory. Recently, however, very considerable advances had been made in the design of oil-filled metallic controllers and also liquid controllers, and, therefore, on main-and-tail haulages, ordinary jaw clutches could be used.

A large number of interesting lantern slides were shown.

A discussion took place on Mr. Mountain's paper on February 12th.

MR. F. O. HUNT said that the portable haulage sets described seemed to be a step in the right direction, as they brought mechanical handling of material closer to the coal face. Their advantages, however, must depend upon the facility with which they could be moved, and upon the method of fixing and the arrangements for extension of length. Controllers on haulage motors had to work under very arduous conditions. The liquid type, which was operated by allowing water to flow in and out of the tank, had the great advantage of having a fixed speed of operation independent of the operator.

MR. H. J. MOYSEY said that the powers for endless-rope haulage given by Mr. Mountain were lower than he had been accustomed to use. It was important that the figures should be got out, not for the tubs running at full speed, but for starting conditions, and he thought that, in many cases where motors were said to be too small, the trouble lay in the enormous current required to start.

MR. J. E. F. LEEBETTER agreed that three miles per hour was quite fast enough for endless-rope haulage, and that this type was the cheapest in upkeep, &c. He said that girder frames should be filled up solid with concrete to form the best foundation.

MR. T. A. W. SMITH favoured the use of flexible shaft couplings, and had found these a cure for broken commutator connections.

MR. A. BARKER thought that frames were better constructed of cast-iron, built up in segments pinned together. Frames which allowed of any spring were a fruitful source of burnt-out rotors. He strongly advocated the bringing out of the neutral point of

stator windings, and thought that English manufacturers might follow Continental practice in this respect, as it facilitated testing.

MR. H. J. FISHER agreed that girder frames were liable to spring, and thought that the motor and its bearings at least should be on a separate cast-iron bed-plate. This was of special importance where the slip-rings were overhung and liable to chatter. He favoured the liquid type of controller as being more efficient, cheaper and lower in maintenance cost.

MR. H. K. TRECHMANN said that one great disadvantage of metallic controllers lay in the liability of the nuts on grid resistances to work loose, and this might give rise to dangerous sparking.

MR. H. W. CLOTHIER said when comparing the relative costs of metallic and liquid resistances the cost of pumping the water should not be overlooked, as this would form a large item in the case of a frequently-operated controller.

MR. H. L. RISELEY criticised the usual design of split bearing. This was usually split on the horizontal axis, and it was difficult to take up wear in consequence. He thought that if bearings were split along the vertical axis they would be much more easily adjusted.

Several other members also spoke.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Simplex Electric Irons for Laundries.

Fig. 1 shows a new type of electric iron which is being put upon the market by MESSRS. SIMPLEX CONDUITS, LTD., of Birmingham and Charing Cross Road, London, W.C., and is designed specially to

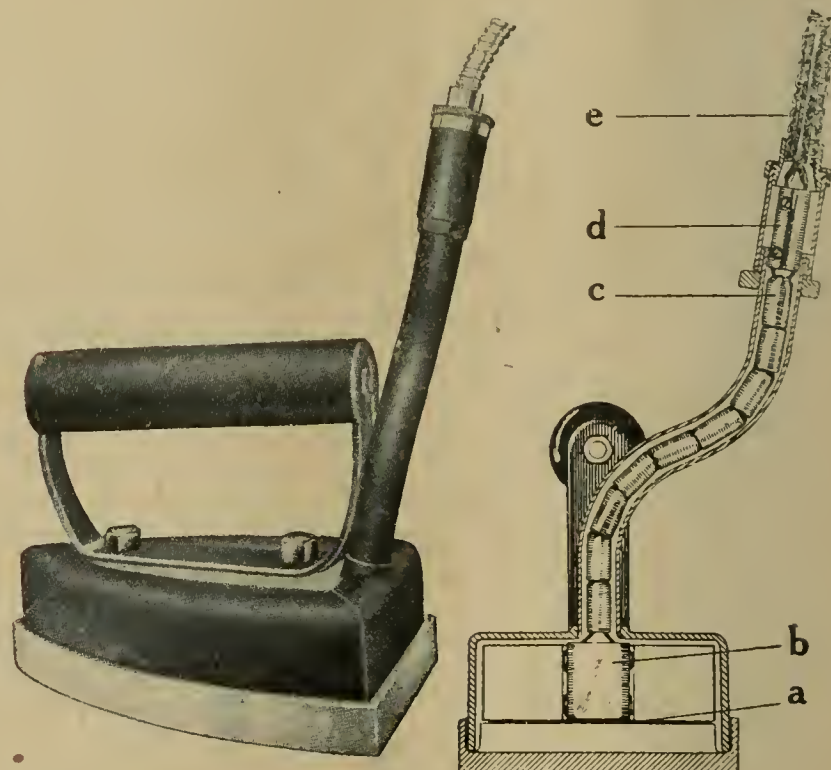


FIG. 1.—SIMPLEX ELECTRIC IRON.

FIG. 2.—SECTIONAL DIAGRAM OF PROTECTING DEVICE.

comply with the severe conditions which obtain in laundries and dry-cleaning shops. It is fitted with a special attachment arranged in such a manner that the combustible insulating covering of the

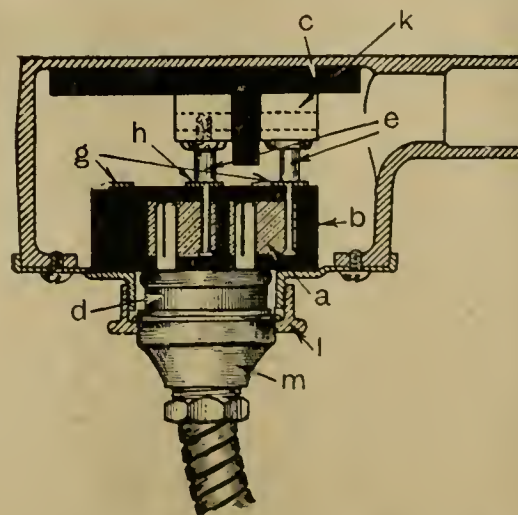


FIG. 3.—SECTION OF SWIVELLING CONNECTION.

flexible lead is protected at those points which are likely to become very hot, and thus to damage the insulation. This is one of the most troublesome forms of breakdown. Fig. 2 is a sectional diagram showing the construction of the iron; a represents the heating ele-



ment, from which two wires are brought into a porcelain connector *b*, which consists of two solid brass terminals embedded in porcelain, the wires being held in position by set screws, without soldering; to these terminals at the top are connected two copper wires, which are carried in iron tubing and insulated by being threaded through small pieces of porcelain *c*, which abut closely together, so that there is no possibility of the two leads accidentally short-circuiting. They form practically a continuous length, one end being convex so as to fit into a concave end on the piece of porcelain immediately succeeding it. These two copper wires terminate in a second connector, *d*, to which the flexible lead is attached; this second connector is enclosed in a coupling piece with a brass cap which may be easily unscrewed, so that the connections are readily accessible.

This arrangement is primarily designed for use with flexible metallic tubing *e*, but the iron may be used in the ordinary way if so desired.

Another source of trouble is the destruction of the flexible through the continual twisting of the iron and therefore of the flexible. Fig. 3 shows in section a patent revolving connection-box designed to overcome this difficulty and made to work in with the special iron described. It is designed to be used where flexible metallic tubing is employed as a mechanical protection to the flexible leads.

In the diagram, *a* is a brass connection piece into which the two pins of a standard two-pin wall plug are inserted; *b* is a rotatable insulating piece enclosing these two connection blocks, on the under side of which are two concentric contact pieces, *g* and *h*, connected to the connection block *a*, into which the two pins of the plug *d* are inserted, and to which the leads to the portable apparatus are connected; *k* are the terminal connection blocks for the circuit wires, which carry two spring plungers, *e*, which press against the concentric pieces *g* and *h*. These contact blocks, *k*, are carried on an insulating piece, *c*, attached to the bottom of the iron box, and separated by an insulating fillet; *m* is a brass cap fitted to the two-pin plug *d*, which carries a split gripping bush, to which is attached the flexible metallic tubing, enclosing the leads to the portable apparatus; *l* is an internally screwed ring which, while allowing the cap *m* (and, therefore, the two-pin plug *d* and insulating piece *b*) to rotate freely, securely attaches it to the iron box. Ample provision is made for the earthing of the iron. The appliance, when supplied complete, is wired with three-wire flexible, and the iron is earthed by means of the third wire to the brass cap of the plug *m*. As the box is an integral portion of the conduit system, the iron is thereby effectively connected to earth.

In the accompanying fig. 5 we show a type of wrought-iron fittings for outside use, which is being supplied by MESSRS. SIMPLEX CONDUITS, LTD., for several important orders, their destinations including a well-known theatre in the West End of London.

#### A Portable Drying Oven.

The necessity of some simple means of drying and baking which is free from complications, enabling it to be used by the ordinary

electrical work in general. Its external appearance is indicated by the sketch; it consists of a chamber within a chamber, the inner one being intended for the reception of the articles which have to be dried, while the outer one is reserved for combustion gases and fumes. It is heated by gas or paraffin, assisted by waste products from the drying chamber, and an automatic and constant circulation of fresh air through the drying chamber is arranged for. This fresh air, after being heated and dried, is permitted to enter the drying chamber at the bottom, and ascends through the suspended work, carrying with it the volatile fumes from the varnishes. These then pass out of the top, and downward to the bottom of the combustion chamber where they are fed to the flame of the gas bunsen burner, and consumed. In this way the gases assist to raise the temperature of the oven, and after passing spirally round the chamber are allowed to escape by the flue seen in the illustration. In the drying compartment the varnish is oxidised, and the drying process thereby accelerated, the exuding moisture, volatile fumes and gases from the work that is being dried, being rapidly expelled. The combustion chamber in which the gas expelled from the varnished goods is consumed, in order to assist the primary source of heat generation, is surrounded by a walled-in dead air space; this in turn is covered with silicate wool and magnesia, and the whole arrangement is held in position by substantial wooden sheathing and metal bands. The bunsen burner is removable, and may be withdrawn from the oven for lighting purposes, thus avoiding the risk of explosions common to most gas-heated ovens, and the burner flame may be adjusted before it is reinserted in the combustion chamber. Natural draught alone is responsible for automatic circulation of fresh air, and only 6 cb. ft. of gas per hour is required to maintain a temperature in the neighbourhood of 300° F. Obviously, the gas consumption would be less with a lower oven temperature, and an automatic gas regulator controlling the maximum temperature is sometimes attached. A paraffin blow lamp flame shot in the hole in the door will give an equally good effect, so that the oven may be put to work anywhere, even out of doors if necessary.

The size which is usually constructed is 18½ in. in diameter × 36 in. deep, accommodating any armature up to 17½ in. in diameter, regardless of the length of the shaft. Field coils and other work within these dimensions can, of course, be accommodated also. Varnished goods can be efficiently dried in at least 75 per cent. less time than is usually the case, and the operating cost is very small. With this oven, armatures and field coils may be dried, dipped in varnish and baked without the necessity of transporting the parts out of the building in which they are located. Armatures and other work less than 17½ in. in diameter may be baked in this oven within three hours, and when it is remembered that insulating varnishes of the baking variety as a rule require a plentiful supply of oxygen properly to set and harden the varnish, the automatic circulation of fresh air is an advantage which is obvious. Two ovens of the standard size have recently been installed at a big steel works at Shotton near Chester, where the coal strike has proved a blessing to those responsible for the electrical installation as they have systematically overhauled the electrical equipment, drying, dipping the parts in varnish, and baking so that the insulation resistance is now of a very high order throughout the whole plant. Its advantages in practice will therefore be obvious.

#### An Ediswan Lighting Accessory.

In many cases cost of wiring is undoubtedly an obstacle in the way of electricity becoming "the poor man's light." With a view to helping in reducing this cost a new combined ceiling rose and pull switch has just been placed on the market by the EDISON AND SWAN UNITED ELECTRIC CO., LTD., of 36-37, Queen Street, E.C. It is claimed that by the use of this fitting a considerable saving can be effected in the cost of installation, and in many instances the contractor will be able by its aid to install the electric light in rooms where otherwise it would not be adopted, by reason of either the expense or the inconvenience of cutting away the walls or decorations to admit of the wires being run down to the switch point. The fact that the switch and ceiling rose are combined in one also effects a saving in spacing in addition to reducing the installation costs. The switch cord may be made to any length, so the fitting will be found useful in bedrooms or nurseries where it can be shortened so as to be quite out of the reach of children. The fitting, which is of polished brass on white porcelain base, is made throughout by the company at their Ponder's End works. A leaflet dealing with the switch has just been issued by the publicity department of the company, and a copy will be sent to any contractor interested.

#### Reid's Patent Time Switches.

THE accompanying illustrations show automatic time switches made by MESSRS. F. T. REID & CO., of 46, Longbrook Street, Exeter. Fig. 6 shows a time switch, and fig. 7 the base for it; it is of remarkably small dimensions, viz., 3½ in. × 2½ in. diameter × 2½ in. deep, including the base; the clock is a fully-jewelled lever, perfectly dust-proof, and runs 14 days with one winding; the base, fig. 7, is fixed in position and wired once for all; there are two renewable fuses, one for each pole. The clock switch is simply slipped on and held in place by the bayonets A, B, and pillar C; the system is absolutely interchangeable, and its small dimensions will permit of its being fixed in most of the present switch boxes in place of the old hand switch. Current is supplied to the spring hour hand G (which is insulated from the clock) by a forked spring connected to socket A; E is a movable metal plate electrically con-

E

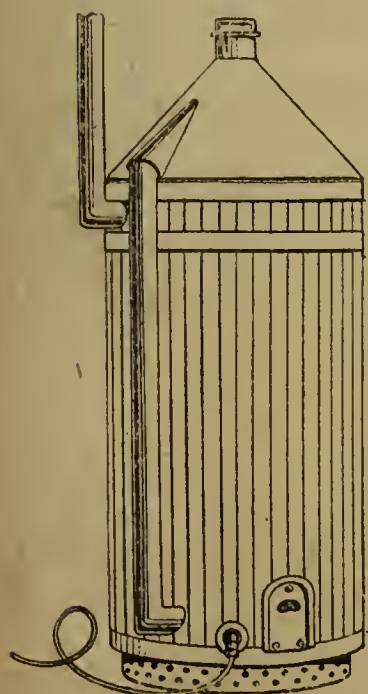


FIG. 4.—PORTABLE DRYING OVEN



FIG. 5.—SIMPLEX FLAMBEAU.

workshop assistant, has led MR. H. W. TURNER to introduce an oven designed to give an economical and efficient means for drying armatures, field coils, transformers, insulating materials and



needed to B, to vary the time of "switching-off"; F is an insulating plate, movable to vary the "switching-on." The action is as follows: the spring hour-hand carries a wedge-shaped shoe H, which rises over the insulated plate F and continues to the required period, when it falls by spring pressure on the metal plate, completes the circuit and continues the required period until free from the plate; the hour-hand wedge then springs down and the plate springs up, causing a sufficient break for up to 600 watts. A larger size is

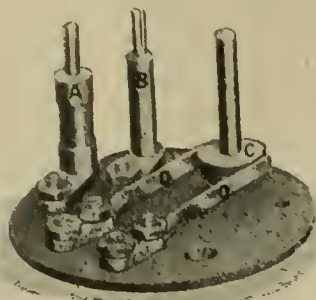


FIG. 6.—REID TIME SWITCH. FIG. 7.—BASE OF SWITCH.

made for one or two circuits, such as lighting the arc lamps at dawn and, at a later hour, "switching off" and on to an incandescent lamp, and, later still, switching this off; this is in use by the Exeter and other Corporations, and is stated to be perfectly satisfactory.

Fig. 8 is a power-driven time switch intended for powerful currents: it is made in two parts, viz., the clock to which is fixed the switch portion. The switch is driven direct without gearing, and is arranged so that no bridges or bearings are brought to the switch portion, the object being to ensure insulation and to prevent

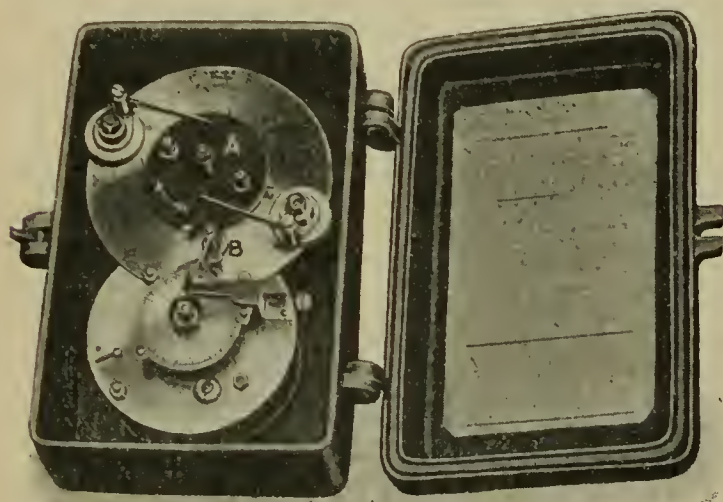


FIG. 8.—POWER-DRIVEN TIME SWITCH.

the arc when contact is broken, from flashing to any metallic support. The circle around is available for one or many circuits, in fact, the switch can be made to fulfill any purpose which a time switch is intended to serve.

The action is of a most simple character; referring to the illustration, the disk A is tensioned to revolve in the direction of the arrow, and is held in check by the trigger B; as the cam on the clock moves it to the left, the tooth enters its interior until the cam allows it to escape, it then switches "on" or "off" according to the cam, and is caught again by the next tooth.

**Coating Iron with Lead.**—Hitherto the coating of iron and steel surfaces with lead has been almost exclusively confined to the production of terne plate, as the thickness of lead which can be applied is within narrow limits. The process at present in use consists of dipping the sheets into molten lead, in some cases a small percentage of tin being added. Mr. Cowper-Coles has now developed a new and cheap process, by which the weight of lead deposited can be varied from the fraction of an ounce to any weight up to several pounds per superficial foot. This development opens up a large field of applications, enabling lead coatings to be applied to a variety of purposes—such as the lining of iron pipes inside and outside, or inside only, for the conveyance of corrosive liquors, the lining of pumps, chemical vessels, &c. The process can also be applied to the coating of earthenware and wood, and to the protection of ornamental ironwork.

**Electricians' Wages.**—Mr. O'Grady asked the Postmaster-General whether the Corporation of Belfast had since 1904 insisted that contractors carrying out electrical installations should pay the district rate of 8½d. per hour to electricians employed on contracts for the Corporation; and if so, would he insist that the firm of Messrs. Craig & Paton should pay the same rate of wages—viz., 8½d. per hour—to the electricians engaged on the work at the head post office at Belfast?—Mr. H. Samuel said he was not aware of any such arrangements, but he would have inquiry made.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Gas Tar as Fuel.

Engineers who are paying high prices for coal and who are also running short of supplies owing to the strike, will, no doubt, be interested to hear that an easy way of getting over the difficulty is by burning ordinary gas tar.

I have fitted to one of our water-tube boilers the necessary apparatus for burning tar at a total cost of £2, and the same has done its work far beyond expectations. On working out the cost of this fuel, I find it to be little more than the cost of coal at an extremely low rate per ton.

The apparatus is quite a simple one, and I shall be pleased to give details or any information to engineers who are on the verge of curtailing their electric light or power supply.

Wm. C. Bexon,  
Engineer and Manager

Kilmarnock Electricity Works.  
March 27th, 1912.

### Tariffs for Electrical Energy.

On page 524 of your issue of March 29th, I am represented as having said that "the cost of meter-reading ran out at about 9d. or 10d. a day."

What I actually said was, that with men at 30s. per week, reading about 80 meters per day each, and taking 12 readings in the year, the cost of reading a meter was 9d. or 10d. per annum. As Mr. Lackie had said that the cost of reading the meter and rendering the account was 7s. per annum per consumer, I asked for information as to how the difference was accounted for.

A. J. Cridge.

London, W.C., March 29th, 1912.

[We regret the error which arose in the transcription of our notes.—Eds. E.R.]

### The Central Station Engineer.

In your issue of last week, "Colonial" has hit upon several evils that exist in the colonial central stations, and I would add that, to some extent, the same evils exist in this country. To my mind a chief engineer of a municipal authority requires an expert knowledge of "human nature," as this would be more useful in saving his bacon than any amount of engineering skill. Once on the back of a tame old horse it is quite easy to guide it. Also the prevalent system of pupilage at central stations is largely responsible for the production of the "self-styled engineer." I would include those young men who, like myself, have ambitions, but no practical means of getting qualified, on account of not having the same opportunities as the moneyed classes.

A. K.

Farnworth, April 1st, 1912.

### Electric Lighting in the House of Commons.

Replying to Mr. King last week, Mr. W. Benn stated that it was proposed, if found desirable after experimenting, to substitute electric lighting for gas in the debating chamber of the House of Commons. This would probably be more efficient and would certainly reduce the cost of lighting. It was intended to carry out the work in sections in order to give members an opportunity of observing the effect of the change.

Mr. Ormsby Gore asked the hon. member for St. George's-in-the-East, as representing the First Commissioner of Works, whether he would give the House an opportunity of discussing the matter before it was decided to replace the lighting of the House by gas with electric light; whether he was aware of the opinion of leading oculists that gas light was less harmful than electric light; and whether gas assisted in the proper ventilation of the House.—Mr. Wedgwood Benn said an opportunity would arise on the Vote for the House of Parliament. The First Commissioner was not aware that leading oculists had expressed any such opinion in regard to lights placed as those would be. The reply to the third paragraph was in the negative. Under the arrangements proposed the House would be better ventilated than hitherto.



## BUSINESS NOTES.

**Liquidations.**—**REORGANISATION AND CONTROL SYNDICATE, LTD.**, 2, Coleman Street, London, E.C.—Under the compulsory liquidation of this company, which was formed with the object of acquiring the controlling interest in the London Electrobuses Co., Ltd., the statutory meetings of the creditors and of the shareholders were held on Tuesday last week, at Bankruptcy Buildings, Carey Street, W.C., Mr. H. M. Winearls, Assistant Official Receiver, presiding. The chairman reported that the statement of affairs lodged on behalf of the company, showed liabilities £2,160, and a surplus in assets with regard to the creditors of £2,840. With reference to the shareholders, however, a deficiency of £5,411 was disclosed. The Official Receiver must, however, point out that there was nothing for the shareholders unless a certain amount of £5,000 was recovered, and, perhaps, nothing for the creditors. The syndicate, which he should refer to as the Control Syndicate, was registered on January 21st, 1909, by Mr. Demetrius John Delyannis, with a nominal capital of £10,000, divided into shares of £1 each, but by extraordinary resolution passed in April, 1910, this was increased to £40,000 by the creation of an additional 30,000 £1 shares, which were to rank *pari passu* with the original shares. The issued capital consisted of 6,424 shares allotted for cash, and £2,000 as fully paid, under an agreement. Some of the cash subscriptions were obtained in response to letters and circulars containing statements which would require investigation. The Official Receiver was, however, unfortunately unable to trace the whereabouts of Delyannis, who, according to the other directors and the secretary, controlled the affairs of the company. In July, 1909, the trustee for the debenture-holders of the Electrobuses Co. appointed a receiver and manager of that company's property, and on January 10th following, the Control Syndicate agreed to purchase from the trustee all the undertaking, garage installation, property, and assets of that company for £3,000, payable as to £1,000 in cash and as to £2,000 in shares, to be issued as fully paid. The property, which included 22 buses, was in the possession of the International Motor Traffic Syndicate, Ltd., which agreed to continue the bus service, and to render weekly accounts to the Control Syndicate. In April, 1910, the latter syndicate arranged with one, Dr. Lehmann, for delivery of the property that it had bought; but shortly afterwards the Control Syndicate discovered that eight of the best buses and parts had been disposed of by the Traffic Syndicate to another of Delyannis's companies (a Brighton company) for £3,400. The remaining buses and parts were sold under a distress levied in July, 1910, for £255. Proceedings were commenced by the Control Syndicate for the recovery of the buses, but were unsuccessful on a technical ground as far as the Brighton company was concerned; with regard, however, to the Traffic Co., an inquiry was directed with regard to the amount due under the agreement of January, 1911. At both meetings it was decided to leave the liquidation in the hands of the Official Receiver.

**HARRIS PATENT FEED WATER FILTER, LTD.**—A meeting is called for April 29th, at Sunderland, to hear an account of the winding up from the liquidator (Mr. A. E. Usher).

**WAKELIN BROS.**, 9, Tottenham Street, Tottenham Court Road, London.—On March 7th, Mr. W. A. Henderson, of 3, Fenchurch Street, E.C., was appointed liquidator, with a committee of inspection.

**Möller Air Filters.**—**MR. H. R. WITTING**, of 41, Berners Street, London, W., who is the sole British representative for the Möller patent air filters, informs us that the following are among the orders for these filters which have been booked during the last six months:—

Rand Mines General, Johannesburg Vereeniging Central Station.—Two filters, capacity 84,750 c. ft. per min.

Glasgow Corporation Tramways.—One of capacity 25,440 c. ft. per min.

Dorman, Long & Co.—Eight of capacity 18,400 c. ft. per min.

Edward Lloyd, Ltd.—Two of 12,900 and one of 10,600 c. ft. per min. capacity.

Waihi Grand Junction Gold Mining Co.—One of capacity 10,750 c. ft. per min.

Dick, Kerr & Co.—One of capacity 10,000 c. ft. per min.

Cardiff Washed Coal Co., Ltd.—One of capacity 6,500 c. ft. per min.

Ashington Coal Co., Ltd.—One of capacity 6,000 c. ft. per min.

Vickers, Ltd.—One of capacity 5,000 c. ft. per min.

Coltess Iron Co., Ltd.—One of capacity 3,530 c. ft. per min.

James Howden & Co.—Two of capacity 13,000 c. ft. per min.

**Catalogues and Lists.**—**MR. O. N. BECK**, 11, Queen Victoria Street, London, E.C.—12-page pamphlet (No. 65) containing fully-illustrated and tabular matter, including prices, relating to elastic corrugated tubes for expansion joints, heating and smoke tubes, superheaters, condensers, &c. The corrugations are parallel to each other, instead of spiral, facilitating bending of the tubes to very small radii.

**MESSRS. ROSE BROS.**, 38 and 39, Beech Street, Barbican, London, E.C.—12-page catalogue showing by excellent illustrations on art paper their portable electric lamps, hand, belt, traveller's, cycle, signal, inspection, watchman's and other types. Lamps with special fittings for aviators are shown, also battery wall lamps, electric clocks and watch-stands, reading lamps, &c. A report on National Physical Laboratory tests of the R. B. Cordesia batteries is printed in the pamphlet.

**MESSRS. ADNIL ELECTRIC CO., LTD.**, Adnil Building, Artillery Lane, London, E.C.—Leaflet illustrating the slow-speed motor and Marples' patent organ regulator used at Olympia during the run of the "Miracle." A list of institutions to which the firm have recently supplied electric organ-blowing equipments is given.

**MESSRS. S. BOWLEY & SON**, Wellington Works, Battersea Bridge, London, S.W.—Brochure containing notes on lubrication for power

station, railway and other engineers, and drawing attention to the firm's oils for electrical machinery, &c.

**THE POWER PLANT CO., LTD.**, West Drayton.—Illustrated postal card showing their machine-cut double helical gearing as applied to electrically-driven endless rope haulage machinery for working in collieries and mines.

**MESSRS. DARGUE, GRIFFITHS & CO., LTD.**, 138-140, Vauxhall Road, Liverpool.—24-page catalogue giving descriptive particulars regarding their patent "Economic Centralized" system of heating and hot water supply. The system utilises exhaust steam to heat the water, and has been applied in a large number of public buildings and institutions.

**MESSRS. MARSHALL, SONS, & CO., LTD.**, Gainsborough.—Illustrated circular relating to their oil-burning apparatus for using liquid fuel in all types of boilers. The circular emphasises the importance of the use of liquid fuel in view of the coal strike. The firm make a special feature of converting boilers for oil burning.

**MESSRS. MATHER & PLATT, LTD.**, Salford Ironworks, Manchester.—Thirty-two page catalogue, containing full descriptive particulars of their patent mechanical filters for industrial purposes. Excellent half-tone pictures and clear line drawings are given of these filters supplied for various installations. A number of pages are occupied with a list of buildings, mills, factories, breweries, &c., where such installations are at work.

**Trade Announcement.**—**THE ACCESSORIES MANUFACTURING CO., LTD.**, announce that, by arrangement with Messrs. Samuel Heath & Son, Ltd., Birmingham, who have acquired the business of the Electrical Fittings Co., Ltd., 38, Conduit Street, W., they are carrying on this business at 11, Dean Street, Oxford Street, London, W., on their behalf. A fittings showroom will shortly be opened at that address, and a new catalogue is in course of preparation.

**Book Notices.**—"Provisional Regulations for Examinations in Art and in Science and Technology, applicable to the Examinations of 1912." London: Wyman & Sons, Ltd. Price 2d.

"Lehrbuch der Photometrie." By Friedrich Uppenborn and Berthold Monasch. 1912. Munich: K. Oldenbourg.

"Bulletin of the Bureau of Standards." Vol. VIII. No. 1.

January, 1912. Washington: Government Printing Office.

"Atti della Associazione Elettrotecnica Italiana." March, 1912.

Milan: Stucchi, Ceretti e Cie.

**For Sale.**—**MESSRS. FULLER, HORSEY, SONS & CASSELL** will, on April 18th, sell by auction, at Vine Street, E.C., the goodwill, electrical plant, machinery and stock, of Messrs. F. A. Glover and Co., Ltd. See our advertisement pages in this issue.

## LIGHTING and POWER NOTES.

**Accrington.**—The Electricity Committee has considered the supply of current for power purposes to cotton manufacturers and other large power users during ordinary factory hours, and has resolved to fix a charge of 5d. per unit on a minimum consumption of 250,000 units per annum, at a coal price basis of 12s. per ton, and subject to the usual sliding scale variations of 0.025d. for every 10 per cent. fluctuation in the price of steam coal delivered.

**Ashton-under-Lyne.**—The B. of G. has decided to have the electric light installed at the workhouse.

**Balderton.**—The village is about to undertake an electric lighting scheme, having been unable to come to terms with the gas company. A parish meeting was held, when Mr. Dilley explained a scheme by which electricity could be obtained from the works of Messrs. J. Simpson & Co., Ltd., engineers. The cost was estimated at £600, as follows:—Main cables for 1,300 yards, £54; distributing cables, £92; 75 copper lamp shades, £32; 75 standard brackets, £22; brackets and cables, £13; 75 steel standards, £186; 75 wooden supports, £56; switchbox, £10; labour, £50; legal and other expenses, £33; extras, £50. The running cost would be 75 lamps for 1,500 hours at 1d. per unit, £33; labour for switching and cleaning, £12 10s.; repairs and renewals, £9; repayment of capital and interest, £17; making a total for the first year of £115. This would be a diminishing sum year by year. A rate of 2½d. in the £ would provide £117. Messrs. Simpson were willing to guarantee a supply of electricity for street lighting for 15 years (the parishioners to have the option to terminate the agreement at the expiration of five or ten years) at a cost of 1d. per unit, which amounted to about £32 or £35 a year. A formal resolution was passed to raise a loan of £650 for the purpose.

**Birmingham.**—The City Council has authorised the Electric Supply Committee to erect a new boiler house at Summer Lane station and provide new boilers, &c., at an estimated cost of £28,900, in lieu of the extension previously authorised at £14,250, and resolved that the application to the L.G.B. be amended accordingly, and that the Finance Committee be instructed to borrow the amount required. The Council has also given its approval to the proposed loan of £10,000 to inaugurate a scheme of wiring houses upon the hire system.

**Bispham.**—The electric light was used here for the first time on March 27th and proved extremely satisfactory. It is stated that there are reserves of coal, so that the lighting of the township is assured for some time to come.



**Bolton.**—The British Westinghouse Electric and Manufacturing Co. has kindly undertaken to supply, on special terms, motors to drive the machinery which is being installed at the Technical School by Messrs. Dobson & Barlow, Ltd.

**Bradford.**—The Corporation Electricity Committee proposes to extend electricity mains in various parts of the city at an estimated cost, including provision of transformers and switchgear, of £5,255, this figure including the tender of the Paterson Engineering Co. for the supply and erection at the Valley Road Electricity Works of oil-eliminating plant for feed water purification for £605, and the tender of the Sandycroft Foundry Co. for the supply and erection at the Valley Road Works of one emergency excitation battery and stands for £488 10s.

**Bridlington.**—The T.C. has decided to apply to the L.G.B. for a loan of £1,500 for the extension of the condenser plant at the electricity works.

**Canada.**—A movement is on foot to have the Niagara Falls illuminated by electricity during the evening hours. Senator Gittins, of Niagara Falls, New York, has presented a Bill at Washington for \$50,000 to pay the United States share of the expense. It is proposed to spend \$100,000 on a permanent means of illumination, and allow \$5,000 per year for the upkeep of the same. It is to be an international affair.

The Ontario Hydro-Electric Commission has taken steps to expropriate the Chats Falls water power as a source of available power for Eastern Ontario. These falls are owned by the Hon. William Harty, of Kingston, who is said to have secured this 150,000-H.P. from the late Laurier Government for \$60,000.

**Cheltenham.**—On March 26th a B. of T. inquiry was opened into the application of the T.C. for an order to extend the area of supply to 10 parishes in the areas of the Cheltenham and Winchcombe R.D.C.'s: as intimated in a recent issue of the ELECTRICAL REVIEW, there was opposition on behalf of the Cheltenham R.D.C. and the Gas Co., and by private persons. Owing to the statutory notice not having been given, the parishes of Badgeworth, Up Hatherley, and Shurdington were withdrawn from the scheme, and the T.C. offered, in the event of the order being granted, to give the Cheltenham R.D.C. a reasonable purchase clause, modifying the term of 42 years laid down in the Act.

**Chesterfield.**—A L.G.B. inquiry was held on March 26th into the application of the T.C. for a loan of £7,000 for extensions at the electricity works and additional plant. The Inspector, Mr. H. R. Hooper, thought the application was not large enough, and the matter was adjourned temporarily for consideration by the Electricity Committee.

**Chile.**—The *Diario* of February 21st publishes a decree approving the plans submitted by Don Antonio Bellet for the erection of a central generating station designed to supply the town of San Javier with electric light. Twelve months are allowed for carrying out the work.

**Continental Notes.**—GERMANY.—Under the auspices of the Allgemeine Electricitäts Gesellschaft, of Berlin, a company has lately been formed at Gotha with a capital of £300,000, and the title Die Thüringer Electricitäts Lieferungs Gesellschaft, to exploit a concession granted by the Duchy of Saxe-Coburg-Gotha to the A.E.G. for the supply of electrical energy for lighting and power purposes, and for the construction and working of electric tramways throughout the Gotha district, which extends from Gotha to Ersenach in one direction, and to the south as far as Meiningen. The generating station in Gotha of the Gotha Electricitätswerk und Schassenbahn Gesellschaft is being taken over and extended, and, in addition, a new generating station, having a capacity of 12,000 H.P., is to be erected at Altenbrietungen. The two plants will be interconnected by an overhead transmission line working at a pressure of 25,000 volts, so that they will form a mutual reserve for each other. The new undertaking is taking over the tramways in the town of Gotha, and a new electric railway is to be built between Gotha, Friedrichroda and Grosslabarz, with a branch to Waltershausen.

SPAIN.—In the Spanish Province of Cataluna are very considerable water powers under development, whose energy for the greater part will be transmitted to Barcelona. The following companies are at the present time busied with the erection of new stations:—(1) La Energia Electrica de Cataluna.—This is a foundation of the Compagnie d'Electricité de Paris, and utilises the falls of the Lac de Capdella, to the north of Barcelona, in the Province of Lerida. The station will supply about 40,000 H.P. at a pressure of 80,000 volts to Barcelona. (2) The Compania de Fuerzas Motrices y Riegos del Ebro.—This company was founded by Canadian capitalists, at the head of whom is Dr. Pearson. The falls of the River Ebro will be utilised to the extent of about 100,000 H.P., the current being distributed in the Provinces of Barcelona, Gerona, and Tarragona. This company has bought up the station of the Compania Barcelonesa de Electricidad, which has a capacity of 40,000 H.P. at its steam plant. (3) The Fuerzas Motrices de Cataluna.—This undertaking was formed of the Compania Cataluna de Gas y Electricidad and the firm Bertrand y Ca. The company utilises the Esera Falls in the north of the province of Huesca, and will place about 30,000 H.P. at the disposal of Barcelona. For the support of its hydraulic stations the Energea de Cataluna will, besides, build a steam station in Badalona, the equipment of which will consist of two steam turbines and generators of 8,000 kw. capacity each. The province of Cataluna, with its capital Barcelona, contains the

greatest industrial undertakings in Spain. The entire Spanish textile industry is there located. The machine-worked factories of Barcelona, with the localities Sabadell, Tarrasa, Manresa, Badalona, Mataro, Montgat, Cranotlers, &c., now employ steam power aggregating 180,000 H.P. If it is further borne in mind that Barcelona itself is a great town with considerable consumption of light, it will be seen that these schemes are justified, and that these remarkably large additional supplies of electric current are likely to find ample and profitable appropriation.—*Elekt. Zeitschrift.*

**Croydon.**—The T.C. has decided to terminate on September 29th the lease of the electricity showroom premises at 3, Park Lane.

**Darwen.**—Sanctions have been received from the L.G.B. for the borrowing of the following sums: £2,025 for high-tension mains; £1,393 for low-tension mains and small branch mains (£200); £850 for services and £400 for meters. It was resolved that the sum of £20, excess expenditure on capital, be taken out of revenue.

The T.C. has referred a recommendation in favour of the purchase of a new turbine to a sub-Committee for report to the General Purposes Committee.

**Eccles.**—The electrical engineer has been instructed to prepare an estimate of the cost of extending the boiler house, so as to accommodate an additional boiler. The Public Lighting Committee has decided to make application to the L.G.B. for sanction to borrow £5,220 for the purposes of the electricity undertaking, which sum includes £2,000 for mains, £750 for services, and £750 for transformers.

**Egypt.**—According to *Elektrotechnik und Maschinenbau*, an official of the Finance Department of the Khediveh has undertaken a journey to Europe to raise a loan on the private possessions of the Khediveh, with the object of purchasing dynamos and other electrical material, engines and boilers, &c., for certain improvement works which are projected.

**Ellesmere Port.**—At its monthly meeting the Council unanimously adopted without discussion the recommendation of the newly-formed Electricity Committee, that the Council which lately passed a resolution to apply for a provisional order, agrees to the application for such an order being made by the Mersey Power Co., Ltd., instead of by itself. The Widnes Corporation obtained an order, but transferred it to the Company, and the charges the Company may make are governed by the agreement between the Corporation and the Salt Union, Ltd. This agreement has been taken as the basis of the arrangement with Ellesmere Port. The traction clauses are struck out as inapplicable to the Port (though the question of electric car services with Birkenhead and Chester have been repeatedly discussed) and some of the other clauses are modified. For public lighting the charge for current is not to exceed 2d. per unit; and for private lighting 4½d. during the first seven years and 4d. thereafter. For power the charge is limited to 1½d. with a minimum, or £6 per K.W. of the subscriber's maximum demand with 1½d. per unit, and consumers are to be allowed to use on the same premises current supplied primarily for power, for either heating or lighting, or both, at power rates. There are provisions for reducing the charges after 21 years.

**Epsom.**—Subject to the consent of the L.G.B., the U.D.C. had decided to install at the electricity works a Diesel oil engine at a cost of £3,721.

**Goole.**—The R.D.C. on March 28th consented to the proposals of the Electrical Distributor of Yorkshire, Ltd., which is applying for a provisional order under the Electric Lighting Acts to supply electricity to some of the villages in the district.

**Ilkeston.**—The Council's engineer is to prepare specifications, &c., for the lighting installation at the new secondary schools; he has also been given charge of all the electrical and mechanical work in the various Corporation departments, including the new sewage pumping and disposal works.

**India.**—The Delhi Electric Tramways and Lighting Co. has applied to the Punjab Government for permission to amend the provisions of its licence, so as to include within its area of electric supply the whole of the area which may be contained within the limits of the Imperial City of Delhi.—*Indian Engineering.*

**Leyton.**—The estimated surplus for the year ending March 31st, 1912, on the electricity undertaking, is put at £1,934. Half of this sum is to be carried to the reserve fund for depreciation and renewals, and the balance is to be given in aid of the rates. For the ensuing year the surplus is estimated to amount to £1,005. The electrical engineer has been directed to obtain quotations for two miles of 2 sq. in. cable required for giving a supply to the L.G.O. motor garage and the Stratford Co-operative Society.

**London.**—LAMBETH.—The Baths Committee of the Council reports having had under consideration the question of improving the exterior lighting of the baths, which are at present illuminated by five 1,000-c.p. arc lamps and 12 35-c.p. metallic-filament lamps. Quotations have been considered from the South London Electric Supply Corporation and the Gas Light and Coke Co. for lighting by means of electricity and high-pressure gas. The offer of the Electric Light Co. is to supply, fix and maintain and keep in lighting eight 2,500-c.p. flame arc lamps from an hour after sunset to midnight, six days a week, for £11 per lamp per annum, subject to an agreement being entered into for a period of five years. The Gas Co. submitted three quotations for 10 high-



pressure gas lamps from ordinary lighting-up time to midnight for six days a week, subject to an agreement for three years, viz., 3,000 c.p., £16 10s. per lamp per annum; 2,000 c.p., £14 per lamp; and £1,000 c.p., £8 15s. The Committee, being of opinion that the offer of the Electric Light Co. was the more favourable of the two, has accepted its offer on the terms mentioned.

**POPULAR.**—It is stated that the L.C.C. has agreed to sanction borrowing powers of £69,626 applied for by the B.C. for electricity extensions.

**Lytham.**—On the agenda for the General Purposes Committee, on March 28th, was the subject "Electric Light"; Councillor W. F. Holden, J.P., was the prime mover in the matter. The meeting decided to give consideration to the question of providing an electrical supply and to make the necessary inquiries. Years ago the authority obtained a provisional order from the B. of T., and at one time it seemed likely that it would proceed to act under that order, but the scheme was eventually abandoned and the order passed into the hands of a private company. A very recent effort by this company to raise the necessary capital was unsuccessful.

**Manchester.**—The Corporation Electricity Committee has decided that the supplies of electric current to some of the largest power consumers will be cut off for five days, beginning on Good Friday, on account of a shortage of fuel through the coal strike. Circulars to this effect have been sent out. Manchester Corporation supplies electric current to Failsworth, Denton, Droylsden, Heaton Norris, and Audenshaw, and altogether about 40 firms will be closed down as a result of the decision.

**Norwich.**—A L.G.B. inquiry was held on March 26th into the application of the T.C. for a loan of £25,000 for electricity purposes, made up as follows: Turbo-generator, £10,000; mains, £6,000; services, £3,000; new offices, £3,000; and two boilers, £3,000. There was no opposition.

**Sevenoaks.**—The U.D.C. has received from Messrs. Crompton & Co. proposals regarding an electric light scheme for the town. The firm offers to form a company to take over the Council's powers under an order, to proceed at once with a scheme, and to pay up to £400 towards the cost of obtaining the order. The Council has decided to favourably consider the application of Messrs. Crompton, and to ask the B. of T. for its advice on the matter, and permission to accept the offer, subject to an undertaking on the part of the firm to put down the installation within a given time.

**South Africa.**—The Wynberg Municipal Council has accepted the tender of the Kalk Bay Municipality for the supply of electricity, the Wynberg Council, it is stated, furnishing capital to the amount of between £15,000 and £20,000.—*South Africa.*

**Southampton.**—The estimates of the electricity undertaking for the year 1912-13 provide for an income of £49,200, as against £45,070 for 1911-12. The expenditure is put at £26,429, as against £24,276 for the previous year. Provision is also made for a contribution of £6,660 in aid of the district rate. In connection with these estimates the electrical engineer points out that the results of the Council's hiring-out scheme have been most satisfactory, and would have an accumulative effect as to receipts. The charge for current for power to the Tramways Department is to be reduced to 1½d. per unit.

**Stalybridge.**—The Stalybridge Joint Board on Thursday, last week, decided to give notice to large consumers of electricity of the Board's intention to cease the supply of electricity. Several mills and workshops in the town are dependent upon the Tramway Board for electricity for motive power.

**Warrington.**—The Electricity Committee has adopted a recommendation of a Sub-Committee for a restricted-hour supply for power and heating purposes, to consumers who agree not to use current between the hours of 3.30 p.m. and 5.30 p.m. during the months of November, December, January and February, at a charge of £2 per kw. per annum of sustained maximum demand plus ½d. of a penny per unit. A special time switch will be used in connection with this supply, the approximate rental being 10s. per annum. Consumers under the above rate will be required to agree to take current for a period of not less than 12 months. This rate will not apply to installations of under 20 H.P.

**York.**—The Electricity and Tramways Committee of the T.C. has recommended the application to the L.G.B. for a loan of £4,955, for two new water-tube boilers with chain-grate stokers and an economiser.

**Asiatic Turkey.**—Smyrna is served by two horse tramways, operated by French and Belgian owners respectively. The lease to the latter being almost at an end, it has been decided to renew it for another 50 years on condition that the line is electrified, and that 30 per cent. of the net profits are paid over to the municipality. It is understood that the French company's concession will be similarly treated when the opportunity serves.

**Blackpool.**—It having been legally decided that tramways are to be assessed for district rate purposes on the same footing as railways—at one-fourth—the Tottenham authorities, against whom the decision was pronounced, are now appealing to other authorities to assist them to take the matter to the House of Lords. The application came before Blackpool Finance Committee on March 28th, and it decided to assist in the appeal. The question is of extreme importance to Blackpool authorities, seeing that two companies run cars into the town.

**Bradford.**—The Corporation Tramways Committee has decided to recommend the building of 12 new electric cars, complete with equipments, at an estimated cost of £8,400, and that 12 additional new car equipments be purchased at an estimated cost of £3,600.

**Canada.**—A group of English capitalists has held a conference with R. H. McElroy, M.P. for Carlton County, Ont., with a view of taking over the stock of the proposed Kingston, Smith's Falls and Ottawa Electric Railway Co.

The electric railway systems throughout the Dominion, in common with other industrial enterprises, have received a large share of the general prosperity of the past year. The net profits of seven of the more prominent roads amounted to \$10,500,000.

Montreal, with 154 miles of track, had total earnings of \$4,775,300. Toronto, with 110 miles of track, earned \$4,851,541, and Winnipeg, with a mileage of 70, earned \$3,829,749.

The Halifax Tramway will expend \$200,000 this year in improving and extending its tracks. A new auxiliary steam plant of 12,000 H.P. was constructed during the year. The company now has auxiliary power to the extent of 20,000 H.P. available in the event of a serious breakdown at the hydraulic plant.

**Continental Notes.**—GERMANY.—An unlooked for accident occurred on the Berlin underground railways last week. In connection with extensions on the other side of the River Spree, work was in progress for building a concrete tunnel under the river, a portion of the latter being fenced off by means of a coffer dam for the purpose, so that work could be carried on in the open excavation. It is suggested that the dam gave way and the inrush of water found its way into the working railways under Berlin, the latter being, in consequence, closed down, pending the blocking up of the tunnel leading to the river and subsequent pumping out of the water.

It was recently intimated in the Budget Commission of the Prussian Diet that a scheme would shortly be presented in relation to the proposed conversion to electric traction of the Berlin City, Circle, and Suburban Railways, and since then the Minister for Railways has submitted a memorandum on the subject to the Lower House. After referring to the development of the passenger traffic during the past 20 years, the report states that the carrying capacity of the railways is already inferior to the requirements of the traffic, and notwithstanding the increase in the number of trains and accommodation, the carriages are at times intolerably crowded on almost all the lines. At present with heavy tender locomotives it is possible to operate a maximum of 24 steam trains hourly in each direction over the city lines, giving seating places to a total of 11,712 persons. In 1916 it will be necessary to increase the number of trains to 30 per hour, in order to satisfactorily deal with the constant growth of traffic, whilst later on the expansion will render it essential to have 40 trains per hour in each direction, providing sitting accommodation for 24,400 persons.

The memorandum proceeds to state that, in order to cope with the augmentation in traffic, the most suitable form of working for the Berlin railways is by means of electric traction with locomotives, and the process of conversion would require a period of 4½ years from the time of the voting of the necessary funds. According to the scheme which has been prepared, the trains on the City and Circle lines are to consist of 13 three-axle passenger coaches in times of the heaviest traffic, whilst those on the suburban lines are to be composed of 12 coaches and a luggage van. An electric locomotive is to be provided at each end of the train and will receive current from an overhead conductor at 15,000 volts and 16⅔ periods. During the hours when the passenger traffic is light, the trains will be divided and only one locomotive will be used. It is intended to retain the motor-car trains which have been in service for a number of years on the Berlin section between the Potsdamer railway station and Gross Lichterfeld-Ost and which are operated on the direct-current system. A conversion of this line to the alternating-current system, it is submitted, would not be advantageous as the existing costly electrical equipment would become worthless. Nevertheless, the direct current is to be produced from an alternating-current converter installation, and this will result in the realisation of considerable economy as compared with the existing state of affairs.

It is proposed to obtain the electric power for working the railways from two power stations, and a legally binding offer for this purpose has been made which ensures the supply on advantageous terms for a period of 30 years certain. According to the offer, one power station would be erected in a lignite coal district, presumably near Bitterfeld, and the second would be established near Berlin, partly as a reserve station and partly to assist in

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—The *Boletín* of February 22nd contains a law empowering Sres. Lacroze Hermanos y Cia to construct and work a double-track underground electric railway from Federico Lacroze station (Buenos Ayres Central Railway) by way of the Calle Corrientes to the Pasco de Julio, Buenos Ayres.



meeting the load in excess of the average consumption, that is to say, when the density of traffic is the greatest. The feeder mains are to be underground cables for a pressure of 60,000 volts, and the transmission from the power stations to Berlin is to be effected by six pairs of cables, which are to be so arranged that injuries cannot disable more than one pair of cables at the same time. The power will be transmitted by the long-distance cables to a number of transformer sub-stations, where the pressure will be reduced to that required for the working conductor—15,000 volts. It is estimated that an expenditure of £4,500,000 will be incurred by the contractor for the supply of energy in establishing and equipping the two stations, each of which will have a capacity of 100,000 kw., and in providing the feeders and sub-stations.

The expenditure contemplated by the Railway Ministry amounts to £6,167,000, of which £2,500,000 will be for the installation of the working conductor, alterations of platforms, and of certain tracks, workshops, the provision of wiring, &c.; whilst the balance is required for the acquisition of, and alterations to, rolling stock. It is proposed to provide 557 electric locomotives, 690 passenger coaches, and 29 service vehicles, and 573 steam locomotives will be released for use elsewhere. At present the receipts of the City and Circle Railways do not cover the working expenses, and a deficit of £99,000 is estimated for 1912. As a consequence, no interest is earned on the invested capital. It is, however, intimated that on the conversion of the railways to electric traction, it will be necessary to raise the passenger fares not only in order to extinguish the deficit, but also for the purpose of providing for depreciation and, at the same time, obtaining interest on the new capital expenditure.

Among new German electric railway schemes are the following:—The construction of electric lines is projected, running from Lüchow, in Hannover, to Bevenzen and Uelzen respectively; a line from Mannheim to Waldhof and Sandhofen is to be constructed by the Oberrheinischen Eisenbahngesellschaft; the plans have been prepared for a line from Opladen to Burscheid, in the Rhine province; the T.C. of Delmenhorst, in the Duchy of Oldenburg, has started the preliminaries for a line from that town to Lemwerder; and the T.C. of Stuttgart is considering a project to establish electric transit facilities between that city and Kannstadt.

The efforts of the Government of Baden on behalf of the electrification of various subsidiary lines are daily taking more tangible shape. The first line to be taken in hand will be that of the Wiesen Valley. The great power station at Augst-Wyhlen, which has been built by the City of Basle and the Rheinfelden power company jointly, is capable of supplying at normal water-level 30,000 H.P., while at the same time good and cheap water transit is secured between Basle and Rheinfelden. Regular navigation for vessels will be available by the middle of the summer.—*Elek. u. Masch.*

BUDAPEST.—The T.C. has drawn up regulations relating to the construction and equipment of such electric motor-cabs as may be licensed for use in the capital. It is required that the electric vehicles shall carry four passengers and their luggage throughout the city, the accumulators being equal to covering a distance of 80 km. The vehicles are to be after the laundulet model, fitted with side window, forward roof, space for luggage on the top of the roof, with brass mounting fittings at back, a hook for the reserve wheel, two electric or petroleum head lamps, and two reserve acetylene lamps, with reservoir, for extra-urban travel, and a glass blind in front of the driver. The body of the vehicle is to be painted blue, and its number at the rear lit up, an electric lamp being fitted to light the interior.—*Elek. u. Masch.*

RUSSIA.—Permission has been accorded to the railway contractor, N. N. Kaschinew, for the building of two electric long-distance lines from Moscow to Podolsk and Obiralowka respectively. The total extent of the two lines is 55 versts. The Government has refused to give a guarantee.—*Zeit. Elek. und Masch.*

Hull.—It was reported to the Corporation Tramways Committee on March 27th that successful experiments had been made at the power station with oil fuel. Two boilers had been fitted with the installation, and the steam was generated entirely by the oil fuel. The city engineer, Mr. White, said the cost was much cheaper than coal at the present prices, but it would be more expensive than coal at the normal contract prices, and the experiment would not be continued after coal prices were normal again.

Ilkeston.—Last week we noted the stoppage of the Corporation tramways. We are informed by Mr. Stokes, the engineer and tramway manager, that this is owing to the failure of the Derbyshire and Notts. Power Co. to continue its bulk supply contract. The company's station is situated at a pit, and the shortage of fuel is causing some surprise.

Leyton.—The Tramways Committee reports that the estimated surplus for the year ending March 31st, 1912, will amount to £2,846. Of this sum one-half is to be carried to the reserve fund for depreciation and renewal and the other half is to be given in aid of the rates.

London.—The G.C. Railway Co. has been experimenting with a petrol-electric coach accommodating 50 passengers, on its Marylebone-South Harrow route. Speeds of 40 or 50 miles per hour are obtainable, and the car has a working range of 150 miles. A somewhat similar, but smaller, coach is in use by the G.W. Railway Co. on its Windsor-Slough branch.

The Highways Committee of the L.C.C. is proposing to send a deputation to the Home Secretary to urge the necessity for more sympathetic co-operation by the Metropolitan Police authorities in connection with the Council's tramways.

Mexico.—According to a recent issue of the *Financier*, the Mexico tramway system was recently held up for about an hour, owing to bandits tampering with the Necaxa transmission lines. The damage was repaired in this case, but the company has four local power plants available in case of serious trouble.

Oldham.—It was reported to the Oldham Tramway Committee on Thursday evening that during the year ended March 25th a record had been created in tramway receipts, which exceeded £100,000, for the first time. The total receipts were £100,364. There had been 20,072,908 passengers against 19,125,202 in the previous year. The cars had run 1,940,740 miles, against 1,892,785, yet there had been a saving in energy to the value of £1,128.

West Bromwich.—With regard to our note under this heading last week, we regret that we were misinformed as to the use of railless trolley vehicles in the town, no such scheme being under consideration.

## TELEGRAPH and TELEPHONE NOTES.

Automatic Telephone Equipment.—The Postmaster-General last week said that the small exchanges being installed at Epsom and at the General Post Office, London, are expected to be completed in April and May, respectively. Larger exchanges are contemplated for Leeds, Brighton, and Portsmouth, but their provision must depend to a considerable extent on the possibility of obtaining the switching equipment at near dates from manufacturers in this country.

Colonial Wireless Telegraph Stations.—In reply to a question in Parliament recently, Mr. Harcourt stated that the wireless stations in Jamaica, Trinidad, and British Guiana had been erected and were being maintained at the cost of the cable companies, and another station in Trinidad at the cost of the Colonial Government. The power at these stations varied from 1½ to 3 kw. In British Honduras negotiations were proceeding on the basis that the Government should erect a 3-kw. station, and that a private company should refund the initial cost and the loss on its operation. In the Bahamas only a local private system between Nassau and Abaco had, so far, been authorised, each station to have a power of 1½ kw. The Barbados Government was considering the question of erecting a Government station, but the power and system to be adopted were not yet decided.

Mr. Harcourt, in reply to another question, said that in Jamaica the Lepel system of wireless telegraphy was in use, and in Trinidad, British Guiana and Tobago the Lodge-Muirhead. In the cases of British Honduras, the Bahamas and Barbados, neither the system which would be adopted, nor the estimated cost, could yet be stated, with the exception that the cost of erection and equipment of a 3-kw. station in British Honduras had been roughly estimated at £2,000 to £2,500. The cost of maintaining the two wireless stations of the Trinidad-Tobago service was about £900 a year. The cost of maintaining the stations of the Trinidad-British Guiana service and the Jamaica station could not be given, since these stations were in the hands of private companies.

London Telephone Service.—The Telephone Committee has decided to raise a debate on the administration of the telephone service on Wednesday, April 10th.

Nauen Station Wrecked.—On March 30th the wireless station at Nauen, near Berlin, was blown down in the gale. No one was hurt. The tower, as recently mentioned, had been doubled in height, and was 660 ft. high. The tower was supported on a single ball and socket base, and there was a similar joint between the lower and upper halves. The rebuilding will take five or six months, and cost £25,000.

Pacific Cable.—The total number of words sent over the Pacific cable system, exclusive of inter-colonial traffic between Australia, New Zealand, and the Fijis, amounted to about 208,000 words in January, 1912, and about 211,000 in February, 1912, as follows:—

	Jan., 1912.	Feb., 1912.
Ordinary.. .. .	123,731	124,847
Deferred ordinary .. .. .	13,902	14,351
Government .. .. .	15,212	15,230
Press .. .. .	41,830	28,095
Deferred press.. .. .	18,907	28,913
	208,582	211,436

The Telephone Transfer.—The Postmaster-General's attention was recently called to the fact that, notwithstanding his agreement with the National Telephone Co. to pay interest on the unpaid purchase money for the company's property taken over by him, certain preference capital of the company, amounting to nearly 3½ millions sterling, was being deprived of any interest pending the payment of the purchase money by him, owing to the form of the company's articles of association. He replied that the agreement to pay interest on the unpaid purchase money would be carried out, and a further instalment of the purchase money could be paid by means of annuities or Exchequer bonds if an award on account could be obtained from the Railway and Canal Commissioners; but he was unable to say how the company's articles of association would affect the distribution of such instalment by the liquidator.



## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—April 23rd. 2,000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

April 24th.—Power generating plant for the Federal Capital site. Secretary, Department of Home Affairs, Russell Street, Melbourne.

May 1st and 8th.—Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—As stated last week the Electric Supply Committee of the City Council of Melbourne are inviting tenders for an electrical three-seated motor-car fitted with Edison storage battery capable of running 80 miles on one charge at an average speed of 20 miles per hour fully loaded, and two electric motor vans for loads of 1,000 and 2,000 lb. respectively, at an average speed of 15 miles per hour. Tender forms and specifications can be obtained from Messrs. McIlwraith, McEacharn & Co. Propy., Ltd., Billiter Square Buildings, London, E.C.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays. See "Official Notices" to-day.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" to-day.

QUEENSLAND.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

SOUTH AUSTRALIA.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" March 15th.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

**Belfast.**—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

**Brazil.**—PERNAMBUCO.—April 18th. Concession for the establishment and working of several lines of electric tramways. Preliminary deposit, 20,000 milreis; final deposit, 80,000 milreis. Particulars, Direction Générale des Travaux Publics, Pernambuco.

**Cape Town.**—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

**Dublin.**—April 15th. Flame arc lamps and suspension gear, for the Corporation. See "Official Notices" March 29th.

**France.**—ROUEN.—Six 4,000-kg. capacity and four 2,500-kg. capacity electric cranes, with automatic driving machinery, for the harbour. Particulars, Président de la Chambre de Commerce, Rouen.

**Germany.**—April 15th. The municipal authorities of Frankfurt-am-Main are inviting tenders for the supply of four 5-ton electrically-operated cranes.

PILSEN.—April 15th. Sundry machine tools with electric driving. Particulars from the K.K. Staatsbahndirektion, Pilsen.

**Krakau.**—April 15th. For the railway workshops at Neu Sandez. One electric drilling machine for 20-mm. holes, one electric exhaustor, one portable electric boring machine for 50-mm. holes, one electric circular saw (for wood), two turning lathes of 200/1,000 mm. and 150/750 mm. respectively, one pneumatic riveting hammer, one 1-H.P. continuous-current motor, and one 2½-H.P. three-phase-current motor, &c. Deposit, 5 per cent. of cost. Particulars, K.K. Staatsbahndirektion, Krakau.

**Leeds.**—April 20th. Eight miles of 2 sq. in. three-core cable, 6,600 volts, for the City Council. See "Official Notices" to-day.

**London.**—L.C.C.—April 16th. Supply, during twelve months, of 484 tons of rolled-steel bar, special section, for magnetic brakes of electric cars. Chief Officer of Tramways, 62, Finsbury Pavement, E.C.

The Highways Committee is about to invite tenders from selected firms for the renewal of the electrical installation in Blackwall Tunnel (£4,000, estimated). The matter will be fully settled during the Easter recess.

April 16th.—Electrical installation at the Lyham Road School. See "Official Notices" March 29th.

METROPOLITAN ASYLUMS BOARD.—April 10th. Two electrically controlled passenger lifts at Tooting Bec Asylum. See "Official Notices" March 22nd.

METROPOLITAN WATER BOARD.—April 12th. The Board is inviting tenders for 6 Diesel oil engines and two 10-ton overhead cranes for Cricklewood and Fortis Green pumping stations, also one Diesel engine and one 8-ton overhead crane for Green Street Green pumping station. Specifications and forms of tender from the Chief Engineer's Department, Savoy Court, Strand, W.C.

ST. PANCRAS.—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" March 22nd.

H.M. OFFICE OF WORKS.—April 17th. Conduit boxes for two years. See "Official Notices" March 29th.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Rhodesia.**—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

**Russia.**—MOSDOK.—The T.C. invite offers for a concession to supply electric lighting.

**Spain.**—Tenders have just been invited for the concession for the working during a period of 15 years, of the telephone exchange in the town of Pamplona (province of Navarra).

The municipal authorities of La Escala (province of Gerona) have just invited tenders for the concession for the electric lighting of the town.

**Turkey.**—CONSTANTINOPLE.—June 15th. Tenders are invited for a concession to lay an electric suburban tramway system to serve Skutari, Kadikoi and neighbouring districts. Particulars from the Ministry of Public Works.

**Vienna.**—April 15th. The Imperial and Royal State Railways Direction invite tenders for some 50 machine tools of various kinds, with electric driving equipment (including boring, shaping, riveting and leather-sewing machines, metal and wood circular saws, electric fans, portable electric dust-exhausters, eight cranes, &c.). Particulars, K.K. Direktion der Staatseisenbahnen, Schwartzbergplatz 3, Vienna I.

**Walsall.**—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" March 29th.

**West Hartlepool.**—April 15th. High and low-tension switchgear, for the Corporation Electricity Department. See "Official Notices" March 29th.

**York.**—April 12th. Two water-tube boilers, with superheaters, automatic stokers, economiser and pipework, for the City Electricity Department. See "Official Notices" March 22nd.

### CLOSED.

**Belfast.**—The Committee has accepted the tender of the Reason Manufacturing Co., Ltd., for demand indicators for the year.

**Bolton.**—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for wire and cables required for the fittings department during the next 12 months. The electrical engineer was authorised to obtain tenders for 12 months' supplies for the works department.

**Bradford.**—The T.C. Electricity Committee has accepted the tender of the Paterson Engineering Co., Ltd., for an oil eliminating plant for feed-water purification, for the Valley Road Works, at £605.

**Epsom.**—The U.D.C. has accepted a tender from the Diesel Engine Co., Ltd., for an oil engine for the electricity works, at £3,721.

**Ilford.**—The Council has accepted the tender of the Electrical Apparatus Co., Ltd., for electricity meters for 12 months.

**Leyton.**—The tenders of Messrs. Headland & Headland and Messrs. E. H. Grimshaw & Son have been accepted by the U.D.C. for carrying out electric light repairs at schools on the west and east sides of the G.E. Railway respectively, for a period of 12 months.

**London.**—POPLAR.—The B.C. Electricity Committee reported having received the following tenders for plant required for extensions at the main generating station:—

Two 1,000-kw. rotary converters.—General Electric Co., £3,599, alternative £3,795; British Westinghouse Co., £3,983; Siemens Bros. Dynamo Works, £4,146; Dick, Kerr & Co., £4,992; British Thomson-Houston Co., £7,453. Motor converters.—Bruce Peebles & Co., £4,260. Switchgear.—Crompton & Co. (low-tension only), £714; Electric Construction Co. (incomplete), £1,800; Johnson & Phillips (not in accordance with specification), £2,066; Switchgear & Cowans (incomplete), £2,179; Ferranti, Ltd., £2,562, alternative £2,463; British Westinghouse Co., £2,608, alternative £2,357; British Thomson-Houston Co., £2,789; Reyrolle & Co., £3,356.

In regard to the tenders received for the two 1,000-KW. converters, the Committee stated that motor-converters had been installed in all sub-stations except Orchard Place, where two small rotary



converters of the Westinghouse type were installed in December last. For simplicity in starting and switchgear generally, the motor-converter had advantages over the rotary, which is, however, less costly. The rotary converter for 50 cycles, had made rapid strides in general construction and reliability during the past five years, and the electrical engineer reported that he had every reason to believe that the machine of this type recently installed would give every satisfaction, but he advised that, before deciding upon rotary converters for all future extensions, more actual experience should be obtained. He therefore recommended, in this instance, that one rotary converter and one motor-converter be obtained, and that the Council should be guided by the practical results of such installation in providing for future standardisation. The General Electric Co., the Committee continued, offered the lowest tender for rotary converters, but up to the present time this company had not built any machine approaching the size required. The engineer could not recommend the placing of an order experimentally, in view of the serious trouble experienced in the past with the early type of converters; and having regard to the much longer and greater experience of the British Westinghouse Co. in the manufacture of rotary converters, he suggested acceptance of the tender of that firm. Messrs. Bruce Peebles & Co. were the makers of motor-converters, and, although the guaranteed efficiency was not so high as in the case of rotaries, all the latest-type machines had been thoroughly reliable and had given no trouble. In accordance with the engineer's suggestion, the Committee recommended the acceptance of the British Westinghouse Co.'s tender for one 1,000-KW. rotary converter, at £1,991, and the tender of Messrs. Bruce Peebles and Co. for one 1,000-KW. motor-converter, at £2,130.

The Committee, reporting on the tenders received for the switchgear, stated that of those complying with the conditions specified, those of Messrs. Ferranti, Ltd., and the British Westinghouse Co. were the lowest, and the engineer suggested that in order to comply with the latest and most up-to-date practice, gear on the electrical remote-control system, as tendered for by these firms in their alternative schemes, with the heavy type switches be adopted, and that switches capable of dealing satisfactorily with a load of 20,000 KW. be installed on all extensions to switchgear at the main station, such switches to be fixed in the existing battery room. The advantages of the type of gear proposed were stated to be (1) immunity from personal danger during examination and overhaul; (2) minimum fire risk; (3) heavy type desirable in view of bulk supplies to other authorities and (4) modification of existing switchboard, with consequent risk, expense and delay, obviated. Of the alternative tenders of the firms in question, that of the British Westinghouse Co. was the lowest, and was reported also to embody the most practicable scheme. The Committee therefore recommended the acceptance of the tender of the British Westinghouse Co. at £2,357. The Committee had also accepted the following tenders:—Babcock & Wilcox, Ltd., main steam, feed and blow-down pipes, £728; Strachan & Henshaw, telpher coal-handling plant, £2,337; New Conveyor Co., lantern roof over new bunkers at generating station, £441. At the meeting of the Council these recommendations were agreed to.

**BATTERSEA.**—The B.C. has accepted the tender of Messrs. Belliss and Morcom, at £7,187, for carrying out extensions to plant at the central generating station.

**L.C.C.**—In order to avoid delay, the Education Committee has been authorised to accept tenders for the electric lighting of Morden Terrace and Lyham Road schools during the Easter recess. The Highways Committee will also settle the contract for rolled-steel bar for magnetic brake shoes during the recess.

**Sunderland.**—The T.C. has accepted the tender of the A.E.G., Berlin, for the supply of a turbo-alternator, condensing plant, &c., for £13,475. This was the lowest tender, the next being for £16,425; the estimated cost was £16,400.

**Northampton.**—The T.C. has accepted the tender of Messrs. Keliher & Co. for a supply of 50 sets of tramcar destination screens, at 3s. 3d. each.

**Warrington.**—The T.C. has accepted the following tenders:—

Jas. Howden & Co., Ltd.—Two spare armatures for turbo-alternator condensing plant.

Brush Electrical Engineering Co.—Transformers.

British Westinghouse Co., Ltd.—Direct and alternating-current motors.

**Wrexham.**—The Electricity Committee has accepted the following tenders:—

Arc lamp carbons.—General Electric Co.

3 and 5-ampere electrolytic meters.—Bastian Meter Co.

10-ampere miniature electrolytic meters.—Reason Manufacturing Co.

Boiler solution.—W. G. Tranter's Boiler Co.

**York.**—The Electricity and Tramways Committee of the T.C. has accepted the tender of Messrs. Siemens Bros., Westminster, for overhead gear, &c., for an electric locomotive, at £207.

## FORTHCOMING EVENTS.

**Smoke Abatement Exhibition.**—Until April 4th inclusive. At the Royal Agricultural Hall, London.

**Institution of Electrical Engineers (Scottish Local Section).**—Tuesday, April 9th. Meeting at Edinburgh.

**Association of Engineers-in-Charge.**—Wednesday, April 10th. At 7.30 p.m. At St. Bride's Institute, E.C. Paper on "Some Notes on the Use and Calibration of Electrical Instruments," by Messrs. G. E. Elphinstone and W. Phillips.

**Leeds Association of Engineers.**—Thursday, April 11th. At 7.30 p.m. At 5, Park Lane, Leeds. Annual meeting.

## NOTES.

**Legal.**—**GOTT v. VERITYS, LTD.**—At the Birmingham Assizes, Nisi Prius Court, on March 27th, after several previous hearings, Mr. Justice Lush delivered judgment in this case. According to the *Southall and Norwood Gazette*, plaintiff, Arthur Edward Gott, a mechanical and electrical engineer and inventor, of Southall, sued defendants, seeking to recover damages for breach of contract. "The plaintiff's case was that it had been agreed between him and the defendants that the latter should manufacture and sell certain patented articles of which he was the inventor, and pay royalties in respect of them. After some time the defendants, without giving three months' notice to the plaintiff, in accordance with the agreement, discontinued the manufacture and sale of the articles. It was alleged that they substituted others with the object not only of avoiding the payment of royalties, but of preventing the patents being worked elsewhere. It was stated that the case should stand or fall on one of the patents, his Lordship stating at the previous hearing that if he held there was no breach upon that one patent judgment would be entered for the defendants. If he held there was a breach, the action would be referred to the Official Referee to see if there were any further breaches and to assess damages. His Lordship now said he had come to the conclusion that there was a breach of agreement with regard to one of the patents; and by mutual agreement between the parties the case was referred to the Official Referee to decide whether there were any other breaches and to assess damages."

**CAMPBELL v. OBAN COUNCIL.**—This action, taken by John Campbell, gasfitter and electrician of Oban, against the Provost, Magistrates, and Council of the Burgh of Oban, has recently been before Sheriff Wallace. According to the report of the matter in the *Oban Times* of March 30th, his Lordship, who after the debate on the preliminary pleas made avizandum, issued on Thursday last week his decision on these pleas. The Sheriff repelled pleas one, two, and three stated for defenders, and continued the cause for further procedure till the Vacation Court on April 17th next, and meantime granted interim interdict as craved. At the close of a lengthy note, he says, that on the whole matter he is of opinion that the pursuer has alleged a sufficient title and interest to sue, and that the action, so far as it alleges patrimonial loss by pursuer due to defenders' actings in *ultra vires* of their statutory powers, is competent and relevant. Further, it appears that no question of really relevant or vitally essential facts is disputed in the case, the question in controversy being one solely of law and of the defenders' powers under the Acts and their Order to engage in the supply of electric fittings to the detriment of pursuer's business and to his patrimonial loss. "No doubt defenders deny that they are engaged in the business or trade of selling or supplying electric fittings. But they admit that they have been in the habit of supplying, and no doubt intend to continue supplying, their customers or persons who take their supply of electric energy from them with the fittings and adjuncts incidental to the use of that supply; and that, it appears to me, is sufficient admission on their part to enable me to decide the real question in controversy between the parties without further delay and expense. I think, therefore, no good purpose could be served by allowing a proof."

**SALFORD CORPORATION AND SOUTH LANCASHIRE TRAMWAYS CO. v. ECCLES CORPORATION.**—In the House of Lords on March 29th, their Lordships had before them an appeal from the decision given in the Court of Appeal in May, 1910, in which the judgment given by Mr. Justice Eve in January, 1910, had been reversed. The question raised related to agreements for running powers over a section of tramway in Eccles and Salford, which gave through communication between Manchester and Liverpool. The proceedings in the Appeal Court were fully reported in the *ELECTRICAL REVIEW* for June 3rd, 1910, page 898, and in their decision of last week the House of Lords confirmed the judgment of the Court of Appeal there set forth, and dismissed the present appeal.

**'Bus and Tram Accidents in London.**—Mr. Kellaway asked the Home Secretary last week whether his attention had been called to the fact that during the five years 1907-11, 305 persons were killed by motor-omnibuses in the metropolitan area, and only 127 by mechanically-propelled tramcars, although the tramcars carried nearly twice as many passengers as the motor-omnibuses; whether he was aware of the suggestion repeatedly made by Dr. Waldo, Coroner for the City and Southwark, that many of these fatalities would be avoided if motor-omnibuses were fitted with a safety tender similar to that which the Board of Trade insists on being fitted to mechanically-propelled tramcars; and whether he proposed to take any action. Mr. McKenna, in reply, said that the Commissioner of Police had from the outset impressed upon proprietors of motor-buses the importance of providing a suitable guard, and had intimated to them that when one was available certain concessions would be made as to the minimum road clearances of these vehicles. No satisfactory device, however, of the nature indicated, had yet been submitted to him. The safety tender on tramcars, suitable as it was for a vehicle running upon fixed rails, was not suitable for a vehicle meeting frequent inequalities of road surface.

**London Aviation Meeting.**—From the Graham White Aviation Co., Ltd., the proprietors of the London Aerodrome, Hendon, N.W., we have received full particulars of the events that are to take place at the forthcoming first London meeting at Hendon on Good Friday, Saturday and Easter Monday, and the conditions and regulations controlling them.

(Continued on page 551.)



## SOME RECENT BÖVING WATER-TURBINE PLANTS.

It is difficult to judge whether the builder of water-turbines is more indebted to the builder of electrical machinery or *vice versa*. It is enough to say that it is only the advances in electrical practice which have made it possible to develop water-power in more or less inaccessible places and to convey energy to the spot at which it can be utilised.

Since the days—about 20 years ago—when the first hydro-electric distributing stations were being installed in Switzerland, enormous strides have been made, both as regards size of units and range of falls utilised. Units of 15,000 H.P. are not uncommon, and heads up to 3,200 ft. have been harnessed, turbine efficiencies of 86, and even 88, per cent. have been obtained, and the difficult problem of automatic regulation satisfactorily solved: in fact, the construction of the hydraulic turbo-motor may be said to have reached a stage where very little room remains for improvement, and which is marked by the definite triumph of two types of turbine only: the Francis turbine for low and medium heads, and the tangential impulse wheel.

The great advantage of the Francis type—under which name are comprehended all radial inward flow, semi-axial outflow reaction wheels—over the older types, Jonval, Girard, Fourneyron, &c., lies in its wonderful adaptability to all conditions of head and speed.

The various Francis wheels in fig. 1 encompass the widest range of possibilities in this respect. The narrow wheel on the right hand side is the "slow runner," as used for comparatively high heads; the large one on the left hand side is a "quick runner" working at high speed under a low head.

It would be difficult to exaggerate the importance of the

be increased by the introduction of gear wheels or belt drives, direct-drive is now the rule in hydro-electric plants.

The firm in Europe which stands foremost as builders of "quick-running" Francis turbines are the Kristinehamn Works of Messrs. Jens Orten-Böving & Co.

Owing to the conditions in Sweden, where nearly all the falls are between 5 and 35 ft., they had to give

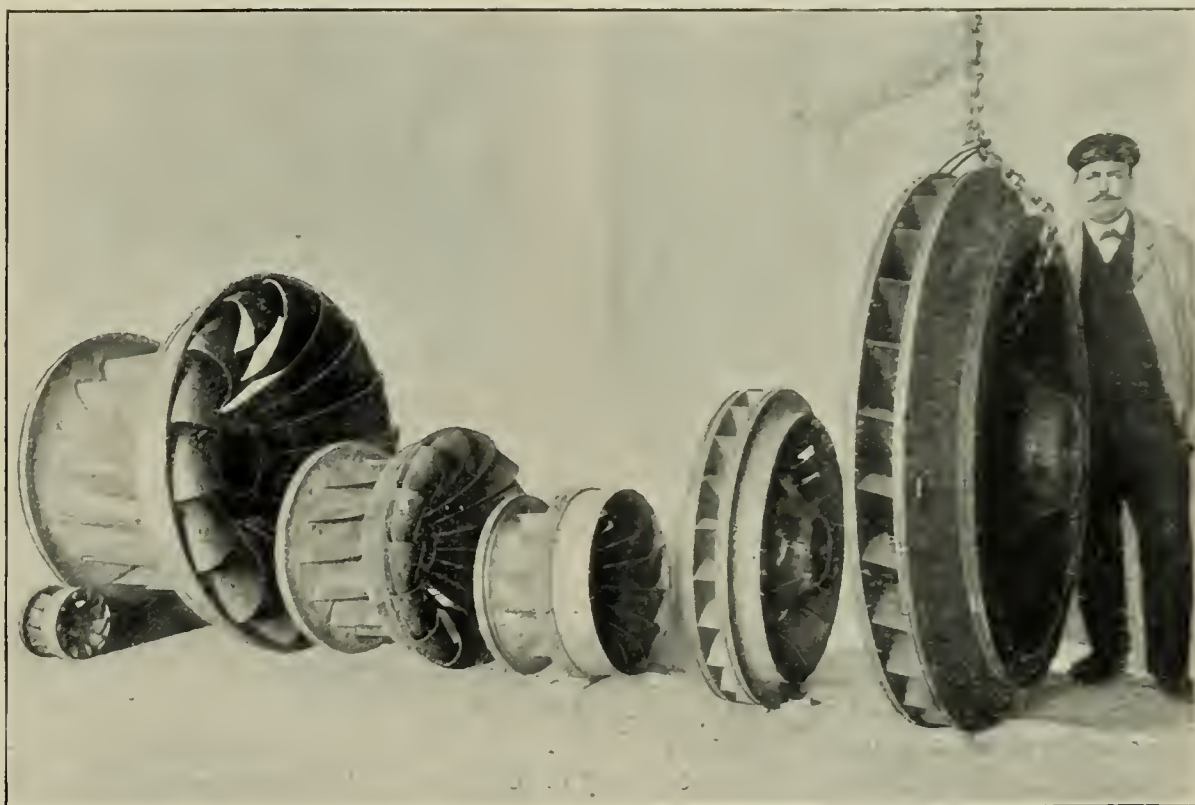


FIG. 1.—FRANCIS WHEELS: LOW HEADS TO COMPARATIVELY HIGH HEADS, LEFT TO RIGHT.

their attention quite early to the difficult problem of designing high efficiency quick runners, and five to six years ago they were already supplying standard quick runners with a "specific speed" of 355 R.P.M., whilst the big Continental firms had not yet built runners for more than 300 R.P.M.

It is interesting to note, for instance, that the Böving Co. were the only European firm in a position to quote for the plant of the City of Winnipeg, on account of the high speed stipulated. They secured the whole contract for five double generator turbines of 5,300 H.P. running at 164 R.P.M., and two exciter turbines of 450 H.P., all with automatic governors. At the tests the large turbines were found to give 5,800 H.P.

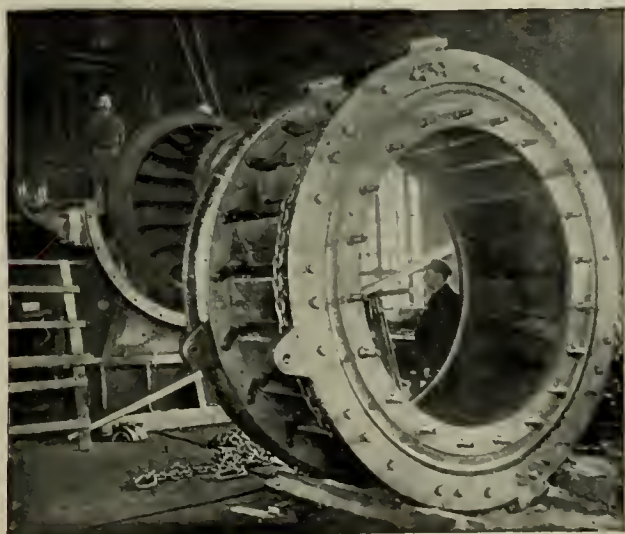


FIG. 2.—DISTRIBUTING WHEEL AND RUNNER, WINNIPEG POWER PLANT.

quick runner in modern turbine practice; it is applied for nearly all the plants of the open-flume type, *i.e.*, for heads up to 40 ft. (or even more for very large units).

As a concrete example, it can be said that 15 years ago the maximum possible speed for a 1,000 H.P. single turbine with 20 ft. head was about 65 R.P.M.; nowadays 108 R.P.M. is easily reached. Whilst in the old days the speed had to

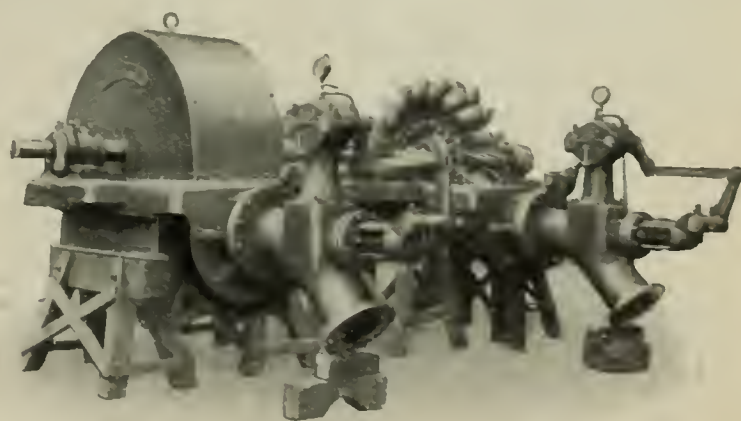


FIG. 3.—IMPULSE TURBINES FOR ARGENTINA.

Fig. 2 shows one of the distributing wheels with runner and discharge casing in the background. The power station is at Point du Bois, on the Winnipeg River, about 75 miles from Winnipeg, and is already built complete for an ultimate total output of 75,000 H.P. The head is 45 ft.

A good idea of the considerable dimensions of Francis turbines for low heads is given by fig. 7, showing one of



the six generator-turbines of 4,000 h.p. (4,500 h.p. on test), supplying current to the Domnarfvet Iron Co., of Sweden, for smelting iron ore by the use of Gronwall reduction furnaces, the patent rights for which furnaces are held by Electro-Metals, Ltd., a company controlled by Messrs. Jens Orten-Böring & Co. The turbines work under a head of  $33\frac{1}{2}$  ft. and run at 187 r.p.m. They each consist of four runners, discharging in pairs in common suction casings, the whole being erected in an open flume. The funnel in the middle

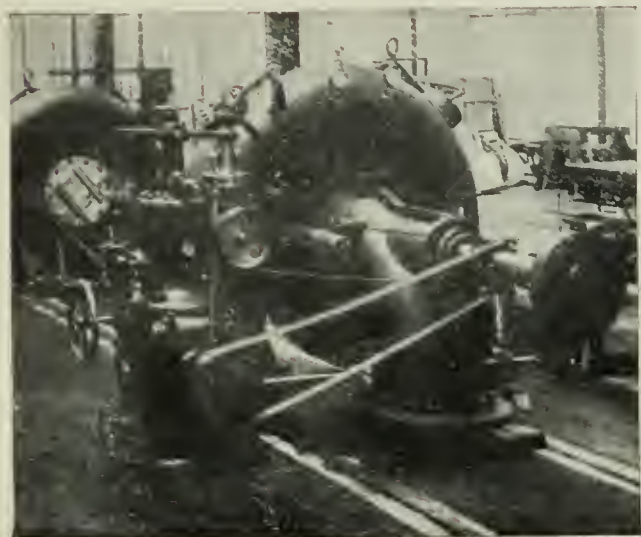


FIG. 4.—FRANCIS SPIRAL TURBINES: AUTOMATIC GOVERNOR IN FOREGROUND.

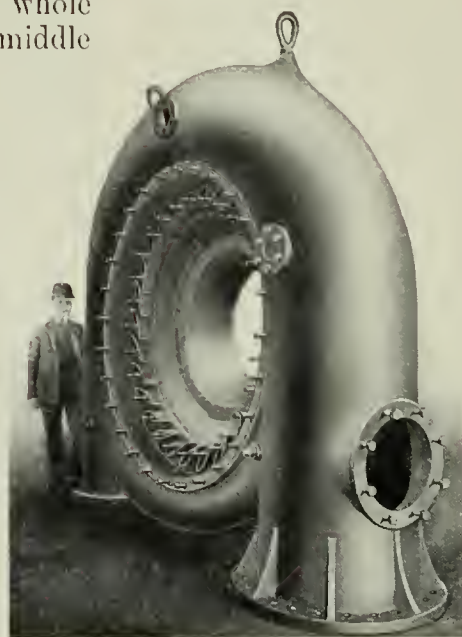


FIG. 5.—SINGLE SPIRAL TURBINE, 3,300 B.H.P.

gives admission to a water-tight chamber in which are placed the ring lubricated main bearings.

These machines are, however, of quite moderate size if compared to the three 14,000-B.H.P. turbines, the order for which has just been given the company by the Swedish Government for their plant at Elfkärlby. They are exactly of the same type as above, and work at 150 r.p.m. under 53 ft. head. They have, accordingly, a capacity of 88 tons

including governor, is about 300 tons, and an efficiency of 86 per cent. is guaranteed.

Another plant of the same type—four-fold open flume—is that recently supplied to the Waihi Gold Mining Co., New Zealand, and consisting of six turbines of 1,500 h.p. each, under 24 ft. head. These are, however, considerably smaller, the shaft length being only 53 ft.

Fig. 6 shows one of the turbines installed in the Swedish Government's power house at Trollhättan. These machines are of the Francis double type, and are enclosed in steel plate casings with axial inlet (removed in the view). They are rated each 12,500 h.p. (13,300 h.p. on test) under 100-ft. head with a speed of 180 r.p.m. Most of the castings are of steel on account of the pressure. There are three main bearings, one on the generator side in front of the casing and two inside same, at the back of the turbine, and between the two runners respectively, accessible through inspection shafts. They are all of the ring-oiled type, with four and two rings.

For heads above 100 ft. up to 350 or even 500 ft., Francis turbines in spiral casing are generally used. Fig. 4 illustrates one of three turbines which have just been erected at the Rio Lules plant of the Tucuman Hydro-Electric Co., Argentine. They each develop 1,800 B.H.P. at 600 r.p.m. under 330 ft. head, and are of the single-discharge type, the end-thrust being taken care of by a special bearing. The view also shows the automatic oil pressure speed governor

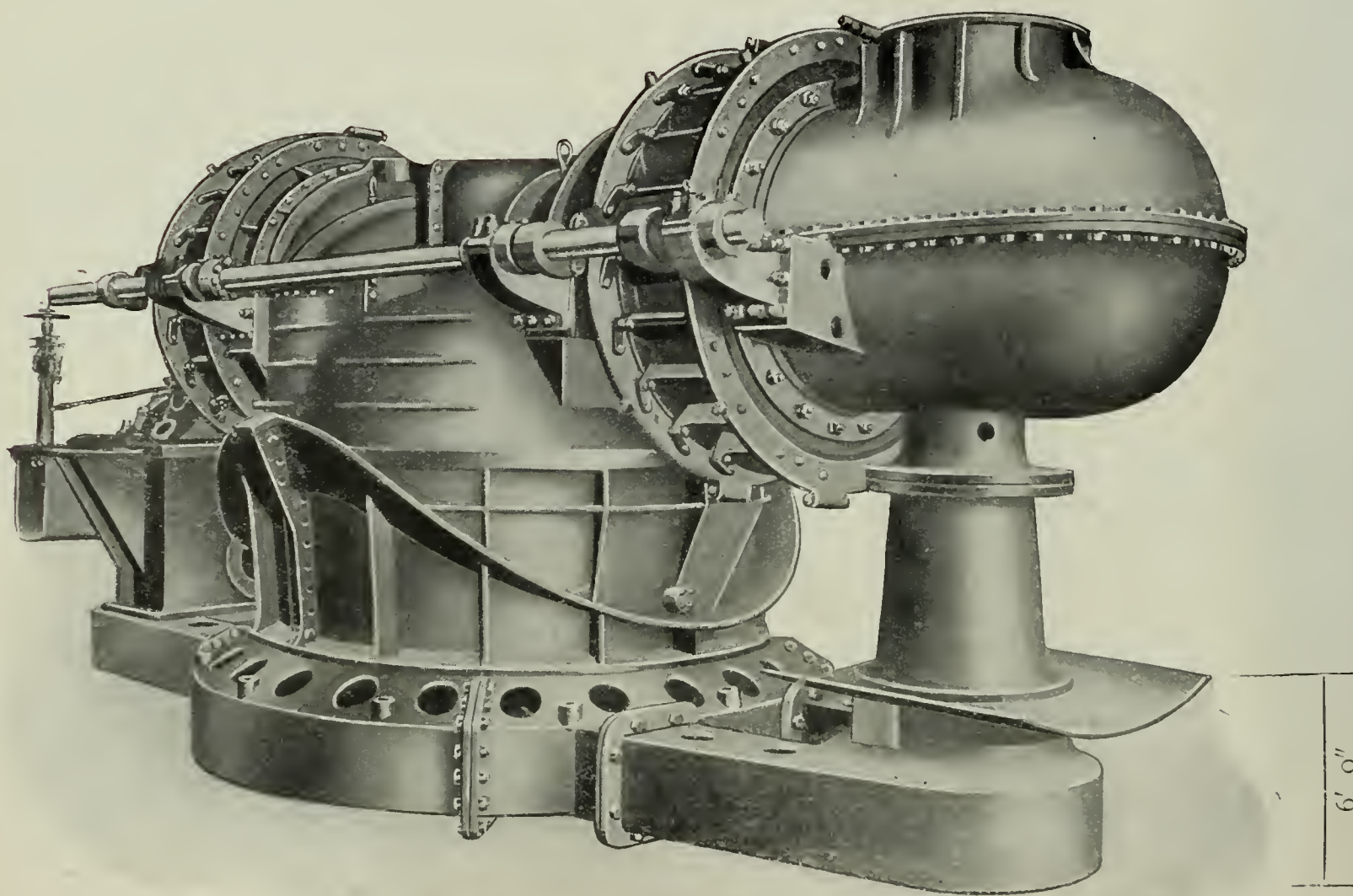


FIG. 6.—FRANCIS DOUBLE-TYPE TURBINE OF 12,500 H.P., TROLLHATTAN.

of water per second each, and are easily the biggest low-pressure turbines in the world. Each of the four runners has an outside diameter of about 8 ft. The turbine shaft, of nickel steel, is hollow and in four lengths, with forged coupling flanges; its length is 75 ft., and the diameter in the main bearing is 17 in. The weight of each turbine,

which is of an absolutely self-contained type, with rotary oil pump and air vessel.

A smaller machine of the same type was shipped recently to New Zealand for the New Plymouth municipal plant; it is designed for an output of 420 B.H.P. under 120 ft. head. The speed is 750 r.p.m.



Fig. 5 shows a large single spiral turbine which has been in operation for some time at the Stangfjord plant of the British Aluminium Co., in Norway. It develops 3,300 B.H.P. under 290 ft. head when running at 300 R.P.M. The wheel is 53 in. in diameter, and, as far as we are informed, this is a record dimension in Europe for such a high head.

As manufacturers of high-pressure impulse wheels, Messrs. Jens Orten-Böving & Co. have also an interesting record: firstly, on account of the size of some of the plants, and, secondly, by the reason that the manufacture of large impulse wheels of more than 1,000 H.P. is entirely new to this country. They shipped a few weeks ago from their works at Oakengates to Japan a double impulse turbine of 1,550 B.H.P., which is the largest water turbine ever manufactured entirely in British workshops. They have also just started the manufacture of two large impulse turbines of 5,000 H.P. each, to operate under 1,000 ft. head.

Fig. 3 gives a good example of impulse turbines made at the firm's works at Oakengates. This shows two units which are exciter machines of 200 B.H.P. for the Rio Lules plant, Argentine, the generator turbines for which are described above. Three exactly similar machines each developing 450 B.H.P. are being at present manufactured to the order of the Indian Government for their plant at Simla.

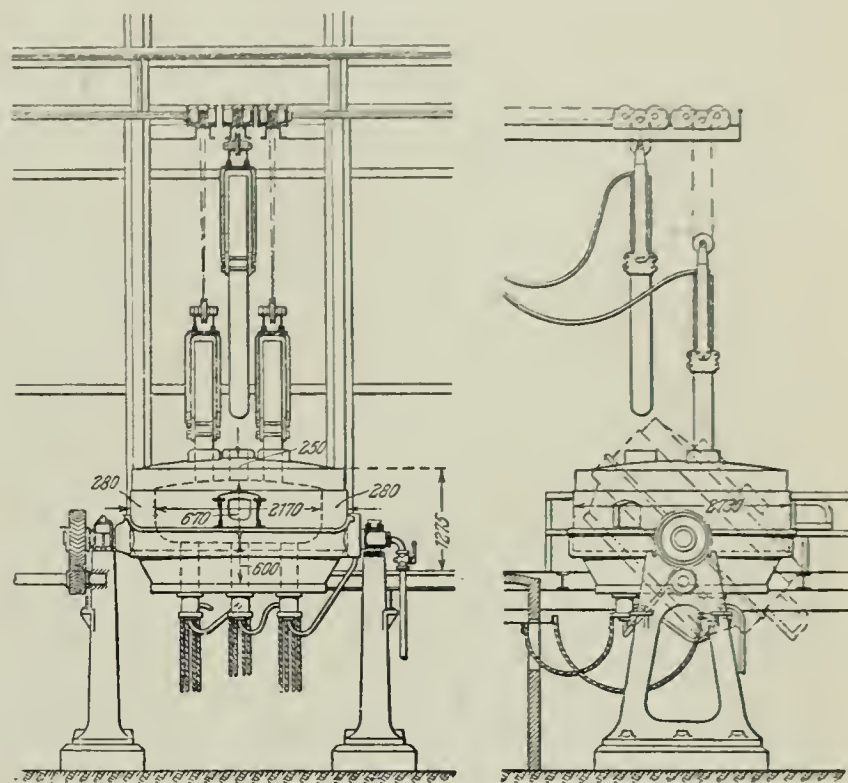
### A NOVEL ELECTRICAL STEEL FURNACE.

[BY OUR BERLIN CORRESPONDENT.]

IN designing the electrical steel furnace described here, Dr. H. Nathusius endeavoured to combine the individual advantages of the Héroult and Girod furnaces, without the drawbacks of either.

It will be remembered that in connection with the Héroult furnace two carbon electrodes of opposite polarity are introduced vertically through the roof into the melting compartment. After entering the slag and metal bath through one electrode, the current traverses the charge on its surface, leaving it through the second electrode. The heating effect thus mainly occurs at the surface, which has

In connection with the Girod furnace a principle first suggested by Siemens is utilised, the whole of the charge being in the circuit, as the current enters from the top through one or more carbon electrodes, passes on through the electric arc to the slag and metal bath, and after traversing the latter, leaves the furnace through water-cooled steel electrodes which project through the hearth bottom as far as the steel bath. In this case, the current



ARRANGEMENT OF NATHUSIUS ELECTRIC STEEL FURNACE.

traverses the whole of the steel bath which serves as a heating resistance, a method which is especially advantageous in the melting of solid charges. While the electric arc starting from the carbon electrode produces a local heating of the slag, there is no extensive heating comparable to the surface effects in the Héroult furnace.

In the Nathusius furnace, which is of the combined arc

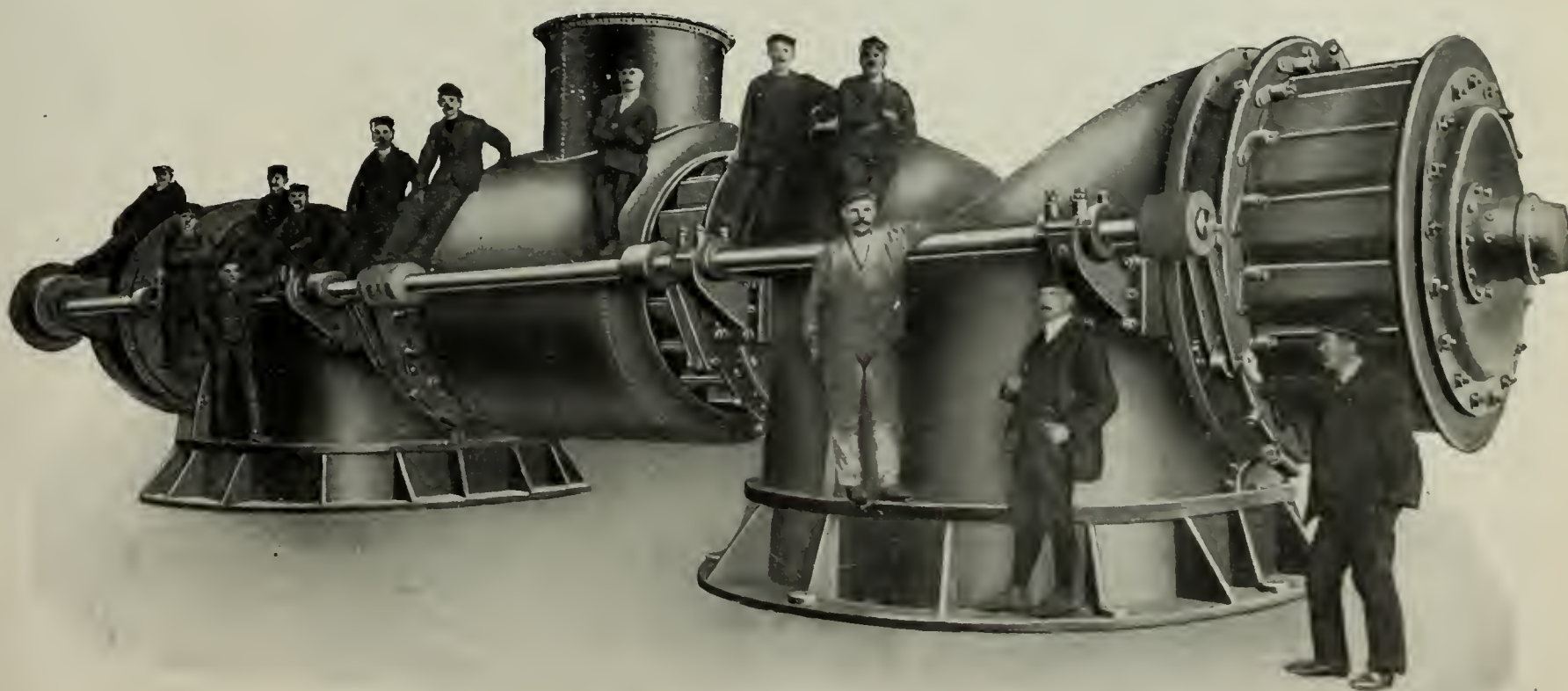


FIG. 7.—FRANCIS TURBINE WITH FOUR RUNNERS FOR 33½-FT. HEAD, DEVELOPING 4,000 H.P.

some advantages as well as disadvantages, the former being due to the very hot and chemically active slag thus produced, while the excessive heating which the charge has to undergo in order to raise the bottom and walls of the furnace to the proper temperature, is an undoubted disadvantage. Furthermore, there is the mutual dependency of the two electric arcs, which, in some cases, is bound to prove disturbing.

and resistance type, there are three surface carbon-electrodes penetrating vertically into the hearth compartment, at the corners of an equilateral triangle: these electrodes are connected to the outside terminals of a three-phase generator or transformer, and three steel electrodes in the bottom (also arranged at the corners of an equilateral triangle) are joined to the inside terminals of the same three-phase generator or transformer, the furnace charge itself forming the neutral

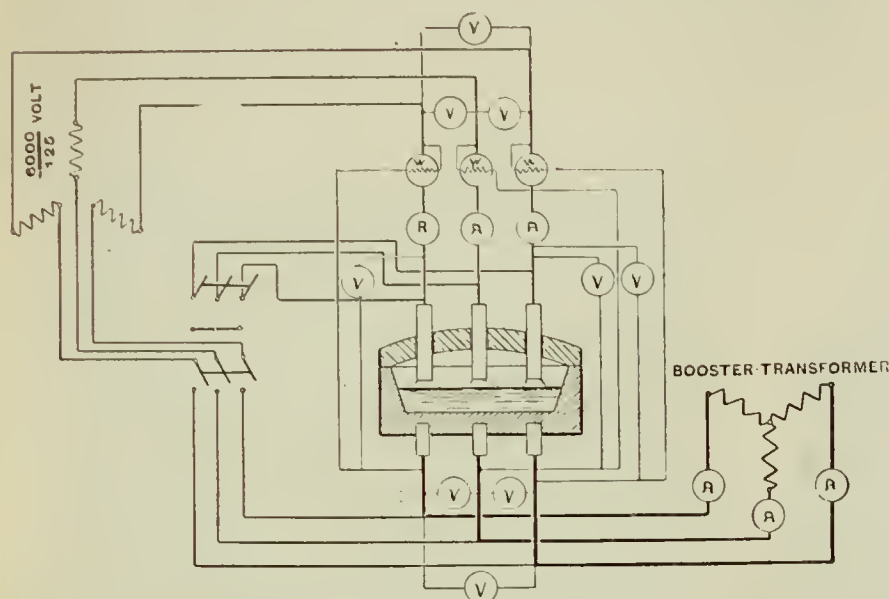


point of the latter. As both the upper and lower electrodes are of mutually alternating polarities, the current passes from one surface electrode to another, from one bottom electrode to another, and from each surface electrode to one of the bottom electrodes. In fact, there is inside the charge a per-

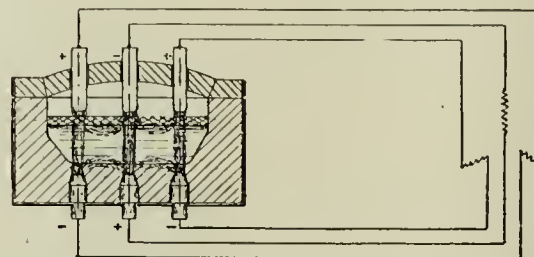
tinually, but also the slag layer, the steel bath and the mass rammed upon the bottom electrodes, any shocks produced by short-circuits in the electric arc are compensated as though by an electric buffer, thus dispensing with any furnace regulation in normal operation.

A further advantage from the electrical point of view is that the current flowing from one bottom electrode to the other is easily regulated by a special generator with adjustable neutral conductor, or by a booster transformer. As this current only flows between the bottom electrodes, and therefore through relatively small resistances, it can be increased without any risk of using under-loaded machinery of excessive dimensions.

While during the first stage of operation (the refining stage) effective heating of the slag (the only refining



ARRANGEMENT OF CONNECTIONS.



ARRANGEMENT OF ELECTRODES.

fect concentration of currents, instead of the surface currents of the Héroult and the cross currents of the Girod furnace. This heating process by which the whole of the charge is traversed and encircled by heating currents is obviously as economical as can be desired.

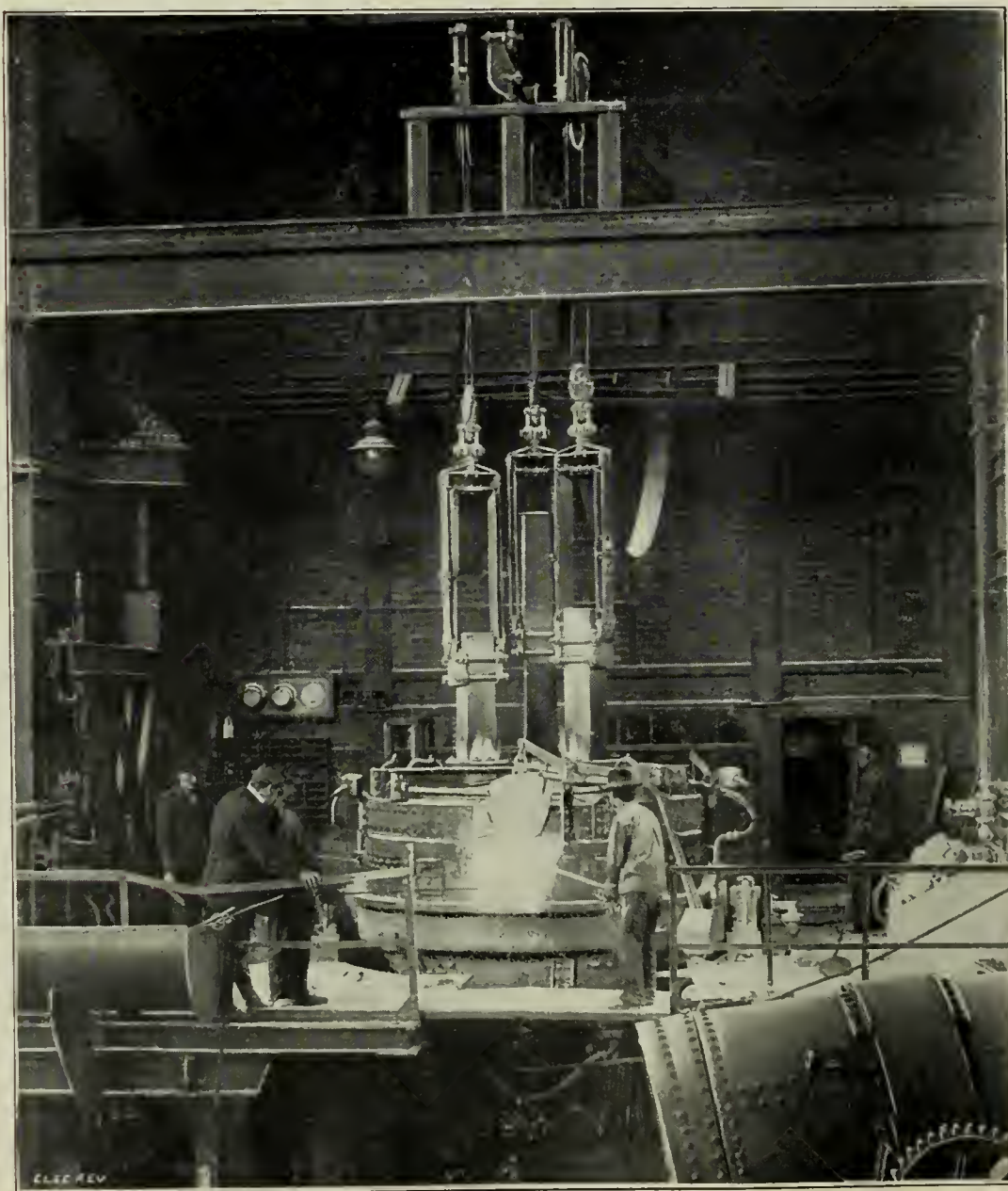
Further, it is well known that round each current traversing the iron bath there are formed rotary fields which, as in the case of a three-phase motor, will set the surrounding iron parts rotating. With the Héroult furnace this rotation only occurs at the surface, while the Natusius furnace is traversed throughout the bath by dense current lines, setting up everywhere whirlpools, which, apart from a very uniform heating, ensure an excellent mixing of the material and a perfect uniformity in the final product.

Again, the Natusius furnace heats much more rapidly than furnaces with only two heating centres, and, as the surface electrodes are placed as close to one another as possible, the electric arcs will repel each other in virtue of the electrodynamic repulsive forces exerted by the currents.

agent in the electric furnace) by intense arcs is of much importance, it should not be overlooked that during the ensuing deoxidising stage the slag is only a protective cover, and accordingly requires no strong heating. During this second stage the whole of the bath should, therefore, be heated as effectually as possible, which, in the Natusius

furnace, is done by using a booster transformer, and thus deriving from the electric arc a considerable amount of energy concentrated in the bath or the bottom.

After once preparing the charge it is often desirable to allow the bath to rest for some time, during which stage the amount of heat to be added only corresponds to the heat lost by radiation and conduction; this is effected by allowing current to flow only between the bottom electrodes, and thus doing away with arc heating. The furnace thus affords during the last stage of the process a good equivalent of the crucible furnace process, which is of especial importance for the quality of the final products. All the electrical apparatus (measuring instruments, &c.),



THE NATUSIUS ELECTRIC STEEL FURNACE.

As three-phase current is employed in practically all large metallurgical works, its use is a further advantage, while the problem of including the charge in the circuit is solved most ingeniously by locating the neutral point in the bath itself, and the process is independent of resistances. As the circuit comprises not only the electric arc, which varies con-

are installed in a special room, protected against dust and heat, whence a ready view is obtained of the furnace. The surface electrodes are suspended from ordinary cables, by pulleys and rails, being rapidly lifted in tilting the charge by means of high-speed motors, and inserted immediately the furnace returns to its normal position.



The furnace is pivoted in the same way as a steel converter, and the tilting device is operated electrically or hydraulically. The bottom electrodes, which are made of cast-steel, do not penetrate into the steel bath, and are covered by a layer consisting of the same material as the floor. The whole of the furnace, exclusive of the lid, consists of a rammed dolomite mass, and is exceedingly durable.

## NOTES.

(Continued from page 546.)

**Inquiries.**—A correspondent asks for makers of Crawford car replacers for grooved rails, and "Peerless" coil-winding machines.

**The B.E.A.M.A. and the Electrical Trades Benevolent Fund.**—The Olympia Electrical Exhibition was a decided financial success, and owing to the new method of management, the net profits passed automatically into the hands of the British Electrical and Allied Manufacturers' Association; these profits have been ascertained to amount, after paying rebates both to the ordinary exhibitors and a special rebate to the members of the Association who exhibited, to over £3,500, and part of the profits has been paid over by the Exhibition Executive Committee to the B.E. & A.M.A., who are naturally utilising it for their ordinary requirements and propaganda. When the Exhibition was first commenced, it was stated, so we are given to understand, that the profits from it would be devoted to the benefit of the electrical industry. It will, therefore, be interesting to ascertain what persons should be considered in the application of these surplus funds. The larger proportion of the space for which rent was paid in the Exhibition, whether reckoned by size or by money value, was occupied by firms who were not members of the B.E. & A.M.A., but who contributed in various ways to making the event so great a financial success.

On previous occasions when electrical exhibitions have been held under the auspices of the National Electrical Manufacturers' Association, which has now been taken over by the British Electrical and Allied Manufacturers' Association, the profits, after paying all the expenses, have been allotted to charitable purposes, and the Electrical Trades Benevolent Institution consequently enjoyed a contribution from the profits of the Olympia Electrical Exhibition in 1905, of £650, and also a very substantial sum from the Manchester Electrical Exhibition in 1908.

The Electrical Trades Benevolent Institution, although quite separate now from the B.E. & A.M.A., is still the deserving offspring of the predecessors of that Association, and two-thirds of its Committee are members of the B.E. & A.M.A. Owing to the reorganisation and new powers of voting introduced in the Manufacturers' Association, the present Council is very widely different in character to that of any previous Councils of the Electrical Manufacturers' Association, and it may be that some of its members are not conversant with the origin of the Electrical Trades Benevolent Institution.

Under the articles of association of the B.E. & A.M.A., Clause 3, Sec. N, it has full powers to make grants to charitable organisations, &c., connected with the industry, and it will be particularly appropriate on the present occasion, when the realised surplus from Olympia has been nearly twice the anticipated surplus, that a donation of, say, £500, should be freely given to the Electrical Trades Benevolent Institution. A Committee has been formed to consider the matter, but it has not yet come to a decision. We learn that many of the members of the Council have expressed themselves favourably disposed towards the Benevolent Institution, but have decided to await the report of this Committee. One member of the Council, however, seems to have raised objections, and bases these objections upon the introduction of the National Insurance Act. Some people conversant with this Act hold that it will not assist materially to lighten the burden that the Benevolent Institution has taken upon its shoulders; it will not be applicable to quite a large number of cases where ill-health is the controlling factor, and it will never be applicable in the cases where the recipients have been in superior positions.

**The B.E.A.M.A.**—We are informed that the second Council meeting of the British Electrical and Allied Manufacturers' Association (Incorporated) was held at the offices, 36, Kingsway, London, W.C., on March 21st. The following members were present:—A. Bruce Anderson, chairman (Ferranti, Ltd.); F. R. Davenport (Willans & Robinson, Ltd.); F. C. Gibbons (Browett, Lindley & Co., Ltd.); C. Koettgen (Siemens Bros. Dynamo Works, Ltd.); B. Longbottom (Electromotors, Ltd.); F. H. Nalder (Nalder Bros. & Thompson, Ltd.); E. S. New (D.P. Battery Co., Ltd.); M. J. Railing (General Electric Co., Ltd.); W. Rutherford (Dick, Kerr & Co., Ltd.); W. O. Smith (Elliott Bros.); A. D. Williamson (Vickers, Ltd.); A. P. Wood (Lancashire Dynamo and Motor Co., Ltd.). The following firms were elected "Members" of the Association:—The British Electric Plant Co., Ltd., Alloa, N.B.; the Osram Lamp Works, Ltd., London; Robertson Electric Lamps, Ltd., London.

The secretary, having reported applications for the Association's patronage of certain proposed exhibitions, was instructed to send to members the letter of which a copy is given herewith.

The secretary further reported that the exhibition proposed for

1912 by Bradford Corporation would not take place this year. A report upon the Association's recent action in the case of West Ham Corporation was approved. The following reports of progress were read and adopted:—(1) "Model general conditions of contract"; (2) sectional meetings; (3) conferences; (4) the Electric Lighting Acts: Bill for further powers. The Publicity Committee was constituted a Standing Committee for conference with the Electric Supply Publicity Committee and other purposes.

Copy of letter *re* Exhibitions:—

"We have been approached from several quarters as to the participation of our members in Exhibitions which are being promoted under the name of Electrical or "Smoke-Abatement" Exhibitions.

"The feeling of the Council of the Association is that, in view of the very large expense which electrical manufacturers incur in promoting their own triennial Exhibitions, it is not desirable that they should be called upon to bear to any extent the expense of various local exhibitions throughout the country; nor do they see that any good purpose is served by incurring such expense in carrying and exhibiting heavy machinery which is only of interest to those people who are, as a matter of fact, already fully acquainted with such various manufactures.

"On the other hand, they appreciate to the fullest degree the necessity of the electrical industry demonstrating to the public, as far as possible, the superiority over gas or coal of electrical appliances for domestic and other purposes. For this reason, the Council are of opinion that such members who manufacture any apparatus which it is desirable should be exhibited to the general public should be at liberty to do so.

"I shall be glad to know, therefore, if it is your desire to exhibit any such apparatus at any of the proposed Exhibitions enumerated below, and, as soon as I am in possession of the names of the firms who wish to exhibit, I will endeavour to make the best possible terms for those manufacturers, on collective lines.

"The first experiment in this direction has been made at the Smoke-Abatement Exhibition at the Agricultural Hall, London, which opens to-morrow, and it will doubtless interest our members to see that exhibit.

"D. N. DUNLOP, *Secretary*.

"March 22nd, 1912."

Place.	Promoters.	Dates.
Birmingham.	City of Birmingham.	Oct. 7th-26th, 1912.
Glasgow.	Corporation of Glasgow.	Sept. 20th—Oct. 12th, 1912.
Newcastle.	Newcastle Exhibitions, Ltd.	(Not yet fixed).

**Wages and Prices in New Zealand.**—Referring to some remarks in a leading article in our issue of March 22nd, "A New Zealander" writes to say that wages and prices in New Zealand are compared with those in England to illustrate a preceding statement. The object of the illustration is obvious, but the means used to emphasise that object are calculated to convey an entirely wrong impression of living in New Zealand:—"The word 'artisan,' I take it, includes bricklayer, plasterer, carpenter, joiner, fitter, turner, &c., and for each of these I can furnish the usual wage paid in New Zealand.

"Bricklayers and plasterers are paid from 11s. to 18s. per day of eight hours (working week of 48 hours). Carpenters and joiners at the rate of 10s. 8d. to 12s. 6d. for the same time as the first mentioned. Fitters and turners from 11s. to 12s. 6d., also for the same time.

"With reference to rent, I am perfectly satisfied that whatever manner of house the Englishman can rent for 5s. per week, the Colonial can obtain just such another in New Zealand for 7s. 6d., with the difference that, inasmuch as a large city in that Colony consists of 50,000 inhabitants, the house mentioned would most probably be much nearer to the city, and turn out the cheaper of the two because of the difference in car or train fares. With regard to boots, I will furnish to any reader addresses of firms in New Zealand, where he may be supplied with boots of the 10s. English standard at 12s. 6d. per pair and satisfaction guaranteed. I have found living in London to be much more expensive than the same standard in New Zealand, where I have resided over 20 years: in some of the provinces it works out in about the same ratio as the prices of boots as above."

**Educational.**—An Exhibition of the work of students of engineering in London, organised by the London County Council, was opened last week at the Whitechapel Art Gallery by Mr. Cyril S. Cobb, chairman of the L.C.C. Education Committee. A special feature of the Exhibition is the collection of engineering drawings and designs from King's College, University College, and East London College.

**Parliamentary.**—SECOND AND THIRD READINGS.—In the House of Commons, on March 26th, the London Electric Railway Bill was read a third time. The Preston, Chorley and Horwich Tramways Bill passed its second reading.

In the House of Commons, on March 29th, the Metropolitan District Railway Bill was read a third time.

**Fatality.**—According to the *Daily Mail*, through receiving an electric shock at 6,000 volts, a youth named Shapcott was killed at a North Finchley tramway station, where he was an electrical assistant. "Accidental death" was the verdict at the inquest held on March 27th.

**Appointment Vacant.**—Station superintendent, for the Corporation Electricity Works, St. Helens (£170). See our advertisement pages to-day.



**Institution and Lecture Notes.—PHYSICAL SOCIETY.—**

At the meeting held on March 8th "A Method of Making Capillary Filaments" was exhibited by Mr. H. S. Souttar, F.R.C.S. The apparatus demonstrated was designed by the author in 1901, and recently has been applied to the construction of fibres for the string galvanometer. The essential part of the apparatus is a small box of mica, between the upper and lower plates of which a fine platinum wire is strung backwards and forwards so as to form a small cage enclosing a cylindrical space 1 cm. in diameter and 2.5 cm. deep. On passing a current through the wire it can be heated to redness, and the box is converted into a small furnace. A small glass tube is hung in the centre of the furnace, and supports a small weight. As the glass softens the weight falls, and the glass is drawn out into a fine capillary. The weight is a long light rod with a disk on its lower end, which nearly fits a tube into which it falls. The tube is filled with a mixture of glycerine and water, with the result that the weight falls smoothly and evenly till it reaches a stop. It is easy with this appliance to draw down a tube of 1 mm. external diameter into a tube of any length, and of a diameter of 0.001 mm., with a wall less than 0.0001 mm. in thickness. As the thick ends remain attached to the filament it is easy to manipulate. The filaments are exceedingly light, 10 cm. of such a thread weighing, roughly, 0.1 milligramme. They are exceedingly strong, such a thread supporting a weight of at least 0.05 gramme, corresponding to a tensile strength of, roughly, 100 tons to the sq. in. The tubular form exposes a large area for silvering, and the resulting conductor has a low resistance.

Mr. R. S. Whipple stated that the Cambridge Scientific Instrument Co. had given up quartz fibres in favour of glass ones for use in string galvanometers. Glass fibres could be silvered much more easily than quartz ones.

Mr. W. Duddell said he was greatly interested in 1897 in string galvanometers in connection with wireless telegraphy, and constructed one with a narrow strip of gold leaf. Such a filament about 0.25  $\mu$  thick by 2 or 3  $\mu$  wide made a string of extremely low rigidity.

**INSTITUTE OF MARINE ENGINEERS.**—The annual report shows that the membership is now 1,284, an increase of 56. The City Premises fund amounts to £4,567. The revenue account shows a credit balance of £159, and the total assets amount to £4,178.

**INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).**—The meeting that was fixed for April 17th has been postponed.

**THE ASSOCIATION OF MINING ELECTRICAL ENGINEERS (NORTH OF ENGLAND BRANCH).**—A meeting was held at Armstrong College, on Wednesday, April 3rd, when Mr. F. Milburn read a paper on "Underground Lighting with Low-Voltage Metallic-Filament Lamps." Discussion was to follow, time permitting, on the paper on "Motor Starters for Mining Work," by Mr. A. P. Drake, B.Sc.

**Post Office Telegraphs and Telephones.**—The financial statement of the Postmaster-General for 1910-11 presented to Parliament last week showed that the net revenue of the telegraph service was £5,121,342 and the expenditure £6,085,166, showing a deficiency of £963,824—the largest deficit ever recorded. The amount received in royalties, mainly from the National Telephone Co., was £342,542, and the amount paid to cable companies, foreign countries, &c., was £781,487 (deducted from the gross revenue). Of the expenditure, salaries and other working costs amounted to £4,721,158, and items of the nature of capital outlay to £1,036,321. The total expenditure, apart from the latter, was £5,048,845, or £72,497 less than the total receipts. The figures are exclusive of the capital expenditure on the purchase of the telegraphs, &c., which amounted to £10,129,687; the interest paid on this account was £271,691, which brings up the total deficiency on the telegraphs for the year ended March 31st, 1911, to £1,235,515.

The capital expended on telephone purposes to March 31st, 1911, was £11,130,327. The total capital expended on both telegraphs and telephones, including sums spent on extensions, &c., is given as £29,293,289.

The total deficiency in the telegraph account from the commencement is £19,821,381; excluding items of the nature of capital from the expenditure, the deficiency is reduced to £7,942,226, but in this no charge is made for interest on capital expenditure not provided by the issue of stock or the creation of annuities.

The total expenditure on trunk telephone lines was £5,337,725, and on exchanges £3,913,204 in London, £1,691,619 in the provinces. The telephone revenue was £1,595,787, and expenditure £1,146,629, leaving a balance of £449,158, which, added to the royalties above mentioned, fell short by £262,187 of the amount necessary (£1,053,887) for the repayment of principal, interest, &c., on outstanding loans.

**Osram Lamps.**—The General Electric Co., Ltd., announce that they have now decided to withdraw the 5 per cent. extra charge which has hitherto been charged for Osram lamps required for series burning.

**Printers' Rifle League.**—The ELECTRICAL REVIEW Rifle Club, which entered Division II of this League for the season 1911-12, finished fourth. Twelve teams competed in each division; no other technical paper was represented.

**An All-Electric Scheme.**—According to the *Daily Telegraph*, the city of Boston, U.S.A., is preparing to carry out a scheme on the lines advocated by Mr. Ferranti. It is hoped that electricity generated on the coalfields of Pennsylvania, some hundreds of miles away, will in a few years be transmitted to Boston, and enable all coal fires, chimneys, and other objectionable accompaniments of combustion, to be abolished.

**Social Events.**—The staff of Messrs. Marryat & Place gave a smoking concert, on March 25th, at the Old Bell Restaurant, Holborn. Mr. H. Marryat presided. During the evening there were brief addresses by Mr. Huddell, the chairman, and by Mr. Lock, who voiced the thanks of the meeting to Mr. Marryat for presiding.

On Friday, March 29th, the employes of the Bradford Corporation electricity works department held their annual social and dance, at the Peel Park Hall, in connection with their Sick and Benevolent Fund. Messrs. F. Birch and Alf. Dickinson proved efficient M.C.'s over the dance and whist drive respectively. We are told that good music, numerous prizes and splendid refreshments were all conducive to the success of the event. The attendance of over 100 couples indicates the increasing popularity of these annual gatherings, and also the capable manner in which the Socials Committee, including Messrs. Railton, Holt, Laidlow and Richmond carried out their work.

**OUR PERSONAL COLUMN.**

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—MR. H. R. DOBSON, chief show-room attendant and representative of the Harrow Electric Light and Power Co., Ltd., who is leaving the Company's service to take up the position of District Representative to the St. Marylebone Borough Council, was the recipient of a handsome present subscribed for by the members of the staff. The presentation was made at the offices of the Company on Saturday last by the engineer and manager, Mr. J. A. Bernard Horsley, who in handing Mr. Dobson the present, referred to the good work done by him during his long connection with the Company.

The Gillingham Corporation has advanced the salaries of Messrs. R. H. LEE and C. FRITTON, shift engineers, by three annual instalments of £6 10s. per annum to a maximum of £91 per annum.

The salary of MR. GRAY, borough electrical engineer of Accrington, is to be increased from £350 to £400.

The Willesden Council has appointed MR. A. W. BLAKE as electrical engineer in place of MR. BRUCE, who is leaving for Buenos Ayres. Mr. Blake was borough electrical engineer of Monmouth from 1899 till 1906.

The Electricity and Tramways Committee of the Newport (Mon.) T.C. on March 28th decided to recommend MR. A. NICHOLAS MOORE for the appointment as borough electrical engineer. Mr. Moore has for 4½ years been chief assistant engineer to the Belfast Corporation Electricity and Tramways Department. There were 97 applicants.

MR. KENNETH F. BISHOP's recent appointment at Warrington was to the position of mains superintendent, not shift engineer, as previously stated.

**Tramway Officials.**—The following salary increases have been sanctioned by the Manchester Corporation:—MR. J. WOOD, financial superintendent of the tramways, from £450 to £475; MR. J. T. OAKES, traffic superintendent, from £425 to £450; MR. F. A. MITCHESON, accountant, from £350 to £375; MR. H. MATTINSON, permanent way engineer, from £350 to £375; MR. BLACKBURN, rolling stock superintendent, from £325 to £350; MR. R. BEATTIE, chief claims clerk, from £300 to £325; MR. G. W. HANCOCK, parcels superintendent, from £275 to £300.

MR. G. A. BAXTER has been appointed traffic superintendent to the Darlington Corporation tramways.

The Oldham Corporation Tramways Committee last week considered the appointment of a works superintendent at the dépôt. There were 70 applications for the position. The Committee appointed MR. THEODORE GERRARD, employed by the British Westinghouse Co., Manchester.

The special committee appointed by Northampton T.C. to go into the duties and salaries of the Council's various employes recommends, among other things, the increasing of the salary of MR. GOTTSCHALK, tramways manager, from £340 to £360 per annum, rising by two subsequent annual increments of £20 each to a maximum of £400.

**General.**—Among those presented to Her Majesty the Queen by Prince Alexander of Teck on the occasion of her visit to the Middlesex Hospital last week, was MR. A. MURRAY COOMBS, the consulting electrical engineer.

MR. H. CHARLES GOVER, who has been secretary of the Edison and Swan United Electric Light Co., Ltd., since 1882, having been with the company all through its existence, retired from the position on March 31st. He will carry with him at the conclusion of this unique record in the electrical industry the good wishes of a host of friends.

MR. J. E. LLOYD BARNES was on Saturday last presented, at the Central Technical School, Liverpool, with an illuminated address by his old students, on relinquishing his position as lecturer in electrical engineering. Mr. J. Wemyss Anderson, Dean of the Faculty of Engineering at Liverpool University, in making the presentation, mentioned that Mr. Barnes was the first to found an evening laboratory class in electrical science in the provinces.



## CITY NOTES.

**British Insulated and Helsby Cables, Ltd.**

THE annual meeting was held on March 25th at the Exchange Station Hotel, Liverpool, Dr. E. K. Muspratt presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 475), the CHAIRMAN said, according to a report in a Liverpool paper, that trade generally throughout 1911 had been better than in previous years, and that the electrical industry had participated in this improvement. During the year they had been kept busy in all departments of the works, and, while no contract of exceptional magnitude or unusual profit had been obtained, each department had contributed its share to the increased profits. This remark specially applied to the recent additions made to the range of the company's manufactures, and, as at present advised, it was not the intention of the company to further increase the scope of its manufactures, but it would be necessary to extend several departments which were extremely congested with work, and orders had been lost due to the company's inability to supply the needs of the market. A change of considerable importance has been made during the year, the company having sold its Liverpool works to a new company, the Automatic Telephone Manufacturing Co., Ltd. The accounts before the shareholders did not show the changes in the company's balance-sheet made by this sale, as the transfer took place as from January 1st this year, and the profits on the working of the Liverpool business to the end of 1911 were included in the present balance-sheet figures. The primary reasons for accepting the offer of the Automatic Co., were that the Liverpool works were not of a size commensurate with the company's operations in other directions, as the telephone business of this company was a new creation, without any specialities or goodwill. Under these circumstances, it was found difficult to compete with other longer-established firms, and the directors felt the only way to meet the situation would be to get hold of some speciality, so that the business should not be entirely dependent on work which met with the keenest competition. A great change was impending in operating the telephone exchanges by the introduction of automatic working, dispensing with a large number of operators. Their general manager, Mr. Sinclair, being intimately acquainted with the telephone business, went to the United States to inquire into what had been done in that country in this direction and found that the Automatic Co. controlled a system which was working successfully. As a result of the fullest inquiry into every detail of the business, the arrangement mentioned was entered into. They had parted with their Liverpool works, but, at the same time, had retained a very considerable interest in them, and their directors felt confident that the profits to be earned under the new arrangement would be satisfactory. The Automatic Co. would, of course, be closely allied to the Helsby Co., and to ensure this the board had nominated the majority of the directors of the Automatic Co. The prospects were quite satisfactory. Referring to the balance-sheet, they had spent £44,416 almost entirely on plant and machinery at the Prescott and Helsby works. This additional expenditure was necessary to enable company to meet the ordinary requirements of the business and increase the output in some of the subsidiary departments. Against this capital expenditure, however, the amount written off plant and machinery as depreciation and the sums put to other reserves (not counting increased carry forward) amounted to £43,500, practically an equivalent amount. The stock and work in progress had increased by £40,600, due to the larger amount of trade done and work in hand at the end of the year. The sum for sundry debtors had been increased by £43,541 during the year owing to the growth of the business. With regard to investments, after writing off £8,500, the balance left was £552,193, as against £526,769 at the commencement of the year, being an increase of £25,424, which was almost entirely due to the requirements of the Midland Electric Corporation for Power Distribution, Ltd. They practically owned all the shares in this company, and its position had further improved during the year, and there was every indication of steady and continuous progress. With regard to the other company in which they were so largely interested, viz., the Electric Supply Co., of Victoria, Ltd., this company was doing better. Changes had been made in the management, and more remunerative prices were being obtained for the current sold, and as a consequence of this it was expected that a marked improvement would be shown in the near future.

MR. J. S. HARMOOD BANNER, M.P., seconded, and the report was adopted.

**Callender's Cable and Construction Co., Ltd.**—The directors announce (says the *Financier*) that the accounts for the year to December 31st show a balance to the credit of profit and loss account of £76,835, or £20,997 in excess of that for 1910. This, with the amount brought forward, £40,073, gives a total of £116,908. The payment of interest on debenture stock, dividend on preference shares, and the appropriation for depreciation of buildings, plant, &c., absorbs £32,127 of this amount. The directors propose to recommend a further dividend on the ordinary shares at the rate of 5 per cent., together with a bonus of 5 per cent., making, with the interim dividend already paid, 15 per cent. for the year. This will absorb £26,250, leaving to be carried forward £58,531.

**Underground Electric Railways Co. of London.**—The scheme for the acquisition by this company of ordinary stock of the London General Omnibus Co. became binding on March 26th. The new securities will be issued in exchange for deposit receipts on a date which will be advertised shortly.

**Berlin Elevated and Underground Railway.**

THE report of the directors of the Gesellschaft für Elektrische Hoch und Untergrundbahnen, of Berlin, states that the year 1911 was of special importance to the undertaking in so far that it resulted in a certain conclusion of the years of negotiations in regard to the further development of the railway. On the completion of the network already sanctioned, the total length of the railway will be 20·7 miles, of which 14·35 miles will be underground, and the remainder will be of the elevated class. The construction of the new lines, and the alteration of existing lines, is to be accompanied by the adoption of far-reaching measures for the accommodation of connecting lines. As bearing on this point, it is mentioned that in the case of the Wilmersdorf-Dahlem connecting line of a length of 4·3 miles, suitable forms have been arranged in such a way that the local authorities concerned will remain the owners of the line, and retain the requisite influence on the construction and course of working, whilst a working community and fares agreement will be introduced with the lines of the Elevated Railway Co. The accounts show the following results for the two years:—

	1911.	1910.
Share capital.. .. .	£2,500,000	£2,500,000
Gross profits .. .. .	303,000	278,000
Interest on loans .. .. .	80,000	68,000
Reserve for redemption and renewal of lines	43,000	40,000
City taxes .. .. .	9,000	8,300
Depreciation .. .. .	3,600	3,400
Net profits and balance forward .. ..	162,000	153,000
Dividend, per cent. .. .. .	5½	5½

During the year the elevated and underground railway carried 62,585,512 passengers, as compared with 56,890,000 in 1910, and the average receipts per passenger were 13·05 pfennigs and 13·23 pfennigs in the two years respectively. In addition, the short flat or level line, which is equipped with 10 motor-cars and seven trailers, transported 2,020,000 passengers, as against 1,530,000 in 1910. The rolling stock of the elevated railway consists of 139 motor-coaches and 112 trailers. The balance of £500,000 of the loan capital was issued in 1911, and this raises the total loans to £2,991,000, whilst the sum of £375,000 is still outstanding of the total ordinary share capital of £2,500,000.

**Prospectuses.**—*Consolidated Diesel Engine Manufacturers, Ltd.*—The prospectus of this company has been before the public. The list opened on Monday, and was to close on Wednesday, 427,076 ordinary shares of £1 each (the whole of which have been underwritten) being offered for subscription at par. The company has been formed to amalgamate the businesses of the undermentioned firms and building new works at Ipswich for the manufacture of Diesel engines. The amalgamation will be effected by the acquisition of share capital of the Diesel Engine Co., Ltd., and half the share capital of Messrs. Usines Carels Frères, S.A., and the businesses will be worked as mutually co-operating branches of a single undertaking. Dr. Diesel is a member of the board. A report by Prof. W. C. Unwin, on the outlook for the Diesel engine and its extending use for electric light and power stations, accompanied the prospectus.

Another prospectus before the public is that of the Burmeister and Wain (Diesel system) Oil Engine Co., Ltd., offering at par 500,000 six per cent. participating preference shares of £1 each. The oil engine installation on the *Selandia* was carried out by Messrs. Burmeister & Wain. The new company will erect large works in Great Britain for the manufacture of oil engines on (*inter alia*) the Burmeister-Wain system. The prospectus contains a good deal of information regarding the prospects for marine oil-engine work. Closing day, Thursday, April 4th.

**Liverpool District Lighting Co.**—At the annual meeting held on March 27th at Liverpool, Col. A. Hill Holme, the chairman, said that the company had come to the end of the years affected by the introduction of the metallic lamp which had given customers their normal amount of light at some 60 per cent. less expenditure of electrical energy. The decreased cost was now bringing more customers among the occupiers of small houses, who were finding that electric light need not cost more than gas if carefully used. The low cost of energy would enable them, he expected, to supply light to the new Seaforth House Home for the Aged Poor, and the Seaforth Barracks. They had already got the new board schools at Cambridge Road. Even the small houses now being built were wired for electric light. The use of electrical energy for cooking, laundry, dyeworks, and other purposes was also extending. There was every probability of a great new departure in the use of electricity. One gentleman of great business capacity and knowledge was anxious for the company to supply him with energy for all household purposes, so that he need not have a hundredweight of coal in his place. The profits of the past year were the largest the company had ever made. The company had nothing to do with politics, but instead of the old parties in the State, there were now a lot of people who openly declared their intention to rob and despoil all who had capital invested in such industrial concerns as their own. They wanted more capital, and could with great advantage spend £10,000 in laying mains that would increase their revenue, but they could not expect to obtain it as long as Socialism was the dominant spirit that ruled those who ruled the country.

**Continental.**—FRANCE.—The balance-sheet of La Société Hadraide d'Énergie Electrique, of Eayre, for the last financial year shows a net profit of £36,718, as compared with only £26,604 in the preceding 12 months.



### Vera Cruz Electric Light, Power and Traction Co., Ltd.

MR. VINCENT W. YORKE presided on Wednesday last week at the fifth annual general meeting of the above company, which was held at 47, Parliament Street, London, S.W.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 515), said he was sure they would agree with him that the results shown by the accounts were fully satisfactory. The gross earnings of both the lighting and tramway sections showed steady regular increases with corresponding increases in the net revenue. They had been somewhat disappointed at the amount of power and light which the Vera Cruz Terminal Co. had taken from them under their contract with them, but they were hopeful that in the near future they would be in a position to call for a larger supply. He would like to remind them that the report of the engineers, which was issued with the prospectus of the debentures, stated that the net earnings in Mexico might eventually reach £28,000 per annum. It was a great satisfaction to them that within a period of some 18 months after that report they had been able to show an income within a few pounds of that estimate, and they still had the future with the natural growth that it should bring to the business to look forward to. The earnings for the past two months of 1912 showed an increase of over \$10,000 Mex. on those of the corresponding period of 1911, and the prospects of the business generally appeared to be distinctly encouraging. The temporary steam plant, about which he told them last year, was completed and available for use, and they had made arrangements by which they hoped to be able to dispose of that plant at very little loss to the company as soon as they had at their disposal the supply of water-power from the Tuxpango Falls of the Puebla company. The contract which they were making with that company was not yet finally settled, but the negotiations were so far advanced that he thought they might conclude that no hitch in the arrangements was likely to occur, and that in about two years' time they would have at their disposal a large amount of power, and that without the expenditure of any capital on the part of the company. They had considered it wise to transfer from the accumulated profit balance a sum of £15,000 to depreciation and general reserve account before arriving at the amount which they recommended should be paid as dividend to the shareholders. That transfer was, he thought they would agree, a prudent step, but they must not think that the directors had considered it either necessary or advisable to deal with such an amount for depreciation alone. The depreciation on an undertaking like that, the property of which was kept in first-class condition and fully maintained, was not large, and that transfer had been made mainly with a view to establishing a reserve account before they began to pay dividends. He was glad to be able to tell them that the last reports received from Mexico indicated that political conditions generally were more normal. Private advices that he had received also indicated that the Provincial Government of the State of Vera Cruz had been particularly active and successful in stifling such outbreaks of disorder as had occurred in that State. They had had little or no trouble in Vera Cruz itself, and with the re-establishment of political peace the country ought to experience a great revival in trade in which they must, naturally, participate. He would like to express on behalf of the board their appreciation of the zeal and energy shown by Mr. Worswick, the general manager, and his staff in Mexico.

MR. NEWMAN, a shareholder, seconded the motion, and the report was adopted.

### County of Durham Electrical Power Distribution Co. Ltd.

THE annual meeting was held on March 27th at Newcastle-on-Tyne.

DR. J. T. MERZ, in moving the adoption of the annual report (see ELECTRICAL REVIEW, page 475), said the company's total connections increased during the year by 4,455 H.P., which was rather more than they had to report in the preceding year. Their connections were increasing much more rapidly than their capital expenditure. Their profit last year was £32,031, an increase over the previous year of £3,325. They had also adopted the plan of writing off from the revenue account amounts which were set aside for improvements at the stations. These came to £712, and to that extent, therefore, the accounts were better. The consumption for lighting had increased by 103,792 units, and the total now stood at 1,149,000. The increase was not quite so much as in the year before. He explained that a large proportion of the lighting in Durham area was included in the figures of the power consumers. The large works got their current at an overhead price, and therefore the lighting figures were not shown. The capital of the company was the same. They spent £12,597 during the year, of which £6,203 was spent in mains, £5,744 in sub-stations, and £646 in motors and other sundries. As they did not increase the capital of the company, shareholders would want to know where they got the money from. They got it, first, from the depreciation, from the amounts they had written off; secondly, by reducing their stocks by £1,130; thirdly, by a better collection of their debts, which had given them some £5,000. The improvements in the profits of the company had enabled them to declare the full preference dividend of 5 per cent. against the 3½ last year. The increase in the volume of business was promising up to March 1st, when the coal strike began. The increase was then 13½ per cent., but this increase had been practically swallowed up by the loss in business during the last month, for, as they knew, a large number of their customers were collieries, and a large part of their supply had been taken off. At the same time they were, he thought, satisfied with the connection with them because they still consumed a considerable amount of

power in order to keep the collieries in order. An important item was the connection that had been made between some new manufacturing companies and the Dunston station. One of these, a metallurgical works, was likely to consume a large quantity of energy. So far as the coal strike was concerned, their company was only indirectly interested because it got the whole of its supply from the Newcastle Electric Supply Company, and that company's works were well stocked with coal.

The report was adopted. A dividend of 5 per cent. on the preference shares was declared.

Mr. R. P. Sloan and Sir Lindsay Wood, Bart., were re-elected directors.

### Newcastle-on-Tyne and District Electric Lighting Co., Ltd.

THE annual meeting of this company was held in Newcastle on March 28th, Mr. A. Scholefield in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 471), said that the true position of the company, speaking generally, showed that the gross profit had increased both at Newcastle and at Lemington, and that the final balance-sheet exceeded that of any previous year. Some time ago they entered into contracts for coal for this year, and seeing what had happened since, and with prices ruling so high—which he was afraid would last for some time to come—he thought it was a matter for congratulation. Another favourable feature of the report was in regard to the arrangements made with the Newcastle Corporation for a period of 10 years to supply all electrical energy required for the Newburn tramway route. This was not yet completed, but he understood that it was expected that the trams would be working in six months' time. That would form a new and profitable undertaking for the company. They would remember the very serious losses that not only that company, but all electric lighting companies, had suffered from the use of the metal-filament lamp. He was pleased to say that they had now lived this down altogether, and were actually reaping a benefit from the cheapening of the system, for the low price of electricity was inducing more and more people to use it, and as time went on they would get more and more benefit. Another thing they would be glad to hear was that during the strike, when many feared that all power companies would have suffered, that company had not suffered at all. The demand so far during the strike period had actually increased both for power and lighting, and that showed the great provision the manufacturers on the Tyne had made for the strike. It was a matter of congratulation to the trading community that they should have anticipated the trouble in the coal world. They laid in stocks of coal and provided other material for manufacturers to carry on their trade. Other parts of England he knew had suffered losses, but, so far as that company was concerned, he was glad there had actually been an increase.

COL. W. M. ANGUS seconded, and the motion was carried.

The CHAIRMAN moved, and MR. BRACKENBURY seconded, the declaration of a dividend at the rate of 3 per cent. per annum, which was carried.

The retiring directors and auditors were re-elected.

On the proposition of the CHAIRMAN, £50 was given to Armstrong College, Newcastle, and £21 to the Royal Victoria Infirmary, Newcastle.

**Canadian General Electric Co., Ltd.**—The report for 1911, as printed in the *Financier*, states that the profits amounted to \$1,405,889, the largest in the history of the company, the recent additions to plant and equipment having permitted of manufacturing in greater volume without materially increasing overhead expense account. From this amount the directors have written off for depreciation \$353,721, and have paid in interest on borrowed capital \$162,422, leaving \$889,745. Deducting from this amount dividends on preference and common stock at the rate of 7 per cent. per annum, amounting to \$525,109, there remains a net balance of \$364,636, which has been carried to the credit of profit and loss. This sum, added to the balance to the credit of that account at the end of the previous year, makes a balance of \$675,779, which, together with the reserve fund of \$1,669,531, makes a total surplus of \$2,345,311. The volume of business transacted being much larger than in previous years, the current liabilities have necessarily increased, in order to take care of work in progress, but against these current liabilities the current assets amount to \$7,926,840. During the year the company acquired the property and assets of the Sunbeam Incandescent Lamp Co., of Toronto, and contracts have been let for additions to the buildings and equipment which will double the capacity of this plant. A new stores building at the Peterborough works, 325 ft. by 80 ft., is being erected at the present time, and plans have been accepted for the erection of a new plant in Toronto for the ornamental iron, bronze and art metal department, the growth of which has surpassed expectations. The directors have passed a by-law providing for increasing the authorised capital stock of the company to \$12,000,000, of which increase shares to the par value of \$1,900,000 will be offered to all holders of ordinary shares of record on April 20th, 1912. The growth of the business renders this policy advisable, and the only extra charge to the company will be the difference between the rate of dividend paid to the shareholders and the rate of interest paid to the bankers.

**Southport Tramways Co., Ltd.**—The directors' report states that the accounts for 1911 show a surplus of £549. £500 has been transferred to reserve, and £49 is to be carried forward.



### Potteries Electric Traction Co., Ltd.

MR. G. F. M. CORNWALLIS WEST presided on Friday at the Electrical Federation Offices, Kingsway, W.C., over the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 515), the CHAIRMAN said that although the dividend on the ordinary shares was not a large one, they might congratulate themselves on the year's working. It was a record year since the inception of the company, as their traffic receipts amounted to no less than £101,000, this being the first time they had touched six figures under this heading. The amount carried to the balance-sheet, which was, after all, the most important figure, was £35,500, as against £27,800 last year. They had carried nearly two million more passengers on approximately the same car-mileage, and when the small increase in working expenses was taken into account, he thought they would agree that the result was eminently satisfactory. He had hoped at the end of February to have been able to come before them and have prophesied an equal, if not still more prosperous, year, and even now he was not despondent, although like all other industrial and traction companies they had suffered from the coal strike. In fact, as they would have seen in the papers, the distress in the Potteries district, owing to this most disastrous strike, was very acute. At the commencement of the strike their receipts showed an increase of £790 over 1911, but this increase had been more than wiped away, and they were now actually down by about £750. This figure was, however, counterbalanced to the extent of about £500 by the natural decrease in their working expenses, so that assuming the coal strike was settled shortly, and the company continued carrying its normal amount of traffic and ran its normal mileage, they would be no worse off during the year under review. Their service had been an adequate one as circumstances required, and they had not reduced it owing to shortage of coal, which, in other words, meant that they foresaw what was coming. Now he was on the subject, he would like to say a word of gratitude for the loyal manner and uncomplaining way in which the staff had done their work. Owing to the reduction of the service, the employment they had been able to give had necessarily been reduced from 60 hours a week to about 35 hours per man—a hardship which, he need hardly say, they had been unwilling to inflict. The appreciation of the staff for so loyally working under these conditions, would be shared by the shareholders. Their parcels traffic had been of a satisfactory nature, and the profits showed an increase of £197. Advertising receipts remained as before, and the decreased return from their holding in the North Staffordshire Tramway Co. was counterbalanced by an increase in sundry receipts. The slight increase in general expenses and administration was highly satisfactory when compared with the large increase in the net receipts. Some years ago a policy was instituted by the board of ensuring that the permanent way should be kept up to a high standard of repair, and for this purpose a renewal fund was started, and last year they expended £10,413 under this head, as compared with £4,025 in the previous year. They had put no less than £12,000 to that fund this year. He was glad to say that they had had no complaint from the local authorities as to the condition of the permanent way, and the increased expenditure, a small proportion of which was chargeable to capital expenditure owing to the laying down of a heavier rail than was originally used, had more than justified itself. They had taken £2,000 from the reserve fund for the purpose of writing off motor 'buses, which had not proved a success, although they were the best they could purchase at the time. They did not consider, with the experience they had had, that they were suitable to the roads of the district. They paid back the £2,000 to the reserve fund that year so that the figure remained as before. The expenditure on capital account only amounted to £417.

MR. S. MEAR seconded the motion, and it was carried without discussion.

MR. CROFT, who subsequently seconded a vote of thanks to the board and the staff, complimented the board on having met a difficult situation this year, and expressed the appreciation of the shareholders at the conduct of the staff during the strike.

### British Aluminium Co., Ltd.

THE annual meeting was held on Thursday last week at Winchester House, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 515), said that the trading profit for the year, together with interest and dividend on investments and deposits, and the revenue derived from the Kinlochleven and Foyers estates, and transfer fees, was £152,902, as against £126,472 last year, an increase of £26,429. Those results were satisfactory considering the prices which had ruled during the period. The increase was due chiefly to the trading profit for the year, which had risen from £116,380 in 1910, to £140,378. The amount had been dealt with as follows: Provision for legal expenses, bad and doubtful debts, depreciation of furniture, and proportion of profits payable to directors, £13,407; prior lien debenture interest, £40,000; debenture stock service fund, £43,224; reserve for depreciation, £35,000; carried to reserve account, £17,269; leaving to be carried forward £4,002. The interest on the debenture stock for the year to December 31st, 1911, would be paid on April 1st. The amount of reserve for depreciation had been increased from £25,000 to £35,000. There had been added to reserve account the sum of £17,269, bringing that item to a total of £50,000. The

amount allocated to reserve last year had been invested in securities outside the company's business, and it was the intention of the directors similarly to invest the amount allocated out of profits for 1911. This fund would form the nucleus of a liquid reserve which would be of the greatest possible advantage to the company in the future, as it would enable them to take advantage of favourable opportunities in the industry, or to weather periods of depression. The output and sales for the year were larger than in any previous year. This showed an encouraging increase in the demand for the metal, and they had every reason to believe that this increase would steadily continue. During last year the price of the metal was low, and in the latter part of the year a falling tendency was shown—not from any decrease in the demand, but owing to the policy adopted by foreign producers. This necessarily had its effect not only upon sales for immediate delivery, but also to a considerable extent upon the prices which were obtained for contracts spread over a year. He was pleased to say, however, that, since that time, prices had materially improved, and there was a reasonable prospect of still further improvement before the close of the present year. Although there was no fixed relation between the demand for aluminium and copper, the recent steady increase in the price of the latter was bound to have some effect on the demand for and price of aluminium. The fluctuations to which the market for aluminium was subject were due in a considerable measure to the capacity of the various works being in excess of the present consumption; but if the demand continued to increase in the satisfactory manner it had done in the past three years, there was every reason to believe that the position would shortly be greatly improved, and this would, no doubt, have its effect on the price which producers could obtain for their product. The rolling mills of the company had been well supplied with orders during the whole of the year, and it had been necessary to increase the plant to cope with the business. There had been a large increase in the demand for the motor industry, and the demand in the electrical industry for transmission lines, underground cables, and for switchboard connections was only just beginning, and was likely to extend rapidly. The works had been operating satisfactorily during the year, and the whole of the reduction works have been practically fully employed. Further plant has been installed at Kinlochleven to increase efficiency of working, being chiefly in connection with the carbon works, where they manufactured their own carbon electrodes for the electrolytic furnaces. The extensions to the plant at the alumina works at Larne have been completed, and they are now able to supply all the alumina required to keep the whole of the reduction works at Kinlochleven, Foyers and Stangford, in full operation. The company had carried out the programme for the provision of further large stocks of bauxite of good quality, which he outlined at the last annual meeting. The board considered this to be a prudent course, and authorised their subsidiary company, the Union des Bauxites, to complete the purchase, as the bauxite which was offered was of exceptionally good quality, and ensured to this company a continuous supply of raw material for many years to come. With regard to the Orsières powerscheme, last year it was stated that arrangements had been made under which the company's rights were maintained and the existing works properly supervised to December 31st, 1912. Negotiations were in progress for an extension of the company's rights in respect of this scheme, and meantime, on the recommendation of the company's engineer in Switzerland, a certain amount of necessary development work would be proceeded with during the current year, which would also have the effect of reducing the charge in connection with the maintenance of the work which had already been executed. The balance-sheet clearly set forth the position at the end of the year. Property, buildings and engineering works had been increased by the sum of £32,429, being the cost of additions during the year. The investments had increased from £527,167 to £571,256, largely on account of the bauxite matter to which he had drawn attention. The reserve fund investments now appeared as a separate item at £32,061. The investments were spread over a good selection of bonds, and he was pleased to be able to state that a valuation made at December 31st, 1911, showed that the depreciation amounted to a negligible quantity. He was afraid this might not have been the case if they had invested in trustee securities. The stocks of metal, raw materials and stores were almost the same as for the previous year, being £90,348, as against £86,940. There was, however, a considerable increase in the amount of sundry debtors. These had risen from £58,854 to £96,605. This was largely due to the increase in the company's foreign trade, and, in accordance with the contracts which had been made, payment for the metal was not due until 30 days after arrival at the customers' works. As this business was likely to continue, they might regard the figure shown at December 31st, 1911, as a normal amount, taking into consideration the volume of trade which the company was doing. Of the debenture stock an amount of £8,602 had been redeemed, and the service fund of £7,552 fell to be applied in respect of the year. The purchases in respect of this had already been made, and on or before April 30th a further £8,878 of debenture stock would be cancelled, bringing the total up to £17,480. The depreciation reserve account now stood at the figure of £60,000. The balance to the credit of profit and loss account, amounting to £4,002, had been carried forward, and, while the directors regretted they were not yet able to make payment of the preference dividend, they hoped the day was not far off when this could be done; but in view of the low prices which had been ruling for some time, it was felt to be the only prudent course to strengthen still further the position of the company. With regard to the coal strike, in view of the unrest exhibited for some time previous to the strike, they took the precaution to lay in stocks of coal at the various factories, and although this had only been done at considerable expense, it had enabled the whole of the works to



be kept in full operation until now, and it was hoped that they might be able to do so until the strike was over.

CAPT. S. H. POLLEN seconded the motion.

Replying to a SHAREHOLDER, the CHAIRMAN said he was fully in sympathy with what had been said as to the non-payment of the preference dividend, but it was clearly pointed out at the time the reconstruction scheme was put forward that it would seriously hamper the company if the cumulative rights of preference shareholders had been maintained. The board were very anxious to pay a dividend on the preference shares at the earliest possible moment, but in placing large sums to reserve, they were protecting the future interests of both classes of shareholders.

The report was adopted.

### Puebla Tramway Light and Power Co.

CONCURRENTLY with the ordinary general meeting in Toronto a meeting of the above company was held at Winchester House, E.C., on March 28th. under the chairmanship of Sir Clarendon G. Hyde (president).

The CHAIRMAN, having explained that the company was a Canadian limited liability company constituted under the laws of the Dominion of Canada, carrying on its business in Mexico, but having by far the greatest part of its securities held in Europe, said his colleagues saw no reason why they should not annually meet the shareholders at an informal meeting, and give them that information by word of mouth to which they were entitled. Although in the name of the company the word "Tramway" figured prominently, they were all aware that the tramways were not at present the most important asset of the company. The company's main business was the generation and sale of electricity for lighting and power in the city of Puebla and the surrounding districts. Puebla claimed to be the second city of importance in Mexico; it had a population of over 100,000, and carried on many large manufacturing businesses, especially in connection with the cotton industry. The company had the contract for the city public lighting, and its successful method of illumination was constantly causing additional municipal demands for the extension of its services to other parts of the city. The company, since it started business in about 1906, had been supplying a yearly increasing quantity of electrical energy for light and power. The company's supplies of electrical energy up to the present had come from the Portezuelo Water Falls, some 14 miles distant from the city, and capable of generating 6,500 H.P. Recently, by the purchase of a local competing company called the San Agustin Co., another waterfall on the Rio Los Molinos, some 18 miles away, and capable of generating 1,000 H.P., had been added, making a total of 7,500 H.P. at the switchboard over the 24 hours, whilst with the reservoir at Portezuelo that company had a peak load capacity of over 11,000 H.P. Practically the whole of this H.P. had been sold, and the maximum development of the company had been almost attained, except by the addition of further H.P. from new sources. Under the company's concession with the city of Puebla it had, by August, 1913, to provide a minimum continuous supply of 16,500 H.P., available for sale within the city limits. It was, of course, out of the question in such a district as Puebla to consider the production of electricity by steam or oil when cheap water-power could be obtained. The company some years ago, before the present board assumed control, purchased concessions granted by the Federal Government for the utilisation of the waters of the Rio Blanco at Tuxpango, in the district of Orizaba, and of the Rio Atoyac, in the district of Cordoba. They were advised that the falls when fully developed would give a continuous power of 45,000 H.P. at the turbines, and would have a peak load capacity of some 70,000 H.P. Of course, at the present time they did not require anything like this quantity of power, but at the same time with the rapid growth of industries in Mexico, and especially in the Puebla district, it was not unreasonable to expect that in a few years' time the whole of this power could be commercially employed. For the present it was sufficient for them to add some 17,000 H.P. to the supply they had, basing the scheme of construction upon lines which would enable the subsequent harnessing of further H.P. by means of the addition of more units to a comprehensive and progressive scheme. The cost of the construction work with its transmission lines complete entailed an expenditure of approximately £300,000. They had also to provide about £150,000 for the purchase of the rival business of the San Agustin Co., whose installation had been handed over to them two years ago on their giving an undertaking to pay by June, 1913. They had also to provide for the repayment of certain moneys borrowed by the company to enable it to complete its underground extension work, and had therefore to finance a sum of over £500,000. To provide funds for these payments it was necessary for them to make immediate financial arrangements. Of the first mortgage 5 per cent. bonds there remained to be issued about 1½ million dollars, say about £350,000 nominal, but the considerable discount at which these unquoted bonds were being dealt with entirely precluded them, as prudent financiers, from considering the sale of the remaining portion of the issue at anything like the price then current. There remained, therefore, only the expedient of issuing prior lien bonds, and in the report of 1910 they notified the shareholders of their intention to proceed by this method. Accordingly, under the powers contained in the trust deed of the first mortgage bonds, they procured the consent, in writing, of the holders of two-thirds of the bonds outstanding, to the creation of 6 million dollars 50-year prior lien 5 per cent. gold bonds, ranking in all respects prior to the first mortgage bonds. Of these bonds they sold \$3,000,000 gold firm in December last, and, as a result, they had paid the price for the San Agustin Co., which purchase

money was carrying a rate of interest which increased from year to year, and only now became economical to redeem, and they had funds in hand sufficient to enable them to complete the development of the Tuxpango Falls as far as they at present contemplated that work. The managing director and engineer, Mr. Worswick, was now engaged on the work of construction at Tuxpango. The tunnel was being driven from both ends; the necessary machinery was under order: the towers to carry the transmission lines were on the ground and were being erected, and so far as they could at present say, the work ought to be completed in about two years' time. Meanwhile, it was necessary for them to make sure that they could comply with their concession by bringing the requisite horse-power to make up 16,500 H.P. within the city limits by August next year. For this purpose, to ensure them having the necessary power available in any event, they had entered into a temporary arrangement with an industrial company owning falls at Orizaba, and having power in excess of its needs. Of the 17,000 H.P. which they were developing at Tuxpango, a considerable quantity would not at first be required at Puebla. They were therefore arranging to carry transmission lines not only from Tuxpango to Puebla (a distance of 78 miles), but in the opposite direction from Tuxpango to the Port of Vera Cruz (a distance of some 68 miles). At Vera Cruz there was an English company, the Vera Cruz Electric Light, Power and Traction, Ltd., with which they were intimately connected, and of which Mr. Worswick was also managing director. This company was carrying on at present a successful business, generating electricity by means of a Diesel oil engine plant with a temporary and auxiliary steam plant. The demands on the company were rapidly exceeding its available supply of energy, and it must in the near future add to its reserve. They were arranging a contract with the Vera Cruz Co., which would be at once economical and profitable to that company, and remunerative to themselves, by which they would be able to supply energy in bulk to the Vera Cruz Co. The tramways owned by the company, which were some 44 miles in length, were at present being worked by mule traction, and there was no obligation on the part of the company to electrify them, and the city tramways were on a different footing. They carried last year some 1,670,000 passengers. It was, therefore, probable that in the near future, as a result of negotiations with the municipality which had been pending for some time, terms might be arranged for converting an efficient, but somewhat out-of-date, system into the more modern outfit of electric traction. They had this year made a net profit in Mexico of £67,039, as against £61,607 for 1910, and £48,607 for 1909, and £27,354 for 1908. The net receipts for January and February this year showed gratifying increases on the same months of the preceding year. The only thing, in the opinion of the directors, which was required to ensure the continued success of the company was the return to normal political conditions in Mexico. Having referred to the exaggerated reports of the troubles in Mexico, which came from New York, the chairman said there seemed to the directors, who were in constant touch with Mexican affairs, good reason to believe that as soon as these political differences had settled themselves, and the nation turned once again to quiet development of its untold resources, there should follow a great revival in trade, coupled with a spread and growth of industries, which, especially in the district of Puebla, could only result in a greatly increased demand for light and power, with a consequent increase in the prosperity of this company. They carried forward a balance of £6,000. The directors did not hold out any prospect of a dividend until such time as the Tuxpango horse-power was connected and commercially dealt with; but there was no doubt that the yearly improvement in the company's position and earnings must mean, in the course of a few years, the creation of a great business and goodwill, which could only result in producing a good return to the shareholders of the company.

A formal motion by the chairman to receive the accounts was seconded by SIR G. S. ROBERTSON and carried.

**Stock Exchange Notices.**—Applications have been made to the Committee (1) to appoint a special settling day in and to grant a quotation to—

Constantinople Telephone Co.—50,000 shares of £T5.50 each.

(2) To appoint a special settling day in—

Bell's United Asbestos Co., Ltd.—60,000 6 per cent. cumulative preference shares of £1 each, fully and partly (7s.) paid (Nos. 140,001 to 200,000).

Canadian Western Natural Gas Light, Heat and Power Co., Ltd.—Fully-paid scrip for £811,643 5 per cent. first mortgage debenture stock.

And (3) to allow the following to be quoted in the Official List:—

Mexican Northern Power Co., Ltd.—\$4,500,000 five per cent. first mortgage 30-year gold bonds, in lieu of the scrip.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Further issue of 160,000 shares of £1 each, fully paid.

**Oriental Telephone and Electric Co., Ltd.**—The directors announce a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year to December 31st, less income-tax, and a final dividend of 5 per cent. on the ordinary shares issued, free of income-tax, making 8 per cent. for the year.

**Anglo-Argentine Tramways Co., Ltd.**—A final dividend of 3½ per cent. on the £2,500,000 ordinary share capital for the half-year ended December, 1911, less income-tax, is recommended, making 7½ per cent. for the year, after placing £120,000 to the depreciation renewal funds, &c. £10,946 is carried forward.

**South Metropolitan Electric Light and Power Co., Ltd.**—Warrants for interest on the 4½ per cent. first mortgage debenture stock, for the half-year, were posted last week.



### The Diesel Engine Co., Ltd.

THE directors issued to the shareholders a circular letter dated March 27th, in the following terms:—

"It will have come to your knowledge that your directors have recently been engaged in negotiations for amalgamating the business of your company with that of the Usines Carels Frères (Société Anonyme) of Ghent, the world-renowned Belgian manufacturers of Diesel engines. These negotiations have resulted in an arrangement which your directors regard as eminently satisfactory, and which they have no hesitation in recommending unreservedly for the acceptance of the shareholders. The expanding demand for internal combustion engines is well known, and a moment has been reached at which the demand for such engines (and, indeed, for all engines requiring no coal) may be expected to expand at an accelerated rate. It is imperatively necessary that you should be in a position to meet and profit by this demand, which will otherwise go to building up the business of other manufacturers, while your own splendid opportunity will have been lost. To put the matter in a nutshell, your present undertaking is not big enough for the work that promises, and either it must be made big enough to secure work with the resulting profit, or else you must run the risk of seeing the business pass into other hands. The scheme which has been arranged by your directors to cope with this situation is, shortly, as follows:—

(a) A company with a capital of £750,000, divided into shares each of £1, will immediately be registered under the name "Consolidated Diesel Engine Manufacturers, Ltd." to control and extend the manufacture and sale of Diesel engines.

(b) 427,076 shares of the new company will be offered for public subscription at par. These shares have been underwritten.

(c) The new company will acquire half the share capital of the Belgian company (Usines Carels Frères S.A.), and one additional share therein, thus vesting the management and control of that company in the new company. The new company will, in return, pay to the shareholders of the Belgian company a sum of £150,000 in cash, and £100,000 in fully paid shares of the new company. The arrangement with the Belgian shareholders includes the supervision of the new company's works, and the training of its staff under experts from the Belgian factory.

The Belgian company owns an old-established business which has made very large profits, and it is the sound position of that company which enables the new company to secure on reasonable terms the large cash subscription which it requires.

(d) The new company will issue to each shareholder of the present Diesel Engine Co., Ltd., who assents to the scheme, one fully-paid £1 share of the new company in exchange for every two preference shares (each of 10s.) of the present company, and one fully-paid £1 share of the new company in exchange for every six ordinary shares (each of 5s.) of the present company, and will pay in cash 10s. for each odd preference share and 3s. 4d. for each odd ordinary share over and above exact multiples of 2 and 6 respectively. Thus, if you assent to the scheme, you will receive fully-paid shares of £1 each in the new company, and cash in exchange for your present holding of shares in the existing Diesel Engine Co., Ltd. By means of these exchanges the new company will in effect become the owner, or substantially the owner, of the business of the existing Diesel Engine Co., Ltd.

(e) The balance of the cash subscriptions of the new company amounting (after paying all necessary preliminary expenses) to roughly £240,000, will be used in establishing a large new factory in a very convenient situation at Ipswich, and in generally extending the business of the amalgamated concern.

(f) Shareholders of the existing Diesel Engine Co. supporting this scheme will, if they desire to subscribe for additional shares of the new company, be given the preference in the allotment of shares therein.

"In the opinion of your directors, the scheme contains the promise of a highly successful undertaking. . . . A prospectus of the new company offering the above-mentioned 427,076 shares for subscription will be sent to you in the course of a few days. Your directors had intended summoning a meeting of the shareholders to explain the position, but events have moved too rapidly and time is now too valuable to permit of the delay that would be occasioned by so doing."

As announced on another page the prospectus of the Consolidated Co. has now been circulated.

### Newcastle-on-Tyne Electric Supply Co., Ltd.

THE annual meeting was held in Newcastle on March 27th, Dr. J. Theo. Merz, presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 471) said the connections to the system showed an increase of 11,851 H.P., as compared with an increase of 10,557 H.P. in the previous year. The total expended on capital account was £2,119,114. The cost per H.P. for the year had been reduced. It was only £6 10s. per H.P. connected; in the previous year the connections cost £10 10s. per H.P. The net profit showed an increase of £7,059. The increase was really considerably more, because last year they benefited by interest received on moneys which they had got, and which they had not spent during the year. They made in that way £9,103, whereas in the previous year they got only £2,876. In addition to that, they had charged to revenue account an item which in former years was calculated in the amount provided for depreciation and reserve. These two items brought the increase of profit to something like £12,000, compared with £5,626 the year before. Thus the accounts, when dissected, showed better than on the face of the report. As he mentioned a year ago, the expenditure upon horse power connected was going down, and, in consequence, the profit on the horse power connected was going up. Some time ago, he told them that they expected to make about £1 profit per horse power connected, but that sum went down considerably owing to various causes. Last year the profit per horse power connected was 21s. 6d., whereas the year before it was only 14s. 6d., and in the year before that 16s., so that they saw that, while the capital expenditure on horse power decreased, profit increased. The lighting business was a scarcely less important portion of the company's trade, and that had considerably increased last year. They had sold 3,732,268 units, as against 3,469,596 units the year before, an increase of 262,673 units.

The company had saved in coal 6·8 per cent.; in the previous year the saving was 3·6 per cent., so that in the two years they had reduced the consumption of coal per unit produced by something over 10 per cent. In the year they had had to spend £2,495 more in rates, the rates on the Dunston station having come in for the first time, and there was an increase in the rates in Tyne-mouth Union in which area the Carville power station was situated. Referring to the Newcastle-on-Tyne Corporation Parliamentary Bill, he said that the shareholders would see that £8,054 had been put to the reserve. The Corporation for some time supplied their own current for the tramways in Walker district, but an agreement was made between the company and the Corporation, under which the latter paid the company a certain sum. The agreement ran out last year; then the Corporation took up the position that the company's power ceased, while the company took up the attitude that they had the right to supply, and that there must either be a new agreement, or the company must be indemnified. The Corporation were anxious to supply their own tram service, and the point was included in their Corporation Bill, with the result that an agreement was come to that the Corporation should pay the company £12,250, which included a sum for the unexpired period during which the company had the right to supply the power for the trams. The chairman also referred to the fact that at Dunston two customers had put down works, one on the company's ground and the other on ground contiguous. One was a steam foundry and the other a metallurgical process that was expected to develop. These firms were really the customers of the Durham Electric Supply Co., but the Newcastle company benefited, as they had an agreement to supply the Durham company with all the current they required. The company were able to pay  $\frac{1}{2}$  per cent. more dividend than they did last year, which represented £3,500. The profits had increased by more than that amount, but the directors thought it safe and right to increase the dividend by only a slight amount, in the hope that they might increase it to similar extent another year. In regard to the coal strike effects upon the company, so far as they, as shareholders, were concerned, it was impossible so far to give them any exact figures or data, but the output in the previous week was as large as it was in the corresponding week of 1911, despite the stoppage at the pits, which were large consumers. Business had increased in other ways, and up to the present they had supplied their customers as usual, and the company intended doing so. He might mention that the amount of coal in stock was three-fifths of what the company had when the strike began. He would like to say that the favourable position the company was in, so far as supply was concerned, was very largely due to the foresight, diligence, and a great anxiety to do what was best, which had been shown by their manager, Mr. Sloan, and by the whole of his very able staff, including the advisory engineers. He took that opportunity, on behalf of himself and his colleagues, of thanking the staff for what they had done.

MR. HOBART ARMSTRONG seconded the report, and it was adopted.

The dividend resolution was also carried.

MR. F. W. DENDY was eligible for re-election as a director, but he intimated, through the chairman, his intention of resigning his seat on the board, owing to pressure of business. The two other retiring directors were reappointed.

**Windsor Electrical Installation Co., Ltd.** — The annual meeting was held on March 20th, Sir W. Shipley presiding. The chairman said that the accounts showed a gratifying improvement over those of the past year or two, and the dividend was increased by a half per cent. He hoped that at future meetings they would be able to recommend further increases—subject to no further upheaval caused by labour troubles. While the revenue had increased by £150, the costs had been reduced by £690, due to the lower costs of the bulk supply and the great saving effected in their fuel bill by the Diesel oil engine. This engine had given such satisfaction that they had decided to order a second, which would be running in April. The Slough and Datchet Electric Supply Co. had installed similar plant at their works, which would result in lower cost of the bulk supply. The allocation to depreciation, renewals and reserve was £250 more than last year, and this year they would further increase the fund by transferring to it the balance of the dividend equalisation fund. An amendment that the dividend be 5 per cent. instead of 4½ per cent. was discussed at length, but was ultimately withdrawn and the report was adopted.

### STOCKS AND SHARES.

Saturday Afternoon.

THE incidence of the Easter holidays has made very little difference to Stock Exchange business. Once more the feature of the markets is the manner in which specialities have been singled out for particular attention, and, put colloquially, run to death. Such things as Bus stock, Marconi shares, Underground Electric issues, and City Lights have been centres of eager and excited dealings; while, on the other hand, the broad volume of ordinary bread-and-butter trade is not on a very large scale.

It may be pointed out here that the quotations on the following pages are those of Friday night, March 29th, the Easter recess necessitating an alteration from the day upon which the prices are generally collected.



Prospects of peace in the coal world continue to have a very steadying effect upon Home Railway prices as a whole, but the grand features of the week have been the soaring of such securities as are connected with the underground transport of Londoners. The Central London trio has, however, ceased rising for the time being, though the big previous improvements are all maintained. City and South London gained  $\frac{1}{2}$ , but the principal excitement is over Metropolitans and Districts, both of these shooting up at a rapid rate. The rise in Metropolitans was 3 points in the same number of days. Districts did still better, putting on  $4\frac{1}{2}$  to their quotation. Underground Electric issues are very strong also, the shares rising to  $4\frac{1}{8}$  this, Saturday, morning. The Underground bonds remained at 89, and at that figure attracted a lot of buying. London General Omnibus stock has had a further sensational rise, and already this year has added something like 90 points to its quotation within three months. Fired by the rises in the Underground group, buyers pressed in for Great Northern and City Preferred Ordinary shares; and, finding their efforts to get hold of stock were unavailing, they ran the price up to  $2\frac{1}{2}$ , at which it shows a nominal gain of 15s. There were, however, practically no shares about. So far as we can see, the Great Northern and City Tube lies outside the scope of the Speyer group, its principal hope of salvation lying in the prospect of its being taken over by the Great Northern line. However, the mere fact of its being underground, proved enough to send buyers flying into the market, with the result already detailed. East Londons have been rising also. The Ordinary jumped up 2 points, rising to  $9\frac{1}{2}$ , while the three debenture issues have gone up several points as well.

Metropolitan Electric Tramways Ordinary have benefited to the extent of  $\frac{1}{8}$  by the issue of a report the other day showing the company to be making excellent progress. British Electric Traction issues are still very dull, and the London United Tramways descriptions have not moved.

The Electric Supply market is very steady on the whole, though there has been some natural profit-taking in the cases of City "Lights" and County ordinary. Considerable discussion is going on still as to the prospects of the Corporation taking over the City Company, either now or in 1914. On balance the price shows no quotable change, but the Preferences are slightly easier. County of Londons fell  $\frac{3}{4}$ , in consequence principally of the steady flow of new shares that was returned to the market by proprietors who preferred to sell their right to subscribe to the new issue. Upon this, the new dwindled to 5s. premium. It is said in the market that, as usual, some of the shareholders failed to exercise the privilege extended to them, so probably there will be a few left over for disposal at the discretion of the directors. Charing Cross have risen  $\frac{1}{4}$ , perhaps by reason of the hint given here last week; while St. James's are  $\frac{1}{2}$  up, and London Electric have put on  $\frac{1}{4}$ . On the other hand, Westminster shed 5s. of their recent rise. Metropolitans went back  $\frac{1}{2}$ , and there are a few other minor declines which are not worth mentioning.

The feature in the Telegraph market once more is the extraordinary rise in Marconi shares, which has taken the price to more than double what it stood at in January. The buying is extremely persistent, nor is there much in the nature of a setback allowed to take place. The shares have come to be a very popular gamble, and possibly they are getting rather a dangerous one. In the train of the rise in the parent company, Canadian Marconis, after dropping back to 33s., went ahead to 38s. The special settlement is now taking place in the shares of the Spanish and General Wireless Trust Company, introduced not long ago to the market at the price of about 33s. 9d. The making-up price on Friday for the special settlement was  $2\frac{1}{2}$ , after which it steadily mounted to  $2\frac{1}{8}$ , and is talked by its supporters substantially higher. Marconi new and Preference have, of course, followed the rise in the old shares. Another feature is the recovery in West India and Panama Telegraphs. Touching  $4\frac{1}{2}$  on Tuesday, there was a sharp recovery to  $4\frac{3}{4}$ . In the Eastern group there is not much going on, and prices are on the dull side.

National Telephone Deferred, upon fresh optimism with regard to the price at which the Government is going to pay out the company, rose  $4\frac{1}{2}$  points, the buying coming from various parts of the country. Other Telephone issues are merely quiet.

The Latin-Canadian group is steady to good. Rio Trams rose  $\frac{1}{4}$ , and this is said to be a preliminary to a big rise which is coming in them—this, by the way, being merely a market tip, to which no more importance is to be attached than to other advice of the same sort. British Columbia Electric stocks are good, the Deferred rising 3. Rangoon Electric Preference have come into favour on account of the good yield which they still return. Mexicans are steady, and show little change. Shawinigan Water rose  $4\frac{1}{2}$  points, and Kaministiquia Power bonds put on 2.

In the Manufacturing group a drop of  $2\frac{1}{2}$  lowered Willans and Robinson Debenture to 60, while General Electric Debenture fell 2 to  $87\frac{1}{2}$ . Callender's lost half their rise of last week. Whispers went round to the effect that British Westinghouse stocks and shares were to go better; they had the effect of inducing a little buying, with the result that Preference shares are up to 5s., and the 4 per cent. Debenture gained a point.

#### Jarrow and District Electric Traction Co., Ltd.—

The directors report that the accounts for 1911 show an available sum, after providing for debenture interest, and placing £700 to permanent way renewals account, of £2,657. The directors have declared a dividend of 2 per cent., and added £275 to depreciation and reserve account, carrying forward £633.

### ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
†Aberdeen .. ..	Mar. 20	1,187	+ 1	42	62,095	+ 3,460	14.4 ..
†Ayr .. ..	" 23	193	+ 12	45	13,295	+ 168	8 ..
†Bath .. ..	" 20	679	+ 17	12	8,086	+ 324	14.75 ..
†Birkenhead .. ..	" 24	996	+ 28	51	5,183	+ 2,256	13.68 ..
Birmingham Corp.	" 23	20,611	+ 6,834	51	464,636	+ 108,149	56.4 ..
†Blackburn .. ..	" 20	993	+ 87	51 $\frac{1}{2}$	58,363	+ 4,621	14.68 ..
Blackpool Corp.	" 28	796	— 5	51	64,009	+ 7,765	11.87 ..
†Blackpool-Fleetw'd	" 25	263	+ 19	11	3,118	+ 265	8 ..
Bournemouth .. ..	" 27	8,197	+ 317	52	90,691	+ 1,495	21.95 ..
Bradford .. ..	" 23	10,605	+ 1,079	51	276,944	+ 16,500	56 1.2 ..
†Brighton .. ..	" 24	785	+ 14	51 $\frac{1}{2}$	51,323	+ 2,755	9.5 ..
†Bristol .. ..	" 22	5,716	+ 418	..	71,858	+ 6,481	30.5 ..
Brit. Elec. Trac. Co.							
Airdrie .. ..	" 22	606	+ 187	12	8,270	+ 780	8.65 ..
Barnsley .. ..	" 22	232	— 120	"	1,992	— 4	.. ..
Barrow .. ..	" 22	647	+ 183	"	3,621	+ 932	5.87 ..
Devonport .. ..	" 22	1,000	+ 155	"	5,767	+ 8 2	8.85 ..
Gateshead .. ..	" 22	1,974	+ 11	"	11,716	+ 146	11.25 ..
Gravesend .. ..	" 22	396	+ 96	"	2,286	+ 227	6.5 ..
Greenock .. ..	" 22	1,586	+ 366	"	8,293	+ 1,297	7.25 ..
Hartlepool .. ..	" 22	453	+ 23	"	2,709	+ 243	6.72 ..
Kidderminster .. ..	" 22	187	+ 14	"	1,051	+ 89	.. ..
†Leamington .. ..	" 22	287	+ 31	"	1,111	+ 108	.. ..
Merthyr .. ..	" 22	816	— 46	"	2,172	+ 32	2.9 ..
Metropolitan .. ..	" 22	16,624	+ 1,185	"	96,114	+ 7,461	22 ..
Middleton .. ..	" 22	601	+ 31	"	3,256	— 11	8.5 ..
Mid. Joint Com'tee	" 22	6,168	+ 410	"	34,519	+ 1,242	.. ..
Oldham—Ashton ..	" 22	1,154	+ 1.8	"	6,402	+ 380	9.18 ..
Peterborough .. ..	" 22	222	+ 13	"	1,326	+ 163	5.81 ..
Potteries .. ..	" 22	3,716	— 1,031	"	21,533	— 383	29 ..
Rotherham .. ..	" 22	104	+ 13	"	589	+ 78	2.75 ..
Southport .. ..	" 22	504	+ 52	"	2,722	+ 75	8.17 ..
S. Metropolitan ..	" 22	1,542	+ 197	"	8,250	+ 334	.. ..
Swansea .. ..	" 22	2,115	+ 74	"	12,751	+ 626	12.5 ..
Tynemouth .. ..	" 22	333	+ 54	"	1,666	— 38	3.75 ..
Weston-s-Mare .. ..	" 22	44	+ 1	"	297	+ 85	8 ..
†Worcester .. ..	" 22	472	+ 11	"	2,758	+ 73	5.75 ..
Wrexham .. ..	" 22	200	+ 22	"	1,096	+ 81	.. ..
Yorks. Wool. Dist.	" 22	2,013	+ 114	"	11,945	+ 464	17 ..
Miscellaneous .. ..	" 22	437	+ 68	"	2,374	+ 151	.. ..
†Burnley .. ..	" 23	1,932	+ 152	..	..	..	11.78 ..
†Burton-on-Trent ..	" 24	257	+ 17	51	14,562	+ 781	6.6 ..
†Bury .. ..	" 24	1,212	+ 144	51 $\frac{1}{2}$	64,818	+ 5,008	22.5 ..
†Cardiff .. ..	" 23	1,952	— 151	51	123,515	+ 8,889	17.95 ..
Chatham and Dist.	" 21	1,531	+ 80	12	8,840	+ 48	14.95 ..
†Cork .. ..	" 21	487	+ 37	12	5,014	+ 47	9.89 ..
Croydon .. ..	" 15	3,347	+ 280	..	88,583	+ 5,818	11.6 ..
Darlington .. ..	" 16	420	+ 25	51	11,225	+ 1,027	4.87 ..
†Darwen .. ..	" 22	229	+ 10	51	13,476	+ 833	4.36 ..
Dover .. ..	" 23	979	+ 42	51	12,570	+ 1,634	4.75 ..
†Dublin .. ..	" 22	5,561	+ 941	..	61,845	+ 3,888	54.25 ..
†East Ham .. ..	" 23	1,041	+ 39	51	56,327	+ 3,761	7.87 ..
†Exeter .. ..	" 22	263	— 1	51	16,945	+ 1,052	5.5 ..
†Glasgow .. ..	" 23	18,914	+ 1,809	..	759,036	+ 43,452	98 25 ..
†Hastings .. ..	" 21	715	— 70	..	..	+ 201	19.3 ..
†Huddersfield .. ..	" 23	1,811	+ 99	51	97,438	+ 8,127	29.6 1 ..
†Hull .. ..	" 23	2,841	+ 98	51	150,188	+ 8,633	14.5 ..
Ilkeston .. ..	" 14	204	— 33	50	6,486	+ 114	3.8 ..
†Ipswich .. ..	" 23	315	+ 16	51	21,970	+ 1,138	10.5 ..
Kilmarnock .. ..	" 23	264	— 2	45	7,249	+ 467	4.25 ..
Lancashire United	" 27	2,183	— 198	..	14,864	— 54	89 ..
†Leeds .. ..	" 23	7,156	+ 868	51	383,936	+ 24,506	57.5 ..
†Leicester .. ..	" 23	2,413	+ 170	..	..	..	20 ..
Leith .. ..	" 23	1,346	+ 315	44 $\frac{1}{2}$	28,903	+ 2,449	8.72 ..
Liverpool .. ..	" 23	22,884	— 1,480	11 $\frac{1}{2}$	136,848	+ 7,541	116 ..
†L.C.O. .. ..	" 20	85,650	+ 3,113	..	2,224,215	+ 107,150	189.5 3 ..
†London United ..	" 23	5,452	+ 68	..	63,569	+ 1,056	.. ..
†Lowestoft .. ..	" 23	120	— 10	25	3,943	+ 15	8.5 ..
†Manchester .. ..	" 23	16,147	+ 933	51	829,992	+ 45,721	105 ..
†Newcastle .. ..	" 23	4,062	+ 271	..	218,850	+ 15,839	31.3 ..
Newport .. ..	" 23	1,115	— 103	51	35,696	+ 1,041	7.25 ..
†Oldham .. ..	" 24	1,945	+ 136	52	100,864	+ 5,221	28 ..
†Pontypridd .. ..	" 23	262	— 124	51	20,872	— 214	5.50 ..
†Portsmouth .. ..	" 23	1,601	— 11	51	108,890	+ 7,372	15.25 ..
†Preston .. ..	" 20	739	+ 84	51	39,553	+ 2,806	10 ..
†Rotherham .. ..	" 21	598	— 52	50 $\frac{1}{2}$	34,911	+ 2,416	12 ..
†Salford .. ..	" 25	4,633	+ 220	51 $\frac{1}{2}$	249,170	+ 10,498	41 ..
†Sheffield .. ..	" 26	6,024	— 99	..	336,871	+ 20,134	40 ..
Southampton .. ..	" 20	2,165	+ 239	51	62,172	+ 7,219	11 ..
Southend-on-Sea ..	" 27	1,030	+ 257	52	34,098	+ 5,464	7 ..
†South Shields ..	" 23	508	+ 2	51	31,584	+ 3,166	10.25 ..
†Swindon .. ..	" ..	..	..	..	..	..	.. ..
†Tyneside .. ..	" 20	453	+ 73	12	4,816	+ 253	11 ..
Wallsley .. ..	" 16	2,243	+ 377	50 $\frac{1}{2}$	54,747	+ 6,719	8.72 ..
†Walthamstow .. ..	" 23	647	+ 25	51	37,495	+ 2,361	9 ..
West Ham .. ..	" 21	519	+ 272	51	137,993	+ 11,761	15.25 ..
Wolverhampton ..	" 27	1,860	+ 109	52	50,998	+ 2,385	13.75 ..
†Gen. London Rly.	" 23	4,905	— 400	12	60,533	— 4,150	6.82 ..
†City & S. Lon. Rly.	" 24	3,248	— 180	12	30,497	— 1,142	7.26 ..
†Dublin-Lucan Rly.	" 22	188	+ 59	12	1,296	+ 40	7 ..
†G.N. and City Rly.	" 28	1,616	+ 74	12	20,434	+ 1,279	3.5 ..
†L'pool Overh'd Rly.	" 24	1,424	+ 60	12	17,634	+ 1,215	6.6 ..
†Llandudno-Col. Bay	" 22	155	+ 28	16 $\frac{1}{2}$	2,212	+ 212	6.5 ..
†Lond. Elec. Ry. Co.	" 23	14,245	+ 250	12	177,640	+ 7,365	21.25 ..
†Mersey Railway ..	" 23	1,906	— 119	12	24,616	+ 245	4.5 ..
†Metropolitan Rly.	" 24	14,562	— 1,671	12	200,894	— 1,897	25.75 ..
†Met. District Rly.	" 23	12,275	+ 290	12	151,336	+ 7,429	25 ..
Anglo-Argentine ..	" 25	102,557	+ 1,571	..	616,435	+ 22,145	.. ..
†Auckland .. ..	Mar. 17	413	+ 1,409	..	154,172	+ 12,457	23.8 ..
Bombay (B.E.T.) ..	Mar. 16	6,373	+ 452	7	20,563	+ 1,778	.. ..
†Brisbane .. ..	Feb.	6,700	— 1,975	8	23,734	— 18,101	.. ..
Brit. Columbia Rly.	" ..	..	..	..	..	..	.. ..
†Calcutta .. ..	Mar. 25	8,905	+ 405	..	..	..	.. ..
Cape Electric T.Ld.	" ..	..	..	..	..	..	.. ..
†Kalgoorlie, W.A. ..	Feb.	2,684	..	8	5,568	..	20.5 ..
†Lisbon .. ..	" ..	..	..	..	..	..	.. ..
†Madras .. ..	Mar. 16	1,584	— 141	10	7,783	+ 190	.. ..
†Montevideo .. ..	Feb.	85 (21	+ 5 22)	4	125,833	+ 13,837	.. ..
†Perth (W.A.) ..	Mar. 22	1,906	+ 278	..	22,624	+ 8,345	29 ..

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations March 30th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations March 30th.	Rise + or Fall	Present Yield p.c.		
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.		
Bournemouth & Poole, Ord. ..	10	5½	5½	8½ — 9½ xd	..	5 19 0	Kensington & Knightsbridge, Ord	5	9	9	6 — 7½	..	6 4 2
Do. 4½ % Pref. ....	10	4½	4½	8½ — 9½	..	4 14 9	Do. 4 % Deb. ....	Stock	4	4	92 — 95	..	4 4 3
Do. Second 6 % Pref. ....	10	6	6	10½ — 11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 81	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½	4½	10½ — 102	..	4 8 3	London Electric, Ord. ....	8	2	2½	1½ — 2½	+ ¼	2 19 8
Brompton & Kensington, Ord. ....	5	10	10½	8½ — 8½ xd	..	5 14 3	Do. 6 % Pref. ....	5	6	6	4 — 5½	..	5 14 3
Do. 7 % Cum. Pref. ....	5	7	7	7½ — 8½ xd	..	4 6 2	Do. 4 % First Mort. Deb. ....	Stock	4	4	90 — 93	..	4 6 0
Central Electric Supply, 4 %	100	4	4	98 — 101	..	3 19 3	Metropolitan ....	5	5	4½	3½ — 4½	- ½	6 1 3
Guar. Deb. ....	5	5	5	4½ — 4½	+ ¼	5 2 7	Do. 4½ % Cum. Pref. ....	5	4½	4½	4½ — 4½	..	4 17 4
Charing Cross, West End & City	5	4½	4½	4½ — 4½	..	5 0 0	Do. 4½ % First Mort. Deb. ....	Stock	4½	4½	99 — 101	..	4 6 7
Do. 4½ % Cum. Pref. ....	5	4½	4½	4½ — 4½	..	5 2 10	Do. 3½ % Mort. Deb. ....	Stock	3½	3½	84 — 87	..	4 0 6
Do. "City Undertaking"	5	4½	4½	8½ — 4½	..	5 2 10	Midland Electric Corporation	100	4½	4½	96 — 98	..	4 11 10
Do. Do. 4 % Deb. ....	100	4	4	94 — 97	+ 1	4 2 6	4½ % First Mort. Deb. ....	5	4	4½	2½ — 2½ xd	..	5 3 3
Chelsea, Ord. ....	5	5	5	4½ — 5	..	5 0 0	Newcastle-on-Tyne ....	5	5	5	3½ — 4½ xd	..	5 14 3
Do. 4½ % Deb. ....	Stock	4½	4½	98 — 101	..	4 9 1	Do. 5 % Pref., Non-Cum. ....	5	5	5	99 — 102	..	4 13 0
City of London, Ord. ....	10	7	8	18½ — 20	..	4 0 0	North Metropolitan Power Sup-	100	5	5	99 — 102	..	4 13 0
Do. 6 % Cum. Pref. ....	10	6	6	13½ — 15½	- ½	3 17 5	ply, 5 % Mortgages (Red.)	10	..	..	10 — 11	..	5 9 1
Do. 5 % Deb. ....	Stock	5	5	117 — 121	..	4 2 8	Notting Hill, 6 % Non-Cum.	5	7½	7½	5½ — 6½	..	5 13 9
Do. 4½ % Second Deb. ....	100	4½	4½	101 — 104	..	4 6 7	Oxford ....	5	10	10	9½ — 9	+ ½	5 11 1
County of Durham, 5 % First	Stock	5	5	87 — 89	..	5 12 4	St. James' and Pall Mall, Ord.	5	7	7	6½ — 7½	..	4 16 7
Mort. Deb. ....	10	5	6	10½ — 11	- 3/8	5 9 1	Do. 7 % Pref. ....	100	3½	3½	85 — 87	..	4 0 6
County of London, Ord. ....	10	6	6	11½ — 11½	..	5 3 0	Do. 3½ % Deb. ....	5	Nil	2	1½ — 1½	..	..
Do. 6 % Pref. ....	Stock	4½	4½	107 — 109	..	4 2 7	Smithfield Markets, Ord. ....	4	5	5	2½ — 3½ xd	- 3/8	6 0 0
Do. 4½ % Deb. ....	Stock	4½	4½	101 — 104	..	4 6 7	South London, Ord. ....	100	5	5	99 — 102	..	4 18 0
Do. 4½ % Second Deb. ....	5	Nil	Nil	2 — 2	..	Nil	Do. 5 % First Mort. Deb. ....	1	7	7	1 — 1½	..	6 4 5
Edmundson's, Ord. ....	5	Nil	Nil	2½ — 3½	..	Nil	South Metropolitan, 7 % Pref. ....	100	4½	4½	95 — 98 xd	..	4 11 10
Do. 6 % Cum. Pref. ....	100	4½	4½	86 — 89	..	5 1 2	Do. 4½ % First Deb. Stock ..	5	5	..	1 — 1½	..	..
Do. 4½ % First Mort. Deb. ....	5	6	6½	4½ — 5	..	6 0 0	Urban, Ord. ....	5	5	..	2½ — 3½	..	..
Folkestone ....	5	5	5	4½ — 5½	..	4 17 7	Do. 5 % Cum. Pref. ....	100	4½	4½	85 — 87 xd	..	5 3 6
Do. 5 % Cum. Pref. ....	100	4½	4½	93 — 96	..	4 13 9	Do. 4½ % First Mort. Deb. ....	5	10	10	8½ — 9½	..	5 8 1
Do. 4½ % First Deb. ....	5	9	9	6½ — 7½	..	6 4 2	Westminster, Ord. ....	5	4½	4½	5 — 5½	..	4 5 9
Hove ..	5	9	9	6½ — 7½	..	6 4 2	Do. 4½ % Cum. Pref. ....	5	4½	4½	5 — 5½	..	4 5 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	6	6	5 1/2 - 5 1/2	..	5 2 2	Monterey Rly. Light & Power, } 5 % 1st Mort. Deb. ....	100	5	5	88 - 90	..	5 11 1
Calcutta, Ord. ....	5	8 1/2	7 1/2	5 1/2 - 7 1/2	+ 1/4	5 17 3	Montreal, Lt., H. and Power ..	\$100	7	8	198 - 202	..	3 19 3
Do. 5 % Pref. ....	5	5	5	5 - 5 1/2	..	4 15 3	Northern, Lt., Power and Coal, } 5 % 1st Mort. Bonds	\$500	5	..	39 - 41	..	12 3 10
Calgary Power, 1st Mort. Bds.	100	5	5	92 1/2 - 94 1/2	..	5 5 8	River Plate, Ord. ....	Stock	10	..	248 - 258	..	3 17 6
Canadian Gen. El. Com. ....	\$100	7	7 1/2	113 - 117 xd	..	5 19 8	Do. 6 % Non-Cum. Pref. ....	Do.	6	6	110 - 115	..	5 4 4
Do. 7 % Pref. ....	\$100	7	7	114 - 118 xd	..	5 18 8	Do. 5 % Deb. Stock ..	Do.	5	5	102 1/2 - 104 1/2	..	4 15 8
Cordoba Lt., Power and T., Ord.	1	3	3 1/2	3 1/2 - 1 1/2	..	2 18 3	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. ....	100	4 1/2	4 1/2	101 - 103	..	4 7 5
Do. 5 % Deb. ....	100	5	..	93 - 98 xd	..	5 2 0	Shawinigan Water, Capital ....	\$100	4	5 1/2	137 - 140	+ 4 1/2	3 11 5
Eleo. Lt. and P. of Cochabamba, } 6 % Bonds	100	6	6	92 - 94	..	6 7 8	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	108 - 110	..	4 11 0
Eleo. Supply Victoria, 5 % 1st Mort. Deb. ....	100	5	5	83 - 86	..	5 16 3	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	4 1/2	103 1/2 - 105 1/2	..	4 5 4
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5	5	92 1/2 - 94 1/2	..	5 5 10	Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2	4 1/2	99 1/2 - 101 1/2	..	4 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7 1/2 - 5 1/2	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. ....	100	5	5	92 1/2 - 94 1/2	..	5 5 10
Do. 6 % Pref. ....	1	6	6	8 1/2 - 8 1/2	..	8 0 0	Victoria Falls Power, Pref. ....	1	Nil	11 1/2 d.	2 - 1 1/2	- 1/2	..
Raministiquia Power, 5 % G. Bs.	\$500	5	5	110 - 112	+ 2	4 9 3	West Kootenay Power and Lt., } 1st Mort. 6 % Gold	100	6	6	104 1/2 - 106 1/2	..	5 12 8
Madras, Ord. ....	5	..	..	2 1/2 - 3	..	..							
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 - 105	..	4 15 3							
Mexican El. Lt., 5 % 1st M. Bds.	..	6	5	84 1/2 - 86 1/2	..	5 15 7							
Mexican Lt. & Power, Common	\$100	4	4 1/2	85 - 87	..	4 12 0							
Do. 7 % Cum. Pref. ....	\$100	7	7	105 - 107	..	6 10 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 1/2 - 96 1/2	..	5 3 8							

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4 1/2	7 1/2 - 7 1/2	..	..	Monte Video Telephone, Ord. ....	1	6	6	1 - 1 1/2	..	5 6 3
Do. 5 % Deb. Red. ....	Stock	5	5	97 1/2 - 99 1/2	..	5 0 6	Do. 5 % Pref. ....	1	5	5	3 1/2 - 3 1/2	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8 1/2	149 1/2 - 151 1/2 xd	..	5 5 7	National Telephone, Pref. ....	Stock	6	6 1/2	99 1/2 - 102 1/2	..	5 17 1
Do. Collat. Trust ..	\$1000	4	4	94 - 96	..	4 3 4	Do. Def. ....	Do.	6	6 1/2	133 - 135	+ 1 1/2	4 8 11
Anglo-American Telegraph ..	Stock	3 1/2	3	66 - 68	..	4 8 6	Do. 6 % Cum. 2nd Pref. ....	10	6	6	9 1/2 - 10	..	6 0 0
Do. 6 % Pref. ....	Do.	6	6	110 - 111	..	5 8 1	Do. 5 % Non-cum. 3rd Pref. ....	5	5	5	5 1/2 - 5 1/2	..	4 15 3
Do. Def. ....	Do.	30/-	30/-	24 1/2 - 25 1/2	- 1/2	5 18 2	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	102 1/2 - 103 1/2	..	4 6 9
Anglo-Portuguese Tel., 5 % Mort. Deb. ....	100	5	5	100 - 102	..	4 18 0	Oriental Telep. and Elec. ....	1	8	8	12 - 1 1/2	..	4 11 5
Chili Telephone ..	5	7	..	7 1/2 - 7 1/2	..	4 13 4	Do. 6 % Cum. Pref. ....	1	6	6	1 1/2 - 1 1/2	..	4 16 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	85 1/2 - 87 1/2 xd	..	4 11 5	Do. 4 % Red. Deb. ....	Stock	4	4	87 1/2 - 89 1/2	..	4 9 5
Cuba Telegraph ..	10	6	6 1/2	9 1/2 - 10 1/2	..	5 11 7	Pacific and European Tel., 4 % Guar. Debs. ....	Do.	4	4	98 1/2 - 100 1/2	..	3 19 7
Do. 10 % Pref. ....	10	10	10	17 - 18	..	5 11 1	Reuter's ..	8	5	5 1/2	12 - 12 1/2	..	3 5 4
Direct Spanish Telegraph, Ord.	5	4	4 1/2	3 1/2 - 3 1/2 xd	..	5 6 8	Submarine Cables Trust ..	Cert.	6	6	130 - 133	..	4 10 3
Do. 10 % Cum. Pref. ....	5	10	10	7 1/2 - 8 1/2 xd	..	6 1 3	Telephone Co. of Egypt, 4 1/2 % Deb. Red. ....	Stock	4 1/2	4 1/2	99 - 101	..	4 9 1
Do. 4 1/2 % Debs. ....	50	4 1/2	4 1/2	99 - 101	..	4 9 1	United River Plate Telephone	5	8	8	7 1/2 - 7 1/2	..	5 8 3
Direct United States Cable ..	10	4 1/2	..	7 1/2 - 8	..	5 12 6	Do. 5 % Cum. Pref. ....	5	5	5	5 1/2 - 5 1/2	..	4 8 11
Direct W. India Cable, 4 1/2 % Reg. Deb. ....	100	4 1/2	4 1/2	99 - 101	..	4 9 1	West Coast of America ..	2 1/2	2 1/2	2 1/2	1 1/2 - 1 1/2	..	3 11 5
Eastern Telegraph, Ord. Stock	Stock	7	5 1/2	129 - 133	..	5 5 3	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. ....	100	4	4	97 1/2 - 99 1/2	..	4 0 5
Do. 8 1/2 % Pref. Stock ..	Do.	8 1/2	3 1/2	80 - 82	..	4 5 4	West India and Panama Teleg.	10	1 1/2	1 1/2	4 1/2 - 4 1/2	+ 1 1/2	..
Do. 4 % Mort. Deb. ....	Do.	4	4	100 1/2 - 102 1/2	..	3 18 1	Do. 6 % Cum. 1st Pref. ....	10	6	6	10 - 11 1/2	..	5 6 8
Eastern Extension ..	10	7	5 1/2	12 1/2 - 12 1/2	..	5 9 10	Do. 6 % Cum. 2nd Pref. ....	10	6	6	9 1/2 - 10 1/2	- 1/2	5 17 1
Do. 4 % Deb. ....	Stock	4	4	98 1/2 - 101 1/2	..	3 18 10	Do. 5 % Debs. ....	100	5	5	102 - 104	..	4 16 2
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. ....	25	4	4	99 - 101	..	3 19 3	Western Telegraph, Ltd. ....	10	7	6 1/2	13 - 13 1/2 xd	..	5 3 8
Globe Telegraph and Trust ..	10	5 1/2	6 1/2	10 1/2 - 11 xd	+ 2/-	5 9 1	Do. 4 % Deb. ....	Stock	4	4	99 - 101	..	3 19 3
Do. 6 % Pref. ....	10	6	6	12 1/2 - 13 1/2 xd	+ 3/-	4 9 9	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106 - 109	..	3 13 5
Great Northern Telegraph ..	10	18	5 1/2	3 1/2 - 3 1/2	+ 1/4	5 8 3	Do. 4 1/2 % Fdg. Bonds ..	\$1000	4 1/2	4 1/2	102 - 105	..	4 5 9
Indo-European Telegraph ..	25	13	5 1/2	56 1/2 - 58 1/2	..	5 10 2							
Mackay Companies Common ..	\$100	5	5 1/2	81 - 84 xd	..	5 19 1							
Do. 4 % Cum. Pref. ....	\$100	4	4	70 - 73 xd	..	5 9 7							
Marconi's Wireless Telegraph	1	5	..	6 1/2 - 6 1/2	+ 1 1/2	..							
Do. 7 % Cum. Partio. Pref.	1	16	..	5 1/2 - 6 1/2	+ 1 1/2	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 30th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations March 30th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord. . . . .	1	Nil	Nil	73 — 83 xd	..	Nil	Metropolitan Railway Consol. . . . .	100	13	17	63½ — 64	+ 3	2 18 7
Do. 5 % Pref. . . . .	1	5	5	..	..	6 13 4	Do. Surplus Lands . . . . .	100	23	27	67 — 69	..	4 3 4
Do. 4½ % Deb. . . . .	100	4½	4½	..	..	5 8 5	Do. 8½ % Deb. . . . .	100	3½	3½	83 — 91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. . . . .	100	..	..	12 — 14	..	..	Do. 3½ % Pref. . . . .	100	3½	3½	85 — 87	..	4 0 6
Do. Do. Deferred . . . . .	100	..	..	8 — 10	..	..	Do. 3½ % Con. Pref. . . . .	100	3½	3½	84 — 86	..	4 1 5
Do. Do. 6 % Cum. Pr'f. . . . .	100	..	..	90½ — 92½	..	..	Metropolitan District Ord. . . . .	100	Nil	..	42½ — 43½	+ 4½	Nil
Do. 7 % Non-Cum. Pr'f. . . . .	100	..	..	36 — 39	..	..	Do. 6 % Deb. . . . .	100	6	6	144 — 146	..	4 2 2
Do. 5 % Perp. Deb. . . . .	100	5	5	93½ — 96½	- 2½	5 3 8	Do. 4 % Deb. . . . .	100	4	4	96 — 98	..	4 1 8
Do. 4½ % 2nd Deb. . . . .	100	4½	4½	80 — 84	..	5 7 2	Do. 4 % Prior Lien . . . . .	100	4	4	100 — 102	..	3 18 5
Central London Railway, Ord. . . . .	100	3	3	86 — 88	..	3 8 2	Do. 4½ % First Pref. . . . .	100	3½	4½	89 — 91	..	4 18 11
Do. Pref. . . . .	100	4	4	86 — 88	..	4 10 11	Do. 3½ % Gtd. . . . .	100	3½	3½	76 — 78	..	4 9 9
Do. Def. . . . .	100	2	2	86 — 88	..	2 5 5	Metropolitan Elec. Trams, Ord. . . . .	1	5½	5½	82 — 132	+ 1½	6 6 8
Do. 4 % Deb. . . . .	100	4	4	101 — 103	..	3 17 8	Do. Def. . . . .	1	Nil	..	..	..	Nil
City & South London, Ord. . . . .	100	1½	1½	42½ — 43½	+ ½	3 14 9	Do. 5 % Pref. . . . .	1	5	5	..	..	5 14 3
Do. 5 % Pref., 1891 . . . . .	100	5	5	107 — 109	..	4 11 9	Do. 4½ % Deb. . . . .	100	4½	4½	99 — 101	..	4 9 1
Do. Do. 1896 . . . . .	100	5	5	102 — 104	..	4 16 2	Do. 5 % Deb. . . . .	100	5	5	98 — 100 xd	..	5 0 0
Do. Do. 1901 . . . . .	100	5	5	101 — 103	..	4 17 1	Potteries, Ord. . . . .	1	2	..	..	..	..
Do. Do. 1903 . . . . .	100	5	5	101 — 103	..	4 17 1	Do. 5 % Pref. . . . .	1	5	5	..	..	6 19 3
Do. 4 % Deb. . . . .	100	4	4	101 — 103	..	3 17 8	Do. 4½ % Deb. . . . .	100	4½	4½	89 — 92	..	4 17 10
Dublin United Trams, 6 % Pref. . . . .	10	6	6	103 — 113	..	5 2 2	South Metro. Trams, 6 % Pref. . . . .	1	6	..	..	..	6 17 2
Great Northern & City, Pr'f. Ord . . . . .	10	Nil	..	23 — 25	+ ½	Nil	Do. 4 % Deb. . . . .	100	4	4	72 — 77	..	5 4 0
Hastings Trams, 6 % Pref. . . . .	5	Nil	9½	..	..	..	Underground Elec. Railways . . . . .	10	..	..	..	..	..
Do. 4½ % Deb. . . . .	100	4½	4½	71 — 76 xd	..	5 18 5	Do. 4½ % Bonds . . . . .	100	4½	4½	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref. . . . .	5	2½	2½	23 — 27	..	4 6 11	Do. 6 % Income . . . . .	100	1	1½	88 — 90	..	..
Do. 4 % Deb. . . . .	100	4	4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord. . . . .	5	Nil	..	..	..	Nil
Lancashire United, 5 % Deb. . . . .	100	5	5	82 — 84	..	5 19 1	Do. 6 % Pref. . . . .	5	Nil	..	23 — 34	..	Nil
London Elec. Railw'ys, 4 % Deb. . . . .	100	4	4	97 — 99	..	4 0 10	Do. 4½ % Deb. . . . .	100	4½	4½	80 — 84	..	5 7 2
London United Trams, 5 % Pref. . . . .	10	Nil	..	3½ — 4	..	..							
Do. 4 % Deb. . . . .	100	4	4	75 — 78	..	5 2 7							

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	51 — 53	+ ½	5 2 4	La Plata Elec. Trms, Ord. ..	1	..	..	..	..	..
Do. 2nd Pref. ..	5	5	5½	4½ — 5½	..	5 3 6	Do. Pref. ..	1	6	6	..	..	6 0 0
Do. 4 % Deb. ..	100	4	4	94½ — 95	..	4 4 3	Lisbon Elec. Trams, Ord. ..	1	5½	6½	1 — 1½	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	102 — 104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb. ..	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	5	95 — 99	..	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	102 — 105	..	4 15 3	Madras Elec. Tr. (1904), Deb. ..	100	5	5	96½ — 98½	..	5 1 6
Bombay Elec. S. & Trams, Pref.	10	6	6	103 — 111	..	5 6 8	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93 — 96	..	5 4 2
Do. 4½ % Deb. ..	100	4½	4½	98 — 100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	99½ — 101½	..	4 18 6
Do. 5 % 2nd Deb. ..	100	5	5	98 — 100	..	5 0 0	Mexico Trams Com. ..	\$100	7	7½	119 — 121	..	5 15 8
Brisbane Trams Invt., Ord. ..	5	8	8½	94 — 94½	+ ½	4 6 6	Do. Gen. Con. 5 % Bonds ..	..	5	5	96½ — 98½	..	5 1 6
Do. 5 % Pref. ..	5	5	5	46 — 54	..	4 15 3	Do. 6 % Bonds ..	100	6	6	100½ — 102½	..	5 17 1
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 — 7½	..	7 0 4
B. Columbia Elec. Rly., Def. ..	100	8	8½	138 — 143	+ 3	5 11 11	Do. 6 % Pref. ..	5	6	6	6 — 6½	..	7 0 4
Do. Pref. Ord. ..	100	6	6	122½ — 126½	+ 1½	4 14 10	Do. 5 % 1st Deb. ..	100	5	5	97½ — 99½	..	5 0 6
Do. 5 % Pref. ..	100	5	5	111½ — 114½	+ 1½	4 7 4	Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1½ — 1½	..	1 18 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 — 103	..	4 7 5	Do. 5 % 1st Deb. ..	100	5	5	101 — 104	..	4 16 2
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	+ ½	5 6 8
Do. 4½ % Con. Deb. ..	100	4½	4½	102 — 104	..	4 6 7	Do. 4½ % 1st Deb. ..	100	4½	4½	98 — 101	..	4 9 1
Calcutta Trams, Ord. ..	5	6	..	6 — 6½	..	4 16 0	Rio de Janeiro Trams ..	\$100	4½	5½	119 — 120	+ ¼	4 3 4
Do. 5 % Pref. ..	5	5	5	4½ — 5½	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	103 — 104	..	4 16 2
Do. 4½ % Deb. ..	100	4½	4½	99 — 102	..	4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	99½ — 100½	..	4 19 9
Cape Electric Trams ..	1	Nil	2½	..	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10½	197½ — 199½	..	5 0 3
City Buenos Aires Trams (1904)	5	5	5	5½ — 5½	..	4 6 0	Do. 5 % 1st Deb. ..	\$500	5	5	104 — 106	..	4 14 4
Do. 4 % Deb. ..	100	5	5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	81 — 84	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 103	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5½ — 5½	..	6 1 9
Kalgoorlie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 6 % Pref. ..	5	6	6	5½ — 5½	..	5 11 7
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	101 — 104	..	4 16 2
Do. 6 % B Deb. ..	100	5	6½	56 — 63	..	10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103 — 105	..	4 5 9

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	..	..	..	Dick, Kerr ..	1	5	..	27 — 31	..	5 3 1
Do. 6 % Pref. ..	1	9	6	..	7 2 2	..	Do. Pref. ..	1	6	6	1 — 1½ xd	..	5 12 11
Babcock & Wilcox ..	1	26	24½	..	3 15 7	+ ½	Do. Deb. ..	100	4½	4½	97 — 100	..	4 10 0
Do. Pref. ..	1	6	6	..	3 13 10	..	Edison & Swan, A, £3 paid	5	Nil	..	..	..	Nil
B.I. & Helsby Cables ..	5	10	10	6½ — 7 xd	7 2 10	..	Do. fully paid ..	5	Nil	..	..	..	Nil
Do. Pref. ..	5	6	6	54 — 64	4 16 0	..	Do. 4 % Deb. ..	100	4	4	71 — 75	..	5 6 8
Do. Deb. ..	100	4½	4½	101 — 103	4 7 5	..	Do. 5 % Second Deb. ..	100	5	5	75 — 73 xd	..	6 8 2
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	4 13 9	..	Electric Construction ..	2	Nil	2½	..	..	..
British Westinghouse, Pref. ..	3	Nil	..	3 — 1	..	+ ¼	Do. Pref. ..	2	7	7	1 — 1½	..	7 9 4
Do. Deb. ..	100	4	4	60 — 64	6 5 0	+ 1	Greenwood & Batley, Pref.	10	7	7	7 — 8½	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	102 — 105	5 14 3	..	Do. Deb. ..	100	5	5	94 — 96	..	5 4 2
Browett, Lindley, Ord. ..	1	Nil	..	1/6 — 2/6	..	..	General Electric, Pref. ..	10	5	5	9 — 9½	..	5 5 3
Do. Pref. ..	1	Nil	..	5/6 — 6/6	..	..	Do. Deb. ..	100	4	4	85 — 90	- 2	4 8 11
Brush, Ord. ..	2	Nil	..	0 — ¼	..	..	Henley's, Ord. ..	5	15	10½	11½ — 12½	..	6 2 6
Do. 7 % Pref. ..	2	Nil	..	0 — ¼	..	..	Do. Pref. ..	5	4½	4½	4½ — 5½	..	4 6 9
Do. 4½ % Deb. ..	100	4½	4½	54 — 59	7 10 6	..	Do. Deb. ..	100	4½	4½	104 — 106	..	4 4 11
Do. 4½ % Second Deb. ..	100	4½	4½	37 — 42	10 14 4	..	India-Rubber, G. & T. ..	10	10	..	9½ — 10½	..	..
Callender's Cable ..	5	15	10½	9½ — 10½	7 6 4	- ¼	Do. Pref. ..	10	5	5	9½ — 10½	..	4 17
Do. Pref. ..	5	5	5	5 — 5½	4 15 3	..	Telegraph Construction ..	12	20	10½	33 — 35	..	6 15 2
Do. Deb. ..	100	4½	4½	98 — 100	4 10 0	..	Do. Deb. ..	100	4	4	99½ — 101½	..	4 9 0
Castner-Kellner ..	1	17½	20	3½ — 3½	5 10 4	..	Willans & Robinson ..	1	Nil	..	..	..	Nil
Do. Deb. ..	100	4½	4½	105 — 109	4 10 7	..	Do. Pref. ..	5	Nil	..	..	..	Nil
Crompton & Co. ..	3	Nil	Nil	..	..	..	Do. Deb. ..	100	4	4	59 — 61	- 2½	6 11
Do. Deb. ..	100	5	5	58 — 68	7 7 1	..							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.



## REVIEWS.

*Rubber.* By PHILIP SCHIDROWITZ, Ph.D., F.C.S. 1911.  
London: Methuen & Co. Price 10s. 6d. net.

The author of this work is a well-known authority on rubber, and has aimed at presenting in a practical manner the most important features of the rubber industry to the layman, as well as to the technical man. The book contains numerous reproductions of photographs taken by the author himself during a recent tour in Malaya and Sarawak, together with others from Africa and South America, most of which are deserving of the highest commendation. Praise must also be accorded to the illustrations of machines, as well as to the production of the book as a whole. After a chapter on the history of the industry, Dr. Schidrowitz discusses the production and consumption of rubber in the leading countries of the world; he estimates that in 1915-16 the plantations should produce over 80,000 tons of rubber, out of a total of about 150,000 tons. This country consumes about  $\frac{1}{5}$  of the world's total.

He then treats of the conditions and methods of rubber production obtaining in South America, and passes on to the Eastern plantations, the foundation of which he regards as the most important occurrence in the rubber industry since the invention of the process of vulcanisation. It is estimated that the total acreage under planted rubber is nearly a million acres, which in time will probably yield 300 or 400 lb. per acre per annum.

The planting, care, and tapping of rubber trees are dealt with in an interesting and instructive way, followed by a discussion of the mechanical treatment of the product before it leaves the country of origin. The subject of rubber latices and their coagulation is one to which the author has obviously devoted much attention, and, together with the chemistry of rubber and the theory of vulcanisation, is treated at considerable length.

The remainder of the work deals with the manufacture of rubber goods, many of the processes being extremely interesting, and the various properties of vulcanised rubber and the chemical, physical and mechanical tests to which it can be put. The work of Prof. Schwartz in this connection receives due notice.

At the end of the book extracts from a paper by the author on the main causes of difficulties between manufacturers and consumers are reprinted. The work can safely be commended to all who are interested in this important subject, though the author does not deal with the use of rubber in the electrical industry.

*Machine Tools.* By J. W. FRENCH, B.Sc. Two volumes.  
London: The Gresham Publishing Co., Ltd. Price 42s. net.

These two large volumes contain a great deal of useful and interesting information. The outstanding feature is the method by means of which the arrangements of the parts of the details of some typical tools are illustrated. This is done with a series of sectional models. Thus, in the case of a lathe there are two pieces of thick paper pasted on to the plates, to represent the headstock. The reader turns back the top piece, and sees within the two half sections of the headstock; he then looks on the back of the second piece of paper, and sees the other elevations of the headstock. This idea is ingeniously carried out in order to exhibit the sections of the framing of the tools, the gearing and other internal parts. There is a key to each of the illustrations.

Another interesting feature of the book is the fore-word by Prof. J. D. Cormack, of University College, London. He says:—"Fifty years ago the machine shop of an engineer contained a comparatively limited number of types of machine tools. Machines of the same type were distinguished chiefly by size, and one important aim of the designer was to produce tools which could deal with a large variety of work, for at that time a typical engineer's shop had very varied work in hand, and the same tool was called upon to deal with a succession of jobs whose character was continually changing. Little was written in regard to these tools, and a knowledge of the uses and possibilities of a tool

was acquired in a somewhat haphazard fashion by the young engineer in the course of his apprenticeship. The tools of that time, however, turned out good work, and some of them of good design and workmanship are still in use."

He then goes on to show how during the last 25 years there has been enormous progress in new and improved kinds of tools. At the same time, it is only those mechanical engineers who are specially concerned with either the product or the use of such tools that take much interest in them.

Until recently there has been very little literature on the subject. Mr. French has produced a book that Prof. Cormack calls "readable, interesting and useful." So far as we can gather, he has collected together a great deal of information from the leading tool-making firms concerning their products, and has made every use of their catalogue illustrations. We are not quite sure for what class of reader the work has been produced.

Although the two volumes are beautifully got up, yet we cannot help feeling that 42s. is a large sum to spend in the purchase of them. For instance, we should not like to recommend an ambitious mechanic to expend that amount, and it is more than the ordinary engineering student can afford.

A very large number of the illustrations are from the makers' catalogues, and a good deal of the letterpress must have been obtained from the same source. Of course, it may be argued that the descriptions of the various tools have been condensed, and that the various makes of the same class of tools are easily compared. On the whole, however, we cannot help feeling that the most generous subscribers should be the firms whose names appear in such large letters on the illustrations.

We wish to give the author full credit for his ingenious models and energy for collecting together information, all of which seems to be right up to date. We must, however, judge of the book by the standard of whether it is good value for the money expended.

We think that the whole thing has been produced in too lavish a fashion; the art paper, the large size pages, with the big margin, the somewhat grandiose binding: all that sort of thing has to be paid for. If the author had been contented with his models, some sectional illustrations, and a rather more close editing of the text, he could surely have produced a book which would have fitted on an ordinary shelf of the library, and it would have been obtainable at, say, a half, or even a quarter, of the price of the volumes before us. It is only fair to add that we can trace no errors in the text, and we think the style of description good.

*Alternating Current Design.* By JULIUS FRITH. 1912.  
London: Harper & Brothers. Price 5s. net.

This book is intended to be a companion volume to the treatise on "Continuous Current Machine Design" issued by the same publishers, and the reader is referred to this work for the information common to both classes of design, in order to save duplication.

Chapter I deals with the elementary properties of alternating currents. Presumably everyone commencing to read a book on design has some previous knowledge at least of the principles of the subject, and the reason for introducing a chapter of this kind is not clear.

Armature reaction is treated by means of vector diagrams in the second chapter. A small amount of information is also given regarding the regulation of alternators.

The third chapter, consisting of three pages, is devoted to the consideration of the relations between core dimensions and output. We are of the opinion that the chapter would have been considerably improved if quadrant diagrams had been given for gap induction, ampere-conductors per inch of circumference, number of poles, &c. The values given for these vital points in the design of an alternator are somewhat vague and meagre.

The design of a 250-kw. alternator is worked out in detail in Chapter IV. The treatment is evidently based on practical experience in the design of alternators, and the chapter is a distinct improvement on the preceding ones.

The next two chapters are short articles dealing with the parallel running of synchronous machinery, and the compounding of alternators, respectively. The matter is put



forward in an interesting style and the chapters are quite good as far as they go.

Chapter VII deals with the theory of induction motors and the method of calculating the leakage coefficient: the Heyland diagram, and so on are well treated.

The design of a 50-h.p. induction motor is next worked through, and like the design of the alternator, bears the stamp of the practical man rather than that of the theorist.

The design of static transformers is dealt with in Chapter IX and an example is worked out in Chapter X. The treatment is really not at all bad, but we are sceptical as to how far a student would get in the design of a commercial transformer after having read these chapters.

Very short chapters are then devoted to transmission lines and choking coils, together with two more worked examples dealing with the design of an alternator and a two phase squirrel cage induction motor and auto-starter.

A two-page appendix gives some information which is really not worth putting in a book of this character.

The book consists of only 115 pages of large print and we are of the opinion that the author has attempted to cover far too wide a ground in the space at his disposal. The author's style is good and interesting, and it is a pity that he did not confine his attention to, say, the design of alternators and induction motors. Surely there is a limit to the number of subjects which even a modern student requires in a book which is sold at 5s. net.—H.G.S.

*Boiler Draught.* By H. K. PRATT. London: Constable and Co., Ltd. Price 4s. net.

This little book may be found useful to some engineers, although it appears to us to be rather superfluous. It contains a good deal of matter that is found in most of the books on boilers. We cannot imagine any man sufficiently intelligent to read this book who has not one of the standard treatises on boilers, in which may be found practically everything that it contains.

There are eleven chapters in all, the first of which occupies about a page and a half, and contains about 500 words of an introductory nature. The next chapter is on calculations relating to air, and the third is on chimneys.

An example is given of the way in which the height of a chimney necessary to burn fuel at a definite rate is calculated, but there seems nothing original in the methods used.

The best pages are those on artificial, forced and induced draught, but here the illustrations are not very good and not sufficiently numerous.

As for the last chapter on the chemistry of combustion, well, you can get all that, and a great deal more, in a handy little book on heat engines published at about 2s. 6d. On the whole, we reluctantly come to the conclusion that most of the contents are to be found in an ordinary engineer's pocket-book, and there seems to be no *raison d'être* for this latest addition to the literature about boilers. We can find no actual mistakes in the text or calculations, so the contents may be taken as reliable.

**An Electrical Invention (?).**—Reports have appeared in the lay Press regarding a phenomenal invention put forward in New York by an "electrical engineer," who is said to have been working on the thing for 18 years. He made the well-known discovery that an alternating magnetic field (called a "current" in the report) repels metals, and proposes to utilise this principle to abolish gravitation in the case of railway trains, by building a row of electromagnets along the track, which repel the aluminium base-plate of a steel car, and thus cause the car to "float." Other electromagnets pull the car to and fro. The idea appears to be that cars will "slide through the air at a speed of 300 miles an hour without encountering any friction except air resistance." We do not know how far the report may be trusted; but if there is a grain of truth in it—and the account is circumstantial enough—we can only regret that an intelligent man should so utterly waste his time as to pursue an investigation of this kind. Had he taken the trouble to study his subject, he would have found that friction can easily be made an almost negligible matter, and his method does not reduce in the least the energy that must inevitably be expended in overcoming gradients; moreover, at 60 miles an hour air resistance is by far the most important factor, and as it increases as the square of the velocity, a speed of 300 miles an hour could not possibly be approached by a self-propelled car. The scheme is hopelessly impracticable, and in addition is uncalled for. Nobody wants to travel at such high speeds.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(Continued from page 498.)

16. *Orange River Colony.*—By an ordinance (No. 27 of 1905) "for regulating the employment of electricity for the purposes of electric lighting and powers generally," it is provided that the Lieutenant-Governor may make regulations similar to that of the English Board of Trade for securing the safety of the public and for minimising as far as may be reasonable any interference with the electric lines of the Government, or of any other authority, company or person, and may provide for penalties. The regulations must deal (*inter alia*) with the height, dimensions, &c., of poles and their connections with earth: the height of wires above the earth: the precautions to be observed to prevent the fall of wires: the employment of insulated returns: and prevention of electrolytic action, and generally the use of overhead wires for currents of high or low pressure.

17. *Natal.*—There does not seem to be any public Act in force in Natal which authorises or regulates the supply of electricity. In 1902, however, an Act was passed entitled the "Durban County Tramways, Lighting, and Electric Current Supply Act." The greater part of this Act, of course, relates to the establishment of an electric tramway, and is, therefore, somewhat outside the scope of this article, but reference may be made to other provisions which show the trend of legislation in the colony anent the supply of electricity for light and power.

By Sec. 4 the promoters are "authorised and empowered, subject to such terms as may be imposed by the Government in the contract referred to in Sec. 5 hereof (*vide infra*) to construct, carry on, complete and maintain the said tramways, and to erect standards, posts, supports or other requisite appliances, whether above or below the surface of the ground, for wires or cables, for transmitting electric current for the purpose of the said tramway, or for the purpose of supplying the same for electric lighting and other purposes to the owners or occupiers of lands adjacent to or near to the said tramway, and to transmit and supply the same for the purpose aforesaid and elsewhere in the County of Durban according to the rules, orders and directions hereinafter set forth and expressed for that purpose."

By Sec. 5 "The promoters and the Government of Natal are hereby authorised to contract with each other for the purpose of the promoters acquiring from the Government aforesaid, whether by way of letting, hiring, or granting, and upon such terms as may be mutually agreed upon, the following rights:—

"(a) The right of constructing the said tramway aforesaid along the hereinafter mentioned public roads, and the right of working the same.

"(b) The right of erecting, or constructing and working, standards, posts, supports, or other adequate appliances, whether above or below the surface of the ground, for wires or cables on and along the hereinafter mentioned public roads, for the purpose of transmitting or carrying electric current, together with the right of working or transmitting along such wires or cables electric current for lighting or other purposes."

It is provided by Sec. 17 that "subject to the acquisition of powers from the said Government in terms of the Act, the promoters shall have the right to contract with the owners or occupiers of land in the County of Durban for the supplying of electric current, and to charge and demand from any such person or persons so contracting, rates and charges not exceeding those set forth in the schedule to the Act. Provided that the Governor in Council shall have the power from time to time to revise, and, if necessary, reduce such rates and charges."

The promoters are given power by Sec. 18 to make by-laws with regard to (b) the charges to be made to persons requiring to be supplied with electric current: (c) the interference with, or obstruction by, any person of any of the works authorised by the Act, while, by



Sec. 26, the Governor in Council may, from time to time, make regulations in accordance with the regulations for the time being of the Board of Trade of the United Kingdom, for securing the safety of the public from personal injury, or from fire or otherwise, and for minimising, as far as may be reasonable, any interference with the electric wires, lines, &c., of the Government.

The promoters are also under heavy responsibility to prevent their works occasioning any damage to anybody.

Sec. 33 of this Act, which related to compulsory purchase, was repealed by Act No. 24, of 1903, Sec. 3 of which provides that: "The Governor in Council, or any municipal Corporation, local board or other local authority, which may hereafter have jurisdiction over the lands served by the said tramway, shall be empowered, subject to the approval of the Parliament, at any time after the expiry of 21 years from the date of this Act coming into force, and after giving not less than six months' notice, to purchase and take the whole of the works authorised by this Act, and the promoters shall be required to sell, transfer and hand over to the Colonial Government, or any such corporation, board, or authority, the works so purchased, and the purchase price shall be paid to the promoters."

Any such purchase shall be effected according to the provisions of the Law No. 16 of 1872.\* Thus Sec. 25 provides that "The promoters shall be answerable for all accidents, damages, and injuries happening through their act or default, or through the act or default of any person in their employment, by reason or in consequence of their works, cars, carriages, and for all damage done by electrolysis or otherwise, resulting from electric leakage, and shall save harmless all other road authorities, companies, bodies, collectively or individually, and their officers and servants from all damages and costs in respect of such damages, accidents and injuries."

Sec. 27 provides "That the promoters, subject to the acquisition of certain rights from the Government, shall have the right to purchase or take such lands as may be necessary for the purposes of (*inter alia*) carrying out and completion of any works under and by virtue of the powers and privileges granted to them by this Act. Provided that if the taking of any such lands shall cause damage to any person or his property, such person shall be entitled to compensation or recompense, to be settled in case of difference as if the claim constituted damage to land within the meaning of Sec. 65 of the Lands Clauses Consolidation Law.

"(a) That the purchase price shall be determined according to the value of the works at the time of purchase, without any addition in respect of compulsory purchase, statutory rights, goodwill, or profits, save as is provided in Sub-Sec. (b); and

"(b) That there shall be added to the value ascertained as aforesaid an amount as interest, equal to 10 per cent. on the value ascertained as aforesaid."

Sec. 34 provides that "Nothing in this Act shall be deemed to create a monopoly in favour of the promoters."

In 1903 the Natal Legislature passed another Act (No. 23 of 1903) entitled the "Sydenham Tramways, Lighting and Electric Current Supply Act." To all intents and purposes it is the same as the measure which we have just considered. There is one clause, however, to which attention should be drawn, namely, that which relates to injury to ocean cables or landline subsidised by the Government. It is there provided that:—

"If any ocean cable or the landlines connected therewith subsidised by the Government of Natal is at any time in any way injuriously affected by the construction by the promoters of their electric lines and works, or by the working of the undertaking of the promoters, the promoters shall pay the expenses of all such alterations in, or addition to, such cables or landlines as may be necessary to remedy such injurious affection. For the purpose of this section, a cable or landline subsidised by the Natal Government shall be deemed to be injuriously affected by an act or work if telegraphic communication by means of such cable is, whether through induction or otherwise, in any manner affected by an act or work, or by any use made of such work."

The introduction of the above clause is interesting, and probably came about in consequence of the decision of the Judicial Committee of the Privy Council in the case of *Eastern and South African Telegraph Co., Ltd., v. Cape Town Tramways Co.'s, Ltd.* (1902) A.C. 381. It will be remembered that in that case the plaintiff company brought an action against the tramway company for disturbances in the working of their submarine cable caused by an escape of electricity stored by the respondents for the due working of their tramway system. It was decided in regard to that section of the tramway which had not been constructed under statutory authority, the principle of *Fletcher v. Rylands* (which imposes upon a man the duty of keeping anything dangerous on his own land in safe custody) did not apply in its entirety, because the disturbances only resulted when the cable was constructed without certain precautions which the evidence showed had subsequently secured its immunity.

It is probable that the Natal Act above-mentioned was passed with the express object of neutralising the effect of this decision, which would be considered binding upon all Colonial Courts in the British Empire.

(To be concluded.)

## TRANS-ATLANTIC TELEGRAPHY.

BY CHARLES BRIGHT, F.R.S.E., M.Inst.C.E., M.I.E.E.

At a recent meeting which had for consideration the proposed Imperial Atlantic Cable a resolution in its favour was, for some unaccountable reason; withdrawn. If the case against the cable was so strong, it seems strange that those opposed to it should ask for the withdrawal of a resolution in its favour; still more that those in favour should—out of awe or affection—fall in with so complacent a course on such an occasion. However, no reply having been given to the speech in opposition to the resolution, the following brief observations may be made in that connection:—

1. The existence of a trans-Atlantic cable monopoly *commercially* speaking has never been suggested, but our communication with Canada being now in the hands of two American companies constitutes a highly undesirable monopoly in a *national* sense.

2. A cable landed on British territory with British clerks, and *foreign ownership, directors, and managers*, does not constitute British control, as anyone knows who has to do with the working of a cable system. There are several cases that might be cited to prove this. Meanwhile, the following may be quoted from an American contemporary:—"The eight trans-Atlantic cables of the Western Union, Anglo-American, and Direct United States Companies were consolidated on March 8th, under one operating management, and will be known hereafter as the *Western Union Cable System*."\* Here we have evidence of the way facts are appreciated at their correct value in the United States.

As further evidence, but from *this* side, we have the following remark made by the chairman of the Anglo-American Telegraph Co. at their last shareholders' meeting:—

"All we have to do now is to sit down and receive our dividends."

3. It is unwise to rely upon Naval supremacy as sufficient reason for allowing all our British trans-Atlantic cables to pass into American hands, especially when we remember that control of cable communication with other parts of the Empire is even more important during the period when International trouble is brewing, than during actual warfare. Germany and France have recently recognised this by establishing separate cable links to their own colonies.

4. The loss quoted on the Pacific Cable as of last year was, as a matter of fact, that of some years ago—a loss which is steadily decreasing each year. Parenthetically, it may be

\* A law which corresponds to the Lands Clauses Consolidation Acts.

\* *Telegraph and Telephone Age*, March 16th, 1912.



added that we do not talk about a loss on our Navy and Army; yet efficient and reliable telegraphic communication with the rest of the Empire is equally essential, and is, indeed, *inter alia*, a necessary strategic adjunct.

5. As an argument against the proposed Imperial Atlantic Cable, it was stated that the line would require to be laid in duplicate. Personally, I should propose that the duplication should be effected by "wireless," either with the existing Marconi system or by establishing a new wireless system on an extreme northern route. But, in any case, it may be pointed out that, whereas a cable on the route of the "All British" Pacific Cable would be far more likely to give trouble than one across the Atlantic, the Pacific line has only once been interrupted—and that quite recently—for a very brief period, on one of the shorter sections. It has, in fact, got on very well by itself ever since it was laid some 12 years ago. On the other hand, its value as a strategic asset was more or less wiped out on the day when its Atlantic connecting links became entirely American.

6. A great deal was said about the Government wireless scheme; but though much was made of the cost of the proposed Imperial Atlantic Cable, there was no reference to the corresponding cost of the wireless project, a cost which has been already estimated at a figure considerably in excess of that which would be entailed by the Atlantic cable link.

7. A point was made that all the new wireless stations were to be on British territory. But this by itself does not appear to be of transcendent value in the case of wireless, unless the intervening æther space can be also rendered "All-British."

8. Apparently the principal opponent to the Imperial Atlantic Cable was greatly impressed with the efficiency of "Wireless"; for he spoke of the cable system as being conceivably "knocked out" by wireless. Suggestions of this sort, unfortunately have their effect when coming from certain quarters, even though based on no direct technical knowledge of the two methods of telegraphy. Thus, holders of cable stock are being needlessly disturbed, partly on this account and partly due to the constant "writing up"—very much "up"—in the non-technical press of everything to do with wireless telegraphy, without any corresponding announcement as to what is being done by cables in the ordinary every-day course.

9. Special attention was called to "a new automatic method by which messages would be ticked off at the rate of 50 words a minute." Apparently this had reference to the Imperial wireless scheme; and if this be so superior—as seemed to be thought—why trouble about cable rates? It was also stated that each station was to work "practically instantaneously," yet each was to "repeat to the other"; most of us know something of those repetitions, whilst we also know of the great value (and the reverse) of simultaneously spreading news and information to a wide and attentive audience—whether for legitimate Press purposes or otherwise. In the case of war it would be distinctly "otherwise."

The present position certainly suggests the desirability of full and important public inquiry into the relative merits of cable and wireless telegraphy—as I have constantly urged for. The two systems should, in fact, be put to actual test by independent parties under similar conditions. That would be better than mere generalisations such as seem so rife just now.

**A Duchy Lighting Monopoly.**—A combination of German manufacturing and financial interests is represented by the formation of the Thuringian Electricity Supply Co., of Gotha, which has been constituted by the A.E.G., the Electricity Supply Co., of Berlin, the Electricity Supply Co., formerly Lahmeyer and Co., the Bank for Electrical Enterprises, of Zurich, and the Electric Light and Power Investment Co., of Berlin. The object of the company, which will have a total share and bond capital of £600,000, is to work a concession granted by the State Ministry of Gotha, and unanimously approved by the Diet of the Duchy of Gotha, for the supply of light and power throughout the whole of the Duchy. It is proposed to erect a new power station for this purpose near Altenbreitungen, whilst the existing station at Gotha is to be acquired and enlarged. The stations will be connected together by means of overhead conductors, and will, therefore, be able to render mutual assistance. The scheme also provides for the construction of tramways.

## WIRELESS TELEGRAPHY IN HOROLOGY, NAVIGATION AND CARTOGRAPHY.\*

By S. M. POWELL.

AN accurate knowledge of the exact time in a standard meridian, whether that of Greenwich or Paris, is essential to all clockmakers, public services (such as railways) and, above all, to navigators.

Whether in mid-ocean or "hugging the coast," the navigator must know precisely where he is at every moment, and, to obtain this information, he plots his course on a chart by aid of the magnetic compass and the log.† The inevitable errors in such a system of navigation are rapidly cumulative, and it is a matter of great importance to secure frequent astronomical observations, for the only changing feature from one part of the ocean to another is the aspect of the stars. The astronomical observations enable a determination of the *latitude* of the place to be made, but to determine *longitude* involves a knowledge of the local time and of the corresponding time in a "datum" meridian (Greenwich or Paris). The local time is determined by a solar observation, and the datum time is transported by chronometers,‡ so that latitude and longitude are simultaneously determinable, and thence the precise instantaneous position of the vessel. The accuracy of the results obtained depends upon that of the sextant and of the chronometers; but, in any case, the errors are not so cumulative as those of "dead reckoning."

Harrison's navigator's watch (1761-3) varied less than two minutes from correct time in a voyage of 147 days' duration, while Leroy and Berthoud's chronometers, of about the same date, kept the determination of longitude correct to 0.5°, six weeks after leaving port. Chronometers are still used for the transportation of datum time, and the advances of horology have evolved surprisingly accurate and compact instruments. Nevertheless, it is not easy to guarantee a knowledge of standard time, on long voyages, correct to within ½ second—this being a necessary and sufficient approximation in practice. For this reason it is usual to provide a check by carrying two, three or more chronometers, whose readings are carefully compared.

Again, land exploring parties must carry chronometers, if it be required to keep an accurate record of the route followed, and in this case the difficulty of transporting several instruments and preserving them from injury, by careless or curious native bearers, is enormous.

Whether on sea or land, the accurate determination of datum time has hitherto been costly, complicated and hazardous, but wireless telegraphy affords an avoidance, or at least a reduction of all

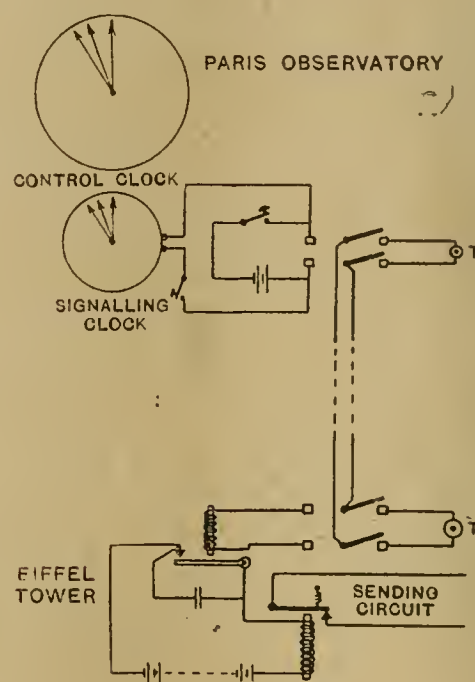


FIG. 1

three difficulties. The Eiffel Tower radio-telegraph station now despatches diurnal time signals, making possible the checking of all chronometers within the range of the transmitting station and greatly reducing the importance of the accuracy of these time-pieces.

"Wireless" Time Signals.—Though the possibility of the wireless transmission of time signals was foreseen in the earliest days of wireless telegraphy, the limited range of action of the latter and the time lag of "coherer" detectors made an immediate application quite impracticable. Later forms of detectors led to extended range of operation and instantaneous telephonic perception of

\* Notes compiled from similar articles in *La Lumière Electrique* and the Supplement to *La Technique Moderne*.

† Such is navigation by "dead reckoning"; the ship's position is determined on the chart by polar co-ordinates.

‡ No astronomical means of determining the "datum" time is sufficiently simple and accurate, under the conditions obtaining on shipboard.



signals, while a sufficiently powerful sending station is now to be found in the Eiffel Tower.

The French Central Marine Commission undertook experiments in 1907, which showed, among other things, that the Tower signals were received over a large part of the Mediterranean and the Atlantic coast of Morocco. The immediate effect of this observation was that Ferrié and Tissot carried out trial time signals between the Eiffel Tower and Brest (December, 1907). Chronometers at these two places were compared by aid of very short signals despatched at predetermined times. To approach conditions which would be likely to obtain in ordinary mercantile vessels, the experimental ship (anchored in the roads of Brest) was provided with a simple horizontal aerial, suspended some 20 metres above the deck. The high degree of accuracy with which the vessel's chronometers could then be compared with Paris time, proved that shipping could depend with certainty upon radio-telegraphic time signals. More ambitious trials were conducted under the supervision of Commander Guyon, with the final result that a regular diurnal series of time signals are now despatched by the Tower under the control of standard chronometers in the Paris Observatory. This service has been in continual operation since May 23rd, 1910, the morning signals, however, being only inaugurated on November 21st, 1910; mean Paris time is, of course, transmitted.\*

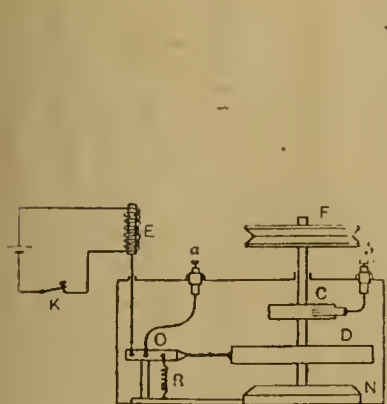


FIG. 2.

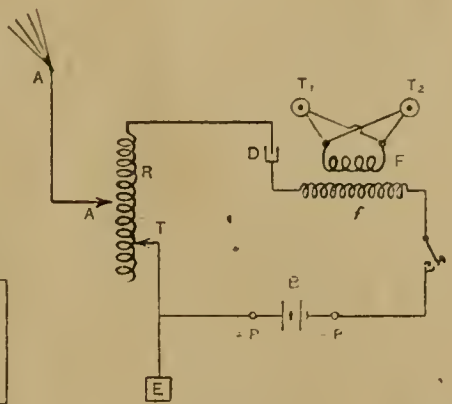


FIG. 3.

Two groups of signals are emitted:—(a) Warning signals: (b) actual time signals. To guard against vessels missing the warning signals and therefore failing to receive the actual time signals accurately, the latter are despatched thrice, at two-minute intervals, viz.:—At 11.0, 11.2 and 11.4 a.m. (day signals), and at 12.0, 12.2 and 12.4 a.m. (night signals).

The time signal is invariably a single short "dot," but the warning signals—ceasing two or three seconds before each time signal—are arranged as follows, so that confusion between the various time signals is impossible:—

At 11.0 a.m. (or 12.0 midnight): Long dashes — — — — —  
At 11.2 a.m. (or 12.2 a.m.): Dash, 2 dots, and so on — . . . . .  
At 11.4 a.m. (or 12.4 a.m.): Dash, 4 dots, and so on — . . . . .

The warning signals are sent by hand (key S, fig. 1), there being always an operator on duty at the Eiffel Tower and no great precision (of time) being required by these signals. The time signals, however, are despatched by the automatic arrangements shown in fig. 1, a duplicate subterranean operating cable being provided between the Observatory and sending station, and the correct working of the whole plant being tested some 15 minutes before each group of time signals.

In order to send out a time signal, a current of about 50 amperes must be temporarily established and then interrupted by a switch, relay-controlled from the Paris Observatory. This heavy-current switch is actually a converted mercury-jet turbine interrupter. As shown in fig. 2, a turbine N forces a mercury jet out through a pivoted nozzle O. Normally this jet clears the contact drum D, the nozzle being held down by the spring R, but, on exciting the coil E (from the Observatory, clock circuit), O is tipped and the mercury stream, impinging on the drum D, closes the main sending circuit. Directly the circuit of E is opened, the mercury jet is again diverted, and the "wireless" signal ceases. The mercury jet forms a non-arcing switch and is immersed in petroleum, alcohol or other dielectric liquid, to further ensure smart rupture of the main sending circuit.

It will be seen from fig. 1 that an appreciable time must elapse between the closing of the clock circuit at the Observatory and the emission of the time from the Tower. As this time lag is a constant amount, and as the time taken to propagate Hertzian waves (over the maximum range within which they can be received from the station), is negligible, it follows that the Observatory clock can be adjusted, once for all, to close its local circuit so much before 11 a.m. (or 12 midnight, &c.) that the actual time signal is heard thereafter, by all stations within range, at precisely the correct moment. This adjustment is made with the aid of a receiving station adjacent to the Observatory, and when effected, subsequent signals are emitted and received with an error certainly less than half a second (which approximation is amply sufficient, since 4 sec. represent one equatorial mile.)

*Receiving Time Signals.*—Any existing land or ship wireless telegraphy installation can, of course, receive time signals without any additional apparatus, and as the tentative experiments of Ferrié and Tissot showed the special equipment required by any vessel, not already furnished with "wireless" apparatus, is quite simple and need cost no more than £10—£20 at the most.

The antenna required will be higher, the further the vessel is from Paris, but an elevation of 18-20 metres suffices for distances up to 250-300 km. (155-190 miles). A special receiving circuit, used only for the reception of time signals, has the considerable advantage that it may be tuned, once for all, to be syntonic with the waves radiated by the Eiffel Tower, thus becoming specially suitable for unskilled handling as well as simple and cheap in construction.

Two specially designed types of receiver now in use employ:—(a) An electrolytic detector; (b) a solid contact detector.

*Type (a)* is represented diagrammatically in fig. 3. It must be noted that though the absence of a transmitting circuit in these special sets considerably simplifies their arrangement as a whole, it usually removes all possibilities of charging secondary cells for use in the local circuit of the receiving detector. For this reason, two Leclanché cells are employed in the arrangement of fig. 3. An electrolytic detector, consisting of a lead cathode and dilute sulphuric acid electrolyte is connected as shown; the back E.M.F. of this detector is very slightly greater than that of the two Leclanché cells in series, so that the circuit may be left permanently closed without any fear of electrolysis of the detector or polarisation of the battery. No potential box is needed in the detector circuit, and, since the battery only gives current, and that of infinitesimal strength, during the short time occupied by the warning and time signals, it requires no more attention than the occasional making-up of evaporation. The transformer *f*, *F* (fig. 3) compensates for the small diminution of sensibility incurred by applying to the detector a voltage slightly less than its back E.M.F., and, further, allows of the use of ordinary, cheap telephones (of, say, 150 ohms resistance), instead of the costly, specially high resistance receivers (about 7,000 ohms), generally employed in wireless circuits.

The syntonic resonator, *R*, connected in series with the battery and detector (to the positive of each), avoids the necessity for a condenser in the circuit, thus further simplifying the apparatus, without at all detracting from its efficacy.

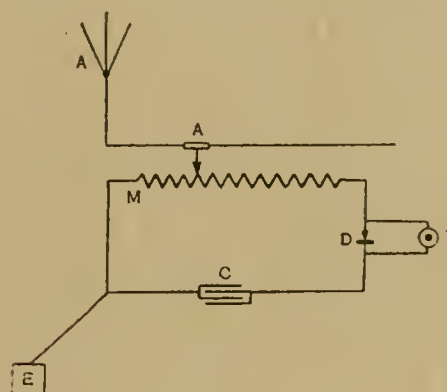


FIG.

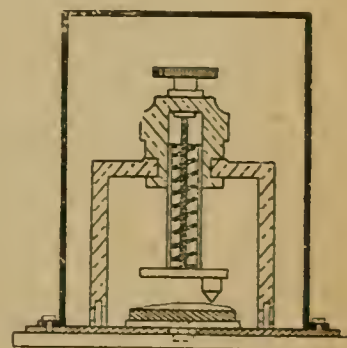


FIG. 5.

*Type (b).*—The great advantage of the following arrangement (figs. 4 and 5), is that it avoids the necessity for a local battery and "volt box" by the use of a rectifying, solid contact detector.\*

Referring to fig. 4, a rectangular Oudin resonator forms the secondary of the receiving circuit, and is once for all tuned to the wave length of the Eiffel Tower waves. The whole may be used with any aerial system, and the robust detector employed needs a minimum of care and skill in its manipulation. The primary of the resonator, connected between aerial and earth, consists of the turns between the cursor A and terminal M. By traversing the cursor A, the best receiving position is soon found, the closed resonant secondary circuit rendering tuning very sharp and allowing of the elimination of parasitic signals (by its very arrangement the receiver can only detect signals of the Tower wave length, a fact further obviating the risk of confusion).

Wherever the Eiffel Tower time signals can be received, a good watch keeps sufficiently accurate time, subject to this diurnal control, for all practical purposes: to facilitate comparisons between the watch or chronometer and the time signals, the former should be mounted as near as possible to the receiving apparatus. The present effective radius of transmission of the Tower—for such work as the above—is about 2,000 km. (1,250 miles), and will be considerably greater when the new station is in operation. As already explained, the utility of these diurnal time signals extends, not only to mariners and explorers, but also to towns far from an Observatory, to postal authorities, to railway companies and similar bodies and to individual experimenters and clockmakers.

*The Accurate Determination of Differences of Longitude.*—Though a single "dot" signal suffices to give a time notification accurate enough for ordinary navigating and similar purposes, it is insufficient to fix the precise value of a difference of longitude to that

\* Lead sulphide or galena, mounted in a brass cup, forms the fixed contact, while a piece of cast zinc oxide, mounted in a metallic capsule constitutes the adjustable contact. The latter is held down by a suitable spring and guide-piston as shown in fig. 5. The whole is protected by a brass shell secured by a bayonet joint, and capable of being turned through 30° in one direction or the other, to place the electrodes in or out of contact.

\* The German Norddeich station (at the mouth of the Elbe) has also instituted a service of time signals, the time transmitted in this case being that of the meridian of Greenwich. In March 11th, 1911 (some time after these notes were prepared), Paris time was put back 9' minus 21", and is now in agreement with Greenwich.



degree of accuracy requisite in cartographical and similar work. Instead of accuracy to within 0.5 sec., it is now required to make time comparisons correct to some hundredths of a second. This result has been attained by emitting a sustained train of Hertzian "dots," then applying the principle of *coincidences*, as below.

Two stations, A B, whose difference of longitude is required—for mapping or other purposes—or whose chronometers are to be accurately compared, are provided with second pendulums. At a

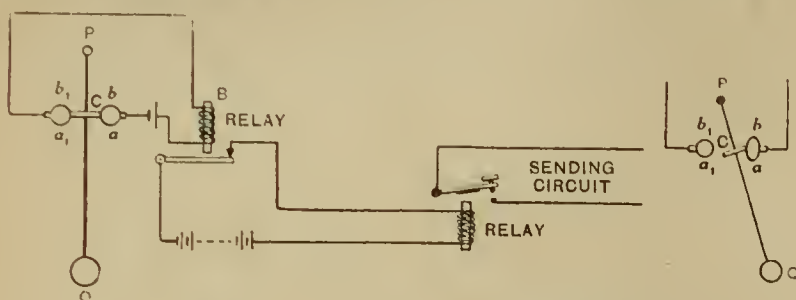


FIG. 6.

FIG. 6A.

third—reference—station (here the Eiffel Tower), a pendulum beating, say,  $1\frac{1}{100}$  sec., controls the "wireless" transmitting circuit, and thus sets up a train of "dots" at intervals of  $1\frac{1}{100}$  sec. (see figs. 6 and 6A).

Both stations A B hear these "dots" in their receiving telephone, and, superposed thereon, the beats of their own "local" clocks. The latter result is secured by mounting microphones in the cases of the clocks concerned; the microphone currents traverse an induction coil, the secondary of which is shunted across the receiving telephone (see fig. 8). Regulating resistances in the primary (microphone) and secondary (telephone) circuits, enable the local beats to be adjusted to the same quality and intensity as those of the Eiffel Tower—heard through the intermediary of wireless telegraphy.

Each observer, A B, will hear his local beats gain on, coincide with, and gradually recede from those of the Tower, this cycle being indefinitely repeated, and a coincidence of beats being heard whenever the faster pendulum gains one beat on the slower. These periodical coincidences form the basis of the whole method; they may be detected with great accuracy, and all each observer has to do is to count the number of Eiffel Tower beats between each coincidence, and note the time shown by the local clock at the occurrence of each.

Suppose, for instance, that A hears a coincidence at 10 hr. 7 min. 3 sec., after the Tower clock has beaten 182 times, and that B hears a coincidence at 12 hr. 17 min. 43 sec., at the 195th beat. Between these observations there elapses  $(195 - 182) \times 1.01$  sec. = 13.13 sec. Hence, when A's clock shows 10 hr. 7 min. 3 sec., B's shows 12 hr. 17 min. 43 sec. — 13.13 sec., i.e., 12 hr. 17 min. 29.87 sec.; similarly when B's clock shows 12 hr. 17 min. 43 sec., A's shows 10 hr. 7 min. 16.13 sec.

It is thus possible to determine, very accurately, the *simultaneous* local times in the stations A B, and thence, in the ordinary way, and to an equal degree of accuracy, the difference of longitude between the two places.

The origin from which the beats of the Tower pendulum should be counted is determined thus:—The pendulum is started at an approximately fixed time (determined in advance). After a certain time, an interrupter opens the relay circuit for one beat, thus missing one signal. The observers at A B note this interruption, and thence count 1, 2, 3, &c., starting on the next beat. At beat

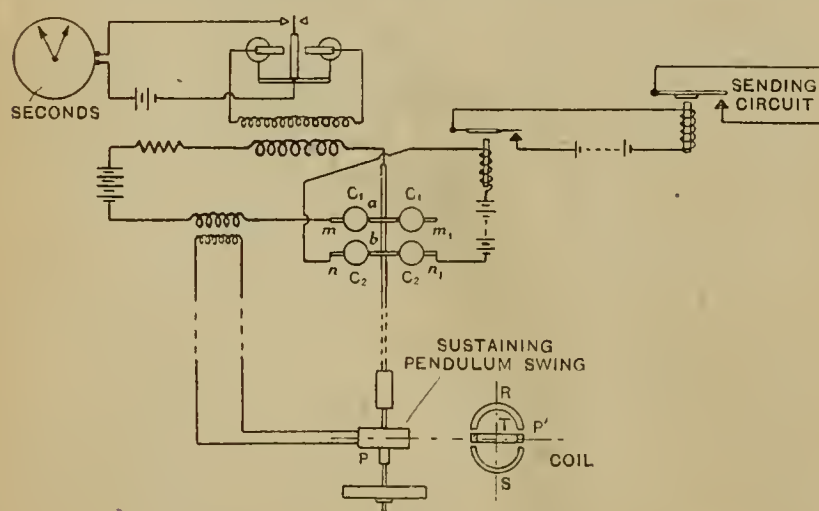


FIG. 7.

60 a further gap is created, and observers who missed the origin can thus pick up the sequence and go on 61, 62, 63, &c. At beat No.  $(120 + 10) = 130$  the sending circuit is again opened and further checking points are thus afforded from time to time, the interval between gaps being increased by 10 beats per gap. At whatever point an observer may "break in," it is possible for him to refer his observations to the true origin of the series of Tower beats, by noting the number of beats to the next gap and the succeeding interval between gaps.

The Eiffel Tower signals are controlled by an electromagnetically maintained Lippmann pendulum (figs. 6 and 7) adapted to its present use by the addition of two silver bars *a, b* (fig. 7) which

make contact with rings  $c^1 c^1, c^2 c^2$  of silver thread mounted on supports  $m n, m^1 n^1$ , which are capable of micrometric adjustment to vary the duration of the contact effected by the rings  $c^1 c^1, c^2 c^2$ . The latter ensure an even contact, of any duration requisite to ensure correct working of the relay R (which controls the mercury turbine contact maker, see fig. 2) and this without disturbing the correct oscillation of the pendulum. In order to reduce the delicacy of the latter, it is found advisable to use a half-second pendulum, making contact in the relay circuit once per complete oscillation instead of once per swing.

*Tests of the Above Method.*—Tests were initiated in January, 1910, by the collaboration of the Bureau des Longitudes, the Montsouris Observatory and the Eiffel Tower authorities. The preliminary tests showed that no personal equation was involved in the measurements, and that the time lag of the transmitting apparatus was sensibly constant. The maximum error in the observation of a coincidence was never greater than a single beat; and the mean of eight comparisons made by two observers agreed to within  $\frac{1}{100}$  sec., the mean error on a single observation being  $\pm 0.006$  sec.

These experiments were soon interrupted by the Seine floods (which disorganised the Eiffel Tower plant), but were resumed in

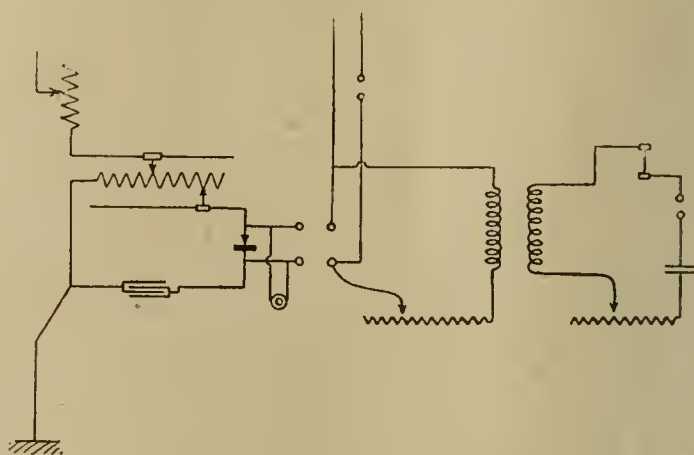


FIG. 8.

July, 1910, when the results already obtained were verified, the complete practicability of the whole scheme being so clearly demonstrated that the method is soon to be applied to cartography in Africa (see below).

The results obtained in the Montsouris-Brest trials were checked by the direct telephonic transmission of signals. The maximum discrepancies between the time comparisons,\* effected by telephone and by "wireless," were less than 0.01 second,† and it was found throughout that the wireless signals were received with greater ease and consistency than those transmitted over wires.

The wireless determination of differences of longitude (primarily, of course, differences of time) is highly convenient and accurate, and possesses the important advantage of making possible simultaneous comparisons between any number of pairs of stations within the range of the standard or reference station.

Large ports and inland towns are gradually being provided with wireless telegraph apparatus, and it does not seem too much to predict that in the comparatively near future, vessels on all the oceans of the world will be able to receive daily time signals and probably various meteorological signals, useful to the navigator. When within 200 or 300 miles, at least, of land they will be able to locate wireless "beacons" with an error not exceeding 2°. The dangers of lost bearings and of collision or shipwreck in fog or on dangerous coasts will be almost eliminated, and assistance will be summoned, in case of necessity, with maximum rapidity and certainty.

Again, starting from various wireless stations skirting unknown territory, the difference of longitude between these reference bases, and distant or inaccessible places (reached only by explorers and the required few observers with a simple portable wireless receiving apparatus, and a clock showing the time of the place), will be obtained with an ease and accuracy hitherto unattainable.

Various blanks in the map of Africa are soon to be filled in by this method. The Etablissement Militaire de la Telegraphie is at present organising a vast radio-telegraphic network in Africa. Stations at Rufisque and Port Etienne are already complete; stations at Dakar, Konakry and Monrovia are under construction, and schemes are on foot for stations at Loango and Brazzville, Tchad and Sénégal, Timbuctoo, Tabou, Kotonou and Grand Bassam.

This vast network will be completed this year and will result in a triangulation closing on Paris and the Navy and Administration des Télégraphes stations at Bizerta, Oran and Algeria.‡ No more striking instance could be quoted of the tremendous possibilities lying before wireless telegraphy—some known, but unutilised, many more probably yet to be conceived.

\* Mean Paris time and sidereal time at Brest.

† The telephonic comparisons agreed to within less than 0.003 second, while the more readily effected wireless comparisons agreed to within 0.009 second (maximum error).

‡ See "Syntony and Directive Wireless Telegraphy," ELECTRICAL REVIEW, December 15th, 1911, page 974.

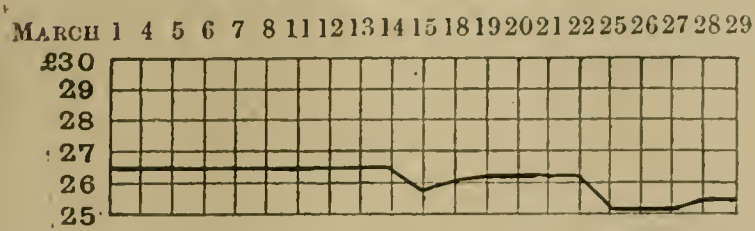
|| Measurements of the longitude differences Paris-Bizerta, Paris-Dakar, are to be commenced at once. The Rufisque station signals have been received at the Eiffel Tower, though the power employed is only 5 kw., and the route (4,700 km., i.e., 2,937 miles) is mainly over land.



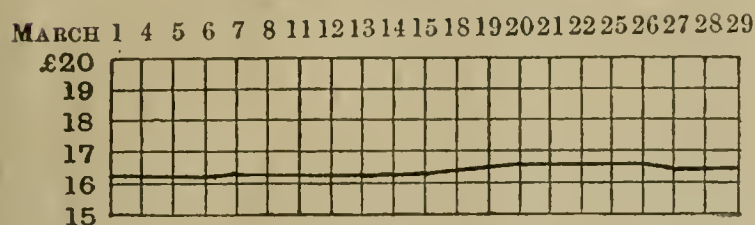
## METAL MARKET.

Fluctuations in March.

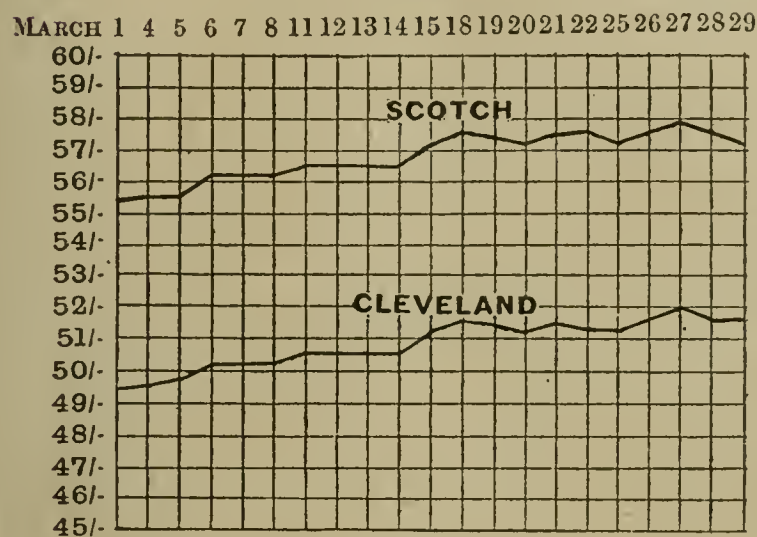
## SPELTER (G.O.B's.).



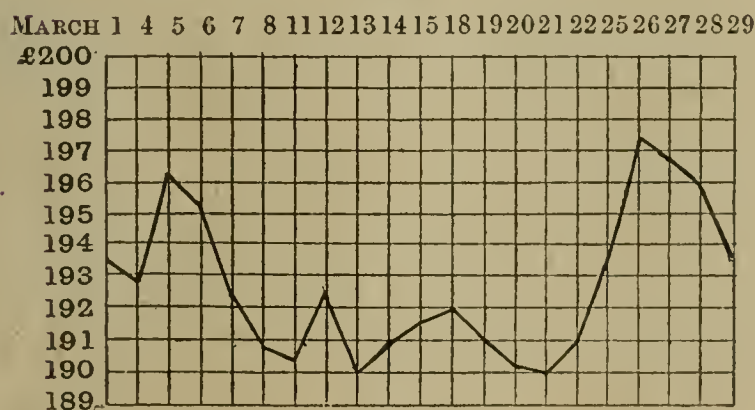
## LEAD (ENGLISH).



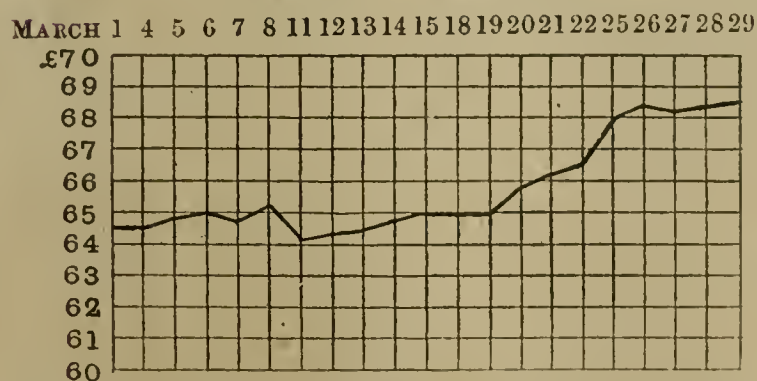
## IRON.



## TIN.



## COPPER (G.M.B's.).



**Agricultural Machinery Competition.**—An international competition of motor-driven agricultural machinery is to be held in Monte-Video from April to October this year, as the result of the efforts of the Ministry of Trade to further the use of agricultural machinery in the Republic of Uruguay. Some 60 motor ploughs are already in use, mostly supplied from England and the United States. A jury has been named, the chairman of which is Engineer Otto Kasdorf, the head of the testing department of the Agricultural High School, who has drawn up the regulations of the competition, which aims to be purely practical, the show element as far as possible being eliminated.—*Zeit. Oest. Ing. und Arkt.*

## LEGAL.

BAILEY v. WENDON

ON March 27th, before his Honour Sir W. L. Selfe, in the West London County Court, C. J. Bailey, electrical engineer, of 45, Grafton Road, West Kensington, sued James Wendon, of Fulham Palace Road, for £15, the value of a dynamo which he was detaining. The facts were that the defendant had let 158, Fulham Palace Road to a Mr. Lawrence, and about the end of August he sold to the plaintiff a dynamo of the Manchester type for £15. After the bargain was struck the machine was left with Lawrence to sell, plaintiff at the same time saying that he also would endeavour to find a purchaser. Some weeks passed by and Mr. Reginald Wicks, of 231, Kilburn Park Road, manager of the Paddington Tyre Company, hearing that the dynamo was for sale, offered £20 for it. When plaintiff and he went to 158, Fulham Palace Road to view the purchase, Lawrence had gone, after handing over all his debts and goods to the landlord, the defendant, in satisfaction of £139 rent overdue. When applied to to deliver up the dynamo, Wendon declined unless Lawrence was produced to say that the dynamo was plaintiff's. As that person could not be found, defendant stuck to the machine. After evidence, the jury found that the dynamo was the property of the plaintiff, and gave a verdict in his favour, assessing the value of the dynamo at £10, and awarding him damages. His Honour entered judgment for delivery up of the dynamo on the payment of £10, with the damages and costs on the lowest scale.

COOPER v. L.C.C.

ON Tuesday, March 26th, P. Cooper, an ironmonger, of High Street, Deptford, sued the L.C.C. for damages for injuries caused to him through the alleged negligence of defendants' servants. On July 14th last plaintiff was on his way to his Deptford premises, when, in crossing the road, he was knocked down by an electric tramcar near the Broadway, Deptford. The defence was contributory negligence on the part of the plaintiff, but the jury found for the plaintiff, with £300 damages. Judgment accordingly, with costs.

[Other Legal matter will be found in our "Notes" pages.]

**The Transfer of Municipal Works in Germany.**—A new phase of the question of electrical monopolies in Germany has now arisen in connection with electric supply works. As is well-known, various Federal Governments in that country have issued orders warning the local authorities against entering into agreements which would confer upon any firm a monopoly of the supply of installation materials, motors and accessories, lamps, &c., in respect of central or overland stations, whilst at the same time the Government officials have been instructed to refuse to sanction any agreements between local authorities and manufacturing firms which would result in the latter obtaining a direct or indirect monopoly. It is now of some interest to observe that the Saxon Ministry for Home Affairs has taken a further step by the issue of an order advising the local authorities who own electric supply works against the sale or leasing of the works to large electricity concerns. It is pointed out, in the first place, that if the communal works in Saxony should gradually decrease in numbers and pass into private hands, the danger would arise that the country would become dependent upon a few large private undertakings for the supply of current. In the course of time such dependence, both in connection with the fixing of prices for current and in other respects—as, for instance, the construction of tramways—would turn out to be very oppressive. The Ministry, therefore, wishes that all communal authorities and combinations of such authorities should clearly understand the serious consequences which would follow, and what great responsibility they would assume, if they took the step of disposing of their works to private companies. This situation would not be changed in any way by momentary advantages and financial relief, or by long term contracts in regard to the obtaining of current. By the sale of their works the communes might irretrievably surrender the important right of fixing the conditions for procuring electric power according to their own estimates. This right would become of greater importance in the future, as industries and small trades are adopting electricity in an increasing degree, and the requirements of individual households are constantly growing. The order proceeds to remark that if an electricity works has to contend with difficulties in the early years of its existence and requires financial grants in aid, this is not a sufficient reason for disposing of it to a private contractor. Works which have for a long time past yielded profits have also had to pass through such unfavourable times, and the interests of a distant future should not be forgotten in connection with present unsatisfactory annual balance-sheets. The Ministry does not wish to limit in any way the local right of self-government, but it is desired that the local authorities should recognise more than hitherto that they have to defend this right also in relation to private enterprise. It is considered that the reasons adduced in the order against the sale of supply works are equally applicable to the leasing of works, as, after the expiration of the lease, especially if it extends over several decades, the lessor for technical and economic reasons would never again be able to take over the working of the undertakings.



## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**NEW ZEALAND.**—The New Zealand Customs Authorities have decided that the bar dial bridge (a Wheatstone bridge) shall be dutiable at the rate of 20 per cent. *ad val.* if of British origin, and at the rate of 30 per cent. *ad val.* if of foreign origin.

The New Zealand Minister of Customs has issued an order to the effect that every entry for *ad valorem* goods imported into the Dominion shall have endorsed thereon, or shall be accompanied by, a declaration in a prescribed form, and that such declaration shall be signed by the person making the same in the presence of one of the undermentioned persons, viz.: a collector of customs, a proper officer of customs acting for such collector, a postmaster or a Custom House agent. The form of declaration is to be filled up as directed by or for the importer of the goods and no declaration will be deemed sufficient to enable an entry to be passed at the Customs until so filled up and until every alteration or correction thereon has been initialled by the declarant and by the person before whom the declaration is made.

**SOUTH AFRICA.**—The South African Customs Authorities have decided that electric detonators and fuses are to be dutiable at the rate of 15 per cent. *ad val.* if of foreign origin, and at the rate of 12 per cent. *ad val.* if of British origin.

**AUSTRALIAN COMMONWEALTH.**—The Australian Customs Authorities have recently issued the following decisions as to duties to be levied on certain electrical and similar goods. In all cases the duties quoted are those under the British Preferential Tariff:—

Glass globes with metal neck and cap perforated to admit electric wires. (Used to protect electric lights in exposed places.)	10 %
Automatic switch with overload coils and transformers attached	Free.

**CORSICA.**—A Bill has recently been laid before the French Chamber of Deputies and referred to the Customs Commission, proposing to modify the existing Customs régime in Corsica. This Bill provides that foreign products shall, on importation into Corsica, pay the same rates of duty as those leviable in France. At present, goods are dutiable at rates leviable under a special Corsican tariff which although framed on the French tariff, is not absolutely identical.

**SALVADOR.**—A Decree has recently been issued by the Salvador Government reducing the surtax on imported goods in general from 20 per cent to 14 per cent. This Decree was to come into force 60 days after its publication, which took place on September 19th last.

**PANAMA.**—The fee payable to Consuls of Panama for certifying a set of bills of lading, has been reduced from three dollars to one dollar in cases where the value of the goods entered on the bills does not exceed 100 dollars.

**GRENADA.**—The Grenada Government have recently promulgated a new Customs Tariff. Under this tariff the duty to be levied on "unenumerated articles" has been raised from 7½ per cent. *ad val.* to 10 per cent. *ad val.* This duty would apply to most electrical and similar goods which are not admitted free of duty (see statement as to the duties on electrical goods in Grenada published in the ELECTRICAL REVIEW.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 6,624. "Multiple control of electric motors." R. RICHTER and MAFFRI-SCHWARTZ-KOPFF WERKE G.M.B.H. (Convention date, April 21st, 1911, Germany.) March 18th. (Complete.)
- 6,639. "Selective electric signalling on omnibus circuits." G. H. CROOK. (Addition to 8,233/1911.) March 18th. (Complete.)
- 6,640. "Selective electric signalling on telephone exchange party lines." G. H. CROOK. March 18th.
- 6,645. "Electric medical appliance." E. T. BRAARUP. March 18th.
- 6,647. "Alternating current electricity meters." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, March 18th, 1911, Germany.) March 18th. (Complete.)
- 6,650. "Electric ear trumpet." J. GREEN. March 18th.
- 6,653. "Automatic arrangement for giving a small and a large gear ratio between two shafts for starting internal combustion engines with small electric machines." P. L. R. FRASER. March 18th.
- 6,655. "Vapour electric apparatus." M. A. E. LEBLANC. March 18th.
- 6,656. "Remote control electrically operated lock." G. W. PEARSON. March 18th.
- 6,670. "Suspension of overhead conducting wires for electric railways." A. G. BLOXAM. (Bergmann-Elektricitäts Werke Akt.-Ges., Germany.) March 18th. (Complete.)
- 6,673. "Switches combined with plug terminals for electric circuits." W. E. WATSON. March 18th.

- 6,716. "Distance operated mechanisms and signals on electric supply systems." H. W. HANDCOCK. March 19th.
- 6,752. "Electrical signs." T. PYBUS. March 19th.
- 6,758. "Batteries." W. C. BANKS and R. C. WOOD. March 19th. (Complete.)
- 6,763. "Electrical heating apparatus." L. G. BYNG and J. H. COLLINGS. March 19th.
- 6,772. "Electrostatic separating devices for sorting heterogeneous materials, more especially minerals, metallic and others, sulphur, phosphates of lime, and like materials." A. M. F. BLANCHARD. March 19th.
- 6,778. "Tungsten or the like metal filament and a process of manufacturing the same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany.) March 19th.
- 6,785. "Primary batteries." T. A. TAYLOR and T. H. JONES. March 19th. (Complete.)
- 6,803. "Electrical distribution apparatus." J. BIJUR. March 19th. (Complete.)
- 6,807. "Electric arc lamps." G. E. TATE. March 19th.
- 6,828. "Electric governors for engines." S. RUMOLINO. (Addition to 29,754, 1909.) March 19th. (Complete.)
- 6,832. "Callendars for use in connection with telephone instruments." F. S. POCOCK, E. S. SIBUN and L. G. CROOK, trading as Pocock & Sibun. March 19th.
- 6,857. "Wind-driven electric generator apparatus." J. L. NOBLETT. March 20th.
- 6,882. "Method of restraining the augmentation of an electric current and contrivance therefor." A. N. HAZLEHURST and LONGSTRETHS, LTD. March 20th.
- 6,889. "Graded service automatic telephone system." H. BARON. March 20th. (Complete.)
- 6,918. "Method of and apparatus for making incandescent lamp bases and the like." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) March 20th.
- 6,920. "Conduits for electrical cables and the like." M. KAHN. March 20th.
- 6,922. "Safety apparatus for electrically-propelled trains." SIEMENS BROS. DYNAMO WORKS, LTD., and F. LYDALL. March 20th.
- 6,946. "Cover for electric arc and gas incandescent lamps to prevent dust nuisance during cleaning operation." S. A. MOSS and A. G. MOSS. March 21st.
- 6,961. "Connection box with revolving contacts." L. M. WATERHOUSE and SIMPLEX CONDUITS, LTD. March 21st. (Complete.)
- 6,962. "Apparatus for the generation of electricity from the motion of currents of water." A. VISSER, J. H. DE GOEDE and J. DE VEEN. March 21st. (Complete.)
- 6,977. "Apparatus for indicating speeds at a distance." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) March 21st. (Complete.)
- 6,988. "Inductor alternator." E. PODLESAK. March 21st. (Complete.)
- 6,990. "Reverse current relays." E. MÖLLER. March 21st.
- 7,014. "Relays for electric control systems." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) March 21st.
- 7,014. "Continuous current electrical machines without commutators." F. MACKINTOSH. March 22nd.
- 7,053. "Electrical resistance used for heating purposes." F. B. COX. March 22nd.
- 7,055. "Electric motor controllers." J. W. GIBSON and J. H. GIBSON. March 22nd.
- 7,056. "Lamp pillars for electric lighting." J. SOUTHALL. March 22nd.
- 7,057. "Electric and other lamps and their attachments." J. T. DALLAWAY. March 22nd.
- 7,087. "Electric lamps with concentrated illuminating effect." H. HIRSCH. March 22nd.
- 7,096. "Cam regulating mechanism." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Elektrizitäts Ges., Germany.) March 22nd.
- 7,097. "Method of fixing contacts to springs and the like for electrical purposes." TELEPHON APPARAT FABRIK E. SWIETUSCH & Co. G.M.B.H. (Convention date, March 22nd, 1911, Germany.) March 22nd. (Complete.)
- 7,100. "Telephone systems." E. A. MELLINGER. March 22nd. (Complete.)
- 7,102. "Electric couplings." J. MAY. March 22nd.
- 7,115. "Switch for controlling electric circuits." H. S. BENSON. March 23rd.
- 7,133. "Electro-mechanical transmission systems for vehicles." H. PIEPER. (Convention date, April 29th, 1911, Germany.) March 23rd. (Complete.)
- 7,135. "Arrangement for starting groups of electrical machines consisting of a synchronous and an asynchronous machine connected in cascade with it." W. P. THOMPSON. (Ateliers de Constructions Electriques de Charleroi, Belgium.) March 23rd. (Complete.)
- 7,137. "Means for supporting electric lamps." L. G. BYNG and J. H. COLLINGS. March 23rd.
- 7,145. "Switches for electric circuits." I. DEUTSCH. (Convention date, March 23rd, 1911, United States.) March 23rd. (Complete.)
- 7,146. "Electrically operated switches." R. WIKANDER. (Convention date, March 23rd, 1911, United States.) March 23rd. (Complete.)
- 7,147. "Electromagnet apparatus." H. A. LEWIS. (Convention date, May 22nd, 1911, United States.) March 23rd. (Complete.)
- 7,148. "Electric incandescent lamps." R. H. HENDERSON. (Convention date, March 23rd, 1911, United States.) March 23rd. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

SYSTEMS OF ELECTRICAL TRANSMISSION. H. LEITNER. 27,395. November 24th.

### 1911.

- DEVICE FOR SUPPORTING OR SUSPENDING ELECTRIC LAMPS AND THE LIKE. G. P. Kent and A. R. Mitchell. 4,491. February 22nd.
- ELECTRIC CIRCUIT CONTROLLING APPARATUS FOR TRAIN LIGHTING AND SIMILAR SYSTEMS. Electric and Ordnance Accessories Co., E. H. M. Langley and F. W. Price. 5,005 and 5,012. February 28th.
- ELECTRIC TRANSFORMERS. A. E. Berry. 5,190. March 1st.
- TRANSMISSION OF LIGHT PICTURES IN ELECTRICAL TELESCOPIC AND SIMILAR APPARATUS. B. Rosing. 5,486. March 4th.
- AUTOMATIC REGULATING DEVICES FOR ELECTRIC SUPPLY SYSTEMS. H. Lake. (United States Light and Heating Co.) 7,530. March 26th.
- CONTROLLERS FOR ELECTRIC MOTORS. British Thomson-Houston Co. and N. Wise. 8,238. April 3rd.



THE

ELECTRICAL REVIEW.

Vol. LXX.

APRIL 12, 1912.

No. 1,794.

ELECTRICAL REVIEW.

THE MINIMUM—AND AFTER.

Vol. LXX.]	CONTENTS: April 12, 1912.	[No. 1794.	Page
The Minimum—and After...	...	...	569
"Coalite" ...	...	...	570
Gas Direct from the Coal Mine ...	...	...	571
The Compulsory Working of Patents ...	...	...	571
Passenger Transport ...	...	...	572
Fraudulent Tests ( <i>concluded</i> ) ...	...	...	573
Some Notes on Table Standards ( <i>illus.</i> ) ...	...	...	573
Notes from Canada ...	...	...	574
Correspondence:—			
Tests of Metal-Filament Lamps ...	...	...	575
The Education of the Engineer ...	...	...	575
Irish Peat ...	...	...	575
The International Smoke Abatement Exhibition and Conference ...	...	...	576
Proceedings of Institutions:—			
The Electric Driving of Rolling Mills ...	...	...	577
Physical Society ...	...	...	578
The Faraday Society ( <i>illus.</i> ) ...	...	...	578
Domestic Electricity ...	...	...	579
Legal ...	...	...	579
Business Notes ...	...	...	581
The Sterling Telephone Works, Dagenham, Essex ( <i>illus.</i> ) ...	...	...	587
Notes ...	...	...	592
City Notes ...	...	...	595
Stocks and Shares ...	...	...	598
Market Quotations ...	...	...	598
Share List of Electrical Companies ...	...	...	599
Reviews ...	...	...	601
Some Thoughts on Publicity ...	...	...	602
The Trouble with the Electric Cooker ...	...	...	604
Electrical Law in the British Dominions ( <i>concluded</i> ) ...	...	...	605
5,000-kw. Curtis Turbo-Alternator ( <i>illus.</i> ) ...	...	...	607
New Patents Applied For, 1912 ...	...	...	608
Abstracts of Published Specifications ...	...	...	608
Contractors' Column...	Advertisement pages xxii and xxiv		

THE great coal strike is ended, by order of the Council of the Miners' Federation, and by the time this issue is in the hands of our readers we hope most of the miners will have returned to work, in spite of their ballot vote being in favour of continuing the strike. The leaders, indeed, saw the uselessness of continuing the war, and expected the miners' ballot to be in favour of the men accepting the Act: but, as the reverse actually happened, it was necessary to call a full meeting of delegates and to take a card vote, which resulted in a majority of 3 to 1 in favour of resumption of work, and consequently the men got orders to resume. The question naturally arises why the ballot of the men was ever taken, as, if the meeting on Saturday last could determine the matter by taking a card vote, clearly this could have been done over a week ago, and much valuable time saved. The truth is, of course, that the leaders wished to throw the onus of accepting the Act, without a money value being included, upon the men themselves, and thus to relieve themselves of any responsibility. It is, however, only a question of time when they will have to face a serious reckoning: and in the meantime it may be interesting briefly to review the position and what may be expected in the near future, because, far from settling the unrest in the coal trade, we believe the Minimum Wage Act will be the cause of greater friction between miners and owners than any of the old methods of settling disputes, which will now be superseded by the "District Wages Board."

In the first place, the actual cause of the strike, undoubtedly, was the working of the Eight Hours Act, which was passed by the Government practically at the dictation of a few Labour leaders, and which resulted in more men being employed to obtain practically the same output of coal as was obtained previously to the introduction of the Act. We have mentioned this before, and it is interesting to note that this fact is now admitted by Mr. Brace, one of the men's leaders, who stated a few days ago that the men had not been able to obtain such good wages since the passing of this Act as they did before. Naturally, if more men are to be employed to do the same amount of work for the same amount of wages, someone will have to go short, and the men begin to complain. In a word, the miners had been badly treated by their leaders, and to save their own skins they had to look out for some remedy. Hence the "abnormal place" question—which was always a convenient one for raising a dispute—was resurrected and placed upon a pedestal for all to see, but unfortunately for the leaders it would not bear investigation, and the owners were ready, as they always have been, to consider any machinery to overcome this difficulty. Failing in this, they next demanded the minimum daily wage for all underground workers, telling miners that what was

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION  
of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street.

TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. BERLIN: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION      READY.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.



wanted in addition to the Eight Hours Act was a fixed daily wage, and persuaded the individual that all he had to do was to strike for it. The men were asked to vote for the *principle* of a minimum wage, and many of them imagined that the *principle* really meant the 6s. to 7s. 6d. per day, according to the district; further, the majority of the men believed they would get this wage *irrespective of the amount of work they did*. This may seem incredible but it is true nevertheless, and the ordinary acceptance of the meaning was tritely given by the Northumberland pitman who explained: "The minimum wage is for gannen doon th' pit, and if he dis ony work he gets mair." Hence it appealed to the good workman as well as the poor one, for, as Lord Furness has already pointed out, if the poor workman were to get 6s. or 7s. per day, naturally the better workman would expect his earnings increased by a corresponding amount; and the result was the strike which has just ended.

Then came the period of negotiations between the Government and the Labour leaders, for it must be noted that all through the conferences the owners only received bare courtesy, and had finally to break off negotiations in absolute disgust when Mr. Smillie brought forward his famous *dicta* of 5s. 9d. and 3s. in place of what had become known—and was almost, we believe, agreed upon—as the 5 and 2 minima, the former being the 5s. datal wage for men and the latter the 2s. datal wage for boys of 14 years of age. That the Government did the right thing in trying to bring the two parties to an agreement no one, we imagine, will deny, but undoubtedly a great error of judgment was made in truckling to the demands of the Labour Party, at the expense of the owners and the community at large, by bringing in a Bill to enforce a minimum wage; in the opinion of many, which we share to a large extent, had it not been for this promise the strike would probably have ended sooner. There is, we think, now no doubt but that the great majority of miners fully believed that the scheduled rates of the districts for coal-getters would be included in the Bill. As it is, they have obtained nothing; or rather, they have obtained what they voted for, the *principle* of a minimum wage, which may mean anything. One thing, however, is certain: the trouble, far from being removed, will be very considerably enhanced when the district boards are set up and begin proceedings, as, whatever decision may be come to, there is little likelihood that it will suit the miners, and the owners are disgusted with the Act, owing to the omission—in spite of the definite promise of the Government to the contrary—of adequate safeguards against abuse by the miners. It was this very point which prevented the Federated Owners' and Miners' Associations from coming to an agreement long ago; yet the Government had so little confidence in themselves that they dared not make it part of the measure. Another point of dispute is the amendment introduced by Mr. Buxton in Clause 2, setting forth an instruction that the Joint Boards shall have regard to the *average* daily rate of wages in settling the minimum for any class of workmen. The Government promised the owners that the words would be "the *prevailing* daily wage rate," which is a vastly different thing to the average rate; but, as the miners' leaders would not agree to this, it could not be inserted. For instance, if a miner under present circumstances can only earn, say, 4s. per day,

unless the minimum is below this there will be no incentive to this man to work at all; and supposing the minimum is 6s., the man who, on most days, earns little more than this has the incentive to relax his efforts and be content with the minimum of which he is assured. In these circumstances we may assume the management will dispense with the 4s. per day workman, as his employment would mean on a 6s. minimum a loss of 2s. per day; for otherwise, once a principle like this held sway, there would be an end to profitable industry.

It may be taken, therefore, as a foregone conclusion that whatever minimum may be decided upon in any district, any workman who at present fails to reach that minimum will either be dismissed by the management or will have to have his case specially considered by the District Board, and a special rate made to suit his individual case, and this will lead to endless strife and dissatisfaction, as undoubtedly the Union officials will do all they possibly can to enforce the payment of the minimum average rate.

The worst feature to be feared, however, of the "average" minimum wage is the demoralising effect upon the majority of fair workmen, who may not think it worth their while to put sufficient effort into their work to secure something more than the minimum, and who will become mere day-wage men instead of pieceworkers: this will react upon the community at large, as undoubtedly the output will decrease, the cost of production may enormously increase, and the selling price of coal will be considerably higher than it has been in the past. So far as we can see the Bill will benefit no one, and least of all the miner himself.

---

#### "Coalite."

It is not often that the shareholders in any company are treated to such a frank and unvarnished statement of its financial affairs as that presented by Mr. James Todd to the shareholders of the British Coalite Co. on Tuesday, March 27th, on the occasion of the adjourned general meeting, at River Plate House, Finsbury Circus. The chairman had to announce to the shareholders that the company, which was founded in 1907 with a nominal capital of £2,000,000, and a subscribed capital of £580,000, had lost between £444,496 and £552,212 of the latter sum, as a result of the past four years' operations, the details of expenditure being as follows: Plant and buildings, £218,591; formation expenses, £85,809; debenture issue and discounts, £13,190; loss on operation of plant, £129,905; total, £444,496; to which must be added a contingent liability of £107,715 if a compulsory realisation of the company's assets should occur. Those who favoured the compulsory winding-up of the company were defeated at the adjourned annual meeting held in July, 1911, the board being of opinion that it would be wiser to wait a little longer before taking this drastic action. The present chairman naturally made some very scathing remarks upon the past management of the company's affairs, and declined all responsibility for the present position. The formation expenses of £85,809, and cost of debenture issue £13,190 (equal to 17½ per cent. of the principal sum received), show that there was a scandalous transfer of fees and commissions to the pockets of promoters, underwriters, and "experts," in the early stages of this company's history, and that the remarks made in our article of October 7th, 1910, upon "Coalite Management and Finance," were thoroughly justified. Drastic reforms are now in progress, but it is doubtful whether they are not too late.

The Board of the company have cut down the adminis-



trative expenses to £500 per annum; the directors are at present drawing no remuneration, and are simply waiting for the results of the extended trials with an improved process which is being financed by a subsidiary company, the "Eticoal Syndicate," before deciding whether to wind up the British Coalite Co. or to continue its operations. This syndicate has taken over the plant at Barking, and it is stated that from September until the middle of January (when the threatened coal strike caused some difficulties) the operations were continued at a profit, 60 per cent. of the coal put into the retorts being delivered, as against 40 per cent. by the original "Coalite" process. We shall be only too pleased if the new process realises the hopes of the Board, and serves to rehabilitate the company. Our criticism has been directed, not against "Coalite" or any other smokeless fuel, but against the excessively bad management and finance that have marked the history of the British Coalite Co. We are glad to see that Mr. Thomas Parker, the inventor of the process, cleared himself of all participation in the past mismanagement of the company's affairs at the meeting, and stated that he had never received any money for the patents, and had underwritten 10,000 shares, which he still held. He was re-elected a director of the company. Sir William Preece, the other director who retired this year, did not seek re-election, and we are glad that he has at last severed his connection with this unfortunate company.

#### Gas Direct from the Coal Mine.

SIR W. RAMSAY'S suggestion, to cease coal mining and to fire the seams *in situ* and bring up the resulting products in the form of gas, is, no doubt, startling, but none the less interesting. There appears to be no impossibility in the operation, though there are many difficulties. To begin with, there is no limit to the thinness of the seams that can be worked. It would probably be deemed necessary to work or burn out the upper seams first, just as is done in ordinary present-day mining, where the lower seams, if worked before the upper ones, would cause so much shattering of the ground and of the upper coal, that this could not afterwards be got.

In order to gasify a seam of coal it would be necessary to start a fire and supply air down a shaft and draw the gas out by a second shaft. Were these two shafts at all near to each other, the admitted air might start an intense fire and produce complete combustion, only CO<sub>2</sub> being given off. Apparently what would be needed would be a central air-admission shaft, and on the borders of the area gas outlet shafts. Much preliminary work would be necessary. Headings would be required to enable the air to travel. The question is, would such air be properly converted to monoxide at a rational efficiency of conversion, not productive of too great a percentage of dioxide? Would the burned-out areas fall in and stop the travel of the air and gas? Would it be necessary to brick these air ways so as to ensure freedom up to a point, and, if so, how close together would such headings be necessary?

Again, would it be difficult to know if the whole of the coal had been burned out of a given area? And if not burned out, is such coal to be lost? Assuming it possible to carry out the scheme, the possibilities of economy are great. Lost areas of coal, too small to recover by present means, would become available. For dealing with small areas, mere small boreholes would suffice to admit air and give back gas.

At first thought it all sounds very simple, but on further study one encounters water difficulties. Water would effectually quench the great gas producers. How are the areas to be drained? Gas can be produced if the coal can be reached by air. It is true that when a seam of coal now gets afire, it appears to get air enough to keep it going for years at a more or less rapid rate. But the perversity of

accidental fires always has been extraordinary, and difficult to understand to the man who has failed with the best of igniters to start a domestic fire, and it can hardly be anticipated that this perversity will not extend to a wished-for coal seam conflagration. Given that some such scheme of headings and a control shaft proved to be practicable, it is not impossible to agree that it might be practicable to control an underground fire. This desirable possibility would depend upon the maintenance of breathable air from the down-cast towards the fire area. With an uninterrupted flow of air from the downcast, the fire could be followed to any point by tunnelling towards it. We believe that the floor and roof of old mine drifts sometimes meet so closely as to destroy all passage-way, even for air. It is difficult to imagine how a burned-out seam can do otherwise than close up absolutely. If the fire would obligingly travel evenly after the manner of a "long-wall" system of getting, the roof might close up a few feet behind the fire face, and all would be well.

The subject is one that admits of a vast amount of engineering thought and speculation. Meantime, and pending a solution, would it not be well that engineers should look into the question of gas production about the base of the shaft? Coal, as got, could be converted into gas and would, so to say, lift itself to the surface by gravity difference, and at the surface the gas could be relieved of its by-products and used to generate electricity. This course is perfectly practicable, though it would not dispense with coal hewers, whom Sir W. Ramsay threatens with extinction. It is reported that the Ramsay system, as we will call it, is to be put to the test in a small pit in Wales, and the results will be awaited with interest.

#### The Compulsory Working of Patents.

It was always believed that the Act which compels a patentee to "work" his invention in this country as a condition of retaining his monopoly would give rise to some curious cases. Experience has shown that this belief was well founded. Certain facts which led to a recent decision by Mr. Justice Parker show how the Act might be made an engine of oppression to the unfortunate patentee, were it not that the Courts have a dispensing power. It appeared that in 1904, one Taylor obtained a patent for "Improvements in and relating to Mechanical Underfeed Stokers." In 1899 a patent had been obtained for a somewhat similar device known as Deeley's patent, which is now being worked in this country. In 1908 it was decided in the United States that Deeley's patent was the master patent, and that Taylor's patent could not be worked in that country without infringing Deeley's. In these circumstances, Taylor's patent had not been worked in England, and the proprietors of the master patent accordingly applied for the revocation of Taylor's on the ground that it was not being worked as required by Sec. 27. The Comptroller decided that Taylor's patent should be revoked. On appeal, Mr. Justice Parker pointed out that the onus was upon the proprietors of Taylor's patent to show sufficient reason why it should not be revoked. Those who applied for the revocation said that a compulsory licence ought to be applied for, to work their patent, but did not say that they would grant a voluntary licence. In these circumstances it was for the Court to say whether there was sufficient reason for not working. "The Court," said the Judge, "is bound to look primarily at the interests of the public. It is impossible to see what else the appellants could have shown in answer to the application for revocation. Without laying down any general rule, it must be said that in this case the non-application for a voluntary or compulsory licence is not a sufficient reason for revoking their patent, when nothing they could have done in the way of working the patent here could have been done without the risk of proceedings against them for infringement." In the event he made an order that the patent should not be revoked, without prejudice to any future application for revocation.



## PASSENGER TRANSPORT.

THE author of a long article in our contemporary the *Westminster Gazette* optimistically claims the whole field of passenger transport for internal-combustion engines. Particularising main-line railway working, he proceeds to embellish his claims and prophecies with a number of irrelevant statements and misstatements and numerous serious flaws of reasoning, meanwhile adopting a laxity and extravagance of language which, even in columns designed for lay perusal, is ill-suited to its subject.

The opening paragraphs idealise a 10 minutes' service to and from every centre of importance in the kingdom, and the consequent abolition of the time-table (which is much less of a worry to "every enterprising manager" than the author would have us believe). Passing over, for a moment, the absurdity of a 10 minutes' service on long-distance main lines, we are informed that electricity has been superseded by "a more agreeable and economical prime mover."

"And this new and economical power that railway directors and shipowners and the rest of the world whose interests are vested in commerce have been expecting and waiting so long for, has at length been discovered in the form of the latest developments of the internal combustion engine—that self-contained power in a nutshell device—which in the year 1912 brings us to the parting roads in power sources in its application for railway work."

Leaving this interesting statement to the mercy of our readers, we certainly cannot agree that the gas engine is replacing the steam engine "in every department where power is used"; a 3,000-H.P. gas engine still evokes as much interest as a 30,000-H.P. steam turbine, and, in the event of main-line electrification—at present or at any time in the reasonably remote future—internal-combustion engines would no more be used in preference to steam turbines than "the mammoth generators would go on supplying current just the same whether 50 or 500 trains were in use." (Comment on such heart-breaking ignorance as is exemplified by this gem is as unnecessary in these columns as protest seems, in any place, futile.)

We see no connection between the number of horse 'buses replaced by motor vehicles and the problems of railway working. The electrically-driven tramcar has certainly not "been beaten by the internal-combustion engined omnibus in the first years of its existence," and the future which the writer claims for motor-'buses will far more probably be realised by the electric trolley-'bus. In any case, main-line problems cannot be considered by reference to the conditions and results of highway transport. Questions of traffic-dodging, route-changing and passenger-landing do not arise in railway working, and, in place of vehicles of 5-10 tons weight, driven at 8-12 M.P.H. by 20-40 H.P. engines or motors and stopping every few hundred yards at most, we have, on main-line railways, to consider the propulsion of 300-600 tons at 50-70 M.P.H. (necessitating 800-2,000 H.P.), with many miles between stops.

Equally pronounced are the distinctions between the conditions of suburban and main-line operation—a point which the *Gazette* writer apparently fails to realise. It is safe to prophesy that city and suburban railways can never be worked by internal-combustion engines, for, though a satisfactory transmission between the engine and driving wheels were obtained, it would still be necessary to provide on each locomotive that enormous, temporarily-required accelerating power which is so readily provided by the central station in electrical schemes.

Main-line conditions—long-distance runs at fairly constant speed—are essentially favourable to working by self-contained locomotives; but, even here, Continental experience has proved the great practical advantages of electrical operation. The capital cost of electrification is admittedly high, but the efficiency of service is greatly enhanced, and the overall working costs are greatly reduced. Internal-combustion engines of a size and form suited to main-line requirements have still to be evolved, and, even for small powers, the problem of providing a variable-speed-and-power transmission, comparable in simplicity and efficiency with those used by steam and electric locomotives, has yet to be solved. The capital cost of replacing steam by gas or oil

locomotives would be very considerable, and an exorbitant depreciation would have to be allowed on the engines, while there is no reason to suppose that the wear and tear on permanent way would be any less than under steam or electric operation.

The writer loosely speaks of the use of crude-oil fuel in internal-combustion engines without taking into account the great difficulty—indeed, present impracticability—of utilising such material in engines suitable for traction work. This being so, he appears to have burnt his boats by the candid admission that "petrol at 6½d.-7½d. per gallon is hardly a commercial proposition"! On economic and engineering grounds alike, there is not yet available an internal-combustion engine capable of competing with steam or electric locomotives.

We fail to see why the fact that "electricity as a prime mover needs another prime mover" should involve the failure of electric main-line working. Electric generators are not "of themselves power-creating," but neither are internal-combustion engines; nor, indeed, anything under our control. Latent energy is available in coal, oil, and gas, and the use of a central station with engine-driven generators and transmission lines merely adds a few links to the chain of processes whereby this energy is applied to the driving wheels. The overall efficiency of the more involved procedure is so high, and the security of supply, reserve power capacity, and numerous incidental advantages, are such as to counter-balance the lower capital cost of all "self-contained" locomotives. "Our present railway development has been achieved with independent power units and not with central power stations," but it does not follow that the former arrangement is the more satisfactory.

Reverting to the proposal for a 10 minutes' service on main lines—which could, of course, *per se* be provided by trains of any length or by single coaches electrically operated, with full retention of the advantages of electrification—it is surely obvious that the scheme is ridiculous, in that it is totally unwarranted by traffic requirements. A person wishing to travel from London to Manchester is quite prepared to consult a time-table on the subject, and to arrange his plans to suit the railway service, in so far as the latter, arranged to meet the average requirements of the public, fails to suit his greatest convenience by an hour or two. The many conveniences of modern long-distance travel—dining cars, office compartments, and so on—could not possibly be provided on the vast number of single-coach or trailer trains which would be in service under the proposed scheme. Possibly speeds are to be so raised that there will be insufficient time to conduct correspondence or dine on long-distance journeys? Higher speeds than 100 to 120 M.P.H. are not likely to be employed on main-line railways, and, in any case, electric traction makes possible higher schedule speeds than are feasible by any other known means.

It is not so much at the ultimate possibilities of internal-combustion locomotives that we cavil as at the inference that their use on main lines is immediately pending, the omission to state clearly the many great difficulties to be surmounted and, above all, the grossly biased view taken of the prospects and characteristics of electric main-line traction.

Among the communications published from correspondents (mainly motor engineers), we find one looking forward to the use of 80,000-100,000-H.P. internal-combustion turbines in the near future. There is no harm in looking forward, but a basis of fact and reason is desirable. The opinions expressed are naturally favourable to the views of the original author, emanating as they do from enthusiasts of his own complexion, and most of them exhibit an equal lack of familiarity with the technical considerations which obtain in this connection. Almost the only serious opponent is Mr. A. H. Walton, who states the actual facts concisely and with moderation. Among other points, he emphasises the impossibility of substituting single coaches for long trains in suburban traffic, and the economy and elasticity of electric traction, while he exposes some of the fallacies and misstatements of fact contained in the articles. Mr. B. D. Fox also points out the inherent unsuitability of the internal-combustion engine for urban service by rail or road, and the great superiority of the electric motor supplied with power from a central station. Several of the other correspondents have their own axes to grind, and do this with zest.



## FRAUDULENT TESTS.

[CONTRIBUTED.]

(Concluded from page 535.)

THE governor trials of an electric lighting set usually consist in increasing and diminishing the load on the plant, a quarter at a time, and finally in suddenly throwing on and off the full rated load of the machine. The essential object of these trials is to ensure that no undue change of voltage occurs with varying loads, although both the speed regulation of the engine and the compounding qualities of the dynamo are simultaneously involved. Suppose, in a certain case, that the voltage regulation is bad, the fault being attributable either to the engine governor or to the design of the dynamo; in order to get such a plant through its tests, a second rheostat is inserted in series with the ordinary field rheostat. The latter, of course, has to remain untouched throughout the proceedings, but the auxiliary rheostat is in charge of some ingenuous youth apparently busy with some other test. The attention of the inspector is concentrated on the voltmeter, and every time the load is changed the auxiliary rheostat is simultaneously jerked over a predetermined number of stops, thus neutralising the rise or fall of voltage which would otherwise occur. The programme needs rehearsal beforehand, but it has proved wonderfully effective with Admiralty inspectors. Engines have also been got through governor trials by surreptitious manipulation of the cylinder-cocks, but this is difficult to do undetected, and is generally too risky to attempt.

When undergoing its governor trials, the greatest danger of an engine failing to comply with the speed regulation guarantee occurs when the load is changed from zero to one-quarter full load and *vice versa*. This is because the ordinary type of throttle valve for a high-speed engine leaks considerably, and at small openings the uncontrollable leakage steam amounts to a fair proportion of the steam which the engine requires at light or zero load. To get an engine through this portion of its governor trials with credit, it is sometimes necessary to furnish it with a small extra load which is not indicated by the ammeter. Thus when the load is apparently changed from zero to one-quarter, it really is changed from one-quarter to one-half.

The fact that a tachometer can usually be adjusted to read either fast or slow is another thing that the inspector should never lose sight of, because sometimes this adaptability of the instrument is made use of. For instance, to obtain a good ratio between the indicated horse-power and the kilowatts generated, there is a temptation to run the engine faster than its apparent speed, thus making the indicated horse-power work out to less than it really amounts to, and so obtaining a spurious figure for the efficiency. A similar adjustment is occasionally useful when it is desired to increase the apparent speed at which an emergency run-away device comes into action. The engine speed is first reduced by the desired number of revolutions, the tachometer screwed up to indicate the normal speed, and the field rheostat adjusted to bring back the voltage to that specified. All is then ready for the inspector to carry out the emergency test.

In briefly reviewing a few of the tricks practised upon inspectors of plant, the writer has mentioned none except some of those which he has actually known to be carried out, or which he has heard of from unimpeachable sources. No doubt any experienced tester could add to the list, as, given reasonable ingenuity and nerve, suitable conditions, and an average inspector, all things are possible. The blame for the vast amount of fraud that goes on must be divided about equally between the firms who profit by it and the inspectors who permit it. The natural temptation on the part of the former, to acquire an unwarranted certificate of excellence for their plant, is encouraged by the incompetence or laxity of the inspecting officer. There is no inducement for a firm of engine builders to strive after efficiency, when even the Admiralty authorities are content to accept steam consumption figures obtained by dipping a graduated stick into a more or less rectangular tank of reputed capacity, into which the air pump discharges, and of which the outlet is invisible. Under the same system of inspection, steam consumption tests have been run month after month without

its ever being noticed that a standing turbine was also connected to the condenser, and, of course, robbed the measuring tank of as much water as the turbine casing and exhaust branch could hold. The writer has also been told of Admiralty engineer officers spending days in altering the setting of a slide valve in order to cure an engine of vibration. Even a premium pupil could have told them that the steam distribution in the cylinders could have no more to do with the trouble than the colour of the paint.

In spite of their comparative inexperience, some of the younger inspectors would, no doubt, discover many cases of fraud, had they any object to gain in doing so. But the fear of "giving themselves away" by showing an apparently unfounded suspicion deters them no less than a misgiving as to the effect of annoying a firm having powerful "friends at court." And so the game goes on, and no doubt will continue to do so.

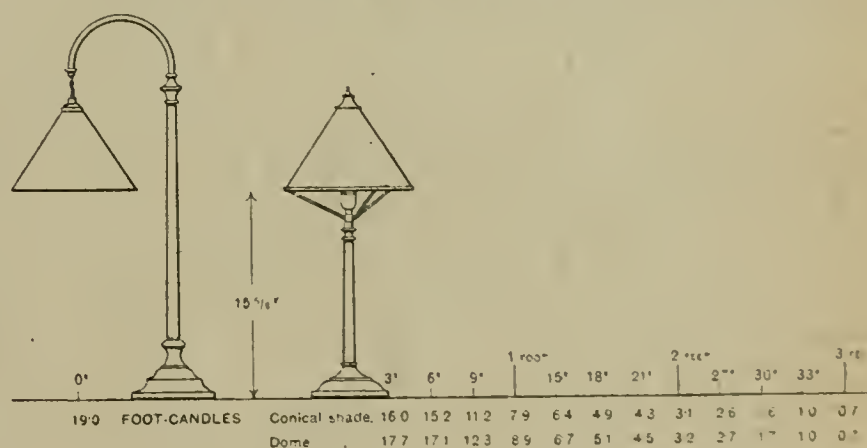
## SOME NOTES ON TABLE STANDARDS.

[CONTRIBUTED.]

PORTABLE fittings on an office table are often a great nuisance, and the flexible to them is a greater one, but they provide such a cheap and simple means of either supplementing or dispensing with the general lighting, that there are many places where they have to be installed.

A glance through any fittings catalogue will show that table standards may be divided into two classes—the erect and the inverted, the proportions listed being, roughly, six of the first to every one of the second type. This proportion seems directly opposed to their respective desirabilities from a lighting point of view, but is accounted for, no doubt, by the simplicity of construction of Type 1 and its smaller height.

As users of metal-filament lamps are aware, no such lamp (unless of very low voltage) can long withstand the constant jarring to which it is subjected in a portable fitting, so that the old, inefficient, carbon filament has to be retained for table standards. With standards of Type 2, however,



the lamp life is lengthened considerably, especially when the arching top is not of too stiff tubing, and when the lampholder hangs from it by a few inches of flexible. A filament which fails almost immediately from the trembling of a rigid support will survive a quite marvellous amount of violent, but free, swinging.

But there is another point on which the second type has the advantage—the gain of 6 in. of the most brilliantly lighted area, as is evident from the accompanying sketch. The readings for this were taken under ordinary working conditions, *i.e.*, not in a blackened laboratory, but in an ordinary office (whose ceiling was white several years ago), with the standard surface laid flat on the table—not inclined so as to be always at right-angles to the rays of light. A carbon lamp of nominally 16 c.p. was used under a green-backed opal shade, 10 in. × 5 1/2 in.

It might be thought that there would be some difference in the light obtained owing to the reversal of the position of the lamp under the shade in the pendant type, but a number of measurements proved this (apart from the shadow of the spider) to be negligible; this is due to the fact that the direct rays bear but a small proportion to the reflected rays illuminating the table.

This point is brought out very clearly by substituting a



10-in.  $\times$  4 $\frac{1}{2}$ -in. dome shade (also of green-backed opal), when, with the same fitting, and the lamp consequently at the same height above the table, the illumination is materially increased—except at the extreme radius of effective lighting. Although part of this may be due to the greater efficiency of the concave reflector, much of it results from the apex of the shade being an inch nearer the surface of the table, which conclusion is borne out by the falling away in illumination at a distance of 3 ft., where the angle of incidence would be proportionately less.

---

## NOTES FROM CANADA.

---

[FROM OUR SPECIAL CORRESPONDENT.]

---

A RECENT report published by the Department of Railways and Canals on the subject of telephones shows that there are in Canada more than 537 telephone companies with a combined capital of something over £8,000,000. Three provinces viz., Manitoba, Alberta and Saskatchewan have Government telephones. In the last-named there are still many companies operating, but in the former two all telephones are controlled by the Government. Telephones are in much more common use here than at home, although the rates charged are by no means low, possibly the severe winters partly account for this.

The writer of these notes was very glad to see the recent editorial in the REVIEW on "The desire of the Britisher abroad." In spite of the very decided vote of Canadians against "Reciprocity" with the U.S.A., which was recorded last September, there are many people here, including engineers, who have very little regard for Canada's connection with "Home." Canadian-born engineers, in very many cases, receive a good part of their training in the United States, and return here imbued with a due sense of the greatness of that country combined with not a little contempt for Great Britain and her sons.

It must be borne in mind that the Americans take very great pains to inculcate the idea that anything not pertaining to, or emanating from, their country is not worth consideration.

The average native of the Dominion has not the least conception of what Great Britain is like—to him it is an island of very insignificant size, which he could drown in two or three of his great lakes, and which is far behind the times. He has never seen the sea and has no notion of the vastness of Britain's navy or mercantile marine, neither knows he anything of the great engineering workshops and huge mills which she possesses.

The writer has just received a letter from a friend, a man quite well known in the Manchester district, of high ability and refinement, and possessing a splendid technical training, who has recently come out here, in which he indicates that he at any rate finds that some Canadians are inclined to treat an Englishman with contempt, as something decidedly inferior to themselves. This is not as it should be and though there are signs that, owing to the large numbers of well-educated Britishers now coming over here this idea will be gradually dispelled, it were well that, if possible, concerted action be taken both here and at home with that object in view. So far as electrical engineers are concerned the proposed formation of a Canadian section of the I.E.E. would certainly be of assistance if taken up in a proper and determined manner. The word determined is used advisedly, as there is little doubt that, for some time, such a section would have to struggle for existence, and would probably receive but little support from any except British engineers, and not in all instances from even these as, for want of any other electrical engineering society, many of them are, perforce, already members of the local branches of the American I.E.E. If anything can be done, it should be done at once, and that thoroughly, in no half-hearted fashion. In 10 years' time the formation of a Canadian Section of the I.E.E. will be more difficult than at present, and the branches of the American Institute will be much more numerous and influential. At the moment of writing the

Canadian branches of the Am.I.E.E. are appointing committees to consider the question of standards. These standards are, of course, those formulated by the parent section in the U.S.A. Some of them, no doubt, are international ones, but the fact that the request to consider the standards comes from the States, and that many of the standards are purely American, does not help Great Britain much or tend to advertise her wares. A remark made a day or two ago to the writer by a prominent electrical engineer, of Canadian birth, is somewhat significant in this connection. It was to the effect that, though he did not like the idea of standards being called "United States standards," if adopted by both countries, as they would belong to Canada as well, he saw no objection to their being called *American* standards; but one might well ask, who, that heard the latter term, would think of Canada as a separate entity in relation to it? Once include Canada in the term America, and—well, hang her, like the proverbial dog, so far as Great Britain is concerned.

If British manufacturers wish to improve their trade connections with Canada, they must bestir themselves—the effort will be well worth it, but, as shown recently in these notes, from an electrical standpoint they stand, even now, a long way behind the U.S.A., and unless the matter be taken up in earnest, the "lag" will become rapidly greater.

One method which would tend to improve the trade relations between Canada and Great Britain, which suggests itself to the writer, is that the large manufacturers in the latter country should develop some scheme whereby it would be easy for Canadian graduates of technical schools and colleges to go over to receive a practical training in British workshops.

This would, in time, furnish Canada with numbers of young engineers whose attitude towards the mother country would be very different from what is generally the case now, and, being Canadian born, they would have more influence over here than those who are not natives of Canada. There may be difficulties and objections raised against this suggestion, but the fact that the graduates go now to the U.S.A. and return with ideas which are certainly not of such a character as to assist British manufacturers, coupled with the additional fact that American-born engineers come over here in large numbers to take up appointments, frequently some of the best, should make it worthy of more than passing notice.

Canada's position, as pointed out in the editorial already referred to, is unique owing to her geographical position relatively to the U.S.A. and to Great Britain. While much nearer home than the other Colonies she is, at the same time, much nearer to a powerful trade rival, who already has the whip hand, and means to keep it.

Too gloomy a view of the situation, however, must not be taken, for, in spite of all that has been said, Canada has strong leanings towards the Mother Country, and, if British firms will but try, much lost ground may be recovered, and a very fair share of the rapidly-increasing trade may be secured.

To revert once more to the subject of a Canadian Section of the I.E.E., a nucleus might be formed from the representatives of firms who have come over here, being in close and constant touch with the home-land, and working for her interests. It would surely be a pleasure to them to feel that they had still another link binding them to her.

That a way may soon be found for the formation of such a section is the sincere wish of the writer of these notes, who would gladly do all in his power to further the carrying out of the idea.

---

**Mazda Lamps at the Bottom of the Sea.**—We understand that the P. and O. steamship *Oceana*, which foundered recently in collision with a sailing vessel, was taking a large consignment of Mazda drawn-wire lamps to Bombay. These lamps were intended for use in the Bombay Town Hall, and in consequence of the total loss of the *Oceana*, a repeat order has been placed with the British Thomson-Houston Co., Ltd.

**Entertainment Houses and Electricity.**—A correspondent writes:—"There is a big demand just now for complete electrical installations amongst the entertainment houses illuminated by gas. The strike has caused them great anxiety, many of them in the smaller towns having been compelled to close, owing to the supply running out."



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## Tests of Metal-Filament Lamps.

I have noted with interest the recent comments in the electrical papers, advertising columns and elsewhere, on the results of some comparative tests of metal-filament lamps, particularly as several manufacturers have claimed superiority for their lamps as a result of such tests, the interesting thing being that several manufacturers are using the same test, each claiming it to show his product to be the best.

I should like an opportunity of pointing out that there have been no published comparative lamp tests of the various makes of metal-filament lamps made thus far in England, which have been of any value.

Such comparative metal-filament lamp tests as have been made are insufficient, incomplete and inconclusive tests for the following reasons:—

1. The number of lamps tested is entirely too small to give any true indication of the average quality of the lamps. All lamp-testing experience shows the necessity of having a large number of lamps—at least 50 to 100 lamps for initial test readings, and at least 10 to 20 lamps of each make for life test.

2. The life tests have not been conducted on the proper basis. Such tests as have been conducted have been run at rated voltage, which results in some lamps being started at one efficiency and others at other efficiencies. The results have been published just as they have come out, without any corrections for differences in efficiency, all of which leaves the life and candle-power results incomparable. A true life and candle-power test of lamps requires that all lamps should be started at the same average initial efficiency, or, at least, that the results obtained be corrected to bring them to a basis of equal initial efficiencies. This point is totally neglected in tests so far conducted, giving inconclusive results and very misleading information.

When it is realised that a difference in initial efficiency of only 0.5 watts per candle means one-third longer life for the lower efficiency lamp, and that the difference between 1.25 watts per candle and 1.35 watts per candle means a difference between 100 and 175 per cent. in life, and the difference between 1.25 watts per candle and 1.5 watts per candle multiplies the life by 4, it will readily be appreciated that the differences in initial efficiencies are extremely important, and results must be brought to a comparable basis of equal initial efficiency for any real determination of relative life value.

Lastly, the method of obtaining sample lamps from the manufacturers is open to strong objection, as these may be specially selected lamps. They should be the average product of the manufacturer, such as would be given if packages were purchased in the open market from the regular stock product.

These points are indisputable, and must be accepted by anyone familiar with the necessities for correct lamp testing. It is time, therefore, that attention should be directed to these matters so that there will be a proper understanding of what is necessary for complete and conclusive tests on lamps.

It is important that the full facts regarding lamp tests that have been conducted should be known and understood, so that the inconclusive results of such tests will not mislead lamp purchasers and users.

F. W. Willecox.

London, E.C., March 30th, 1912.

## The Education of the Engineer.

I have before me a new book on "Power House Design," by John F. C. Snell. From page 10 of the book I copy the following passage:—

"*Feed Water Supply.*—If the geological strata are such as to provide not only a good foundation, but also a supply of good feed water through sinking an artesian well or a bore-hole, the site will be more valuable, since the cost of pumping such water is usually only one-sixth, or less than the cost of

purchasing the water, and, moreover, dispenses with evaporating plant and reagent apparatus which would be necessary were brackish or salt water used from which the circulating water is obtained."

Some of your readers might like to amuse themselves by trying to find out what this means. I do not advise anyone to try to *parse* it.

Imagine one to have got as far as the "moreover dispenses": he sets out to seek for the subject of the verb "dispenses." How long will it be till he gives up in despair?

It would be a graceless performance to criticise line by line the English of a book that seems so likely to be valuable to the technical man. But the volume is the first of a new series; the publishers are the great firm of Longmans. Surely they have someone about the house who is able to advise on the questions raised by a reading of the passage quoted above.

A Mere Irishman.

## Irish Peat.

Mr. Tomlinson's ideas as to peat drainage are good and sound and would be quite applicable to many of the Irish bogs, which are so placed as to be drainable by gravity without unduly deep cutting out of the sides of the containing hollow in which the peat has grown. To the writer the Irish bogs as a rule appear to be ponds, the outlets of which have become choked by vegetable growth, and in this way the plant growth has risen to many feet above the land about, and drainage has had to take effect by numerous seepages all round the bog area.

The first care should be to find the probable old lake outlet, and clear this down to the valley before commencing to cut down the edge of the basin to the lowest level of the deposit. Probably this could not be done at once. The first work to be carried out would be surface drains, to be cut deeper and deeper as the water fell and the peat dried out. After the upper parts had dried to quarrying depth, this work could then commence while the drains were cut deeper. This would greatly simplify the drainage by removing the top weight. Subaqueous peat when kept undisturbed and left to dry is as hard as wood, and if quarried, as Mr. Tomlinson suggests, in big lumps, could, when dry, be cut to block size by sawing.

But are there not many bog areas which cannot be drained by any short drain to a near valley—areas of real lake country, below the general level, which cannot be cheaply treated by bottom drainage? Would such areas be economically treated by mechanical reduction of the water-level over a period of years? Would it pay to pump all the water, or would it pay to dredge the whole mass and deposit it on the nearest drainable area to dry out by gravity?

Coal is very dear in Ireland, and the peat industry should pay as well as it does in Sweden or in Holland. Especially should it be commercially profitable to-day in view of the value of the by-products available where gas producers are used, and energy can be exported through wires to any point in the island. The "friends" of electricity in this country have done it a disservice by their frequent denunciation of the possibility of high-tension distribution. The man in the street does not see why high-tension leakage should be worse on a wet day in Great Britain than it is in Mexico or California, where it is quite moist when it rains. One would think it rained dust in Mexico, to hear some experts talk.

Mr. Tomlinson refers to an honest and alert public department to deal with Irish peat. Experience with "the Castle" does not encourage any hope of alertness from that quarter. The writer once tried to interest the Irish Government in a peat recovery system. Finding all endeavours hopeless, he applied for the return of his papers, but they were declared unfindable or as having never been received, or some such explanation was given. They were never recovered. One wonders if they were ever noticed further than being acknowledged. The "Castle" is hopeless to deal with. Let there be a regularly appointed Committee free from Castle influence, and with men of scientific and commercial ability at the helm; something might then be done for Irish peat.

Simon.



## THE INTERNATIONAL SMOKE ABATEMENT EXHIBITION AND CONFERENCE.

[BY OUR SPECIAL CORRESPONDENT.]

THIS Exhibition and Conference, preliminary details of which have already appeared in the *ELECTRICAL REVIEW*, was opened upon Saturday, March 23rd, by the Duke of Argyll, in the presence of a large gathering of scientists and engineers, and closed last Saturday evening, after a very successful run.

The most notable feature of the opening speeches was the suggestion made by Sir William Ramsay, F.R.S., President of the British Association and the leading English chemist, that coal mining might soon be an unnecessary and decaying industry, gasification of coal in the pits, and the withdrawal of this gas for heating and power purposes, taking the place of the hewing and raising of solid fuel.

Although the majority of critics have dismissed the scheme as Utopian and impracticable, the suggestion really deserves consideration and trial. One speaker during the Conference proceedings, on March 27th, in fact, stated that a small coal mine which was fired accidentally in New South Wales some years ago was still burning, without any artificial aids to increase the air circulation or to prevent falls of roof. This fact seems to indicate that with a regulated air supply and artificial draught, the gasification of coal *in situ* is a perfectly feasible operation, especially in those cases where the natural stratification of the fuel-seams lends itself to this method of work. Sir William Ramsay has since announced that the new method will be tried experimentally at an English colliery during the current year. Since the proposal covers the use of gas for generating electricity at the mine, and distribution of this electricity over a wide area, electrical engineers will have a very keen interest in watching the development of Sir William Ramsay's suggestions.

The Exhibition embraced all classes of factory and domestic appliances for minimising or reducing smoke. As customary in all recent successful exhibitions of this character in the United Kingdom, the exhibits covered both gas and electrical apparatus, and those relating to household smoke rather overshadowed the exhibits relating to factory smoke. The combined displays of cooking and heating appliances made by the various metropolitan electricity and gas companies were, in fact, the most striking and artistic exhibits in the Hall.

In the joint exhibit by the London electric supply authorities and by various manufacturers of electrical apparatus, the latest methods of utilising electricity for lighting, heating and cooking purposes were displayed amidst very artistic surroundings, and one could indulge in an electrically-cooked meal, to the strains of a Russian orchestra. The writer sampled the viands at all refreshment places open to the visitors in the Exhibition (also one outside it), and he can truthfully say that the Electricity Hall was by far the best of the four. Whether this was due to the better management, or to the use of electricity for preparing the food, he does not presume to say.

As already stated, the exhibits of special interest to manufacturers were rather outclassed in attractiveness by these more popular shows; but the leading English makers of mechanical stokers, gas producers, and smoke-consuming devices were all represented. The international character of the Exhibition was maintained by the displays of the Compagnie Française des Brevets Schaller, of Paris; N. V. Hoek & Co., of the Hague, Holland; H. Kowitske & Co., of Berlin; Hjalmer Lofquist, of Stockholm; the Compagnie Russfang, of Hanover; the Treibel Smoke Combustion Co., of London; and Carl Zeiss, Ltd., of London.

MESSRS. BENNIS & Co., of Bolton, had their customary well-arranged exhibit of machine stoking and ash-handling plant. Two different methods of supplying coal to two types of mechanical stokers were demonstrated: the "Bennis" high-temperature smokeless and gritless coking stoker, fitted to an internally-flued boiler, and the "Bennis" new patent smokeless and gritless chain-grate stoker, fitted to a water-tube boiler.

A "Bennis" elevator, fitted with a rotary feed and special chain and buckets for boiler-house use, was shown elevating the coal to bunkers composed of riveted plates and supported on massive stanchions. Part of the bunker was provided with a hopper bottom, and fuel was fed direct from the bunker into the coking stoker. A shoot leading from the bunker fed the chain-grate stoker. The fuel thus fed into the stokers travelled along the bars, and after passing through the furnace was fed by a "Bennis" gravity bucket conveyor, fitted with automatic tripping levers, into the boot of the elevator mentioned above. The entire process was continuous, and the plant was driven by an A.E.G. motor.

MESSRS. BABCOCK & WILCOX exhibited one of their well-known chain-grate stokers, of which there are now 5,200 in use.

THE CARRON Co. exhibited an electric cooking range, with which they demonstrated how effectually cooking of all kinds could be carried out with electric heating.

OZONAIR, LTD., had a large exhibit of ozonising apparatus; while the London firm of CARL ZEISS, LTD., showed their new apparatus for the technical analysis of gas and water by an optical method. This apparatus is most convenient in use, for it can be carried anywhere, and can be arranged either for gas or water tests. By this apparatus percentages of CO<sub>2</sub> and CH<sub>4</sub> in mine gas can be determined within .01 or .02 per cent. of accuracy. The weight of the portable "gas interferometer" is 11 lb.

Devices for automatic regulation of the supply of secondary air above the fires and at the bridges of Lancashire boilers were shown by the SMOKE CONSUMING Co., of London; the COMPAGNIE DES BREVETS SCHALLER, of Paris; the TREIBEL SMOKE COMBUSTION Co., of London; and H. KOWITSKE & Co., of Berlin. The last-named was a strongly-made apparatus, and a very large number have been installed in hand-fired boilers in Germany with most satisfactory results, over 300 of these automatic appliances being in use in Hamburg alone. The use of similar automatic apparatus for controlling the secondary air supply of hand-fired boilers has not, so far, become general in this country. It may be hoped that this exhibition of automatic regulating apparatus at the Agricultural Hall will awaken English engineers and owners of steam-raising apparatus to the importance of the subject.

TINTOMETER, LTD., showed apparatus for measuring and recording the colour and density of smoke, while WITTING BROS. exhibited the Meguin coal screening and washing plant. One permanent result of the miners' strike will be an increase in the cost of fuel, and it would certainly pay many large consumers to buy the very cheapest fuel, and to wash and screen it themselves before use, either by the Meguin process or by some similar English process.

MR. A. F. DAVIS, of London, showed a new and improved type of furnace bar, and the THERMAL SYNDICATE, of Wallsend, exhibited a most varied assortment of "Vitrosil" (fused quartz) goods made by aid of electrical heat. Among the chief uses for "Vitrosil" may be mentioned tubes and plates for electric heaters and cookers, pyrometer tubes, for rapid readings and high temperatures, globes for high-pressure gas lighting, basins for sulphuric acid concentration, and all forms of apparatus for the chemical industry. A new use to which the material is now being put is in connection with gas fires, where silica is employed as the heat radiating medium. These tubes and vessels are perfectly acid and heat proof, and can be exposed to most rapid changes of temperature without fracture.

MESSRS. TOWNSON & MERCER had a large exhibit of gas-testing apparatus, thermometers and flash-point apparatus. JAMES HODGKINSON, LTD., of Salford, showed his automatic coking stoker.

HJALMER LOFQUIST, of Stockholm, exhibited an electrical apparatus, made in two sizes, for heating bath water. That using 4½ units at 200 volts will raise the temperature of 40 gallons of water 27° F. in 40 minutes.

(To be concluded.)

---

**Blackburn Lighting.**—The Corporation has decided to apply to the L.G.B. for sanction to borrow £1,050 for the purpose of extensions to the electricity works.



## PROCEEDINGS OF INSTITUTIONS.

## The Electric Driving of Rolling Mills.

By MR. C. A. ABLETT.

ON March 27th this paper was discussed by the INSTITUTION OF ELECTRICAL ENGINEERS, at Birmingham (for abstract of paper see ELECTRICAL REVIEW, February 9th, 1912.)

MR. W. W. WOOD said the friction of fly-wheels was a very important point about which very little was known. The author deduced that a larger constantly rated motor was required with a light than with a heavy fly-wheel, but the difference in power was apparently very slight, and would be surely more than off-set by the extra power required to drive the heavy fly-wheel. The author had assumed that the loss in driving ropes was 10 per cent. of the normal power they were capable of transmitting; but in a paper recently read before the South Wales Institution of Engineers, Mr. Kenyon referred to tests which showed the loss in rope drive to be only  $2\frac{1}{2}$ - $3\frac{1}{2}$  per cent., and he could quite believe it. It seemed to him, therefore, that the loss in a properly-designed drive would just about off-set the lower efficiency which the low-speed motor had, and there would not, therefore, be the great saving to which Mr. Ablett referred. The driving ropes formed a very excellent coupling between motor and mill, and relieved the motor of shock very considerably. Before one could state that either rope or direct drive was the better, the circumstances of each case should be carefully considered.

MR. N. B. ROSHER said that in mills in the Birmingham district, especially sheet mills, a number of rolls were driven from one train, and the peaks which occurred were very irregular. The connection of the motor to the mill was of considerable importance; and to gear the motor to the roll train without inserting some flexible form of coupling was not desirable. The continuous slip regulator was a very desirable adjunct to the electrical equipment of a rolling mill. He thought it would be interesting if he gave some figures with respect to a sheet rolling mill which had two roll trains; the larger was converted from steam to electricity some four years ago, the smaller being still steam driven. The conditions under which both trains operated were very similar, but in the case of the steam-driven train, the costs per B.H.P. per annum were about £11, whereas the costs of the electric drive per B.H.P. per annum were only £4. The steam engine was shortly to be replaced by an electric motor, and it was estimated that the electric drive would pay for itself in a little over two years.

DR. S. P. SMITH, referring to the scheme which the author said had been installed in three mills in this country, asked if the arrangement shown, which might be described as giving constant output at all speeds for a given input, was better for the kind of work in question than the arrangement with the auxiliary machines mechanically independent of the main motor, which was suitable for giving a constant torque at different speeds.

MR. JUDGE advocated the use of the rope drive as being a very good flexible coupling, and MR. MORE, who had had experience of electrical driving for rolling mills, spoke favourably of it.

MR. W. E. MILNE said that rolling-mill owners paid too little attention to the question of mechanical arrangements when electrifying a mill. A test taken by the Birmingham Corporation Supply Department in a metal works some time ago showed a transmission loss of 70 per cent., while losses of 40 or 50 per cent. were not uncommon. There was a tendency in Birmingham to put too many rolls on one motor; the long heavy train of gearings for such arrangements called for considerable power to drive them. The automatic slip regulator was not required in brass and copper mills, although the introduction of a small amount of permanent slip might be an advantage in certain installations.

MR. A. DU PASQUIER agreed that the slow-speed motor could always justify the additional outlay where rope-driving was the alternative. Mr. Ablett mentioned the case of a 600-H.P. motor driving a sheet mill by means of 20 2-in. ropes. This was certainly an excessive number of ropes to transmit the ordinary overloads of the motor, and presumably the fly-wheel in this case must have been on the motor shaft and discharging through the ropes, which was an undesirable arrangement. It was interesting to note that Mr. Ablett recently recommended a rope drive for a new sheet mill on the north-east coast. There was no doubt that the three-speed rope device, while costing much less than any other system of economic uniform speed control was giving complete satisfaction in practice. The advantage should be with the rotary converter system, especially when more than one mill was to be operated, as would usually be the case. The rotary converter, owing to the small armature reaction and field distortion, was admirably suited to deal with the momentary heavy demands one got with this class of work. Where an average slip was of the nature of  $5\frac{1}{2}$  per cent., variable speed devices with their considerably increased first cost, greater complication, and greater space occupied were commercially unsound, and their advocacy was to be deprecated.

MR. A. M. TAYLOR pointed out that the proportion that the fixed charges bore to the total cost per unit was reduced as the total load on the power station increased, and also as the load factor improved through the increase of the power demands. It was, therefore, to the interest of manufacturers to come on to the Corporation mains. With regard to the overload capacity of electrical machines, they were on the eve of important developments. Much greater overloads than 100 per cent. were quite practicable. At the present time a booster set was being supplied to the Corporation which would be capable of carrying an overload of 500 per cent. for one second.

MR. R. ORSETTICH said compound-wound D.C. motors were very

suitable for driving rolling mills. A 300-H.P. machine recently supplied for this purpose by his firm was heavily compounded, and gave 28 per cent. drop from no-load to full load. He did not agree that the Ilgner system involved a total increase in the capital cost of only 10 per cent. In connection with a 10,000-H.P. plant he found that the increase was from 20 to 25 per cent. The 10 per cent. loss in ropes given by the author was probably correct.

MR. F. J. MOFFETT (communicated) said that a mechanical slip regulator appeared to be superior to the two methods mentioned. If a suitable slipping-clutch was inserted between the motor and the mill, it was possible in case of emergency to produce a slip of 100 per cent., and then utilise the whole stored-up energy in the fly-wheel. Slipping-clutches suitable for this purpose were made by several firms. The speed of the rolls could fall until they came to rest, but the motor was still able to exert its maximum torque. He was not aware that clutches of this description had been applied to rolling-mill drives. In the case of a three-phase motor, a short-circuited rotor could be used instead of the more expensive and less efficient wound rotor, since the motor would start under practically no load, and there would be no need for a flexible coupling.

In his reply, MR. ABLETT said that in every case of an electrically-driven sheet mill that he had had the opportunity of investigating, sufficient ropes had been installed to transmit normally about double the normal motor power without overloading the ropes. It was not unreasonable to consider the rope losses as consuming 5 per cent. of the normal power which the ropes would transmit, and this loss went on whether the ropes were transmitting their full power or not. So by adopting a rope drive for a sheet mill they had a continuous loss going on, due to the rope drive, which amounted to about 10 per cent. of the normal motor power. This loss was more important in the case of a sheet mill than in any other type of mill, because the average power required by the sheet mill was small compared with the maximum power—often not more than one-third of the normal motor power—so that in an unfavourable case the ropes could consume as much as one-third of the total number of units of electricity which were taken by the rolling-mill motor. There were more than 100 electrically-driven rolling mills in this country, and more than 1,000 on the Continent. There were over 50 electrically-driven reversing mill installations in Europe, of which about 30 were at work, the remainder being in course of construction. These figures alone were sufficient to show that electrical driving had justified itself. In almost every one of the electrically-driven reversing rolling mills the motor was direct-coupled to the pinions of the mill, and in one or two cases even to the rolls themselves, the pinions being on the far side of the mill, and no flexible coupling of any form was used. These mills were doing the heaviest work, and were driven by motors capable of giving as a maximum power as much as 20,000 H.P. Some of these reversing mill motors had been at work for four or five years, and not the slightest difficulty had been experienced from shocks. In view of this, it could not be said that in the case of small mills driven by motors up to 1,000 H.P. or over, the effects of shock were in any way to be feared. In the case of a motor driving a rolling mill where a fly-wheel was employed, carried in separate bearings, a flexible coupling interposed between the motor and the fly-wheel would protect the motor bearings from any ill effects due to possible slight lack of alignment between the motor shaft and the fly-wheel shaft. The chief objection to the pole-changing three-phase motor and the three-phase cascade system as applied to merchant mills, where a variable speed was required, was that they only gave a few fixed speeds which in general did not prove sufficient to meet the requirements of the mill, so that resistance would have to be inserted in the rotor circuits in order to obtain intermediate speeds, which involved waste of power. As a merchant mill was rolling heavy sections at the low speeds, which required a greater turning moment than the smaller sections which were rolled at a high speed, in general the motor driving a merchant mill had to be capable of giving the same power at all speeds. If a pole-changing motor, therefore, was employed, it would have to be a big machine, of which the capital cost would naturally be high, in order to give the required power at the low speed. Both the pole-changing motor and the three-phase cascade system suffered from the disadvantage that the power factors at low speeds were not good. Mr. du Pasquier offered some criticism of the variable-speed scheme illustrated, and seemed to prefer the use of a direct-current motor supplied with current through a rotary converter and a transformer for driving a merchant mill where three-phase current only was available. The author was not in agreement with this, because, in the case of the scheme shown, the main three-phase motor was the only machine really necessary to drive the mill, and the rotary converter and the direct-current motor could be regarded as refinements introduced for the sake of economy. If anything should go wrong with either of these two machines, then the mill could still be run without interruption by the main three-phase motor. The arrangement shown, which must be regarded as a single-link chain, had a much greater reliability than the arrangement of transformer, rotary converter and direct-current motor, which might be regarded as a three-link chain. With reference to Mr. Taylor's remarks about the overload capacity of electrical plant and the advisability of allowing mill motors to carry such overloads, it might be mentioned that direct-current motors were being regularly built for 300 per cent. overload and more. Dr. Smith referred to the frequency changer as a means of obtaining variable speed from a three-phase motor without loss of power. At the Hagen Cast Steel Works in Westphalia, as well as in several other places, such an arrangement was adopted for driving the merchant mills. The frequency converter generally resembled a rotary converter, but the field poles had no winding. If a rotary converter was run at a synchronous speed and supplied with three-phase current, it would give direct-current at the com-



mutator. If however, the rotary converter was at a standstill, the three-phase current would pass through the machine with unchanged frequency. If a rotary converter were run at speeds intermediate between synchronous speed and standstill, then the frequency at the commutator was proportional to the amount by which the speed was below synchronous speed. It was, therefore, possible to couple such a frequency converter to a three-phase motor, to connect the commutator of the frequency converter to the three-phase motor, and to connect the slip rings of the frequency converter to the supply mains. If then the main three-phase motor was to be run below speed, the frequency converter took power out of its rotor circuit, converted this power from low frequency back to the frequency of the supply, and returned it to the supply mains, so that the power was not wasted. When such a frequency converter was used, the main three-phase motor could run above synchronous speed, but in this case energy was taken from the supply system and given to the rotor circuit, and it was usual in a frequency converter drive to choose a synchronous speed, so that it came about the middle of the speed range over which variation was desired. In the case of high-speed Ilgner fly-wheels, the windage formed by far the greatest proportion of the loss, and it was found in practice that most of this windage was produced by the rim of the wheel, so that if a light metal cover was provided over the rim of the wheel the windage loss could be reduced to reasonable proportions. It might reasonably be expected that the commutator three-phase motor for driving rolling mills would find considerable adoption in the future.

Physical Society.

At the meeting held on March 22nd, a paper on "A 2,000-Frequency Alternator," was read by MR. W. DUDDELL, who described and exhibited a small machine which he had designed and had constructed for testing purposes, mainly in connection with telephonic measurements. The alternator was of the salient-pole revolving-field type, running at 8,000 R.P.M. The stator was smooth and wound like a gramme ring, the object being to obtain as nearly as possible a sine wave. The author gave curves showing the open-circuit characteristic, the short-circuit current and the regulation of the alternator at four different frequencies. The output of the alternator amounted to as much as ½ KW. at the higher frequencies. Oscillograph curves showed that a slight third harmonic was present.

MR. B. S. COHEN stated that Mr. Duddell had supplied one of his alternators to Telephone House, and it had given thorough proof of its reliability and usefulness. The third harmonic that was present was no practical detriment. If the capacity of a microfarad mica condenser was found from the current taken by it and the voltage applied, the error was less than 0.5 per cent. at a frequency of 1,000. The instrument lent itself to a variety of interesting uses. If a telephone were put across the machine when run at the resonating frequency, the amplitude of vibration was such that matches could be blown out at a distance of 3 or 4 metres.

MR. S. A. POLLOCK described a somewhat similar machine that had been constructed five years ago, and was still running at the G.P.O. The rotor contained 60 poles, which were wound zigzag with eight turns of wire. It had been run up to frequencies of 8,000, and was perfectly balanced at the highest speed. The machine was largely used for measuring the apparent resistance of loading coils. The wave-form was purified by means of sifting circuits. To keep the frequency constant a vibrating reed was placed in series with a split commutator fixed on the shaft of the rotor and connected in series with the armature. If the rotor ran out of phase with the reed, either an accelerating or retarding current was sent through the armature. A counter and a chronograph always showed that the number of revolutions per minute was exactly the same as the vibrations of the reed.

DR. W. E. SUMPNER commented on the small drop in voltage at the high frequencies. From a scientific point of view, the chief points in the machine were the large air gaps and the unslotted armature. It was to these that the good regulation was due.

The AUTHOR, in reply, stated that in the later machines the armature was wound in three sections, which could all be placed in parallel or in series, to avoid having to use a transformer in order to obtain the required voltage, which might distort the wave-form. The zigzag form of winding was an excellent one for the highest frequencies. Messrs. Muirhead & Co. built the machine.

A paper on "A Method of Comparing Capacities at Various Frequencies" was read by MR. A. CAMPBELL.

To compare the capacities of two condensers under conditions similar to those in Maxwell's commutator method, they are charged and short-circuited periodically in two adjacent arms of a bridge by a double rotating commutator, the corresponding contacts being made simultaneously. If the other arms of the bridge are resistances R and S, and a battery and direct-current galvanometer (of long period) are used, then a balance is obtained when  $K_2/K_1 = R/S$ . The method is highly sensitive. Methods (like the above) in which the applied voltage has a square-topped wave-form give results in agreement with those using sine wave-form when the period of charge (and equal discharge) with the square-topped wave is  $2/\pi$  times the half-period of the sine wave.

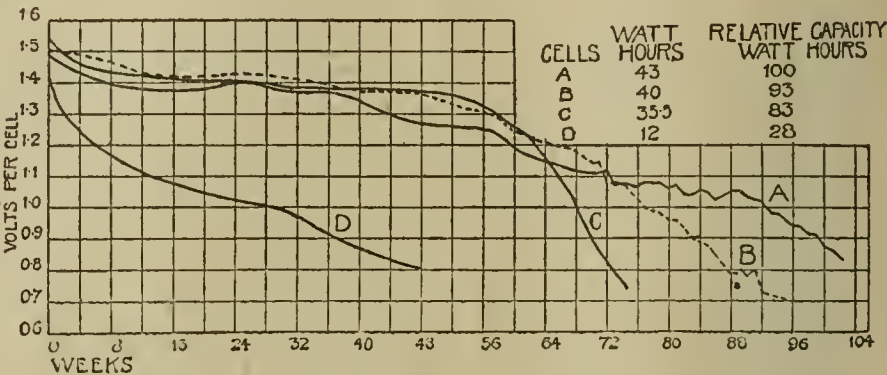
The Faraday Society.

COMPARATIVE TESTS OF DRY CELLS.

AMIDST a lengthy programme for the Faraday Society meeting on March 26th, a paper of special electrical interest was that by MR.

S. W. MELSOM, of the National Physical Laboratory, entitled "Dry Batteries: the Relation Between the Incidence of the Discharge and the Relative Capacity of Cells of Different Manufacture." MR. ALEXANDER SIEMENS, vice-president, was in the chair.

Probably few people realise the extent to which dry cells are used, chiefly, of course, in telephone work. Last year, so it was stated, the National Telephone Co. alone used 300,000, while in the United States some 40,000,000 are said to be in use. Such being the case, it is a matter for some surprise that, apart from the prolonged test of actual use, there is at present no standard test by which to gauge the relative value of a cell which is generally accepted by manufacturers and users alike. The present position is chaotic to an absurdity, as Mr. Maurice Solomon forcibly pointed out in a communication to the discussion on Mr. Melsom's paper. Every consumer of primary batteries—dry or wet—who buys in large enough quantities issues a specification of his own, the



essential feature of which is usually its originality. Frequently not only the results required, but even the method of manufacture, is specified, and it is therefore eminently desirable that some standard simple test should be devised, which could be adopted by all users of primary cells. It was some such test that Mr. Melsom set out to devise. Unfortunately, however, valuable and important as his results are, he has not considered himself justified in pointing to any one of the numerous methods of testing investigated, as the test to be safely employed in gauging the value of a cell, no matter for what purpose it is to be used.

TABLE I.—RELATIVE CAPACITY OF CELLS AT VARIOUS RATES OF DISCHARGE.

No.		Cells.			
		A.	B.	C.	D.
1	5 minutes an hour on 50 ohms ...	100	93	83	28
2	5 minutes an hour on 1 ohm initial	100	59	43	7
	After 6 months' storage ...	100	58	50	—
	After 12 months' storage ...	100	53	42	—
3	6 hours per day on 5 ohms ...	100	50	50	35
4	Continuous at 20 milliamperes—				
	Initial ampere-hours ...	100	43	36	30
	Initial watt-hours ...	100	45	40	29
	After 8 months' storage, watt-hours	100	50	45	5
5	Continuous on 10 ohms—				
	Initial to 0.7 volt ...	100	75	53	60
	Initial to 0.5 volt ...	100	76	55	60
	After 6 months' storage—				
	To 0.7 volt ...	100	59	44	28
	After 12 months' storage ...	100	67	50	2
6	Continuous on 100 ohms ...	100	68	51	35
7	Continuous on 500 ohms—				
	To 1.3 volt ...	100	102	87	10
	To end, i.e., 118 weeks ...	100	94	—	—

For the purposes of the tests four well-known makes of cell were used, four of each being selected at random from a batch of 60 supplied by the manufacturers. For obvious reasons it is impossible to divulge the names of the cells, and they are designated in the tests as A, B, C, and D. It is noteworthy that, whereas in nearly every test Cells A, B, and C showed good and tolerably uniform results, Cells D (which were stated to have quite a good reputation) fell below what ought to be the performance of an ordinary dry battery. This fact alone indicates the importance of making proper tests.

The results of the tests are summarised in accompanying tables. Table I shows the relative capacities of the four makes under the various rates of discharge stated, the output of Cell A being taken as 100 for comparison, and Table II gives the actual capacities in watt-hours in the case of each of the seven tests.

The original paper contains a very interesting series of P.D. curves for every set of tests, but space will only permit us to give here those for Test 1, namely, a discharge of five minutes per hour through a resistance of 50 ohms, as this reproduces as closely as possible the working conditions of a cell on a telephone circuit. The voltage plotted is the P.D. in closed circuit. The discharge was considered complete at a voltage of 0.9, because the current at this point, 0.018 ampere, is the smallest that will work a telephone microphone.

Test 2 is similar to 1, but employs a far higher current. Test 3 is



that specified by the National Telephone Co., while 4 is that formally specified by the Post Office. Test 5 is a favourite with manufacturers, and 6 is on similar lines, but uses a greater resistance. Test 7 is a War Office test.

TABLE II.—RELATION BETWEEN INCIDENCE OF DISCHARGE AND CAPACITY.

Test No.	Cells.				Approximate time for completion of Test 1, case of cell A.
	A.	B.	C.	D.	
1 ... ..	43	40	36	12	100 weeks.
2 ... ..	44	26	10	3	65 "
3 ... ..	126	63	63	46	20 "
4 ... ..	105	47	42	31	27 "
5 ... ..	64	49	35	38	6 "
6 ... ..	107	73	55	38	50 "
7 ... ..	70	66	—	—	Several years.

It will be seen from the tables that very widely varying results were obtained for the capacities in the different tests employed, so that it is not possible to specify any single method of testing as a standard which can be safely employed under all circumstances. Only one of the tests, No. 5, takes a reasonably short time, and this, in the case of cell A, gives a capacity some 40 per cent. higher than Test 1, which is supposed to approximate most closely to conditions of practice. It is, nevertheless, noteworthy that the order of merit of the cells is in every case the same.

Under the circumstances, it would appear that the only safe course for users to adopt is that recommended by the chairman, namely, make the test on sample cells under actual conditions of use, and then insist on the manufacturer employing such care in the process of manufacture as will ensure all his cells of a particular class giving perfectly uniform results.

It is of interest to note that cells A, B and C showed little or no deterioration after 12 months' storage. This fact should suggest uses for dry cells, for instance, as a stand-by on motor-cars for ignition, or for special lighting purposes (where cost is of not much consideration), which are at present overlooked.

### Domestic Electricity.

(*Informal discussion at the INSTITUTION OF ELECTRICAL ENGINEERS, London, March 22nd, 1912.*)

The PRESIDENT, in opening the meeting, referred to the necessity of extending the use of electricity in the home. The discussion was to some extent a result of his suggestion to organise a campaign for cheaper electricity; it was, however, thought by the Council that price was not the only deterrent to its general adoption, and that a comprehensive discussion of the whole subject would be beneficial. The advanced development of lighting by gas and oil suggested that further improvement would be difficult, while electricity was a comparatively recent introduction as a lighting and heating agent, and it was open to great and rapid improvement, and offered every scope for progress.

MR. C. A. BAKER (L.C.C.) said that domestic electrical apparatus showed great development in recent times; its advantages were often indirect, and thus not so readily appreciated by prospective users. It required proper control in order to get economy in its use, and he suggested that it would be better to provide switches on cooking apparatus in which the handles indicated at a glance whether on or off. The great variety of voltages in the London area hampered both makers and dealers in such apparatus.

MR. H. H. COUZENS (West Ham) suggested that progress was retarded by half-hearted publicity effort and the high cost of apparatus. The amount spent on publicity work by the supply authorities was infinitesimal, and this was often due to the engineer who preferred to ignore the commercial side of the business. A definite expenditure must be allocated to publicity and selling. The publicity committee's literature was not suitable for all places, and he thought that the Institution might with advantage take over its work; the publicity committee was to some extent philanthropic, and such an arrangement never worked so well as an ordinary commercial one. He suggested co-operative buying of apparatus and coal as a means of reducing the present cost of those things; this might be carried out through a Committee of the Institution nominated by those interested financially. The gas companies were far better off in the matter of powers and reserves than municipal electricity departments, which were even short of trading capital, a matter which the new Parliamentary Bill might set right. Publicity literature was of little use unless followed up by the canvasser, and a sales department was essential to the success of an electricity undertaking.

MR. W. R. COOPER analysed his own impressions as a consumer, coming to the conclusion that the coal fire, though dirty, was cosy and not costly with a modern range. From a rough test he found that his range burnt  $1\frac{1}{2}$  lb. coal an hour over 13 hours and cost about 2d. per hour, and to substitute electricity at 2d. per unit for radiator purposes was obviously out of the question.\* The gas cooker was also cheap to buy or hire and to use, while similar facilities for obtaining electrical cooking apparatus were non-existent. The hot water difficulty might be got over by connecting an electrical heater direct to the mains—giving 100 per cent. load factor—but the price must be less than  $\frac{1}{2}$ d. per unit.

\* Mr. Cooper takes an extreme case.—Eds. E.R.

MR. S. EVERSHED advised the supply engineer to get rid of his ideas on the subject of peak loads. Other people in the ordinary way of business had peak loads, but did not find it necessary to use maximum-demand systems of charging. He considered that a flat rate of 1½d.-2d. per unit all round would result in his greatly extending his use of electricity for domestic purposes, while cooking was practicable at 1d. per unit. Touching on the hot water question, in the ordinary way it cost him £16-£18 a year for house coal, the hot water being available from the kitchen range; by comparison he found that a 100 per cent. L.F. electrical water heater, taking energy at 1d. per unit, would cost almost as much for hot water alone, viz., £15. [Contract rates of about 5d. per unit have been quoted for water-heating apparatus of this kind. Eds. E.R.] Present-day methods of obtaining new business were very poor: practical demonstrations were the only way to impress some people. As an instance of the way some supply authorities look after their consumers, he mentioned that he had only had two postcards from the electricity undertaking in seven years.

MR. F. W. WILLCOX referred to the publicity work carried out by American electricity suppliers. The American stations had load factors on the average of 40 or 50 per cent., and were selling about 10 times as much current per head as in this country at about 60 per cent. of the price. The contributions made towards advertising and similar work by American central stations varied from £300 per annum for a small one to £6,000 per annum for a large one, and totalled over £400,000 a year, the great bulk being spent on newspaper advertising.

MR. W. A. VIGNOLES (Grimsby) said the cost of putting in electric wiring and apparatus, and the objection to pulling the walls about, deterred people from adopting electricity more than the price of energy; the householder, however, could be caught—by means of suitable advertising—when he was redecorating his house. In Grimsby he had used all forms of advertising, and the number of new consumers per annum has risen from 70 to 200. To get over the wiring difficulty some rental system must be adopted, but few Corporations had power to carry out such a scheme; Corporations should be able to finance such work, but whether they carried it out themselves was not really material. The builder would not wire small houses, which work should be done in bulk, several houses being supplied through one service. Ordinary heating and cooking was practicable at 1d. per unit, with a differential rate giving reduced prices for all day use, but the cooking apparatus was too costly, and he found that contractors charged too much for hiring it: the Corporations must have powers to do this class of hiring.

MR. A. BRUCE ANDERSON (Ferranti, Ltd.) considered that the cost of energy was at the root of the trouble; if apparatus were given away, it would not be used unless the price of energy was substantially reduced.

MR. F. HUSBAND (Glasgow) mentioned some figures of cost per winter quarter, with a three-room plus kitchen house, which were as follows: (a) Gas lighting 19s. 6d.; (b) gas heating 12s. 6d. and electric lighting 15s.; (c) electric lighting and heating 17s. 6d.; the cost of gas was 2s. 1d. per 1,000 cb. ft. and of electricity 3d. per unit. He came to the conclusion that the cost of energy was not so important as the cost of apparatus. The supply authorities must take up the provision of apparatus; in Glasgow, it was known that the contractors were working only for themselves.

MR. L. BUCKELL (Newcastle-on-Tyne) agreed that the cost of energy had very little to do with the extension of the use of electricity. The difficulties raised by consumers would disappear if the central station carried out its work properly, but he was afraid that assisted wiring on a large scale would do more harm than good. He urged the necessity for co-operation in advertising and business getting; a big scheme was necessary with ample funds to carry it out.

MR. E. L. INGRAM (Bournemouth) also spoke on the difficulty of supplying the smaller consumer judging by the estimated cost of energy at present prices.

### LEGAL.

ACCUMULATOR INDUSTRIES, LTD., v. VANDERVELL & CO.

IN the Chancery Division before Mr. Justice Eve, on Tuesday, April 2nd, Mr. Jessel, K.C., with whom was Mr. Winney, moved on behalf of the plaintiffs in this action, for an injunction to restrain the defendants from using and publishing in connection with their goods, testimonials and letters sent to their agent, who is now the representative of the defendant firm, while he was in their (the plaintiffs') employ.

MR. P. O. LAWRENCE, K.C., and Mr. Ward Coleridge appeared for the defendants.

MR. JESSEL said that the Accumulator Industries, Ltd., were the licensees for this country of certain patents relating to the lighting of motor vehicles by electricity. Originally the patent was applied only to trains, but subsequently it came into use for motor vehicles generally. The licensees entered into an agreement with the defendants for the sale of their machinery in Great Britain and Ireland for general use except on railways and metropolitan omnibuses. The plaintiff company agreed with the defendants that they should at all times use their best endeavours to promote the introduction and sale of their dynamos, and the defendants undertook that during the time they were so engaged they should not become directly or indirectly interested in any other dynamos. The licensees agreed to provide all dynamos at cost price to the defendants, who were to give them half the profits of sale after



deducting 10 per cent. The agreement was to be binding for one year, with the option to the defendants of renewal. The defendants experimented with the machine, and at the close of the year's agreement they, as Vandervell & Co., put a new machine upon the market, and they sold other things connected with electric lighting outfits. In association with their business they issued a pamphlet entitled "Electricity v. Acetylene Oil," and in connection with it they used the name C.A.V.

MR. LAWRENCE: The C.A.V. system was used long before.

MR. JESSEL: In September, 1910, the defendants brought out another patent, the agreement having terminated, after a year, in April, 1910. In November, 1911, they issued another document, which they called "Something striking," and of that document the plaintiffs complained, as it contained testimonials sent to defendants' representative while he was their agent, and had reference to their dynamos which had been fitted to the cars of the writers. The defendants were then selling as the C.A.V. system their own Vandervell dynamos, and what the plaintiffs complained of was that testimonials referring to dynamos supplied by them were used as having reference to the defendants. They omitted the dates for the purpose, suggested counsel, of destroying identity. That, he said, was a breach of the contract of agency, and his second point was that it was a clear case of passing-off. The testimonials were used for the purpose of showing that the articles supplied had given satisfaction, and to induce other people to buy.

MR. JUSTICE EVE: What does your writ ask for?

MR. JESSEL said it asked for an injunction to restrain the defendants from pushing the sale of their dynamos in substitution for those of the plaintiffs.

MR. JUSTICE EVE said he could not see what was the cause of action. Did the plaintiffs say that the letters belonged to them?

MR. JESSEL said that they did not; but they had such property in them as would entitle them to say that they should not be used adversely to them. The use the defendants were making of them, amounted to a passing-off. As they were not entitled during the year to become commercially interested in any other invention, they were not entitled afterwards to use anything obtained during that year for their own purposes as against the plaintiffs. They had no right to use testimonials given for one set of goods for the purposes of another set.

MR. JUSTICE EVE said he could not see what right of property there was in the testimonials. It did not arise out of the contract.

MR. JESSEL said it was the right of every trader to see that the goods of other people were not substituted for his.

MR. JUSTICE EVE asked whether the testimonials did not apply to the substitution of self-sustained electric lights for the old oil lamps.

MR. JESSEL said the plaintiffs thought that some of the testimonials were asked for in relation to their dynamos. As the plaintiffs' agents, there was an obligation upon the defendants to push the plaintiffs' machine, and no doubt they would be entitled to use the testimonials, while they retained the agency, but they were not entitled to use them for purposes which were foreign to the agency.

MR. P. O. LAWRENCE, for the defendants, argued that the motion was ill-founded. There was no principal and agency in the case at all. The defendants were the sole consignees of the electric motor, and directly they paid for them they became their property, but they agreed to give the plaintiffs half the profits upon re-sale. If he was right in that, the whole cause of action went. The letters and testimonials were the property of the defendants, who had a right to use them as they thought fit. There was no passing-off and no agency.

MR. JUSTICE EVE, in giving judgment, said that the claim for relief was based upon the relationship between the plaintiff and the defendants, and it was quite obvious that the plaintiffs were proceeding upon the footing that the defendants were, by the agreement, constituted their agents, and that the testimonials were received by them in that capacity. That, however, did not appear to be the case. The whole matter depended upon the relationship between the parties under the agreement. The defendants had apparently for some years been endeavouring to perfect a system of lighting motor-cars by electricity, and the plaintiffs, being the owners of a portable dynamo, came to the conclusion that it might be utilised for the purpose, and they approached the defendants with that view. It became necessary to arrange special terms in order to make business, and an agreement was entered into. There was incorporated in the agreement a covenant that the defendants would not do anything during the year which would interfere with the success of the plaintiffs' invention. He did not think the description of the defendants, as selling agents, was correct. They were simply consignees of the plaintiffs' goods, but that was a point for further consideration at the trial of the action. It was sufficient for him at present to say that he did not see his way to giving the plaintiff the relief for which he asked, on the footing that there was a fiduciary relationship between the parties. All he could do now was to refuse the motion.

MR. JESSEL: Will your Lordship make the costs of the motion costs in the action?

MR. JUSTICE EVE: No.

#### SHRIMPTON v. NORTHERN LIGHT, POWER AND COAL CO., LTD.

THIS case came before the Court of Appeal, composed of the Master of the Rolls and Lord Justice Buckley, on Monday and Tuesday last week, upon the appeal of the plaintiff from an order of Mr. Justice Eve in the Chancery Division refusing to grant an interlocutory injunction restraining the defendant company, its directors,

and agents until the trial of the action, or further order from issuing any more bonds in pursuance of a resolution passed at a meeting of debenture-holders held on August 18th last. The resolution sanctioned the issue of \$1,000,000 prior lien bonds.

It appeared that the plaintiff was the holder of some of the original first mortgage 5 per cent. gold bonds of the defendant company, and he alleged that the chairman at the meeting in question had made misstatements as to the validity of a contract which the defendant company had entered into with the Klondyke White Channel Gold and Gravel Mining Co., by which the latter company undertook to take from the defendant company a large quantity of electric power. Plaintiff alleged that he subsequently discovered that the defendant company had no claim on the contract, and that the representations made were not substantially true, and he claimed that the defendant company could not put the resolution into force.

At the conclusion of the arguments of COUNSEL, their LORDSHIPS dismissed the appeal with costs, holding that it was not a case of an interlocutory injunction.

#### ELECTRIC LIGHTING COMPANY FINED.

ON April 2nd, at the Wonford Petty Sessions, the Topsham Electricity Supply Co. were fined 2s. 6d. and costs for employing a lad, Frank Stanley Boucher, on their premises on Sunday, March 10th. On behalf of the company, it was explained that the lad was a pupil of the engineer. He had a special desire to acquire knowledge, and, in compliance with a request made by him, the engineer allowed him to be at the works every third Sunday evening between six and eight.

#### SOUTHPORT ENGINEERING CO., LTD., v. TAYLOR.

AT the Southport County Court, on April 2nd, the plaintiffs sued A. Taylor, engineer, of Virginia Street, for £28 18s. 6d., for work done and material supplied.

COUNSEL for plaintiffs said that defendant intended to patent a machine for converting refuse into electrical energy by means of an "electric whirlpool," which was going to revolutionise motive power. No proper drawings were submitted, and a great deal of the work done was purely experimental and had to be discarded.

MR. SCHOFIELD, of the plaintiff firm, giving evidence in support of the case, said he could not understand from the inventor at first what the machine was intended for, but its vital part was a hollow egg-shaped piece of metal, on which defendant had mapped out all the component parts of the earth. The inner portions of the machine would be made to radiate in opposite directions, and so create the electrical whirlpool. His idea was that he could put all sorts of refuse into the machine, magnetise it with a given voltage, and convert it into energy. He could, he said, take the machine to a colliery, put in coal-dust, and convert it into energy with 90 per cent. of efficiency.

For the defence, it was submitted that the charges were excessive.

The JUDGE found for plaintiff for the full amount, with costs. His Honour pointed out that this was an experimental article, and when it was begun the inventor had no accurate or clear idea of what he required, and allowance must be made for the number of times it was pulled to pieces.

#### FOSTER v. E.C.C.

AT Walsall County Court, on the 3rd inst., an action was brought by Messrs. Foster Bros., of Wednesbury, to recover £29 1s. 1d., balance due on a contract with the Electrical Construction Co., Ltd., of Bushbury, Wolverhampton. There was also a counter-claim for the same amount on the ground that the installations of steam exhaust and water pipes were imperfect, and not reasonably fitted for the purpose for which they were required.

MR. WRIGHT, for the defence, stated that the claim was admitted, and the action turned on the counter-claim.

The Judge awarded £29 1s., with costs, on the claim, and gave judgment for the defendants on the counter-claim for £14 15s., with costs. Leave, however, was given to appeal, and a stay of execution was granted.

**Tucuman Hydro-Electric Undertaking.**—THE COMPANIA HIDRO-ELECTRICA DE TUCUMAN have just placed in London a large amount of debentures and ordinary shares for the extension of their hydro-electric works and 1,200-volt railway which they are now constructing in the province of Tucuman, Argentine Republic. The company will be in the market for large quantities of materials of all classes, including high and low tension materials and 1,200-volt railway equipments. The London offices of the company are at Donington House, Norfolk Street, Strand, W.C.

**Works Closed.**—MESSRS. MAWDSLEYS LTD., of Zone Works, Dursley, closed their works from the evening of Thursday, 4th inst., until 9 a.m. on Monday next, 15th inst., in order to give their foundry an opportunity of replenishing its stock of castings. We understand that, although at the beginning of the strike they endeavoured to provide for all demands, the number of orders since received has been so large as to seriously diminish the stock.



## BUSINESS NOTES.

**Book Notices.**—“*Journal of the Western Society of Engineers.*” Vol. XVII, Nos. I and II. January and February, 1912. Chicago: The Society. Price 50 cents.

“Investigations of Explosives used in Coal Mines.” By C. Hall, W. O. Snelling and S. P. Howell. “Investigations of Fuse and Miners’ Squibs.” By C. Hall and S. P. Howell. “The Rate of Burning of Fuse.” By W. O. Snelling and W. C. Cope. 1912. Washington: Government Printing Office.

“*Transactions of the Illuminating Engineering Society.*” Vol. VII, No. 2. February, 1912. New York: The Society. Price 75 cents.

“*Proceedings of the American Society of Civil Engineers.*” Vol. XXXVIII, No. 3. March, 1912. New York: The Society.

“*The Physical Review.*” Vol. XXXIV, No. 2. February, 1912. Lancaster, Pa.: The Review Office. Price 65 cents.

The April issue of the *Marconiograph*, published monthly by Marconi’s Wireless Telegraph Co., Ltd., has been enlarged to 48 pages, and contains many articles of general and technical interest. An illustrated account is given of the details of the Empire scheme of wireless telegraphy, and of the contract for the establishment of stations in Portugal.

**Bankruptcy Proceedings.**—DAVID ROBERTS, electrical and motor engineer, 30, Macklin Street, Derby, late 3 and 5, Whiston Street, Derby.—An application was made last week to the Deputy-Judge Gurner, sitting at the Court House, 20, St. Peter’s Churchyard, Derby, for the discharge from bankruptcy of the above-named debtor. The Official Receiver reported that the receiving order was made in June, 1902, on the debtor’s own petition. The liabilities expected to rank for dividend totalled £137, but proofs actually admitted amounted to £120. The assets so far as they were not assigned to creditors figured at £46, and a dividend of 6s. 8d. in the £ had been paid. The debtor started business in 1900 without capital, and he had failed to keep proper books of account. He had also continued to trade after knowing himself to be on the wrong side, and had failed to satisfactorily account for a sum of £70. His Honour said that although the explanation of the loss of this amount was unsatisfactory, he thought the dividend was fairly substantial. Ultimately the discharge was granted, subject to a suspension of two years.

J. TIZZARD, electrical engineer, Abbey Road, Torquay.—Receiving order made March 29th at Exeter Court, on a creditor’s petition. First meeting April 15th, public examination April 25th—both at Exeter.

**Dissolutions and Liquidations.**—W. G. HAYWOOD AND CO., electrical fittings dealers and manufacturers, 56, High Street, Bloomsbury, W.C.—Messrs. S. G. Brounger & W. G. Haywood have dissolved partnership. Mr. Haywood attends to debts, &c.

ECKSTEIN, HEAP & CO., electrical engineers, 5, Chapel Walks, Manchester, and Waverley Mills, Salford.—Messrs. August Eckstein and A. C. Heap have dissolved partnership. Mr. Eckstein will attend to debts and continue the business under the same style. Mr. Eckstein, who has taken over the business, is retaining the entire staff, and will conduct it on exactly the same lines as heretofore. In order to cope with the increased demand for the firm’s manufactures, the factory will shortly be removed to larger premises.

METALITE, LTD.—A petition for the winding up of this company presented on April 1st by A. B. Reckitt, merchant of St. Leonards-on-Sea; W. G. Dell, London; T. C. E. Goff, London; and E. J. Previté, merchant, of London, contributories of the company, is to be heard on April 17th.

BRADFORD ELECTRICAL CO., LTD.—This company is winding up voluntarily with Mr. J. H. Haley, 62, Market Street, Bradford, as liquidator. A meeting of creditors is called for April 19th.

STOCKALL-BROOK TIME RECORDERS, LTD.—This company is winding up voluntarily. A meeting of creditors is called for April 15th, at Huddersfield. Liquidator, Mr. O. Avison, 19A, Westgate, Huddersfield.

TELEPHONE DEVELOPMENT CO., LTD.—This company is winding up voluntarily with Mr. M. W. Jenkinson, 22, Broad Street Avenue, E.C., as liquidator.

CARIBBEAN ANGLO-COLOMBIAN CABLE CO., LTD.—A meeting of creditors is called for April 18th, at 65, Bishopsgate, London, E.C. Mr. A. R. Bennett, of that address, is the liquidator.

**Henley’s Flexibles.**—MESSRS. W. T. HENLEY’S TELEGRAPH WORKS CO., LTD., of Blomfield Street, E.C., announce that they are now manufacturing their “C.M.A.” and “Association” flexibles in smaller sizes than previously, namely, in 13/36 S.W.G. = No. 22 S.W.G. A stock in this size in silk, cotton, and workshop finishes is kept by the firm, and a slip is being circulated stating the prices.

**Coal Strike Effects.**—Notification was posted at MESSRS. DICK, KERR & CO.’s electrical works that the greater portion of the works will remain closed until Monday, April 15th, or, if the coal strike was not over by that date, until further notice. Between 900 and 1,000 men are employed at the works, and about three-quarter of this number are affected by the extended stoppage which has been rendered necessary by the shortage of fuel.

**Catalogues and Lists.**—MESSRS. C. JENNINGS & CO., Pennywell Road, Bristol.—Two hundred and sixty-four-page pocket-size catalogue, containing particulars of a very full and complete collection of manufactured woodwork of British manu-

facture. It is a production of a somewhat different kind from those usually noticed here, but it is both interesting and serviceable. The goods that are illustrated and briefly described and of which prices are given, include such varied lines as the following:—Portable buildings, motor sheds and workshops, greenhouses and summer houses, woodwork for use in house and shop building, fretwork arches, pannelling and staircases, woodblock flooring, wheelbarrows, cabinets and bookcases, door frames, wire fencing and netting, and last, but by no means least, there are electric wood-casings and cappings, creosoted troughing for underground cables, and hardwood cable bridges.

From the EMANDA ENGINEERING CO., of Emanda Works, Laurie Grove, New Cross, London, S.E., we have received a glass paper-weight for desk use, together with an intimation that on application similar weights will be sent to any electrical firm interested in accumulator switchboards, distribution boards, fuseboards and electrical cabinet work.

MESSRS. BRITISH INSULATED AND HELSBY CABLES, LTD., Prescott.—New pamphlet (No. P 119) of eight pages containing descriptive notes, half-tone illustrations, and price information, relating to Prescott welders for welding tires of a number of different sizes.

THE REES ROTURBO MANUFACTURING CO., LTD., Wolverhampton.—24-page pamphlet (No. R.115) containing a full description with line diagrams, half-tones and curves, of their rotary jet condensers and high vacuum air pumps.

THE UNION ELECTRIC CO., LTD., of Park Street, Southwark, S.E., as an Easter souvenir, have sent out a neat vest pocket celluloid envelope of sticking plaster. The envelope carries a calendar for 12 months from April 1st.

THE “ATTRACTA” ELECTRICAL CO., 75, Fetter Lane, London, E.C.—Priced leaflet relating to the “Ajax” electric cycle lamp outfit.

**Mazda Lamps.**—THE BRITISH THOMSON-HOUSTON CO., LTD., announce that the 5 per cent. extra charge for Mazda lamps for series burning is now withdrawn.

**Fire.**—MESSRS. MANN, EGERTON & CO., LTD., electrical engineers, whose establishment was destroyed in the great fire at Ipswich on Saturday, have opened temporary offices at Imperial Chambers, Princes Street.

**The A.E.G. in Mexico.**—The A.E.G. Mexikanische Elektrizitäts Gesellschaft has been formed in Berlin with a capital of £100,000 for the purpose of representing the A.E.G. in Mexico and Central America.

**For Sale.**—The Greenock Corporation electricity department has for disposal one 100-kw. Belliss-Silvertown balancer set and two 150-kw. Belliss-Silvertown sets. See our advertisement pages to-day.

**Trade Announcements.**—MR. T. J. DOYLE has removed from Houghton-le-Spring to 48, Houghton Road, Hetton-le-Hole, co. Durham.

MESSRS. LORD & SHAND, LTD., of Plymouth, have opened a branch at 56, Chapel Street, Penzance, Cornwall. They invite firms to forward catalogues.

MESSRS. WORSLEY & PAGE, LTD. (late F. Worsley & Co., of Peterborough) are in occupation of their new premises, Beaver Works, Cornbrook Road, Manchester, where they have every facility for carrying out electrical machinery repair, and other work.

In order to deal more promptly with the commercial side of the business, the head office of THE BRITISH ELECTRIC PLANT CO., LTD., Alloa, is to be removed from Alloa to 144, St. Vincent Street, Glasgow, and all communications after April 15th should be sent to this address. Mr. R. H. Willis, the general manager of the company, has been elected a director, and will be located in Glasgow. The company have also opened an office at 11, Queen Victoria Street, London, E.C., where Mr. A. T. Young (from the head office) has been appointed local manager.

## LIGHTING and POWER NOTES.

**Abingdon.**—The T.C. has adopted a report of the Electric Lighting Committee accepting the offer of Messrs. Edwards and Armstrong, of Bristol, to take over the prov. order when obtained by the Council. Among other clauses in the agreement, it is provided that the firm shall reimburse the Council the costs incidental to the prov. order, not exceeding £275; that a limited liability company shall be formed; the Council to permit overhead wires fixed to neat steel poles; the charges to private consumers not to exceed—For 0 to 50 units, 6½d. net cash per unit (7d., less ½d. discount); from 50 to 250 units, 6d. net cash (6½d., less ½d. discount); over and above 250 units, 5½d. cash (6d., less ½d. discount). Minimum charge of 10s. for each quarter between September 29th and March 25th, and 5s. per quarter for the other two quarters of the year. These charges not to be increased without the consent of the Council; the standard rate of dividend shall not exceed 8 per cent., but in order to encourage the charging of a lower price for



light, it is provided that for every reduction of a  $\frac{1}{2}$ d. in the price charged per unit, an increase of  $\frac{1}{2}$  per cent. may be made in the dividend payable by the company; that power is reserved for the Council to purchase the company's undertaking.

**Accrington.**—The Haslingden Corporation having asked upon what terms this Corporation would be prepared to carry out the work of laying services and mains for the supply of electric current within that borough, the electrical engineer has been instructed to go into the matter, and authorised to undertake the work provided satisfactory terms can be arranged.

**Argentina.**—The electric light station at Colon (Buenos Ayres), is finished, and the first trial of the machinery took place on March 8th with satisfactory results.

The electric light station at General Paz, Province of Buenos Ayres, will be inaugurated in May, the works being well advanced.

The Government of the Province of Buenos Ayres has forwarded to the Legislature an *ad referendum* contract with the R. P. Electricity Co., in place of the existing contract.

The Compania Alemana Transatlantica de Electricidad has resolved to increase its capital by a further 20,000,000 marks, which will be principally used for the enlargement of the Dock Sud power house.—*Review of the River Plate.*

**Australia.**—NEWCASTLE, N.S.W.—Following the appointment of Mr. J. E. Donoghue as consulting engineer, and Mr. Guy Allbutt as city electrical engineer, the City Council has embarked on a large scheme of reconstruction for its electrical undertaking. To this end a sum of £10,000 has been borrowed, and the work is to embrace a general reconstruction of all overhead mains, erection and equipment of four new sub-stations, a system of high-tension series lighting for the city generally on the constant-current principle for both arc and incandescent lamps. It also provides for the erection of a condenser and cooling tower, water-softening plant, &c., and minor additions to the generating station. It is estimated that the business is capable of very large extensions in all the suburbs, as Newcastle is the second city of the State, and its present business as regards electricity supply does not compare favourably with many smaller towns of the State. When it is known that Newcastle is practically in the centre of the coal supplies of the Commonwealth, and that it is rapidly becoming a large manufacturing centre, the possibilities become more apparent. It is also intended to adopt the very latest methods of obtaining business, and all classes of electrical apparatus will be hired in the manner that has been adopted by many English municipalities.

**Barnes.**—Acting on the suggestions of the engineer, the Electricity Committee recommends that (1) consumers residing in private houses and connected to the Council's electricity mains shall have the option of paying for energy at the existing prices, or as follows:—Where the energy used is for lighting purposes only, 10 per cent. per annum on the rateable value of the premises occupied by the consumer, payable quarterly in advance, plus 1d. for all units used as metered. Where the energy is for lighting and heating or cooking, or all three combined, 10 per cent. per annum on the rateable value of the premises occupied by the consumer, payable quarterly in advance, with an additional 1d. for all units used as metered during the months of October to March inclusive, and  $\frac{1}{2}$ d. for all units used as metered during the months of April to September; (2) when the rateable value scheme of payment is in force no charge is to be made to the consumer for rent of meter. After discussion, these recommendations were agreed to, and the arrangement is to come into force after the March readings.

**Barrow.**—The T.C. has decided that application be made to the L.G.B. for sanction to the borrowing of £22,000 for electricity works purposes. The sum was detailed as follows:—Buildings, foundations, &c., £1,160; turbo-generator, rotary converters, steam pipes, &c., £7,270; high and low-tension switchboards and connections, £1,841; extra-high-tension mains and pilot wires, £8,627; sub-station switchgear and transformers, £2,075; engineering contingencies, £1,027. The Mayor (Ald. Smith) said probably not more than £10,000 would be required immediately.

**Bingley.**—The B. of T. has granted a prov. order for E.L. to the U.D.C.

**Bolton.**—Owing to the impossibility of having the new generating station at Back-o'-th'-Bank ready for next winter's load, a 3,000-ampere-hour battery is being installed, with an automatic booster, to overcome the peak load. The battery also will be used in connection with the tramway supply.

**Bootle.**—An inquiry has been held by the L.G.B. into the application of the Corporation for sanction to borrow £43,755 for the purchase of land and machinery for a new generating station. The borough electrical engineer (Mr. J. D. Clothier), in explaining the proposals, stated that the equipment of the station included two turbines capable of developing 3,000 kw. The new works, he said, would put the Corporation in a position to cope with any future requirements. No opposition was raised to the scheme.

**Brazil.**—The Government has granted to a syndicate the right to utilise the waterfalls at Braculy, in the Province of Angora dos Reis. The power available without storage reservoirs is 24,000 H.P., and with reservoirs as much as 100,000 H.P. The power will be used for electrometallurgical purposes.

**Burton-on-Trent.**—The T.C. has received the consent of the B. of T. to the use of overhead wires for the transmission of current in the outskirts of the borough, and along Bretby Lane, in the area of the Repton R.D.C.

**Colchester.**—The T.C. has decided to give a supply of current to the Lexden and Winstree B.G. for lighting at the workhouse.

**Continental Notes.**—BULGARIA.—The *Nachrichten fur Handel und Industrie* (Berlin) announces that a Bill has been submitted to the Bulgarian Legislature providing for an electrical installation at the "Pernik" State Colliery. The cost of the installation is estimated at £3,200.—*Board of Trade Journal.*

PORTUGAL.—The Lisbon municipal authorities have decided to set up a central electric generating station for the purpose of supplying the city with electric light, and to lay the necessary cable. Tenders will be invited within a month.—*Board of Trade Journal.*

TURKEY.—The municipal authorities of Monastir are at present considering a scheme for the construction of an electric lighting station and an electric tramway in the town. Water power will be utilised.

AUSTRIA.—The plans for a large power plant on the River Danube, near Pressburg, have been drawn up. The scheme contemplates taking the water direct from the river and leading it in a canal, 15.5 km. long, to the power house below Pressburg. The power house will be equipped with 16 Francis turbine groups, one being held in reserve; each group is expected to yield 4,000 H.P. at 75 R.P.M. The year's total output is reckoned at 300,000,000 kw.-hours. A supplementary high-pressure power station with accumulator equipment is planned to take the load of that portion of the distributing network supplying Budapesth.—*Zeit. fur das Ges. Turbinenwesen.*

**Croydon.**—At the last meeting of the County Council it was decided, subject to the issue of an Order by the B. of T., to supply electricity in bulk to the West Kent Electric Co., Ltd.

**Dominica.**—The Government has granted a concession to Mr. Lithgow, of 17, Madison Avenue, New York, to establish water and electric light services in the cities of Santiago de los Caballeros, Moca, La Vega, San Francisco de Macoris, and Puerta Plata. Power to the extent of 6,000 H.P. will be derived from the Yaque River, the turbine station being situated at a point 7 miles above Santiago.

**Dublin.**—When submitting its estimates for 1911, the Electric Lighting Committee estimated that at the close of the current year it would have a surplus of £6,788. This has, however, been realised only to the extent of £3,713, which is carried over to the account of the coming year, at the close of which the surplus is estimated at £13,304, which, added to this year's figure, makes a total estimated surplus on March 31st, 1913, of £17,017. The non-realisation of the figure which the Committee had hoped for in the current year was due to the falling off in the income from private consumers for the December quarter. The Committee's estimate was passed on the assumption that a reduction of 5 per cent. will be granted in the rates for energy for lighting as from April 1st next.

**Doncaster.**—In the estimates of proposed expenditure for the current year, £7,970 is set apart for extension of electricity mains and plant.

**Eastbourne.**—The Electricity Committee has received an application for a reduction in the present charges for power for cooking and heating, and the electrical engineer has recommended the following scale:—First 2,000 units per annum, 1 $\frac{1}{2}$ d. per unit; second 2,000, 1 $\frac{1}{4}$ d.; remainder, 1d. per unit. The Committee has agreed, provided the applicant is willing to enter into a contract to have a supply for three years, and to pay for a minimum of 10,000 units per annum, to adopt the foregoing scale. With regard to a proposal to reduce the charge for motive power, the matter was deferred until the annual accounts of the undertaking have been published. The question of laying a new high-tension main for an alternative supply to Willington and Hampden Park, at a cost of about £962, has been deferred.

**Fife.**—During disturbances last week at the pits of the Fife and Lochgelly Iron and Coal Co., the electric power station came in for close attention from the strikers. In the station, of course, there is very valuable plant, and, as the floor was littered with projectiles, it is feared considerable damage must have been done.

**Greenock-Port Glasgow.**—An agreement has been reached between these towns whereby the former will supply power to the Port Glasgow shipyards. Permission is not to be given to erect a power station at Port Glasgow, either by the town or by private enterprise, until after 30 years from date of signing the agreement. The estimated capital expenditure by Greenock is put at £25,000, for cables, erecting a transformer station, &c.

**Haiti.**—The Government *Gazette* of Haiti publishes the particulars of a contract entered into with the Société Naitienne de Force Motrice. According to its terms the company is accorded a concession for 50 years for the generation of electricity from all the natural waterfalls and watercourses within a radius of 25 French miles from Petionville, which lies 10 km. from Port-au-Prince. The concession has to do with the electrification of the Port-au-Prince street tramways and the working of the projected Port-au-Prince-Petionville railway.—*Zeit. fur Turbinenwesen.*



**Hazel Grove and Bramall.**—The U.D.C. has now decided to assent to the Stockport T.C. supplying current to premises at Offerton, which is in the area of the U.D.C. Stockport had applied to the Board of Trade for an order without the assent of the U.D.C., and the assurances given to the latter body—which had intimated its intention of applying for a prov. order for E.L.—by the B. of T., have resulted in consent being given.

**Hereford.**—The Corporation has under consideration an improved lighting scheme for the centre of the city.

**Heywood.**—The Corporation on Thursday, last week, had to suspend the supply of electricity for users of power, and this affected between 60 and 70 works of various kinds. The stoppages of mills also increased, it being estimated that 4,000 people are unemployed in the town, as a result of the coal strike.

**Leeds.**—It will be remembered that at a recent inquiry of the L.G.B. into an application of the Corporation for powers to borrow £60,000 for electricity purposes, the Inspector strongly criticised the inclusion of sums in the suggested loan for service mains. The L.G.B. has since communicated with the Town Clerk on the matter, suggesting that in future the cost of such services and the purchase of meters should be provided out of revenue. The Finance Committee has agreed to act on the suggestion as from the end of March, and has decided to ask the Board to assent to the inclusion of the sum asked for in this special instance.

**Limerick.**—Mr. Cloran, borough electrical engineer, has submitted plans and specifications to the Electricity Committee in connection with the three different schemes put forward with regard to the improvement of the plant at the power station. It was decided to circulate copies of the report, and to consider the whole matter at a future special meeting.

**Leith.**—The Corporation electricity department has benefited from the coal strike. According to Councillor Craig, convener of the Electric Lighting Committee, the consumption has gone up, as consumers who generally used both steam and electric power turned to the electric motor in emergency. Mr. Craig also stated that while in some towns electric tramway services had to be curtailed, in Leith the facilities had been increased.

**Lincoln.**—The Electricity Committee has voted £1,000, being one-third of its profit, in relief of the rates.

**London.**—**HAMMERSMITH.**—The Finance Committee has decided to carry the sum of £3,330, the estimated net surplus of the electricity undertaking for the year ending March 31st, 1912, to the relief of the rates. A further sum of £4,000, half of the accumulated surplus profits standing to the credit of the revenue account, is to be carried to the reserve fund. The Electricity Committee has decided to ask the Metropolitan Boroughs Standing Joint Committee to give consideration to the question of London electricity supply, upon which a Committee has been appointed by the L.C.C.

**Lytham.**—The B. of T. has informed the Council in respect of the proposed provisional order for supplying electricity that as the Lytham Electric Light and Power Co. failed to establish an undertaking under that order, the Board is not aware of any power under which that order could be revested in the Council. At the Council meeting, on April 4th, this was interpreted as meaning that the Council must apply for a new order next October.

**Manchester.**—The City Council has now decided to resume the normal supply of electricity on and after the 10th inst., and instruction has been given for the various firms to be notified to this effect.

**New Zealand.**—The Government having decided to abandon the Wairua Falls hydro-electric scheme, the Whangarei Council has resolved to apply for the use of the power for electrical purposes. It has been estimated that a revenue of £6,600 per annum would cover working expenses, and one concern is stated to have guaranteed to take £6,000 worth of energy per annum.

**North Wales.**—Various authorities are discovering the value of generating electricity by water-power, and steps are being taken to promote electric lighting schemes at Harlech and Llanbedr, in Merionethshire, the motive power being supplied by the waterfalls in the adjacent hills.

**Nuneaton.**—The T.C. has decided to apply to the L.G.B. for a loan of £3,770 for the following purposes:—Cable extensions to Griff Granite Quarry, £1,850; prospective expenditure on mains and services for three years, £1,750; excess expenditure, £170.

The Council has adopted the following alterations in the charges for current:—Large power consumers, first 5,000 units per quarter, 1d. per unit; next 1,000, 3d.; next 4,000, 1d.; beyond 10,000, a flat rate of 3d. for the whole supply. Current to licensed premises for lighting will be charged on a flat rate of 3d. per unit provided the supply is used throughout, and that there is a minimum average quarterly consumption of 200 units.

**Perth.**—After considering the Loch Erich Electric Power Bill, the T.C. agreed to take all necessary steps towards safeguarding the interests of the city in relation to the water rights, &c. A Committee was also appointed to visit the Loch and take levels of the water.

**Peterborough.**—Reports are under consideration by the T.C. for an extension of the borough boundaries, by taking in several villages, and one urban district in the vicinity. In this connection, the electrical engineer, in dealing with the electricity undertaking, suggests that the Walton district is already ripe for a public electricity supply, and advises the Electricity Committee to consider the advisability of installing at the existing generating station H.T. alternators, and a special main through New England to Walton, to supply all the large works adjoining the railways all the way from the River Nene to Warrington. The northern portion of the existing borough could also be supplied for lighting purposes from the H.T. plant, the current being converted to 200 volts D.C. He adds that the limit of D.C. distribution has already been reached in a northerly direction, and the question of supplying the extreme limits of the borough will have to be met whether the boundaries are extended or not.

**Rochdale.**—The L.G.B. has sanctioned the borrowing of £8,700 for extensions of buildings and plant at the electricity works.

**St. Helens.**—The Corporation Electricity Committee has decided to give a supply of current at 400 volts by means of overhead lines to the works of Baxter's Chemical Co., Bramwell's Chemical Works, and the British Electric Detonator Co.

The price of current supplied to the Technical School has been reduced from 4½d. to 3½d. per unit.

**South Africa.**—The increased consumption of electricity in Pietermaritzburg, due to the lighting of the new railway workshops, as well as increased demands by private consumers, has led the Council to consider the extension of the public generating plant. At the last meeting of the Council it was decided to install a steam turbine of the "Impulse" type, at an estimated cost of about £7,000, which would replace three of the present 60-kw. reciprocating sets.

In a recent month the consumption of electric current from the Durban power station for lighting purposes amounted to no less than 35 per cent. more than in the corresponding month of last year. So, also, is the power demand largely on the increase, the latest consumer being the Coronation Brick Works, some five miles out of town, which has installed two 300-H.P. motors, supplied at 6,600 volts three-phase from the new plant recently started up at the power station. It is hoped that by next month the whole of the railway and harbour load will be transferred to the municipal plant, the Government power station becoming a sub-station for distribution. It is apparent that there will be still greater increases in the immediate future, especially as the Corporation now has power to supply outside the borough.

**Torquay.**—An application has been received by the Electric Lighting Committee from the Works Committee asking for a reduction in the charge for lighting public arc lamps. Owing to the fact that the latter Committee is now getting the current at practically cost price, to the large expenditure incurred in converting lamps from carbon to metallic filament, and to the fact that lamps are now kept alight until midnight, the Electric Light Committee is unable to make any reduction in the price charged, but the engineer has been directed to prepare a statement with regard to the matter to be submitted to the Works Committee.

**Uruguay.**—The Finance Committee of the Uruguayan Legislature will shortly issue its report on the Government Bill for the nationalisation of the electric light and power service throughout the country. All towns with more than 4,000 inhabitants are to have power houses. This will mean a large purchase of plant for which tenders will be invited.

**Venezuela.**—The Compania Generadore de Fuerza y Luz Electrica has been formed by a group of capitalists at Caracas and La Guaira, for the construction of a hydro-electric station at the Mamo Falls, 16 miles above La Guaira, in connection with the electric installation at La Guaira, which supplies that town and several neighbouring localities.—*Zeitschrift für Turbinenwesen.*

**Wallasey.**—The minutes of the T.C. show that the Ferries Committee has had a scheme submitted by Mr. Marchant White, engineer, of Seacombe, for utilising the tides of the River Mersey for the generation of electrical energy to work the hydraulic lift at the Seacombe Ferry Stage and illuminate the promenade.

**Windermere.**—The U.D.C. has instructed the surveyor to obtain prices for wiring the Hospital for electric lighting. At present oil lamps are utilised.

**Worthing.**—In introducing the estimates for the coming half-year at a recent meeting of the T.C., the chairman of the Finance Committee mentioned that since the new oil engines had been at work he was authorised to say they had more than fulfilled the expectations of the Committee, and they quite anticipated that 12 months hence the undertaking would show a credit balance of £1,184. The economies which they were effecting by the new plant, and in other ways, would also enable the Electricity Committee to charge a flat rate of 4½d. per unit for public lighting instead of 5d.



## TRAMWAY and RAILWAY NOTES.

**Algeria.**—Negotiations are proceeding for the construction of a system of electric tramways at Bona. This, says *African Engineering*, may be connected with a comprehensive scheme for the municipalisation of the waterworks, electric tramways, and electric lighting of the town.

**Argentina.**—Work on the electric tramway in Mendoza is being rapidly pushed ahead. *The Review of the River Plate* says that apparently a great mistake has been made by the Provincial Government in insisting that the gauge should be 5 ft. 6 in. instead of the standard 4 ft. 8½ in.

**Bolton.**—The Tramways Committee is spending from £1,500 to £2,000 on new machinery for the new repair shed, and deputations are visiting various towns for information on the subject.

**Bradford.**—The figures of the Corporation Tramways Department show that during the year just ended the approximate number of passengers carried totalled 56½ millions, as against 52,919,559 in the previous year. The mileage run increased by 223,000 miles, and the average receipts per car-mile were 11'92d., as against 11'60d. The total receipts amounted to £282,356, as against £264,075, an increase of £18,281. The number of through tickets between Bradford and Leeds was 291,396 (at 6d.) and 14,186 (half-fare), as against 254,236 and 12,171 respectively. The whole of the figures constitute a record for the city.

**Bury.**—At the Council meeting last week it was reported that the result of the year's working of the tramways undertaking was a net profit of £8,575. The number of passengers had increased from 13 millions to 14½ millions, and the receipts from £60,000 to £66,000, though the working expenses had only been increased by £500. A reserve fund of £20,000 has been built up. It was decided to carry £3,575 to the reserve fund and place the balance of £5,000 to the credit of the borough rate.

**Continental Notes.**—GERMANY.—A scheme for the construction of a light electric railway between Klingenthal and Untersachsenburg, Saxony, is at present under consideration.

FRANCE.—Plans are being prepared in respect of a projected electric railway between Vitry-le-François and Brehan (Marne). The power station, of 600-H.P. capacity, would be situated at Larzicourt.

RUSSIA.—A scheme for the construction of an electric tramway in the town of Perm is at present under consideration.

**Exeter.**—The year ending 31st ult. has been a record one for the Corporation tramway undertaking. The passengers carried numbered 4,244,671, as compared with 3,974,142 in the previous year. The cars ran 429,878 miles, compared with 426,993 miles, whilst the receipts were £17,290, against £16,165. The earnings per car-mile were 9'65d., against 9'08d.

**Fife.**—Owing to the failure of the electric supply, the Wemyss and District Tramway system, which covers about eight miles, and connects a number of important towns, was partly closed down for 48 hours last week. The Kirkcaldy authorities supplied energy to the section to East Wemyss, which was kept running, but Buchhaven, Methil and Leven were isolated.

**Glasgow.**—One of the most remarkable features of the coal strike, so far as Scotland is concerned, is the daily increase in the amounts taken on the Glasgow Corporation cars. The average increase per day has been about £100.

**Halifax.**—The report on the working of the tramways for the year ending March 31st shows that there is a net profit of £17,293, as against £11,500 last year, and £13,065 in the previous year. Of the total income of £101,893, £98,115 was derived from passengers, £794 from private cars, &c., £2,047 from parcels traffic, and £937 from advertising. The chief items of expenditure in the total of £84,600 are traffic expenses, £25,400; general expenses, £1,683; repairs and maintenance of permanent way, £6,986; ditto, overhead equipment, £1,455; cars and meters, £5,594; rates, £2,415; accident insurance, &c., £1,290; power, £16,769; parcel traffic, £737; interest on loans, &c., £10,550; sinking fund, £10,197; Parliamentary expenses, £250. The total number of passengers carried was 18,749,456, compared with 17,067,865 for the preceding 12 months.

**Ilkeston.**—The T.C. has adopted a new scale of charges for electricity for lighting and power purposes, also a new and increased scale of tramway fares. Several members opposed increased tramway fares, on the ground that when a similar proposal was previously put into effect, the public boycotted the cars. It was, however, stated that the tramways manager staked his reputation on an increased revenue by the adoption of the new scale, and in the end the proposals were adopted.

**Jamaica.**—In the House of Commons last week, Mr. Amery asked the Secretary of State for the Colonies whether he could give any information with regard to the interference of the populace in Kingston, Jamaica, with the running of the electric tramway service in that city; and whether it was a fact that the Colonial authorities had declined to afford the tramway company the police protection necessary to enable it to run its service.—Mr. Harcourt, in reply, said that he had no official information as to further interference with the tramway since the riot which was

reported in the Press at the time. He had asked the Governor by telegraph to report as to any further developments which might have taken place.

**Liverpool.**—The City Council on April 3rd received the engineer's report on a proposal to construct a single line along Ulbert Road, thus connecting Smithdown Road and Aigburth routes at the Dingle. The capital expenditure to construct this line would amount to £12,386. Added to this would be the cost of three cars, £1,800, making the total £14,186, which would involve an annual charge of £944 for interest and sinking fund, and £2,613 for operating charges. Taking the earnings on the basis of 7d. per car-mile, and assuming that 80,000 miles annually would be run, the total receipts would amount to £2,333, making a deficit £1,224 per annum on the operation of the line, without allowing for reserve, renewal, and depreciation. Regarding another proposal to construct a line between Aigburth Vale and Smithdown Road, via Ibbotson's Lane and Greenbank Road, the engineer estimated that the cost of constructing it would be £14,586, and adding £2,400 for four cars, a total capital expenditure of £16,986. As this road was not yet constructed, the Tramways Committee was of opinion that it was desirable to postpone consideration until such time as the roads were completed. Sir Charles Petrie (chairman of the Committee) said they hoped some day when the Queen's Drive was completed across Mossley Hill, which would go into Aigburth Vale, to make a belt route in that neighbourhood. Until then he hoped the Council would not force the Committee to do anything in the nature of the proposal put before them. The Council decided not to authorise the construction of these lines at present.

**London.**—The work of converting the East London Railway for electric traction has been started and, it is expected, will be completed in a few months.

**Madagascar.**—According to *African Engineering*, it is proposed to construct an electric railway between Fianarantsoa and the Port of Mananjary.

**Manchester.**—The City Council has decided to sanction the Tramways Committee's scheme for extending the stages on the tramways, and the city now equals Sheffield in the length of the ride given for 1d., and it far exceeds every other centre for the cheapness of workpeople's fares. The new rates come into operation forthwith, and further extensions consequent on the above alterations are promised.

**Nelson.**—At the T.C., on April 4th, the Electricity and Tramways Committee reported the receipt of a letter from the Colne and Trawden Light Railway Co., suggesting through running of Burnley cars over the systems of Nelson Corporation and the company. The suggestion was not entertained.

**Newcastle-on-Tyne.**—The total receipts on the tramways for the year ending on Sunday were £223,500, this being the largest on record. Out of the revenue during the year £12,000 was given to relieve the rates, and £12,250 was paid to the Newcastle Electric Supply Co., to enable the Corporation to supply power to its cars in the Walker district.

**Rotherham.**—In forwarding its approval of the plans of the extension of the Dalton tramways to Thrybergh, the B. of T. states that, in view of the severe gradient at the commencement of the tramway, it will be necessary, prior to offering the line for inspection, to provide some method of signalling, and that all cars travelling on the new tramway shall be equipped with a track brake, capable of mechanical application during the descent of the gradient.

**Stretford.**—The General Purposes Committee has decided to make application to the Board of Trade for an extension of time for a further period of four years for the construction of light railways authorised by the Stretford Light Railways Order, 1906, and Railway No. 10, West Manchester Light Railways (New Lines, &c.) Order, 1906, in order to synchronise with the extended powers for the construction of tramways authorised by the Manchester Southern Tramways Act, 1903, and the Stretford U.D.C. Act, 1904.

**Tasmania.**—The Government has under consideration a scheme for operating the Huon Valley Railway on the single-phase system. The route is 35 miles in length, and the project has been reported on by Mr. W. G. T. Goodman.

The tramway system of Launceston is to be extended at a cost of £10,000.—*Commercial Intelligence*.

**U.S.A.**—A new type of safety tramcar has been introduced on to the streets of New York, which is the joint invention of Mr. F. Hedley and Mr. J. S. Doyle, of the New York Railways Co. According to the *Standard*, it is shaped somewhat like a torpedo, and is 40 ft. long. The extremities are rounded, and the wheels are encased, causing the car to appear to be sliding along the track. There is no front or rear platform, passengers using a side door, and entering directly from the street into the car. There are no steps whatever, the body of the car being only 10 in. above the roadway. The conductor sits at one side behind a miniature desk. The side door is worked automatically, and cannot be opened while the car is in motion, and the car itself cannot be started until the door is closed. The seating capacity is 50 passengers, and there is standing room for 30 more. Fresh air is provided by eight automatic ventilators. A device, controlled by the weight of the persons inside, registers the amount of air entering through the ventilators. During the winter the air is heated before it enters. The car is operated by the motorman from an enclosure in front, but an emergency device permits the



conductor to stop the car from his desk by turning a lever. An automatic fender applies the brakes immediately the car strikes a pedestrian or any other object.

**Venezuela.**—The Government has granted a concession to Felipe Guerra to construct an electric railway from the Orinoco or the Coroni to Callao. The concession includes the right to use the waters of the Coroni Rivers or of the Canon del Toro for the generation of electric power for the use of the railway and for industrial purposes.—*Elek. u. Masch.*

**West Hartlepool.**—It was stated at the last meeting of the T.C. that the Corporation is at present losing on the Park and Foggy Furze sections of the tramways, £12 or £14 per week. It was explained that the sections had been acquired by the Corporation and were being run for the Corporation by the tramways company.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The Australian Wireless Co., Ltd., is issuing a writ against the Adelaide Steamship Co., as users of the Marconi wireless system, for an alleged infringement of the patent rights of the former in Australia. The company has also decided to issue a writ against the Maritime Wireless Co. (Shaw System), Ltd., as manufacturers of the apparatus of the Melbourne Government station, for alleged infringement of the patent rights of the company.—*Australian Mining Standard.*

**Cable Communication with Canada.**—In the House of Commons last week the P.M.G. said he was aware that the Canadian House of Commons had expressed a desire for cheap and easy communication with the United Kingdom, but he did not see his way to demand further rate reductions at present, nor could the Government grant a subsidy towards the formation of a cable company by British subjects. In February the Press sent more telegrams to Australia at the deferred rate of 4½d. than at the urgent rate of 9d. He had entered into an agreement with the Marconi Co. for the erection of a chain of wireless stations between this country and India, Australia and New Zealand, at a cost of half a million, which would place Great Britain far in advance of any other country in respect of wireless telegraphy.

**Police Telephones.**—According to the *Daily Chronicle*, the Berlin police are all provided with pocket telephones, and connection boxes are fixed in every street, so that communication can be immediately effected with headquarters. The pocket apparatus fits into a nickel case 2½ in. in diameter × ¾ in. thick, and weighs only 7 oz.

**Post Office Engineering Staff.**—Last week Mr. Snowden asked the P.M.G. whether, in connection with the recent reorganisation of the engineering department of the Post Office, 32 second-class engineers who entered the Post Office service from the Universities, and whose average length of service was two years, had been assigned to the new class of assistant engineers over the heads of 112 non-University second-class engineers of proved executive and technical ability, with average Post Office service of 22 years; whether he would give particulars of the qualifications required for the position of an assistant engineer, and the tests the University men were subjected to in order to demonstrate their executive ability, and in what respects they were found to be superior to the engineers whom they passed over—Mr. Herbert Samuel replied that the new class of assistant engineers comprised those officers of the late second class of engineers, numbering 271, who, in the opinion of the engineer-in-chief, possessed the qualifications required for the new class. This new class consisted of 209 officers, among whom 32 were trained at various Universities and 177 were not. All the University officers were successful candidates on their entrance to the Post Office service in a competitive technical examination conducted by the Civil Service Commissioners, the standard of which was much higher than that by which the second-class engineers entered. Great care was taken in the selection.

**Postal Servants' Conference.**—The annual conference of the United Kingdom Postal Clerks' Association was held on Monday at Bristol. The president, referring to the relations between the Association and the Department, pointed out that the subject of a strike policy had been introduced into the agenda. A motion to affirm the right of postal workers to withdraw their labour in support of just demands was defeated by 98 votes to 47.

**Russia.**—The Government proposes to establish four wireless stations on the shores of the Kara and White Seas, at a cost of 100,000 roubles, to facilitate commercial intercourse between Siberia and Europe by way of the Arctic Sea.

**United States.**—The abuse of wireless telegraphy in the United States has grown to such a pitch that the Government has at last been compelled to initiate legislation, insisting upon the licensing of all wireless installations and operators. The multiplication of private stations, and the development of the wireless hobby, has caused serious interference with commercial and official communication, and the practical joker has commenced issuing false alarms, calling for aid to fictitious shipwrecks and similar follies.

The enmity between the Postal Telegraph Co. and the Western Union Telegraph Co., which fiercely compete for the telegraphic business of the country, has been intensified by the allegation that the Western Union is in league with the Bell Telephone Companies to divert traffic from the Postal Telegraph to the Western Union lines. When telephone subscribers call for the Postal Co., in order to telephone messages for transmission by telegraph, the exchange, it is alleged, connects them with the Western Union office instead of the Postal Co. The charge is denied by the Western Union, but is pressed by the Postal Co., which is applying to the Public Service Commissions for relief.

**Wireless Rescue.**—Once more wireless telegraphy has played a useful part in saving life at sea. The ss. *Ontario* caught fire on Monday night, and as the fire got beyond control, aid was summoned by the wireless operator. The vessel was beached, and the passengers were rescued by coastguards. The crew of the vessel eventually succeeded in subduing the flames.

**Wireless Telegraphy.**—M. Turpain has presented a communication to the French Physical Society regarding the graphic recording of signals transmitted by wireless telegraphy. He claims to have succeeded in recording by automatic apparatus the time signals emitted from the Eiffel Tower, at a station at Portiers, 300 km. away, but has not been able to record messages.—*L'Electricien.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdeen.**—The T.C. has decided to invite offers for a new generating plant at the electricity works; estimated cost £6,200.

**Ashton-under-Lyne.**—May 1st. Two sets of counter-current jet condensing plant with steam-driven pumps, and one natural draught wooden chimney cooler, for the Borough Electricity Department. See "Official Notices" to-day.

**Australia.**—VICTORIA.—April 23rd. 2,000-KW. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

May 1st and 8th.—Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—Electric vehicles for the Electric Supply Committee of the City Council of Melbourne. See particulars in this column last week.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays. See "Official Notices" to-day.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

QUEENSLAND.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

N.S.W.—Three centrifugal pumps (12,000 gallons per minute), five 350-KW. transformers, A.C. motors, for White Bay power house, for N.S.W. Government Railways and Tramways Department. Electrical Engineer's office, 61, Hunter Street, Sydney.

**Austria.**—VIENNA.—June 10th. Tenders are invited for the supply of 9,600 telephone wall instruments, 4,200 telephone table instruments, and 1,100 telephone desk instruments, for single connections to the central battery system, and 4,000 telephone wall instruments for company connections to the central battery system. The supplies may, at the option of the Minister of Trade, be either increased or lessened by 20 per cent. Particulars, Postökonomieverwaltung, the Börseplatz, Vienna.

**Bolton.**—April 25th. Materials and stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Bosnia.**—SARAJEVO.—The T.C. is about to call for the supply of a transformer, estimated to cost 10,000 kronen, for the municipal power station, and a freight electric locomotive (28,000 kronen, estimated); also for vacuum brakes (4,000 k., estimated).

**Bray (Ireland).**—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-KW. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" to-day.

**Dublin.**—April 15th. Flame arc lamps and suspension gear, for the Corporation. See "Official Notices" March 29th.



**Felixstowe.**—April 22nd. Replacing 40 arc lamps by glow lamps, for the U.D.C. See "Official Notices" to-day.

**Italy.**—GALLARATE.—April 23rd. Supply of an 11-ton portable bridge crane. Particulars of the Direzione Generale, Ferrovie dello Stato, Rome.

**Leeds.**—April 20th. Eight miles of .2 sq. in. three-core cable, 6,600 volts, for the City Council. See "Official Notices" April 5th.

**Lincoln.**—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous current dynamo, or two 500-H.P. Diesel engines, with continuous current dynamos: one 120-KW. motor-generator and one switchboard, for the Corporation. See "Official Notices" to-day.

**Lisbon.**—The T.C. having decided to erect its own municipal station and distribution system, tenders will be invited within a month's time for the necessary materials, &c.

**London.**—L.C.C.—April 16th. Electrical installation at the Lyham Road School. See "Official Notices" March 29th.

**ST. PANCRAS.**—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" March 22nd.

**H.M. OFFICE OF WORKS.**—April 17th. Conduit boxes for two years. See "Official Notices" March 29th.

**HAMMERSMITH.**—Tenders are to be invited for the supply of 14 steam traps, also for the supply of six testing instruments for the provision of testing stations as required by the L.C.C.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

**Rhodesia.**—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

**Salford.**—April 17th. Tenders are required for repairs to two chimneys at the electricity works. Borough Electrical Engineer, Frederick Road.

April 22nd.—Electrically-operated travelling jib crane, bulk weigher, and tray conveyor, for the Corporation Electricity Department. See "Official Notices" to-day.

**San Francisco.**—May 8th. The Board of Public Works invites tenders for the supply of 43 tramway cars for the Geary Street municipal tramway. Deposit 10 per cent. Specifications and forms of tender may be obtained on application to the City Engineer, San Francisco. Specification, form of tender and drawings may be seen at the Commercial Intelligence Branch of the B. of T. in London.—*Board of Trade Journal*.

**South Africa.**—JOHANNESBURG.—The *British and South African Export Gazette* for April states that electricity consumers in Johannesburg are increasing at such a rapid rate, the average number of new connections being nearly 200 per month, that the Municipality's stock of meters has become very low, and further supplies, chiefly of "two-rate" type, are rendered necessary.

**Cape Town.**—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

A copy of the specification may now be seen at the Com. Int. Department of the Board of Trade in London.

May 9th.—Our Durban correspondent writes:—Owing to the extended use of electric current within the city of Cape Town and the adjoining municipalities, &c., the City Council has authorised tenders to be invited for the supply of additional plant, among which may be mentioned:—

1. A steam turbine-driven alternator and converter, the turbine to be capable of giving a continuous output of 2,000 K.V.A.
2. High and low-tension switchgear and transformers.
3. Approximately 24,750 yards of E.H.T. three-phase cable, joint boxes and disconnection pillars.
4. Green's economiser.

Tenders are to be deposited at the City Hall, Cape Town, not later than May 9th, 1912, excepting for certain switchgear and transformers, for which tenders were to be in on March 25th.

**Southend-on-Sea.**—Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Walsall.**—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" March 29th.

**West Hartlepool.**—April 15th. High and low-tension switchgear, for the Corporation Electricity Department. See "Official Notices" March 29th.

**Wigan.**—April 22nd. Construction of 700 yards of single-track tramway (including three short passing places). Borough Engineer, King Street West.

## CLOSED.

**Acerington.**—The Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for one double-deck car and one single-deck car, at the price of £746 and £696 respectively.

**Ashton-under-Lyne.**—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for 10-ampere meters for the ensuing year.

**Atherton.**—The U.D.C. has accepted the following tenders:—

British Electric Transformer Co., Ltd.—Two oil-cooled transformers.  
Caldender's Cable and Construction Co., Ltd.—1,000 yd. high-tension cable, and 1,000 yd. earthenware troughing.

**Australia.**—The following contracts have been placed, according to the *Australian Mining Standard*:—

QUEENSLAND.—P.M.G.'s Department:—

25 switchboards, common-battery, at £9 15s. each; five ditto, at £14 15s. each; one switchboard, 120 lines, at £67 10s.; two switchboards, magneto, at £15 each; 80 switchboards, magneto, at £6 each; 20 ditto, at £8 10s. each; 10 ditto, at £9 3s. each; 20 ditto, at £12 16s. 3d. each.—Western Electric Co. (Australasia), Ltd.  
27 switchboards, magneto, non-multiple, 100 lines, at £39 11s. 8d. each.—British Insulated and Helsby Cables, Ltd.  
1,417 iron or steel poles, at 32s. 6d. each.—Siemens Bros. Dynamo Works, Ltd.  
61 poles, tubular, iron or steel, 24 ft., at 59s. 4½d. each; 616 poles, 26 ft., at 70s. each; 173 poles, 30 ft., at 110s. 9d. each.—Stewarts & Lloyds, Ltd.

FOOTSCRAY (V.).—City Council:—

Three transformers for electric supply undertaking, £309.—Australian Metal Co.

PRAHRAN and Malvern Tramways Trust (V.):—

1,272 tons of 60-ft. steel rails, at £6 18s. per ton.—R. W. Cameron & Co.

SYDNEY.—City Council:—

Arc lamp brackets, £5 2s. each.—W. Elder & Co.  
Oil switches (10,000 volts), £1,240.—Australian General Electric Co.  
5,000 volt switchgear, transformers, &c., £1,454.—Noyes Bros.  
Transformers, £1,314.—Noyes Bros.  
10,000 volt switchgear and transformers, &c., £4,611.—Noyes Bros., provided the firm is prepared, without added cost, to supply a type of inverse time-limit relay apparatus to be specified by the city electrical engineer.  
Lightning arresters, £90 5s.; earth detectors, £35 10s.; line switches, £2 10s.—Australian General Electric Co.  
1,000 K.V.A. transformers, £1,230.—Australian General Electric Co.  
Wright's M.D. indicators for the year (Reason Manufacturing Co.).—W. G. Watson & Co., Ltd., 3-amp., £115; 5-amp., £115; 10-amp., £20; 25-amp., £255; 50-amp., £200; 100-amp., £62 10s.

VICTORIA.—P.M.G.'s Department:—

480 trembling bells, £73; 200 common battery wall telephones £367; 200 common battery wall telephones (residence type), £275.—British General Electric Co., Ltd.  
550 rolled-steel beams, at 49s. 6d. each, £1,361; 2,200 rolled-steel beams, £6,352.—Dorman, Long & Co., Ltd.  
3,000 four-conductor telephone cords, £156.—British General Electric Co.  
4,000 yds. submarine telephone cable, at £278 per nautical mile, £548.—Siemens Bros. Dynamo Works, Ltd.  
10 tons galvanized steel wire, at £16 4s. per ton, £162.—W. S. Hill.  
43,000 steel spindles at 3½d. each, and 10,300 at 9d. each, £1,013.—Williams and Co.  
11 tons bronze wire, at £87 1s. 9d. per ton, £958.—Gibbs, Bright & Co.  
Copper wire, resistance sets, rheostats, total contract £5,970.—British Insulated and Helsby Cables, Ltd.

SOUTH AUSTRALIA.—P.M.G.'s Department:—

Switchboards for private branch exchanges, &c.—J. Bartram & Son Pty., Ltd.  
25 miles wire, 40 miles wire, 17 miles wire, 3 miles wire.—W. T. Henley's Telegraph Works Co., Ltd.  
10,000 insulators, shackle, large porcelain, at 4½d. each; 10,000 insulators, porcelain, at 4½d. each.—Dalgety & Co.  
55,000 insulators, at 1½d. each.—Western Electric Co. (Aust.), Ltd.  
5,000 insulators, at 1'925d. each.—Steele & Baker.

**Barrow.**—The T.C. has accepted tenders as follows:—

Engine and crank chamber oils.—Jas. Light & Son, Ltd.  
Cylinder oil.—A. Duckham & Co.  
Coza and boiled linseed oils, &c.—Burnip & Macdougall, Ltd.  
Copper wire.—Thos. Bolton & Sons, Ltd.  
Shellac varnish, &c.—W. Drysdale.  
Electric stores.—Baxendale Bros.  
Arc lamp carbons.—Ship Carbons, Ltd.  
Arc lamp globes and shades.—The City Glass Co.  
Switch cut-outs.—British Insulated and Helsby Cables, Ltd.  
Electric meters.—Chamberlain & Hookham, Ltd.  
Electrolytic midget meters.—Reason Manufacturing Co., Ltd.  
Tantalum and other lamps.—Drake & Gorham, Ltd.  
Earthenware pipes.—Doulton & Co., Ltd.  
Pavement covers.—W. T. Henley's Telegraph Works.  
Rubber gloves.—Siemens Bros. & Co.  
Galvanized tubing and steel conduits.—Simplex Conduits, Ltd.  
Brass saddles and pins.—General Electric Co., Ltd.

**Bedford.**—Messrs. W. S. Wilton & Co. have secured the contract for the wiring of Messrs. Blake Bros.' Empire Picture Palace in Midland Road.

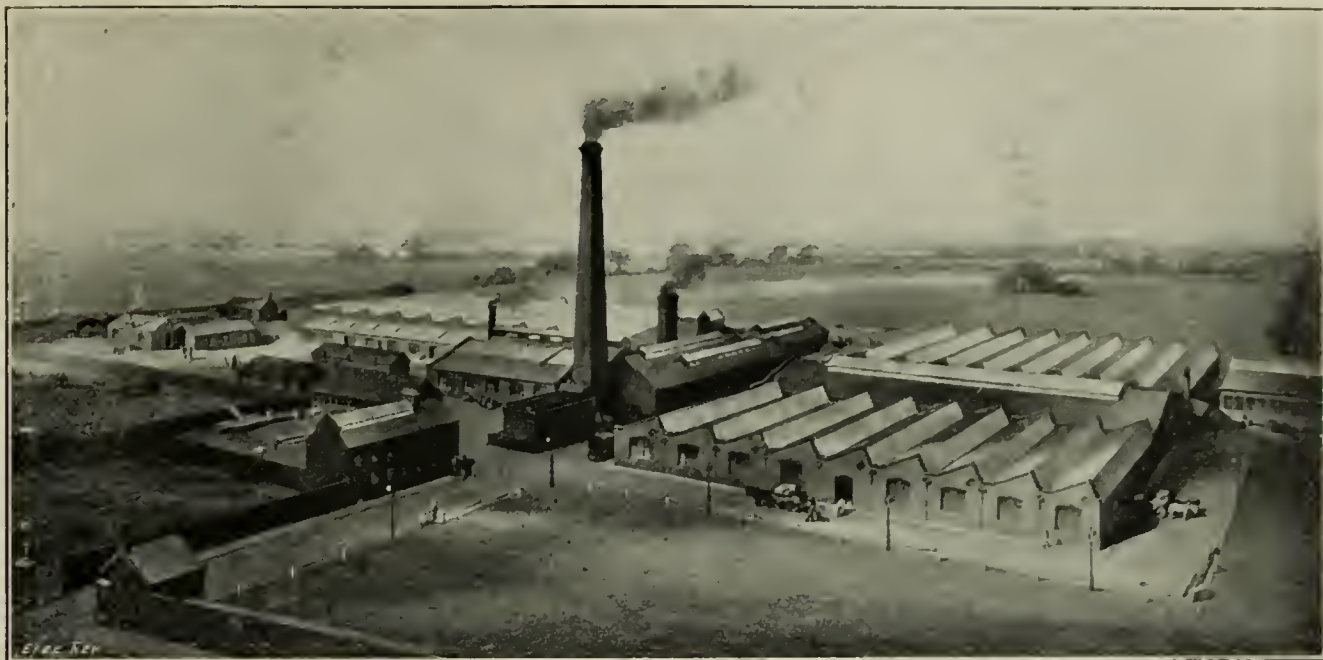
(Continued on page 591.)



## THE STERLING TELEPHONE WORKS, DAGENHAM, ESSEX.

WE recently had the pleasure of paying a visit to the works of the Sterling Telephone and Electric Co., Ltd., at Dagenham, Essex, on the invitation of Mr. Guy Burney, the managing director. The works are pleasantly situated in

Sterling Co. required them, and were soon occupied to the full; but the accommodation proved insufficient to cope with the demand for their products, and it became necessary to carry out extensions on a considerable scale. The new buildings

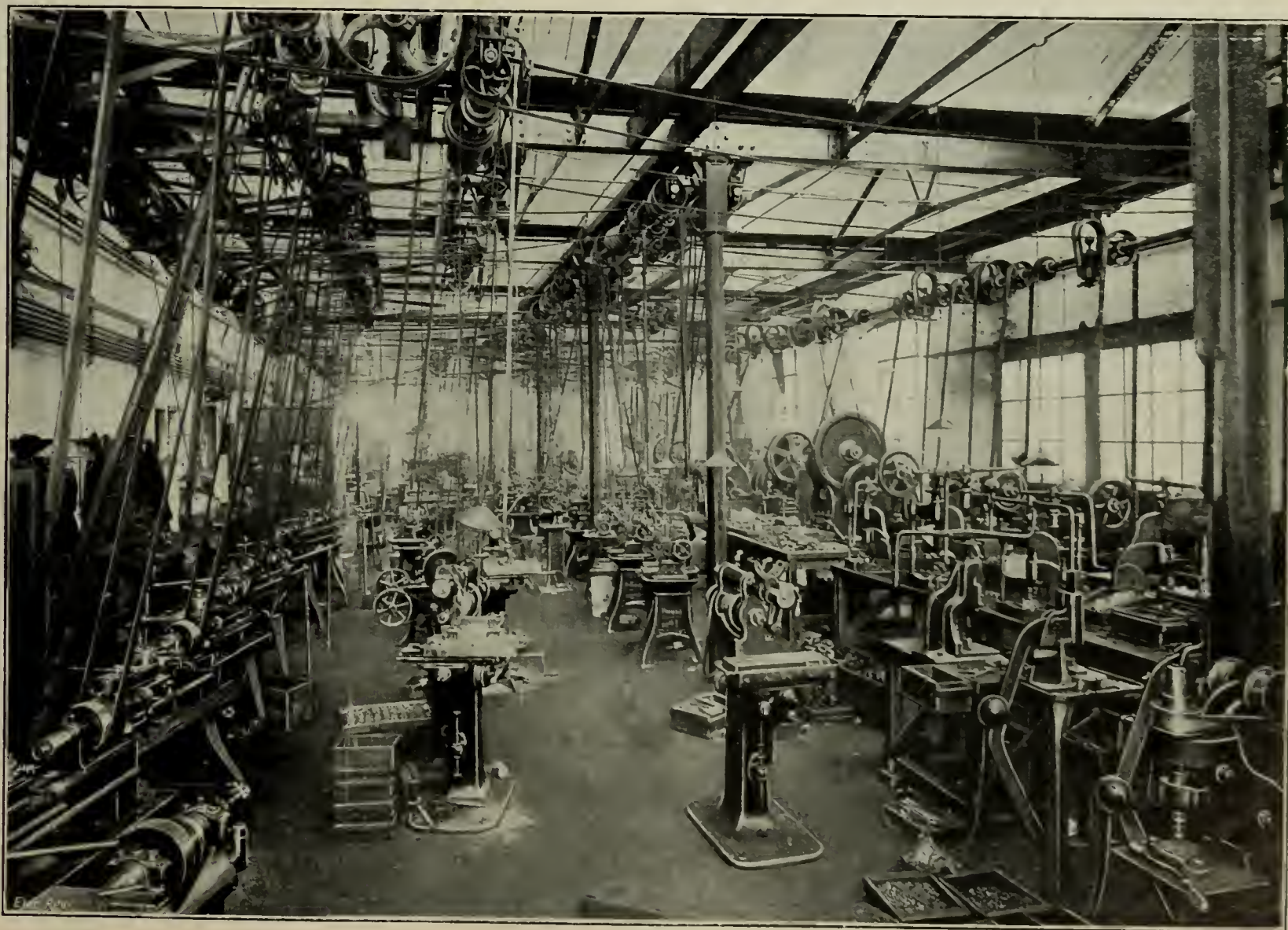


BIRD'S-EYE VIEW OF THE STERLING TELEPHONE WORKS, DAGENHAM.

the country amongst the strawberry fields, where rents and rates are low; but they are easy of access from London, and within range of a large and industrious population. It is now about  $2\frac{1}{2}$  years since the company purchased the site,

have now been finished, and are being brought into use as the necessity arises; the power plant has also been more than doubled in capacity, in order to cope with the increased load.

A general view of the works is given in the accompanying



NO. 1 MACHINE SHOP.

upon which some excellent buildings had been erected and equipped with shafting and power plant by the late Morris Aiming Tube and Ammunition Co., Ltd. The buildings lent themselves admirably to the purposes for which the

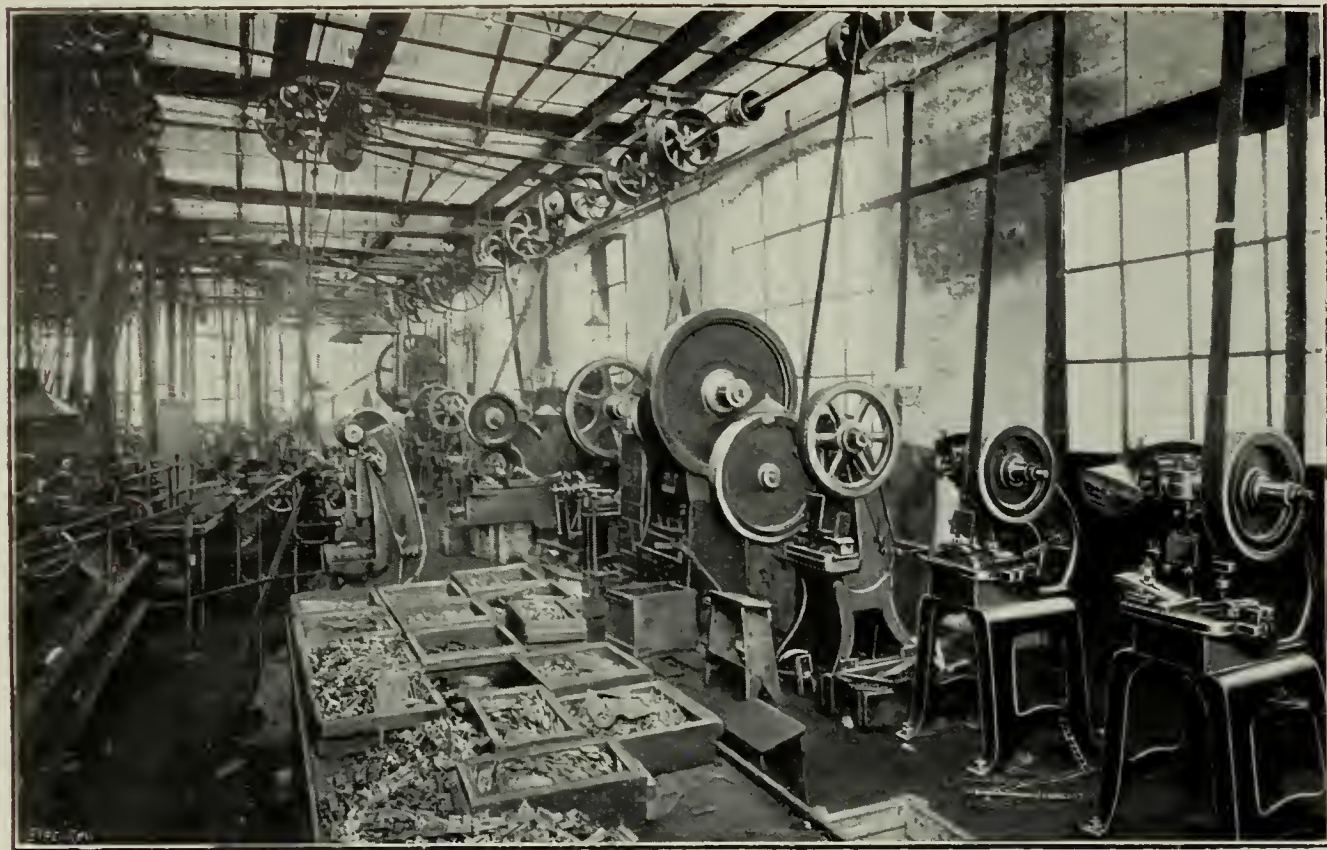
illustration. The site includes an area of some 11 acres, providing ample facilities for future extensions; the buildings are almost all of one storey, with saw-tooth roofs and north lighting, and are very substantially constructed.



Power for driving all the machinery, and for the bulk of the lighting of the works, is derived from an engine room containing two horizontal Tangye gas engines, of 45 and 65 H.P.

board controlling the whole works is fixed close to the wall at the rear of the engine-room. Two Tangye suction-gas producers and a Campbell producer, fed with anthracite, provide a supply of gas for the engines, and require very little attention. The engines also have given great satisfaction.

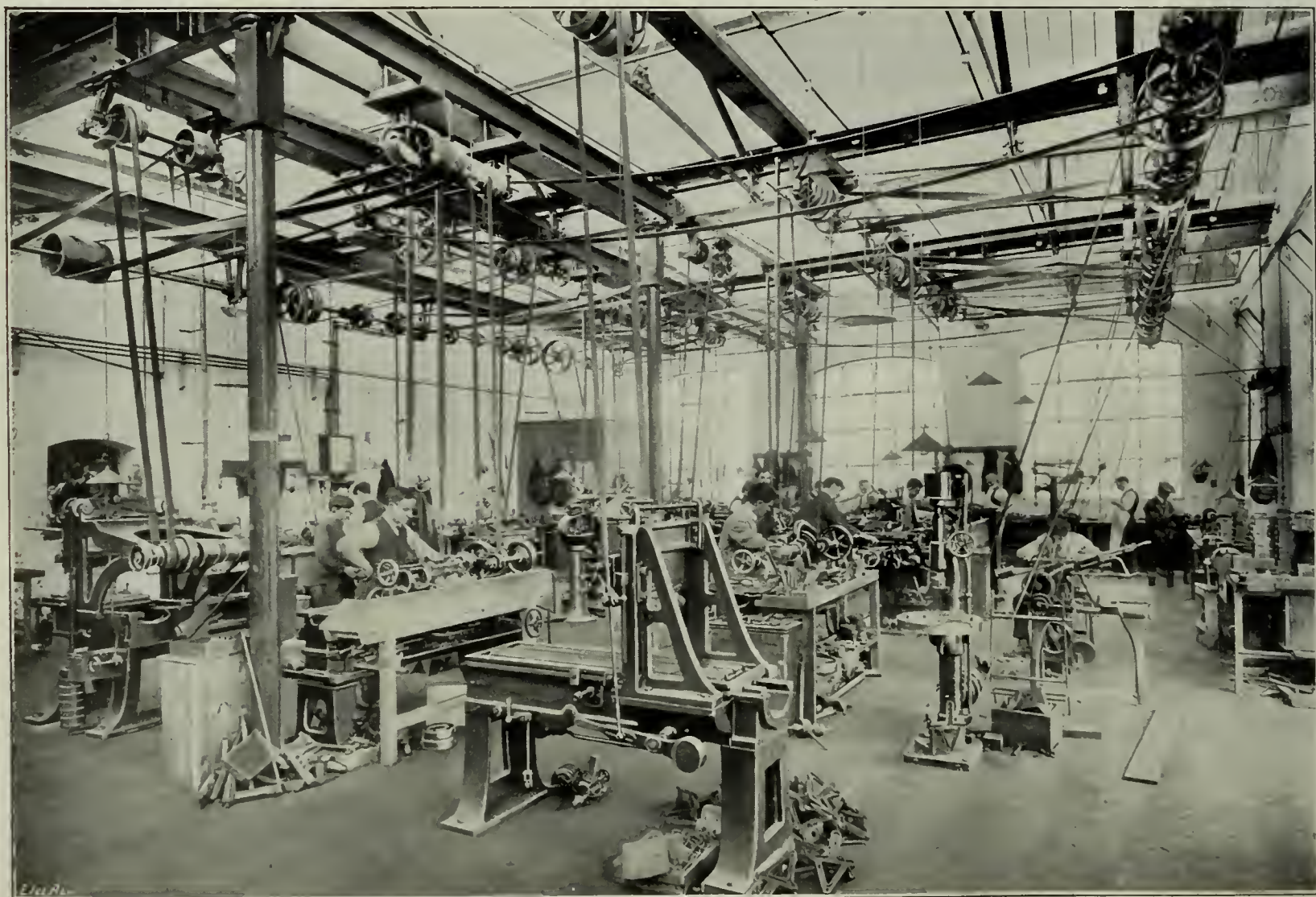
Taking the various shops in order, we may begin with the tool-making department—a very important one, for the company make all their own punches and dies, and similar special tools, which involve a vast amount of painstaking labour and a very considerable admixture of brains. The art of milling is here developed to a high degree of accuracy and finish—some tools being completely finished on the milling machine—but as far as possible each workman specialises in his own class of work, and thus a tool passes through several hands in the course of its evolution.



POWER PRESS AND AUTOMATIC DEPARTMENT.

respectively, driving by belt Morris-Hawkins dynamos, and a vertical Campbell four-cylinder engine of 120 H.P., directly coupled to a Phoenix dynamo (p. 590). The last-named set is

A useful tool in this department is a fret-saw capable of cutting out steel dies, &c.,  $1\frac{1}{2}$  in. thick; the saw is 50 ft. long, the spare length being coiled up on the machine, so that it can



TOOL-MAKING DEPARTMENT.

able to carry the whole load when required. These generating sets are housed in what used to be a steam engine room; the engines and boilers were removed, and the room partly rebuilt and provided with a new roof. The main switch-

be fed out as required. Many of the dies, punches, and jigs are of extremely complicated shapes, the aim being to render each operation as far as possible automatic, and to reduce the amount of labour required. A small store of such special



tools, in a corner of the department, contains material worth many thousands of pounds.

Passing on to the machine-shop (No. 1), we may note that the tools are wholly group-driven, from countershafts. The

with a bell mouth, the closed end is bulged out to a larger diameter than the barrel, by a special process devised by the company's staff for the purpose. The safety device for presses, which consists of an arrangement necessitating the

use of *both hands* to start the press, is worthy of mention, as it renders an accident to the operator's hand quite impossible. Besides these operations, others, such as grinding to exact dimensions, drilling, turning, &c., are carried on in this shop. The annealing shop (shown overleaf), to which constant recourse is necessary, opens into one end of it, and contains a large annealing furnace fired with coal, as well as a hardening furnace for steel magnets, which are made in thousands at a time. An electric pyrometer is used for determining the temperature at which these operations are carried on.

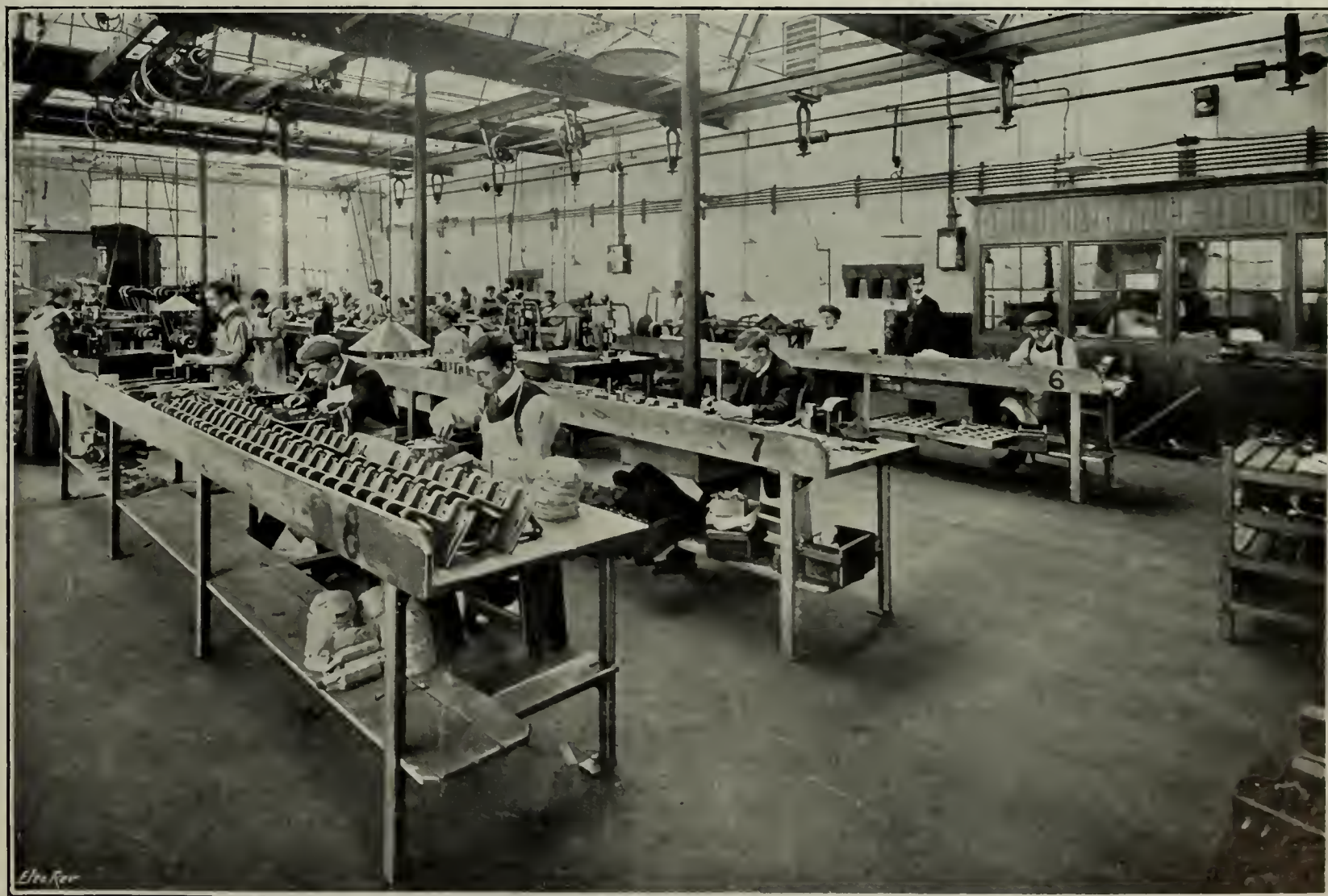
We give on p. 590 an illustration of the buffing and polishing and grinding shop. This is provided with a powerful air-exhausting system, which draws off all the dust and discharges it into a dust-catcher. Next comes the pickling and depositing shop, where copper and nickel-plating is carried on; several improved processes are in use here, of



No. 1 ASSEMBLY SHOP.

motors—two in number, of 20 H.P. each—are situated in the roof, to economise space. A large number of presses, some of them very heavy, are installed in this shop, a great proportion of telephone and similar work consisting of stamping and pressing metal parts. The brass cases for the familiar

ing and polishing and grinding shop. This is provided with a powerful air-exhausting system, which draws off all the dust and discharges it into a dust-catcher. Next comes the pickling and depositing shop, where copper and nickel-plating is carried on; several improved processes are in use here, of



PART OF NO. 2 ASSEMBLY SHOP.

G.P.O. Bell receivers, for example, are drawn into their final shape by successive operations from an initially flat plate, the metal being annealed after each drawing. Finally, after the receiver has been drawn into the shape of a closed cylinder

which more will be heard in the future. All iron castings are here given a coating of deposited copper before painting, to ensure freedom from rust.

An entirely new building has been erected for the



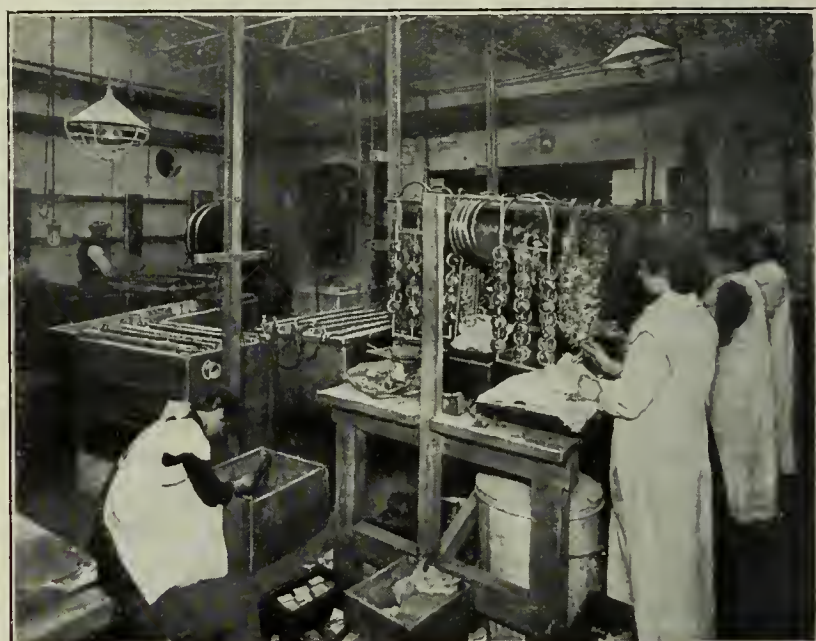
lacquering department. To ensure a perfect finish, this room must be kept at a uniform temperature, dust-proof and free from condensation of moisture. The lacquering room therefore is entered through double doors; it is lined completely with white enamelled brick, and is of entirely fireproof construction. The air supply is filtered, and is warmed before it is admitted to the room—or cooled, according to the season. Water pipes are provided round the walls, with which the latter can be washed down. With the aid of these precautions, and by taking infinite pains, the company has succeeded in mastering the difficult problem of securing a perfect black enamel finish. A large and well-equipped stove room is provided.

Close by are the raw-material stores. At the time of our visit, thanks to the coal strike, the stock of raw material had run down to a point which threatened the necessity of a partial or total cessation of work for want of stuff—not for want of coal, of which there was plenty in hand. Now, however, the crisis has been safely passed without more than

popularity, and is made in large batches. Some automatic drills in this department call for notice; the act of feeding the drill—or rather, raising the platform—sets the drill in motion, a small motor providing the driving power. Economy of energy and time is thus ensured, as the drill is never running except when it is drilling, while it is always ready the moment it is wanted. In the adjoining coil-winding department, induction coils, receiver coils, &c., are made and tested. They are wound by machines driven by hand or motor, with great dexterity by the operatives.

The principal assembly shop (No. 1 assembly department) is accommodated in a new building, where all sorts of instruments are assembled, from the cheap battery set to the G.P.O. standard central-battery instrument.

A separate building has been erected for storing the “piece parts”—that is, the finished components, which are drawn upon as required for orders in progress. Here, in countless compartments and pigeon-holes, are stored about ten million separate parts, worth in the aggregate some £30,000. A



Engine room.  
Buffing Shop.

Plating shop.  
Annealing shop.

#### VIEWS IN THE DAGENHAM WORKS.

temporary inconvenience. There is also an “intermediate store,” into which all work is sent between successive operations, to be inspected, if necessary, and checked.

We come next to No. 2 machine shop, which is situated in one of the new buildings. This contains a large equipment of automatic machines, making screws and other small parts, of which huge quantities are used in the construction of telephones and bells. Semi-automatic machines, wood-drilling machines, &c., are provided, and are being added to as the need arises. Close by is the experimental department, where new designs are worked out, and special batches of apparatus in small quantities, not sufficient to justify their being handled in bulk in the ordinary way, are dealt with. Here, for instance, indicators, large watertight bells, and similar items are made.

In the “small assembly” department receivers, transmitters, bells and such like apparatus are assembled—not forgetting the “Parlyphone,” which has maintained its

large proportion of this stock consists of telephone apparatus for the Post Office, which has been completed and is awaiting removal; a Post Office inspector is constantly at work, examining and testing the apparatus destined for his department, and large numbers of receivers, transmitters, bells, wall sets, &c., are passing through the shops. The company does not concern itself at present with the construction of large exchange switchboards, but manufactures all kinds of telephones for public and private use, including, of course, the “Primax” central-battery intercommunication telephones, mining telephones, bells of all sorts, magneto-exploders—in fact, almost all the instruments, &c., with which its name is associated, 95 per cent. of its products being made at Dagenham.

All the apparatus has to pass through the testing shop, where the whole of the finished material is examined and tested ready for dispatch—the testing, in the case of telephones, including an actual “*viva-voce* examination.”



A large part of the equipment of the works has been done by the company's staff, a joiners' shop being provided: a special type of bench is used in the assembly shops, mounted on cast-iron legs, of which the pattern belongs to the company. The benches are shown in the views on page 589, and it will be seen that the design is very simple and easily constructed, while experience has proved that it is highly efficient.

The shops have been wired with screwed barrel in a very substantial fashion, high-grade insulated wire being used, and metallic-filament lamps at 220 volts, with the exception of one or two shops that are lighted with high-pressure gas.

A manufacture involving the use of such large numbers of parts, many of which are utilised in the construction of quite distinct types of apparatus, could not be carried on with economy and efficiency without the aid of a highly organised system of management, and this we find fully developed at the Dagenham works.

The foundation is, of course, the card-index system, which pervades the whole factory: there is also an elaborate system of shop orders by means of which the exact position of every order can always be immediately ascertained, and every shop foreman knows precisely what work he has in hand, where he is to send it to when he has done with it, and whence he will receive a further batch. The governing principle in the "progress department" is always to keep one week's work allocated to the various departments, and to keep track of every order throughout its passage through the works. In the drawing office, too, a rigid system of filing and classification prevails. All drawings are made on standard sizes of paper, commencing with 8 in.  $\times$  5 in., and proceeding through 8 in.  $\times$  10 in., and so on, by regular steps: this greatly aids filing, enabling hundreds of drawings to be filed on edge in a single drawer. In fact, every device is adopted that assists in lessening labour and hastening the arrival at the desired end.

The interests of the employees have not been neglected; in addition to exceptionally well devised sanitary arrangements, a kitchen has been provided, with large mess-rooms, where the workpeople can cook and eat their meals in comfort. This is a particularly important feature in the case of a works situated, as this is, in a neighbourhood where facilities for refreshment are lacking.

Considering that the works were only started 2½ years ago, and that in the interval they have been fully organised, filled with work, and extended, great credit is due to the management of the undertaking for the ceaseless application and unremitting attention to detail without which success would have been impossible. The factory is now in full swing, and the work turned out is of a quality aptly designated by the style of the firm—of "sterling" worth, and British manufacture.

In concluding this brief account of the new works, we take pleasure in congratulating the company on the excellent progress it has made, and in expressing our gratification at the successful establishment of the business as a manufacturing concern, which we trust will enjoy a full share of prosperity.

## CONTRACTS CLOSED.

(Continued from page 586.)

**Bacup.**—Messrs. A. Diggle & Son, of Rochdale, have secured the order for motor equipment, &c., at the Corn Mill, Bacup, for Messrs. Ormerod & Co., who are converting part of the premises into a boot and shoe factory.

The T.C. has accepted the tender of the Rawtenstall Corporation for the laying of the cable at Lee Mill and Stacksteads, the cable being supplied by Messrs. W. T. Glover & Co., Ltd.

**Birkenhead.**—The tender for the six new tramcars for the New Ferry route, which was given to Messrs. Siemens Bros. Dynamo Works, Ltd., at the March meeting of the T.C., was brought up again on April 3rd, when Mr. Willmer declared that the previous vote of the Council was given under a misapprehension. He referred to a letter from Messrs. Milnes, Voss & Co., Ltd., stating that a design for a 60-passenger car 3 ft. 2 in. shorter in body than the present New Ferry car, with an approximate weight of 10½ tons, was submitted by the firm. The lowest weight (Mr. Willmer con-

tinued) that the Council knew anything about at the last meeting was over 12 tons, and many of them protested against the weight of these cars for that particular route. As an amendment to the motion for the approval of the Tramway Committee minutes, he moved that the matter be referred back, and that the whole question of the weight of the cars to be used on the New Ferry route come before the Council again, the Committee to supply the fullest information. In the subsequent discussion, it was contended that information had been withheld from the Council. The vice-chairman of the Committee explained that the Committee's recommendation was for an 80-passenger car. The price of the 10½-ton car was so much higher relatively than the others that the Committee did not consider it. The amendment was carried by 29 votes to 9.

**Blackburn.**—The T.C., on April 4th, decided to accept the tender of Messrs. J. W. Garsden & Co. for the supply of telephone and electric bell installations, and that of Messrs. T. Burton and Co. for electric clocks.

The T.C. also accepted the following additional tenders for the supply of goods to the electricity and tramways departments:—

Metallic joint rings, screws, &c.—Messrs. Burrows & Garland.  
Packing a-bestos.—Messrs. Cresswell's, Ltd.  
Presspalm sheets and shellac.—The Birmingham Mica Co.  
Waterproof tape.—Messrs. Wm. Geipel & Co.  
Siemens's Ozokerit tape, non-hygroscopic tape.—Messrs. Siemens Bros and Co.

**Bootle.**—The T.C. considered 57 tenders submitted for the supply of machinery and plant for the new electricity works, and accepted the following:—

Boilers.—Babcock & Wilcox, Ltd., £4,598.  
Turbo-alternators.—B.T.H. Co., £6,619.  
Condensers, with motors.—Rees Roturbo Co., £1,810.  
Three converters.—British Westinghouse Co., £3,050.

The tender of the B.T.H. Co., Ltd., for switchgear was accepted on condition that it included Messrs. Reyrolle & Co.'s high-tension switchgear.

**Devonport.**—The T.C. has been recommended by the E.L. Committee to accept the tender of Messrs. Howden & Co., of Glasgow, for a steam turbine, at £5,110.

**Glasgow.**—The Tramways Committee has recommended the acceptance of the following tenders:—

Brass tubing.—John Stewart & Co., Ltd.  
Car bells.—Standard Electric Co., Ltd.  
Workshop flexible cable.—W. T. Henley's Telegraph Co., Ltd.  
Copper strip.—Charles Henderson & Co., Ltd.  
D.C.C. copper wire.—British Insulated and Helsby Cables, Ltd.: London Electric Wire Co. and Smiths, Ltd.  
Scrap for disposal—  
(a) Copper.—P. & W. MacLellan, Ltd.  
(b) Lead.—J. D. Anderson & Co.  
(c) Brass, &c.—Geo. Cunningham.  
(d) Cable.—Shearer Bros.  
(e) Zinc.—R. M. Easdale & Co.  
Commutators.—Mavor & Coulson, Ltd.

The North British Railway Co. has accepted the tender of the Corona Lampworks, Ltd., for "Corona" 1912 type annealed tungsten wire railway and traction lamps.

**Gloucester.**—The T.C. has accepted the tender of Messrs. Brown, Bayley's Steel Works for tramcar wheel tires; and that of the Tyne Metal Co., Ltd., for brake blocks.

**Kirkcaldy.**—Tenders for the supply of the new plant for the electricity works have been reported upon by the manager, and the Committee recommends the Council to accept that of Messrs. Willans & Robinson, at £8,396.

**London.**—STEPNEY.—The B.C. has accepted the following tenders for annual supplies:—

Motors.—Siemens Bros. Dynamo Works Co., Ltd., 1 H.P., 730 R.P.M., £12 18s. 2d.; 1½ H.P., 830 R.P.M., £12 18s. 2d.; 2 H.P., 1,210 R.P.M., £12 18s. 2d.; 830 R.P.M., £13 18s. 2d.; 2½ H.P., 1,000 R.P.M., £13 18s. 1d.; 3 H.P., 735 R.P.M., £16 18s. 1d.; 3½ H.P., 800 R.P.M., £16 6s. 10d.; 4 H.P., 1,050 R.P.M., £16 6s. 10d.; 755 R.P.M., £19 8s. 8d.  
Bruce Peebles & Co., Ltd.—5 H.P., 895 R.P.M., £20; 6 H.P., 1,125 R.P.M., £20; 7½ H.P., 870 R.P.M., £24 15s.; 10 H.P., 790 R.P.M., £29 5s.; 15 H.P., 870 R.P.M., £31 2s. 6d.; 20 H.P., 500 R.P.M., £49 11s.; 2½ H.P., 800 R.P.M., £40; 27 H.P., 715 R.P.M., £49 10s.; 35 H.P., 675 R.P.M., £58.  
Rheostats.—Ferranti, Ltd., 4 H.P., £1 14s. 8d.; 5 H.P., £1 15s. 8d.; 7½ H.P., £4 11s. 8d.; 10 H.P., £4 14s. 8d.; 12½ H.P., £2 16s. 6d.; 15 H.P., £3 3s. 9d.; 20 H.P., £1 2s. 9d.; 25 H.P., £4 14s. 8d.; 30 H.P., £5 18s. 6d.

The contract for the complete installation of lifts for the Institution of Civil Engineers' new buildings, London, has been entrusted to Messrs. Smith, Major & Stevens, Ltd., their standard machine, with vee wheel drive, rendering overwinding impossible, having been selected after investigation of several types. The three main passenger lifts will be fitted with their patent full automatic button system of control.

**BERMONDSEY.**—The B.C. has accepted tenders submitted by Messrs. Pirelli, Ltd., for paper cable, lead-covered; by Messrs. W. Geipel & Co. for rubber cable; by the General Electric Co., Ltd., for jointing material, cut-outs, sealing troughs, fuses; by the Dussek Bitumen Co. for jointing material; by Craig, Sharpe, Ltd., for bitumen; by Chamberlain & Hookham, Ltd., for meters, demand indicators and time switches.

**Pacific Cable Board.**—The *Australian Mining Standard* for March 7th states that the tender of the India-Rubber, Gutta-Percha and Telegraph Works Co. has been accepted by the Pacific Cable Board for the construction and laying of the new cable between Australia and New Zealand. "The starting point on the Australian coast will be in the neighbourhood of Sydney, probably



Bondi, and the terminal point in New Zealand will be Auckland. It is intended also to bring the Norfolk Island cable to Auckland instead of to Doubtless Bay. The work will occupy about ten months."

**Salford.**—The T.C. has accepted the following tenders for biennial supplies to the Tramways Department:

Car accessories (electrical) and insulating materials.			
Imeson, Finch & Co. .. ..	£58	Associated Battery Co. .. ..	£84
L. Andrew & Co. .. ..	2:0	Manchester Armature Repair Co. 1,048	
B.I. and Helsby Cables, Ltd. ..	99	Geipel & Co. .. ..	353
Micanite and Insulators Co., Ltd. 204		North British Rubber Co. .. ..	102
Watlington & Co. .. ..	11	C. Mackintosh & Co. .. ..	35
General Electric Co. .. ..	24	A. Clare & Co. .. ..	34
Schultz & Co. .. ..	96	British Thomson-Houston Co. ..	81
Ward & Goldstone .. ..	63	Radium Electric Co. .. ..	27
W. McGeoch & Co. .. ..	80	Gabriel & Co. .. ..	23

Car accessories (mechanical).			
Imeson, Finch & Co. .. ..	£229	W. Boydell & Sons .. ..	£793
John Hall .. ..	48	National Rail and Tramway Ap-	
Malleable Steel Castings Co. ..	117	pliances Co. .. ..	1,494
Phosphor Bronze Co. .. ..	465	John Baker & Co. .. ..	1,895
G. W. Allsopp .. ..	76	British Hele-Shaw Patent Clutch	
Fleming, Birky & Goodall, Ltd. 684		Co. .. ..	584

Glass.—J. F. Power & Co., £118.

Gravel, sand, pitch, &c.			
J. Smith .. ..	£300	Lancashire Chemical and	
Buxton Lime Firms Co., Ltd. ..	577	Mineral Co. .. ..	£1,283
H. Heys & Co., Ltd. .. ..	131	Knowles Oxygen Co. .. ..	60
J. Statham & Sons .. ..	62	A. Warden & Co. .. ..	26

Iron and steel.

J. Kidd & Sons, Ltd. .. ..	£285	Vickers, Ltd. .. ..	£27
----------------------------	------	---------------------	-----

Special car accessories.—Imeson, Finch & Co., schedule of prices.

Special paints and varnishes.			
W. Harland & Son .. ..	£219	Docker Bros. .. ..	£166

The following tenders have also been accepted:—

Aiton & Co.—C.I. suction pipes in connection with cooling towers, £83.  
B. Thomas.—Main switchboards, &c.—£3,413.

In connection with the electrical undertaking, the following tenders have been accepted for the periods mentioned. Triennial supplies:—

W. Turner (Ardwick), Ltd.—Asphalt bridges, £24.  
Beecroft & Wightman, Ltd.—Wood troughing, bends, &c., £1,100.  
British Insulated and Helsby Cables, Ltd.—Service fuse boxes, £385.

**South Africa.**—Among orders recently placed by the South African Railways are the following:—

Electrical wire for delivery at Durban, East London, Port Elizabeth, Cape Town and Braamfontein.—Siemens, Ltd., Johannesburg, £559; Telegraph Manufacturing Co., Johannesburg, £658; Henley's (S.A.) Telegraph Works, Johannesburg, £630; Messrs. Sykes & Co., Johannesburg, £23.—*Commercial Intelligence*.

**Stretford.**—The U.D.C. has accepted the tender of the Electric Construction Co., at £762, for a booster.

**Swansea.**—The E.L. and Tramways Committee of the T.C. have accepted the tender of the British Thomson-Houston Co., Ltd., for turbo-alternators and condensing plant.

**Tunbridge Wells.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for new switchgear, at £857, including £50 for contingencies.

**Watford.**—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works, Ltd., for an annual supply of cable.

**West Hartlepool.**—The Corporation has again accepted the tender of the Bastian Meter Co., Ltd., for 3 and 5-ampere meters for the year.

**Worcester.**—The city electrical engineer has been authorised to purchase from the British Thomson-Houston Co 300 A.C. meters.

## FORTHCOMING EVENTS.

**Institution of Electrical Engineers (Manchester Local Section).**—Tuesday, April 16th. At 7.30 p.m. At the University, Manchester. Paper on "The Mechanics of Electric Train Movement," by Mr. F. W. Carter.

**Illuminating Engineering Society.**—Tuesday, April 16th. At 8 p.m. At the Royal Society of Arts. Papers on "The Lighting of Private Houses by Gas and Electricity," by Messrs. W. H. Y. Webber (Gas) and W. R. Rawlings (Electricity).

**Junior Institution of Engineers.**—Wednesday, April 17th. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "The Lay-out and Erection of Electric Power Plant," by Mr. E. Kilburn Scott.

**Institution of Electrical Engineers (Dublin Local Section).**—Thursday, April 18th. At 8 p.m. At the New Royal College of Science, Dublin. Paper on "Recent Developments in the Application of Electricity in the Textile Trade," by Mr. F. S. Crowley.

**Institution of Electrical Engineers (London).**—Thursday, April 18th. At 8 p.m. Adjourned discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes."

**Royal Institution.**—Thursday, April 18th. At 3 p.m. Lecture on "Synthetic Ammonia and Nitric Acid from the Atmosphere," by Prof. A. W. Crossley.  
Friday, April 19th.—At 9 p.m. Discourse on "Electricity Supply: Past, Present and Future," by Mr. A. A. Campbell Swinton.

**Association of Engineers-in-Charge.**—Saturday, April 20th. Social, Bohemian concert.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Friday, April 12th.—"D" Company. Recruit training, 7 to 9 p.m. Technical work and lecture on "Military Telephones," 8 to 10 p.m.

Saturday, April 13th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

Monday, April 15th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, April 16th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.

Thursday, April 18th.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, April 19th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.

Saturday, April 20th.—Annual course of musketry, at Purfleet. Members are requested to keep open this date in order to attend the above. Railway tickets and information regarding train service will be sent to members notifying their willingness to shoot on this date. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

## NOTES.

**Inquiry.**—Mr. L. H. King, electrical engineer to Whitby U.D.C., asks whether any system of electrically-driven pumps for fire extinguishing purposes has been installed in any town in England. By the foregoing is meant an electric motor-driven pump that can be plugged on to suitable standards erected in the streets for that purpose. If any manufacturers have such suitable apparatus, he would be pleased to receive their catalogues.

**Appointments Vacant.**—Assistant telegraph engineer, for the posts and telegraphs department of the Federated Malay States Government (£300); chief meter inspector and tester for the Greenock Corporation electricity department (42s.); assistant engineer, for the Corporation electricity works, Nuneaton (£110). See our advertisement pages to-day.

**Parliamentary.**—CLYDE VALLEY ELECTRICAL POWER Co.—On Tuesday, last week, an inquiry was opened into an application by this company for permission to extend their area of supply. Mr. Wilson, K.C., counsel for promoters, explained that the company had spent something like £600,000, and erected two generating stations—one at Yoker and the other at Motherwell, with about 45,000 H.P. between the two. There were also a large number of sub-stations. The present order had little to do with the Clyde Valley Co. except as regarded the capital of the company. They had issued 60,000 £10 shares, raising £600,000 out of the £900,000, and Clauses 1 to 7 of the present order had been introduced for the purpose of getting power to create real preference shares as regarded both dividend and capital, the rate being 6 per cent. The object of that was to enable the shares to be placed in the market more easily. There was no opposition to that. Mr. Wilson went on to point out that the opposition of the Glasgow Corporation affected only one of the four lighting districts—Shettleston and Tollcross—and the reason they confined themselves to that was that Glasgow were expecting to annex the district under their present Boundaries Bill. They said that in the event of their getting the extension they would be themselves the parties to supply electricity there. The Corporation, Mr. Wilson pointed out, were assuming that they had already got Shettleston and Tollcross, whereas they had not. He contended they should not have a *locus*. He could deprive them of a *locus*, but did not want to do it. As ratepayers the Corporation were covered by the County Council just like all other ratepayers, and they had no *locus* as ratepayers at all. The Corporation were owners of water and gas pipes, and of Tollcross Park, but the company were not touching these at all. In the course of evidence, Mr. McKenzie, chairman of the company, said that this year the company expected to have a profit of £55,000, but people in Shettleston, Bellshill, Uddingston and Bothwell had been pressing them for a supply of electricity. The attitude of Glasgow, however, in their application for Parliamentary powers for extension of their boundaries practically put those districts out of the company's area. Subsequently the Commissioners approved of the preamble.

**House of Commons Lighting.**—In connection with the proposal to light the House of Commons by electricity, Mr. Lynch asked whether the First Commissioner of Works, in view of the fact that under certain conditions electric light was more fatiguing to the eyes than gaslight, and under other conditions might be preferable, would be guided by expert advice in the installation of any new system in the House of Commons. Mr. Wedgwood Benn replied that the First Commissioner would be happy to obtain the opinion of an oculist upon the question. Replying further to a question by Mr. Ormsby-Gore, Mr. Benn said that if it were the wish of the House that a Select Committee should be appointed to inquire into the best method of lighting the House before any alteration was made, the Chief Commissioner would be glad to accede to it.



**Manchester Electro-Harmonic Society.**—The first smoking concert in connection with the newly formed Society was held on March 22nd, at the Albion Hotel, Manchester.

The hon. sec., Mr. J. Hill, introduced Mr. S. L. Pearce, the city electrical engineer, to the members as the first president of the Society, who, on rising to address the members, said he was exceedingly gratified to see so many people present—there being over 200. The formation of the Society, he said, was largely due to the great amount of work and time Mr. J. Hill, the hon. sec., had given to it. It was proposed to have four smoking concerts during the session, which would run from October to March, and, in addition, to hold two ladies' evenings. They wanted the membership of the Society to include all who were interested in the electrical industry—Corporation engineers, consulting engineers, manufacturers, wholesale houses and contractors. He was perfectly sure that such gatherings would help to establish good feeling in the electrical engineering industry.

Mr. P. B. Hall (hon. treasurer) stated that the finances of the Society were in a healthy condition.

Mr. C. M. Dorman congratulated the committee on getting Mr. Pearce to become the first president, and said that in Manchester they considered Mr. Pearce as "the Dean of the electrical industry." He proposed a hearty vote of thanks to him for taking the chair, which Mr. J. H. Greaves seconded, and the president was received with musical honours on rising to reply. He said that they had made an excellent start. Some of them did not give as much time to music as they ought to, but in coming there they would make amends.

The whole of the items on the programme were excellently rendered and were received with great appreciation.

**Walking Contest.**—From various causes only four competitors started in the Hackney and Clapton Walking Clubs' first annual time trial walking race from London to Southend-on-Sea, a total distance of 41½ miles, which took place on Saturday, April 6th, starting from the Royal Exchange (Mansion House end of Cornhill) and finishing at Southend Pier entrance. A. R. Edwards (late of May-Oatway Fire Appliances, Ltd.), who holds several road walking records, led all the way, and in finishing first in 6 hours 47 minutes 37½ seconds was well inside the standard for record. The second man, S. C. Haynes, of Associated Fire Alarms, Ltd., who is only 18 years of age, did a splendid performance, this being his first attempt in a walking race. Result: A. R. Edwards, Hackney W.C., 6 hours 47 minutes 37½ seconds, first; S. C. Haynes, Hackney W.C., 8 hours 17 minutes 2½ seconds, second; C. T. Osterberg, Hackney W.C., 8 hours 23 minutes 50½ seconds, third; W. J. Spayne, Clapton W.C., 10 hours 15 minutes 5½ seconds, fourth. The Committee are now considering the promotion of a walking race to be held on Whit-Monday, at a distance of about 24 miles, and invite suggestions, which should be sent to Mr. E. H. Rooft, 2, The Oval, Kennington, S.E., or Mr. S. C. Haynes, 20, Penda Road, Clapton Park, N.E.

**Another Accumulator Sell?**—Some time ago it was reported that a German scientist, residing in Norway, had invented an electric accumulator for high voltage; however, it did not fulfil expectations. But the inventor did not give up the task, and now claims to have succeeded. The cell is described as a little thing, not more than 11 cm. square and 10 cm. high, although it is capable of producing a current of 6 amperes. The pressure, it is stated, has been worked up to 65 volts, and a 16-candle lamp can be kept burning for 24 hours by means of the energy supplied from this little accumulator. The plates used are made of metallic oxide, and are said to be as hard and solid as if they had been made of metal, besides being very durable. They are placed in a pulpy mixture, resembling green soap, the composition of which is kept secret by the inventor. The cell is said to have a capacity of 350 watt-hours, and its weight is 2.8 kg., in which is included the weight of the box, which is 0.7 kg. It can be manufactured at a cost of 16s. 6d. to 22s.

Candidly, we do not believe this report, nor do we ask our readers to put any faith in it. But we should be only too glad if so excellent a performance could be achieved.

**Royal Commission on Imperial Trade.**—The King has approved of the appointment of members of a Royal Commission to inquire into the natural resources and improvement of trade of the Empire. The United Kingdom will be represented by the following:—Lord Inchcape of Strathnaver; Sir Edgar Vincent; Sir C. J. Owens; Sir H. Rider Haggard; Mr. T. Garnett; and Mr. W. Lorimer. Canada will be represented by the Hon. G. E. Foster, Australia by Mr. Donald Campbell, New Zealand by Sir J. G. Ward, South Africa by the Hon. Sid D. de Villiers Graaf, and New Zealand by the Hon. E. Bowring. Mr. W. A. Robinson, of the Colonial Office, is secretary of the Commission.

**Electrical Imports and Exports in March.**—The following are the figures appearing in the foreign trade returns for the month of March:—

	March, 1912.	Increase.
Imports.—Electrical goods and apparatus ... ..	£136,270	£10,269
Machinery ... ..	607,967	30,340
Exports.—Electrical goods and apparatus ... ..	£2,799,172	£394,060
Machinery ... ..	2,799,172	33,733

For the three months electrical goods and apparatus imported show an increase of £9,875, and electrical goods and apparatus exported, a decrease of £95,502.

**Institution and Lecture Notes.**—**IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.**—A special short course of lectures on "Rubber" will be delivered in the Chemistry Lecture Theatre of the Royal College of Science by Dr. Philip Schidrowitz and Mr. H. Wright on Mondays, Wednesdays, and Fridays from 5 to 6 p.m. The first lecture will be given by Mr. Wright on Wednesday, April 24th, and thereafter the lectures will be delivered alternately by Dr. Schidrowitz and Mr. Wright. A synopsis of the course (fee 2s) has been published, and communications should be addressed to the secretary.

**INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE LOCAL SECTION).**—Mr. W. T. Wardale, of Sheffield, recently gave a lecture on the relative advantages of electrical and mechanical driving of factories before the Local Section. Comparing various power systems, he gave the cost per B.H.P.-hour (capital costs included) for a 20-B.H.P. load as follows: Town's gas engine, 0.551d. (at 1s. 4d. per 1,000 cb. ft. for gas); Diesel engine, 0.558d. (at 2s. per ton for oil); suction-gas engine, 0.51d. (at £1 per ton for anthracite peas); as against an electric motor, 0.6d. (at 0.7d. per unit).

**THE INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).**—The honorary secretary (Mr. J. B. Sparks, 27, Mowbray Road, Brondesbury, N.W.), will be pleased to receive nominations for extra-collegiate members of the Committee for the session 1912-13. Nominations should be sent in before Tuesday next.

**INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).**—The meeting announced for April 9th was postponed to April 11th. Unfortunately the notice reached us too late for insertion in our last issue.

**SOCIETY OF ENGINEERS (INCORPORATED).** A paper on ligno-concrete was read by Mr. Gerald O. Case on April 1st. The author referred to the use in America and Australia of concrete in combination with timber, and pointed out that while the concrete effectually preserves the timber, for the same ultimate strength of beam, it is necessary to use 9 per cent. of sectional area of pitch-pine tensile reinforcements, as against 1 per cent. steel reinforcements. A comparison of the prices of steel and pitch-pine shows a saving in favour of ligno-concrete. Where more than about 1.2 per cent. of steel reinforcement is required, ligno-concrete cannot compete with ferro-concrete, because the timber bars would be too large for convenient use.

**Copper.**—During the past month, we find from Messrs. Merton's statistical circular, the visible supplies of copper (European) have decreased only 1,332 tons. This might be attributed to the low demand, consequent upon the general feeling of instability prevailing, but, with deliveries at 40,756 tons, this can hardly have been so deeply affected as other metals. The diminution generally has been in stocks at Liverpool and Swansea, with 450 tons less afloat from Chile and Australia. Copper has been transferred from both Rotterdam and Hamburg, the former being less by 300 tons, and the latter by the same quantity. Detailed supplies show North American average, Spain and Portugal very low, Chile little more than half average, but Australia just over average. Stock in American producers' hands, as published by their Association, shows 1,491 less, but this is showing a decrease, standing only at 28,098 tons for the end of February (last figures published). The world's supply stands at 79,605 tons for the same date. The restriction of output in the States cannot be otherwise than beneficial to the majority of those engaged in the industry, and shows what can be effected by the intelligent administration of an energetic industrial class.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. W. L. D. GUNDRY, late mains engineer, has been presented with a handsome Gladstone bag by the staff of the Plymouth Corporation electricity works on his leaving the Corporation, to join, as a director, Messrs. Lord and Shand, Ltd., electrical engineers, of Plymouth, Launceston, Newquay, and Penzance.

MR. F. B. SIMS, of the Grantham staff of the Urban Electric Supply Co., who is leaving to take up a position under the company at Stamford, has been presented by his colleagues with a silver-mounted walking stick, fountain pen, and pocket book.

MR. H. P. STOKES, borough electrical engineer, Ilkeston, has been requested by the County Council to prepare specifications for the lighting of the new secondary schools, about to be erected at Ilkeston, and also to superintend the work on the usual terms as to commission. The T.C. has also given Mr. Stokes control of all the electrical and mechanical apparatus in use in the various departments of the Corporation, and in addition to this, he is to take charge of the plant now being installed at the new sewage disposal works.

MR. J. G. BRUCE, chief electrical engineer of the Willesden District Council, who is leaving shortly for Buenos Ayres, was on Wednesday last the recipient of a recording barometer presented by the members of the staff, the chairman of the Electricity Committee, Mr. H. Davey Turner, making the presentation.



The Nelson T.C., on April 4th, decided that the salary of Mr. D. HELME, electrical engineer and tramways manager, be increased from £250 to £275 per annum. Small increases were sanctioned in the following cases: Mr. W. M. THOMSON, senior charge engineer; Mr. A. COLBENSON, shift engineer; Mr. W. G. COATES, shift engineer; and Mr. W. D. CHALMERS, outside assistant.

Mr. F. FRENCH, of Kidderminster, has been appointed mains assistant to the Bridlington Corporation Electricity Department.

On 3rd inst., Mr. F. R. WILKINSON, electrical assistant at Lancaster, was the recipient of a silver-mounted walking stick and tobacco pouch from the staff and employes of the electricity works. The presentation was made by Mr. G. C. MILNES, borough electrical and tramways engineer, who expressed the regret which all felt at Mr. Wilkinson's departure.

**Tramway Officials.**—At Burnley Town Council meeting on April 4th, Alderman Grey moved that a minute recommending an increase of from £400 to £450 per year in the salary of Mr. MOZLEY, tramway manager, be referred back. In doing so, Alderman Grey said when they advanced wages they ought to know the reason why. Mr. H. Lees seconded, pointing out that in some towns one person performed the dual office of tramway manager and electrical engineer. In Burnley they paid a separate £400 a year to an electrical engineer. Mr. Heap, chairman of the Tramways Committee, said the tramways receipts had increased considerably under Mr. Mozley's management. When Mr. Mozley was appointed the receipts were £8,300. Last year they were £22,454. The amendment was defeated, as was also a further amendment by Mr. Lees, that the increase be £20.

Mr. S. WOODFIELD has accepted the position of chief engineer to the Buenos Ayres Lacroze Tramways Co. and the Buenos Ayres Central Railway, and will shortly leave for Buenos Ayres.

**General.**—Mr. JOHN H. BUNTING, of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, is about to leave this country for an extended tour in South America, on behalf of his firm. He sails from Southampton on 12th inst., on the s.s. *Aragon*, for Rio de Janeiro, and in addition will also visit Buenos Ayres, Valparaiso, and other important cities. He expects to be away for about four months, and his many friends at home and abroad, will wish him a safe and prosperous journey.

MESSRS. LACEY & SILLAR, consulting engineers, have dissolved partnership. Mr. A. M. Sillar will continue practice at 40, Broadway, Westminster, S.W., and Mr. E. M. Lacey remains at Iddesleigh Mansions, Caxton Street, Westminster, S.W.

Mr. ALBERT H. STANLEY, managing director of the Underground Electric Railways Co., of London, has been appointed a director of the London General Omnibus Co.

Mr. T. STEVENS, is resigning his position as engineer to the London office of the B.T.H. Co. His first work will be in connection with the water-power developments and electric railway now in progress under the consulting engineers, Messrs. McCarter and Kerr Bock, Donington House, W.C., for the Compania Hidro Electrica de Tucuman, in Argentine Republic. Mr. Stevens leaves London to-day, 12th inst., for Buenos Ayres, and he will be in Argentina about two or three months.

**Obituary.**—Mr. ROBINSON SOUTTAR.—In its obituary of Mr. Robinson Souttar, who died last week at the age of 64 years, the *Times* says that in his early years Mr. Souttar came to London to the office of Mr. George Hopkins, a well-known Parliamentary engineer, under whom he was employed in superintending the building of the North Metropolitan, Dublin, and Liverpool tramways. Eventually Mr. Souttar took a contract in Calcutta with Messrs. G. A. Parrish, and lived there for five years, building 40 miles of tramways.

## NEW COMPANIES REGISTERED.

**Electric Blasting Apparatus Co., Ltd.** (120,963).—This company was registered on March 20th, with a capital of £20,000 in £10 shares, to carry on the business of manufacturers of and dealers in electric detonator fuses (with or without detonators), insulated wires and cables, batteries, exploders and other appliances, &c., and to carry into effect a contract with F. W. T. Brain. The subscribers (with one share each) are:—E. S. Harper, 24, King Edward's Terrace, All Soul's Avenue, Willesden, N.W., clerk; J. A. Fuller, 110, Sirdar Road, Wood Green, N., clerk. Private company. The management is vested in a "committee of management" of less than two or more than seven members. The subscribers are to appoint the first. Remuneration as fixed by the company. Registered office, Cinderford, Glos.

**B. & S. Massey, Ltd.** (121,004).—This company was registered on March 22nd, with a capital of £110,000 in £1 shares, to take over the business of steam and power hammer manufacturers and engineers, carried on by S. Massey, L. F. Massey, and H. F. Massey, at Openshaw, Manchester, as B. & S. Massey, and to carry on the same and the business of mechanical, electrical, and hydraulic engineers, electricians, &c. The subscribers (with one share each) are:—L. F. Massey, Steam Hammer Works, Openshaw, Manchester, engineer; H. F. Massey, Steam Hammer Works, Openshaw, Manchester, engineer. Private company. The number of directors is not to be less than two or more than five; the first are L. F. Massey and H. F. Massey; qualification, £500; remuneration (except managing director) as fixed by the company. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

**Perak Hydro-Electric Power Syndicate, Ltd.** (121,146).—This company was registered on March 28th, with a capital of £10,000 in £1 shares, to carry on in the Federated Malay States and the Straits Settlements the business of an electric light and power company in all its branches, and to adopt an agreement with F. D. Osborne. The subscribers (with one share each) are:—C. A. Peyton, 55, Lavington Road, Ealing, W., clerk; J. Gray,

65, London Wall, E.C., secretary to public company; E. C. Brown, 20, Station Parade, Enfield, N., clerk; A. Knight, 79, Langthorne Street, Fulham, S.W., clerk; E. M. Coleman, 22, Elm Road, Wembley, N.W., typist; S. W. Tunbridge, 33, Moring Road, Tooting, S.W., clerk; A. W. Shearman, 61, Canton Street, Poplar, E., clerk. Minimum cash subscription seven shares. The number of directors is not to be less than two or more than six; the first are F. D. Osborne, C. V. Thomas, and W. A. Luning (all permanent); qualification, £250; remuneration (except managing director), 10 per cent. of the net profits in each year. Registered office, 65, London Wall, E.C.

**W. R. Reynolds, Ltd.** (121,153).—This company was registered on March 28th, with a capital of £250 in £1 shares, to carry on the business of electrical engineers, manufacturers of electrical engines, machines and fittings, &c. The subscribers (with one share each) are:—W. R. Reynolds, 312, Barking Road, East Ham, electrician; R. Levin, 65a, Cranbrook Road, Ilford, cabinet maker. Private company. The number of directors is not to be less than two or more than five; the first are not named. Registered by Roberts & Co., 87 and 88, Aldgate, E.C.

**Anglo-Argentine General Electric Co., Ltd.** (121,204).—Registered April 1st, by F. Samuelson, 71a, Queen Victoria Street, E.C. Capital, £65,000 in 63,000 preference shares of £1 each and 40,000 ordinary shares of 1s. each. Objects: to carry on in South America or elsewhere the business of electricians, electrical and mechanical engineers, suppliers of electricity, &c., and to adopt an agreement with the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., and Colson, Brookhouse & Pyne, of Buenos Ayres. The signatories (with 100 preference shares each) are:—H. Hirst, 67, Queen Victoria Street, E.C., electrical engineer; T. Colson, Dawson Place Mansions, Bayswater, W., merchant. Private company. The first directors (to number not less than two or more than six) are H. Hirst (appointed by the General Electric Co., Ltd.) and T. Colson (appointed by Colson, Brookhouse and Pyne); qualification, 250 preference shares; remuneration as fixed by the company. Registered office, 67, Queen Victoria Street, E.C.

**Electric Appliances Co., Ltd.** (121,215).—This company was registered on April 1st, with a capital of £8,000 in 4,000 preference shares of £1 each and 16,000 ordinary shares of 5s. each, to carry on the business of manufacturers of, and dealers in, vacuum cleaners, vibrators, electro-medical appliances, dry batteries and electric supplies and accessories, &c. The subscribers (with one share each) are:—E. C. Harkness, 31, Rusthall Avenue, Bedford Park, W., merchant; W. F. Harkness, 31, Rusthall Avenue, Bedford Park, W., merchant. Private company. The number of directors is not to be less than two or more than five; the first are E. C. Harkness (managing director), W. F. Harkness and J. G. McDougall. Registered office, 28, Rosebery Avenue, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Carlsbad Electro-Thermal Baths, Ltd.** (114,257).—Particulars of £500 debentures, created by resolutions of December 1st, 1911, and March 13th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, appliances, patents, &c. No trustees.

**South Metropolitan Electric Light and Power Co., Ltd.** (47,875).—Issue on March 30th, 1912, of £30,000 debentures, part of a series of which particulars have already been filed.

**Central Electric Supply Co., Ltd.** (53,080).—Return dated February 14th, filed February 19th, 1912. Capital £100,000 in £5 shares. All shares taken up. £5 per share called up. £100,000 paid. Mortgages and charges: £450,000 4 per cent. guaranteed debenture stock.

**Bright's Light and Power, Ltd.** (58,290).—Return dated December 31st, 1911, filed March 7th, 1912. Capital £200,000 in £1 shares (100,000 preference). 100,000 ordinary shares taken up. £1 per share called up on 66,667 shares. £66,489 5s. paid, leaving £177 15s. in arrears. £33,333 considered as paid on 33,333 shares. Mortgages and charges: £16,000.

**Aron Electricity Meter, Ltd.** (58,650).—A memorandum of satisfaction in full of mortgages created by trust deed dated July 11th, 1901, and supplemental deed dated February 20th, 1902, securing £75,000, has been filed.

**Chichester Electric Light and Power Co., Ltd.** (86,998).—Mortgage dated March 29th, 1912, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital, and sinking fund policy for £10,000. Holders: Caledonian Insurance Co., Edinburgh.

**Rugby Lamp Co., Ltd.**—Particulars of £7,500 debentures, created December 30th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £4,700. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Reading Electric Supply Co., Ltd.**—Particulars of £50,000 debentures, created February 23rd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Ackroyd & Best, Ltd.**—Issue on March 8th, 1912, of £8,200 debentures, part of a series of which particulars have already been filed.

**Bude Electric Supply Co., Ltd.**—The total receipts on revenue account for 1911 were £1,821 and the working expenses £616, leaving a gross profit of £1,205. After deducting interest on debentures and temporary loans, there remains a net profit of £1,065, with £78 brought forward, making a total of £1,143 available for disposal. This, according to a financial paper, the directors recommend should be allocated as follows: To 7 per cent. dividend and commission to secretary, £632; £400 to depreciation account, increasing it to £860, carrying forward £111.

**Carlisle Electric Tramways Co., Ltd.**—The directors report that for 1911, after providing for debenture interest, there is a surplus of £64 to be carried forward.



## CITY NOTES.

## North Metropolitan Electric Power Supply Co.

THE annual meeting was held at the offices of the Electrical Federation, Kingsway, W.C., on April 3rd, Mr. E. Garcke presiding.

The CHAIRMAN, in moving the adoption of the report, said that during the 12 months the revenue had been £132,875, compared with £112,731 in 1910, an increase of £20,144, which was equivalent to 17.6 per cent. The company sold 26,454,492 units of electricity, being an increase of over 5,000,000 units, and equivalent to 25.5 per cent. They commenced supplying in Southgate in April, 1911, and a supply for public lighting and private purposes had also been commenced in the district of Edgware. The supply to the latter place was particularly interesting, because it was not under an electric lighting order, but was under the rather special powers contained in the company's Act of Parliament, of 1907, which enabled them to supply for lighting purposes throughout most of their extensive limits, subject to certain consents. Moreover, this supply in Edgware justified in the public interests the granting of such powers, because there was no doubt whatever that were it not for such a company as theirs, districts like Edgware and the adjoining district of Kingsbury, would be compelled to wait many years before the advantages of electricity could be obtained by means of public supply. Arrangements were now proceeding to supply in accordance with the same powers in the district of Hadley, near Barnet, and subsequently this supply would be extended to East Barnet Valley. The electricity supply business of the company had increased very largely of recent years. Either directly or indirectly the company was responsible for the supply of electricity in no fewer than 12 separate districts throughout the North Metropolitan area, viz., Willesden, Hendon, Stoke Newington, Barnet, Enfield, Hertford, St. Albans, Southgate, Edmonton, Tottenham, Kingsbury and Edgware. The supply had, during the year, been maintained without interruption. Happily, they were able to maintain the supply until such time as they were able to replenish their coal stocks. A feature of serious moment was the fact that not only the price of coal had risen, but the prices of other commodities were rising, and the cost of production would undoubtedly increase abnormally during the present year. It would be a matter for serious consideration by the directors whether some increase in the electricity rates should not be made, but so far no decision had been come to. The expenditure last year increased by £10,374, equivalent to 18.6 per cent. That percentage of increase was just slightly higher than the increase in the revenue and was due to the operation of their new undertakings, where, in the early days, the costs were comparatively heavy. The balance to revenue account had increased from £62,425 to £72,694—an improvement of £9,769, or equivalent to 15.6 per cent. There was a net balance of £66,726 available for appropriation. Included in the item of £5.152 on the credit side of the net revenue account was the dividend of 5 per cent. which they had received in respect of the past year on their investment in the North Metropolitan Electrical Power Distribution Co., whose distribution in Barnet, Enfield, Hertford and St. Albans continued to extend satisfactorily. The capital expenditure last year amounted to £42,164, of which £26,146 was upon mains. Extensions had become necessary at three of their four generating stations in order to deal with the load, which was always tending to increase, and at St. Albans additional plant had already been installed. Two 3,000-KW. turbines were now on order for delivery, one to Brimsdown, and one to Willesden. To meet this expenditure it would be necessary to issue a further £100,000 6 per cent. cumulative preference stock at an early date. He congratulated the shareholders on a successful year, and trusted that, notwithstanding the serious anxieties to which he had referred in connection with the strike, and the rise in prices, the current year would show good results.

SIR ERNEST SPENCER seconded the motion, and the report was carried unanimously.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly, be dissolved:—

City and Surrey Electric Railway Co., Ltd.  
Cooke's Patent Tramway System, Ltd.  
Electrical Manufacturers' and Wholesale Traders' Protection Association, Ltd.  
Electrical Circuit Breaker, Ltd.  
Furnace and Boiler Syndicate, Ltd.  
Galvano Chemical Co., Ltd.  
Garrett Automatic Sprinkler, Ltd.  
Gaseous Steam Generator, Ltd.  
Hughes Metallic Packing Co., Ltd.  
Lowden Electric Lamp Co., Ltd.  
Maybaum Adding Machine Co., Ltd.  
Mechanical and Electrical Power Co., Ltd.  
Munro Fire Detector Co., Ltd.  
Phoenix Peat Fuel Syndicate, Ltd.  
Soler Aluminium French Works Syndicate, Ltd.  
Soler Aluminium Parent Syndicate, Ltd.  
Sperling's Lock Nut (Foreign), Ltd.

**Reading Electric Supply Co., Ltd.**—The report states (says the *Financier*) that the accounts for 1911 show an available sum, including £524 brought forward, of £5,657. A dividend of 3½ per cent. has been declared, and £420 is carried forward.

**Mexico Tramways Co.**—The directors have declared a dividend of 1½ per cent. for the quarter to March 31st.

## Folkestone Electricity Supply Co., Ltd.

At the annual meeting, the CHAIRMAN (Alderman Spurgeon) in moving the adoption of the report (see ELECTRICAL REVIEW, page 514), said that at the previous meeting he told them that the whole of the remainder of the debenture stock had been issued in one lot, and the borrowing powers of the company were then exhausted. The capital stood at £200,000, but they had spent £13,000 beyond that, taking into account the sums placed to reserve and to depreciation account. Last year their expenditure on capital account had been £6,896, compared with £3,190 in the previous year, as they had put in a new set of engines supplied by the Brush Co. Their total revenue had been £25,142, against £23,933 in 1910, an increase of £9,208. In ordinary sales to their customers there was an increase of £1,049, which showed very satisfactory progress, considering that there had been so little building going on. The expenditure on revenue account showed an increase of £698. Coal had cost them more, and they had been obliged to consume more. The profit for the year showed an increase of £858. They had maintained their plant out of revenue, and placed £6,058 to depreciation account. They had at the present time 3,077 consumers, an increase of 146 during the year. Thirteen years ago they had only 176 consumers. The company had not been much affected by the coal strike, and had enough coal in hand to last them until the middle of May, by which time they hoped they would be able to get new stock on fairly reasonable terms, although he anticipated there would be an increase in the price. People might say that a shilling a ton at the pit's mouth would not make much difference to them, but everyone had to get a profit on that shilling, and by the time it got to them it had got to half-a-crown. He looked forward to an increased use of electricity, as they were now competing with the gas companies in the supply of power for cooking and heating purposes, and he felt there was a large opening for electricity companies in that direction. The directors recommended a dividend of 6 per cent. on the ordinary share capital.

COLONEL PENFOLD seconded the motion, which was carried.

In replying to a vote of thanks, ALDERMAN SPURGEN paid a tribute to the memory of the late Mr C. J. Pursey, a director, who had been one of the foremost advocates of the introduction of electrical works into Folkestone, and had been associated with the company from its inception until his death.

## Great Northern Telegraph Co., Ltd., of Denmark.

—The traffic receipts for the year 1911 have, as foreseen, decreased considerably owing to the loss of the company's Norwegian concessions, the sale of the Korean cable, and the tariff reductions made during the year. The decrease has, however, been partly counter-balanced by the increase of the Government and Press correspondence caused by the extraordinary events which the year 1911 has witnessed, especially the revolution in China. On the other hand, the increase of staff required to cope with the increased work, together with all the measures which became necessary in order to secure the maintenance of the telegraphic communications in China and the safety of the company's Danish and native staff, have necessitated considerable extra expenditure. As a matter of fact, the net receipts for the year have decreased by about £24,000 compared with the year 1910, but as this amount is not larger than was expected, and a larger balance than usual was carried forward to 1911, the board of directors announce that they do not hesitate to propose the distribution of a total dividend and bonus of 18 per cent., including the 5 per cent. already paid, and to transfer to the reserve and pension funds the usual amounts of £55,556 and £11,111 respectively. The general meeting will be held at Copenhagen on April 29th.

**Mirrlees-Watson Co., Ltd.**—The annual meeting of this company was held in the company's offices, Glasgow, on March 15th. The profit and loss account showed that the profit available for distribution, after bringing forward from the previous year the sum of £1,996, and providing amply for depreciation and business contingencies, was £50,135. The directors recommended, and the meeting approved of, a dividend of 10 per cent. and a bonus of 5 per cent., both less income-tax, that £30,000 be added to the general reserve account, and £2,479 be carried forward. Last year the company paid similar dividend and bonus.

## Indian Electric Supply and Traction Co., Ltd.

The directors report that the surplus on the year's working to December 31st in Cawnpore, including £282 for interest accrued, was £7,907, against £1,935 in 1910, and including further interest accrued in England, £119, and transfer fees, £1 10s., the credit side of the revenue account shows a total of £8,027: London expenditure was £640, and after providing for debenture interest, £2,700, there remains a net profit of £4,687. This amount, says the *Financier*, has reduced the balance at the debit of profit and loss to £11,852. The first mortgage debentures fall due for payment on December 31st next, and this will necessitate some reorganisation of the company's finances. The directors are giving the matter their careful consideration.

**Lancashire Power Construction Co.**—This company's revenue is derived entirely from the Lancashire Electric Power Co., of which it is the sole owner, and the trading profit of that company for the year 1911 (according to the *Financial News*) amounted to £10,695. The amount standing to the debit of the revenue account, after payment of debenture interest, &c., is £7,737.



### Anglo-Argentine Tramways Co., Ltd.

THE directors report that the results of the working for the year 1911 were as follows: Gross receipts, £2,631,836; less working expenses (which include various items amounting in the aggregate to £120,000 carried to depreciation renewals funds, in addition to £298,012 expended on ordinary maintenance), £1,723,929; leaving £907,907, plus £13,045 brought forward, making £920,952, less interest and charges as per net revenue account, £727,557, leaving £193,395, less interim dividend of 4 per cent. less income-tax, on ordinary shares for half-year ending June 30th, 1911, £94,167 = £99,228. Out of this the directors now recommend that a final dividend of 3½ per cent. be paid on the ordinary shares for the half-year ending December 31st, 1911, less income-tax, making 7½ per cent. for the year, which will absorb £88,281, leaving £10,947 to be carried forward. The inauguration of the excavation work on the first subway took place on September 14th, 1911. The ceremony of turning the first sod was performed Dr. Gomez, Minister of the Interior, representing the President of the Republic. The work is being pushed forward with all possible speed, and it is expected that the first subway—Plaza Mayo to Plaza Once will be opened by June, 1913. Active operations upon the second subway will be commenced at an early date.

In order to provide funds towards the cost of subways construction and properties required in connection therewith, new extensions and additional rolling stock, a further issue of £1,500,000 5 per cent. debenture stock was made in October last at the price of 97½ per cent. Mr. T. Frame Thomson, a former director, has rejoined the board, and has been elected deputy-chairman. The directors record their appreciation of the services rendered by the local committee, the general manager (Mr. Pedriali), and the staff generally, both in Buenos Ayres and at home.

The directors publish lengthy extracts from the report of the general manager, in which he deals with the state of commerce and with building trade activity in Buenos Ayres, and, later, says that the number of passengers carried shows a good increase, in spite of the fact that comparisons are made with the centenary year. The following are the figures:—Passengers carried:—1910, 276,426,524; 1911, 299,154,835; inc. 8·22 per cent. Car kilometres run:—1910, 69,001,773; 1911, 73,550,888; inc., 6·59 per cent. The company's rolling stock at December 31st, 1910, amounted to 1,459 motors and 697 trailers, and at the end of year under review to 1,541 motors and 666 trailers. The following is a summary of the most important works carried out during the year:—

Totally re-constructed .. .. .	Motors	13	Trailers	21
Revised and partially re-constructed ..	Motors	27	Trailers	2
Re-painted .. .. .	Motors	186	Trailers	64
Partially re-painted and re-varnished	Motors	244	Trailers	298

The overhead installation has worked very satisfactorily, the breakages of trolley wire being comparatively few and unimportant in their consequences. As regards the underground feeder system, a very serious accident occurred to the cables of the Bustamante sub-station, which were all completely burnt out as a result of a short-circuit caused by electrolysis. In consequence of this accident the services in the Flores section were partially interrupted during three days. Measures have now been taken for minimising the possibilities of an accident of a similar nature occurring again. Many underground feeder cables of the incorporated companies have been replaced in certain districts by new cables of larger diameter, the old ones existing not being sufficient to carry the high tensions required for the heavy services.

Considerable work has been done on the removal of one of the two existing telephone protection wires in many streets, especially at curves, crossings and at other strategical points where the complicated netting of overhead wires puts the whole overheading installation in imminent danger of being torn down whenever the trolley pole happened to derail. This suppression of telephone protection wires has considerably reduced the number of breakages of trolley wire. The standard trolley wire now used on the surface lines has a section of 80 mm<sup>2</sup>. Whenever it becomes necessary to renew old trolley wire, it is replaced by wire of the standard type.

The permanent way work undertaken has continued to be very heavy, due principally to the reconstruction by the municipality of pavement on a definite level in an abnormal number of streets, which has necessitated completely reconstructing the tracks in the streets affected by these paving works. The number of squares where the company was obliged to reconstruct its tracks as a consequence of the above-mentioned works amounted at end of December to 151 squares, or, say, 15 kilometres more or less.

The new extensions constructed during the year amounted at December 31st to 57 squares of double and 4 of single track, or, say, roughly 7 kilometres of double track. A very considerable amount of works has also been done for the subway construction office.

The average current consumption per car-kilometre has increased slightly. This increase is principally due to the great congestion of street traffic in the city, as also to the extraordinary amount of paving works carried out, which adversely affects the consumption.

The year 1911 was one of exceptionally bad weather. A dry, hot summer, followed by severe rain storms and by an exceptionally severe winter, adversely affected the traffic. The increase in gross receipts over 1910, however, amounted to £209,492, about 8·75 per cent. more than was anticipated a year ago. The receipts in 1910 increased over 1909 by almost 14 per cent., part of which increase was due to the centenary traffic. The increased receipts over 1909 amounted to over half a million sterling, nearly 24 per cent. more in the two years. Expenditure in 1911, apart from normal increases due to heavier traffic, had had to bear some exceptionally heavy charges from temporary or unavoidable circumstances. An expense which would not recur was the bonus to guards, motormen and workmen for the last quarter of 1910 paid during 1911, £12,356. The rise in the price of coal had cost an extra £22,563 for energy. An item of expenditure which reappeared in the accounts was the 12 per cent. additional municipal tax, in respect of which \$240,000 had been paid. When the gross receipts amount to more than \$50,000 per km. of line in service, the municipal tax of 6 per cent upon the gross receipts is increased by 12 per cent. in respect of the excess over the above rate per kilometre. The above special items of expenditure amounted together to about £56,000, or rather over 2 per cent. on the gross receipts. The percentage of expenditure on receipts increased from 59·10 per cent. to 60·41 per cent. owing to the three particular causes already mentioned.

A petition was presented to the Mayor for leave to construct some 30 km. of new tracks. This petition has been favourably reported upon by the Departments concerned, and now awaits the drawing up of the necessary *ad referendum* agreement.

	1909.*	1910.†	1911.†
Receipts .. .. .	£1,938,888	£2,419,186	£2,631,836
Expenditure .. .. .	1,207,222	1,564,093	1,723,928
Passengers carried ..	223,823,792	276,426,524	299,154,835
Miles run .. .. .	35,130,039	42,881,395	46,019,328
Receipts per mile run..	13 25d.	13 54d.	13 73d.
Expenses per mile run	7 90d.‡	8 14d.‡	8 36d.‡
Cars in stock .. ..	2,030	2,156	2,207

\* Includes La Capital, Buenos Ayres Grand National, La Nueva and Metropolitano systems for the last nine months of the year. † Full year's working of incorporated companies. ‡ Does not include credits or debits to depreciation renewal funds.

### Alderley and Wilmslow Electric Supply, Ltd.

THE directors' report for the year ended December 31st, 1911, says that the total lamp connections have increased from an equivalent of 21,377 to 22,866 8-c.p. lamps. The result of the year's working shows a profit of £2,252, which, with £129 brought forward, gives a total of £2,381, and after paying £1,547, interest on debentures and loans, there remains a balance of £834, of which the directors recommend that £650 should be put to reserve fund, and the balance, £184, carried forward.

Units generated .. .. .	234,708
Units sold—Public lamps .. .. .	31,007
Private consumers by meter .. ..	146,464
Total sold .. .. .	177,471
Used on works .. .. .	50,289
Total quantity accounted for .. ..	227,760
Quantity not accounted for.. .. .	6,948
Number of public lamps .. .. .	257
Total maximum supply demanded, kW... ..	149
Lamps connected January 1st .. .. .	21,377
Lamps connected December 31st.. .. .	22,866

**Babcock & Wilcox, Ltd.**—The board have declared a final dividend for 1911 of 8 per cent., together with a bonus of 8 per cent., making a total distribution for the year of 28 per cent., as compared with 26 per cent. for 1910. In the preceding 12 months the distribution amounted to 26 per cent. According to a financial paper, the directors state that, having regard to the fact that the extension of the business has required the reserve fund to be employed as working capital, they have under consideration a proposal that an amount equal to the existing ordinary capital of the company be taken from the reserve fund, and added to the capital account.

**Guildford Electric Supply Co., Ltd.**—The annual meeting was held on March 27th. Mr. H. P. Smallpiece, in moving the adoption of the report, said that the gross receipts for 1911 were £8,679, or £794 better than in 1910, the largest increase for eight years, but the total expenses were, unfortunately, £935 more than in 1910, thus more than wiping out the increase. The chief item of increase was £358 in respect of coal and other fuel, due to the installation of a new large oil engine. On account of complaints made by neighbours as to the vibration caused by the working of the engine, it had, consequently, practically been in use hardly at all during the past year, and the company had had to generate by steam plant instead, which had necessitated an increased outlay on coal and fuel. The difficulty had been overcome, and the oil engine had for some weeks past been in constant use. The capital expenditure had been £2,616, as against £4,593 in the previous year. The prospects for the current year were very promising, and he had good grounds for hoping that in a year's time he would be able to congratulate them on a record year's business. The report was adopted, and the dividend resolution (5 per cent. on the ordinary and 6 per cent. on the preference) was carried.

**Hart Accumulator Co., Ltd.**—The directors' report to December 31st, 1911, states that the profit for the year was £16,089, plus the balance brought forward £7,162, making a total of £23,250 to be dealt with. After deducting the dividend on preference shares, £423, and transferring £7,500 to reserve account, the balance standing to the credit of profit and loss account was £15,327. The directors recommended that a dividend of 10 per cent. per annum, and a bonus of 2½ per cent. per annum, both free of income-tax, be paid on the ordinary share capital, absorbing £8,297, leaving £7,030 to be carried forward. During the past year the directors paid off the remaining £4,000 of the mortgage to complete the purchase of freeholds. The buildings, plant, tools, &c., had been augmented by £972, which had been charged to capital, and due depreciation on same had been made. The maintenance of the works, plant, &c., had been well kept up at a cost of £1,620, paid for out of revenue. The annual meeting was held on March 13th, at Stratford, E.

**Anglo-American Telegraph Co., Ltd.**—The directors have resolved to declare an interim dividend for the quarter ending March 31st, 1912, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock less income-tax payable May 1st. The dividend of 1½ per cent. to the "A" shareholders is not payable before the end of the year.

**Kalgoorlie Electric Power and Lighting Corporation, Ltd.**—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months to March 31st.



### Cork Electric Tramways and Lighting Co., Ltd.

THE directors' report for the year 1911 states that the result of working is as follows:—Receipts £57,180, expenses £33,327 = £23,853; plus £1,319 brought forward, making £25,172; less interest on debentures £1,600, leaving a balance of £20,572. Of this amount, £6,163 was paid on July 1st and January 1st for the half-yearly dividends on the 5 per cent. cumulative preference shares. £6,500 was added to reserve for depreciation, £1,753 written off, as per revenue account, and the directors recommend that the balance be disposed of as follows:—4 per cent. dividend on the ordinary shares £1,600, carrying to revenue new account £1,555. The lighting and power business again shows satisfactory progress. Agreements for 208 connections were concluded during the past year for an equivalent of 20,246 8-c.p. lamps: this compares with 168 connections and 11,786 8-c.p. lamps for 1910. The additional lighting and power connections represent a total gain of 462 kw., as against 300 kw. in 1910. The total lighting and power receipts are £1,086 in excess of the previous year and the traffic receipts also show an increase of £594. The gross profit for the year is £913 in excess of the previous year. £1,753 has been written off as per revenue account, and £6,500 transferred to reserve for depreciation, as compared with £1,771 and £5,000 respectively for the previous year. The capital expenditure during the year has been mainly expended on additional plant in the power station, house services, and cables. About £9,000 have been invested in first-class securities. No shares or debentures have been issued during the year. The meeting is called for April 25th.

TRACTION—	1909.	1910.	1911.
Miles open .. .. .	9.89	9.89	9.89
Passengers carried .. ..	5,349,041	5,704,071	5,866,523
Average fare .. .. .	1.05d.	1.17d.	1.07d.
Car mileage .. .. .	864,228	899,173	891,417
Number of cars .. .. .	35	35	35
LIGHTING AND POWER—			
Number of customers .. ..	2,013	2,181	2,389
8-c.p. lamps (equiv.) applied for	134,946	146,732	166,978
8-c.p. lamps (equiv.) connected	129,186	139,403	155,538

### Metropolitan Electric Tramways, Ltd.

MR. EMILE GARCKE (chairman) presided over the annual general meeting of the above company held on April 3rd at the Electrical Federation Offices, Kingsway.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 514), the CHAIRMAN said that the year had been marked by expansion in both branches of their business. With regard to the tramways and light railways, in February they opened for traffic the remaining piece of tramway authorised by their Middlesex Light Railway Order, which would join up Enfield with Ponder's End; and this completed the system of 56½ miles. Apart from this the route-mileage was the same as in 1910, but their traffic receipts showed an increase of £66,674, while the number of passengers carried was, in round figures, 90,000,000, as compared with 76,500,000 for 1910. Their working expenditure was large and showed an increase of £42,746, but their receipts had expanded at a greater rate. The average profit per route-mile was £2,700, compared with £2,400 in the preceding year. This increase indicated the development of traffic in the outlying districts on the more recently opened lines; the £2,700 per route-mile was arrived at after including in the working charges the amount set aside as a reserve for future reconstruction and renewals. They were setting aside £27,170, against £21,900 for the preceding year. This reserve fund was in addition to the £47,700 which they actually expended during the year on repairs and maintenance of their tramways and light railways. The electric supply business carried on by a separate company, in which they held practically all the issued ordinary share capital had given them a better return. For 1911 they received a 6 per cent. dividend, besides a considerable bonus. The total received was £31,500, against £26,250 for 1910. In view of the impending purchase by the L.C.C. of the company's tramway between Finsbury Park and the Manor House—a short, but very important section—they promoted a Bill last Autumn, asking Parliament to sanction a new tramway between these points running parallel with the existing tramway and situated within a portion of Finsbury Park. Prior to second reading, they were able to come to an understanding with the London County Council, by which they agreed to negotiate with the company for through running powers to the London termini, and, therefore, they had been able to withdraw their Bill. At the sitting of the Council on the previous day they had agreed to the running of a through service from the Tottenham Court Road to Enfield. The successful results lately obtained by the London General Omnibus Co. led that company to enlarge the sphere of their operations, and the number of buses running within the area of the company had considerably increased during the past year. With a view to opening up districts in their area not yet served by tramways, and with the object also of preserving the undertaking from an increase of motor-bus competition, the directors had since the commencement of the year joined with the British Electric Traction Co. in the formation of a new omnibus company under the title of the Tramways Metropolitan Omnibus Co., Ltd. The object primarily was to protect the terminal points of their tramways. The new company had been incorporated with a capital of £200,000 divided into 200,000 shares of £1 each, all of which had been subscribed for as to half by their company and as to the other half by the British Electric Traction Co. They thus held 100,000 shares in the new company, on which 1s. a share had been paid. The new company had created and issued £100,000 4½ per

cent. debenture stock, which had been guaranteed both as to principal and interest by their company. Therefore they had a strong financial interest in the new venture. Mr. Devonshire, their managing director, was chairman of the new omnibus company. The directors of the omnibus company anticipated that they would in the course of the present year put into operation 100 up-to-date omnibuses, which were to be worked in connection with their tramway system as feeders. It was also proposed to have a system of through bookings between their omnibuses and the tramways. It might be a little difficult for them to understand all the reasons which had actuated the directors in adopting this policy, but it was the subject of most earnest consideration, and they did not decide on the policy until after they had exhausted all efforts to come to an understanding with the London General Omnibus Co. The chairman then referred, at some length, to the test case fought by the company in regard to the assessment of their tramways in the Tottenham district, the decision of the Court of Appeal being that tramways were rateable on the same basis as railways and tramroads. He pointed out that the decision was not necessarily a final one, as the local authority might appeal to the House of Lords, but the three judges were unanimous in holding that the tramways were entitled to the exemption. The point was of great interest to the whole of the tramway industry, and in their own case it meant a saving of approximately £1,100 a year. With regard to the coal strike, they decided, after consultation, to reduce the service to the extent of about 20 per cent. of the car-mileage, and that, had been in operation since March 18th. So far as they could see, it would not be necessary for them to shut down any of their lines altogether. Nevertheless, the strike caused them very considerable anxiety, for not only had the cost of coal gone up, but the price of all other materials was tending to rise, and their working expenses during the current year were almost certain to show a large increase. The matter was under the very careful consideration of the directors, as it might unavoidably involve the necessity of raising fares. They could not come to a decision in the matter without conference with the Middlesex County Council, but he felt bound to mention it, as it might have a far-reaching effect on the company during the current year. After briefly referring to the figures in the balance-sheet, the chairman referred to a letter received from a deferred shareholder, asking why they did not put less to reserve and pay something to the deferred shareholders. He explained the circumstances under which these shares were created. When the company took over the remaining property of the North Metropolitan Tramways Co., they issued preference shares up to the real value of the property taken over, and then, to facilitate the arrangement, they gave deferred shares, which would be entitled to a dividend when the company had paid 8 per cent. Those deferred shares really represented no assets. There was no doubt that with the increased dividend being paid on the ordinary shares, an agitation would be commenced by the deferred shareholders, which would not be a good thing for the company. With the difficulties they had to face, and with the necessity of maintaining the permanent way, he would be very sorry if shareholders were led to expect a large and rapid increase in dividends. They were now paying 6 per cent. dividend, and it would be the policy of the board to maintain it before they made any great efforts to increase it. At the same time, to prevent disappointment to the deferred shareholders, the directors would seriously consider whether it was practicable to formulate some scheme by which they might adjust the conflicting interests of the two classes of shareholders. In conclusion, the chairman paid a high tribute to the hard work and loyalty of the officers and staff.

SIR E. SPENCER seconded the motion.

MR. ENNIS supported the chairman's statement as to the desirability of doing everything possible to maintain a steady dividend, and expressed the hope that no higher dividend would be paid until the item of preliminary expenses was dealt with.

The CHAIRMAN said he quite sympathised with Mr. Ennis's view, and they would see what could be done.

The report was adopted, and the retiring directors and auditors re-elected.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Monterey Railway, Light, and Power Co.—Further issue of £200,000 5 per cent. first mortgage debenture stock.  
 Pennsylvania Water and Power Co.—Further issue of \$100,000 first mortgage sinking fund 5 per cent. gold bonds of \$1,000 each (Nos. 7,581 to 7,680).

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Puebla Tramway, Light, and Power Co.—\$3,000,000 prior lien 5 per cent. 50-year gold bonds.  
 Rio de Janeiro Tramway, Light, and Power Co., Ltd.—Further issue of £213,000 5 per cent. 50-year mortgage bonds.

**Direct United States Cable Co., Ltd.**—The board announces a final dividend of 2s. per share, together with a bonus of 1s. per share (less income-tax), payable 30th inst., making with the two interim dividends already paid a total distribution of 5 per cent. for the nine months ending March 31st. The accounts will in future be made up to March 31st in each year. The transfer books will be closed from April 15th to 29th.

**Edgar Allen & Co., Ltd.**—The directors have declared a final dividend on the 5 per cent. cumulative preference shares for the year ended March 31st.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 10th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. per "	22/-	..
a " Oxalic .. .. per lb.	23d.	..
a " Sulphuric .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. per "	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. per ton	£5 10	..
a Bisulphide of Carbon .. .. per "	£18	..
a Borax .. .. per "	£16 10	..
a Copper Sulphate .. .. per "	£24 10	£1 15 inc.
a Lead, Nitrate .. .. per "	£26 10	£1 10 inc.
a " White Sugar .. .. per "	£25 10	10/- inc.
a " Peroxide .. .. per "	£32	..
e Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	33d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. per lb.	33d.	..
a " Perchlorate .. .. per "	43d.	..
a Potassium, Cyanide (98/100 %) .. .. per ton	73d.	..
(for mining purposes only)		
a Shellac .. .. per cwt.	68/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. per "	£6 10	..
a " Recovered .. .. per "	£5 10	..
a " Lump .. .. per "	£5 5	..
a Soda, Caustic (white 70/72 %) .. .. per lb.	£10 5	..
a " Chlorate .. .. per lb.	33d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. .. per ton	£67	..
b " Wire, in ton lots .. .. per "	£102	..
b " Sheet, in ton lots .. .. per "	£120	..
p Babbitt's metal ingots .. .. per lb.	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) .. .. per lb.	83d.	..
c " Tube (brazed) .. .. per "	103d.	1d. inc.
c " (solid drawn) .. .. per "	9d.	1d. inc.
c " Wire, basis .. .. per "	83d.	1d. inc.
c Copper Tubes (brazed) .. .. per "	113d.	1d. inc.
c " (solid drawn) .. .. per "	103d.	1d. inc.
g " Bars (best selected) .. .. per ton	£86	£2 inc.
g " Sheet .. .. per "	£86	£2 inc.
g " Rod .. .. per "	£86	£2 inc.
d " (Electrolytic) Bars .. .. per "	£74 5	£3 5 inc.
d " Sheets .. .. per "	£91 5	£3 5 inc.
d " Rods .. .. per "	£79 5	£3 5 inc.
d " H.C. Wire .. .. per lb.	93d.	1d. inc.
f Ebonite Rod .. .. per "	5/8	..
f " Sheet .. .. per "	4/9	..
n German Silver Wire .. .. per "	1/11	..
h Gutta-percha, fine .. .. per "	..	..
h India-rubber, Para fine .. .. per "	5/-	1d. dec.
i Iron Pig (Cleveland warrants) .. .. per ton	52/1 1/2	6 1/2 d. inc.
i " Wire, galv. No. 8, P.O. qual. .. .. per "	£14	..
g Lead, English Pig .. .. per lb.	£16 10	..
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per hot.	£8 12 6	..
e Mica (in original cases) small .. .. per lb.	6d. to 2s.	..
e " " medium .. .. per "	2/6 to 4/-	..
e " " large .. .. per "	4/6 to 8/6	..
p Phosphor Bronze, plain castings .. .. per "	11d.	..
p " " rolled bars & rods .. .. per "	1/0 1/2	..
p " " rolled strip & sheet .. .. per "	1/1	..
o Platinum .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. per lb.	10d.	..
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. per "	£200 to £202	£1 inc.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/4	..
p White Anti-friction Metals .. .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) .. .. per "	£29 5	£1 inc.

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p W. F. Dennis & Co.
h Edward Till & Co.	

## STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange on returning from its Easter Holidays, found the usual accumulation of orders, which resulted in the markets wearing an appearance of decided animation for an hour or two during the morning, after which there was a slackening tendency, both as regards trade and, in some directions, as regards prices also. However, there is a general cheerfulness in the financial world which finds expression in the greater willingness on the part of the public to embark upon speculative investment. In one section and another there is a good deal of business about, and the conclusion of the coal strike gives an added fillip to the appetite for public purchases of stocks and shares. Mr. Lloyd George's Budget, humdrum in most of its characteristics, and of questionable soundness in the rest, had the effect of depressing the price of Consols; though here, again there was a recovery after the fall.

In the Home Railway market, the activity continues to be marked in all of the Underground Railway descriptions. A good deal of interest is absorbed by conflicting rumours, reports, and statements respecting the Central London Railway; and, reading between the various lines, it would appear as though the company were holding out its hands to one of its bigger neighbours with a view to seeing which one would like to take it under its own control. The Preferred stock rose 1, but the Ordinary and Deferred have both given way on sales made before the settlement by those who had good profits available, and by reason of the threatened trouble amongst the company's men. City and South London put on a point. Great Northern and City Preferred are 5s. to the good, having risen £1 in a fortnight. Districts, after being 47 1/2, fell back to 45 1/2, from which there has again been a sharp recovery; leaving an advance of 4 1/4 on the week; while Metropolitan went ahead in good style. The market argument that both Metropolitan and Districts are over-valued at their present quotations does not imply that there is no room for further appreciation, and it is recognised that to be a "bear" of either stock is a dangerous proceeding. Underground Electric shares touched 4 1/8, reverting to 3 1/2, and at 3 3/4 are 1/2 down on balance, the Income bonds keeping very firm at 89. Metropolitan Electric Preference are a shade harder, and the Deferred shares at 3s. 9d. middle have put on 1/8 in consequence of the attention drawn to them by reason of the good report out recently. British Electric Traction continue a very dull market, and London United Trams show no change.

In the foreign tramway group, the Canadian-Latin issues are mostly in strong demand. One or two of the Mexican bonds are still rather under a cloud in consequence of the revolution, but otherwise speculation is rife in many of the lesser-known things, as well as investment in the better-class bonds. Rio Trams have risen 2 1/2. British Columbia Electric Railway stocks are strong, especially the Preferred Ordinary, which gained 2 1/2. Sao Paulos at 202 are 3 1/2 higher. Montreal Common shares spurted 10 1/2 points. Such shares as Alabama Light and Power, which are comparatively little known, shot into prominence, and were brought up to 43 1/2—a jump of about \$8 on the week. Georgia Light Railway shares, another comparatively unknown share on this side, are being sought after on the basis of 38—39. Speculation will, no doubt, put all these things too high, and there is far too much of buying on mere tips. However, if the public are keen on having such things, the critic can only utter warnings which he knows pretty well will be flung to the winds: and, moreover, if he happens to have a sneaking conviction that such shares are likely to go considerably better, the warning will be tinged with a reservation of half-reluctance.

The telegraph market continues to be absorbed by the magnitude of the dealings in Marconi shares. The world seems to have gone mad after these, and buying goes on from all quarters. It is contended that the company is now in a position far superior to anything that it has ever occupied before, and that on this ground the current quotation is justified. We are not going to attempt to say whether this is the case or not; it is sufficient to note that much of the buying has been of good class, and that the prospects favour the idea of a further advance. On the week there is a substantial improvement again exhibited, although at one time last Thursday the market was seized with a fit of flatness. Spanish hold their price with remarkable tenacity, but there has been selling in Canadians which caused the price to give way smartly to 34s.

Eastern Telegraph stock and Eastern Extension shares have commenced to recover from the depression which put them down two or three weeks ago, when Marconis were rising hand over fist. Both show an improvement, and the recent selling has ceased. Anglo-American Telegraphs are unchanged upon the declaration of the usual quarterly dividends, and Great Northern at 32 1/2 have not moved upon the announcement of the final dividend of 13 per cent., making the regular 18 per cent. for the year. West India and Panama gave way again, the Ordinary shares falling to 4 3/4. Reuters eased off 5s. in connection with the new issue. National Telephones have been going ahead again, and the Deferred stock is talked many points higher yet. The gamble was aptly described as a giddy one, for nobody can tell what is going to happen.

Underwriters in the Consolidated Diesel Engine Company were left with a small amount of their application, and the price eased off to 1 1/2 discount for special settlement. The fact of two companies making somewhat similar engines coming out on the same day, no doubt, had its effect in contributing to this; while the rumour runs that some of the underwriters took advantage of the pre-allotment premium, in order to make certain of a good profit. Still, it must be remembered that the issue was a comparatively big one, and it is not altogether surprising that the results should have turned out in this way.

The raising of the dividend on Babcox & Wilcox from 26 to 28 per cent. was in accordance with general expectations, and the price of the shares remained unchanged at 6 1/2. The company's statement has been received with a great deal of satisfaction, and when the shares are quoted ex dividend, it seems likely enough that they will recover at least part of the deduction. Callenders have had a big rise, and Westinghouse 4 per cent. Debenture is 1 1/2 higher. The Manufacturing market, as a whole, is steady, without showing any special changes, apart from those just mentioned.

The London lighting group is marking time. City Lights lost 10s. of their recent big improvement, and County Ordinary went back 5s. The County Company's new issue was a decided success. For Special Settlement the price of the new shares is 1/4 premium. Kensingtons come out best this week, with a jump of 12s. 6d. Somewhat overlooked up to the present, a very little demand served to put up the price sharply, the market being none too well supplied with shares.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 9th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 9th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	84—9½ xd	..	5 19 0	Kensington & Knightsbridge, Ord	5	9 9	7½—7½	+ ½	5 14 3
Do. 4½ % Pref. ..	10	4½ 4½	8½—9½	..	4 14 9	Do. 4 % Deb. ..	Stock	4 4	92—95	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100—102	..	4 8 8	London Electric, Ord. ..	8	2 2½	1½—2½	..	3 11 2
Brompton & Kensington, Ord. ..	5	10 10½	8½—8½ xd	..	5 14 3	Do. 6 % Pref. ..	5	6 6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7 7	7½—8½ xd	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	91—94	+ 1	4 5 1
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	98—101	..	3 19 3	Metropolitan ..	5	5 4½	8½—4½	..	6 1 3
Charing Cross, West End & City	5	5 5	4½—4½	..	5 2 7	Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½—4½	..	4 17 4
Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½—4½	..	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	99—104	..	4 6 7
Do. " City Undertaking "	5	4½ 4½	8½—4½	..	5 2 10	Do. 8½ % Mort. Deb. ..	Stock	8½ 8½	84—87	..	4 0 6
Do. Do. 4 % Deb. ..	100	4 4	95—98	+ 1	4 1 8	Midland Electric Corporation } 4½ % First Mort. Deb. }	100	4½ 4½	96—98	..	4 11 10
Chelsea, Ord. ..	5	5 5	4½—5	..	5 0 0	Newcastle-on-Tyne ..	5	4 4½	8½—3½ xd	..	5 3 8
Do. 4½ % Deb. ..	Stock	4½ 4½	98—101	..	4 9 1	Do. 5 % Pref., Non-Cum. ..	5	5 5	3½—4½ xd	..	5 14 3
City of London, Ord. ..	10	7 8	18—19½	— ½	4 2 1	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.) }	100	5 5	99—102	..	4 13 0
Do. 6 % Cum. Pref. ..	10	6 6	13½—15½	..	3 17 5	Notting Hill, 6 % Non-Cum. Pref. }	10	.. ..	10—11	..	5 9 1
Do. 5 % Deb. ..	Stock	5 5	117—121	..	4 2 8	Oxford ..	5	7½ 7½	5½—6½	..	5 13 9
Do. 4½ % Second Deb. ..	100	4½ 4½	101—104	..	4 6 7	St. James' and Pall Mall, Ord.	5	10 10	8½—9	..	5 11 1
County of Durham, 5 % First Mort. Deb. }	Stock	5 5	87—89	..	5 12 4	Do. 7 % Pref. ..	5	7 7	6½—7½	..	4 16 7
County of London, Ord. ..	10	5 6	10—10½	— ¼	5 11 7	Do. 8½ % Deb. ..	100	8½ 8½	85—87	..	4 0 6
Do. 6 % Pref. ..	10	6 6	11½—11½	..	5 3 0	Smithfield Markets, Ord. ..	5	Nil Nil	1½—1½	..	..
Do. 4½ % Deb. ..	Stock	4½ 4½	107—109	..	4 2 7	South London, Ord. ..	4	5 5	2½—3½ xd	..	6 8 0
Do. 4½ % Second Deb. ..	Stock	4½ 4½	101—104	..	4 6 7	Do. 5 % First Mort. Deb. ..	100	5 5	99—102	..	4 18 0
Edmundson's, Ord. ..	5	Nil Nil	2½—3½	..	Nil	South Metropolitan, 7 % Pref. ..	1	7 7	1½—1½	+ ½	5 1 0
Do. 6 % Cum. Pref. ..	5	Nil Nil	2½—3½	..	Nil	Do. 4½ % First Deb. Stock ..	100	4½ 4½	95—98 xd	..	4 11 10
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86—89	..	5 1 2	Urban, Ord. ..	5	5 5	1½—1½	..	..
Folkestone ..	5	6 6	4½—5	..	6 0 0	Do. 5 % Cum. Pref. ..	5	5 5	2½—3½	..	..
Do. 5 % Cum. Pref. ..	5	5 5	4½—5½	..	4 17 7	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	85—87 xd	..	5 3 6
Do. 4½ % First Deb. ..	100	4½ 4½	93—96	..	4 13 9	Westminster, Ord. ..	5	10 10	8½—9½	..	5 8 1
Hove ..	5	9 9	6½—7½	..	6 4 2	Do. 4½ % Cum. Pref. ..	5	4½ 4½	5—5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, } 5 % 1st Mort. Deb. }	100	5 5	87½—89½	— ½	5 11 9
Calcutta, Ord. ..	5	8½ 7½	6½—7½	..	5 17 3	Montreal, Lt., H. and Power ..	\$100	7 8	203—213	+ 10½	3 15 2
Do. 5 % Pref. ..	5	5 5	5—5½	..	4 15 3	Northern, Lt., Power and Coal, }	\$500	5 ..	39—41	..	12 3 10
Calgary Power, 1st Mort. Bds.	100	5 5	92½—94½	..	5 5 3	5 % 1st Mort. Bonds }	Stock	10 ..	252—262	+ 4	3 16 4
Canadian Gen. El. Com. ..	\$100	7 7½	116—120	+ 3	5 16 8	Do. 6 % Non-Cum. Pref. ..	Do.	6 6	110—115	..	5 4 4
Do. 7 % Pref. ..	\$100	7 7	116—120	+ 2	5 16 8	Do. 5 % Deb. Stock ..	Do.	5 5	102½—104½	..	4 15 8
Cordoba Lt., Power and T., Ord.	1	8 3½	2½—1½	..	2 18 3	Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. }	100	4½ 4½	99—101 xd	..	4 9 1
Do. 5 % Deb. ..	100	5 ..	93—98 xd	..	5 2 0	Shawinigan Water, Capital ..	\$100	4 5½	141—145	+ 4½	3 9 0
Elec. Lt. and P. of Cochabamba, }	100	6 6	93—95	+ 1	6 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108—110	..	4 11 0
6 % Bonds }	100	5 5	83—86	..	5 16 3	Do. 4½ % Per. Deb. ..	Stock	4½ 4½	103½—105½	..	4 5 4
Elec. Supply Victoria, 5 % 1st Mort. Deb. }	100	5 5	91—93	— 1½	5 7 6	Toronto Power, 4½ % Deb. ..	Do.	4½ 4½	99½—101½	..	4 8 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds }	\$500	5 5	91—93	— 1½	5 7 6	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. }	100	5 5	92½—94½	..	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	7½—5½	..	Nil	Victoria Falls Power, Pref. ..	1	Nil Nil	3½—3½	— 3½	..
Do. 6 % Pref. ..	1	6 6	8½—9½	..	8 0 0	West Kootenay Power and Lt., }	100	6 6	104½—106½	..	5 12 8
Kamistiquia Power, 5 % G. Bs.	\$500	5 5	110—112	..	4 9 3	1st Mort. 6 % Gold }					
Madras, Ord. ..	5	.. ..	2½—3	..	..						
Melbourne, 5 % 1st Mort. Deb.	100	5 5	102—105	..	4 15 3						
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	84—86	— ½	5 16 3						
Mexican Lt. & Power, Common	\$100	4 4½	84—86	— 1	4 13 0						
Do. 7 % Cum. Pref. ..	\$100	7 7	105—107	..	6 10 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	94—96	— ½	5 4 2						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½ 7½	— ½	..	Monte Video Telephone, Ord. ..	1	6 6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5 5	97½—99½	..	5 0 6	Do. 5 % Pref. ..	1	5 5	8½—8½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8 8½	148—150 xd	..	5 6 8	National Telephone, Pref. ..	Stock	6 6½	99½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4 4	94—96	..	4 3 4	Do. Def. ..	Do.	6 6½	137—139	+ 1	4 6 4
Anglo-American Telegraph ..	Stock	8½ 3	66—68	..	4 8 6	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½—5½	+ ½	4 9 0
Do. 6 % Pref. ..	Do.	6 6	109½—110½	— ½	5 8 7	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	102½—103½	+ ½	4 7 0
Do. Def. ..	Do.	80/- 30/-	24½—25½	..	5 18 2	Oriental Telep. and Elec. ..	1	8 ..	1½—1½	..	4 11 5
Anglo-Portuguese Tel., 5 % Mort. Deb. }	100	5 5	100—102	..	4 18 0	Do. 6 % Cum. Pref. ..	1	6 6	1½—1½	..	4 16 10
Chili Telephone ..	5	7 ..	7½—7½	— ½	4 15 0	Do. 4 % Red. Deb. ..	Stock	4 4	87½—89½	..	4 9 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	35½—87½ xd	..	4 11 5	Pacific and European Tel., 4 % Guar. Debs. }	Do.	4 4	99½—101½	+ ½	3 18 10
Cuba Telegraph ..	10	6 6½	9½—10½	..	5 11 7	Reuter's ..	8	5 5½	11½—12	— ½	3 6 8
Do. 10 % Pref. ..	10	10 10	17—18	..	5 11 1	Submarine Cables Trust ..	Cert.	6 6	130—133	..	4 10 3
Direct Spanish Telegraph, Ord.	5	4 4½	3½—3½ xd	..	5 6 8	Telephone Co. of Egypt, 4½ % Deb. Red. }	Stock	4½ 4½	99—101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10 10	7½—8½ xd	..	6 1 3	United River Plate Telephone	5	8 8	7½—7½	..	5 3 3
Do. 4½ % Debs. ..	50	4½ 4½	99—101	..	4 9 1	Do. 5 % Cum. Pref. ..	5	5 5	5½—6½	..	4 8 11
Direct United States Cable	10	4½ ..	7½—8½	+ ½	5 9 0	West Coast of America ..	2½	2½ 2½	1½—1½	..	3 11 5
Direct W. India Cable, 4½ % Reg. Deb. }	100	4½ 4½	99—101	..	4 9 1	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. }	100	4 4	97½—99½	..	4 0 5
Eastern Telegraph, Ord. Stock	Stock	7 5½	131—135	+ 2	5 3 8	West India and Panama Teleg.	10	1½ 1½	4½—4½	— ½	..
Do. 8½ % Pref. Stock ..	Do.	8½ 3½	81—83	+ 1	4 4 4	Do. 6 % Cum. 1st Pref. ..	10	6 6	10½—11½	— ½	5 8 0
Do. 4 % Mort. Deb. ..	Do.	4 4	101—103	+ ½	3 17 8	Do. 6 % Cum. 2nd Pref. ..	10	6 6	9½—10½	..	5 17 1
Eastern Extension ..	10	7 5½	12½—13	+ ½	5 7 3	Do. 5 % Debs. ..	100	5 5	102½—104½	+ ½	4 15 8
Do. 4 % Deb. ..	Stock	4 4	99½—101½	..	3 18 10	Western Telegraph, Ltd. ..	10	7 6½	13—13½ xd	..	5 3 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. }	25	4 4	99—101	..	3 19 3	Do. 4 % Deb. ..	Stock	4 4	99—101	..	3 19 3
Globe Telegraph and Trust ..	10	5½ 6½	10½—11 xd	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4 4	106—109	..	3 19 5
Do. 6 % Pref. ..	10	6 6	12½—13½ xd	..	4 9 9	Do. 4½ % Fdg. Bonds ..	\$1000	4½ 4½	102—105	..	4 5 9
Great Northern Telegraph ..	10	18 18½	3½—3½	..	5 8 3						
Indo-European Telegraph ..	25	13 5½	56½—58½	..	5 10 2						
Mackay Companies Common ..	\$100	5 5½	81—84	..	5 19 1						
Do. 4 % Cum. Pref. ..	\$100	4 4	70—73	..	5 9 7						
Marconi's Wireless Telegraph	1	5 ..	7½—7½	+ ½	..						
Do. 7 % Cum. Partic. Pref.	1	16 ..	6½—6½	+ ½	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 9th.	Rise + or Fall	Present Yield p.o.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 9th.	Rise + or Fall	Present Yield p.o.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	12 1/2	65 1/2 — 66 1/2	+ 2 1/2	2 16 2
Do. 5 % Pref. ..	1	5	5		6 13 4	Do. Surplus Lands ..	100	2 1/2	68 — 70	+ 1	4 3 4
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	7 1/2 — 8 1/2 xd	5 8 5	Do. 8 1/2 % Deb. ..	100	3 1/2	8 1/2 — 9 1/2		3 16 11
Brit. Elec. Trac., 5 % Pref. ..	100			11 1/2 — 13 1/2		Do. 8 1/2 % Pref. ..	100	3 1/2	85 — 87		4 0 6
Do. Do. Deferred ..	100			8 — 10		Do. 8 1/2 % Con. Pref. ..	100	3 1/2	84 — 86		4 1 5
Do. Do. 6 % Cum. Pr'f. ..	100			90 1/2 — 92 1/2		Metropolitan District Ord. ..	100	Nil	47 — 47 1/2	+ 1 1/2	Nil
Do. 7 % Non-Cum. Pr'f. ..	100			3 1/2 — 3 1/2		Do. 6 % Deb. ..	100	6	144 — 146		4 2 2
Do. 5 % Perp. Deb. ..	100	5	5	98 1/2 — 96 1/2		Do. 4 % Deb. ..	100	4	96 — 98		4 1 8
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2	50 — 84		Do. 4 % Prior Lien ..	100	4	100 — 102		3 18 5
Central London Railway, Ord.	100	3	3	83 — 85	- 3	Do. 4 1/2 % First Pref. ..	100	3 1/2	89 — 91		4 18 11
Do. Pref. ..	100	4	4	87 — 89	+ 1	Do. 8 1/2 % Gtd. ..	100	3 1/2	76 — 78		4 9 9
Do. Def. ..	100	2	2	83 — 85	- 3	Metropolitan Elec. Trams, Ord.	1	5 1/2	6 1/2 — 1 1/2		5 5 8
Do. 4 % Deb. ..	100	4	4	101 — 103		Do. Def. ..	1	Nil	6 1/2 — 1 1/2	+ 1 1/2	Nil
City & South London, Ord.	100	1 1/2	1 1/2	43 1/2 — 44 1/2	+ 1	Do. 5 % Pref. ..	1	5	99 — 101	+ 3 1/2	5 10 6
Do. 5 % Pref., 1891 ..	100	5	5	168 — 110	+ 1	Do. 4 1/2 % Deb. ..	100	4 1/2	97 — 99 xd		4 9 1
Do. Do. 1896 ..	100	5	5	103 — 105	+ 1	Do. 5 % Deb. ..	100	5	97 — 99 xd		5 0 0
Do. Do. 1901 ..	100	5	5	102 — 104	+ 1	Potteries, Ord. ..	1	2	3 1/2 — 3 1/2		
Do. Do. 1903 ..	100	5	5	102 — 104	+ 1	Do. 5 % Pref. ..	1	5	99 — 101		6 19 3
Do. 4 % Deb. ..	100	4	4	101 — 103		Do. 4 1/2 % Deb. ..	100	4 1/2	89 — 92		4 17 10
Dublin United Trams, 6 % Pref.	10	6	6	10 1/2 — 11 1/2		South Metro. Trams, 6 % Pref.	1	6	72 — 77		6 17 2
Great Northern & City, Pr'f. Ord	10	Nil		2 1/2 — 2 1/2	+ 1 1/2	Do. 4 % Deb. ..	100	4	72 — 77		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2	71 — 76 xd		Underground Elec. Railways	10		99 — 101		4 9 1
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	71 — 76 xd		Do. 4 1/2 % Bonds ..	100	4 1/2	99 — 101		
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2	23 — 28		Do. 6 % Income ..	100	1	88 — 90		Nil
Do. 4 % Deb. ..	100	4	4	75 — 80		Yorkshire (West Riding), Ord.	5	Nil	2 1/2 — 3 1/2		Nil
Lancashire United, 5 % Deb. ..	100	5	5	82 — 84		Do. 6 % Pref. ..	5	Nil	2 1/2 — 3 1/2		Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99		Do. 4 1/2 % Deb. ..	100	4 1/2	80 — 84		5 7 2
London United Trams, 5 % Pref.	10	Nil		3 1/2 — 4							
Do. 4 % Deb. ..	100	4	4	75 — 78							

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2 — 5 1/2		5 2 4	La Plata Elec. Trms, Ord. ..	1					
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2 — 5 1/2	+ 1 1/2	5 7 4	Do. Pref. ..	1	6	6	6 1/2 — 1 1/2		6 0 0
Do. 4 % Deb. ..	100	4	4	9 1/2 — 95		4 4 3	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	1 — 1 1/2		4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	102 — 104		4 6 7	Do. 6 % Pref. ..	1	6	6	1 — 1 1/2		4 16 0
Do. 5 % Deb. ..	100	5	5	103 — 105		4 15 3	Do. 5 % Deb. ..	100	5	5	95 — 99		5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	104 — 106	+ 1	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	96 1/2 — 98 1/2		5 1 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10 1/2 — 11 1/2		5 6 8	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93 — 96		5 4 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98 — 100		4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	99 1/2 — 101 1/2		4 18 6
Do. 5 % 2nd Deb. ..	100	5	5	98 — 100		5 0 0	Mexico Trams Com. ..	\$100	7	7	118 — 120	- 1	5 16 8
Brisbane Trams Invt., Ord. ..	5	8	8 1/2	9 1/2 — 9 1/2		4 6 6	Do. Gen. Con. 5 % Bonds ..		5	5	96 — 98	- 1/2	5 2 0
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2		4 15 3	Do. 6 % Bonds ..	100	6	6	100 1/2 — 102 1/2		5 17 1
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100 — 103		4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 1/2 — 7 1/2		7 0 4
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	139 — 144	+ 1	5 11 1	Do. 6 % Pref. ..	5	6	6	5 — 5 1/2		7 0 4
Do. Pref. Ord. ..	100	6	6	125 — 130	+ 2 1/2	4 12 4	Do. 5 % 1st Deb. ..	100	5	5	98 — 100	+ 1/2	5 0 0
Do. 5 % Pref. ..	100	5	5	111 1/2 — 114 1/2		4 7 4	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2		1 1/2 — 1 1/2		1 18 1
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	100 — 103		4 7 5	Do. 5 % 1st Deb. ..	100	5	5	101 — 104		4 16 2
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	103 — 105		4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2 — 5 1/2		5 6 8
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102 — 104		4 6 7	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	98 — 101		4 9 1
Calcutta Trams, Ord. ..	5	6		6 — 6 1/2		4 16 0	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	121 1/2 — 122 1/2	+ 2	4 1 10
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2		4 16 5	Do. 1st Mort. 5 % Bonds ..		5	5	103 1/2 — 104 1/2	+ 1/2	4 15 8
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99 — 102		4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	96 1/2 — 97 1/2 xd		5 2 4
Cape Electric Trams ..	1	Nil	2 1/2				Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	201 — 203	+ 3 1/2	4 18 6
City Buenos Aires Trams (1904)	5	5	5	5 1/2 — 5 1/2		4 6 0	Do. 5 % 1st Deb. ..	\$500	5	5	104 — 106		4 14 4
Do. 4 % Deb. ..	100	5	5	101 — 103		4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	79 — 82 xd		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98		5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95		5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 103		4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2 — 6	+ 1/2	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil		1 1/2 — 1 1/2		Nil	Do. 6 % Pref. ..	5	6	6	5 1/2 — 5 1/2		5 11 7
Do. 5 % A Deb. ..	100	5	5	91 — 94		5 6 5	Do. 5 % 1st Deb. ..	100	5	5	101 — 104		4 16 2
Do. 6 % B Deb. ..	100	5	6 1/2	56 — 60		10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	103 1/2 — 105 1/2	+ 1/2	4 5 4

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6				Diak, Kerr ..	1	5				5 3 1
Do. 6 % Pref. ..	1	9	6			7 2 2	Do. Pref. ..	1	6	6	2 1/2 — 3 1/2		5 12 11
Babcock & Wilcox ..	1	26	28	6 1/2 — 6 1/2		4 1 5	Do. Deb. ..	100	4 1/2	4 1/2	97 — 100		4 10 0
Do. Pref. ..	1	6	6	1 1/2 — 1 1/2		3 13 10	Edison & Swan, A, £3 paid	5	Nil		1 1/2 — 1 1/2		Nil
B.I. & Helsby Cables ..	5	10	10	6 1/2 — 7 1/2	+ 1 1/2	6 18 0	Do. fully paid ..	5	Nil		1 1/2 — 2 1/2		Nil
Do. Pref. ..	5	6	6	5 1/2 — 6 1/2		4 16 0	Do. 4 % Deb. ..	100	4	4	71 — 75		5 6 8
Do. Deb. ..	100	4 1/2	4 1/2	101 — 103		4 7 5	Do. 5 % Second Deb. ..	100	5	5	75 — 78 xd		6 8 2
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	92 — 95		4 13 9	Electric Construction ..	2	Nil	2 1/2	1 — 1		
British Westinghouse, Pref. ..	3	Nil		3 — 1		Nil	Do. Pref. ..	2	7	7	1 1/2 — 1 1/2		7 9 4
Do. Deb. ..	100	4	4	62 — 65	+ 1 1/2	6 3 1	Greenwood & Batley, Pref.	10	7	7	7 1/2 — 8 1/2		8 5 8
Do. 6 % Prior Lien ..	100	6	6	99 — 102 xd		5 17 8	Do. Deb. ..	100	5	5	94 — 96		5 4 2
Browett, Lindley, Ord. ..	1	Nil		1 1/2 — 2 1/2		Nil	General Electric, Pref. ..	10	5	5	9 — 9 1/2		5 5 3
Do. Pref. ..	1	Nil		5 1/2 — 6 1/2		Nil	Do. Deb. ..	100	4	4	85 — 90		4 8 11
Brush, Ord. ..	2	Nil		0 — 1 1/2		Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2 — 12 1/2		6 2 6
Do. 7 % Pref. ..	2	Nil		0 — 1 1/2		Nil	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2 — 5 1/2		4 6 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	54 — 59		7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	104 — 106		4 4 11
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	37 — 42		10 14 4	India-Rubber, G. & T. ..	10	10		9 1/2 — 10 1/2		
Callender's Cable ..	5	15	10 1/2	10 1/2 — 11 1/2	+ 1	6 14 6	Do. Pref. ..	10	5	5	9 1/2 — 10 1/2		4 17 7
Do. Pref. ..	5	5	5	5 — 5 1/2		4 15 3	Telegraph Construction ..	12	20	10 1/2	33 — 35		6 15 2
Do. Deb. ..	100	4 1/2	4 1/2	98 — 100		4 10 0	Do. Deb. ..	100	4	4	99 1/2 — 101 1/2		4 9 0
Castner-Kellner ..	1	17 1/2	20	3 1/2 — 3 1/2	+ 1 1/2	5 6 8	Willans & Robinson ..	1	Nil		1 1/2 — 1 1/2		Nil
Do. Deb. ..	100	4 1/2	4 1/2	105 — 109		4 10 7	Do. Pref. ..	5	Nil		1 1/2 — 1 1/2		Nil
Crompton & Co. ..	8	Nil		1 — 1		Nil	Do. Deb. ..	100	4	4	59 — 61		6 11 2
Do. Deb. ..	100	5	5	58 — 68		7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## REVIEWS.

*Electric Mains and Distributing Systems.* By J. R. DICK, B.Sc., M.I.E.E., and F. FERNIE, A.M.Inst.C.E., A.M.I.E.E. London: The *Electrician* Printing and Publishing Co., Ltd. Price 10s. 6d. net.

Not many years ago it could be truthfully said that there were few, if any, books of practical and theoretical value to the mains engineer. His library has grown of late years, and is still growing. The long-heralded "Dick and Fernie" is now added to it.

Authors of books on mains work are curiously at one in admitting that it is scarcely possible to theorise beforehand on questions of distribution. The authors of the work now under review are no exception, for they admit, in the first chapter, that synthesis is impossible, and that "the designing of a network is possibly as much an art as a science."

True as this view is, it is no less true that a really scientific engineer would much prefer to build up his mains system as he builds up his station and his boiler house, laying down in every part of his undertaking as nearly as possible what is required, neither under-estimating his demand, and so causing dissatisfaction, nor over-estimating it and so spending capital unprofitably. Experience is in all things the best teacher, and no matter what a man's training may be, he always has to go to the school of experience to finish that training—so far as a scientist can be said ever to have finished it.

To the mains engineer whose heart is in his work, such a book as that which we are now considering ought to be of considerable assistance. We say "ought to be" advisedly, for it is our painful duty to point out many instances where the industry of the authors in writing has been nullified by inaccuracy in printing and by careless revision. We do not intend to give a list of ordinary misprints, or places where the type is out of line, or pages are set askew, for if we did so the space available for an ordinary review would be entirely occupied with the catalogue. It has been necessary, in reviewing the book, to check every calculation and every formula used, and this, we are glad to say, is not generally the case, or the lot of the reviewer would be worse than it is already.

On page 10, in three places, formulæ are rendered utterly meaningless and inaccurate by the careless use of the sign of addition (+) instead of the sign of division ( $\div$ ); and on page 14, in the first formula on the page, we see clearly that a sign of division has been roughly constructed by picking bits out of a "plus."

There is no list of errata (a true one would certainly have been terrifying to the possible buyer), and so one has to detect errors of this kind, which are as unexpected as they are annoying, without aid.

On page 12, after differentiating, we are given  $-\frac{(C_1 + C_2) l_1}{K v_1^2}$  as part of the expression which is put equal to zero.  $l_1$  should be  $l_1^2$ .

Again, on page 114, the squared index of the expression for the apparent resistance of a conductor, where the circuit contains capacity, is omitted in the second term.

There are some authors who start their work by making a list of the symbols which they will use throughout for various quantities or conceptions. This has not been done in the present case, for we have sometimes  $s$  for cross-section and sometimes  $a_1$ ,  $a_2$ , and so on.  $K$  means capacity in farads in one line (page 114), and capacity in microfarads in the next line but one. On page 33 a distributor is variously described as  $A B$  and  $F$ , and later we are given  $F_1$  and  $F_2$  for distributors, while  $D_1$  and  $D_2$  are the feeders.

On page 26, recourse is had to a footnote to explain symbols, and we commend to the notice of the authors—and of all who intend to write books in which mathematical formulæ will be used—the practice before mentioned, of providing a glossary at the beginning.

On page 51, line 21, the word "joints" should be "points." There are instances of omitted words on pages 67, 207, and 221, while a redundant word is found on page 116. Fraction lines are omitted on pages 101 and 127, and there is no number under fig. 88, on page 242.

On page 125 a three-phase delta-connected system, shown as part of fig. 53, is described as "Two-phase four wires," while a star-connected three-phase four-wire system is called "Two-phase three wires"—descriptions which clearly belong to, and are correctly repeated under, fig. 54 on page 126.

Then we meet some curious chemical notions. On page 204 we are introduced to "phenol phalein," which is known in the laboratory as "phenol-phthalein." On page 207 we are greeted by the news that "lead oxides . . . will slowly turn to carbonates by absorption of  $CO_2$ ," that is to say, by the absorption of two atoms of metallic cobalt! Carbon dioxide, as everyone knows, is  $CO_2$ .

So we could go on pointing out instance after instance in which serious carelessness in revision has occurred. We do not, in fact, at all like the way in which the book is printed. The advertisements among the contents list, and the method adopted of beginning a chapter on a right-hand page, which leaves 12 completely blank pages and many partially unoccupied, might very well be dealt with differently in a new edition. We are really very sorry and disappointed that a book which we have anticipated with some pleasure should have been published in such a grievous state. It would not be too much to say that the present issue should be called in and revised, for as it stands now the book is practically useless except to the mains engineer who is already sufficiently expert to be able to do without it.

When we reach the descriptive and practical parts of the book, however, we are glad to find a different state of things. There is a complete absence of all that would tend to make it into a kind of catalogue of different appliances, and the extensive experience of both of the authors in the work of which they are treating, provides us with useful, instructive, and highly interesting reading.

The shrewd remarks about workmen which we encounter in various places; the fearless and straightforward way in which results of experience are given; the careful diagrams of appliances for use with mains systems: all these are deserving of high praise and of the most careful attention.

So also are the care and attention bestowed upon points which are apparently small and likely to be overlooked, such as—to take one out of many instances—the necessity of using gun-metal nuts on iron screws in buried fittings, so as to do away with the trouble frequently experienced through rusting.

There are useful tables at the end of the book, and so far as they can be tested, they are correct. The index is complete, and we like the method of selecting the more important entries by means of heavy type, whereby much time is saved.

We think a lighter paper might with advantage have been used, and space should be economised as far as possible. However great the utility of a book may be in itself—and (properly printed) the utility of this book could surpass that of any other on the mains engineer's bookshelves—that utility is always considerably enhanced by portability and convenience.

We trust that we shall soon see a second edition, carefully revised, and embodying the suggestions we have offered in the endeavour to render the book more useful to those whom it is intended to benefit. When this consummation has occurred, "Dick and Fernie" is likely to become the standard English work on the subject with which it deals.

*Revolving Vectors: with Special Application to Alternating Current Phenomena.* By G. W. PATTERSON. London: Macmillan & Co. Price 4s. 6d. net.

In his prefatory note the author refers to the great advance in the use of vector methods of treating alternating current problems due to the work of Dr. C. P. Steinmetz. It is in consequence of this advance that more than one book has appeared within the last year or two dealing with the subject of vector analysis applied to alternating-current phenomena. For many students, the introductory treatment to be found in Steinmetz's own books is too brief, leaves too many questions unanswered, and appears at first to be too arbitrary for a clear perception of the subject to be gained on a first reading. A need is consequently felt for a more detailed explanation of vector methods and for a more



systematic examination of the symbols and expressions which arise. We believe that it has been with the intention of fulfilling some such function as this need suggests that the author of the present work has undertaken his task.

By the study of some book like the one now before us, which is kept on strictly theoretical lines, a student will realise something of the methods and scope of vector analysis, as employed by such writers as Steinmetz in the solution of the practical problems which arise in connection with electrical engineering.

Dr. Patterson assumes his readers to be possessed of a fair knowledge of mathematics, such as should be expected of a third-year student in one of our day technical colleges. He begins with a chapter dealing with the effects of the roots of  $(-1)$ , when regarded as operators producing rotation of direction. If the critical reader takes exception to the expression just used, "rotation of direction," we can only say that it is difficult to describe more clearly the function of the operators dealt with in the first three chapters of the book. The author draws no clear distinction between a direction, a straight line, the position of a point (as expressed by the sum of its rectangular co-ordinates) and a vector. An operator is made to act indiscriminately on any of these, and to produce what we have called a "rotation of direction."

Chapter 4 deals with simple harmonic quantities, and introduces the reader to the relations between current and electromotive force in a simple alternating circuit and in circuits connected in series or in parallel. Although the problems here are more concrete, and such as will be readily followed by the student, we feel moved to make the same kind of criticism of the author's treatment which we have already hinted at in connection with the first chapters. We can imagine the student continually asking the question, "What is a revolving vector?" and hunting through this chapter, where he might reasonably expect to find the answer to his question, but hunting without success.

The nature and meaning of the symbols employed are not so clearly stated that the student can always realise what is being done when a mathematical operation is introduced. In fact, it would almost seem as if the author did not desire that the reader should obtain too near a view of the pitfalls which beset the inquiring mind. Thus, he occasionally seeks to prevent his shying at possible dangers by introducing such passages as "We may, therefore, fearlessly deal with impedances just as though resistances and reactances had, in fact, perpendicular (or quarter-period difference) relations."

In Chapter V, which deals with the product of two harmonic quantities, the author seems to throw off the guise of a cautious and protecting guide, and to lead the reader at once into the middle of one of the direst quagmires, from which he indicates only two tortuous and difficult exits. He begins this chapter by obtaining the product of two harmonic quantities, and then proceeds at once to confront the student with a *reductio ad absurdum* (to use the author's own expression) by applying the same method which he has just used in order to obtain the product of an alternating current and an E.M.F., and then showing that the result is not the power of the circuit. He then suggests two arbitrary methods of multiplication, either of which, if applied in this case, will give the correct answer. Of the reason for the failure of the first method, or of that for the success of the arbitrary methods, he attempts no explanation. Indeed, it is difficult to see how a treatment which appears to avoid, of set purpose, any distinction between vector and scalar quantities, and the difference between the expressions for vectors and for complex numbers, could afford any simple explanation.

The remaining chapters of the book contain applications of the rules and methods previously obtained to problems of various kinds, all of which are treated from a rather abstract and mathematical point of view, and without concrete numerical examples. The problems treated of include the determination of the power in balanced and unbalanced polyphase circuits, oscillatory and non-oscillatory discharge of a condenser, power and power-factor in circuits carrying non-sinusoidal currents, magnetically interlinked circuits and transformers.

In trying to arrive at a general estimate of the practical value of the book, the reviewer is bound to confess himself disappointed. From a purely mathematical point of view, he has found much that is interesting. On the other hand, from the standpoint of an electrical engineer, the book seems to offer little help either to the student or to the practitioner. It neither forms a satisfactory introduction to the works of Steinmetz, nor does it offer a system of notation which can be compared with his on grounds of practical utility. The author draws no clear distinction between the two meanings which are to be attributed to the symbol  $j$ . The symbol is used to indicate "unit normal vector," while it is also used to represent an operator producing rotation through  $90^\circ$ . The same ambiguity is, of course, to be found in Steinmetz's notation. But while using Steinmetz's symbol  $j$ , the author does not make use of the further simplifications, which render the Steinmetz notation of such great practical value to electrical engineers. In fact, the equations given by Dr. Patterson are sufficiently formidable in appearance to frighten the majority of engineers from their use, although they do not possess any corresponding increase in accuracy over the simpler and much more convenient forms employed by Steinmetz.

It is to students of mathematics and physics, rather than to electrical engineers, that the author must look to find readers of his work.

## SOME THOUGHTS ON PUBLICITY.

By C. H. WORDINGHAM, M.INST.C.E.

CENTRAL electrical stations, or rather the engineers designing, operating, and managing them, have from the inception of the industry of generating and distributing electrical energy suffered, and suffered badly, from epidemics of fashion. At one time, the fashion was a particular kind of current, alternating or continuous; at another, a special make of single-acting engine; later, exhaust steam turbines, and so on, *ad infinitum*. At present the plague takes the form of "more publicity"; this is the panacea (to reverse the metaphor) that is to cure every ill, to gloss over every defect and to fill the coffers emptied by the rapacity of the capitalist who demands interest on his capital, by the audacity of the workman who demands more than all the profits for his labour, and by the mendacity of the politician who says he wants the lion's share of the earnings of capitalist and workman for the good of mankind.

The charge was recently brought against engineers by Mr. Couzens, speaking at the Institution of Electrical Engineers, that they, as a body, adopted a lordly spirit of aloofness, and looked with disdain on the commercial side of their work. Is this true? Is it not rather a contradiction in terms to speak of a non-commercial engineer? Surely it is of the essence of the work which the word engineering denotes, that its practiser should have regard primarily to the cost and financial result of his designs and schemes. It is this vital condition that distinguishes the engineer from the natural philosopher or, to use the modern, though somewhat objectionable word, scientist. The latter pursues knowledge for its own sake by experiment and reasoning without any regard to the commercial usefulness or financial result of his work; the former is beset at every turn by the questions, "Will it pay?" "Is this design, good though it obviously is for effecting its purpose, such as can be made and sold at a profit at a price that people will pay?"

With all respect to those who think the average engineer is a scientific dreamer who wants teaching that commercial considerations must receive attention, who wants hustling, who must "wake up," and who must have applied to him any number of other catchwords, it is greatly to be doubted whether he deserves any of the reproaches so lavishly hurled at him.

The burden of the song is "Advertise." No one in these days can doubt that if a man has anything to sell he must advertise, for, unless a possible purchaser knows that an article is on the market, he cannot consider the question of



whether he shall buy it. But surely it is of little avail to tell a man that an article is in existence unless it is really useful to him, and actually fulfils the promises made in the advertisement both in letter and in spirit. With the one exception of patent medicines, no article can meet with permanent success, however skilfully boomed, unless it is, in fact, good of its kind, and it would be well if those who clamour for more publicity would first ascertain that the articles, the small utilisation of which they bemoan, effect their object commercially as well as scientifically. It is strongly to be suspected that those who call loudest for more commercial-mindedness are the very persons who fail to recognise that what they advocate is not a commercial proposition to the ordinary householder.

Now what are the possible applications of electrical energy in the ordinary English household? Let us realise what kind of people we are dealing with when we contemplate catering for the great bulk of those now using coal, oil and gas. The householder with a well filled servants' hall, with dozens of bedrooms filled with hungry guests wanting to be fed, tarnishing huge quantities of plate in the process, who shed hundreds of dirty boots that must be cleaned, soil presses full of linen that must be washed, mangled and ironed, who curl their hair from morning to night, light cigars every few seconds, make dust that must be evacuated almost continuously, and generally give employment to multifarious ingenious applications of electrically-driven machines, are few and far between. No, the prosaic people who might consume electrical energy, and who do consume gas, oil and coal are those who keep two "generals" (called by courtesy cook and housemaid), or more often one, and who have to look to every penny to keep their expenditure within their means. Let us take a few concrete cases and see what possible inducement there is to such people to use the articles referred to.

A very nice vacuum cleaner can be bought for £10 to £25. What will it save? If the servant is a good one, it will enable her to stand instead of her having to go down on her hands and knees, but a Ewbank would do this (though at the expense of damaged skirting boards and furniture within its line of erosion), and some wholesome muscular effort will be saved, but not a penny will come off the wages. Owing to the modest scale of the domestic machine, a good deal more time will be spent on cleaning the floor; dusting will have to be done just as if the room were swept with a broom, for passing motors, &c., will provide the material to be removed. Net result, £20 or so spent and a certain amount of time lost.

Plate-polishing machines can be bought for about £6 each, boot-cleaning machines for about £23, cigar lighters for from 12s. upwards, and so on. But how can this expenditure be justified when the family plate can be easily cleaned by a housemaid by means of a rag and brush in a couple of hours, rescued from the *Family Herald* once a week? The boot-cleaning machine seems lightly loaded with one or possibly two pairs of "master's" boots per diem (missus' probably will not stand blacking). The work of the cigar-lighter is quite as efficiently performed by a few dozen matches from a box taken out of a neat packet of a dozen purchased for 2½d. per packet. "But look at the advantages of an electric iron." We will. This interesting article is listed at 12s. 6d. upwards. Out of Lancashire the amount of washing done at home is mighty little. At most the iron is probably used a couple of hours a week. Two really nice ordinary flat-irons can be purchased at the Army and Navy Stores for 2s., and they will come 20 miles out free on an enclosure card if you make the order up to 5s. You can make them hot on the fire without perceptible abstraction of heat therefrom, and you can use them wherever you like without tying copper, rubber, and silk into knots.

In all these cases the cost of the electrical appliance is enormous compared with that of what it is a substitute for, and the saving in actual cost of the work done is absolutely nil.

Let it not be thought that it is sought to imply that any of the appliances referred to are useless or unpractical. Far from it; it is simply a case of standing costs on the part of both of the competitors. On the one side, the length of user is so appallingly short that the capital cost kills the use

of the appliances (and this is true whether the consumer or some hiring authority finds the capital, for shifting the burden from one paymaster to another does not alter the financial result) and, on the other, the standing charges for domestic service, kitchen fire, &c., are no whit affected by the saving due to the machines.

In restaurants, clubs and large establishments generally the conditions are utterly different, and the load factor is such as to make the capital costs quite small relatively to the work done, and the saving in labour is real and actually enables the wages bill to be substantially reduced.

If these considerations be admitted as true, of what possible use is publicity in effecting the sale of the appliances to the ordinary private householder? Even if he be cajoled into a few purchases, more harm than good is done ultimately by the discredit entailed on electrical appliances generally.

Notwithstanding what has been said, there are certain outlets other than lighting for electrical energy in the case of the class of consumer referred to. Electric radiators have a special field, which they fill better than any other heating agent. In the drawing room they can be switched on before the doorbell is answered, thus giving, if of the radiant type, the impression that they have been going all day, cheering and warming the visitor who has just come from the outside air, and saving the expense of a fire kept alight all the afternoon for the sake of chance visitors, and very possibly nearly out when one does happen to call. Again, in the sick room, a radiator is absolutely innocuous, maintains an equable temperature without attention and involves no risk of noise, such as is entailed by putting coal on a fire, noise which may break the slumber of a patient whose very existence may depend on his getting sleep at a critical juncture. Again, in the winter, radiators switched on for a couple of hours at night and while dressing in the morning are quite satisfactory in lieu of a fire in a bedroom, and obviate the necessity for the sleeper being disturbed unduly early for the fire to be lighted, besides saving the trouble and cost of maintaining the fire during the day.

Electric radiators in rooms requiring occasional or intermittent heating have great advantages in such households as those under consideration. They effect great saving in coal, in kindling wood (the cost of which is by no means negligible), and in labour (possibly making the difference between having to employ three servants or being able to manage with two).

Electric hot plates for boiling small quantities of water, making coffee, boiling eggs, making toast and similar duties, are exceedingly convenient, and not costly to use. When used instead of methylated spirit stoves, they save much money, trouble, and danger. Most of these hot plates suffer from a radical defect in design which puts up the cost for energy, perhaps, 50 per cent. The majority have large heat capacity which entails the expenditure of energy to raise the temperature of the apparatus. When the hotplate is shut off, and the heating operations are stopped, this stored heat is necessarily wasted. For continuous working, the waste, only taking place at the end of a long run, forms a relatively small proportion of the whole expenditure of energy, but for intermittent working, the waste occurs every time the heat is turned off, and may readily form a large fraction of the total heat developed. Apart from the waste, the large heat capacity leads to great loss of time in intermittent working. The height of absurdity of design was reached in an egg boiler that was on the market a short time ago. This precious appliance, which according to the prophets only required publicity to sell it, took about a quarter of an hour to bring the water necessary to cook three or four eggs to the boil, though it is true it would go on boiling after the current was switched off for perhaps half an hour; the number of ordinary human beings, however, who like their eggs boiled for this lengthy period must be very limited, whereas most people would appreciate an appliance that would boil up a few ounces of water in two or three minutes.

When serious cooking is concerned, the case for electrically-produced heat is very different. No doubt large or small quantities of food can be cooked in an excellent manner under exceedingly cleanly and wholesome con-



ditions with extreme economy of heat, it being unnecessary to roast the cook as well as the meat, and under certain conditions an electric galley or range may be greatly superior in all ways to one fired in any other way, and in many cases it may be cheaper to run; especially is this likely to be the case in restaurants and places where floor space is scarce and expensive and solid fuel is inconvenient. We are considering, however, the case of the moderate householder, and we at once find a stumbling block which almost puts electricity out of court for such consumers, viz., the question of hot water. It is all very well to say that such and such a heater will give so many gallons in a certain time for a given expenditure of energy; so it will, but what a poor makeshift arrangement at best is offered in place of the ordinary hot-water conveniences in the average house. The kitchen range, merely by being kept alight, without forcing, will provide an ample supply of hot water which is laid on and can be drawn from a tap in the scullery, one or more lavatories, housemaid's sink, &c., and is available for a bath, or rather baths, at any time. If care be used in planning, the hot water pipes will prevent the cold water ones near them from freezing and will provide quite a useful amount of warmth in the bathroom and adjacent offices, while the hot water cylinder or reservoir will provide for convenient airing of the family wash. No attempt seems to have been made to meet this condition of things, and until it is met no amount of publicity will be of much avail.

It is hoped that enough has been said to show that the prime necessity for any great increase in the sale of electrical heating appliances (and it is in this direction that the chief augmentation of domestic demand must be looked for) is the provision of reliable articles that will readily meet the needs of the householder. This is the crux of the whole question and really what determines the potential demand; other subsidiary, but still important factors, are the first cost of the gear and the price of energy. The lower these both are, the wider-spread will be the use of electric heating, but even at high prices the demand will be good if a real want is well supplied.

Let us suppose that practical apparatus, not unduly costly, is available, and energy can be obtained at a reasonable price: what, then, is necessary to sell it? Unquestionably publicity, more publicity and incessant publicity. But the publicity must be of the right kind. The average householder is a prosaic person who has a good deal of the Scotch regard for bawbees, and is very far removed from an idiot. He may smile at a funny phrase or quaint picture, both of which are probably inferior, the one in wit and the other in drawing, to what he can find in his favourite weekly ha'porth or penn'orth of hashed humour; or he may gaze with admiration at toothy face and scantily clad figure, which, however, are probably less toothy and more covered than a penny postcard of a real actress, or, rather, *poseuse*; but will he go and lay out several pounds in consequence? Emphatically, no; if you want to capture his custom, tell him in plain non-technical language what the thing you want to sell him is, in suitable cases, broadly how it works, in all cases what you say it will do (rather less than more than it will in practice effect), what it will cost to run under certain conditions, with plain data to enable him to calculate what he will have to pay under his own conditions of user if they differ from those you have assumed. Remember you are trying to sell to an individual who not only learnt the first four rules of arithmetic at school, but who has had to apply them ever since in order to earn his bread and butter, and is probably much quicker at them than you are. After all, even electrical calculations do not call for a special brand of multiplication, division, &c. If you treat your prospective customer as an intelligent being, and you are offering him something that it would be to his advantage to buy, you will probably find that he justifies your assumption and demonstrates his intelligence by giving you an order, which action you will doubtless find convincing.

Let us take a case in point. Would any number of smiling old gentlemen looking at their lighting bills, any number of Faust-like demons, or any number of eclipsed suns have sufficed to sell any one particular make of carbon lamp, that differed only from other carbon lamps in having an excessive amount of publicity given to it, and have made

the rest of the carbon lamp industry a vanishing one? By no means; what has effected this for the metal-filament lamp is its inherent, provable superiority to other lamps; it is the few cold definite figures vouchsafed to the public that have sold the lamp and not the array of pictures and witticisms. If this fact were appreciated and laid to heart, we should hear less of the short-comings and apathy of central station engineers, and of the want of intelligence of the public, and more of the booming trade in electrical appliances.

## THE TROUBLE WITH THE ELECTRIC COOKER.

By H. E. GOODY, A.I.E.E.

It is not suggested that there are not plenty of good electric cookers on the market; the trouble is that they have been taken up so little.

For several years it has been established to the satisfaction of everyone, excepting those interested in the exploitation of coal-gas, that electric cooking is an economical, clean, and reliable method of preparing food. It is economical in two ways. With electric cooking the food suffers less from what may be called oven wastage, and the working costs are low; indeed with electricity at 1d. a unit, and gas at 2s. 10d. per 1,000 cb. ft., and taking into consideration the fact that with the former method the food loses neither weight nor flavour, while with the latter it loses a large proportion of the one and all the other, it may be safely asserted that electricity for cooking is cheaper than gas. That it is cleaner than gas cannot be seriously disputed. The reliability of electric cookers is not quite so obvious, but if the guarantees of manufacturers go for anything, it is none the less a fact.

The position, then, is this: here we have a device which is superior in every way to the gas cooker, and yet there are only a few thousand of them in use in Great Britain. The writer can personally vouch for the fact that, in one of the largest of the metropolitan boroughs, there is not a single electric cooker connected to the mains.

The reason for this absurdly restricted use is perfectly clear. At present, if a man wants an electric cooker (and a great many do want them), he has to buy it outright, excepting in the very few districts where advanced supply companies hire them out. Now electric cookers are much too expensive to buy—you cannot get one under about £7 15s., and if you want one of respectable dimensions and moderate strength, you will find it listed at £11 11s. or thereabouts. In these circumstances, it is hardly likely that anyone but semi-millionaires will scrap the gas oven, which may be purchased for £5, or hired for 1s. 6d. a quarter, and replace it with an eleven-guinea electric cooker, which must be paid for on the nail.

The initial expense of the newer culinary method outweighs its advantages. Members of the electrical profession have for years been expatiating to friends and clients on the manifold perfections of the electric cooker; and in everything but price it has reached its approximate perfection. The designers have done their duty well; but the salesmen and the supply companies have failed miserably. It must surely have been apparent from the first that the mere intrinsic merits of the electric cooker would never make it a serious competitor of the coal-gas food-spoiler.

Several London supply authorities have recently opened showrooms; and it is a matter of personal knowledge that in some of these showrooms the inquiries after electric cooking apparatus average as many as five and six a day. The showroom attendants do all in their power to persuade inquirers to install this apparatus; they give instructive demonstrations of electric cooking, and burden the prospective customer with numerous, beautifully-illustrated lists. But when the question of cost comes up for discussion, negotiations are brusquely terminated. The gas companies have accustomed people to all sorts of culinary conveniences for a small quarterly payment, and it is not to



be expected that these will spend £10 or £12 on a new method, of which, after all, the chief advantage is merely cleanliness.

Englishmen, in spite of their reputed love for the morning tub, have never evinced that pure and hallowed affection for cleanliness *per se*, which is willing to make financial sacrifice for its gratification. And anyway, it is only the cook or the wife who suffers from the greasy, fume-evolving gas stove.

Probably, if it were only for the sake of having the very latest thing in cooking apparatus, people would be content to pay a larger quarterly rental for an electric cooker than for a gas stove. But a £12 cash payment is a little too much.

And yet, fatuously enough, supply companies apparently expect that people will go in for electric cooking on the present terms. At least, we must make that assumption, since quite a number of them have gone to the trouble and expense of issuing circular-letters and pamphlets anent electric cooking, without the slightest intention of formulating a hire, or gradual-payment system, in connection therewith. When the cookers obstinately refuse to sell, it is the habit of supply engineers to turn to the manufacturers and say, "Can't you make a cheaper cooker—one that can be sold for £5 or £6?" They do not seem to realise that the actual cost of the electric cooker is only a small part of the trouble; even if they could be sold for £5, there would not be two bought in London, by private persons, in a week. And in any case, it is probable that an electric cooker must always be more expensive, as regards first cost, than the gas cooker. For, after all, it is a complete gas stove (barring the burners, which are merely pieces of pipe with holes in them), with the addition of electric heating elements. And it is the heating elements that cost the money.

No! The blame for the extremely limited use of the electric cooker lies with the supply companies.

Three or four hundred electric cookers would constitute such a valuable load, that it is surprising that station engineers have not taken more energetic steps to secure it. It would pay them to hire out cookers at as low a rate as the gas companies, but there would be no need for that. The writer is convinced that thousands of people would not mind paying 5s. or 7s. 6d. a quarter for an electric cooker, and surely payments of this magnitude would secure to the company a sufficiently large return on its capital outlay.

Free wiring has been taken up most enthusiastically by supply authorities, and at charges which are not in the least likely to prove remunerative. The lighting load obtained by free wiring is almost negligibly small, compared with what might be obtained for an equivalent capital disbursement on electric cookers.

The extensive use of electric cooking apparatus would solve the "peak" problem, or, at any rate, reduce it to less uncomfortable proportions.

Supply authorities seem to have adopted a policy of *laissez faire*, which, if not actually arresting, is putting a very decided brake on electrical progress. The policy is, no doubt, largely the outcome of the municipal rule to which so many supply undertakings are subjected, and, perhaps, there is some excuse for unenterprising municipalities. Theirs is an unenviable position—between the devil of technical expertness and the deep blue sea of ratepaying indignation. But if they are to make anything of their electricity undertakings, they must be warned that it is time they paid more attention to expert advisers, and less to the sordid clamour of short-sighted ratepayers.

If a municipal supply authority has to borrow money in order to undertake the hire of cooking apparatus, it should be regarded as quite an ordinary business transaction, and it should give no ground at all for the extraordinary mouthings about municipal extravagance which every loan seems to excite in the locality concerned.

The Electrical Exhibition has been visited by many thousands of the lay public. There they have doubtless seen and admired electric cooking apparatus of all sorts, and a divine discontent with gas methods has been evoked. Are we to take no advantage of this discontent?—a discontent which, if ignored, will rapidly simmer down into the old rotten acquiescence with things as they are. Are we to meet the many inquiries which the Exhibition is sure to

provoke with the blank impossibility of immense cash payments.

There will not be another electrical exhibition in London until six more years have elapsed, and if we miss this grand opportunity of encouraging (by the only possible means, namely, hiring) the use of electric cookers, we shall be guilty of a terrible wrong against the industry whose very life depends on continuous and untiring advancement.

There are only two methods of disposing of electric cookers (to any extent, that is to say). One is to hire them out, and the other is to scrap them, and give gas a clear but not, we regret to say, a clean, field. So far, the choice of alternatives has not been made, and manufacturers are waiting anxiously for the verdict of the supply companies. What is it to be?

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(Concluded from page 563.)

18. *New Zealand*.—In 1884 an Act was passed by the New Zealand Legislature, entitled "An Act to consolidate and amend the laws relating to the construction, maintenance and protection of electric lines for purposes of communication and for other purposes, and to provide for the regulation thereof." Although this measure was primarily intended to provide for the erection and maintenance of telephone and telegraph wires, nevertheless it contained a series of provisions with regard to electric lighting, but it was repealed, and in substance re-enacted by the Post and Telegraph Act (No. 147, of 1908), which contains provisions for electric light. By Sec. 169 of this Act, any local authority having power by law to construct public works within the district under its jurisdiction may construct and maintain electric lines for lighting purposes within such districts as a public work, in like manner and with like powers, authorities, and liabilities as may by law be exercised in respect of, or as are attached to, the construction of such public works. Then by (Sec. 170) the regulation of lines for transmitting electricity for lighting and power purposes is provided for by the simple expedient of making the provisions of the Act as to telegraph lines applicable (*mutatis mutandis*) to power lines. By Sec. 172 the Minister, or any officer of his department, may grant and issue licences to any person desirous of putting up and maintaining lines for lighting purposes, subject to certain regulations for ensuring the safety of the public.

The Public Works Act, 1908 (No. 160), contains very important provisions with regard to the utilisation of natural sources of power in the Colony. By Sec. 267 (1) subject to any rights lawfully held, the sole rights to use the water in lakes, falls, rivers or streams for the purpose of generating or storing electricity or other power, vests in the Crown. The Governor may (by Sec. 27) delegate to any local authority, on such conditions as he thinks fit, the right to use water from any lake, fall, river or stream for the purpose of generating electricity. Outside a mining district the right to use water for generating electricity for lighting his own premises may be granted by the Governor to any person (Sec. 26 (c)). By Sec. 272 the Governor may, by Order in Council, authorise the Minister to erect, construct, provide and use such works, appliances and conveniences as may be necessary in connection with the utilisation of water power for the generation and storing of electrical energy. Notwithstanding anything to the contrary in any Act, it shall not be lawful for any local authority to grant to any person any right or concession for the purpose of either generating or using electricity as a motive power, without in each instance the previous consent of the Governor-General in Council duly gazetted.

By Sec. 335 of the Municipal Corporations Act, 1900, it is provided that subject to conforming to the provisions of the above measure, the Council of a borough as constituted under the Act, may do all things necessary to light the



streets and public places of the borough with electricity, and may supply electricity to all the inhabitants.

An Act was passed in 1896 (60 V., c. 47) which provided that "Notwithstanding anything to the contrary contained in any other Act, it is hereby declared that from and after the coming into operation of this Act, it shall not be lawful for any local authority to grant to any person any right or concession for the purpose of either generating or using electricity as a motive power, without in each instance the previous consent of the Governor by Order in Council gazetted."

Acts appear to be passed from time to time in Zealand for the purpose of giving county or municipal authorities power to contract with companies for the supply of electricity. Such Acts appear to recognise the principle of compulsory purchase. Thus by the Ohinemuri County Electric Power and Lighting Act (No. 18) of 1899, the chairman, councillors, &c., of the County of Ohinemuri were authorised to enter into a contract of this kind. By Sec. 2 of the Act it is provided that there shall be a Board of Control for the purposes of the Act, consisting of the Governor in Council. This Board of Control may make rules and regulations for the control of any persons contracting with the county authority in the interests of the public safety, and may from time to time alter such regulations. By Sec. 4, subject to the Electric Lines Act (1884) (*ubi supra*) and certain other Acts, the county authority "may contract with any persons or company for the construction and maintenance and working of an electric installation for supplying electrical energy for public and private purposes within the said county, and may for such purposes grant "all the necessary powers for breaking up or otherwise interfering with roads or highways" upon such terms and conditions and for such period not exceeding 42 years and subject to such regulations and provisions as may be agreed upon between the contracting parties. After the agreement is drawn up, it is provided, by Sec. 5, that there must be a submission of the question whether it shall be entered into or not to a poll of the ratepayers.

Sec. 7 provides that, in any such contract, there shall be an express provision entitling the county authority "at the expiration of the term mentioned therein, or earlier, if the parties to the said contract shall think fit, to purchase the installation and works erected in pursuance thereof at a price, in case the said County Council and other contracting party shall not agree, to be ascertained by arbitration in the manner provided by the contract." Then follow the significant words:—"In no case shall the county authority contract to pay or pay, nor shall there be included in the price to be ascertained aforesaid, any sum for goodwill. And any contract or undertaking on the part of the chairman, councillors, and inhabitants of the Ohinemuri County contrary to the last-mentioned provision shall be null and void to all intents and purposes whatsoever."

19. *Southern Rhodesia*.—In 1899 certain by-laws relating to electric light and power undertakings were framed by the Administrator. Part 2 of those by-laws contains certain important rules. Of these the first is that:—"No application for statutory powers to supply or use electricity for lighting or power (other than an application from the local authority of the district) will be entertained by the Government unless proof of the consent of every local authority having jurisdiction within the proposed area of supply to the application is deposited with the Administration. By Rule 4, notice of an intended application must be given to every local authority, company, or person authorised to supply electricity under statutory powers within the district to which the proposed application refers, leaving the same at the offices."

By Rule 9, applicants for statutory powers to supply or use electricity for lighting or power must proceed as follows:—

They must publish notice by advertisement of their intended application, and every such advertisement must contain the following particulars:—(1) The objects of the application; (2) the address and descriptions of the applicants; (3) a description of the proposed area of the applicant's operations; (4) the names of the streets in which it is proposed that electric lines should be laid down within a specified time; (5) the address of an office in Southern

Rhodesia, and another office within the proposed area of supply, at which detailed information in regard to the proposed operations of the applicants can be obtained.

20. *Tasmania*.—The Tasmanian Statute Book contains no measure which deals generally with the supply of electrical energy. In recent years, however, certain Acts have been passed, a study of which will serve to show the principles upon which the right to supply electricity will be conferred upon any municipality. In 1900 "an Act to make provision for lighting the town of Devonport by electricity or gas" was passed. It is provided by this Act that the board of the town of Devonport may take steps to ascertain the cost of providing a supply of electric light for the use of the inhabitants. Sec. 6 provides as follows: "The board is hereby empowered to compulsorily purchase land and to compulsorily acquire any easements which the board may consider to be necessary for the purpose of this Act, and for the purpose of facilitating and effectuating any such purchase of land or acquisition of easements. The Lands Clauses Act, except as hereby varied, shall be incorporated with this Act." The Lands Clauses Act here referred to contains provisions very similar to those with which we are familiar in this country. In order to develop their works and lay their wires, &c., the board are given the usual powers to break up streets, &c., subject to their serving the usual notices on parties interested (Sub-Secs. 7-13). In the exercise of the powers conferred by the Act, the Board "shall do as little damage as can be, and in all cases where it can be done, shall make good such damage" (Sec. 14). They must also make compensation to all parties interested in any land other than land purchased by the Board in or upon which any works may be constructed, or which may be injuriously affected by the construction and maintenance of the works under the Act, or otherwise by the execution by the Board of the powers hereby conferred, for all damage sustained by reason of the exercise as to such land or water of the powers vested in the Board by this Act.

Sec. 17 contains the salutary rule that, in determining claims for damage, regard is to be had to any benefit which may be done or accrue to the claimant by, or as a result of, the provisions of the Act. Further, all claims must be made within three months of the notice stating that the works are about to be executed (Sec. 18). After the necessary works are constructed, if any owner or occupier of a house, building, or other premises in the area shall require a supply of electricity, a supply must be furnished by the board at their usual rates (Sec. 22). The Board may also grant a supply for motive power. It is lawful for the Board to make such a rebatement as they think fit upon all moneys owing to the Board for electricity supplied under the provisions of the Act, and which shall be paid to the Board not later than 14 days after demand has been made for payment thereof (Sec. 24). Secs. 30-33 give the Board power to supply electricity to places beyond the town. For this purpose they may make contracts with neighbouring local authorities.

Secs. 34-39 comprise the usual clauses for the protection of public electric telegraph and telephone lines. It is provided that the Postmaster-General may require the Board to erect their wires, &c., in accordance with the rules and regulations issued by the London Board of Trade. The Act also contains the usual clauses providing penalties for waste or misuse and for taking electricity without authority.

Another Act, entitled the "Longford Lighting Act, No. 44, of 1903," also appears upon the Tasmanian Statute Book. This measure follows very closely that which we have just considered. A similar Act was passed in 1904, entitled the "Deloraim Lighting Act," enabling the municipality of that district to supply electricity. It contains in Sec. 38 a provision which might often, in the past, have been made a feature of our own electric lighting Acts. That section provides that "the trustees"—that is to say, the persons obtaining the statutory powers—may supply electricity to places beyond the lighting district.

21. *Trinidad and Tobago*.—The principles upon which the supply of electricity for lighting purposes is likely to be authorised in Trinidad, may be collated from the Electric Lighting and Tramways Ordinance (No. 4, of 1901). It is well, however, before drawing any conclusion from this Act, to note the preamble which provides that:—"Whereas the



acquisition and consolidation of the existing electric lighting and tramway systems, and the joint maintenance, operation and extension of the same, under rules and regulations from time to time made by his Excellency the Governor in Council, would secure a more efficient service, and tend to promote the development of the town of Port of Spain and its environs, and otherwise conduce to the advantage of the public." It will be seen from this that the object of the measure was to consolidate the tramways, &c., used in and around the town of Port of Spain. As it is probable, however, that any subsequent legislation in Trinidad or Tobago would follow on the same lines, it may be useful to refer to some of the provisions of this Ordinance, *e.g.*, Secs. 7-70, which relate to acquisition, construction, maintenance and operation of electric works and lines other than tramway works and lines, and to the supply of electrical energy through such electric works and lines.

The undertakers, for the purposes of the Ordinance, are the Trinidad Electric Co., Ltd. Sec. 8 provides that "the undertakers shall not, at any time after the commencement of this Ordinance, supply energy on, or except for the purposes of this Ordinance, erect or lay down any electric lines or works beyond the area of supply otherwise than under the authority of the Governor in Council." It will be seen that this provision involves the principle of prohibiting supply except under a Government order, but the prohibition only extends to one company. It does not follow that supply by a private person would also be prohibited. The remaining provisions of this Act down to Sec. 10 are rules and regulations relating to the supply of electricity which follow closely upon the lines of the Electric Lighting (Clauses) Act, 1899.

The Straits Settlements have no Acts or Ordinances relating to electricity, and the laws of Uganda, which were published in a single large volume in 1910 contain no provision for the regulation of the supply of electricity.

### 5,000-KW. CURTIS TURBO-ALTERNATOR.

THE British Thomson-Houston Co., Ltd., of Rugby, recently supplied a 5,000-kw. Curtis turbine to the County of London Electric Supply Co., for their City Road power station. The turbine is of the six-stage Curtis type, and has a normal rating of 5,000 kw., with an overload capacity of 50 per

succession towards the governor end, and returning through passages to the centre of the casing again, passes through the remaining four stages in the other direction to the exhaust. By this method of construction high pressures and temperatures are removed from the end of the turbine, rendering the shaft packing problem easier to solve, and tending to keep the bearings cooler; also, since the casing end is subjected to a pressure very little above that of the atmosphere, the entire casing can be split horizontally without setting up excessive strains or deflection, and the turbine rotor is thus rendered easily accessible for examination and cleaning. The shaft packing employed is of the well-known carbon ring type which has been used with great success for several years by the B.T.-H. Co.

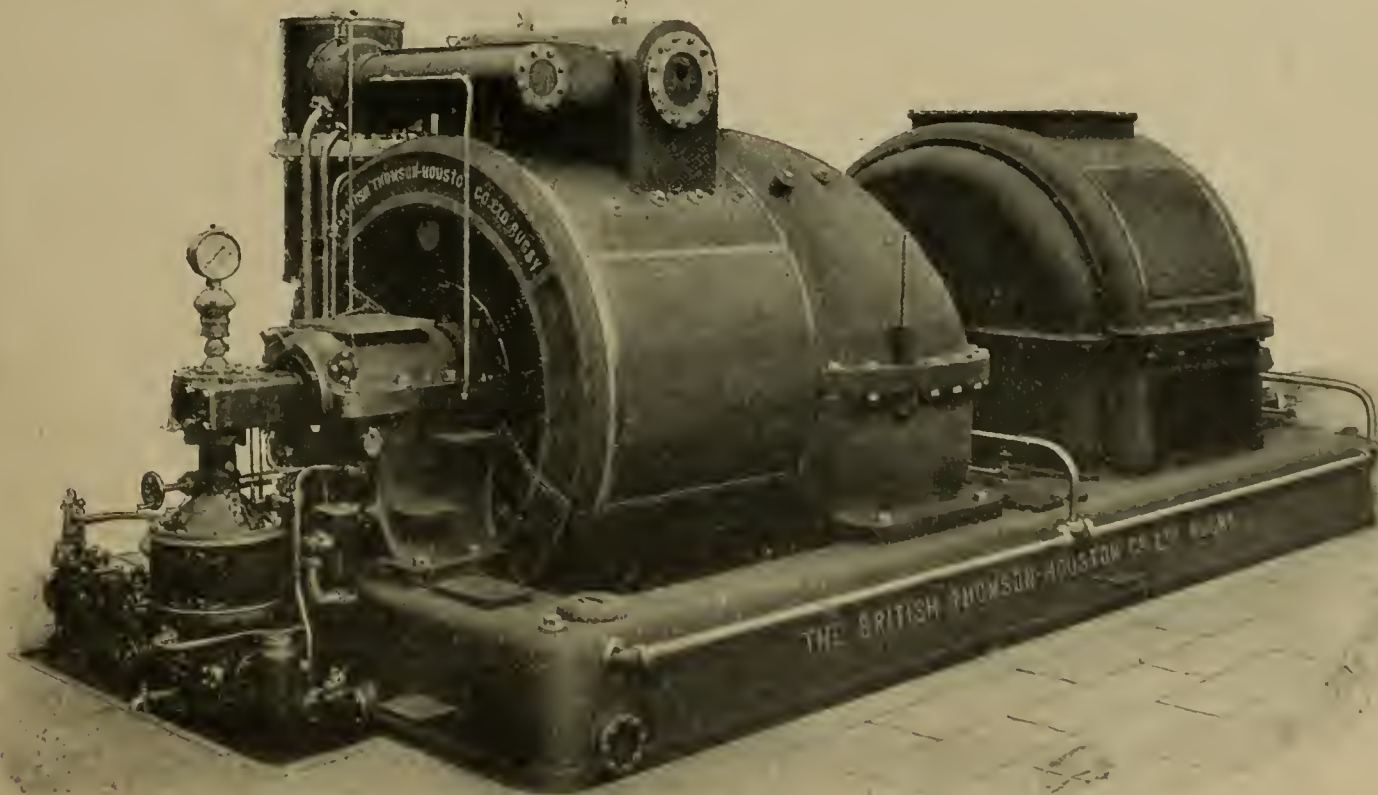
The two bearings are of the spherically seated self-aligning type, and contain cored-out passages for cooling-water circulation. The centres of the bearings are only 8 ft. 6 in. apart, which is an unusually short distance for a machine of this output, but is a desirable feature which is always noticeable in turbines constructed on the Curtis principle. The shortness of the shaft renders it possible, without employing extreme dimensions, to have the running speed considerably below the critical speed, so that no danger from whipping is to be feared when starting up or shutting down.

Steam is admitted to the turbine through several controlling valves, each of which regulates the supply to a separate group of high-pressure nozzles. These valves are opened in succession as the load comes on, by means of a rotary cam-shaft actuated by a hydraulic servo-motor controlled by the governor. As the governor has only to move a small pilot valve, a very sensitive governor can be used, and this type of gear is found to give excellent results, a speed variation of only 2 per cent. between full load and no load being easily obtained. At the same time, the gear is remarkably steady, and no hunting occurs. The hydraulic pressure for operating the servo-motor is obtained from the lubricating system, in which oil is maintained at a pressure of about 60 lb. per sq. in. by a gear-pump mounted on the governor spindle, the governor being driven by worm-gearing from the main turbine shaft. The suction of this pump is taken from an oil reservoir formed in the base-plate of the turbine, into which the overflow from all the bearings is discharged.

The generator has a normal rating of 6,250 K.V.A., in the form of two-phase, 50-cycle current at 2,200 volts per phase. The rotor has four poles. The overload capacity, which the machine is capable of carrying for two hours, is 7,800 K.V.A., or 25 per cent. above the normal rating.

In the rotor the exciting windings are carried in closed slots so as to avoid the use of wedges or other loose parts. At the ends of the rotor they are supported by massive rings on the outside, whereas, on the inside, they are freely exposed to the air in order to ensure proper cooling.

The generator has two bearings which are independent of the turbine bearings, and being driven through a flexible coupling it is capable of running satisfactorily even when slightly out of alignment. This is an important point in big machines, where heavy weights may cause slight settlement of the foundations. The exciter is driven through a flexible disk coupling contained within the alternator main bearing housing, and is also independent of exact alignment.



5,000-KW. CURTIS TURBINE. COUNTY OF LONDON ELECTRIC SUPPLY CO.

cent. when operating condensing, and is able to deal with three-quarter load when exhausting to the atmosphere in case of emergency. The turbine is constructed in accordance with the B.T.-H. patents, with the high-pressure steam admitted to the centre of the turbine; the steam passes through two stages in

Ventilation is effected without the use of any external fans, the rotor itself acting as a very efficient blower. The air for cooling purposes is led through ducts in the base-plate, and after circulating through the machine is expelled through an opening in the top of the stator frame. Before entering, the air passes through a



B.T.H. filter, to prevent dust or other impurities from accumulating in the machine.

Special attention is drawn to the remarkably small space occupied by the turbo-alternator, the main dimensions being 10 ft. 6 in. wide, 29 ft. long and 10 ft. 3 in. high: at 5,000 KW., this works out to 16.42 KW. per sq. ft. of area, a paramount consideration where floor space is limited.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 7,211. "Electrical arrangements for protecting ships' bottoms and submerged structures from barnacles or aquatic life and the like." J. E. JAMES. March 25th. (Addition to 14,181/10.)
- 7,242. "Signalling by means of electro-magnetic waves." F. J. CHAMBERS. March 25th.
- 7,253. "Land storage-battery electrodes and processes of making them." W. MORRISON. March 25th. (Complete.)
- 7,258. "Dynamo-electric alternating-current machinery." AKT.-GES. BROWN, BOVERI ET CIE. (Addition to 4,460/12.) Convention date, January 29th, 1912.) March 25th. (Complete.)
- 7,263. "Method of obtaining electricity from the air." H. N. JOHANNSEN. (Convention date, March 25th, 1911, Germany.) March 25th. (Complete.)
- 7,264. "Automatic toll-recorder for telephone systems." E. G. GODFREE. (Convention date, April 3rd, 1911, United States.) March 25th. (Complete.)
- 7,290. "Telegraph transmitting machines." F. DE ASIS DEL VALLE ATILES. March 25th. (Complete.)
- 7,317. "Electrical apparatus for protecting the hulls of ships and other submerged structures from barnacles and other forms of aquatic life." J. E. JAMES and W. T. SMITH. March 26th.
- 7,330. "Automatic ballot-box, an electric apparatus by which a voter can record or register his or her vote." B. GRAHAM.
- 7,359. "Lighting electrically-driven vehicles." H. LEITNER. March 26th.
- 7,367. "Electrical furnaces." I. RENNERFELT. March 26th. (Complete.)
- 7,369. "Electrically-operated automatic piano and like players." J. T. SIBLEY. March 26th.
- 7,370. "Electrically-operated automatic piano and like players." J. T. SIBLEY. March 26th.
- 7,375. "Electric and automatic control of engines, dynamos, and batteries." L. SUNDERLAND and G. C. PILLINGER. March 26th. (Addition to 29,944, 1909.)
- 7,428. "Electric ignition apparatus for internal-combustion engines." C. F. KETTERING. (Divided application on 5,902, March 2nd, 1911. Convention date, March 12th, 1910, United States.) March 27th.
- 7,430. "Electric ignition apparatus for internal-combustion engines." C. F. KETTERING. (Divided application on 5,902, March 9th, 1911. Convention date, March 12th, 1910, United States.) March 27th. (Complete.)
- 7,435. "Electric signalling circuits for train despatching and like systems." J. C. FIELD. (Convention date, March 30th, 1911, United States.) March 27th. (Complete.)
- 7,467. "Rectifiers for high-tension alternating currents." SIEMENS & HALSKE AKT.-GES. (Convention date, March 27th, 1911, Germany.) March 27th. (Complete.)
- 7,482. "Telephone apparatus." E. GRISSINGER. March 27th. (Complete.)
- 7,552. "Electric lampholders." H. HALE. March 28th.
- 7,572. "Electrical cut-in and cut-out devices for use in charging accumulators." H. LEITNER. March 28th.
- 7,573. "Electrically self-winding clocks." F. H. WALKER. March 28th. (Complete.)
- 7,574. "Winding the rotors of electrical machines." SIEMENS SCHUCKERT-WERKE G.M.B.H. (Convention date, March 28th, 1911, Germany.) March 28th. (Complete.)
- 7,577. "Brush-holders for dynamo-electric machinery." AKT.-GES. BROWN-BOVERI ET CIE. (Convention date, May 8th, 1911, Germany.) March 28th. (Complete.)
- 7,578. "Brush holders for dynamo-electric machinery." AKT.-GES. BROWN, BOVERI ET CIE. (Convention date, June 22nd, 1911, Germany.) March 28th. (Complete.)
- 7,591. "Protective devices for the conductor rails of electric railways." C. H. MERZ and S. G. REDMAN. (Addition to 11,347, 1908.) March 28th. (Complete.)
- 7,595. "Microphones." G. BURNEY and STERLING TELEPHONE AND ELECTRIC CO., LTD. March 28th.
- 7,643. "Electrically-driven dental engines and the like." S. M. KROPMAN. March 29th.
- 7,651. "Dynamo-electric machines." ELECTRIC CONSTRUCTION CO., LTD., and N. PENSABENE. March 29th.
- 7,657. "Instrument for measuring frequencies, self-induction, coefficients, and capacities." W. P. THOMPSON. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) March 29th. (Complete.)
- 7,658. "Frequency indicator for alternating currents." W. P. THOMPSON. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) March 29th. (Complete.)
- 7,697. "Single-phase induction regulators." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, March 31st, 1911, Germany.) March 29th. (Complete.)
- 7,704. "Electric controllers." BRITISH THOMSON-HOUSTON CO., LTD., and H. C. HASTINGS. March 29th.
- 7,729. "Lamp-holder for electric candle." E. J. WILSON. March 30th.
- 7,772. "Trolleys or overhead collectors for electrically-driven vehicles." R. FRANCO and V. FRANCO. March 30th.
- 7,775. "Vapour electric devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 30th.
- 7,780. "Electrical indicating apparatus." SOC. COURTAUD G. GARNIER GIL & Co. (Convention date, April 1st, 1911, France.) March 30th. (Complete.)
- 7,786. "Telegraphy." E. S. HEURTLEY. March 30th.
- 7,795. "Press-button switches." H. WISCHHOSEN and A. HEPKE. (Convention date, April 1st, 1911, Germany.) March 30th. (Complete.)

## PUBLISHED SPECIFICATIONS

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

- TIME MECHANISM FOR OPERATING ELECTRIC SWITCHES, GAS VALVES AND THE LIKE. F. T. Reid. 25,607. November 4th. (May 4th, 1911.)
- POLYPHASE COMMUTATOR DYNAMO-ELECTRIC MACHINES. Allgemeine Elektrizitäts Ges. 27,993. December 1st. (December 1st, 1909.)

### 1911.

- CONTROL OF ALTERNATING-CURRENT ELECTRIC MOTORS. S. Barbour. 8,489. April 6th. (Cognate application, No. 20,512 of 1911.)
- CARBON ELECTRODE FOR ELECTRIC FURNACES. L. E. Bussey. (Planawerke Akt.-Ges. für Kohlenfabrikation.) 9,652. April 20th.
- ELECTRIC LAMPS FOR MOTOR VEHICLES AND OTHER PURPOSES. H. Lucas and W. H. Eggington. 10,968. May 6th.
- ELECTRIC CURRENT LIMITING APPARATUS. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. 13,315. June 2nd. (November 11th, 1910.)
- ELECTROSTATIC VALVES FOR PROTECTING ELECTRIC CIRCUITS AND APPARATUS. N. Steels. 18,997. October 8th.
- BRANCH CLAMPS FOR ELECTRIC CONDUCTORS. K. Walseck and H. Starcke. 20,987. September 22nd.
- INTERRUPTER FOR ELECTRIC CIRCUITS. Firm of Robert Bosch. 25,880. November 19th. (June 13th, 1911.)
- INSULATED RAILWAY RAIL JOINTS. H. F. Roach. 27,940. December 12th.
- ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. A. G. Bloxam. (Firm of Robert Bosch.) 28,518. December 28th.
- REGULATING ELECTRIC TENSIONS. H. Grob. 2,719. February 2nd. (February 4th, 1910.)
- A COMBINATION ELECTRIC RADIATOR OR HEATER AND HUMIDIFIER. A. E. Wilson. 2,914. February 6th.
- METHOD AND APPARATUS FOR THE MEASUREMENT OF THE SPECIFIC RESISTANCE OF ELECTRICAL CONDUCTORS. Evershed & Vignoles, Ltd., and S. Evershed. 5,142. March 1st.
- LIGHTING OF ELECTRIC INCANDESCENT LAMPS. G. F. Richardson and R. J. Crowley. 6,066. March 10th.
- ELECTRIC ACCUMULATORS. L. Fuller, G. Fuller and G. J. A. Fuller. 6,545. March 15th.
- DIELECTRICS FOR CONTACT-BREAKERS. R. S. Wright and E. E. Burnside. 8,063. March 31st.
- DYNAMO-ELECTRIC MACHINERY. A. H. Midgley and C. A. Vandervell. 9,112. April 12th.
- BRAKE ELECTROMAGNET FOR TRAMWAY AND LIKE VEHICLES. C. Shears. 9,475. April 18th.
- APPARATUS FOR PRODUCING ELECTRIC IGNITION IN INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 9,840. April 22nd. (March 27th, 1911.)
- ELECTRODES FOR SECONDARY GALVANIC CELLS. H. P. L. R. Porsche and J. A. E. Achenbach. 10,264. April 27th. (July 12th, 1910.)
- ELECTRIC SIGNAL SYSTEMS FOR RAILWAYS AND THE LIKE. British Thomson-Houston Co. (General Electric Co.) 12,580. May 24th.
- FITTINGS FOR ELECTRICAL CONDUITS. Barton & Sons, Ltd., and A. J. Harper. 12,860. May 29th.
- ELECTROMAGNETS. British Thomson-Houston Co. and E. B. Wedmore. 13,571. June 6th.
- PROCESS FOR THE PRODUCTION OF RADIO-ACTIVE AROMATIC COMPOUNDS OF IODINE AND BROMINE. A. de Szendeffy. 14,471. June 19th.
- MERCURY AND OTHER VAPOUR ELECTRIC LAMPS. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 14,587. June 20th.
- ELECTRIC SIGNALLING APPARATUS. R. B. Ransford. (Thrasher.) 15,052. June 27th.
- ELECTRO-DYNAMOMETERS, WATTMETERS, WATT-HOUR METERS AND THE LIKE. Moore, Gambrell and C. T. Gambrell. 16,095. July 12th.
- CONTROL OF ALTERNATING-CURRENT ELECTRIC MOTORS. R. H. Barbour. 16,361. July 15th.
- CONTACT-BREAKERS FOR USE IN ELECTRIC IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES. B. Brooks and F. H. Alston. 16,875. July 24th.
- TELEPHONES. B. Hwozdz. 18,586. August 17th. (Addition to No. 17,363 of 1911.)
- ELECTRIC ARC LAMPS. Ges. für Maschinen und Metall-Industrie. 19,002. August 24th. (August 31st, 1910.)
- SAFETY DEVICE FOR ELECTRIC CABLES. Siemens-Schuckertwerke Ges. 20,936. September 22nd. (May 2nd, 1911. Addition to No. 17,046 of 1911.)
- ELECTRIC HEATING APPARATUS. J. Monnot. 22,315. October 10th. (October 14th, 1910.)
- MANUFACTURE OF ELECTRICAL ACCUMULATORS. P. Marino. 23,265. October 21st.
- AUTOMATIC RESISTANCE REGULATORS FOR TELEGRAPH LINES AND THE LIKE. E. Belin. 25,158. November 11th. (Divided application on No. 9,556 of 1911. April 19th.)
- ALTERNATING-CURRENT COMMUTATOR ELECTRIC MOTORS. H. K. Schrage. 25,152. November 14th. (November 21st, 1910.)
- METHOD FOR SECURING THE DIAPHRAGMS IN MICROPHONES, TELEPHONES, GRAMAPHONES AND LIKE SOUND-REPRODUCING APPARATUS. W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon and Telegraphenwerke.) 25,450. November 15th.
- METHOD AND APPARATUS FOR LOCALISING FAULTS IN CABLES AND CIRCUITS. J. H. J. A. Stephenson. 25,683. November 17th. (November 18th, 1910.)
- TELEPHONE INSTRUMENTS. Telefon and Telegraphenbau-Gesellschaft Ges. 26,516. November 27th. (June 8th, 1911.)
- ELECTRIC CONDENSERS. G. Seibt. 26,709. November 29th. (December 9th, 1910.)
- TELEPHONE RECEIVERS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 26,717. November 29th.
- CIRCUIT SYSTEMS FOR OPERATING BETWEEN MANUAL AND AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 26,830. November 30th.
- ADJUSTING RING FOR ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 26,928. December 1st. (August 25th, 1911.)
- PROTECTIVE DEVICES FOR ELECTRIC LAMPS. W. E. Perry and S. Davies. 28,909. December 22nd. (Addition to No. 23,781 of 1911.)

### 1912.

- ELECTRIC SWITCHES AND CIRCUITS. G. H. Batley and J. M. Bein. 88. January 1st.
- ELECTRIC-INFLUENCE MACHINES. A. Parfus. 128. January 2nd.
- FUSIBLE CUT-OUTS. C. M. Dorman, R. A. Smith and H. G. Baggs. 315. January 4th.
- SINGLE-PHASE ALTERNATING-CURRENT REPULSION MOTORS. Siemens-Schuckertwerke Ges. 1,250. January 16th. (January 16th, 1911.)
- ELECTRIC SURFACE RESISTANCES. C. A. Allison. (Compagnie de l'Industrie Electrique et Mecanique.) 2,028. January 26th.

**New Zealand.**—H.M. Trade Commissioner for New Zealand, Mr. W. G. Wickham, has furnished a list of firms requiring the representation of British manufacturers in various classes of goods, including electrical goods. Apply to Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*



# THE ELECTRICAL REVIEW.

Vol. LXX.

APRIL 19, 1912.

No. 1,975.

## ELECTRICAL REVIEW.

Vol. LXX.]

CONTENTS: April 19, 1912.

[No. 1,795.

Page

The Importance of the Internal-Combustion Engine ...	609
Peat Fuel ...	610
Electric Ignition in Internal-Combustion Engines ...	611
Correspondence:—	
Colonial References ...	612
Tests of Metal-Filament Lamps ...	613
Legal.—Gott v. Veritys, Ltd. ...	613
Fraudulent Tests ...	613
Some Thoughts on "Some Thoughts on Publicity" ...	614
Notes on Canada ...	614
National Insurance: with Special Reference to the Electrical Industry ...	615
The Temperature of Gas-Engine Cylinders ...	617
The International Smoke Abatement Exhibition & Conference ...	618
Legal ...	619
Business Notes ...	619
Internal-Combustion Engines for Electrical Installations (illus.) ...	625
Notes ...	646
City Notes ...	648
Stocks and Shares ...	651
Electric Tramway and Railway Traffic Returns ...	652
Share List of Electrical Companies ...	653
Proceedings of Institutions:—	
The Diesel Oil Engine and its Industrial Importance, particularly for Great Britain (illus.) ...	655
The Individual Electric Drive for Looms ...	656
Reviews ...	657
Notes on Maintenance of the Diesel Engine ...	657
Oil Engines for Driving Small Generators ...	658
New Electrical Devices, Fittings and Plant (illus.) ...	659
New Patents Applied For, 1911 ...	660
Contractors' Column ...	Advertisement pages xxii and xxiv

## THE IMPORTANCE OF THE INTERNAL-COMBUSTION ENGINE.

TEN years or more ago, it was a common saying that the prime mover of the future was the large gas engine. But the steam turbine, more and more aggressively asserting its claims, gave a new lease of life to the threatened steam plant, and deferred for many years the triumph of its younger rival.

However, "Youth will be served," in this as in other branches of human activity and evolution, and the internal-combustion engine is once more pressing hard upon the defences of its mighty adversary, eager and able to seize the slightest opening for attack, and to turn it to good account.

In some positions, indeed, the gas engine has already for some years firmly established itself—in all places where a cheap supply of gas is available as a by-product of other industrial operations—and there it is almost invariably found acting in partnership with the electrical generator, the sole exception, broadly speaking, being the use of gas power for driving blowers in ironworks. From this cause has resulted the development of the largest electric motors ever built for the purpose of driving steel rolling mills, and the simultaneous extension of electric motive power throughout all up-to-date iron and steel works, and many other factories situated within range of the supply of cheap power thus obtained.

It is true that the domain of public electricity supply is still almost wholly under the sway of the steam plant, not one large undertaking in this country being driven by gas from producers, but there are many private installations in works where the load is steady over long periods—that is, where the load factor is high; under these conditions the gas plant is at its best, as capital charges become of minor importance, and economy of fuel is a paramount consideration. It can no longer be alleged that bituminous coal cannot be gasified on a large scale and successfully employed in gas engines, and therefore the progress of the gas plant in this field largely depends upon the reduction in cost of the engine. In the hands of British designers, material improvements have been effected in the construction of the large engines originally developed on the Continent, as will be gathered from our later pages, and it is not unreasonable to anticipate that at no distant date the gas-driven plant will further invade the territory at present dominated by steam; it has indeed for some years already been a moot question whether it would not be of advantage to install gas plant for the steady load and steam turbines for the peaks.

Latterly a new factor has attained prominence—the crude-oil engine invented by Dr. Diesel—and being made in continually larger sizes, seems destined to win a large share of favour; being unencumbered with a producer and cleaning plant, the Diesel engine is in a still better position to com-

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION  
of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: Wm. DAWSON & SONS, LTD., Manning Chambers. Paris: BORVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



pete with steam plant in electricity works, especially for outputs below the economical limit of the steam turbine, and the wide adoption of the Diesel engine for other purposes tends to hasten its evolution and improvement. Dr. Diesel, it will be noted, regards it as "perfect"; but as even he is unable to decide whether the four-cycle or the two-cycle system is the better, and keeps an open mind on the subject of horizontal *versus* vertical engines, it would appear that his views of perfection are somewhat broad.

Between these two extremes—the waste-gas engine and the crude-oil engine—there is an amazing variety of intermediate types, the number and diversity of which bear witness to the vitality and open-mindedness of British engineering. The vertical high-speed gas engine, for powers up to about 500 H.P., may be claimed as an almost essentially British product in the first instance, and has been developed in the face of many difficulties to a high degree of perfection.

Of the paraffin oil engine, enormous numbers have been built, and the development of the motor-car industry has brought the petrol engine into the electrical field; with the simultaneous introduction of the metallic-filament lamp, the problem of country-house lighting has been satisfactorily solved by the combination, and the sphere of the electrical contractor has been greatly extended.

Reviewing the whole situation, it is evident that extraordinary progress has been made during the past decade, and one is led to wonder what will happen during the next few years. That finality is far from attainment is certain: in view of the continuous rivalry between the four-cycle and the two-cycle systems, and the vertical and horizontal types of engine; the many modifications of the Diesel system which have been introduced; the possibility of a gas turbine being developed, and the resurrection of the proposal to generate electricity at the pit's mouth with the aid of gas engines and transmit it to all parts of the country (thus finally solving the smoke abatement problem)—it cannot be doubted that there is abundant scope for invention and evolution, and that ten years hence practice in connection with internal-combustion engines will have undergone great changes.

However, for the moment we must concern ourselves rather with what is than with what will be; and therefore we have thought it opportune to collect a large number of representative examples of practice in all the branches of the industry to which we have referred, and to place them before our readers in the hope that they will be found instructive, useful, or suggestive, according to individual wants and aims, but interesting, we trust, to all engaged in or connected with the electrical industry.

---

## PEAT FUEL.

---

THE discussion of Mr. Tomlinson's paper in Dublin was of high value. In the first place, the speakers kept strictly to the subject, which cannot be said of discussions in general, and secondly, all those who spoke for other than complimentary purposes seemed to have read the paper carefully beforehand—a precaution which has so much to recommend it that its constant omission is a matter for wonder.

The audience obtained much assistance from the admirable speeches of Messrs. Carter and Turnbull, representing respectively Messrs. Crossley Bros. and the Power Gas Corporation, the two firms which have done most to advance the practical use of peat upon economical lines. The representatives of both firms are to be congratulated upon the strictly legitimate use of a very tempting opportunity for advertisement and odious comparisons.

We believe that a syndicate has spent a large sum of money upon experiments on a bog in Dumfries, which involved the use of a good deal of machinery, but nothing was said of the results at this meeting, so it would not be surprising to hear that in this case, as in so many others, the bog has won again. If that should be so, Mr. Tomlinson's theory will receive further support, and it might pay these experimenters even now to try it.

The record of the old Dutchmen's work may be said to have given birth to this theory that Nature, aided slightly by man, will give us peat in large quantities dry enough to use in gas-producers; and it was from modern Dutchmen's industry that Mr. Carter drew the most helpful facts. In spite of severe competition with cheap Welsh anthracite, and cheaper Belgian semi-bituminous coal, peat is a commercial product in Holland to-day, and that is due to the simple methods of getting it. Moreover, experience has proved that there is an almost negligible difference between the results obtained from peat with 34 per cent., and 62 per cent. of water, while the gas is as good as that from the best Welsh anthracite. In fact, peat is an almost ideal fuel for use in a producer, for it does not clinker, and leaves but little ash, and the grate is kept clean. A centrifugal extractor deals with the tarry matter satisfactorily.

Critics of the theory of drying peat *in situ* may ask, with a show of reason, what is to prevent the winter's rain undoing all the work of the summer's sun, even though the mass be drained in the manner proposed, in which event the peat harvest would be confined, as at present, to the short summer months; but the Dutch have proved that a stack of peat will emerge from winter with only 40 per cent., or thereabout, of water, and any Irish or Scotch peasant, whose only fuel is peat, will point to his stacks in evidence of the fact that summer-dried peat, which has not been protected from excessively humid winter weather, does not take up much more water.

We have advanced much nearer the utilisation of peat upon a very large scale than most people imagine, and the sooner the professional men who have an intimate knowledge, or are able to absorb a knowledge, of the facts, start in to educate the laymen who have the opportunity and the means to turn the bogs into gold and smiling pastures, the better it will be for the country at large.

We know now that peat is an ideal fuel, and that engines of any size can be run with the gas it gives off. We know that the products of peat, other than fuel gas, are as valuable as the products of anthracite, and the method of getting them is an old story. What we do not know is the simplest part of the whole affair; it is the way to get peat into the producer at a cost which will allow a profit to be made out of the sale of the peat products—chemicals and power. That is what we do not know, say for Ireland or Scotland, out of practical experience upon a sufficient scale; but now we are able to guess it more nearly by the light of the



fire which Mr. Tomlinson has struck out of the 18th-century Dutchmen and Mr. McMeadows.

Mr. Turnbull says that his company has solved even the last problem, as instanced by the important peat recovery and power plants at Osnabrück (Hanover) and Orentano (Italy), and there is no reason to suppose that these installations are not quite satisfactory; but they cannot be taken, and Mr. Turnbull did not suggest that they should be taken, as sure guides to success in the Irish bogs.

But what a little thing it is that stands between Ireland and fortune!—£10,000 spread over five years to prove whether or not a bog can be made to contain only 50 per cent. of water by drainage and evaporation.

Not Ireland only stands to win heavily with any stake that is thrown, for England and Scotland possess large peat deposits in parts remote from coal, and the nation is waking up to the belief that the world was not made for the coal miner alone. The price of coal will stay at higher rates than before the strike until the owners and the distributors have recouped themselves for their enormous losses from the pockets of the consumers, and after that the rates will be as much higher than the previous normal as the wages bill is above the old wages bill. Therefore, we shall all keep our eyes turned to the quarters from which relief may be expected, and the peat fuel problem ought to get such a chance of solution as it has never had before.

Mr. Tomlinson's investigations, and the discussion of his last paper, have cleared a broad straight road to success; but let us be quite sure that we have all got out of the jungle of previous failures to the point from which we can see that road clearly. The engine is ready, the producer is ready, and the recovery plant is ready. The peat is waiting in untold quantity to be put into the producer at a price which will allow a net profit to be made upon the manufacturing processes which are to follow, and money will pour in directly the peat is ready at the price. Mr. Tomlinson says that this price is to be not more than 4s. He may be right, or he may be wrong, and nobody can say until what we have called the grand experiment has been made. If 4s. is not exceeded the bog can be worked at a profit for sulphate of ammonia alone, and it is that fact which gives us so much more hope for peat than ever before, and leads us to lay down the following sequence of events for the guidance of those who would see clearly down the broad road.

First, then, comes the drainage of a selected bog—say the Bog of Allen. When this is proved feasible, but not a moment earlier, is to be put down a recovery plant upon a large scale.

When this is working at a profit, but not a moment earlier, may be put down the generating station, upon as large a scale as the probable demand requires; and, as the date of completion of this station might be 5 or even 10 years after the first drain was cut, there would be ample time in which to canvass for consumers of electricity.

A scheme properly thought out on those lines will be much more likely to command success than the scheme to which we are so unhappily accustomed, involving usually the immediate expenditure of huge capital sums upon machinery and plant for cutting and drying the peat, for gasifying it and producing electricity, and for transmitting the electricity over large areas of desolate country in search of consumers.

## ELECTRIC IGNITION IN INTERNAL-COMBUSTION ENGINES.

### THE RESPECTIVE CLAIMS OF THE HIGH AND LOW-TENSION SYSTEMS.

By JOHN S. LEESE.

EACH of the above-mentioned systems of electrical ignition includes amongst its partisans those who look with unqualified disfavour upon the other system—the one, that is to say, which does not meet with their personal approval. That each system has its drawbacks is an undeniable and freely admitted fact amongst tolerant designers and users. The blind adherence to one or other system which one sometimes comes across is usually the result of either a long experience and deep knowledge of that system, coupled with a comparative ignorance of the other, or else early failures with the discredited system.

Internal-combustion engines may be conveniently divided into four classes for the purpose of discussing ignition systems. These are:—

1. Low-speed horizontal gas engines.
2. High-speed vertical gas engines.
3. Low-speed horizontal oil engines.
4. High-speed vertical oil engines, including automobile and similar volatile spirit engines.

Considering the advantages of high and low-tension ignition for the first case, practice is all in favour of the low-tension magneto system for these engines, which are usually applied to more or less steady loads and run at a constant and comparatively low speed. The constancy of the load and speed renders the alteration of the timing of the ignition during running hours a matter of but slight importance; whilst the temporary retardation of the spark for starting-up purposes may easily be accomplished with the low-tension system. The moving parts are comparatively immune from wear and consequent noise owing to the low speed. The system, consisting of low-tension magneto, tappets and sparking plug, is quite separate from the other functions of the engine, and needs practically no attention, the only obvious necessity being to keep the plug electrodes in good condition as regards clean contact, so as to ensure a good spark. This duty can hardly be called troublesome. Oscillating armatures subject the magneto machine to less wear than rotary ones, and altogether the system may be regarded as one of the most reliable parts of the whole power unit. The comparatively low compression of low-speed engines renders the low-tension current eminently suitable for the work, whilst its application reduces the necessity for extreme care of the insulated cables. The spark is just as intense at starting-up speed as it is at normal speed, and thus, other things being equal, easy starting is assured.

The application of high-tension ignition, either in the form of the high-tension magneto or battery and coil, to this class of work has not been altogether neglected, but it has made very little progress. The advantages claimed for it are quietness and ease of control. The former advantage is, however, somewhat discounted by the fact that, as low-speed engines are, as a rule, comparatively noisy in general working, the extra clicking due to the low-tension tappets is not worth considering. The second advantage named is not generally particularly desired in this type of engine, as before noted. Whereas battery and coil systems give as good sparks at starting up as when running at full speed, high-tension magnetos cannot claim this advantage, as the intensity of the spark increases with the armature speed. The sparking points of high-tension plugs require to be kept at the proper distance apart, or else trouble will ensue, but low-tension plugs, so long as they make and break, may be relied upon for constant performance.

In high-speed vertical gas-engine work the noise per cylinder is generally reduced to a minimum, and the addition of four sets of tappets and low-tension plugs would increase it unduly. Also the class of work to which these engines are generally put often makes the facility of timing adjustment whilst running a great advantage. The high compression of these engines and the resultant high explosion pressures tend to cause leaks past the movable electrodes of



the low-tension plugs, whilst the wear on the moving parts of the system generally is necessarily more rapid than at the lower speeds considered above. Unequal wear in the tappets and plugs of each cylinder causes unequal spark timing, and this fault is more difficult to correct in low than in high-tension systems. Battery and coil ignition does not possess the disadvantage of high-tension magneto ignition regarding poor sparking at low speeds, and is, therefore, often fitted as a supplement to the latter for starting-up and stand-by purposes. One sometimes sees battery and coil systems fitted without a magneto, or with a small recharging dynamo in continuous operation, driven by the engine. If conveniences are at hand to render battery recharging easy, this system saves in first cost over the high-tension magneto, and, if well cared for, will be found to be at least as satisfactory.

The class of fuel and consequent amount of dirt in the cylinder has considerable bearing upon the best type of ignition to use upon those low-speed horizontal oil engines which use electric ignition. Taking all things into consideration, low-tension oscillating-armature magnetos appear to be the best, on account of the reduced likelihood of the deposit, which occurs on the constantly making and breaking surfaces of the electrodes, interfering with the passage of the spark. With high-tension systems, the jump-spark plugs would soon be likely to become bridged over with carbon, causing short-circuiting. Most of the other arguments in favour of the low-tension system, which were advanced in referring to class No. 1, may be used again in application to horizontal low-speed oil engines.

The last class, high-speed oil and automobile engines, are practically all favourable to high-tension ignition, except in the uncommon case of a high-speed vertical engine running on heavy oil fuel. Reduction of noise is one of the chief assets of high-tension systems, whilst the system certainly needs less attention than ever when applied to high-speed spirit engines; indeed, it is this application that it is best adapted for. It may be applied as battery and coil, or as magneto ignition, although these two are often both fitted and made supplementary, one to the other. In automobile work neatness counts for a lot, and the absence of moving parts, such as tappets, is much appreciated by the user. This is a field in which the high-tension magneto reigns supreme. For boat engines, heavy commercial motors and other special cases, the low-tension magneto may be advantageously used, if, as is often claimed, it is made more foolproof than high-tension systems, but the control of the low-tension timing is too complicated to commend it for very general use.

In conclusion, when selecting an ignition for an engine, the relative advantages of each type and system must be thoroughly investigated with special reference to the case in hand, regarding the nature of the engine, fuel, work to be done, attendance and general facilities, and neither system should be condemned outright for any class of work, as is too often done by the extremists mentioned in the first paragraph.

### CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

#### Colonial References.

As the article published in a recent number of the ELECTRICAL REVIEW under the heading of "Colonial References," by "Colonial," directly concerned myself, needless to say I started to read it with great interest; before I had finished the article, however, the temperature of my blood had almost reached boiling point. I turned the page back again to read the Editors' note, and when I came to the words "young engineer," I began to reproach myself for so losing my temper over what was only an ebullition of youth.

Now, if "Colonial" had altered the heading of his article to South African References, and signed himself "South Africa," I should not have minded, but to include all the

Colonies as he does, is a great mistake, and I for one must defend the colony with which I am connected.

About the middle of the article "Colonial" says: "It must be admitted that many men who, on account of their poor qualifications, could never get a good position in England, go abroad and manage to get what they cannot get at home." Was this the reason why "Colonial" left the "Mother Isle"? and did he not get what he expected when he went abroad? and is this the reason why he writes an article which will, far from raising the status of the electrical profession in the Colonies, tend to lower it in the eyes of home engineers?

With regard to the up-to-dateness of Colonial engineers and their works, does "Colonial" ever read the "Contract" columns of the REVIEW? If he did, he would see that electrical plant of the most modern type is being tendered and contracted for weekly by the Colonies; and, as a general rule, when this plant arrives in the Colony it is erected and tested by the staff there. In England, on the other hand, an erector is sent out with the plant, and usually some official from the firm comes to "start up." These men know, and are accustomed to, all the peculiarities of their firms' products, and so can instruct the engineer-in-charge as to the best way of running them. The Colonial engineer and his staff must find out all these things for themselves, and in this way gain much useful and practical experience.

And now to come to statistics. The plant I am in charge of is one of the smallest, if not the smallest, in the Colonies, the capacity of the plant being just over 500 kW. Some of the plant is modern, but most of it has been running for the last 16 years. The following are some of our figures:—

Average coal per kW.-hour, 4 lb.

Lb. of water evaporated per lb. of coal, 10 lb.

Price in pence of coal per kW.-hour generated (coal at 26s. per ton), '68d.

Price in pence of oil, waste and engine room stores per kW.-hour generated, '048d.

As to Colonial log books being "funny," I can scarcely agree with "Colonial," and perhaps he will be interested to know some of the things which we do out here. Once a shift the following readings are taken and logged: Specific gravity of boiler and condenser discharges, temperatures of superheaters and feed water, coal per unit, water per pound of coal, engine and boiler hours run, maximum load and power factor. In addition to these, there are installed recording steam and vacuum gauges, recording wattmeters and voltmeters. Engines are indicated every six months, and cards are properly filled in and kept.

In conclusion, I would ask "Colonial" to give details of his training and experience, and let other people judge whether he is competent or not to criticise Colonial engineers and their doings. Hoping I have not taken up too much of your valuable space,

Near East.

With reference to the article by "Colonial" in your issue of March 29th, I have no doubt that South African engineers will accept your invitation to communicate their side of the question, but as the article refers to Colonial engineers generally, I, for one, wish to enter a protest against the publication of such vague statements in your widely-read and influential journal, which being read by persons in authority, are likely to prejudice a Colonial engineer's prospects of obtaining a home appointment.

I further question the right of "Colonial" to include the colonies in his remarks; apparently he has no experience of any colony other than South Africa, and, in my opinion, a limited amount of that.

A belief already exists amongst some managers of "Home electricity concerns" that the Colonial engineer is out of date, and I have suffered from this erroneous idea.

Some few years ago I was an applicant for the post of shift engineer in a large power station, and my application was backed by an engineer prominently connected with the undertaking; the manager, however, would not recommend my application, stating as his reason for refusing to do so "that having been so long in the Colonies (2½ years) I should be out of date with regard to English practice." Had I been in England in an out-of-the-way provincial town I



have every reason to believe that I would have secured the appointment.

The question then is :—"What advantages have assistant engineers in a provincial town over their colleagues in the Colonies"? and how can they keep themselves more up to date? The former can only keep up-to-date by reading the technical journals and perhaps an occasional visit to some neighbouring engineering works; their salaries are usually insufficient to provide the latest text-books or to allow of a visit to the engineering exhibitions; moreover, the vacation leave is restricted to two weeks at the most, and as a general rule they do not make a 'busman's holiday of it.

Now, take the case of the Colonial engineer; the arrival of the technical papers is looked forward to with great interest, and they are perused from cover to cover; the technical works that concern the supply of electricity are usually supplied by the proprietors of the undertaking, and are read with avidity by the staff, who have perhaps less diversion for their leisure hours than home colleagues.

In the undertaking with which I am connected, the engineers are allowed three months' holiday every two years, and personally I spend most of that time in England and take the opportunity to visit all the electricity works that I possibly can, and any engineering exhibition in progress at the time. It is, therefore, obvious that as regards junior engineers, the Colonial should be equally up-to-date with the British.

Chief engineers at home have more opportunities of keeping abreast of the times, and to them the above remarks do not apply, but, at the same time, a chief engineer in the Colonies has to be a capable and self-reliant man, and a man that can erect and maintain the whole of the plant without the aid of the manufacturers, even when handicapped with very indifferent labour. No home engineer can properly appreciate the latter part of the above sentence. In many Colonial stations, when a breakdown occurs, the complete repair is undertaken by the staff. In England, on the contrary, it is usually much quicker and cheaper to order spare parts from the makers, and although this is, perhaps, beneficial to the undertakings, it is not so to the engineers, and does not improve their practical experience.

It cannot be denied that there are Colonial undertakings which are not making normal progress; the cause of this is usually "indifference and neglect on the part of the powers that be," and cannot be ascribed to incompetence on the part of the chief or his staff. Local politics also have quite an influence on the undertakings, usually, as at home, acting as a drag; these obstacles to progress will be overcome by the benign influence of time and the education of the population in matters electrical.

Justice.

#### Tests of Metal-Filament Lamps.

I have read with interest Mr. Willcox's letter on lamp testing in your last issue. The efficiency of the tungsten lamp has not yet been standardised. One maker aims to produce lamps at 1.25, and another at 1.50 watts per c.p. It appears to me incorrect to test either product, except at about the maker's standard efficiency. To test at an efficiency at which the maker does not aim to work appears to me unpractical.

The lamps for recent tests were obtained direct from the makers, who were informed for what purpose the lamps were required. Presumably the makers all sent out new lamps and selected them to run on normal voltage at that efficiency which they considered most suitable. This arrangement appears to me to be fairer to the makers than starting all lamps at one efficiency, irrespective of what the makers may individually desire.

A test carried out on these lines helps to buck up the makers to renewed efforts, sets a fresh standard to be surpassed for each year, and is useful as an indication of the general progress made year by year.

I have often carried out life tests as Mr. Willcox suggests, disregarding the marked voltage and starting the lamps at one common efficiency. Provided that mean spherical and not mean horizontal candle-power is measured, such a test forms a fairly good means of comparison of the wearing quality of filaments, but it is not, strictly speaking, a test of lamps.

The objection to buying lamps in the open market is that the samples would be of various ages—new-laid, fresh and otherwise. Now both the resistance and emissivity of a tungsten filament undergo marked change during the first six or nine months of its existence, even if the lamp is kept idle all the time. The result would be that the various makes would not start fair.

In conclusion, I would like to thank Mr. Willcox for his criticism. I should like to receive, either publicly or privately, such a candid criticism from every subscriber to the lamp test report.

Lancelot W. Wild.

Westminster, April 12th, 1912.

#### Legal.—Gott v. Veritys, Ltd.

In the report appearing in your issue of the 5th inst. of the hearing of an action by Arthur Edgar Gott against Veritys, Ltd., of Aston, you state that the Judge said he had come to the conclusion that there was a breach of agreement with regard to one of the patents.

We should be obliged if you would permit us to correct that statement, the fact being that the judgment of the Court was merely upon the construction of the agreement between the parties, and it was to the effect that if our clients (Veritys, Ltd.) had "wilfully" done certain things, then a breach of the agreement had been committed, but the question whether they had wilfully done these things was referred to an Official Referee, who will, of course, hear the evidence of both sides before arriving at a decision, and the costs of the action are to abide the result of such Referee's report.

Ansell & Ashford,

Solicitors for the Defendants.

Birmingham, April 11th, 1912.

[Our report was derived from the *Southall and Norwood Gazette*, as stated in our issue of April 5th.—Eds. E.R.]

#### Fraudulent Tests.

The publication of the article on this subject in your issues of the 5th and 12th inst. cannot be allowed to pass without strong protest; it is misleading, and with those having little knowledge of the subject treated, it must create an absolutely false impression; it, in fact, accuses directly, or by suggestion, all and sundry firms, of deliberate and systematic fraud in connection with the work done on their test-beds, and, incidentally, grossly libels inspecting engineers in general, and Admiralty overseers in particular.

For some 14 or more years I have been directly engaged in the testing departments of several of the largest firms manufacturing electrical plant in this country, and have attended many "official trials" at engine makers' works and afterwards on site. I have met a large number of Admiralty officials, from those coming direct from Whitehall down to the young assistant overseer (usually first trained as a dock-yard apprentice) fresh to his job, and I cannot call to mind a single one whom I would dare have the effrontery to attempt to befool by most of the obviously crude and certain-to-be-found-out, so-called, "tricks of the test-bed" mentioned by the writer of the article. My experience, Sir, is that, on the whole, the Admiralty overseer knows his job pretty well, and does his work conscientiously and well, for it must not be forgotten that he has always the fear before his eyes that the plant he passes will have to perform equally well later on, and woe betide him should there be any great discrepancy between the results of the two tests.

The charges made against firms of such standing as to be on the Admiralty list can scarcely require any refutation. Considered from the point of simple policy, does anyone believe it to be worth the while of a large firm to run the risk of attempting such frauds as are enumerated, when detection means not only removal from the Admiralty but from all Government, India Office, Colonial and other important lists? The news of such detection would travel far and wide, and would not be long in reaching the ears of competing firms who naturally, as a matter of business, would use the information to the disadvantage of the offending firm.



Again, such practices would be bad policy, as in the case of most contracts, as already pointed out, tests have to be repeated, after erection, on site; now it is obviously unwise to rush things through the test and later on to have trouble on site as the alterations, adjustments, or whatever may have to be done in order to bring the plant up to specification, will cost a much larger amount than if carried out at the maker's works.

Yet another proof of the insanity of such methods is that in these days of competition a satisfied customer is a *sine qua non* for successful business; only those engaged in getting orders know fully how difficult it is not only to obtain new customers but to retain the old ones, or how easily a good customer may be lost.

Your contributor has a very low and perverted view of the testing engineer; it is not only a case of "All men are Liars," but liars all the time. I can assure him that to my knowledge there are many men engaged in this class of work who, if not from a moral point of view, consider their best duty to their employers is to take the rôle not of counsel but of judge and to hold the balance between those responsible for design and manufacture (who rightly are always keen on getting the maximum duty from a given piece of plant) and the customer, and who make it their business to see that he gets a satisfactory article; were this not the case a testing department were unnecessary.

I cannot but think that the writer of the article looks out upon life—business life—through grey spectacles, and if engaged in inspecting work I can well imagine him to be a Shylock with no idea of give and take; for to turn the tables for a moment, I have known a consulting engineer insist on a rebate from the price of a large motor-generator, the armature of which had a rise of two or three degrees above that specified, notwithstanding a 3 per cent. higher combined efficiency (quite genuine, Mr. Author!) than guaranteed.

In conclusion, I deny that specially "falsified" instruments and thermometers with fictitious scales, &c., exist in the test departments of responsible firms, and as regards the faking of the tests of combined sets in the manner stated for temperature and regulation, I cannot conceive that any sane engineer would attempt such almost impossible methods; in fact, the article generally gives one the impression, notwithstanding a statement to the contrary, that most of these "fakes," plausible as they may seem, have come from any place other than the test-bed.

Modulus.

#### Some Thoughts on "Some Thoughts on Publicity."

Because the position of the author of "Some Thoughts on Publicity" on a pinnacle among central station engineers has never been questioned, we must regret that he has published his private opinion and thus loaded the muzzles of the ever-ready opposition with such valuable publicity material.

It may be that he is somewhat rancorous at the loss of dignity to the profession by the introduction into its deliberations of such huckstering topics as "How we diddle them at ———," or "Expedience teaches," but even so a sacrifice of inaction would be more commendable than this "queering of the pitch" and then damnation in a peroration of faint praise.

His philanthropic concern for the purse of the householder who struggles along with two "generals" is praiseworthy but unnecessary. If such a one, before purchasing for his partner a half-guinea flat-iron (which by the way is rather a clean pretty thing and a distinct advance on those 1s. affairs from the Army and Navy Stores), must consider and compare standing charges and running cost per handkerchief or other item, he is admittedly outside the pale of any selling agent, and the sooner the supply engineer fixes a slot meter on his installation the better it will be for the undertaking. There is still a great market for electrical utilities and toys, and if these do not quite come up to the label it is unfair to expect that an infant industry should take the lead in a crusade for the purification of commerce while struggling for existence among unscrupulous competitors. After all, the vacuum cleaner does really remove dust, and has that advantage over the *Family Herald devotee*, who merely stirs and scatters it.

There is doubtless a reluctance on the part of manufacturers to raise the wattage of apparatus, and in consequence we have convectors and radiators which compare badly with the coal fire at its best, and kettles, toasters, and egg-boilers, whose time factors do try one's patience, although, again, it is valuable to know that the time is a constant and can be relied upon. With the tendency of supply authorities to reduce the charge for this class of demand to "units at two a penny," manufacturers would do well to double or treble the capacity of heating elements. With this speeding up, increased appreciation would increase sales, prices would drop, the necessity for much deplorable mendacity would disappear, and George Washington might obtain a post on the publicity staff even in competition with Ananias.

There is a real danger of electric homes becoming over-popular. I have in mind a house of £40 annual rental, where the installation, consisting of lighting, oven, and cooking utensils, radiators, hot water circulators, &c., aggregate 17 kw., with a maximum demand of over 5 kw.; the payment to the supply company, with tariffs 3½d. lighting and 1¼d. heating and cooking, is under £10 per annum, and the price has now been reduced to ½d. per unit during the six summer months. An extended imitation of the above in a residential district must not only give the mains engineer to think, but must dispel the justification for enticing and encouraging this class of demand by recklessly foregoing charges on capital, which will inevitably have to be found.

George C. Law.

Electricity Works, Barnes,  
April 15th, 1912.

#### Notes from Canada.

The able and forcible article on page 574 of your current issue has to me been most interesting, for just recently I have been engaged on a duty which, perhaps, is not particularly common in this country, viz., arranging for the lay-out and purchase of the electrical power and lighting equipment for a large Canadian factory requiring some few thousand H.P., and the experience gained in so doing has been of a very instructive nature.

In common with your correspondent, I find that practically all electrical supply and insurance companies' rules, regulations, and requirements, are those originating in U.S.A., and it is here that the would-be purchaser of British material finds himself up against something approximating to a brick wall.

The standard regulations with respect to wiring and accessories are, I find, those of the National Board of Fire Underwriters, and a wonderful code it is. Many unkind things have been said regarding the rules issued by various municipal authorities of this country, but the worst of them—from the contractor's point of view—is streets behind the "National Electrical Code" in specifying all sorts of pettifoggish details and requirements. Many of these requirements do not by any means add to the efficacy of the installation, and difficulty is experienced in conforming with the regulations when purchasing standard and high-class articles over here; for, naturally, the Code has been written up to suit the American market.

The installation rules of the Institution of Electrical Engineers are not, I gather, accepted by any supply company or fire insurance company in Canada, at least in the West, and it would seem that, in the interest of the British manufacturer, it is very essential that something effective should be done to form a Canadian Section of the Institution of Electrical Engineers, and efforts made to get the Institution of Electrical Engineers' regulations accepted as the standard, instead of the code previously referred to.

Until this is done, it seems to me there is very little chance of many large orders for cable and accessories coming to this country; for example, it is doubtful if many firms over here can give delivery from stock of, say, a mile of "slow burning" wire, or, alternatively, a mile of "slow burning weather-proof" wire, or again, of, say, a gross of lamp-holders screwed ½-in. American pipe thread.

I suppose that over here private individuals cannot do very much towards establishing a Canadian section; most of the work must be done in Canada, but I feel sure that if the idea were suitably placed before Canadian engineers it would



not be long before sufficient response would be made to warrant the establishing of such a section, with doubtless beneficial results to many other than those directly engaged in electrical engineering.

W. H. B.

## NATIONAL INSURANCE: WITH SPECIAL REFERENCE TO THE ELECTRICAL INDUSTRY.

By JOS. J. H. STANSFIELD, F.C.I.S.

FOR months past much has been heard about the National Insurance Act, 1911, from all points of view. Friendly Societies, Trade Unions, doctors, servants and others have expressed their doubts of, or concurrence with, the Act, but perhaps the least has been publicly said or written by the great majority of employers or employed, that is to say, by those who are most vitally affected by its provisions.

Strange as this may appear at first sight, it is not perhaps difficult to account for, because, in addition to the general apathy with which most Bills in the making which affect the social condition of the people are met, the bulk of employers have few officially recognised channels by which their considered views can be made known to our legislators—particularly where a Bill is treated as a so-called non-contentious measure—whilst employes have, so far as they are members of Friendly Societies or Trade Unions, no doubt, made their wishes known through these Societies or Unions, and so far as they are not members have troubled very little about the matter at all.

We are, however, not now concerned with the consideration of the merits of the Act, as whether liked or disliked it is *un fait accompli*, and it must be accepted and made the best of.

The Act is estimated to affect in one way or another about 14 million persons, but it is only proposed in this article to deal with the provisions relating to employers, and particularly those employers who are engaged in the various branches of the electrical industry; but limited as this side of the question is, it is necessary to carefully consider over one-third of its 115 Sections and at least six out of its nine Schedules.

The Act is divided into three parts. Part I (83 Sections and 5 Schedules) dealing with National Health Insurance; Part II (24 Sections and 3 Schedules) with Unemployment insurance; and Part III (8 Sections and 1 Schedule) containing miscellaneous provisions. In considering the matter it will be convenient to take the subjects of national health insurance and unemployment insurance separately.

*National Health Insurance.*—Insured persons are broadly divided into two classes—employed contributors and voluntary contributors—but as the latter are persons who are not employed within the meaning of that part of the Act which refers to national health insurance, we need not concern ourselves about them except to note that the Act contains provisions (Sec. 6) providing for a change from the voluntary rate to the employed rate of contributions, in which case the employer is concerned with the rate of contributions payable.

It becomes necessary, therefore, to consider who are employed contributors, and a definition of these will be found in Part I of the first schedule, which sets out in full what may be shortly stated, that employed contributors are all persons who are employed in the United Kingdom (excluding the Channel Islands and the Isle of Man) under any contract of service or apprenticeship and under any conditions of employment.

The rates of contributions payable in Great Britain are set out in the second Schedule, and so far as they affect employer and employed are as follows: To be paid by the employer—3d. a week; to be paid by the contributor—men, 4d. a week; women, 3d. a week. Should the employe be 21 or over, and the remuneration does not include board and lodging, the rates payable per week vary as follows if the daily wages do not exceed 2s. 6d. :—

Not exceeding per day.	Paid by employer.		Paid by contributor.
	For men.	For women.	
1s. 6d.	6d.	5d.	—
1s. 6d. to 2s.	5d.	4d.	1d.
2s. to 2s. 6d.	4d.	3d.	3d.

The rates payable in Ireland are :—To be paid by employer, 2½d. a week; to be paid by the contributor—men, 3d. a week; women, 2d. a week. In the case of employes of 21 or over, under the conditions above referred to, the rates are :—

Not exceeding per day.	Paid by employer.		Paid by contributor.
	For men.	For women.	
1s. 6d.	4½d.	3½d.	—
1s. 6d. to 2s.	4d.	3d.	½d.
2s. to 2s. 6d.	3½d.	2½d.	2d.

In the case of voluntary contributors, the rates payable by them will vary according to a table to be prepared by the Insurance Commissioners, unless they are below the age of 45 at the date of entry into insurance, and such entry is made within six months after the commencement of the Act, when the rates of contributions will be as above (Sec. 5). Should a voluntary contributor become employed, the rate payable by him as a voluntary contributor will continue to be payable, unless an application is made by him to be treated as an employed contributor (where such an application can be made under the Act), but the contribution payable by the employer will be the same in either case (Sec. 6). Where a voluntary contributor becomes employed, it would appear necessary for the employer to ascertain from the employe what contributions must be deducted on his behalf.

The before-mentioned rates are, however, subject to the following variations :—

1. No contributions are payable by either employer or employed :—

- If the employe is not 16 years of age (Sec. 1 (1)).
- If the employe is 70 years of age or upwards (Sec. 4 (3)).
- If the employe is under a contract of apprenticeship without receiving any money payment (First Schedule, Part I (a)).
- If the employe is engaged in other than manual labour at a salary of over £160 per annum (First Schedule, Part II (g)).
- Whilst the employed contributor is away on holiday, or otherwise without remuneration, or is in receipt of sickness or disablement benefit (Third Schedule (1)).

2. Contributions are payable by an employer on his own behalf, but not on behalf of the employe :—

- If the employe is 65 years of age or upwards, and under the age of 70 (Secs. 1 (4) and 49).
- If the employe has obtained a certificate exempting him from the liability to be insured under the Act, because (1) he is in receipt of a pension or income of an annual value of £26 or upwards, or (2) he is ordinarily and mainly dependent for his livelihood upon some other person (Sec. 2 (1)).

3. It may be arranged for no contributions to be payable :—

- If the employment is under the Crown or any local or other public authority where the Insurance Commissioners certify that the employes are already as well, or better provided for (First Schedule, Part II (b)).
- If the employment is as a clerk or salaried official in the service of a railway or statutory company who are already provided for by a superannuation fund approved by the Commissioners (First Schedule, Part II (c)).

4. It may be arranged to reduce the rate of contributions payable by employers and employed if it is the custom to pay wages during periods of disease or disablement, subject to consent of the Insurance Commissioners and the compliance with certain prescribed provisions (Sec. 47).

5. The rates of contributions payable may be varied :—

- By the Insurance Commissioners including persons now excluded by Part II of the First Schedule to the Act. These include amongst others, the persons mentioned under (3) above and clerks and salaried officials, agents, &c. (Sec. 1 (2)) and



(b) In the case of employment of a seasonal nature and subject to periodical fluctuation, when the contribution payable by both employers and employed may be increased by a special order of the Commissioners (Sec. 50).

6. The employer may be concerned with a varying rate of contributions so far as the employé is concerned under the following circumstances :—

- (a) If a voluntary contributor becomes an employed contributor and does not apply to be transferred to the employed rate of contribution (Sec. 6).
- (b) If an approved society makes a special levy upon its members in consequence of a deficiency in its accounts (Sec. 35). It is not clear from the Act whether this levy should be made upon the society's members direct or through the employer.
- (c) If upon a valuation by an official valuer under Sec. 36, a compulsory levy is made upon members when the employer may be required to collect such levy by weekly instalments.

All contributions in respect of employed contributors (except of course that portion payable by the Treasury) are to be paid in the first instance by the employer (Sec. 4 (2)), the rules as to payment and recovery of contributions paid on behalf of employed contributors being prescribed at some length in the Third Schedule.

Shortly stated, the provisions of this Schedule are :—

1. One weekly contribution is payable for each week or part of a week.
2. If wages are paid the contributions may be recovered by deduction.
3. The contributions deducted must be for the same period as the wages paid.
4. If the contributions are not deducted they can only be recovered summarily as a civil debt within three months thereafter.
5. The first person employing a contributor in any week is the employer for that week.
6. As to indirect employment.
7. No deduction may be made if the contributor is not paid by wages or other money payment.
8. The employer may not deduct his own contribution from the employé.
9. The employé is a trustee for sums deducted.
10. As to outworkers.
11. A week is from midnight on Sunday to the following Sunday midnight.

Provisions (3) and (4) of the above are important, as it would appear that a contribution cannot be deducted from an employé except for that period for which wages are paid, and if wages are paid in full by mistake the amounts overpaid can only be recovered by an application to the Courts made within three months thereafter.

Various penalties and liabilities affecting the employer are contained in the Act as follows :—

- (a) An employer shall make good any extra expenditure of a society caused by sickness or epidemic above the average where, upon inquiry, it is held to be due to the condition or the nature of the employment or to any neglect on the part of the employer to observe or enforce any Act affecting health, housing, &c., or any regulations made under such an Act (Sec. 63).
- (b) A fine not exceeding £10, in addition to any unpaid contribution, is payable in respect of each employed contributor if contributions are not paid or deducted by the employer (Sec. 69).
- (c) The employé may proceed against an employer if he is deprived of any benefits through the employer not making contributions in respect of him (Sec. 70).
- (d) Where an insured person appears to be entitled to compensation under the Workmen's Compensation Act, 1906, the Employers' Liability Act, at common law or otherwise, and refuses or neglects to take proceedings, a society or Insurance Committee may take proceedings against the employer to enforce the claim (Sec. 11).

There are several other sections in this part of the Act

which may affect employers, the most important being as follows :—

Secs. 25 and 73 makes special provisions for superannuation or other provident funds established at the date of the Act for the benefit of persons employed by one or more employers, and

Sec. 39 provides that such funds may be exempted from pooling arrangements made by societies having less than 5,000 members at the time of a valuation.

Sec. 58 provides for advisory committees being appointed by the Insurance Commissioners, consisting of representatives of associations of employers and others.

*Unemployment Insurance.*—In order to ascertain whether a workman comes under the unemployment portion of the National Insurance Act, a careful reading of the Sixth Schedule will be necessary: and although the electrical industry is not specifically included in the list of trades which may be shortly described as (1) building, (2) construction of works, (3) shipbuilding, (4) mechanical engineering, (5) ironfounding, (6) construction of vehicles, and (7) sawmilling, it must not be overlooked that under Sec. 107 (2) in determining any question as to whether any trade in which a workman is employed is an insured trade or not, for the purposes of unemployment insurance, regard must be had to the nature of the work in which the workman is engaged rather than to the business of the employer, and it seems clear that the erection of generating stations and sub-stations, and most of the work of equipping them, will, therefore, come under this part of the Act, and it may be that the laying of mains, the construction of street boxes, the erection of overhead mains, and other similar works, bring the electrical industry in most of its branches within its purview.

As in the case of health insurance, contributions are payable by the employer on his own behalf and on behalf of his workmen (Sec. 85), but there are no provisions as to payment and recovery under the unemployment insurance portion of the Act similar to the Third Schedule dealing with health insurance, it being apparently left to the Commissioners to issue these.

These rates of contributions are set out in the Eighth Schedule, and are as follows for the respective periods of employment :—

Period not exceeding.	Age.	Payable by employer.	Payable by workmen.
1 day	16 or over	1d.	1d.
2 days	16 to 18	1d.	1d.
"	18 or over	2d.	2d.
1 week	16 to 18	1d.	1d.
"	18 or over	2½d.	2½d.

The contribution payable may be added to or varied under the following conditions :—

1. By the inclusion with the consent of the employer of
  - (a) Workmen who are employed under the same employer partly in an insured trade and partly not in an insured trade to be treated as if they were wholly employed in an insured trade (Sec. 91 (1) (a)).
  - (b) Workman employed in a rural district and occasionally occupied in an insured trade (Sec. 97).
2. By the extension of the Unemployment Insurance provisions by an Order of the Board of Trade with the consent of the Treasury (Sec. 103).
3. By an alteration by the Board of Trade of the rate of contributions payable but so as not to treat employer or workmen unequally or to increase the contributions above 1d. each per week.
  - (a) If the unemployment fund is insolvent (Sec. 93 (2)).
  - (b) By septennial revisions if the unemployment fund is insufficient or more than sufficient (Sec. 102).

It should be stated here that the contribution rates may be varied under (b) as between trade and trade, and, should this power be exercised, some difficulties may be expected as the list of insured trades overlap.

The following provisions provide for contributions to be refunded by the Board of Trade to the employer :—

- (a) If an employer applies within one month after the end of any year, one-third of the contributions of the employer must be refunded in respect of any workman



who has been continually employed through the year, and in respect of whom not less than 45 contributions have been paid (Sec. 94 (1)).

(b) If an employer has been systematically working short time, such contribution paid by him for his workmen and himself as may seem just to the Board.

(c) If contributions have been made for a person who has been engaged as an insured workman in error (Sec. 100 (2)).

The most important provisions affecting employers not already enumerated are:—

1. Courts of referees for the purposes of the Act must represent employers with an equal number of workmen's representatives and an independent chairman (Sec. 90).

2. Employers may make arrangements with labour exchanges to carry out certain duties under the Act (Sec. 99).

3. As to fines for offences (Sec. 101).

*General.*—Sec. 110 provides that contributions payable by an employer under the Act are preferential debts within the meaning of the Bankruptcy Act, 1888, and under Sec. 111 the benefits are inalienable.

Under Sec. 112, inspectors have powers of entry and examination in respect of any premises, other than a private dwelling house not being a workshop, where he has reasonable grounds for supposing workmen are employed.

The foregoing deals only with the most important provisions, and, indeed, the Act enters very little into the details of administration, leaving these to the direction of the Insurance Commissioners.

Many points are doubtful, difficulties are already apparent, and more will appear when the Act is put into operation on July 15th next, or such extended date not being later than January 1st, 1913, as the Commissioners may fix.

In the Pensions Act recently passed in France, it is stated that the Book of Industries issued by the Government extends to nearly 900 pages. The National Insurance Act deals with more than the French Act, and it may be anticipated that the various orders and instructions of the respective Commissioners for England, Wales, Scotland and Ireland will be voluminous.

It is clear that for some time to come employers will have to keep up to date with these Orders and Instructions, and the Associations connected with the various industries should be of great assistance in this direction. In this necessary work, no doubt the Institution of Electrical Engineers and the B.E.A.M.A. will take their fair share.

It would appear from a careful reading of the Act that employers will have a good deal of additional work to do in providing for the payment of contributions. An alteration in the ruling of the wages sheets will be necessary in most cases, and an efficient method of checking the issue of stamps, the analysing of contributions, the payment of casuals and gangs and of men working at a distance from the central works, will be required.

In order that workmen may prove continuous employment, or where a workman has lost his card or book, communications with his society or the Post Office will, no doubt, arise, and this additional work will entail additional clerical expense, the cost of which can at present only be conjectured. This article is by no means exhaustive, but it is hoped that it may help somewhat in anticipating the requirements under the Act, particularly so far as it affects employers in the various branches of the electrical industry.

**A Steam Turbine Monument.**—According to *Power*, the General Electric Co. has re-erected in the centre of a park plot in its grounds at Schenectady, N.Y., the first 5,000-kw. Curtis steam turbine installed in the Fisk Street station of the Commonwealth Edison Co. at Chicago. It is to serve as a memorial to the rapid development of the steam turbine unit applied to central station service. This turbine was installed in the Fisk Street station eight years ago, being put in operation on October 2nd, 1903, and remained in continuous service until May 29th, 1909. It was specified in the contract by President Insull when this unit was replaced that it should be set up as a monument to commemorate the great step in engineering which its installation marked. A bronze tablet detailing its history has been placed on the turbine.

## THE TEMPERATURE OF GAS-ENGINE CYLINDERS.

THE general impression is that, as the temperature of the gas-engine cylinder increases, so up to a point does the efficiency, but the power developed becomes less. Experiment has shown, says Mr. Batey in an article in *Cassier's Magazine*, that the efficiency increases up to 212° F., a temperature beyond which opposite results are shown. It is easy to understand why the power grows less as the cylinder wall becomes hotter, for the cylinder must heat the incoming charge, and the expansion of this will reduce the quantity entering the cylinder.

The work done depends, says Mr. Batey, upon the difference between the temperature of the entering charge and that of the exhaust gas. He cites an entering temperature of 80° F., and an exhaust temperature of 900° F., the difference being 820°, which is a measure of the work done. We confess ourselves unable to follow this argument, which appears to be reckoning in a sort of reverse fashion, for is not work done by fall of temperature? The charge may enter at 80°, but it speedily acquires, say, a temperature of 2,500°, and it leaves, say, at 900°. The difference is 1,600°, and it is *this* difference that measures the work done. Mr. Batey may be right in his conclusions, but we cannot follow his argument.

But it is easy to agree to the statement that a highly-heated residual exhaust will prevent the entry of a full weight of fresh charge, though even here it must not be overlooked that a cool exhaust spells a greater weight of residual gases, for the weight of gas occupying unit volume varies inversely as the absolute temperature.

The united volume of charge and residuals remains equal, but the weight of the charge will vary. Thus to get as much power with a hot charge as with a cooler charge a bigger cylinder is required. Generally, therefore, says the author, where results are referred to a theoretical compression of 4 to 1, the engine should be designed for a compression ratio of 5 to 1.

Tests by Prof. Hele-Shaw are quoted to show the relation of variation of water temperature to the gas tests. In five tests, as below, the engine ran at speeds varying from 1,086 to 906 R.P.M., where the exit jacket water varied from 77° to 253.4°. In the first three tests the water ran through the jackets. In Nos. 4 and 5 the water was simply allowed to boil off, glycerine being employed in No. 5 to keep up the temperature.

			TEMPERATURE F°.			
No. test.			Entry.	Exit.	B.H.P.	Rev.
1	...	...	66.2	77	4.775	1,086
2	...	...	64.4	131	4.47	1,084
3	...	...	64.4	212	3.97	903
4*	...	...	212	212	4.07	925
5	...	...	253.4	253.4	3.94	906

It is to be noted that the power per revolution varies but little. It is not always the highest economy that is wanted in daily work. Oftener it is the maximum plant output which is sought, no matter at what cost, and hence, perhaps, the ordinary rule that jackets are best worked at 120° exit temperature.

Of course, in theory it is rank folly to cool the cylinder of a heat engine. But even if it were practicable to work a cylinder without water cooling, this could not be done with present methods of taking in the charge. This simply flows in after the moving piston, and only so much enters as can make its way in. But the charge may be pumped into the cylinder, and is so pumped in, in the case of the Körting engine, which is the modern representative of the Clerk engine. In the Clerk system the charge is forced into the cylinder by a separate pump and at minimum temperature. The cylinder temperature has no effect in controlling or limiting the weight of the entering charge, and the cooling jacket can then be worked at any temperature that may be found best.

The economic advantage of the internal-combustion engine is made the more evident when it is reflected that this economy is secured despite the use of so bad a principle as the water cooling of the working cylinder.



## THE INTERNATIONAL SMOKE ABATEMENT EXHIBITION AND CONFERENCE.

[BY OUR SPECIAL CORRESPONDENT.]

(Concluded from page 576.)

THE Conferences on Smoke Abatement, held on Tuesday, Wednesday and Thursday, March 26th, 27th and 28th, attracted influential gatherings of experts and representatives of municipal and local authorities, as well as many foreign visitors. The attendances were not so large as had been expected, doubtless owing to the difficulties created by the coal miners' strike; on the Northern railways of the United Kingdom especially, a very large number of trains had been withdrawn.

It was stated by Mr. Chubb, the very energetic and courteous secretary of the Exhibition and Conference, however, that 71 authorities and societies had sent representatives to the Conference: there were 21 delegates from the London borough councils, over 25 delegates from provincial councils, nine delegates from foreign municipalities, one each from the Governments of Sweden and Holland, and several from America. The attendance at the Conferences therefore made up in weight and influence what it lacked in numbers, and most interesting papers and discussions were heard.

As 28 papers were presented during the three days, it is impossible in this brief report to give any complete summary of the same or of the discussions upon them, and all that can be attempted is a general review of the results attained. The papers and official reports of the discussions are to be published in volume form by the Coal Smoke Abatement Society as soon as possible, and this volume will be on sale shortly at the offices of the Society.

The nine papers read on Tuesday, March 26th, dealt with the effects of a smoke-polluted atmosphere upon buildings, paintings, statuary and plants. Many interesting details were given by Sir Arthur Church, Mr. H. Redfern, Mr. Ruston, Miss Agar, and others, relating to the injury arising from the soot and dust and acid vapours contained in the air of the metropolis and other towns, and to the best methods of preserving stonework, metalwork, and paintings from further harm from this cause. As Mr. Walter Reid pointed out in the discussion, competent architects ought to choose their building materials with an eye to the atmospheric and climatic influences to which they will be exposed, and not to indulge in marble and bronze combinations for the centre of the metropolis. Tuesday's papers and discussions contained much useful information for all interested in this side of the subject, including details of how the old York Watergate on the Embankment was cleaned by L.C.C. workmen, its inches-deep deposit of London soot being removed without injury to the underlying carved stonework.

On Wednesday, March 27th, 16 papers were planned for reading and discussion; the subjects dealt with all related to the work done in organising preventive action, and to the practical methods of securing the abatement of both domestic and factory smoke. Reports upon the progress of the smoke abatement movement in Germany, in England, and in America, were presented by Herr Ing. Nies, of Hamburg; Mr. J. B. C. Kershaw, of Liverpool; and Mr. Thomas E. Donnelly, of Chicago. These reports illustrated the widely different methods of attacking the problem in the three leading manufacturing countries, and will be useful later for reference purposes. On Wednesday afternoon, the more practical subjects of stoking, wasteful power production, and solid smokeless fuels, were dealt with by Commander Caborne, Mr. John S. Pearson, Dr. John S. Owens, and Mr. W. Scott-Moncrieff, and much useful information was given in the papers and in the subsequent discussions. Captain Sankey, who was in the chair at this sitting of the Conference, made a record by disposing of six papers and the discussion upon them in 80 minutes, which suggests that he had studied to good purpose the editorial remarks upon the duties of chairman of Smoke Abatement Conferences, contained in the issue of the ELECTRICAL REVIEW of March 15th. The representative of a certain patent fuel caused some amusement at this session of

the Conference, by reading a lengthy document setting forth the advantages of this form of coal, but after listening for five minutes to this advertisement for C—l—d, the audience declined to hear more of it, and most effectually applied the closure.

The present laws and prospective legislation relating to smoke abatement engaged the attention of the delegates to the Conference on Thursday, March 28th, when four papers were presented, dealing with this side of the subject. Mr. Joseph Hurst, of London; Principal Graham, of Manchester; Dr. Des Voens, the treasurer of the Coal Smoke Abatement Society, and Mr. Julian S. Corbett, contributed the papers, and a lively and interesting discussion took place upon the rival policies urged by the two different sections of the Smoke Abatement Society.

The following resolution, which was passed unanimously, indicates the compromise that was arrived at, as the result of Thursday's discussion and joint conference between representatives of the two societies:—"That this meeting of delegates to the International Smoke Abatement Conference recommends that the offer of Mr. A. Gordon Harvey, M.P., to introduce into Parliament the Smoke Abatement Bill prepared by the Smoke Abatement League be accepted, and that should such Bill not be passed into law during the current Session, or should there be no prospect of the Bill passing in 1913, steps shall be taken to organise a deputation to the Government to urge the appointment of a Royal Commission to report upon the whole subject of Smoke Abatement."

Since there is not the slightest chance of the Bill referred to in this resolution being adopted as a Government measure either this year or next, the London Society's proposal for a Commission on the subject of smoke abatement is the most probable outcome of Thursday's discussion.

The other resolutions passed at Thursday's Session of the Conference related to—

1. The adoption of a standard method of measuring the atmospheric soot and dust fall and of recording the density of smoke, and the appointment of a sub-committee to draw up details of the same;
2. The education and training of stokers and granting of certificates to the same for efficiency in their work; and
3. The co-operation of Smoke Abatement Societies in other countries with the proposed inquiry of Pittsburgh University into the economic aspects of smoke abatement.

There were several afternoon receptions held at the Exhibition during the twelve days for which it was open—that on March 27th, when Mr. and Mrs. S. Z. de Ferranti received the guests, being largely attended by electrical engineers. The majority of those who attended this reception stayed to hear the lecture by Mr. Frank Bailey, the joint managing director of the City of London Electric Lighting Co., upon "Electricity for Lighting, Heating and Power," which was illustrated by lantern slides, and attracted a very large audience. The ability to hold the attention of a "popular" audience for an hour, when lecturing upon a scientific subject, is not, however, given to every man. That Mr. Bailey was saved from failure was chiefly due to the fact that he had wisely announced he was keeping his "plums," in the shape of a series of cinematograph films, for the end of his lecture. Had he exhibited these first, his fate might have been that of an amateur lecturer, who, after an eloquent peroration at the end of a lantern lecture on astronomy, found, when the lights were turned up, that he and the reporter were the only remaining occupants of the hall. Like the Arabs, the audience, on this occasion, had noiselessly folded their wraps and stolen away. Many others besides the writer followed a similar example on March 27th, under cover of the darkness, long before Mr. Bailey had arrived at the end of his apparently interminable series of lantern slides, showing electric motors driving rolling mills, printing machines, milling machines, combing machines, grinding machines, and every other type of machine used in this world for manufacturing or industrial purposes.

---

**Kilmarnock Electricity Supply.**—The T.C. is to apply to the Scottish Office for authority to borrow £3,750 for extensions at the electricity works.



## LEGAL.

WEBB v. BOOKER.

In the Lord Mayor's Court on Monday, before the Common Serjeant (Sir F. Bosanquet, K.C.) and a jury, Mr. Arthur O. Webb, constructional and electrical engineer, of Park Hill Road, Haverstock Hill, brought an action against Mr. Harry J. Booker, manager of Messrs. J. & H. Grevener, electrical dealers, of Eldon Street House, E.C., to recover the sum of £50. Mr. Wallington was counsel for the plaintiff, while the defendant conducted his own case.

On behalf of the plaintiff, it was stated that he was the inventor of a certain flame-arc lamp, and the defendant's firm were to exploit the invention if it was satisfactory. The lamps were to be made by a German firm. In order that there might be no difficulty in the construction of the lamps, defendant asked the plaintiff, in 1910, to go to Germany, and instruct the manufacturers in the proper way of making the goods. The plaintiff was promised £100 by the defendant for doing that, and he consented to go to Germany. He received £25 before he went to Germany, and while in that country did all that he had undertaken to do. After his return to this country the defendant handed him a further sum of £50, but the balance of £25 had never been paid. The plaintiff also alleged that he and the defendant were associated in a drawing office. The defendant said that he knew of a drawing office which was "going cheap," and suggested that it should be taken and run in partnership. The defendant thought the office would be useful to both of them, and premises were taken at London Wall. The arrangement was that the plaintiff should draw a salary of £8 a month, and that the expenses should be shared equally, the profits also to be divided between them. The expenses were paid by the plaintiff and the defendant. For some time the profits were shared, but when losses were made the defendant left, and now alleged that he was never a partner in the concern. The plaintiff alleged that the defendant owed him £36 17s. 5d. in respect of the drawing office, but, instead of claiming that sum, he only asked for £25.

The DEFENDANT said that it was agreed between him and the plaintiff that the balance of £25 should only be paid when the lamps had been approved. The number of lamps stipulated had not been approved, and therefore the plaintiff could not claim the money. He denied that he was ever in partnership with the plaintiff in the drawing office. In respect of that venture he had lent the plaintiff various sums of money, and he raised a counterclaim for the recovery of such money, which he said amounted to £27 0s. 7d.

The jury found for the plaintiff for the balance of £25 on the contract for £100, and also for the plaintiff on the counter-claim. They also stated that there was a partnership between the plaintiff and defendant.

MR. WALLINGTON suggested that an account should be taken of the partnership matter, but subsequently said he would not press the matter.

[Other "Legal" matter appears in our "Notes."]

## BUSINESS NOTES.

**Book Notices.**—"Les Conducteurs d'Electricité en Aluminium." By E. Dusauguey. 1912. Paris: Dunod & Pinat. Price 7 fr. 50.

"Journal of the American Society of Mechanical Engineers." Vol. 34, No. 4. April, 1912. New York: The Society. Price 35 cents.

THE HILL PUBLISHING CO., LTD., of Bouverie Street, E.C., announce that in future they will publish all books issued in connection with the following New York papers, viz., *Railway Age Gazette*, *Signal Engineer*, and *American Engineer*, as the McGraw-Hill Book Co. have purchased the Book Departments of these papers.

"Bulletin of the Association des Ingenieurs Electriciens." December, 1911. Liège: The Association. Price 6 fr.

"Tests of the Absorptive and Permeable Properties of Portland Cement, Mortars and Concretes," together with "Tests of Damp-proofing and Water-proofing Compounds and Materials." By R. J. Wig and P. H. Bates. 1911. Washington: Government Printing Office.

"Quarterly Trade Journal of the British Chamber of Commerce of Turkey." March, 1912. Constantinople: The Chamber of Commerce. Price 2s. 6d.

"Transactions of the South African Institute of Electrical Engineers." Vol. II, Part 12, and Vol. III, Part I. January and February, 1912. Johannesburg: The Institute. Price 2s.

"Revue d'Electricité." Vol. XXIX, No. 2. February, 1912. Brussels: E. Bruylant. Price 1 fr. 75.

**Correction.**—In our reference to Henley's Flexibles, in our last issue, 13/36 S.W.G. should read 14/36 S.W.G.

**France.**—La Compagnie Popp pour le Traitement des Metaux par l'Electricité is the name of a new company which has lately been formed in Paris, with a capital of £40,000.

**Fires.**—With reference to our notice regarding the fire at the Ipswich premises of MESSRS. MANN, EGERTON & CO., LTD., of Norwich, the firm states that all arrangements have been made for continuing the business without interruption.

The *Times* states that by a fire which occurred at the moulding works of MESSRS. ROWLAND HILL & SONS, Coventry, valuable machinery was much damaged, and electric light and electric power installations were totally destroyed.

**Bankruptcy Proceedings.**—ROAD AND RAIL ENGINEERING, LTD., Derby, late Duffield, near Derby. —The first meeting of creditors herein took place last week at the Official Receiver's Offices, 5, Victoria Buildings, London Road, Derby. The winding-up order was made last February on the petition of a claimant for over £6,000. The company was incorporated in October, 1908, as a private concern with a nominal capital of £30,000, having been formed for the purpose of carrying on the business of electrical, mechanical, and constructional engineers, and to develop and place on the market inventions and improvements connected with road, rail, marine, and aerial transport. The company was promoted by Mr. Alfred Richard Sennett, who, although he exercised the powers and duties of director, managing director, and chairman of the board, according to the Official Receiver, did not hold or subscribe for any shares. He was the vendor of certain plant, machinery, &c., at Peckwash Mills, Duffield, as per an inventory which could not be traced, of the benefit of certain inventions and agreements, and of all drawings, &c., relating thereto, the consideration being £13,332, payable as to £8,888 in cash, and as to £4,444 in fully-paid up shares in the company. The agreement, however, was never executed while other agreements for lease, and relating to Sennett's services, were also incomplete. The first two directors, namely, Mr. Philip Yorke and Mr. A. Wilfred Waddy, were appointed by Sennett, but Mr. Yorke ceased to hold the position after the first board meeting, while the address of Mr. Waddy could not be traced. Eventually it was decided that the Official Receiver and Mr. D. Sibbald be appointed for the position of liquidators.

J. TIZZARD, electrical engineer, Hill Crest, Abbey Road, Torquay, Devonshire.—The first meeting of creditors herein took place on April 15th at the Official Receiver's offices, 9, Bedford Circus, Exeter, when it transpired that the debtor had been carrying on business at Torquay from June, 1905, to January last. He started with no capital, and his business had chiefly consisted of fitting up installations for electric light and telephones in private and other houses in Torquay. At the end of January debtor suddenly left Torquay, in consequence of which a petition was presented on the grounds that he had left with a view of defeating or delaying his creditors. On April 13th he returned and surrendered to the proceedings. He stated that his leaving Torquay had nothing to do with his financial position, but was owing to domestic causes. He further stated that he had a balance to the good of some £30 or £40. The Official Receiver pointed out that the debtor had not included a claim by a lady for £100, money alleged to have been paid on his behalf. Debtor, on the other hand, said that this lady was indebted to him for £90, but this was denied. This claim, however, is being very carefully investigated. No resolutions being passed, the matter remains in the hands of the Official Receiver.

**Dissolutions and Liquidations.**—FIFE ELECTRIC POWER CO., LTD.—A meeting is called for May 14th at 28, Charlotte Street, Edinburgh, to hear an account of the winding up from the liquidator, Mr. J. Watt.

DAVIS ELECTRICAL CO., LTD.—First meetings of creditors and contributories are called for April 30th at 33, Carey Street, W.C.

The summary of statement of affairs shows a deficiency of £4,786. In his observations, Mr. W. J. Warley, Assistant Official Receiver, says:—

"The company was incorporated on October 2nd, 1908, as a private company, with a nominal capital of £3,000, divided into 1,000 preference and 2,000 ordinary shares, all of £1 each. It was formed to acquire as a going concern the business of manufacturer and dealer in electric and other lamps and electrical accessories, previously carried on by the vendor Harry Emanuel Davis, of 17, Moor Street, Cambridge Circus, W.C. Davis states that he was in need of further working capital, and that Charles Levy, who is now his father-in-law, was willing to find funds, upon condition that he received debentures as security. The first and only directors were Davis, Harry Norman Howlett, and Charles Levy. The directors' qualification was fixed at the holding of 10 shares each, and both Howlett and Levy were qualified by the vendor. No remuneration has been voted to the directors as such, but Davis was appointed by the articles managing director for life, to receive by way of remuneration the yearly sum of £500. Howlett also managed a portion of the company's business at £3 10s. per week, with a commission on the net profits. He has overdrawn £62 in respect of commission. Levy resigned from the board on March 15th, 1910. Howlett went abroad shortly before the winding-up order.

"Davis states that he had carried on the business for about 10 years. According to his books the net profits for the three years preceding incorporation were—1905, £559; 1906, £484; 1907, £577. The terms of the purchase were embodied in an agreement dated October 12th, 1908, made between the company and Davis, by which the company agreed to purchase the goodwill and assets, as at January, 1908, subject to the liabilities of that date. The vendor also was to retain £200 in respect of his services in managing the business from January 1st, 1908, to date of completion. The purchase consideration was fixed at £1,998, to be satisfied by the allotment of 998 fully-paid shares of £1 each, and 10 first mortgage debentures of £100 each (forming part of a series



not exceeding £2,000), carrying interest at 5 per cent. per annum and secured upon the whole of the assets of the company.

"The amount of the purchase consideration (£1,993) was arrived at as follows: Assets transferred to company by vendor at January 1st, 1908:—Cash, £297; stock-in-trade, £863; lease of premises, £370; additions to premises, £133; furniture, £45; goodwill, £1,129 = £2,837, less vendor's liabilities taken over in excess of book debts collected, £766; trading loss from January 1st, 1908, to date of completion, £73 = £1,998. On October 12th, 1908, 993 shares were allotted to Davis as fully paid, on November 12th, 1908, ten debentures for £100 each were also issued to him, and the purchase was thereby completed. A further two shares have been issued for cash, and are fully paid. On the same day five debentures of £100 each were issued to Levy for cash then subscribed. According to the books of the company, the result of its trading has been:—From November 12th, 1908, to December 31st, 1908, loss £50; to December 31st, 1909, loss £834; to December 31st, 1910, loss £63.

"In addition to the debentures referred to above, further debentures have been issued from time to time, viz., in September, 1909, five first debentures of 100 each issued to Levy for cash, making £2,000 in all issued in respect of first debentures. In March, 1910, on the occasion of Davis's marriage, first debentures for £1,500 were transferred to the trustees of his marriage settlement, £1,000 out of Davis's name and £500 from Levy. Davis also transferred 960 of his shares to the trustees. On May 17th, 1911, a further issue of £1,100 second debentures, ranking after the £2,000 referred to above, was made, as to £600 to Levy in respect of £300 cash then advanced and for £300 previously advanced, and as to £500 to Davis, being £200 for cash, £200 in respect of an old liability of his taken over by the company, but from which his creditor would not release him, and £100 for salary due. Davis states that some time in September, 1911, owing to delay in payment by some of the company's debtors, he found it necessary to apply for time to certain creditors of the company, who held bills shortly becoming due, but received unfavourable replies; also that he asked Levy to make further advances, but without success. On September 25th he consulted his solicitor, who advised him to call a meeting of shareholders to wind up the company voluntarily. Davis issued the notices on September 28th. On October 6th the resolution for voluntary liquidation was passed, and on the same day Mr. G. E. Corfield, incorporated accountant, was appointed receiver by the debenture-holders, who thereupon entered into, and has since been in possession of the company's property.

"From September 1st to October 6th goods were delivered to the company much in excess as regards value of any delivered during a similar period of trading at any time during the company's existence, viz., £1,614, of which £1,034 relates to the time between September 25th and October 6th (the date of the voluntary winding-up). With the exception of a few small items, the whole of these goods were ordered within a few days of delivery. No creditor in respect of goods was paid after September 15th, but in the fortnight prior thereto accounts for goods amounting to about £310 were paid. Davis's explanation of this apparent method of increasing the debenture-holders' security is that he believed up to the last that Levy would supply sufficient funds to carry on the business, and that liquidation, although provided for, would not be necessary. Having regard to Davis's interest in the debentures, to his relationship to the other debenture-holders, and to the enhancement by the above-mentioned purchases of the debenture-holders' security by at least £1,000 in the period above referred to, the matter will require further consideration. The unsecured claims, £3,358, are in respect of goods supplied, £3,288, printing £3, advertising £15, carriage and freight £10, law costs £17, money lent £25. Davis attributes the failure of the company to lack of working capital and to bad debts."

THE REORGANISATION AND CONTROL SYNDICATE, LTD., 2, Coleman Street, E.C.—Under a compulsory winding up order made against this company, Mr. H. M. Winearls, Official Receiver, has now issued his report to the creditors and shareholders. The liquidation accounts show liabilities £2,160 against assets valued at £5,000, but with regard to contributories a deficiency of £5,411. Mr. Winearls reports that the Syndicate was promoted by Mr. Demetrius John Delyannis, and was registered on July 21st, 1909, with the object of acquiring and controlling interest in the London Electrobuses Co., Ltd. The nominal capital of the company was increased from £10,000 to £40,000, but only £6,424 shares were subscribed for cash, and £2,000 were issued as fully paid in part payment for the undertaking, garage installation, property and assets of the Electrobuses Co. Some of the cash subscriptions were obtained in response to letters and circulars containing statements which will require investigation. The allottee of 40 shares successfully applied to the Court in January, 1911, for the removal of his name from the register of members, on the ground that he was induced to apply for them by misrepresentations.

In June, 1909, the Atlas Banking Corporation, Ltd., of which Mr. Delyannis was at one time principal director, agreed to pay £6,000 cash to the International Motor Traffic Syndicate, Ltd., for £6,000 debentures, £24,000 ordinary shares, and 5,000 deferred shares of 5s. each in that company. The rights of the Atlas Banking Corporation were transferred to the Control Syndicate during July and August, 1909, for £150 in cash and certain further considerations. In the course of litigation which followed between the Control Syndicate and the Traffic Syndicate and another company, the former syndicate was ordered to pay £200 into Court as security for costs. In order to comply with that order, £250 was raised on a debenture for £500, and in August, 1911, the principal and interest due under the debenture being in arrear, Mr. J. H. Byrne, chartered accountant, was appointed Receiver, but up to the present he has not realised any-

thing. He has obtained the leave of the Court to continue the proceedings against the Traffic Syndicate; but unless a substantial amount is recovered, there will be no assets for distribution in the liquidation.

THE LANGDON-DAVIES MOTOR CO. (in liquidation).—Mr. Charles Cape, as receiver for the debenture-holders in this matter, announces that he has disposed of the business for a less sum than is required to pay the amount of principal and interest due to the debenture-holders, and in these circumstances there will be no funds available for distribution amongst the ordinary creditors.

SWITCHGEAR CO., LTD.—This company is being wound up voluntarily. A meeting of creditors was to be held at the office of Messrs. Griffiths, Keeling & Sherwood, 109, Colmore Row, Birmingham, yesterday; Mr. H. Keeling, liquidator. Messrs. Switchgear & Cowans (1911), Ltd., who acquired and are carrying on the business of the Switchgear Co., Ltd., and of Cowans, Ltd., intend to apply to the Registrar for permission to delete the (1911) from their title. They have been informed by the Registrar that the title, Switchgear & Cowans, Ltd., cannot be granted while the Switchgear Co. remains upon the register. A meeting of creditors was called for April 18th.

STASSANO ELECTRO-STEEL AND FURNACE CO., LTD.—A meeting of creditors is to be held at 49, Leadenhall Street, E.C., on April 26th—(a) to determine whether an application shall be made to the Court for the appointment of any person as liquidator in the place of, or jointly with, the liquidator appointed by the company; or (b) for the appointment of a committee of inspection. Liquidator. Mr. Augustus Hobbs.

**Trade Announcements.**—With reference to the notice appearing in our last issue respecting the liquidation of STOCKALL-BROOK TIME RECORDERS, LTD., we are informed that Messrs. G. H. Gledhill & Sons, Ltd., of 153, Cheapside, London, and Trinity Works, Halifax, cash register manufacturers, have bought all the patent rights and the business and goodwill of the Stockall-Brook Co., and will continue the manufacture of these recorders. Having extended their operations to the manufacture of time recorders, and in conjunction with several patents taken out by Mr. A. H. Gledhill, they are now making recorders of various types. Messrs. Gledhill are carrying on this branch of their business under the title of "The Gledhill-Brook Time Recorders." Mr. Frank Brook is retained as sales manager for time recorders, and the works of the late company in Market Street, Huddersfield, are now being employed for contract, repairs and supplies for all makes of such instruments.

The telephone number of MR. CECIL Y. KNIGHT, London representative of the Morgan Crucible Co.'s brush department, is now 460 Hammersmith.

MR. HENRY THOMAS JOY, electric bell fitter, &c., Herne Bay, has removed from 21, William Street to 91, High Street.

THE LANGDON-DAVIES MOTOR CO. announce that their works telephone No. is "Lea Green 1473." All goods and invoices are to be delivered to the works, Eastdown Works, Dermody Road, Lewisham, S.E., and all communications to 110, Cannon Street, E.C.

THE MAGNET GALVANIZING AND PLATING CO., LTD., which has been formed with a new board of directors, has acquired the whole of the plant, business and good-will of the Cowper-Coles Galvanizing Syndicate, Ltd. The address is Magnet Galvanizing Works, Stratford, London, E.

**Catalogues and Lists.**—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C.—The long-expected new 1911-12 edition of the General Electric Co.'s electrical encyclopædia has just been issued, and fully justifies anticipations. In place of the massive tome with which we are all familiar, we now have four bound volumes and a spare binder, fitting into a neat cabinet; the volumes are strongly bound in cloth, with coloured bands which indicate at a glance the nature of the contents, namely:—Vol. I, Dynamos, Motors, Plant and Switchboards; Vol. II, Switchgear, Meters, Lamps, Cables, Conduits, &c.; Vol. III, Fixtures and Glassware, Heating and Cooking; Vol. IV, Telephones, Bells, Cells, Electro-Medical Apparatus, &c. Each volume contains a complete index to the contents of all four, as well as a complete numerical index to the catalogue numbers, showing in each case the volume and page where the item will be found; in many cases there are also at the end of a section or part of a section similar indexes to its contents. An introductory section in Vol. I deals with the various factories and organisation of the General Electric Co., and details its numerous branches in this country and abroad; this volume also contains a section of general and technical information, with approximate estimates of cost of installations and a glossary of technical terms. Concerning the catalogue contents of the volumes we can only speak in general terms; probably most of the sections have been noticed in this column at the time of their separate issue, and when we mention that prices and illustrations are given of nearly every kind of modern appliance connected with electric power, lighting, heating, signalling, telephony and other branches of the electrical industry, it will be obvious that to review so compendious a collection of items would be a Herculean task. The compilation of the work must necessarily have occupied much time, and some alterations made during its progress are indicated by insets; but in order to afford a more satisfactory means of keeping the catalogue up to date, a spare binder has been provided, into which the progress sheets periodically issued by the company can be inserted as received, thus maintaining continuity and completeness between the issue of this catalogue and the next. This binder already contains a few recent bulletins, showing some very fine examples of the company's large generators and other productions, and the private telegraphic code which it



employs. We are informed that each set of volumes actually costs 25s. 6d. to produce, and weighs 15½ lb. The total weight of the first edition equals 48 tons, including 38 tons of paper; each set contains 1,470 pages, and over 10,000 illustrations are given. The utmost care has been taken to exclude all superfluous matter and to improve the catalogue in every possible way, and we can well understand that an enormous amount of work in the aggregate is represented by this unique production, of which we can safely say that nothing like it has ever been previously attempted in this country.

MESSRS. BRECKNELL, MUNRO AND ROGERS, LTD., Thrissell Street, Bristol.—94-page catalogue containing illustrations (art paper), prices, and brief particulars of a variety of manufactures for use in connection with electric traction work. The following are included: Trolley standards, pantograph and bow standards, trolley poles, wheels and heads, many types of line material, trolley standard tools and car-repairing tools, drying stoves for armature and field coils, car fittings, snow-sweeper and rail-cleaner, signalling apparatus, crane and transporter electric equipment and electric locomotives.

MESSRS. HASLAM & SCHONTHEIL, LTD., 11, Windsor Place, Cardiff.—A leaflet just issued illustrates the "Thor" earthing clip, a new type which will fit any size cable or pipe, and requires no soldering. It also shows the "Thor" watertight hand lamp, in which there are no screws running in a horizontal direction, and the lampholder and lamp cap are completely protected. It is supplied in watertight, keyholder, and non-watertight patterns. Prices are given of both articles.

MESSRS. E. READER & SONS, LTD., Phoenix Works, Nottingham.—Catalogue and price list of 64 pages containing very full particulars, descriptive and tabular, also illustrations, of their high-speed vertical steam engines of various types, Corliss and other horizontal steam engines, and steam dynamos for ship lighting and other purposes. Prices, weights, dimensions, code-words, and so forth, are given.

THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, London, E.C.—The company has sent us a number of its new "Gral" stickers, being a reproduction of this metal lamp show-card.

MESSRS. QUILLIAM BROS., Clegg's Court, Chapel Street, Salford.—Catalogue of 16 pages containing a description of the Collins patent point controller (type 15) with mercury-sealed stuffing box, for automatically turning tramway points. The illustrations show the mechanism in detail.

MESSRS. SCHOLEY & CO., LTD., 151, Cannon Street, London, E.C.—Twenty-four page catalogue, in which is given full information regarding the firm's direct-current motors and dynamos (type C). Speeds, prices and other particulars are tabulated for motors from 7.5 to 45 B.H.P., also for small direct current motors, "B" type, from ½ to 2½ H.P., standard type motor starters. Dynamos, D.C. shunt or compound wound, from 1½ KW. output for 100, 140, 230 and 460 volts are listed, as are also shunt field regulators. Dimension, drawings and half-tone illustrations are included.

MESSRS. ARNOLD, GOODWIN & SON, LTD., Sumner Street, Southwark Bridge, London, S.E.—New catalogue consisting of a series of leaflets describing their air compressing and vacuum pumping machinery. The machines are made for 100, 50, and 25 lb. pressure as compressors, one or two stage, belt, steam and motor driven. Both vertical and horizontal machines are made. The small machines below 50 cb. ft. capacity are of an improved single-acting vertical type.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A number of new lists have been issued in the firm's standard size and style for filing, as follows:—No. 329, electric hair dryers; No. 330, oil-immersed  $\gamma$ -delta switches for starting squirrel-cage induction motors; No. 331, continuous-current motors and generators (type DG); No. 332, Tirrill regulators; No. 334, automatic circuit-breakers (type C, form P); No. 335, high torque A.C. wattmeters, single-phase; No. 336, adhesive insulating types. All of these, excepting No. 329, are in supersession of pamphlets previously issued. In most cases prices are tabulated, and dimension particulars are given. No. 332 is a 16-page list containing a useful description with voltage records, diagrams, &c., of the Tirrill regulator, its construction, operation, &c.

MESSRS. PRITCHETTS & GOLD, LTD., 58, Victoria Street, London, S.W.—New 8-page section of their catalogue (No. 121) giving illustrated particulars with weights, prices, &c., of portable batteries for the lighting of motor cars, carriages, yachts, &c., for driving automobiles and launches; for laboratory and medical work; also for firing fuses, ignition work, and hand lamps.

MESSRS. W. & R. JACOBS, 39C, King William Street, London, E.C.—Leaflet showing and stating prices of a number of new designs of bead cascade shades for electric fittings.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., 36 and 37, Queen Street, Cheapside, London, E.C.—Leaflet No. A 2235 giving brief illustrated particulars and prices of their no-waste dimmer lamp adaptor for sick-room, nursery and other service, where a bright or dim light is required at will.

**Hotel with 200 Electric Clocks.**—The new Liverpool Adelphi Hotel of the Midland Railway Co., which was opened recently, is supplied with uniform and accurate time throughout by an installation of upwards of 200 electrical impulse dials on the "Synchronome" system, all operated by one controlling pendulum. With the exception of 40 in the service and servants' quarters, the dials are all of Parisian enamel on copper, supplied by Messrs. Henri Picard & Frère, and set in elaborate cast-brass hand-finished cases, specially designed by the architect to harmonise with their surroundings, and made by Messrs. Veritys, Ltd. Even the bedrooms are provided with clocks, which are fixed on the walls. It is above all things necessary that electric clocks in bedrooms

should be silent in action, and the officials of the Midland Co. instituted a long series of tests some 18 months ago, with dials of four different systems. The "Synchronome" system was selected because its dials could not be heard in the silence of night. The whole installation was carried out at a month's notice by the Synchronome Co., Ltd., of 32 and 34, Clerkenwell Road, in time for the opening of the hotel before the Grand National.

**Prices Advance.**—THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, London, E.C., announce that, owing to the increased cost of raw materials, they are compelled to advance all prices in Section W of their catalogue relating to wires, cables, line material, &c., 10 per cent. on and after April 22nd. This is supplementary to the March 1st notice, which notified this advance as applying to pages 898 to 913, containing the prices of articles constructed wholly or partly of iron or other metal, such as insulators, bolts, &c., for line construction. The present notice extends this advance to the whole catalogue with the exception of tin wire and solder, where the special 20 per cent. advance already notified is maintained.

**The Ideal Home Exhibition.**—We are informed that the new "Corona" 1912 type annealed tungsten wire lamp of the Corona Lamp Works, Ltd., has been selected in conjunction with the Lister-Bruston patent automatic electric lighting plant, manufactured by Messrs. R. A. Lister & Co., Ltd., Dureley, for the exclusive lighting of the ideal house, in the *Daily Mail* Ideal Home Exhibition, now running at Olympia.

## LIGHTING and POWER NOTES.

**Acton.**—At Tuesday's Council meeting the special Electricity Committee notified consideration of correspondence which had passed between the Council's solicitor and the solicitors to the Metropolitan Electric Supply Co., with regard to the negotiations for a settlement of matters between the Council and the company respecting the transfer to the latter of the Council's electricity undertaking. Addressed to the Clerk to the Council came a letter from the secretary to the company, enclosing a cheque for £373, and a statement showing a reduction from the amount of the instalment interest due in respect of loan, proportionate to the amount of capital unexpended, £5,711, which the Council had retained, and which the company claimed. It was resolved that the cheque be returned, and that the Council's solicitor be instructed to consider what action should be taken to recover the full amount of the loan instalment and interest.

**Algeria.**—A central electricity generating station has recently been installed to supply the necessary current for lighting and power purposes at the iron-ore mines of the Société des Mines de Fer de Rouina, at Rouina.

**Bath.**—The Street Lighting Committee of the Council has successfully recommended that seven arc lamps and 17 gas lamps, including one triple burner gas lamp, be dispensed with, and that 47 metal-filament lamps be put up in their place.

**Birmingham.**—On April 10th a L.G.B. inquiry was held into the application of the T.C. for a loan of £43,030 for the electricity undertaking, viz., extension of buildings, sub-stations, high-tension mains, two rotary converters and transformers. There was no opposition.

**Blackburn.**—A loan of £1,050 for electricity purposes has been applied for by the T.C.

**Christchurch.**—The B. of G. has been recommended by a Committee to have the workhouse lit by electricity, rather than by petrol or air gas. The recommendation is being considered by the Visiting Committee.

**Clacton-on-Sea.**—The U.D.C. has been informed by the trustees that the electric light will be installed at the new Convalescent Home for Children, and current will be taken from the Council.

**Clayton-le-Moors.**—Last week there was an inquiry as to what steps were being taken to further the construction of the proposed Clayton-le-Moors light railway. A letter was read from the Lancashire and Yorkshire Railway Co. stating "that the order sanctioning the construction of this railway has not yet been granted by the Light Railway Commissioners, and after it has been granted it has to be submitted to the Board of Trade for their approval." The Light Railway Commissioners have since granted the order.

**Continental Notes.**—AUSTRIA.—Experiments are being made on the Hungerberg, in Vienna, with the surplus water power of the high springs reservoir. The object is to utilise the water power, and a turbine has been placed in the water tunnel for generating electricity. The water thus utilised yields about 2,000 H.P., which it is intended to apply to the purpose of public lighting.—*Zeit. Oest. Ing. u. Architektenvereines.*

The old hand-loom linen and cotton weaving mill of Messrs. Johann Hoffmann, at Bennisch, Austrian Silesia, is about to be replaced by a new mill the firm are erecting, and in which about 80 electrically-operated looms will be installed.

LUXEMBURG.—A scheme has been under consideration for some years to dam the Upper Sure, between Perlé and Nagem, and form



a reservoir. Lately the idea has assumed more tangible shape by the application made by a group of foreign capitalists for a concession. The plans, drawn up by Engineer Klein, outline the erection of a reservoir 54,000,000 cb. m. capacity for supplying a large water turbine plant. The power station will be equipped with a series of generators of 6,000 and 12,000 H.P., with a steam reserve plant to meet eventualities. The current can be distributed throughout the length and breadth of the Grand Duchy, for lighting and motive power purposes, and probably the working of the railways. The primary current will be supplied at 5,000, 30,000, and 50,000 volts, and stepped down at various transformer stations. The dam, built of armoured concrete, will be 42 metres high. A similar scheme carried out by the Belgian Government at Gileppe cost about 5,800,000 fr. The estimated cost of the present scheme is 16,000,000 fr., which the promoters are prepared to find.—*Electro*.

**SPAIN.**—What is claimed to be the highest voltage electrical transmission system in Spain is that being established by the Sociedad La Energia de Cataluna. The concern is putting down a large water-power plant in the Pyrenees, and will transmit the electrical energy generated to Barcelona, a distance of 200 kilometres, at a pressure of 80,000 volts.

A society has been formed at Felanitz, Balearic Islands, with a capital of 1,250,000 pesetas, with the object of installing an electric light service.—*Electron*.

**NORWAY.**—The capital of Norway owns water powers to the extent of 28,000 H.P. These are now to be utilised for the production of light and power. The city has granted to a private firm a concession for 30 years, at the end of which period the entire installation becomes the property of the municipality.—*Electro-industrie*.

**RUSSIA.**—La Société des Tramways de Witebsk is in negotiation with the municipal authorities of Witebsk with reference to a concession for the electric lighting of the town.

The Kharkov municipal authorities have contracted a loan of about £633,000, which is to be employed for carrying out drainage works, electric light works, and for the construction of an electric tramway.—*Board of Trade Journal*.

**Cornwall.**—A syndicate which is investigating the possibilities of electrifying the tin mines in Cornwall has engaged Mr. E. M. Lacey, consulting engineer, to prepare a report.

**Douglas.**—The Electrical Undertaking Committee of the T.C. recommended the Council to apply for borrowing powers to the extent of £5,500, for the purpose of carrying out a scheme of lighting and ornamental illumination by means of electricity of the sea-front during the summer season. The scheme included the festooning of the whole length of the marine promenades with lamps on the lines which proved so effective last summer. The electricity was to be produced by Diesel engines and generators. The T.C. has, by the casting vote of the Mayor, rejected this recommendation. In Committee the voting was six for and one against, and as the division at the Council meeting was equal, the Mayor declined to give his casting vote for the scheme.

**Devonport.**—A L.G.B. inquiry has been held relative to the Council's application for sanction to borrow £9,983 for extension of buildings and plant at the municipal electricity works. The increasing demand on the undertaking made it necessary to provide additional generating plant to meet next winter's load. The present plant capacity was insufficient to meet this, while making allowance for the necessary stand-by. The largest items were £6,460 for a 1,000-kw. turbo-generator with condensing plant, air filters, foundations, piping, valves, traps, circulating water tank and cable between generators and switchboard; and £1,148 for a coal store.

**Dundee.**—The Corporation has arranged to supply a shipbuilding yard with current for motors; over 400 H.P. will be required to drive the various machines. An 80-H.P. motor direct-coupled to an air-compressor is completed, and running with satisfactory results. The Harbour Board has installed flame arc lamps to light one of the graving docks; also eight cast-iron plug boxes, fixed at various points about the dock for the purpose of supplying power and extra lighting when a vessel has to be repaired at night and during the winter months. In each box two plugs are for 50 amperes at 400 volts for power, and two for 25 amperes at 200 volts for lighting. The installation is connected to the Corporation mains.

**Greenock.**—To cope with the greatly increased demand for current, the Corporation has recently made important additions to buildings and plant. On Thursday, last week, a large company gathered to witness the starting of a Westinghouse-Rateau 2,000-kw. turbo-alternator by Mr. J. W. Bailey, convener of the Electricity Committee. After the ceremony, Provost McMillan described the growth of the department, and stated that their output was now over 10,000,000 units a year.

At the meeting of the T.C. on 16th inst., Mr. J. W. Bailey submitted the proposals which had been arranged between the Electricity Department and the Port Glasgow T.C. The agreement was to the effect that no other competitor would get into Port Glasgow for the supply of electricity for 30 years, and that the T.C. there would get the power at the same price as Greenock consumers, with 5 per cent. extra for converters where they were used. The Port Glasgow power users had agreed to allow themselves to be assessed on the value of their works in the event of any deficiency requiring to be made up. Mr. Thomas Baxter proposed that no supply be given unless 5 per cent. extra was paid on current and 10 per cent. where rotary converters were used. His position was that Greenock had already taken all the risks in the capital expenditure and in bearing the losses at the start, and Port Glasgow

now wanted to come in and get all the benefit. Provost McMillan pointed out that Port Glasgow would not share in the profits of the undertaking, and last year the ratepayers received a reduction of 1d. in the £. The arrangements were approved.

**Glasgow.**—After considering a report by the engineer regarding the laying of additional H.T. mains to the Whitevale substation, and to the new substation to be erected in the Irongate district, and also the distribution of electrical energy in the eastern district of the city, and in the Irongate district, the Electricity Committee has agreed to an expenditure of £22,705 for carrying out this work.

**Haverfordwest.**—The T.C. has appointed a committee to consider the advisability of lighting the town by electricity.

**Kirkburton.**—The U.D.C. has granted permission to the Yorkshire Electric Power Co. to erect overhead wires at Dogley Mills for the transmission of current.

**Lanark.**—An electrification scheme has been carried out in connection with a group of pits in Lanarkshire, belonging to the United Collieries, Ltd. These collieries are:—Bredisholm, Calderbank, Ellismuir and Clydeside. The electrical engineers responsible for the scheme are Messrs. D. Selby Bigge & Co. Two mixed pressure turbo-alternators of the Dick, Kerr-Bergmann type are installed, one at No. 3 pit, Bredisholm, and the other at the Calderbank pit. Each turbo-alternator is capable of developing 600 kW., at 3,000 R.P.M. The alternators generate three-phase current at 3,000 volts and 50 cycles. The exciters are carried on the end of the turbo-alternator shaft, and there is also installed in each station a separate motor-driven excitation set. A Thury automatic voltage regulator is installed. An exhaust-steam regenerative accumulator by Messrs. Richardsons, Westgarth, is installed at each station to deal with 24,000 lb. of steam per hour, and is capable of bridging engine stops of 45 seconds duration. The H.T. switchgear is by Messrs. Dick, Kerr. The various pits in the group are linked up by bare aluminium overhead transmission lines, and the system is so designed that either generating station may supply the complete network, or the two stations may run in parallel. A 206 K.V.A. step-down transformer is installed at Bredisholm, No. 3 Calderbank, and No. 3 Ellismuir pits, and a 112 K.V.A. transformer at Bredisholm No. 2 pit, for supplying motors below 75 H.P. at 500 volts, and at Clydeside Colliery a motor-generator of 265 kW. capacity is installed for supplying previously existing plant with direct current at 500 volts. The transformers are by the British Westinghouse Co., and the motor-generator by the British Thomson-Houston Co.

**Liverpool.**—On Monday evening last the whole of the public electricity supply in the city was shut down for three-quarters of an hour at 9 p.m. No explanation has been given of this extraordinary occurrence, which in view of the inconvenience attendant on a failure of such magnitude, appears to call for the fullest inquiry.

**Lowestoft.**—The T.C. has decided to apply to the L.G.B. for a loan of £2,000 for house services.

**Malvern.**—The U.D.C. has applied to the L.G.B. for a loan of £2,000 for cables for mains extensions for two years.

The charges for the meter hire have been reduced to 2s. 3d. per quarter for 30 lights, and to 3s. 3d. for over 30 lights. This will reduce the revenue by £50 a year.

**Merthyr.**—The T.C. has agreed to the erection of transformer stations at Treharris and Merthyr Vale, and the plans submitted by the Merthyr Electric Traction Co. have been passed.

**Prestwich.**—Owing to negotiations between the Council and the Salford Corporation Gas Department having fallen through, the clerk has been instructed to approach the Salford Corporation Electricity Department regarding a supply of electricity for house and street lighting on the Moorfields Estate, and also to ascertain terms for street lighting for the whole district.

**Sevenoaks.**—After consultation with the B. of T. the U.D.C. has accepted the offer of Messrs. Crompton & Co. to take over the E.L. order, subject to the consent of the B. of T. If this is secured there will be a supply of current available within a year.

**Skelton and Brotton.**—The U.D.C. has accepted the tender of Messrs. Graham Bros., of Middlesbrough, for lighting the district by electricity. The change from gas will take place in September, 1913.

**South Africa.**—In connection with a proposal to increase the debenture issue of the Victoria Falls and Transvaal Power Co., Ltd., the secretary states that the Victoria Falls Co. has received applications for electric supplies amounting to 52,000 H.P., while, in addition, the Rand Mines Power Co. has received applications for electrical supplies of 67,000 H.P. and 66,000 H.P. of compressed air, making a total notified demand of 185,000 H.P. The total generating plant capacity installed, including reserve, amounts to 132,000 H.P., and the fresh capital is needed to supply the surplus demands.

**South Molton.**—The T.C. has decided to interview a representative of Messrs. Crompton & Co. with reference to a proposed E.L. scheme for the borough. The firm offers to work an order for the Council, or to form a syndicate for financing a scheme.

**Stanwix.**—The Carlisle T.C. has decided to proceed forthwith with the laying of cables to Stanwix.



**Walsall.**—Negotiations are proceeding with the L. and N. W. Rly. Co. with a view to supplying them with current. The question of letting out motors and other plant on hire is to be taken into consideration. The Electricity Committee has adopted various recommendations for forming a progressive maximum scale of salaries to be paid to the officials and workmen in the electricity department. By these recommendations immediate increases to the aggregate of £30 13s. per annum are involved.

**West Bromwich.**—A L.G.B. inquiry was held last week respecting an application by the T.C. for sanction to borrow amongst other items, £7,700 for the extension of the Corporation's electricity works. The borough treasurer explained that for the first two years—1902 and 1903—of its working there was a loss of £1,840. From 1904 up to the present time, however, the concern had yielded a profit of £15,126, out of which £4,800 had been contributed to the relief of the rates. The consumption of electricity showed an increase for the past year of 600,000 units over the previous year. The present plant, it was also stated, was barely adequate to meet the growing demands, hence the extensions and the application, to which there was no opposition offered. At the conclusion of the inquiry, the Inspector visited the electricity works and promised to report.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The Tramways Committee has unanimously agreed to recommend the adoption of the P.A.Y.E. system on six new cars, which will be tried on the Mannofield route; it has also been agreed to adopt a certain type of wind screen, costing £5 per car, for the protection of the driver, this having been decided on as the result of experiment in the city.

**Ayr.**—A deputation from the Corporation is to visit Leeds and Bradford, to inspect the railless trolley system of traction.

It is proposed to extend the Ayr system to the new racecourse by way of George Street.

**Belfast.**—On Monday the Tramways Department issued a return showing the revenue, net revenue and appropriation accounts of the undertaking up to March 31st. These reports show that the total revenue amounted to £243,074, or an increase of £24,773, and the working expenses to £129,777, or an increase of £16,818. This leaves a working profit of £113,297, or an increase of £7,995. The net revenue charges, including interest on debt, the annual fixed payment of £8,961 to the general purposes fund, income-tax, stamp duty, amount to £52,299. The net revenue, or disposable profit therefore amounts to £60,997, being an increase of £6,946 over the previous financial year. The actual disposal of the net revenue is definitely fixed by the Act of 1904, and it will be appropriated as follows: Sinking fund, £24,554; depreciation fund, £13,000; general purposes fund, £24,443, making a total of £60,997. The anticipated income of the present year is £260,000; working expenses, £135,500; working profit, £124,500; net revenue charges, £50,500; net revenue, £74,000.

At the fortnightly meeting of the Tramways and Electrical Committee, Mr. B. Croft was appointed chief assistant to the electrical engineer, in room of Mr. A. N. Moore, appointed to another cross-Channel post.

The extensions of the tramway lines in various parts of the city are to be commenced this week, it is understood.

**Continental Notes.**—**GERMANY.**—The benzol-electric railway, which has been built by the authorities of Schmöckwitz, and runs to the neighbouring town of Grünau, through the Royal forest and along the shores of the Lange Lake, has just been inaugurated for working.

**SWEDEN.**—The electrification of the State Railway network is making steady progress. The Government is steadfastly pursuing the realisation of its great scheme of electrifying the whole of the southern network, as the recent measures for the acquisition of waterfalls show. The network destined for electrification stretches from the Bollnäs Station to the main line going northward to Lapland. The several northern lines, on the other hand, are not considered in the scheme, with the exception of those employed for the transport of iron ore from the mining district of North Sweden, as the frontier line and the Lulea-Gällivare line, which, as is well known, will be worked from the power station at the Porjus Falls. The lines of the southern network to be electrified comprise the most important main lines, the first in order being the Stockholm-Gothenburg line in the west and that to Malino in the south. The abundant water-power that exists in the southern parts of Sweden facilitates the carrying out of electrification on the amplest scale. One of the first steps in this direction is the agreement come to between the Government and the State Waterfalls Department on the one hand, and the Stockholm Electricity works on the other for the electrification of the Stockholm-Marsta and the Gothenburg-Alingsås sections. For the latter the great power house at Trollhattan Falls will supply the power. At the moment the Government is negotiating for the acquisition of several rapids on the Motala stream. According to the plans of the Railway Department it is intended to build two power stations on the last-mentioned stream, at waterfalls owned by the State, for the working of sundry southern and western sections, and

notably the Järna-Nyköping-Norrköping line, now under construction, which will slightly shorten the journey for Swedish-German traffic. On the opposite side of Sweden the distribution network of the Trollhattan power station already reaches as far as Skofele, and will be eventually extended to Låxi at least, north of the Wettern Lake, coming into touch with the network of the power station on the Motala stream which is to be built. Furthermore, the Government is building a great power station at Eltökarleby Fall, from which energy will be distributed as far as Katrineholm and Nyköping. With these power plants the State will be able to provide for the whole of middle and southern Sweden, with the exception of the remotely southern parts, which, however, will be served by the networks of several private companies. For these districts, however, the Government will also shortly cater, by means of a power station which is to be established at the Karsö Fall. It is, therefore, only a question of time for the Swedish Government to supply the power requirements of the whole of its railway network, in the southern half of the kingdom at least.—*Elektron und Maschinenbau.*

**SPAIN.**—A Royal Decree has been published in the *Gaceta* annulling the concession for an electric tramway from Renteria to the French frontier, granted to Don Gonzalo Hernandez and Perez Medel, owing to the non-fulfilment of obligations officially imposed.—*Electron.*

**RUSSIA.**—A Belgian syndicate has secured a concession for the construction and working of a system of electric tramways in the town of Riga.

**SWITZERLAND.**—The Elektrische Strassenbahn im Kanton Zug Gesellschaft is the name of a new company which has lately been formed at Zug, with a capital of £280,000, to construct and work a system of electric tramways in the district.

**Dundee.**—The extension of the  $\frac{1}{2}$ d. stages on the local tramway system has again engaged the attention of the Tramways Committee of the T.C. It will be remembered that the stages were considerably shortened when the 1d. all-the-way fares were introduced, but it was then hoped that any surplus on the year's working would go to benefit the  $\frac{1}{2}$ d. stages. Mr. Fisher, the manager, in speaking on the proposal, said that while they thought the uniform charge over the system would be popular, they knew they would lose money. They estimated for a drop of £2,200 in the revenue, leaving only £2,900 to be placed to the renewal account, as against £5,550 the previous year. While the coal strike and the ideal tramway weather had benefited the tramways to a great extent, he was of opinion that the Committee was not yet in a position to make a proper comparison with any previous year, and he recommended that no change be made in the meantime. He suggested that they lay aside £4,500 for renewals. The Committee, after discussion, agreed that no change be recommended to the T.C. this year.

**Glasgow.**—A lengthy discussion took place at the last meeting of the T.C. on a proposal to give the general manager power to replace 100 of the converted horse cars still in the service of the department by a similar number of cars of the latest type such as are at present under construction at the departmental works at Coplawhill. The main points raised were the suggestions that double bogies should be introduced, and that the cars should be made half as long again as at present, so as to diminish oscillation on the double-decked type of cars and permit of a larger carrying capacity during the busier hours. It was argued in opposition that the double bogie had been tried on the early cars, but had been discarded, while to lengthen the cars would mean the tearing up and relaying of considerable lengths of rails at some of the more acute angled street corners. The original proposal was adopted. It is understood that in the new cars few new features are being introduced, the main point being an increased wheel base and a lengthened truck to reduce oscillation.

**London.**—The L.C.C. has decided to enter into an agreement with the Metropolitan Tramways, Ltd., for through running of cars between Euston Road and Enfield Town, via Camden Road and Seven Sisters Road. It is expected that through running arrangements will be instituted to other points in Middlesex at later dates.

**Paisley.**—The T.C. has for some time past been pressing the Paisley and District Tramway Co. to carry out the construction of the lines in the Meikleriggs and Greenock Road districts, for which sanction was obtained under its order. It was reported at the last meeting of the Electricity Committee that the company's agent had said that the company might be prepared to put on motor-buses, if the Corporation consented to the repayment of the amount deposited in security of its obligations under the Acts.

**Renfrew.**—A reply has been received from the B. of T. to a letter sent by the T.C. regarding the alleged dangerous swaying of the Paisley and District Co.'s double-decked cars. The board states that it had obtained drawings of the cars, and had to advise the Council that there was no danger. It, however, considered that the centre of gravity should be lowered, and had suggested that in any new cars to be built the tramways company should pay attention to this. In discussing the communication, the opinion was expressed that, to a great extent, a remedy would be effected if the tramway company put its track into proper repair. The clerk was asked to again write the Board on the matter.

**Rochdale.**—The year's working of the tramways has produced a net profit of £6,486, the largest surplus realised since the undertaking was electrified and brought under the Council. From the amount named an item of £580 overspent on capital account is to be met. The balance of £5,904 it is proposed to allocate to a



depreciation fund for renewal of track, &c., on which heavy expenditure is anticipated in the near future. The total income amounted to £73,002, compared with £63,000 for the preceding 12 months. The working expenses were £37,367, against £34,355, and the gross profits £35,635, against £28,644.

**West Hartlepool.**—A B. of T. inquiry was held on the 11th inst. into the application of the Corporation for a prov. order empowering it to construct new lines in Lynn Street, Musgrave Street, Park Road, Wooler Road, and Hart Road. Mr. Kinder said the Hartlepool line was constructed in 1886, the Park and Foggy Furze sections in 1895, and the Seaton Carew light railway in 1897. The Park and Foggy Furze sections had been purchased by the Corporation of West Hartlepool, and were now being worked by the Tramways Co. under agreement. The proposed new lines would, with the existing lines, connect the railway station, the shopping centres, the amusement centres, the public markets, and the residential centres. The length of the new sections would be 4½ miles, and they were designed to serve a population of 30,000. The West Hartlepool Corporation was negotiating with the Hartlepool Tramways Co. for the purchase of the Seaton Carew line and with the General Electric Tramway Co. for the lease of that part of the Hartlepool section that was in the Hartlepool borough. If these negotiations failed the West Hartlepool Corporation was prepared to have a clause inserted in its Order giving powers for mutual through running.—Mr. Jones said all the tramway companies asked was for the insertion of a clause that, failing the purchase by the Corporation, the companies might have power to run over the Corporation's lines to Church Street, and to this Mr. Kinder agreed.—The Inspector said that they could take it as agreed that there would be a clause for mutual running powers. During the inquiry, Mr. Hamilton (Leeds) gave evidence in favour of the scheme, pointing out the advantage of cheap energy, derived from waste heat, to the Corporation.

**Worsley.**—It is reported that arrangements are to be made whereby the service on the South Lancashire Tramways Co.'s section from Worsley Court House to Winton, is to be fully resumed. This service connects with the Salford Corporation system at Winton.

## TELEGRAPH and TELEPHONE NOTES.

**Congo State.**—The Government has allocated £68,000 for the establishment of wireless telegraph stations in the Congo State during 1912.—*Board of Trade Journal*.

**France.**—It is proposed to lay a new submarine telegraph cable between Marseilles and Algiers, and to erect a new telegraph line between Paris and Marseilles.

**Germany.**—A wireless station of the largest dimensions is to be built on the Rübentberg, in Neustadt, Hanover. The chief mast of the station will be 350 metres high.

**Italy.**—The Italian Telegraph and Telephone Department have just commissioned the Bell Telephone Manufacturing Co., of Antwerp, to extend the telephone exchange at Rome, equipped by that firm some years ago. Since the taking over of the telephone service by the State, the Bell Co. have equipped not only the exchange at Rome, but those at Milan, Naples, Catania, Genoa and Turin.—*Electro*.

**Japan.**—A new telegraph cable has just been completed between Osaka and Tokushima.

**Telegraph Clerks.**—The annual Conference of the Postal Telegraph Clerks' Association was held at Cardiff, on Friday and Saturday last week.

According to a recent official statement, the London Central Telegraph Office employs 4,456 persons, and the London Telephone Service 1,796 persons. The former includes 13 superintendents, 112 assistant superintendents, and 158 overseers, with 1,632 telegraphists, and 387 members of the cable-room staff. The latter comprises 12 exchange managers, and a female staff consisting of one superintendent, three supervisors, 160 assistant supervisors, and 1,402 telephonists.

**Wireless at Sea.**—The awful catastrophe by which the s.s. *Titanic* was wrecked and over 1,300 persons lost, again exemplified the enormous value of wireless telegraphy on board ship. The collision was immediately made known by its means, not only to the shore station at Cape Race, but also to a large number of vessels, and the fact that none of these was able to reach the spot before the ship foundered was due, not to any shortcoming on the part of the wireless system, but simply to the unfortunate circumstance that they were all too far off to cover the distance within the four hours at disposal. The speedy rescue of the survivors from the boats was wholly due to the accurate information as to their whereabouts supplied by wireless telegraphy, which also kept those on shore acquainted with the state of affairs. The apparatus on the *Titanic* was that of the Marconi Co., whose operators dauntlessly remained at their post until, for some reason, transmission became impossible; one of them, Mr. Bride, was fortunately rescued, but the other, Mr. Phillips, is missing, and we fear he went down with his fellow-heroes, who placed the safety of others above their own.

**Wireless Fog-Signalling.**—Two new applications of wireless telegraphy for the purpose of protecting vessels against the risks attending sea-fogs have recently been mooted—one by a French inventor, Lieut. Lair, the other by Mr. Marconi. Details are not at present available.

**Wireless Telegraphy and Aircraft.**—The question of fitting military aircraft with apparatus for wireless telegraphy is of considerable interest and importance, and Marconi's Wireless Telegraph Co. have of late given much attention to this problem. Experiments have recently been carried on at the Army Aircraft Factory at South Farnborough. Late in March an Army aeroplane went out for a short flight fitted with a clockwork V sender, and from it good signals were received. Early in April similar experiments were carried out, but in these, Capt. Dawes, of the Air Battalion, went as a passenger and transmitted his observations to the receiving station at the factory. The messages which he sent were very clearly received. Later, the machine flew over an area of 3 or 4 miles' radius from the aircraft factory, and Capt. Dawes was able to report on the movements of troops manœuvring in the vicinity. These reports, which would have been of the utmost military value, were taken down at the receiving station, which was in touch with the aeroplane during the whole of the flight. On the third circuit Capt. Dawes himself received the messages which the Marconi operator transmitted from the aeroplane. The experiments, which were for the purpose of demonstrating the efficiency of the special Marconi apparatus employed, were thus entirely successful.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—May 1st. Two sets of counter-current jet condensing plant with steam-driven pumps, and one natural draught wooden chimney cooler, for the Borough Electricity Department. See "Official Notices" April 12th.

April 23rd.—Electric wiring of the Workhouse. Specifications, &c., from Mr. G. H. Partington, clerk to the Guardians, Poor Law Offices.

**Australia.**—VICTORIA.—May 1st and 8th. Cable for P.M.G.'s Department.

May 6th.—Arc lamp carbons for the Melbourne City Council. See "Official Notices" to-day.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—Electric vehicles for the Electric Supply Committee of the City Council of Melbourne. See particulars in this column for April 5th.

June 4th.—1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" to-day.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays. See "Official Notices" April 12th.

May 28th.—Deputy P.M.G., Melbourne. 100 tons bronze wire, 262 tons of hard-drawn copper wire, 188,500 copper binders, 11,500 sleeves, and 126,000 copper tapes (Schedule No. 686). Specification can be seen at the Board of Trade Commercial Intelligence Department.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

QUEENSLAND.—May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

WESTERN AUSTRALIA.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

N.S.W.—Three centrifugal pumps (12,000 gallons per minute), five 350-KW. transformers, A.C. motors, for White Bay power house, for N.S.W. Government Railways and Tramways Department. Electrical Engineer's office, 61, Hunter Street, Sydney.

**Austria.**—April 25th. The authorities of the Austrian Northern Railway in Vienna are inviting tenders for an installation of electric lighting, comprising 80 arc lamps, at the railway station at Oderberg.

**Bedford.**—Electrical plant (100 lights) for the Powage Press, Ltd. See "Official Notices" to-day.

**Belgium.**—May 20th. The municipal authorities of Bilsen (province of Limbourg) are inviting tenders for the establishment of a central electric lighting station in the town. Particulars may be obtained for 3 fr. from, and tenders are to be sent to, Le College des Bourgmestre et Echevins, Bilsen (Limbourg).

**Bolton.**—April 25th. Materials and stores for a year, for the Corporation Electricity Department. See "Official Notices" April 12th.

(Continued on page 645.)



# INTERNAL COMBUSTION ENGINES FOR ELECTRICAL INSTALLATIONS.

## The Körting Gas Engine.

It is some 10 years since MESSRS. MATHER AND PLATT, LTD., of Manchester, took up the manufacture of the Körting type of two-cycle, double-acting gas engine; and during this period they have modified and simplified the design in accordance with experience, in order to obtain a machine which could be considered reliable for every class of work and varying conditions of load. From the point of view of simplicity, it is claimed that the present design is a very big step in advance of anything yet attempted in internal-combustion engine design, and has resulted not only in reducing cost for upkeep and attention, but also in greater reliability. This is borne out by the non-stop runs carried out with several installations, the engines running continuously for periods of four to five months at a time without any stop whatever, and recently one of these engines ran continuously for one month directly after starting up in the first instance.

It will be noticed

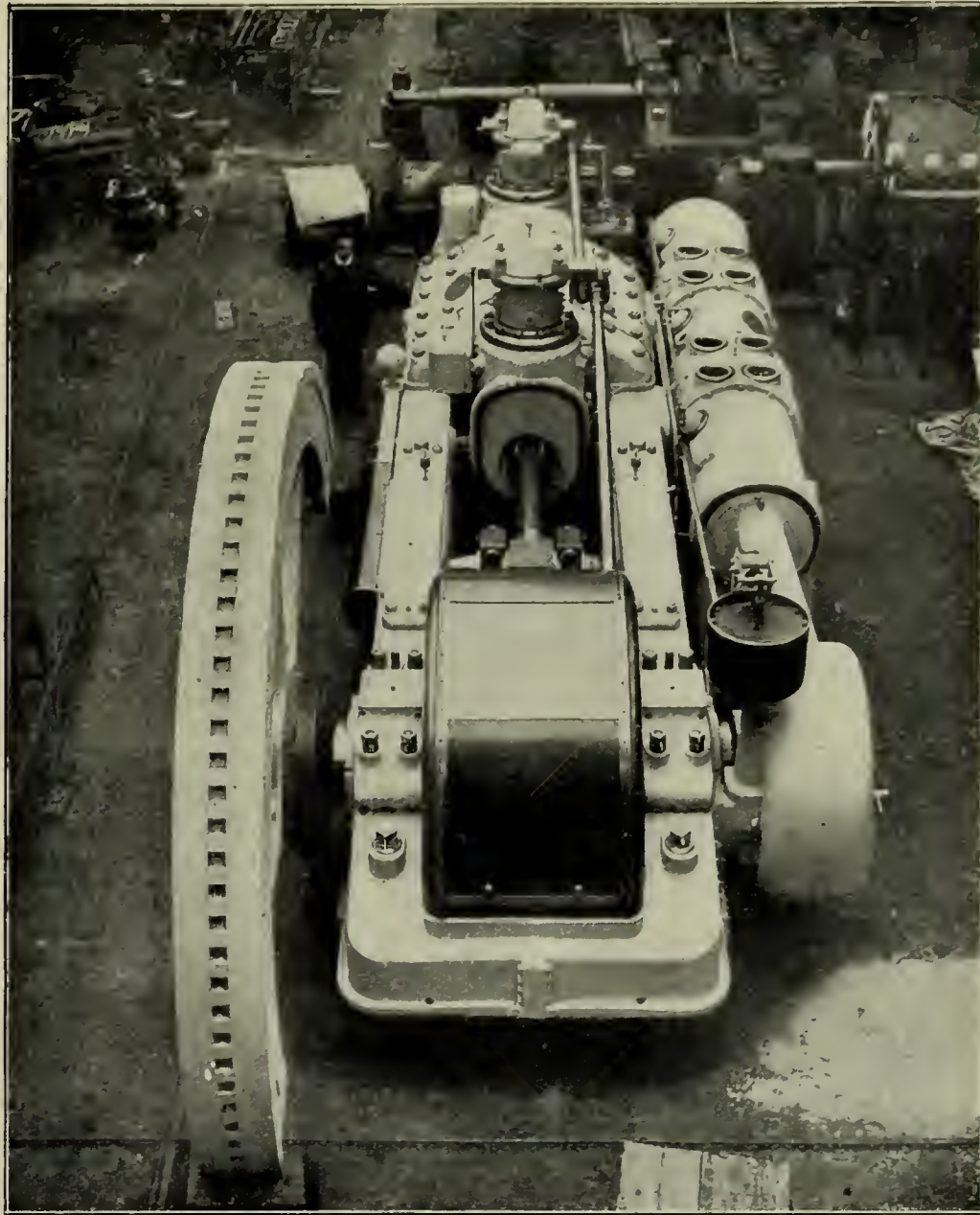


FIG. 1.—600-B.H.P. SINGLE-CYLINDER TWO-CYCLE KÖRTING GAS ENGINE.

that all side shafts, with their accompanying gears, cams and levers, have been dispensed with, as well as the mechanically-operated valves on the pumps. What remain now are simply the two inlet valves, which receive their motion through a rod and eccentric directly from the crankshaft. The valves in the pump are all automatic, and are mounted in a cage which is easily removable.

Messrs. Mather and Platt have carried out a number of large gas-engine installations, where the engines are used to generate electricity, using various classes of fuel, such as bituminous and anthracite coal, coke, wood shavings, &c., town's and coke-oven gas, and blast-furnace gas, and the engines have given satisfactory results under all conditions.

Fig. 2 shows three 500-B.H.P. twin-cylinder gas engines direct coupled to three-phase alternators; the engines use gas made from colliery waste fuel, the by-products being first extracted from the gas.

Fig. 1 shows a single-cylinder two-cycle gas engine of 600 B.H.P. in Messrs. Mather and

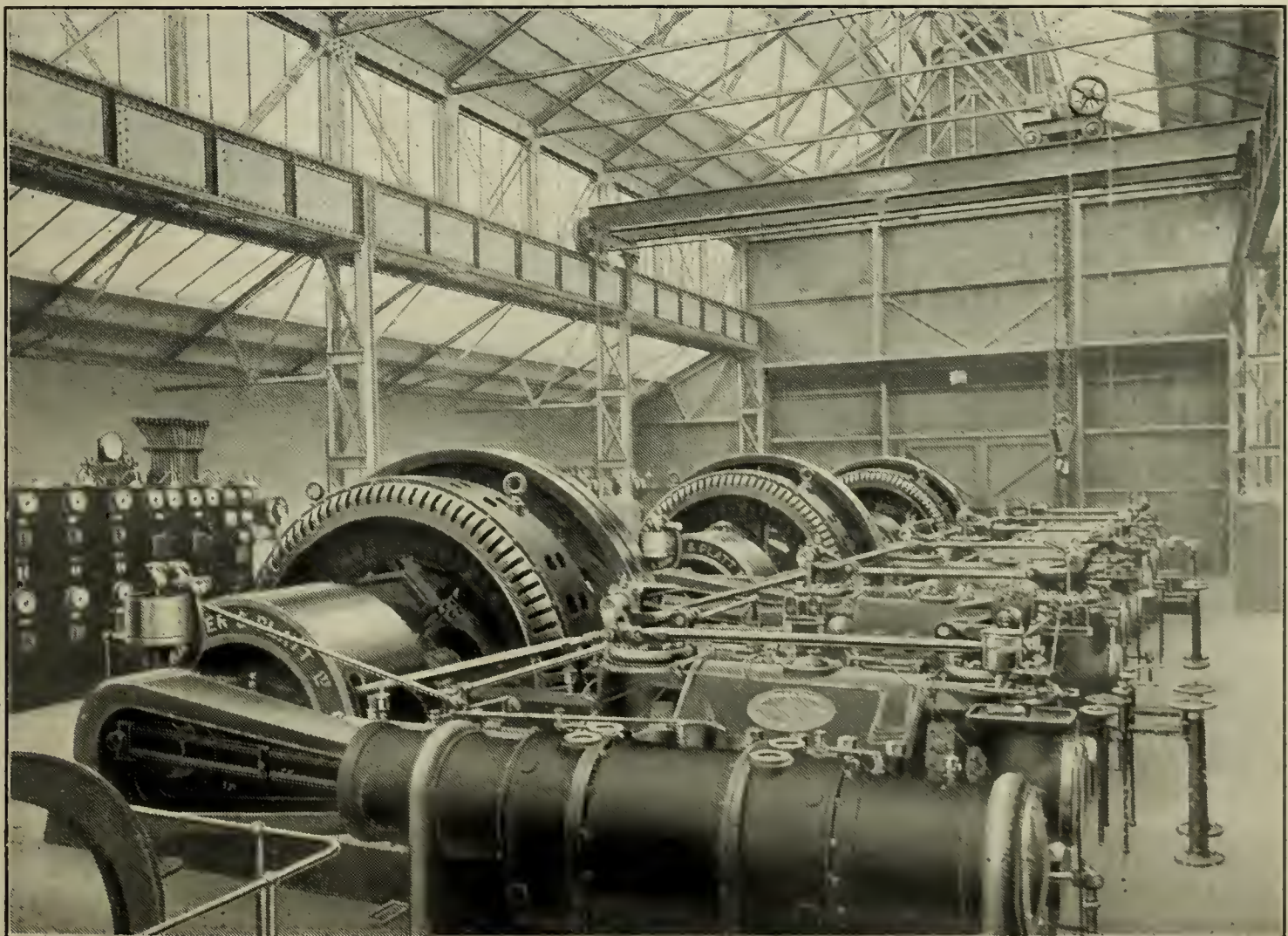


FIG. 2.—THREE 500-B.H.P. TWIN-CYLINDER KÖRTING GAS ENGINES AND THREE-PHASE ALTERNATORS.



Platt's works. An engine of this type is working on coke-oven gas, and generating direct current for colliery work, and a second engine for this plant is being built, after some 18 months' working of the first engine. Similar engines are also being supplied to work on blast-furnace gas.

### Premier Gas Engines.

THE PREMIER GAS ENGINE CO., LTD., of Sandiacre, were amongst the first of our gas-engine makers to build large gas engines, and their system of positive scavenging, devised many years ago and since improved from time to time, has always been

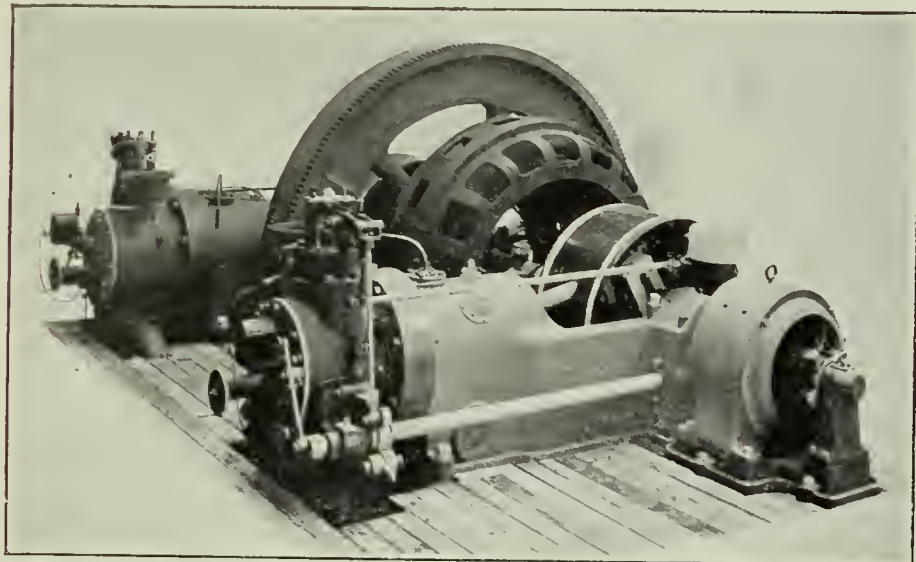


FIG. 3.—PREMIER TWIN ENGINE DRIVING ALTERNATOR.

a distinguishing feature of their engines. They have consistently preferred the horizontal type, considering that their multi-cylinder high-speed horizontal engines are superior to the vertical type and more reliable than the latter, while they occupy but little floor space, are well balanced, have forced lubrication, and are more accessible for cleaning and supervision, as all the parts can be inspected from the floor level.

These engines are made for all powers from 60 to 1,000 H.P., and the firm also make a line of low-speed tandem engines of single, twin and side-by-side patterns, with powers ranging from 400 to 2,500 H.P. The firm have designs ready for engines of 5,000 H.P.

A large number of their twin type engines have been exported to Japan, amongst other countries, and we illustrate in fig. 3 one of these engines driving an alternator, which is mounted on the crankshaft next the fly-wheel, between the two cylinders.

A four-cylinder engine of standard design is shown in fig. 4; this was recently shipped to the Hasami Gold Mines, Japan, and drives an alternator of 300 kW., running for 14 days at a time without a stop. The engine runs at 164 R.P.M. on Mond gas, and is of the "positive scavenger" type.

Another view (fig. 5) shows the front end of a double-twin engine, one of two supplied to the Kankoku Gas-Electric Co., Japan, for driving 300-kw. alternators in parallel. A similar but smaller set is going to the Tokio Military Arsenal. This is not one of the maker's own standard designs, these engines having been constructed to specifications supplied by the purchasers' consulting engineers.

In view of the unfortunate failure of the municipal gas engine plant at Johannesburg, it is interesting to note that a 450-H.P. Premier gas engine has been installed at Groenfontein, at an

elevation of 4,000 ft. above sea-level, fed from a gas producer made by the Power Gas Corporation, Ltd., and drives a 300-K.V.A. A.E.G. alternator. The producer is fed with bituminous coal. The engine has run with perfect satisfaction since its installation last summer, and should do much to remove the prejudice which has been set up in South Africa against gas engines by the Johannesburg fiasco.

### The Mirrlees-Diesel Oil Engine.

Special interest attaches to the engines made by MESSRS. MIRRLEES, BICKERTON & DAY, LTD., of Hazel Grove, Stockport, seeing that the first Diesel engine made in this country was a Mirrlees-Diesel; that was 14 years ago, and the engine is still working. To ensure reliability, the Mirrlees-Watson Co., Ltd., ran several engines for two years in their own works, before they sold any, with the result that when they began to put them on the market they quickly developed a large demand and had to build new works, controlled by a separate company, for the sole purpose of making Mirrlees-Diesel oil engines.

The latter are all of the vertical type, with the valves in the cylinder covers. The engines are single-acting, and operate on the four-stroke cycle. They are made in sizes up to 1,000 H.P., mainly of the enclosed type, and of two classes—low-speed, 200-250 R.P.M., and high-speed, 400-450 R.P.M. All the enclosed engines have forced lubrication.

Fig. 6 shows a high-speed Mirrlees-Diesel engine as supplied to H.M.S. *Dreadnought*, and many other warships; these engines burn the same oil as the boilers are fired with, and their use enables the boilers to be shut down when in harbour, besides effecting a material saving.

A 500-H.P. four-cylinder enclosed engine supplied to the L.B. and S.C. Railway Co., to drive their new carriage works at Lancing, is shown in fig. 7. It is directly coupled to a dynamo. Similar engines of 500 and 750 H.P. have been made to numerous orders, both for home and abroad.

The air compressor of the Mirrlees-Diesel oil engine is of the two-stage type, and is direct driven from the engine crankshaft, being mounted on an extension of the engine bedplate. In this type of compressor the only bearings are the connecting-rod

bottom and top end brasses, and suitable provision is made for taking up any wear that may occur. This form of compressor is a great improvement on the link-driven type of machine, in which there are some eight to ten wearing joints, which are liable to cause trouble. Owing to the position of the compressor, the parts are all readily accessible for inspection or repair, and the valves may be changed with a minimum expenditure of time and trouble.

The valves are of the makers' improved type, which ensures

silent running, the noise peculiar to other compressors being entirely eliminated.

A special intercooler is provided for cooling the air between the two stages of compression, as well as after delivery from the high-

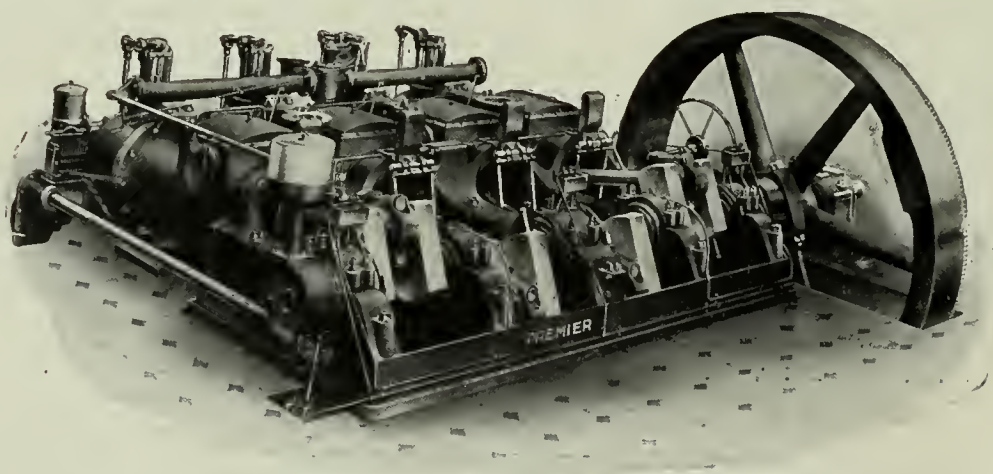


FIG. 4.—PREMIER STANDARD FOUR-CYLINDER ENGINE FOR HASAMI GOLD MINES.

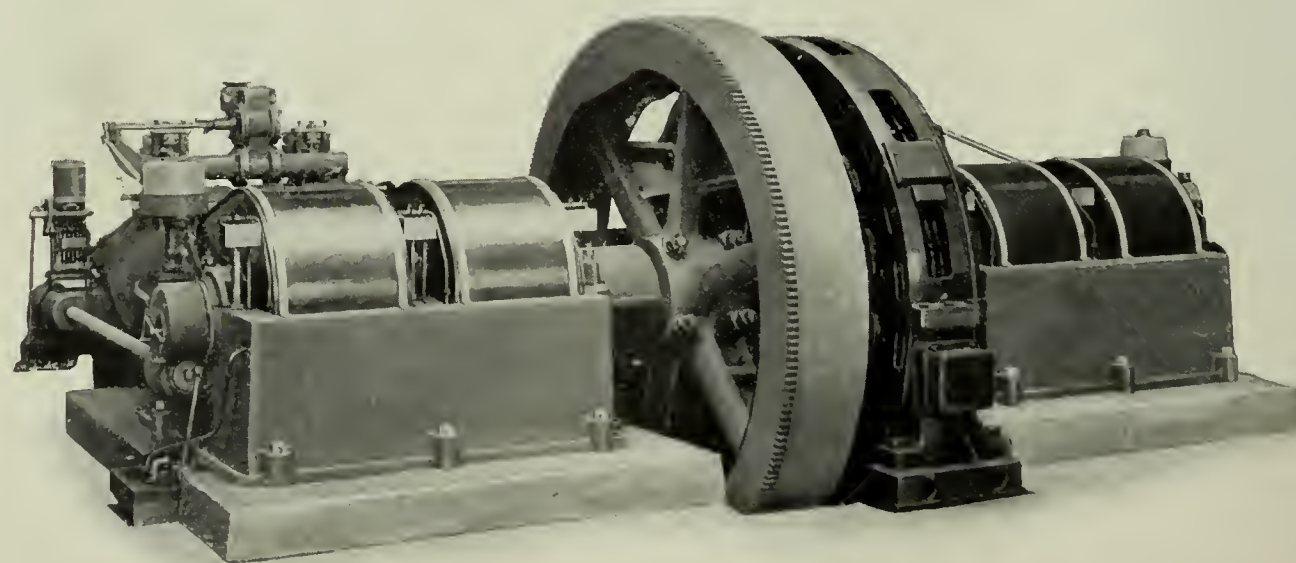


FIG. 5.—PREMIER DOUBLE-TWIN ENGINE DRIVING 300-KW. ALTERNATOR AT KANKOKU, JAPAN.

pressure cylinder, and this intercooler is also arranged so as to act as a separator for any oil or water which may have been carried over with the air.



The fuel pump is of special design, and is provided with a separate plunger and valves for each cylinder of the engine: this arrangement has the advantage that under all conditions of working each cylinder will take an equal share of the load on the engine, whereas in the single-plunger type of pump, as often fitted, this equal distribution can only be arranged for one particular load, and will not hold good over a varying range.

A special safety device is fitted to the starting cylinders of the engine, which automatically by-passes the fuel from the cylinder on starting up, thus preventing any accumulation of oil in the fuel valve casing of that cylinder if the attendant does not put the starting handle into the running position at once. This safety gear

branch of their business, and have supplied a large number of engines of powers up to 450 H.P., and running at speeds up to 250 R.P.M. The great majority of these have been required for

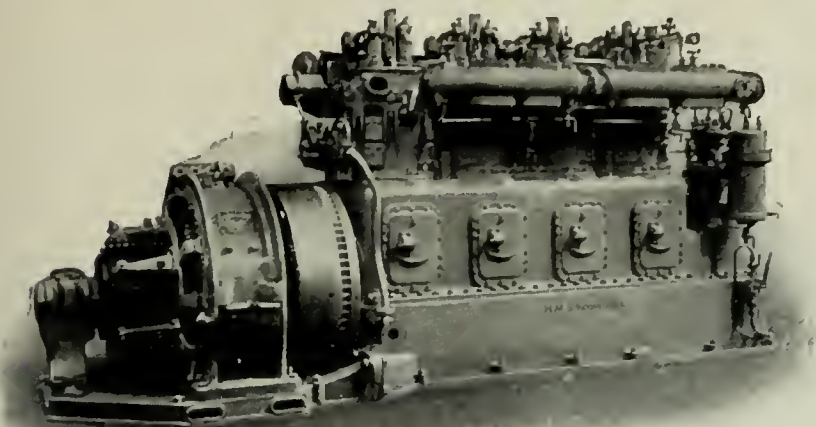


FIG. 6.—MIRRLEES-DIESEL HIGH-SPEED ENGINE AND DYNAMO FOR WAR VESSELS.

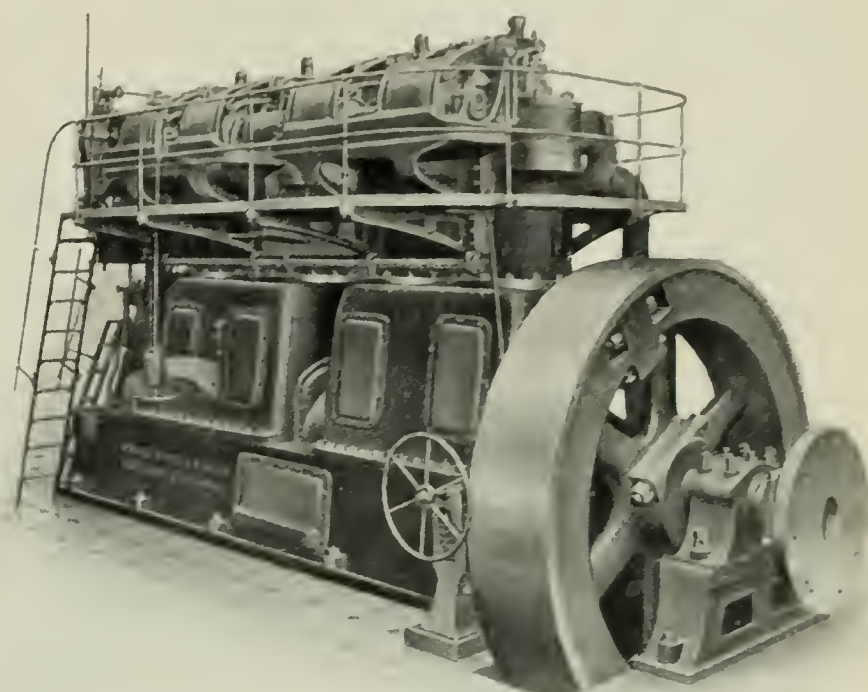


FIG. 7.—MIRRLEES-DIESEL 500-H.P. FOUR-CYLINDER ENCLOSED OIL ENGINE.

is also arranged so that any of the cylinders may be cut out as desired when the engine is running on lighter loads.

All valves are provided with removable seats, and as spare valves and seats for all the main valves are included in the engine equipment, the grinding-in of the valves can be carried out at any convenient time, and not necessarily when the engine is stopped. The actual changing of the valves and seats can be performed in a few minutes. In order to facilitate the changing of the exhaust valve, the valve lever is made in two parts, so arranged that by removing one bolt only the lever may be swung back, thus allowing the exhaust valve to be withdrawn without disassembling the remainder of the valve gear.

The gear wheels for driving the vertical and cam shafts are enclosed in oil-tight casings, and run in an oil-bath. The vertical shaft is cased in by a polished steel tube, with oil-tight glands at the top and bottom; this tube provides a passage for oil from the upper to the lower gear casings, and also acts as a guard, obviating any danger of the attendant's clothing being caught by the revolving shaft.

The cylinder covers are made in two pieces, a loose top being provided, so that any accumulation of sand or dirt which might collect in the water spaces can be thoroughly cleaned out. The cylinder liner can be easily withdrawn from the column, and the jacket space in the main cylinder cleaned if this becomes necessary. This feature of accessibility has proved of great advantage in cases where the water used contained a large amount of sediment.

Orders for Mirrlees-Diesel engines of over 5,000 H.P. in all were received between December 1st and February 29th, 1912, including several of 500 and 750 H.P. for driving electrical generators.

#### Willans-Diesel Oil Engines.

Amongst the earliest to take up the manufacture of the Diesel engine in England—having made certain sizes for the Diesel Engine Co. for some years—MESSRS. WILLANS & ROBINSON, LTD., of Rugby, have given special attention to the development of this

driving electric generators, and many of them have gone abroad. The Willans-Diesel engine is of the well-tryed four-cycle type, presenting no novel features save in the details of its construction; the makers' policy has been to adopt an engine of excellent general design, and to apply to it the many improvements in details and methods of manufacture which they have evolved during the years they have now been manufacturing this type of engine.

Their present standard sizes range from 50 up to 460 H.P., and their engines have been installed and are being manufactured for driving all classes of machinery, either as isolated units or in power houses containing other plant, in many parts of the world, and in the hands of many classes of drivers.

Fig. 8 shows one of four 280-H.P. engines supplied to the Alianza Co. and the Rosario Nitrate Co.'s Works in South America, coupled to alternators; and fig. 9 shows a Willans

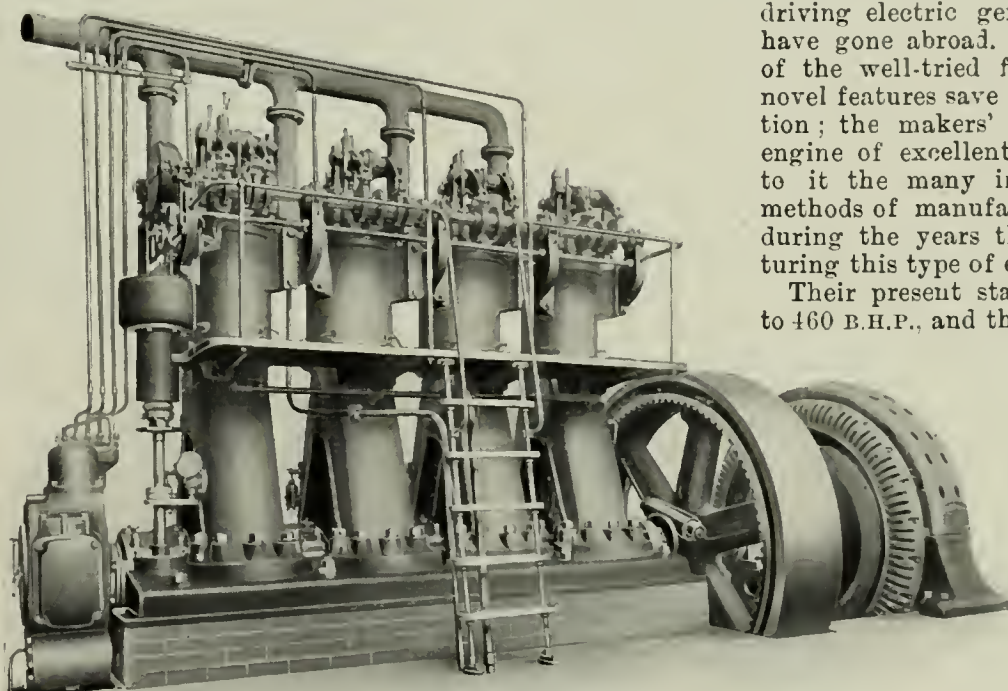


FIG. 8.—WILLANS-DIESEL ENGINE FOR SOUTH AMERICA.

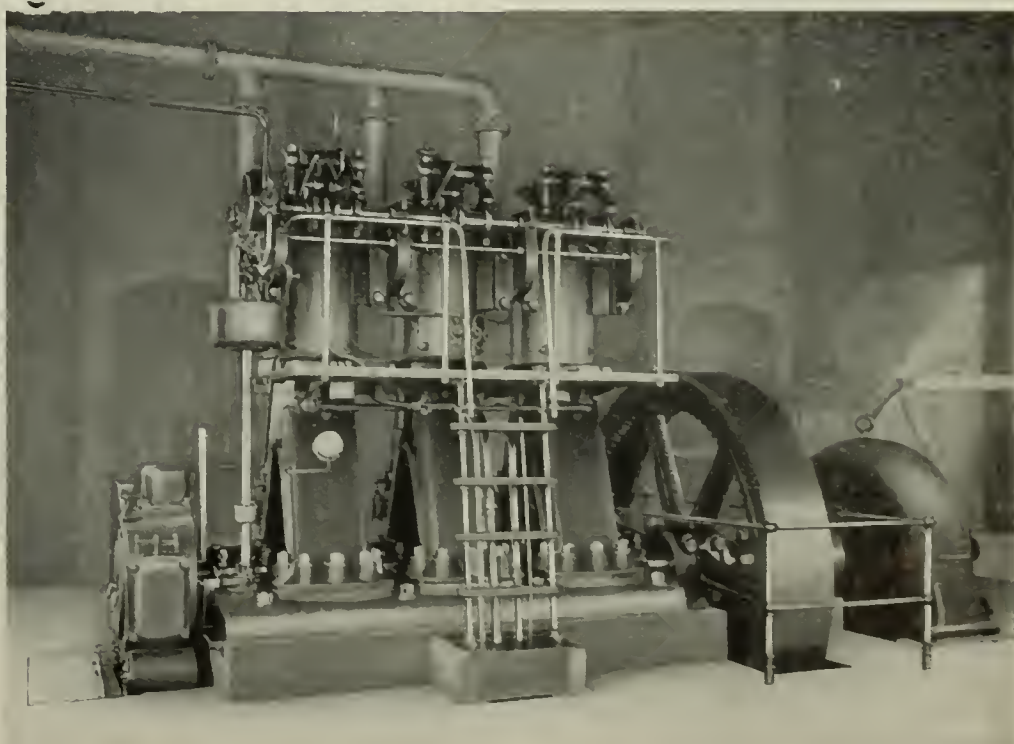


FIG. 9.—WILLANS-DIESEL PLANT, BRITISH URALITE CO.'S WORKS.

225-H.P. engine driving a dynamo at the British Uralite Cos. works in Gravesend.



In the manufacture of these engines, the whole of the parts are made to jigs, thus ensuring strict interchangeability of all similar parts of the same size of engine, and enabling all spare parts to be ordered with the certainty that they will fit the place for which they are intended, without any adjustment on the part of the purchaser—a feature sure to be appreciated by the users of the engines, especially those abroad.

#### The Turner Oil Engines.

These engines are made by MESSRS. E. R. & F. TURNER, of Ipswich, in a range of sizes from  $2\frac{1}{2}$  to 25 B.H.P., and owing to their rigid design and accurate balancing, are specially adapted for electric driving. In the smaller sizes they

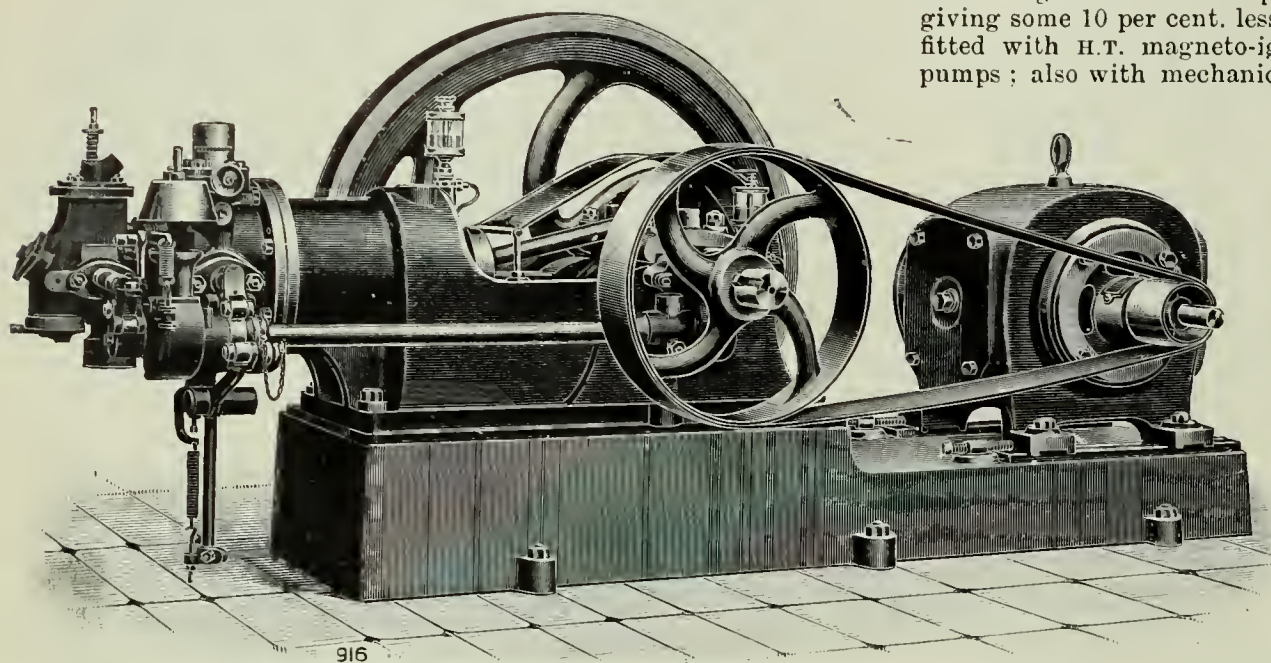


FIG. 10.—TURNER HORIZONTAL OIL ENGINE DRIVING DYNAMO.

are supplied, if required, with an extended base-plate for the dynamo, as shown in fig. 10. The larger sizes are fitted with two extra-heavy fly-wheels when used for electric driving, the smaller sizes being also fitted with two fly-wheels if used for "direct" driving, and balanced crankshafts are provided in all cases. The engines will run on any ordinary lamp oils, and on good-class crude oils, but are not recommended for use with heavy residual or refuse oils. The fuel consumption is exceptionally low, not exceeding '6 pint per B.H.P.-hr. in the small sizes, or '5 pint in the largest, when working on average loads. A starting lamp, supplied with each engine, is only used for a few minutes to heat the vaporiser and ignition tube when starting up; the necessary temperature for vaporising and ignition is afterwards automatically maintained, whether running on full load, or with no load whatever on the engine.

An air throttle is fitted, which is shut at starting and open when running. No adjustment is required when running at any load. The main and cam-shaft bearings of the 7-B.H.P. size and upwards are fitted with continuous oiling rings, while in all sizes the crank-pin bearings are positively lubricated by means of a specially-designed oil ring of the centrifugal type. Valve rollers, pins, lever gudgeons, &c., are hardened and ground exactly to size. For the foregoing reasons, these engines may be depended upon to run for many years without appreciable wear or replacement of parts. They are suitable for all power purposes, being successfully employed in driving grinding mills of all descriptions, chaff-cutters, saw-benches and wood-working machines, pumps both gear and belt-driven, &c. They are supplied in semi-portable or portable types, the former having a wooden carriage with wrought-iron axles and cast-iron road wheels, to facilitate occasional movement from place to place. With the portable type a wrought-iron carriage and road wheels are provided, a water tank being attached to the under side, and circulation and cooling are effected by means of a pump and surface trays. A current of cold air induced by the outgoing exhaust gases is passed through the latter, effectively cooling the water returning to the tank

#### Parsons Motors.

The PARSONS MOTOR CO., LTD., of Southampton, are best known for the numerous marine petrol engine installations which they have carried out.

The Parsons engine has, however, also been adapted for stationary use, and an example of petrol-engine and dynamo work—a 28-H.P. generating set—was illustrated and described in our issue of December 15th last.

It is sufficient to say that long experience has enabled the company to develop a thoroughly reliable engine, built in standard series, having  $4\frac{1}{2}$  in.  $\times$  6 in.,  $6\frac{1}{2}$  in.  $\times$  8 in., and 9 in.  $\times$  12 in. cylinders, giving a complete range of sizes between 7 H.P. and 180 H.P., at speeds of 750, 550 and 450 R.P.M. per series respectively. These engines can be adapted for using either petrol or paraffin, giving some 10 per cent. less output with the latter fuel, and are fitted with H.T. magneto-ignition, and cooling water circulating pumps; also with mechanically-operated main valves arranged on

the company's patented concentric principle, with a nickel steel exhaust valve in the centre of a hollow cast-iron inlet valve.

The company have already achieved considerable success with their engines abroad, there being, we understand, very few countries in which examples of their work cannot be found.

#### Reavell Oil Engines.

MESSRS. REAVELL & CO., LTD., of Ranelagh Works, Ipswich, whose quadruplex type compressors are so well-known, have for several years turned their attention to the manufacture of oil engines. The engines which they build are of the vertical high-speed type, and in designing and constructing them they have made it their aim to produce machines which shall be suitable for continuous

and heavy service for industrial purposes, so that the engines are specially designed for such conditions, and are not adaptations of the "motor-boat" or "motor-car" type arranged for other purposes.

We give an illustration, fig. 11, of one of their two-cylinder engines directly coupled to a dynamo, which is both extremely neat and substantial in appearance. The engine illustrated is of the 10-B.H.P.

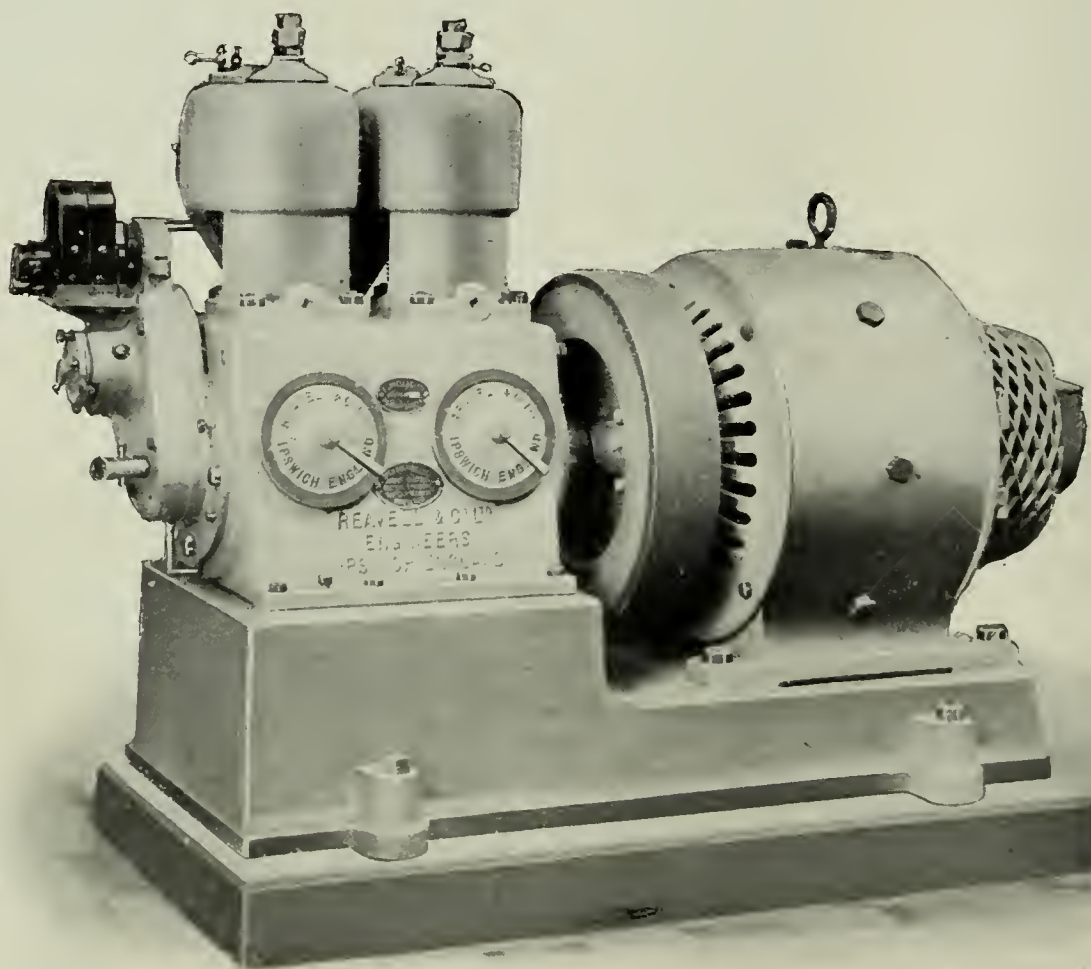


FIG. 11.—REAVELL 10-H.P. OIL-ELECTRIC SET.

size, and the speed is 800 R.P.M. This speed, while being very suitable for driving dynamos, centrifugal pumps, fans and so on, is at the same time not excessive, and conduces to long life of the engine and small wear of the working parts. The lubrication is arranged on the splash principle, and is therefore automatic, the connecting rods dipping at each revolution into the bath of oil in the crankcase and splashing it to the various bearings.

The vaporiser, arranged behind the engine, is of Messrs. Reavell's



own design, and is suitable for using either petrol, ordinary paraffin or lamp oil. The engine is started by using a little petrol, upon which it is run for a few minutes until the vaporiser is sufficiently heated, when the paraffin supply can be turned on. It can also be started on paraffin by heating the vaporiser with a blow lamp, if petrol is not available. All the working parts are interchangeable.

Messrs. Reavell supplied, in addition to other engines, 12 of the size illustrated to one of the large Indian railways last year, and they have a repeat order going through their works at the present moment for 10 more engines of the same size, destined for this railway.

#### The Kelvin Engine.

These engines operate on the four-cycle principle, and are built for both petrol and paraffin fuel.

An interesting constructional feature is the use of ball journal bearings, leading to a reduced length of engine. Every important

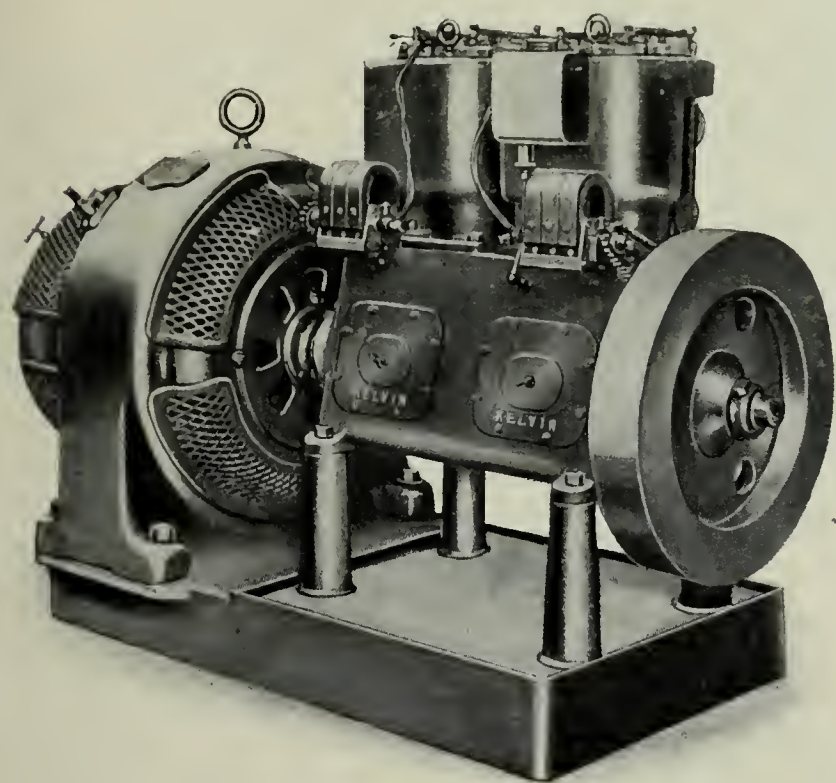


FIG. 12.—KELVIN ELECTRIC LIGHTING SET.

part is immediately accessible without disturbing other parts; the crankshaft can be withdrawn at either end, and the piston and connecting rod can be removed without disturbing the crankshaft or cylinder. In the larger sizes, the engines are fitted with the Bergius starting device, by means of which starting can be carried out without the usual vigorous cranking.

Either L.T. or H.T. magneto ignition is fitted, and a plunger pump provides cooling water circulation to the cylinder jackets. The engine governing, in conjunction with the special dynamo windings employed in the generating sets, gives a practically steady voltage from no-load to full-load.

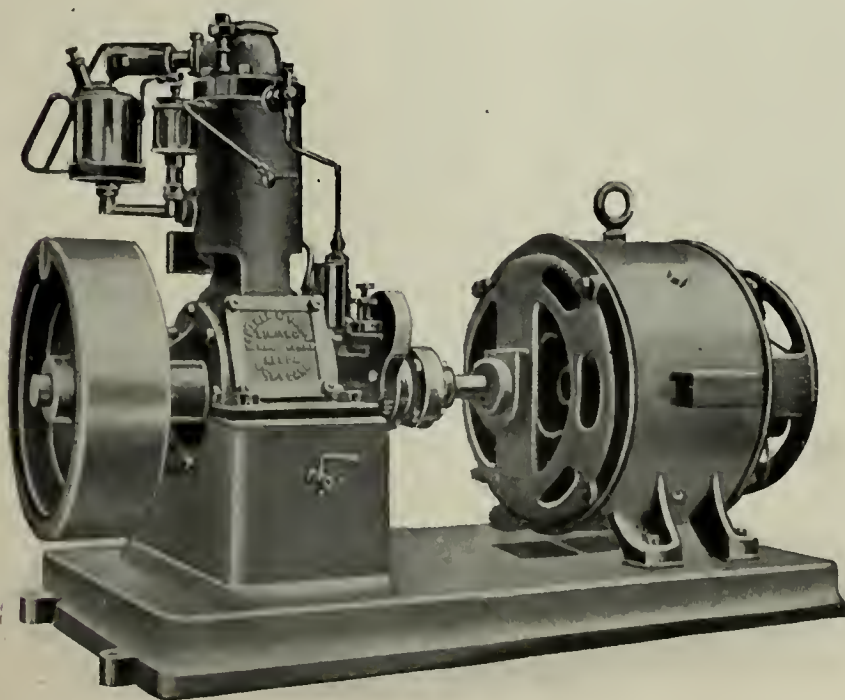


FIG. 13.—MARMOT TWO-CYCLE ENGINE AND DYNAMO.

The Kelvin generating sets are made in sizes ranging from 3 kW. at 850 R.P.M. to 32 kW. at 410 R.P.M.; they are also built in stationary or portable form, and a very large number have recently been supplied for farm work, ship-yards, cinematograph work, &c.

The engine is entirely made at the Kelvin Works, Dobbies Loan, Glasgow, and some idea of its success can be gathered from the fact that the works have been trebled in size within the last three years, 900 engines having been turned out within the last 12 months. The sole selling agents for these generating sets are Messrs. Fyfe, Wilson & Co., of 145, Bath Street, Glasgow.

#### The Marmot Heavy-Oil Engine Set.

We illustrate in fig. 13 a small electric lighting set made by MESSRS. SHAKER & YOUNG, LTD., of Marmot Works, Alloa, the engine being designed to run on any fuel between ordinary lamp oil and crude oil—specific gravity '79 to '89.

The set shown is of 3½ B.H.P. at 900 R.P.M.; it works on the two-stroke cycle, and is provided with fuel pumps giving a positive feed to each cylinder, while the ignition is automatic after starting, that operation being carried out by heating the ignition chamber by means of an oil burner working under air pressure and using the same fuel as the engine.

It is of interest to note that larger engines of 20 H.P. and more have self-starters fitted, working by compressed air—a compressor and air tank being supplied with the engine.

The Marmot engines are solidly made, with gun-metal bearings and phosphor-bronze bushes; inspection doors are fitted to the crank-case, and spare parts which might be required quickly, such as an ignition chamber, piston rings, paraffin strainer, &c., are supplied with each set.

#### Electric Lighting Sets by Chas. Price & Son.

We illustrate in fig. 15, page 630, a new type medium-sized generating set made by MESSRS. CHARLES PRICE & SON, Broadheath, near Manchester, in 1, 2, 3, 4 and 6-cylinder units, of from 10 H.P. to 75 H.P. The engine is built to run on petrol or petroleum, a clear and odourless exhaust being obtained when using either fuel, and the speed is 700-750 R.P.M.

The cam-shaft and valve-operating mechanism are situated above the cylinder, the valve tappets being adjustable for wear; the valves are contained in cast-iron cases, and are held in position by forged clips. The cams are hardened, and operate the valve-rocking lever through hardened rollers running on hardened pins; half-compression gear is fitted to ease the starting. Ignition is effected by H.T. magneto, with a supplementary system of synchronised coil and accumulator.

Oil is forced into the crankshaft bearings by a rotary pump operated by the vertical shaft at the front of the engine, and emergency sight-feed lubricators are also fitted. All the bearings have been arranged to avoid oil leakage, and the plant is exceptionally cleanly in working.

Cooling water is circulated by a gear-pattern pump, and the system is arranged to clear itself through one cock in frosty weather.

The governor is adjustable, and is specially sensitive, to secure the close speed control necessary on this class of work.

A large inspection door is fitted to the crank-case, through which the connecting-rod big-ends and crankshaft bearings can be adjusted for wear when necessary.

The set is adapted for accumulator charging or lighting direct, and runs very steadily and almost noiselessly, so that it can be installed in the basement of a building, where an outside power house is not available. Using fuel at 6½d. per gallon, the total cost per unit is stated to be approximately 1½d.

We also illustrate in fig. 14 one of this firm's high-speed lighting

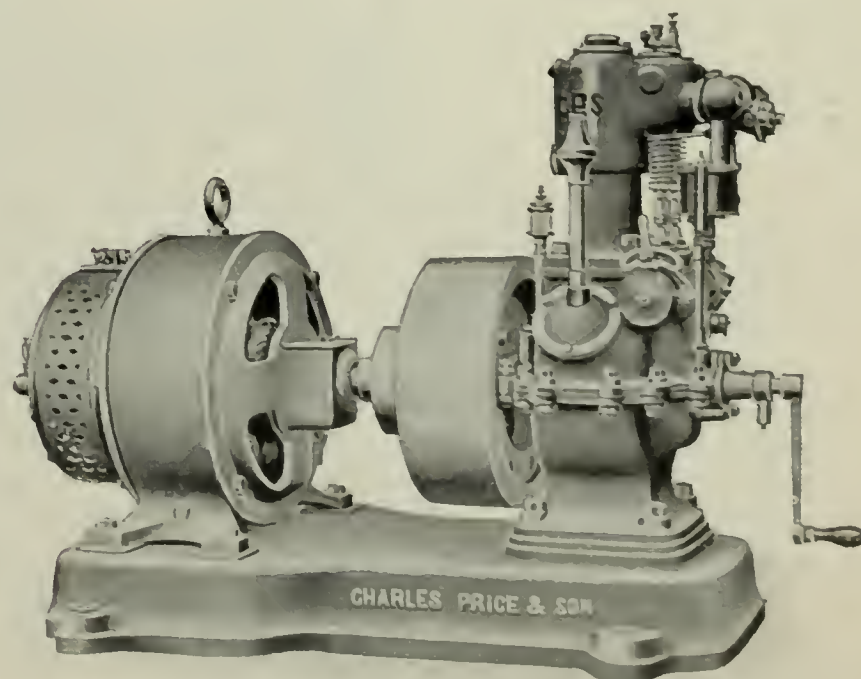


FIG. 14.—PRICE'S 1.5-KW. LIGHTING SET.

sets made in single, double and four-cylinder units from 2 to 26 B.H.P. Our view shows one of their 1.5 kW. paraffin plants, running at 1,000 R.P.M., with accumulator ignition. The engine valves are all on one side, and the cams are solid with the shaft, which is case-hardened, as is also the whole of the valve mechanism. The cam



shaft can be withdrawn easily, and is driven by a spiral gear as follows:—

Between the wheel on the crankshaft and that on the camshaft is fixed a transverse gear shaft, driving at one end the magneto and at the other the governor, which is coupled directly to the throttle, and cuts off at between 1,000 and 1,100 R.P.M. Adjustment for wear is provided on the crankshaft bearings, the connecting rod big-end and the valve mechanism, and by removing a cover the top of the piston can be cleaned.

The lubrication is automatic, and access to the crank-case is given by a large inspection door.

With the spirit engine a float-feed carburetter is substituted for the gas and air regulator, and an aluminium jacket is arranged round the exhaust outlet to supply the necessary warm air to the carburetter.

The cylinders are cast separately, with plugs to allow for the

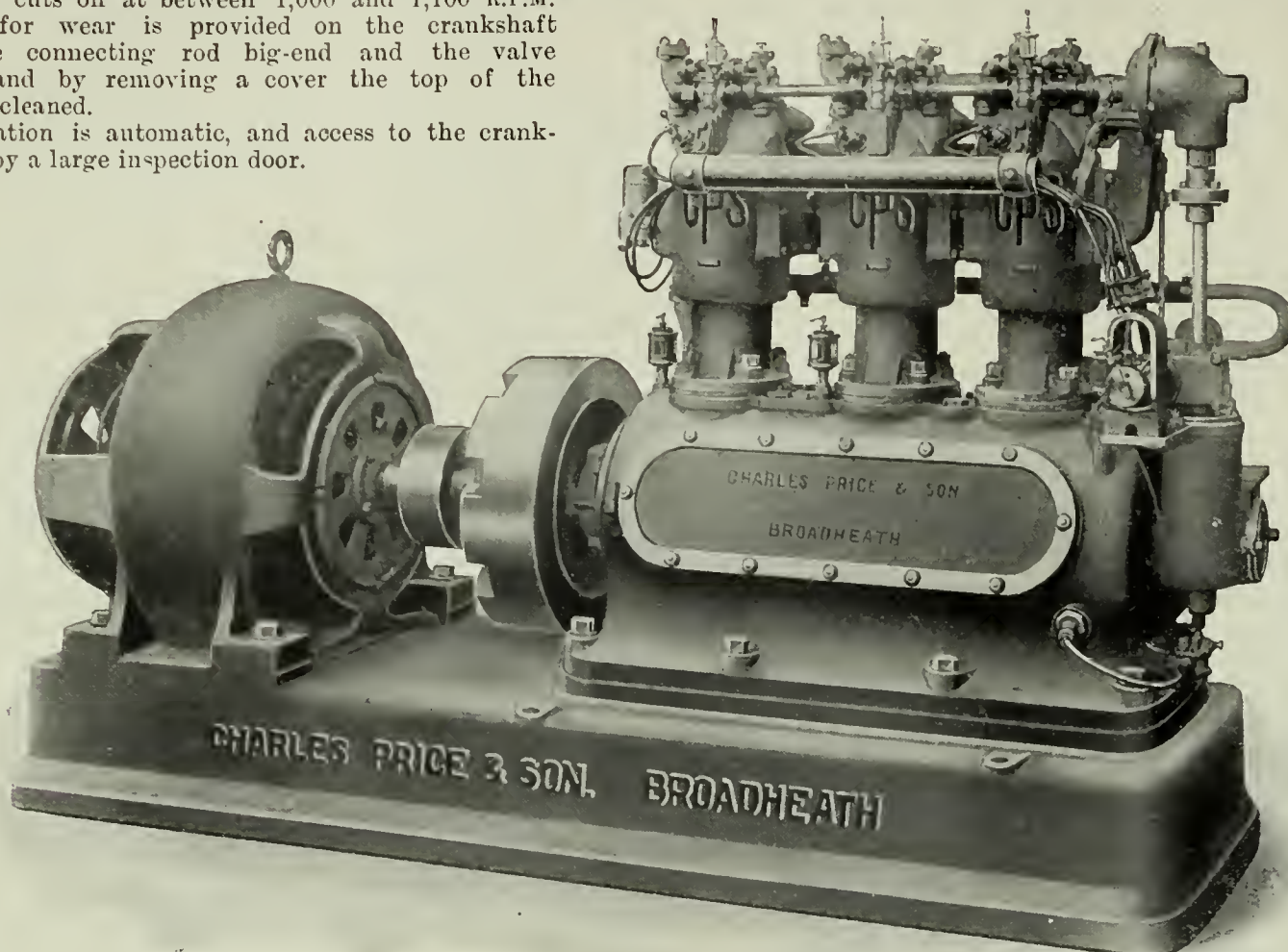


FIG. 15.—THREE-CYLINDER LIGHTING SET BY CHAS. PRICE & SON.

The cylinders are cast singly or in pairs, and the inlet passage has a common central port, while the exhausts for each cylinder have individual ports. The upper half of the crank-case carries all the bearings. The bearing caps are held by bolts passing through the top flange of the crank-case, and by this means the downward stresses are transmitted to the main frame of the crank-case.

#### Gardner Electric Lighting Sets.

The Gardner engines and electric generating sets require little introduction to the engineer, as they have for a good many years found favour both for land and marine uses.

We illustrate in fig. 16 a four-cylinder high-speed engine set by MESSRS. GARDNER, of Patricroft, Manchester, one

cleaning of all parts of the water jacket; the cylinder head forms a plug, which, when removed, allows of the piston and connecting rod being withdrawn without disturbing the cylinders.

Forced water circulation for cylinder cooling and forced lubrication are provided, a gear-driven pump being employed in each case. The speed is governed by a throttle valve, similar in

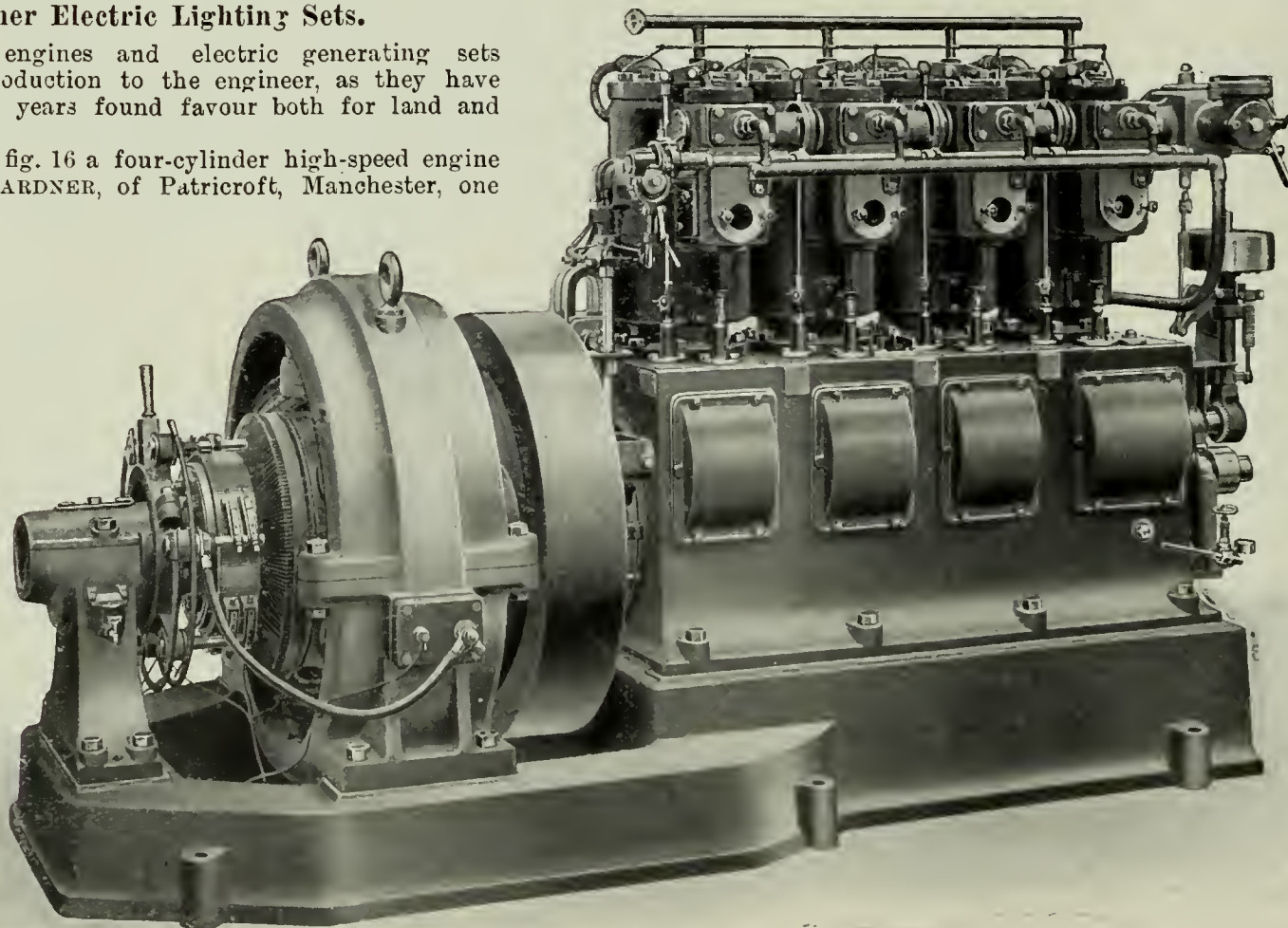


FIG. 16.—GARDNER FOUR-CYLINDER HIGH-SPEED PETROL-ELECTRIC SET.

of a type originally developed for launch and vehicle work, using petrol. The engine referred to can be adapted for use with either town or producer gas or petrol, its outputs in the three cases being 56, 43 and 54 B.H.P. respectively at 600 R.P.M.; engines of this class are supplied up to 130 B.H.P.

type to that used on high-speed steam engines, on the mixture inlet pipe; the governor is provided with an adjusting screw to set the speed to the value desired.

Starting is effected by means of a clutched handle on the crankshaft, and to facilitate this operation the compression is relieved in each



cylinder by throwing over a small lever, which brings into action auxiliary cams acting on the exhaust valves; L.T. magneto ignition is usually fitted.

Gardner engines for use with petroleum, and similar in design to the foregoing, in sizes up to six cylinders and 110 B.H.P., are also made by this firm for a variety of purposes. We illustrate in fig. 17 a little 1½-B.H.P. engine and dynamo, with extended bedplate,

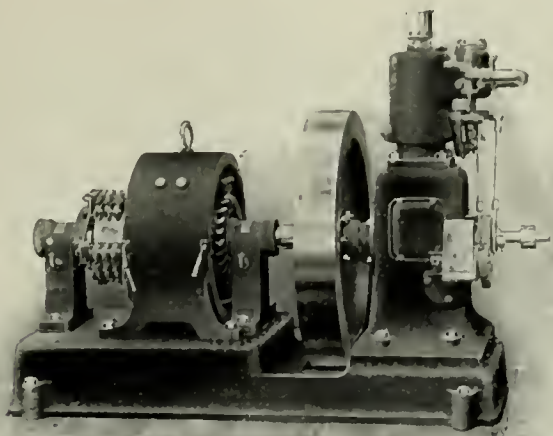


FIG. 17.—GARDNER 1½-B.H.P. ELECTRIC LIGHTING SET.

suitable for country house lighting and similar work, these engines being arranged, as required, for working with petrol, oil or gas, at medium speeds, ranging from 700-750 R.P.M. in the 1½-B.H.P. size, to 370-400 R.P.M. in the 7-8-B.H.P. size.

#### The Fielding Gas Engine.

We illustrate herewith a typical double-cylinder side-by-side gas engine and suction gas producer made by MESSRS. FIELDING & PLATT, of Gloucester, in sizes ranging from 110 to 290 B.H.P.

Constructively, it will be noticed that the engine is strongly built, one massive casting carrying the bearings and cylinders. A system of graduated governing is fitted, the governor being of the high-speed rotary ball pattern, adjustable as to speed while running. A special magneto ignition developed by the firm is fitted, with a simple form of sparking plug; forced lubrication to the crank-pins and pistons, and ring bearing lubrication, are other features of interest.

In the producer plant a patented device of the firm is employed for introducing steam to the furnace. The air and steam are admitted into the generator at the base of the fire from a central orifice beneath the grate, the air and sprayed water passing through a hollow base-plate which carries the fire and entering, as steam, equally all round the base of the fire.

Special claims in the matter of efficiency are advanced for this arrangement of automatic control, which obviates the use of the usual internal steam boiler.

The Fielding producer plant is exceedingly compact, and it is interesting to note that, at the Royal Agricultural Show trials in 1906, it proved to be one of the best plants entered.

#### Silvertown Petrol-Electric Sets.

The "Silvertown" petrol-electric generating sets made by the INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., of Silvertown, are specially designed for private house, hotel and ship lighting and power. The set consists of a dynamo directly coupled to a medium-speed vertical type petrol engine, both being mounted on a common bed-plate.

The dynamo is a standard Silvertown machine, and is supplied shunt or compound wound, in either open, protected or ventilated enclosed type. The engine has one, two or more cylinders, according to the output required. The cylinders are water-cooled in the smaller sizes on the thermo-siphon principle; in the larger engines a circulating pump driven from the crankshaft is provided for this purpose.

The crankshaft, connecting rods and cams are solid forged of high-grade steel, the cams being case-hardened. The engine is fitted with interchangeable valves and adjustable tappet mechanism, and adjustable crank bearings are provided. A large inspection door is fitted, and all joints are truly faced, special precautions being taken to prevent the oil from leaking out of the crank chamber.

Ignition is effected by accumulator and coil or magneto, and dual ignition can be supplied if required. Efficient automatic lubrication is provided for the piston and all bearings.

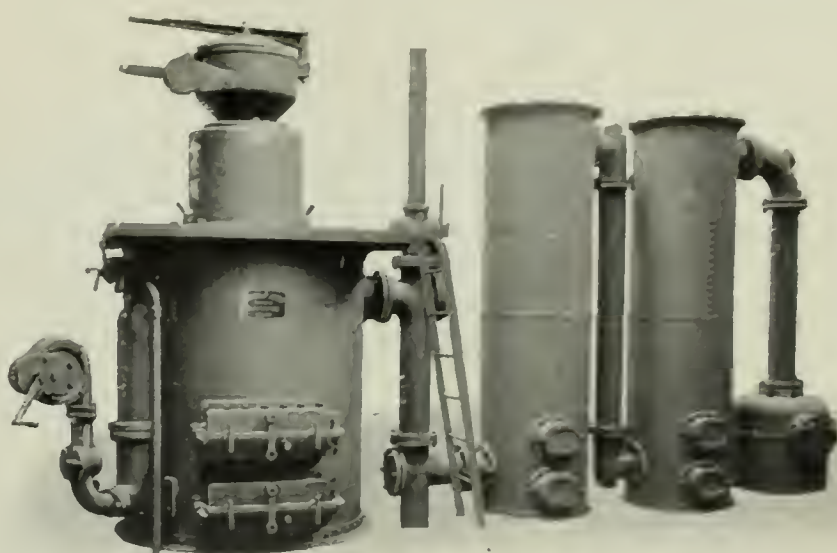


FIG. 18.—FIELDING SUCTION PRODUCER PLANT.

The carburettor is arranged with throttles as close as possible to the valves of the engine, and a governor is fitted which controls the speed within 5 per cent.

If desired these engines can be run with paraffin as fuel, in which case a vaporiser is fitted in place of the carburettor.

#### The G.H.H. Four-Cycle Engine.

The firm of GUTEHOFFNUNGSHUTTE, of Oberhausen, is one of the largest engineering concerns of Rheinland, employing 25,000 workmen, and, mining its own coal and iron ore, turns out every description of heavy steel work, castings, bridges, boilers and engines. We illustrate on page 632 one of its large gas engines, of which a considerable number have been turned out during the past 10 years, for driving blowers and electric generators. These have been mainly of the two-cycle type, but the one here shown works on the four-stroke cycle, and is double-acting, with tandem cylinders. The frame is cast in one piece, and rests over its whole length on the foundation, carrying

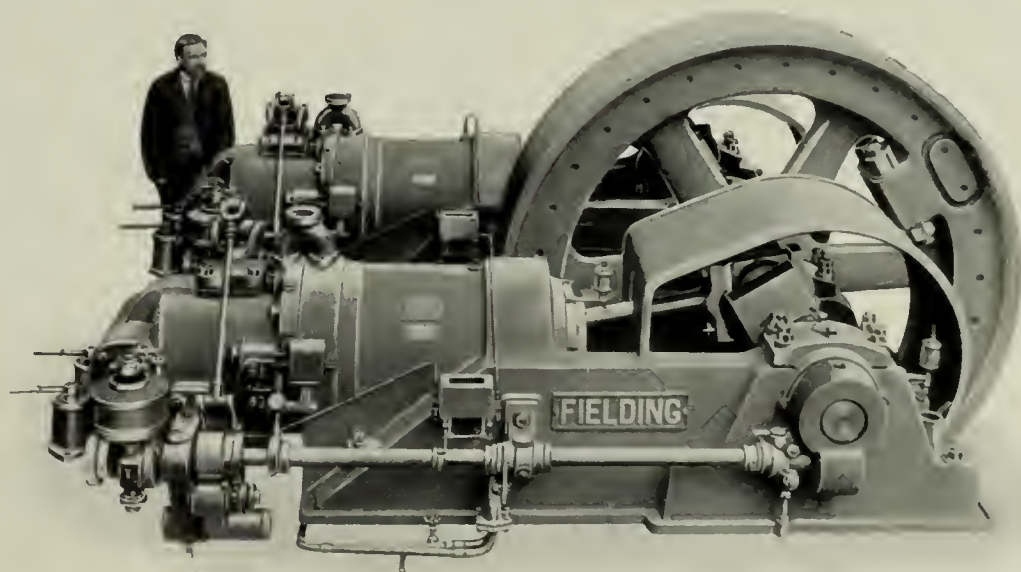


FIG. 19.—FIELDING SIDE-BY-SIDE GAS ENGINE.

the slide for the cross-head and the two main bearings for the crank-shaft. The piston-rods are supported at each end and between the cylinders, so that the cylinder flanges and the stuffing-boxes are relieved of the weight of the rods and

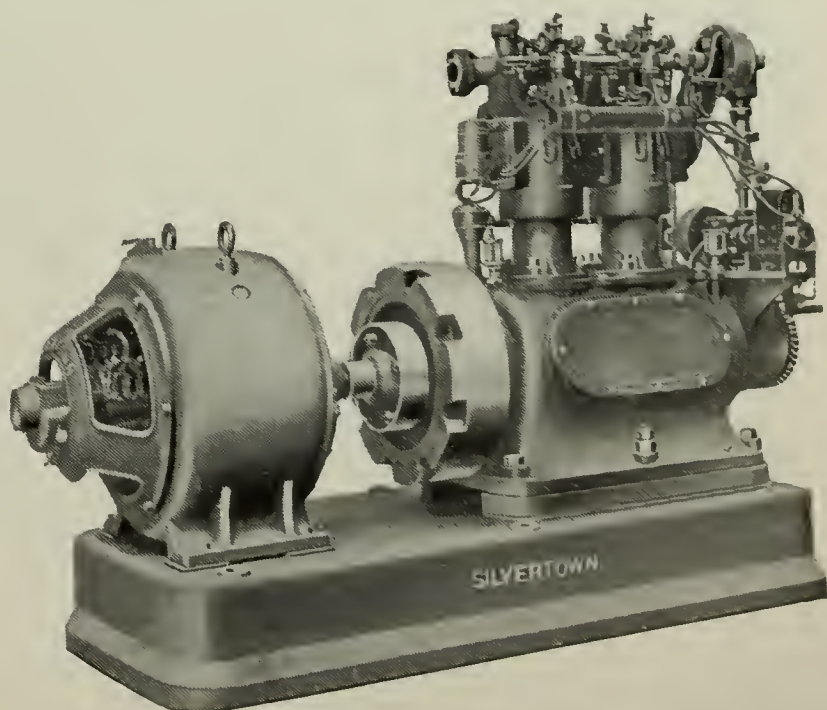


FIG. 20.—SILVERTOWN PETROL-ELECTRIC SET.



piston, and the rods are divided into two detachable parts at the middle guide. The cylinder covers can be drawn forward on the piston rods to enable the pistons and the interior of the cylinders to be inspected and cleaned, without removing any other parts. The cylinder is cast in one piece with the jacket, which can be inspected and cleaned through hand-holes. The inlet and exhaust valves are

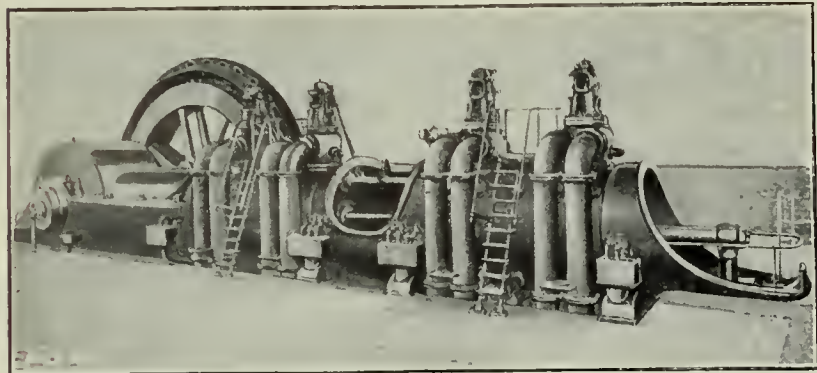


FIG. 21.—G.H.H. DOUBLE-ACTING FOUR-CYCLE TANDEM 1,500-H.P. GAS ENGINE.

arranged respectively above and below the cylinder, giving a plain and symmetrical casting free from internal strains; they are operated by eccentrics and roller levers from a lay shaft driven by worm gear running in oil. The mixing valve, which controls the admission of both gas and air, is arranged on the same axis as

means of the wedge-shaped piece resting on the mixing-valve lever, varies the lift of the latter, and the opening of the gas and air ports. The valve can easily be removed for cleaning, as it comes away with the bonnet. Throttle valves are provided in the gas and air supply pipes, to enable the composition of the mixture to be regulated in spite of considerable variations in the pressure in the pipes. The exhaust valves are of the disk type and work in water-cooled chambers.

Ignition is effected by direct current at 60 to 70 volts, with tappet interrupters inside the cylinder. At each side of the cylinder are two igniters, each provided with its own sparking plug. A contact disk controls the timing, and the interruption is effected by an electromagnet operated by the ignition current.

The stuffing boxes in the cylinder covers are packed with cast-iron rings, allowing free movement of the piston rod in all directions. Forced lubrication is provided to all important working parts. The cylinders, covers, pistons and piston-rods are all water-cooled.

The engine illustrated, which is one of a large number installed at the Eisenhütte Oberhausen, using blast-furnace gas, is one of the latest type, and one of its most noteworthy features is the simplicity of the valve gear, which indeed is no more complicated than that of a steam engine of similar type. Four of the G.H.H. engines of 600 B.H.P. each have been supplied to the Park Gate Iron and Steel Co., of Rotherham, and three of 1,000 B.H.P. each to the Barrow Haematite Steel Co., all for driving blowers.

#### Hick-Diesel Oil Engines.

MESSRS. HICK, HARGREAVES & Co., of Bolton, have recently commenced the manufacture of Diesel oil engines, which are being placed on the market by Hick-Diesel Oil Engines, Ltd., of 11, Queen

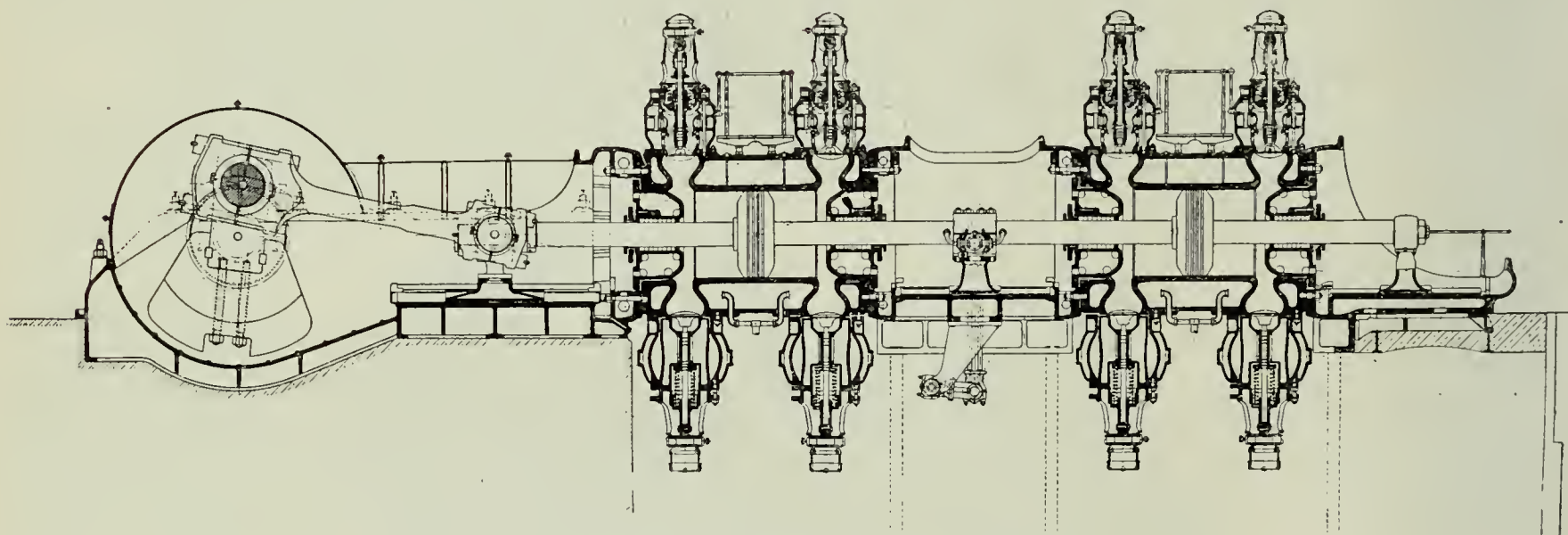


FIG. 22.—LONGITUDINAL SECTION OF G.H.H. ENGINE.

the admission valve, and is of special design; as shown in the sectional view, it is four-seated, the gas valve seats being conical, and the air ports cylindrical, so that the air and gas are intimately

mixed before entering the cylinder. We understand that the original Diesel designs are being followed and that the firm are prepared to build in outputs of from 80 to 1,000 B.H.P.

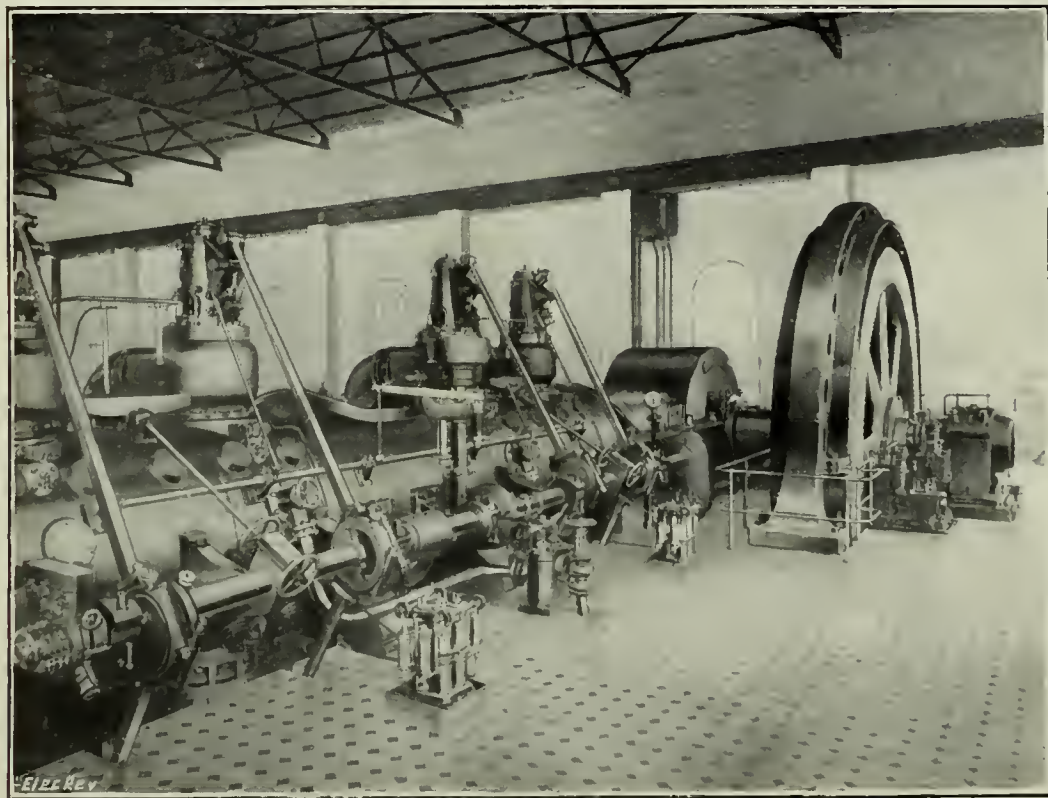


FIG. 23.—G.H.H. ENGINE, SHOWING VALVE GEAR.

mixed before entering the cylinder. The action of the governor can be readily understood from the section, which shows the main eccentric rod above, and the governor rod below; the latter, by

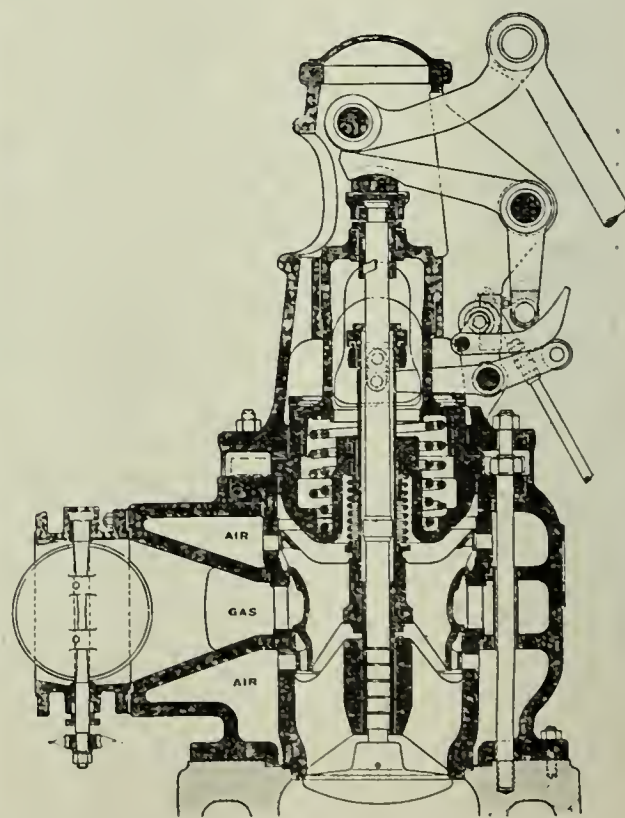


FIG. 24.—SECTION OF AIR AND GAS ADMISSION VALVES OF G.H.H. ENGINE.

As Messrs. Hick, Hargreaves have for so many years been known for the excellent Corliss and other engines which they have supplied, this new departure will be watched with considerable interest.



### The Ruston "Complete Combustion" Crude-Oil Engine.

A very successful engine working on crude and residual oils is made by MESSRS. RUSTON, PROCTOR & CO., LTD., of Lincoln. Its success is due, to a large extent, to the simplicity of the design, and to the fact that long runs can be made without cleaning, even when running on the lowest grades of fuel oil. The engine works with great economy on all loads, and by reason of its close

ducer, which will take any kind of wood refuse, and is specially arranged so that it can run continuously for long periods, the patent cleaning devices being such that whatever cleaning is required can be done easily, without any stoppage. With this producer both lignite and peat can be used, and even sawdust alone. Such plants have been installed at, or are on order for, Grimsby, Hull, Market Rasen, London and other places, for use in sawmills on wood refuse.

### William Beardmore & Co., Ltd.

The Oechelhäuser engine, invented by Dr. Wilhelm von Oechelhäuser and Prof. Hugh Junkers as far back as 1892, has passed through numerous modifications in arriving at its present stage as manufactured by MESSRS. WILLIAM BEARDMORE & CO., LTD., of Glasgow. The essential features distinguishing it from all other prime movers are retained, such as the two mutually-opposed pistons working in one cylinder open at the ends, with a common combustion chamber in the middle. The outlet and inlet ports are also retained, and the balanced action of the engine is preserved. On the other hand, the disadvantages of excessive floor space, of expensive construction, of limited speed and of low mechanical efficiency have all been overcome, whilst the engine details have been greatly simplified.

The overall length has been reduced by as much as 25 to 35 per cent., depending upon the position of the charging pump at the end or side of the engine. In this design the production of cylinder-liners and combustion chamber in one continuous piece of metal is rendered "possible"; the joints subjected to high pressure and temperature are thus avoided, and the liner may be withdrawn from the casings, without further dismantling of the engine.

Economy in construction has also been effected by this design, and a decided reduction has been made in the weight of the whole engine. The triple-throw crankshaft is now made in one piece from fluid compressed steel, instead of being built up as formerly. The width, weight and manufacturing cost of this important part are thus considerably reduced, and a consequent reduction follows in the adjacent parts. The length and weight of the side rods and back crosshead are also reduced largely in the new design, and by this means the speed of rotation of the engine may be safely increased without stress reversal in the rods.

governing is eminently suitable for dynamo driving, the variation in speed from no load to full load not exceeding approximately 4 per cent.

This oil engine is well adapted for power installations in close proximity to dwelling houses, there being no smell, and when suitable arrangements are made, the exhaust can be rendered almost silent. The illustration, fig. 25, shows a typical installation, the engine being of 65 B.H.P. directly coupled to a 40-KW. dynamo.

The generating costs are remarkably low for a plant of this size and simplicity. With fuel oil at 43s. per ton, the total cost per unit, including fuel oil, interest, depreciation and repairs, is approximately  $\frac{1}{4}$ d. per Board of Trade unit, the consumption being  $\frac{1}{2}$  lb. of oil per B.H.P.-hour.

It will thus be seen that the engine possesses all the necessary features to make it suitable for electricity works, country house lighting and general industrial work, and it has been successfully adopted for such purposes not only in this country, but in Russia, Italy, Roumania, India, East Indies, Australia, and other parts of the world. The Ruston "Complete Combustion" oil engine works upon a cycle similar to that of the Diesel engine, the difference being that in the latter the charge is forced into the cylinder by compressed air and ignited solely by the temperature of compression, whilst in the Ruston engine the charge is pumped into the cylinder in a highly atomised state, and the ignition is effected jointly by the temperature of compression and of the combustion chamber walls. The working temperature of the engine is controlled by a water snifting valve.

The governor is of the centrifugal type, and varies the quantity of oil delivered to the atomiser according to the load upon the engine.

The recent improvements introduced into the Ruston gas engines have been in the direction of increasing their durability and reducing the attention required when running the engine. The scantlings adopted are based on a generous scale, and no pains are spared to make these engines first-class in every way. All the larger sizes are governed on the throttle principle, the device adopted being a simple and highly efficient patent held by the firm. These engines are now to be found working in nearly all parts of the world, providing power for various purposes.

In addition to anthracite, coke and charcoal suction-gas producers, the company have now developed their patent wood pro-

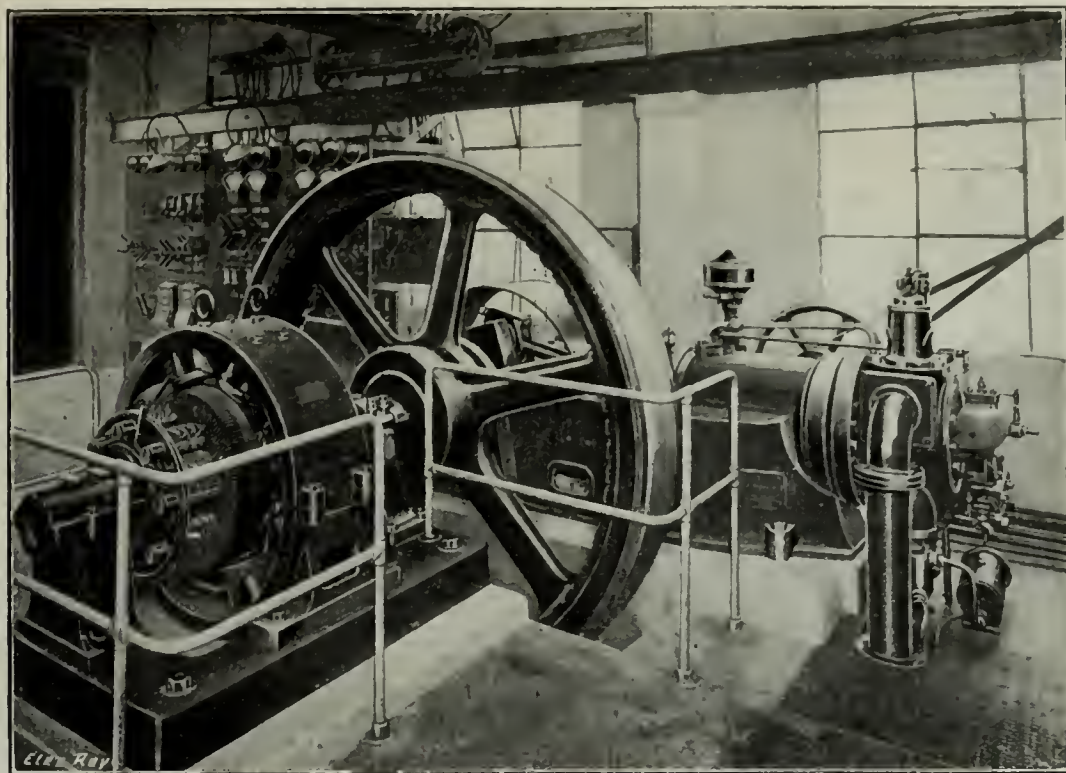


FIG. 25.—RUSTON 65-B.H.P. CRUDE-OIL ENGINE AND DYNAMO.

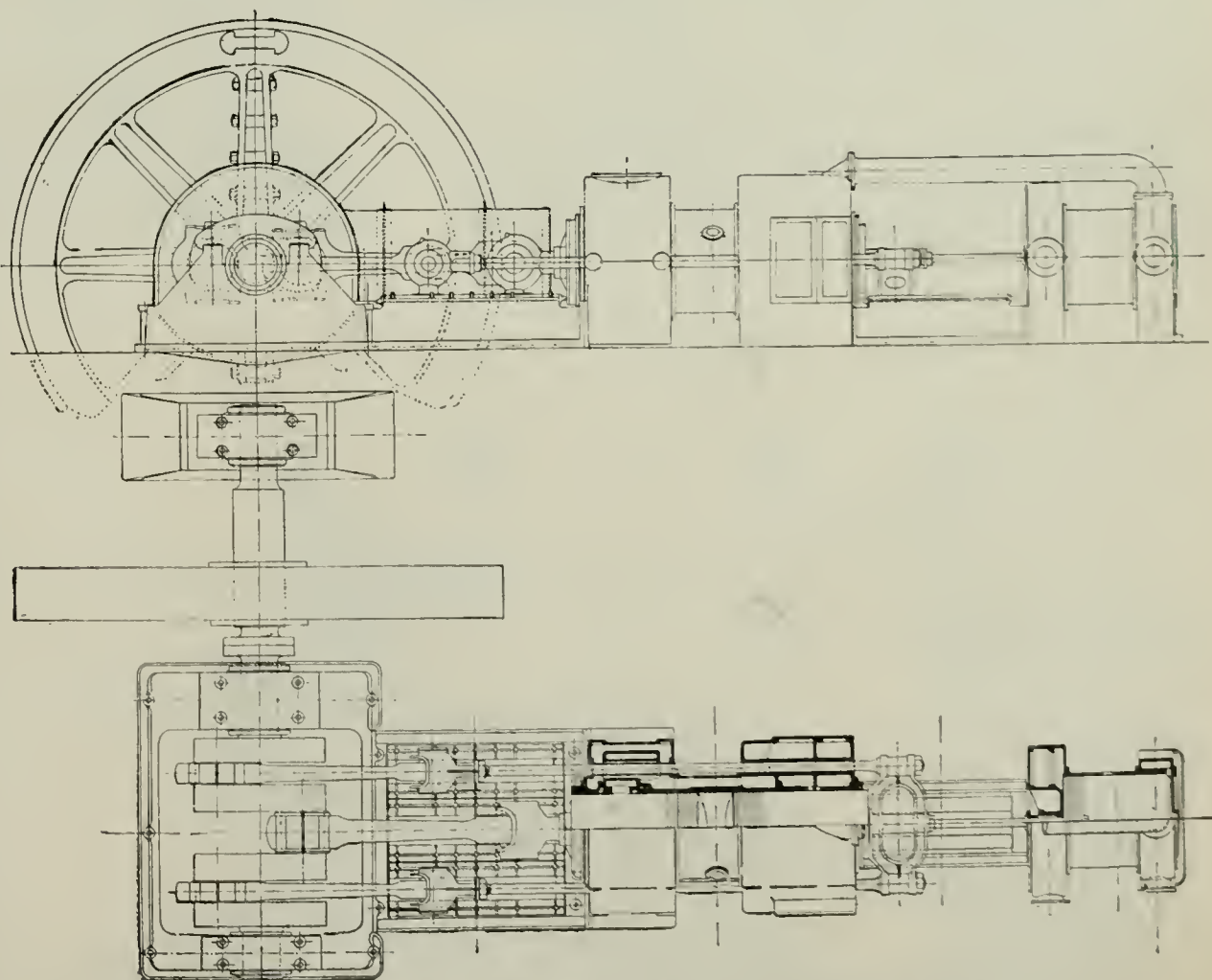


FIG. 26.—BEARDMORE-OECHELHAUSER TWO-CYCLE GAS ENGINE.

In former designs the frictional resistances of the heavy reciprocating masses, together with defects in the mechanical arrangements attached to the charging pumps, were responsible for the low mechanical efficiency obtained with this engine. Alterations made in these parts have enabled the makers to reduce the proportion of indicated work absorbed in the pumps from 20 per cent. down to 7 per cent. of the total quantity developed in the cylinder at full load. Further modifications in the direction of simplicity consist in the abolition of the side shaft with its gears, crms, &c., the



governor drive, ignition timing, &c., now being taken directly off the crankshaft. The general arrangement of the engine, with the pump at the end, is shown in fig. 26, page 633. The following material advantages result from the above disposition of the engine:—

For large powers the Oechelhäuser design now occupies about 20 per cent. less area than that taken up by four-cycle engines.

The engine is practically balanced, due to the mutually-opposed pistons and their moving connections, and a higher speed may safely be adopted without danger of vibration or rocking.

• All mechanically-operated valves are absent, with their attendant eccentrics, links and levers, wear and tear, power absorption, and cooling devices.

There are no working parts below the floor. High-pressure piston rod packings are eliminated, on account of the open-ended

### The Lilleshall Co.'s Engines.

THE LILLESBALL CO., LTD., of Oakengates, build the Nuremberg gas engine under licence in this country, and last year started a 600-B.H.P. gas-driven compressor at the works of the United Alkali Co., Widnes, as well as a 1,000-KW. gas alternator at a chemical works in the Birmingham district. The accompanying illustration shows the appearance of the engine, which is of the double-acting tandem type, and is constructed in single-crank units up to 3,000 B.H.P., and twin tandem up to 6,000 B.H.P. The design is simple and solid, so as to ensure the maximum of reliability and long periods of running without adjustment being necessary. In several of the installations which have been carried out by the company, the engines have to run night and day for long periods without a stop, in works where a breakdown would be a very serious matter.

The makers are strong advocates of the use of gas engines in conjunction with Mond gas producers and ammonia-recovery plant, the arguments in favour of which are well known to our readers; they have recently obtained an order for such an installation, in direct competition with the steam turbine, and under circumstances where great reliability was a prime essential. The load factor in this case was large, and the gas-engine plant was able to show very low running costs, which turned the scale in its favour.

The sectional drawing of the engine, which were reproduce in fig. 28, shows that the cylinders are built in one piece, the makers finding this the most satisfactory plan; all parts are cooled by water under a head of 30 or 40 ft., except the pistons, which require a pressure of 50 lb. per sq. in. The water-cooling pipes are all brought out to one side of the engine, and discharge into large funnels, so that the driver can always feel the temperature of the water; thermometers are also provided on all the pipes. Governing is effected on the quantity system, the lift of the inlet valve being lessened on light load, and thus reducing the amount of mixture entering the cylinder.

The company has received the order for four gas engines of 2,300 B.H.P. each, from the Imperial Japanese Government, to generate electricity for the operation of an electric railway between Tokio and Yokohama.

### Running Costs of the Diesel-Engined Ship.

With the actual adoption of the large Diesel engines in cargo vessels, the purely commercial side of the question of their use is naturally being much discussed.

In its last issue the *Motor-Boat and Marine Oil and Gas Engine* publishes an interesting comparison of operating costs derived from an authoritative source. The case for the steamship is stated by well-known steamship owners, and a steamer of 10,650 tons displacement and 7,400 tons D.W. capacity driven at 11 knots is compared with the *Selandia*, 9,800 tons displacement, 7,400 tons D.W. capacity,

cylinder employed. An ideal combustion chamber is obtained, and the surface exposed to cooling action is decidedly less than in other types, thus ensuring thermal efficiency.

To gain access to the interior of the working cylinder it is only necessary to remove the back piston, an operation requiring not more than from 30 to 40 minutes.

These engines have been built in different sizes from 400 H.P. up to 2,000 H.P. in a single cylinder, and are employed in the generation of electrical energy, and for all kinds of heavy duty.

Recently the principle has been extended to the tandem type with marked advantage, and a number of engines are being built for marine work of the vertical tandem type, which are about to be installed in sea-going vessels.

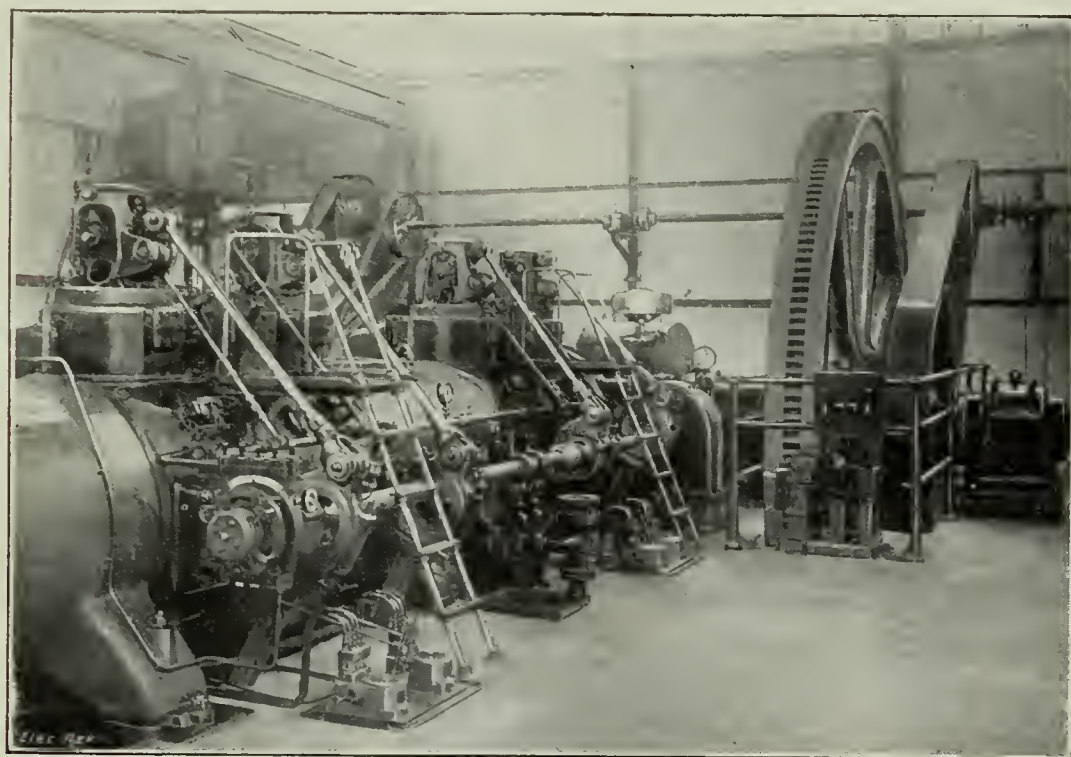


FIG. 27.—LILLESBALL-NÜREMBERG 600-B.H.P. GAS ENGINE.

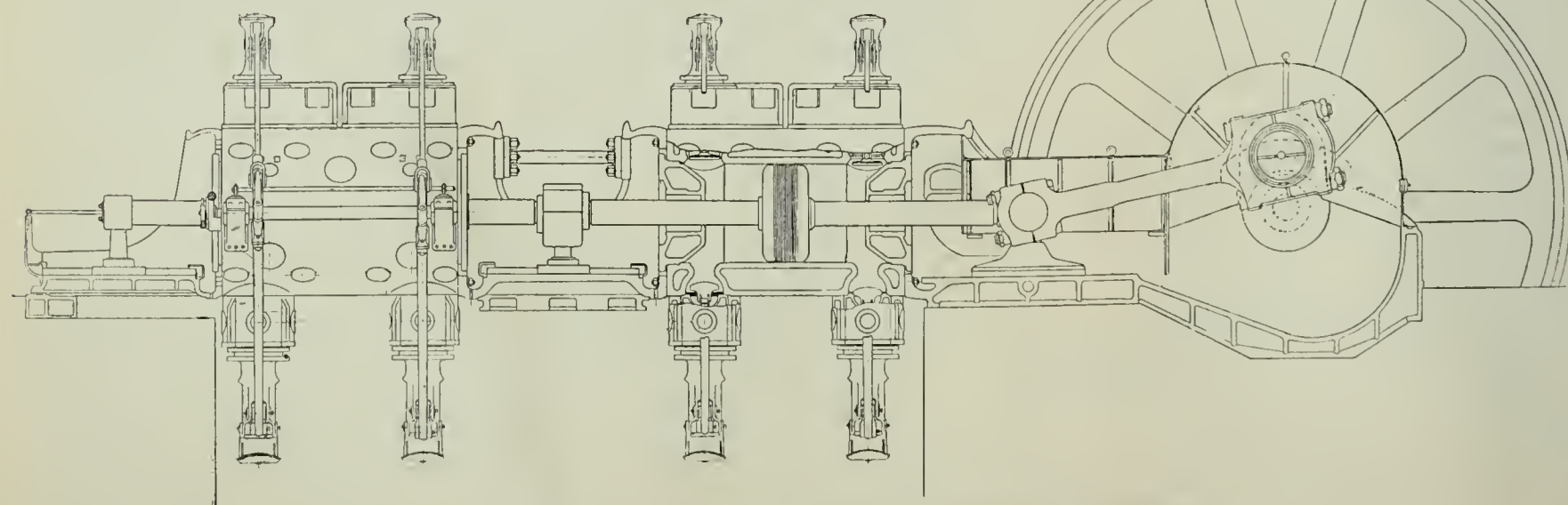


FIG. 28.—ELEVATION AND PART SECTION OF LILLESBALL GAS ENGINE.

### The Brit Oil Engine.

MESSRS. E. A. CHARD & CO., of Bridport, make the Brit engines, which are fitted to use either paraffin or petrol fuel, or town gas. It is claimed that they are easy to start and understand, very economical, and perfectly reliable. A centrifugal governor controls the speed, which can be varied, and regulates the fuel consumption according to the load. The ignition is by low-tension magneto, and lubrication is by direct feed and splash.

speed also 11 knots. Taking 75 days steaming, coal would cost £3,150, as against oil £1,575. The steamer would also lose two days per voyage in coaling, reckoned by the owners at £92. Taking the first cost of the steamer at £60,000 and of the motor ship at £75,000, the latter depreciates £250 per voyage more; there is also an estimated saving in D.W. cargo capacity of 210 tons, or £210 per voyage in favour of the steamer, so that the net gain of the motorship is £1,207 per voyage, or £3,621 per annum, the case of three Far-Eastern voyages per year being assumed. It may be noted that the same total wages are reckoned for each ship.



### Thornycroft Motors.

MESSRS. JOHN I. THORNYCROFT & Co., LTD., of Caxton House, Westminster, S.W., have for many years built high-speed oil engines, which are specially designed to secure reliability of lubrication, steadiness of running, and cheapness of operation. These ends are attained by the adoption of an improved system of forced lubrication, an efficient vaporiser and governor, and the use of the cheapest grades of oil. One of their standard paraffin M1 type dynamo sets, capable of developing  $3\frac{1}{2}$  KW., is shown in fig. 30.

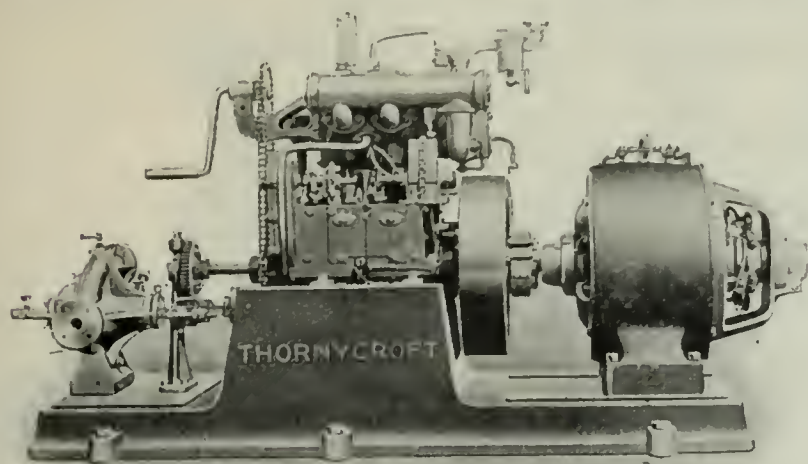


FIG. 29.—THORNYCROFT 7-KW. SET WITH PUMP.

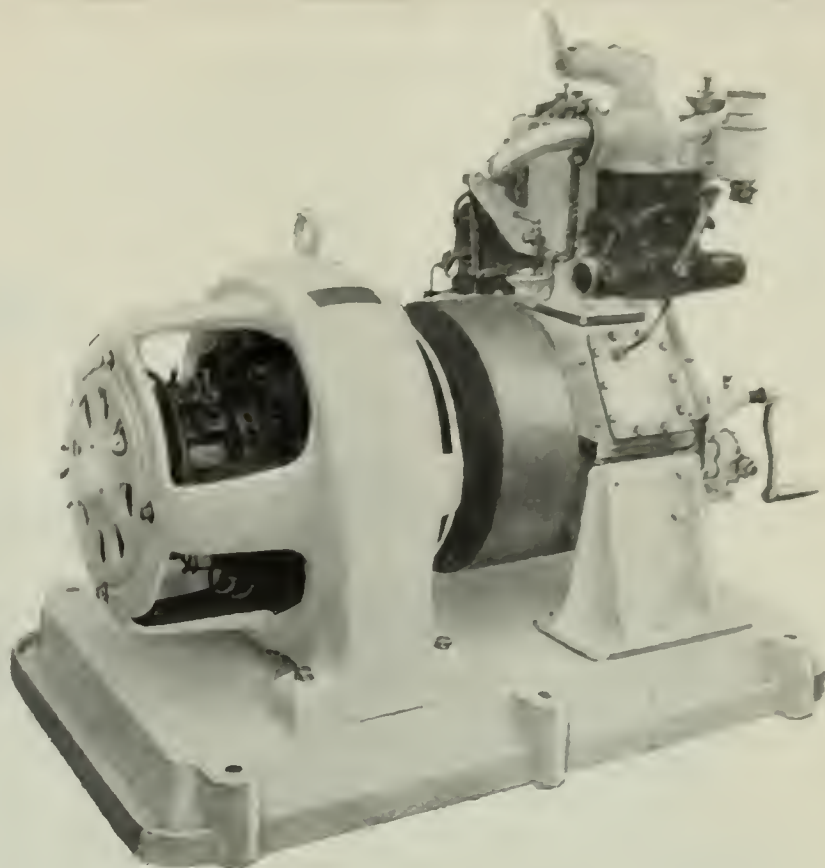


FIG. 30.—THORNYCROFT 3.5-KW. OIL-ELECTRIC SET.

The vaporiser is very clearly seen, and is generally representative of the type fitted to all their paraffin oil engines. These sets are all capable of governing within 5 per cent. The dynamo is of the E.C.C. make, and runs at 25 volts.

Another set is shown in fig. 29, and represents a type of plant which has become very popular in the Far East for house lighting and pumping. The engine is of type M2, and is coupled to a dynamo of 7 KW. output, at 110 volts. The pump is driven by gearing from the other end of the shaft, and is capable of lifting 2,000 gallons per hour to a height of 70 ft., so that it is useful not only for domestic purposes, but also for extinguishing fire, &c.

Three of their oil-engine-dynamo sets are installed in the firm's power house at Basingstoke, of 39 KW. each, and are in constant use, especially for over-time work, needing very little attention.

One has been running for six years, and the other two for three. The standard sizes made range from 3.5 to 45.5 KW.

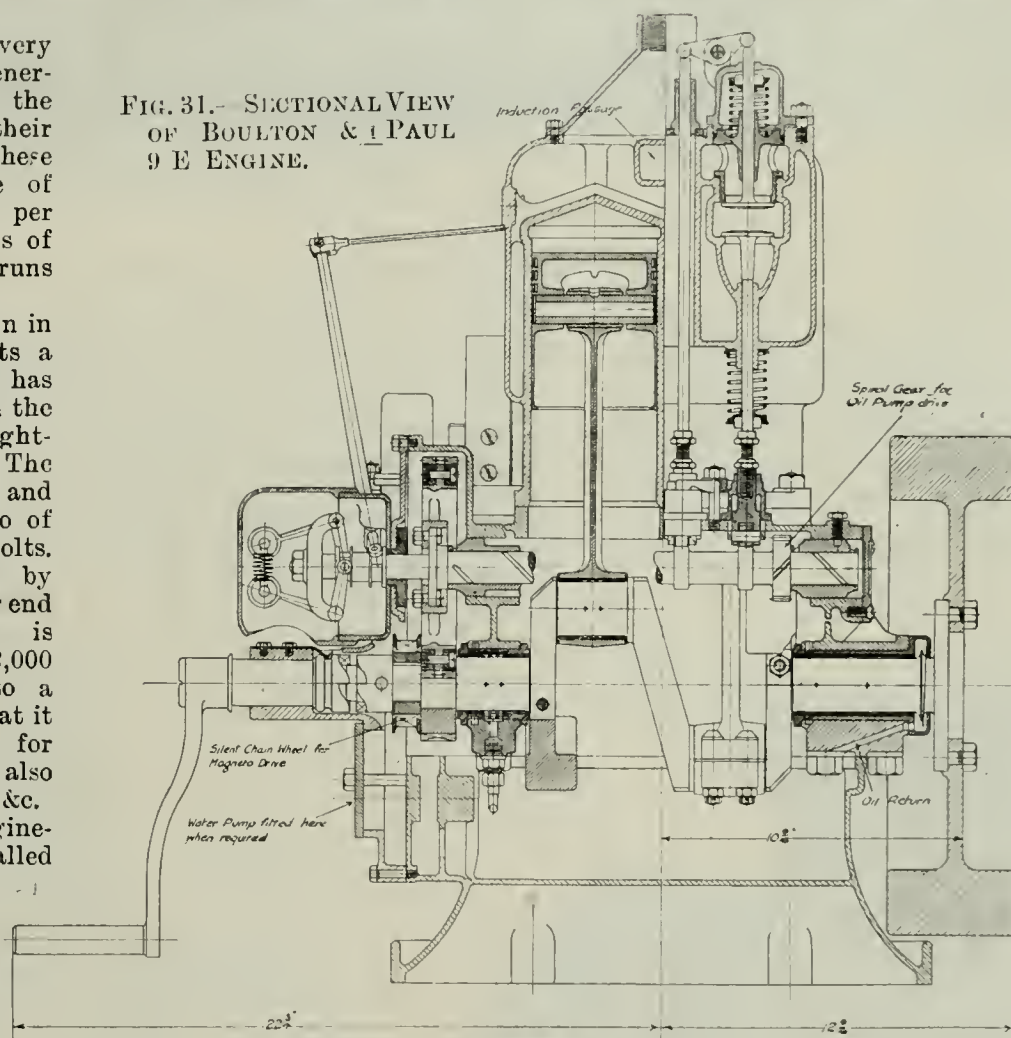
### Boulton & Paul, Ltd.

This well-known Norwich firm took up the construction of the small petrol engine for both land and marine purposes a few years ago. They manufacture both four and two-cycle engines, the latter in the small sizes being less costly, and perhaps rather simpler in construction. A typical section of the former is given in fig. 31.

The firm's standard engines range from  $1\frac{1}{2}$  to 42 B.H.P. in size, the speeds being generally 900-1,000 R.P.M., and the fuel petrol, although they can be adapted for paraffin, giving a somewhat smaller output.

An interesting little set, which we select for illustration, comprises a four-cycle petrol engine coupled directly to a dynamo and pump in tandem, on one bed-plate (fig. 32). A clutch is inserted between dynamo and pump. The engine is provided with thermo-siphon water cooling, and forced lubrication to all bearings;

FIG. 31.—SECTIONAL VIEW OF BOULTON & PAUL 9 E ENGINE.



the standard ignition is by means of H.T. magneto, but ordinary coil and battery ignition can be fitted.

The engine is governed on the throttle, and when arranged for the use of paraffin is started up on petrol. The consumption of petrol and paraffin on full load is approximately '75 and '8 pint respectively. Messrs. Boulton & Paul have specialised in house-lighting equipments, each complete with engine, dynamo, battery and switchboard, and these can be supplied for installations of 50 to 600 16-C.P. metal lamps.

### Browett, Lindley and Co., Ltd.

MESSRS. BROWETT, LINDLEY & Co. entered the gas-engine field some years ago, when they built some vertical enclosed engines with forced lubrication; the success of these led them to form a special department to deal with this class of work, and they have several orders in hand, including one for an engine of 360-400 B.H.P. for the Corporation of Wanganni, New Zealand, to drive the electric tramways in that town. Unfortunately the coal strike has delayed their work, so that we are unable to include a description of the engine in this issue.

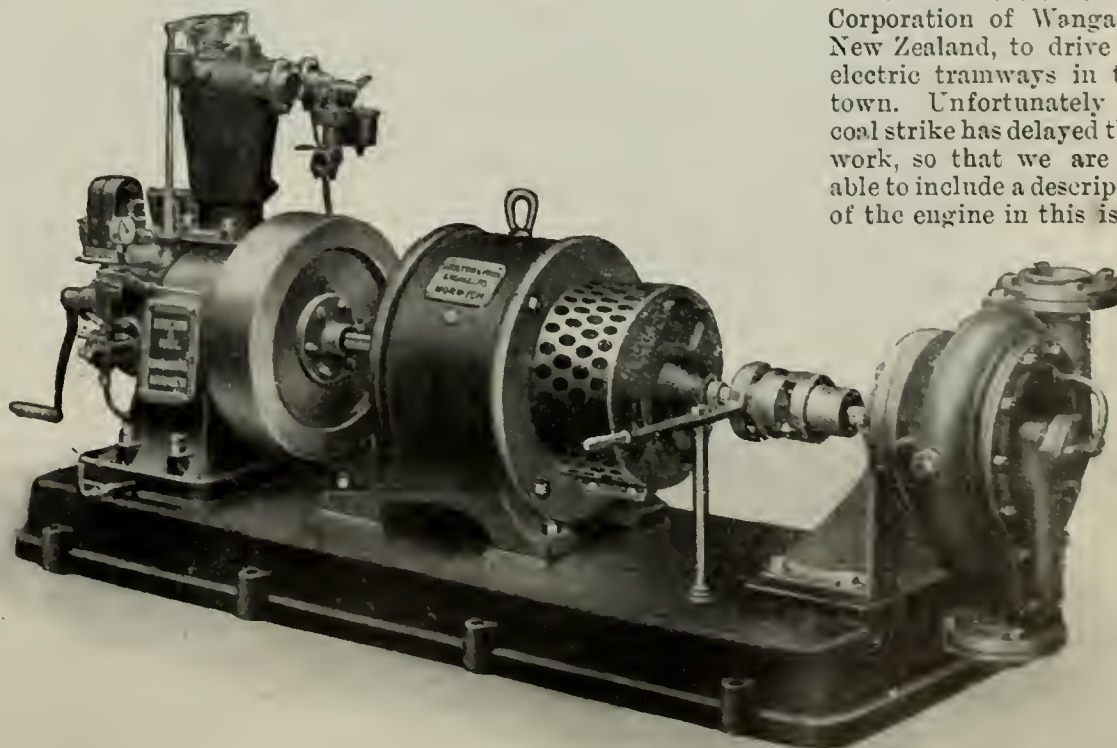


FIG. 32.—BOULTON & PAUL ENGINE DRIVING DYNAMO AND PUMP.



### The Blackstone Oil Engines.

MESSRS. BLACKSTONE & Co., LTD., of Stamford, have for many years been building oil engines, and some three years ago they embarked on the manufacture of crude-oil engines, which they have developed to a high degree of efficiency. The engine works on the four-stroke cycle and the Diesel principle, but uses a lower compression than the latter. The charge of air is compressed to 150 lb. per sq. in., and the oil is sprayed into the cylinder, ignition being effected by means of a bulb-shaped ignition chamber bolted to the back of the cylinder, which is kept at a red heat by the explosions. The oil is sprayed in by air from a reservoir, at a pressure of 400 lb. per sq. in., which is kept charged by a pump driven from the crank-shaft by an eccentric; a small plunger pump with variable stroke feeds and regulates the oil supply. A little oil is blown into the ignition chamber by the opening of a needle valve, at the same time as the charge is sprayed into the cylinder, and the resulting jet of flame from the chamber meets the charge in the cylinder and ignites it, producing a flat-topped indicator diagram, in which the maximum pressure is only about double the compression pressure. The amount of oil admitted to the ignition chamber is simply that required to run the engine light, and remains constant at all loads, while the charge admitted directly to the cylinder is controlled by the governor, in proportion to the load. There are no missed ignitions, so that the ignition chamber is always maintained at the proper temperature.

A centrifugal governor with both gravity and spring control is used, the spring enabling the speed to be adjusted while the engine is running. The ignition chamber is heated by a blow-lamp to start the engine.

The firm makes both vertical and horizontal crude-oil engines on these lines; one of the former, a four-cylinder set of 80 B.H.P., is shown in fig. 33. It is of the enclosed type, with forced lubrication, and has a vertical air-compressor worked off an extension of the crank-shaft. Each cylinder has a special valve connected to the air reservoir, for starting, and a burner for heating the ignition-chamber, shown in front of the cylinder end. The oil pumps are actuated by bell-crank levers working in long slots in the ends of

We illustrate one of the Anderston engines in fig. 34, which gives a general idea of the constructive features of these engines.

### Utilisation of Waste Heat from Gas Engines.

A German engineer, Mr. C. Semmler, has applied himself to the

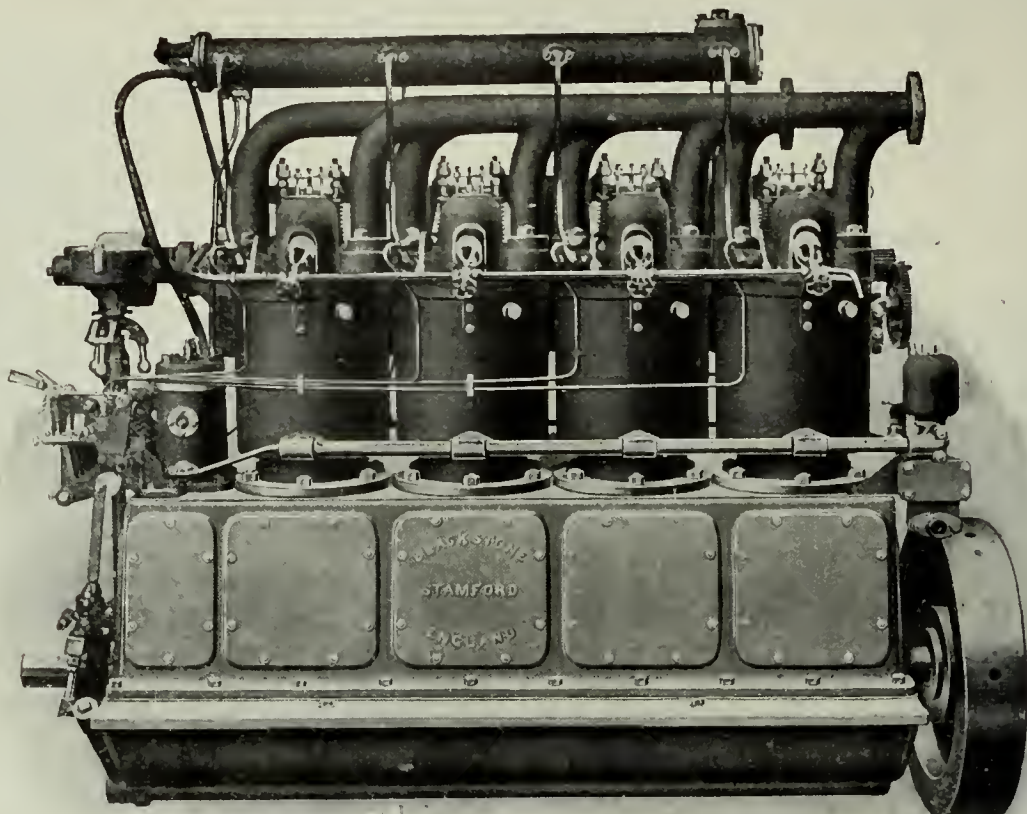


FIG. 33.—FOUR-CYLINDER BLACKSTONE CRUDE-OIL ENGINE OF 80 B.H.P.

problem of utilising part of the heat energy at present rejected by the gas engine in the cooling water and exhaust gases, each amounting to about one-third of the total heat consumed. He proposes to subject the cooling water to pressure in the jacket, from which it passes at a temperature of 110° to 150° Cent. into a "boiler"; the pressure in the boiler is kept at a lower value than that in the jacket, so that a portion of the water is evaporated. The steam thus formed is led through a superheater, surrounded by the hot exhaust gases, and is there raised to a temperature of 300-350° C. It is then supplied to a steam turbine, exhausting into a surface condenser, and the water of condensation is returned to the boiler through the jacket, together with a quantity derived directly from the boiler. The inventor estimates that an additional 3,000 H.P. could be thus obtained from a plant of 20,000 H.P.

### Bituminous Gas Producers.

According to an article by Mr. R. L. Streeter in the *Engineering Magazine*, there were in the United States, at the end of 1909, 474 producer-gas plants, of which 415 used anthracite, 37 bituminous coal, and 22 lignite. Of the bituminous-coal plants, 20 were larger than 500 H.P., the average being 1,460 H.P., and three of the lignite plants were over 500 H.P. Since then the number and size of installations have very rapidly increased.

In some of the bituminous producers the down-draught system is employed, the air and steam supply being admitted at the top of the producer and passing downwards through the hot bed of fuel, to eliminate the tar from the resulting gas. When the up-draught system is used, the tar is kept down to the minimum by adjustment of the air and steam, and is removed by means of a mechanical scrubber.

A 600-H.P. plant fed with Texas lignite, in a district where water is scarce, is provided with cooling towers for the water used for cleaning the gas; the same water is continuously circulated without purification, it being found that the amount of solids

present in the water increases up to a definite limit, when the excess impurities are precipitated without any chemical treatment. Moreover, it is not necessary to add any make-up water, as the moisture contained in the lignite, amounting to 30 per cent., is condensed in the scrubbing apparatus, and thus more than compensates for loss by leakage and evaporation, the surplus having to be run off.

At the works of the Pittsburg Plate Glass Co., Indiana, four 750-KW. alternators are driven by gas engines fed with producer gas from bituminous coal, and the plant, which was installed in 1908-9, is soon to be enlarged to 10,000 H.P. The producers are of the down-draught type.

It would appear, therefore, that the difficulties which have hitherto militated against the use of bituminous coal and lignite in gas producers are being successfully overcome in the States.

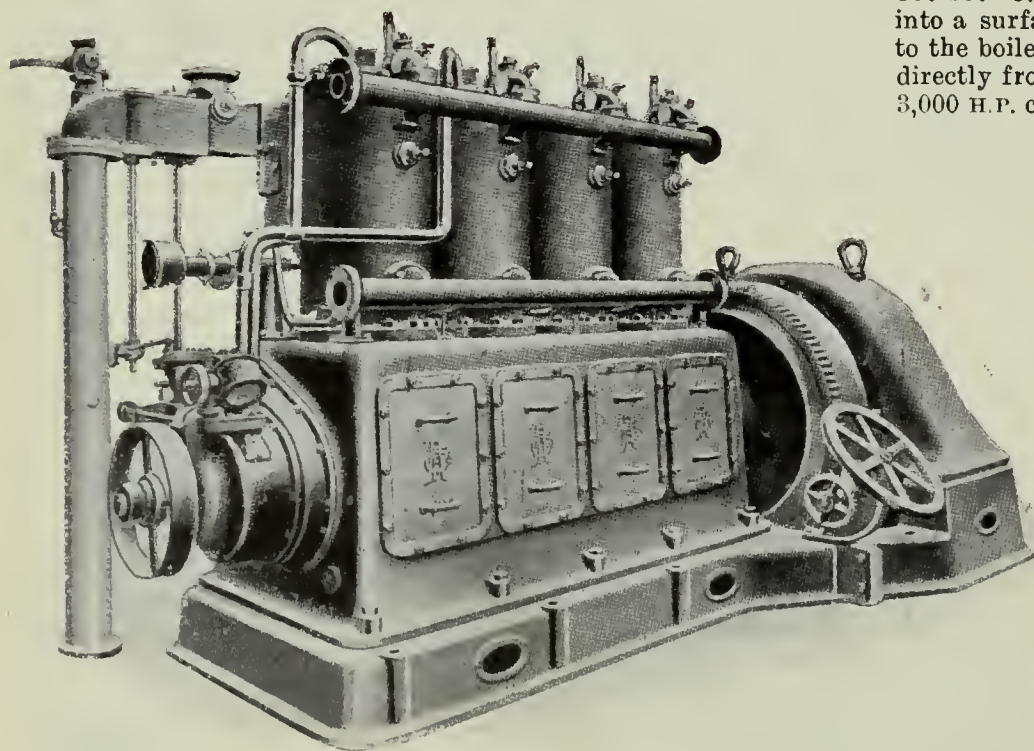


FIG. 34.—ANDERSTON HIGH-SPEED GAS ENGINE.

the pump plungers, seen at the end of [the engine, and the stroke is regulated by the wedges there shown, which are lowered into the slots by the governor.]

### Anderston Vertical Gas Engines.

THE ANDERSTON FOUNDRY Co., of Glasgow, have for some years been associated with the construction of vertical gas engines.

The Anderston engines are of the vertical single-acting type, and are built in sizes ranging from 20 to 500 B.H.P., with either two, three, or four cylinders, and are adaptable for use with any ordinary or waste gas.

The engines run at comparatively high speeds—600 R.P.M. in the smaller sizes, up to 250 R.P.M. in the largest size mentioned—and have been largely adopted for electrical driving.



**J. F. Coates & Co.**

This Manchester firm has specialised in the two-stroke engine, which is of extremely simple construction, as may be gathered from the fact that the working parts comprise only piston, connecting rod and crank.

For running on petrol, the Ruth series of engines giving from 2 to 24 H.P. (at from 850 to 680 R.P.M.) are made. These engines, except in the smallest size, are fitted with a special exhaust scavenging arrangement, an intermediate chamber being provided between

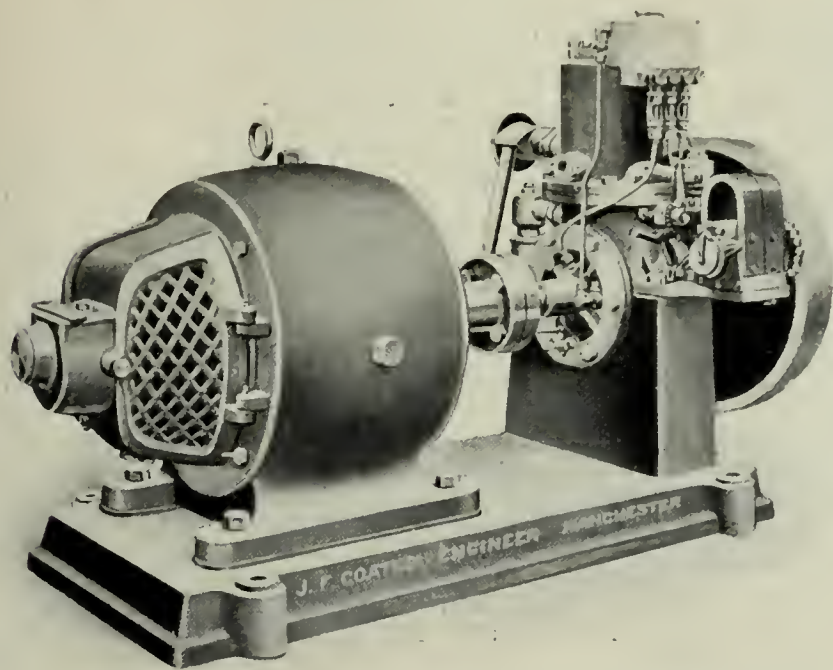


FIG. 35.—COATES TWO-STROKE PARAFFIN-ELECTRIC SET.

crank case and cylinder, into which pure air is drawn by the piston on its upstroke. On uncovering the inlet port, this air is swept through the cylinder, clearing out the burnt gases, before the admission of the new charge.

H.T. magneto ignition is fitted, and a sensitive governor; the sets are largely used for driving small dynamos.

MESSRS. COATES build a somewhat similar engine—the Ajax—which we illustrate in fig. 36, for running on paraffin and starting on petrol. The ordinary two-stroke arrangement is followed, the vapour mixture being held in a special transfer pipe until the cylinder port is uncovered and the air pressure in the crank case forces it into the cylinder.

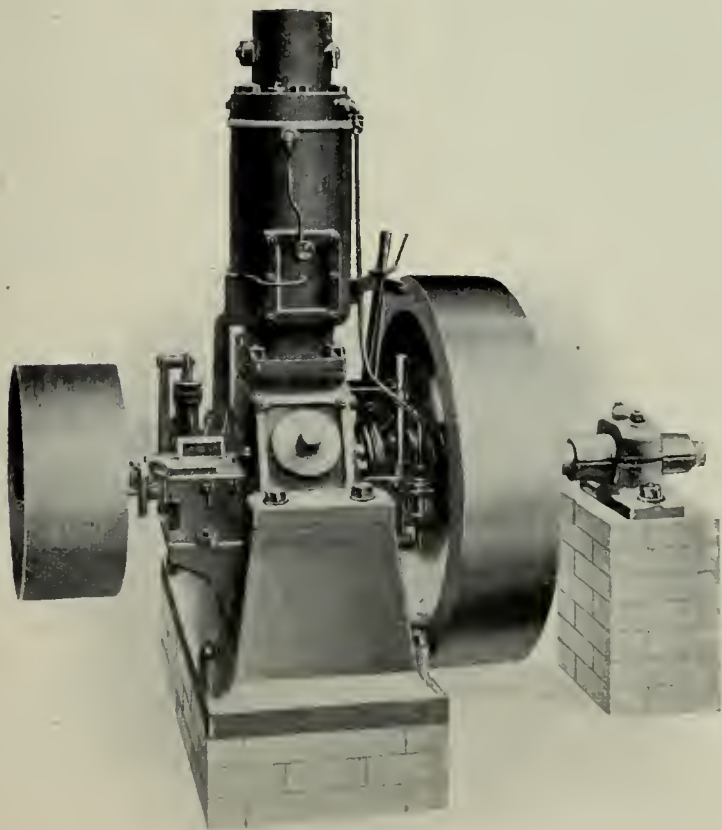


FIG. 36.—TWO-STROKE SEMI-DIESEL ENGINE BY J. F. COATES &amp; CO.

No explosive mixture is drawn into the crank case, only cold air through a special valve, and this is a point of divergence from ordinary practice.

It is claimed that the engines govern within 3 per cent.; they are fitted with H.T. magneto ignition and designed for easy dismantling and access.

The Coates semi-Diesel oil engines—of the vertical two-cycle type—are made in sizes from 8 H.P. to 60 H.P., with one or two cylinders, and will operate on crude oil or paraffin.

We illustrate one of these engines in fig. 36. The small sizes start up with the usual hot bulb and blow-lamp arrangement; in the larger sizes compressed air is used. A certain amount of water from the cylinder head is fed through the inlet ports with the incoming air at each stroke, and vaporised by the hot bulb, keeping the latter at a suitable temperature (dull red heat), and the makers claim increased power by this arrangement. Oil fuel is fed to the cylinder (being injected through a needle valve) by a plunger pump, the stroke of which is adjusted by a fly-wheel governor operating a variable cam.

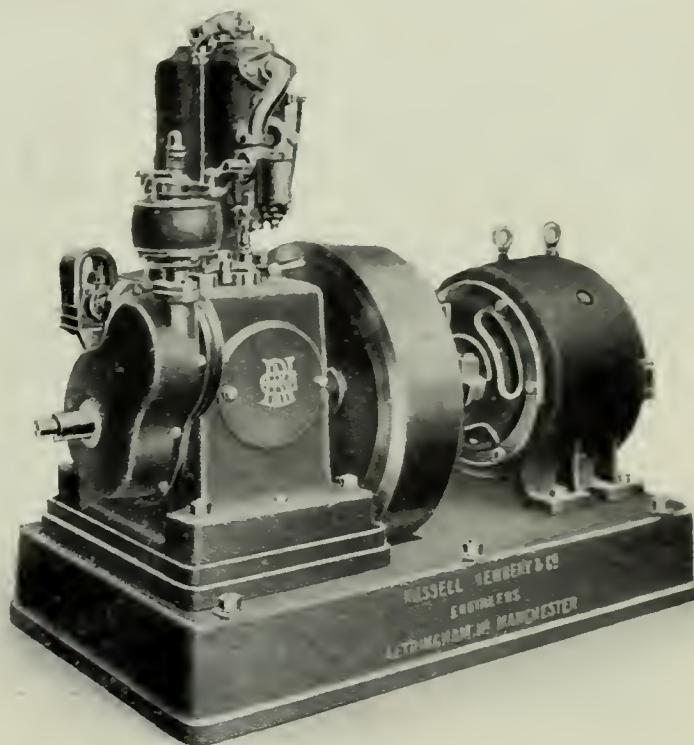


FIG. 37.—RUSSELL, NEWBERY 5-K.W. ELECTRIC LIGHTING SET.

The lubrication and water-cooling arrangements have been carefully arranged, and constructional facilities are provided for dismantling and inspection.

This being a two-stroke engine, the crank-chamber compressed air is employed for scavenging, and the crank-case compression is maintained by revolving bronze shaft washers pressed against the bearing ends by springs.

The Coates engines, it may be added, are designed and used equally for marine or stationary purposes.

**Russell, Newbery & Co.**

MESSRS. RUSSELL, NEWBERY & CO., of Altrincham, manufacture a variety of small and medium-size internal-combustion engines suitable for dynamo driving, some examples of which are illustrated herewith.

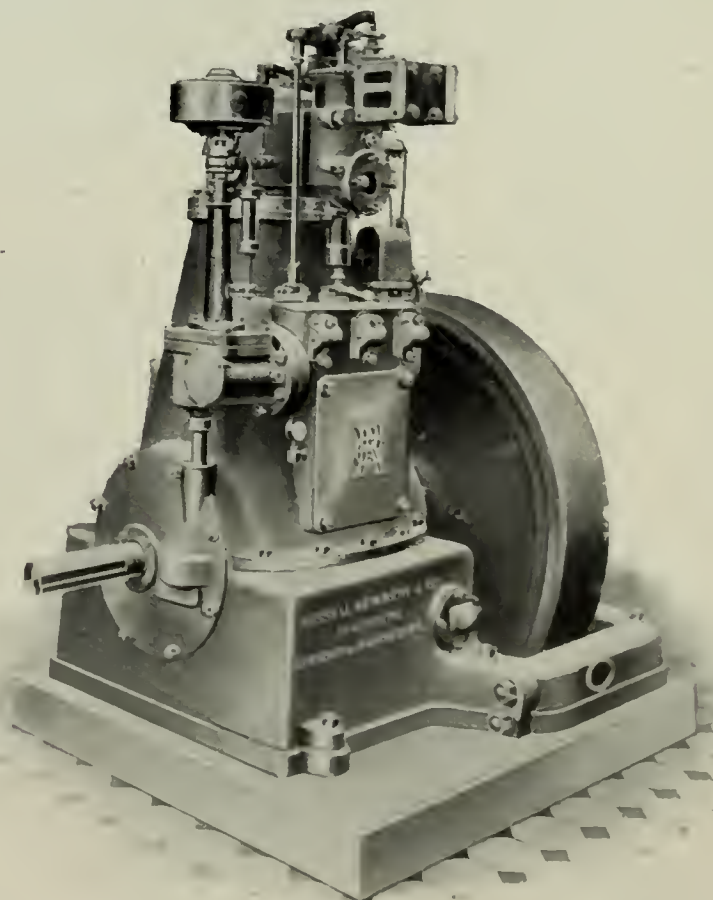


FIG. 38.—VERTICAL SUCTION GAS ENGINE, 25 B.H.P.

Fig. 37 illustrates their 5-K.W. direct-coupled single-cylinder petrol-electric plant, running at 650 R.P.M. This engine has been specially designed to withstand rough usage and to be suitable for long and continuous runs with a minimum of attention. The camshaft is driven by means of machine-cut spur gears from the crankshaft; the method of driving the vertical governor and



magneto calls for special mention, both being driven by means of phosphor-bronze spiral gears meshing in a common mild steel driver at the end of the camshaft.

The cam-shaft is driven by means of spiral gears from the crank-shaft, and can be withdrawn bodily with all the cams at a moment's notice by simply slacking back one set-screw.

The engine illustrated is governed by means of the "hit and miss" method on the gas valve for factory driving, but if required for electric power, the throttling method on both gas and air is employed. Ignition is by means of L.T. magneto and trip gear. The time of firing can be altered at will when the engine is running; this prevents any possibility of backfires at starting, and ensures the engine running with the highest efficiency.

The engines illustrated are manufactured in eight sizes, one to four cylinders, of 15-120 B.H.P.

#### Brooke Petrol Sets.

We illustrate in figs. 39, 40 and 41, some of the petrol-electric manufactures of MESSRS. J. W. BROOKE & Co., Lowestoft. Possibly the most interesting is fig. 40, representing half-a-dozen sets of petrol-engine driven searchlight plants which have recently been shipped for the Greek Government. These sets are in conjunction with complete equipments for six Customs service boats for work amongst the islands, comprising a 25-H.P. Brooke engine, propellers, &c.

The searchlights are of 18-in. diameter, and, together with the dynamos and switchboards, were constructed by Messrs. Crompton & Co. They have a working radius of 600 m. The engine is a 4-H.P. single-cylinder one, running at 950 R.P.M., the dynamo having an output of 40 amperes at 70 volts. A larger engine of similar build, having six cylinders and developing 25 H.P. and 16.5 KW. is shown in fig. 39, which represents a plant recently forwarded to Pernambuco.

#### The Aster Engine.

One of the best known of the small internal-combustion engines operating on petrol or paraffin, is the Aster, made by the ASTER ENGINEERING CO., LTD., Wembley, of which there are over 18,000 at present in use on motor-cars, aeroplanes, boats, and for electric lighting, pumping, cinematograph and wireless purposes. This engine is constructed for powers up to 70 B.H.P., and we illustrate in fig. 43, p. 639, a 35-H.P. engine of this type coupled to a dynamo, with a speed of 950-1,000 R.P.M.

The engine is provided with a well thought-out lubricating system, the oil being drawn from the crank-case sump by means of a geared pump and forced through ducts to the crank-shaft journals, through a slot in the latter

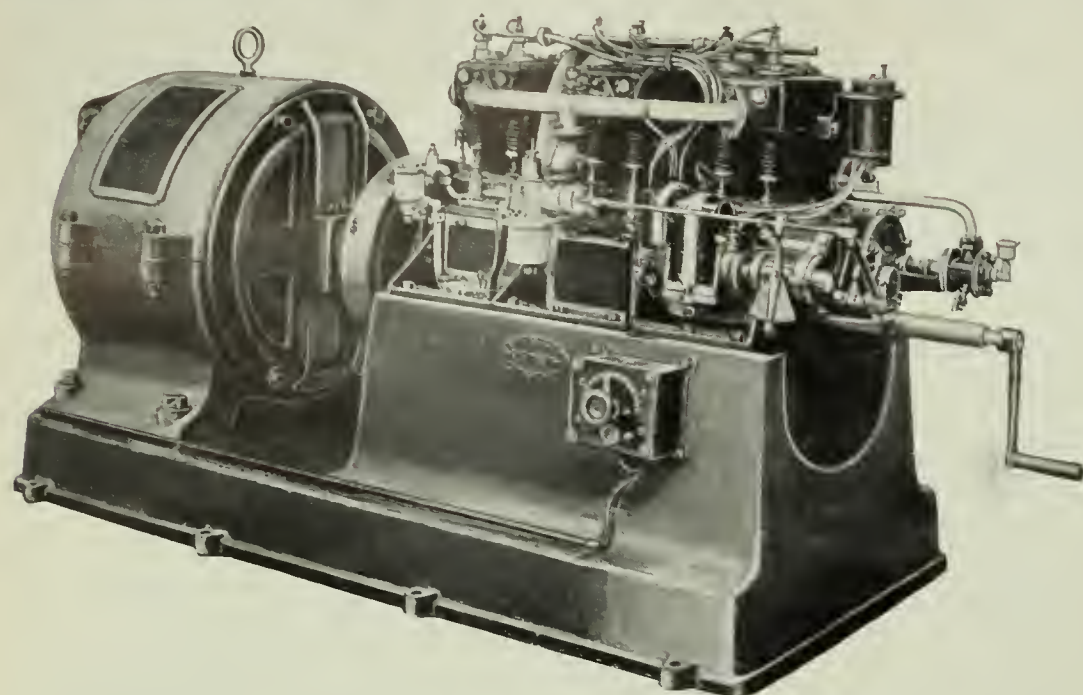


FIG. 39.—BROOKE SIX-CYLINDER ELECTRIC LIGHTING SET FOR PERNAMBUCO.

Half-compression gear is provided for starting: lubrication is by "splash," a scoop at the end of the connecting rod dipping into an oil trough at every revolution, and flinging oil to all the moving parts. The main bearings are provided with automatic ring lubrication, and the ignition is by H.T. magneto. The firm are also manufacturing vertical gas engines. The illustration (fig. 38) represents their 25-B.H.P. single-cylinder vertical suction gas engine, with a speed of 350 R.P.M.

Special attention may be drawn to the method of supporting the cylinder liner, by means of which exceptional rigidity is obtained; it is cast integral with the combustion head and is securely bolted to the upper casing of the crank chamber, the lower end being supported by means of an internal ring in the upper casing, which is bored to receive it—thus the liner is perfectly free to expand, and no distortion can take place.

Forced lubrication is fitted to the main bearings, crank-pin, and piston pin, the pump being situated at the lowest point of the

thought-out lubricating system, the oil being drawn from the crank-case sump by means of a geared pump and forced through ducts to the crank-shaft journals, through a slot in the latter

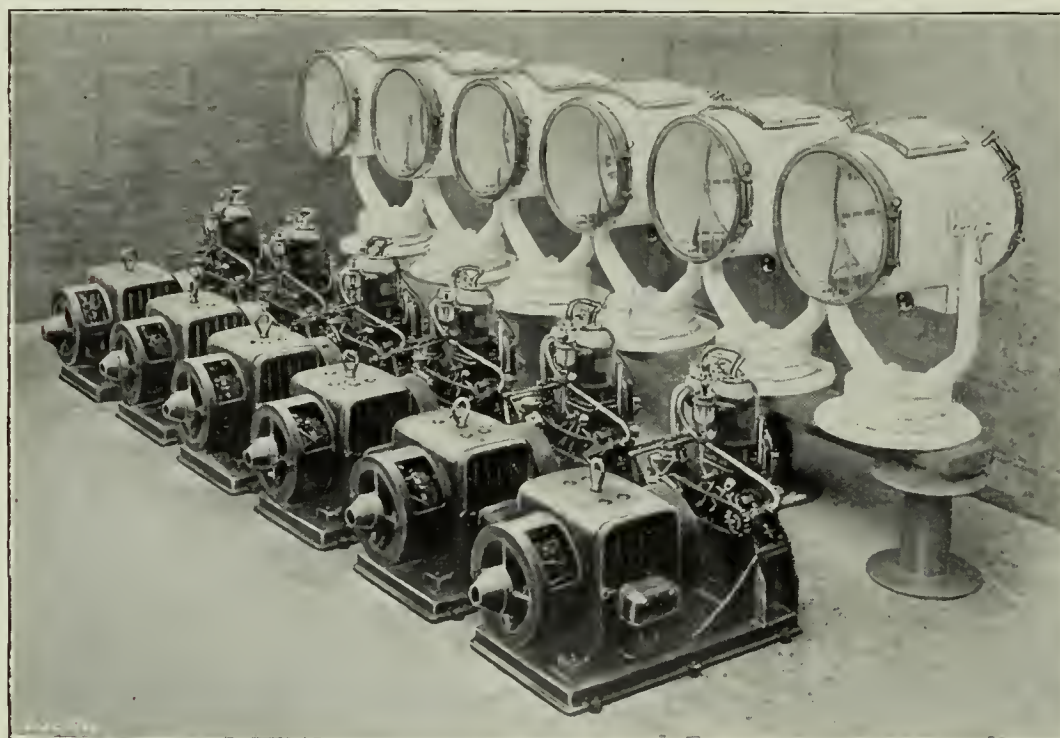


FIG. 40.—BROOKE PETROL-ELECTRIC SETS AND SEARCHLIGHTS.

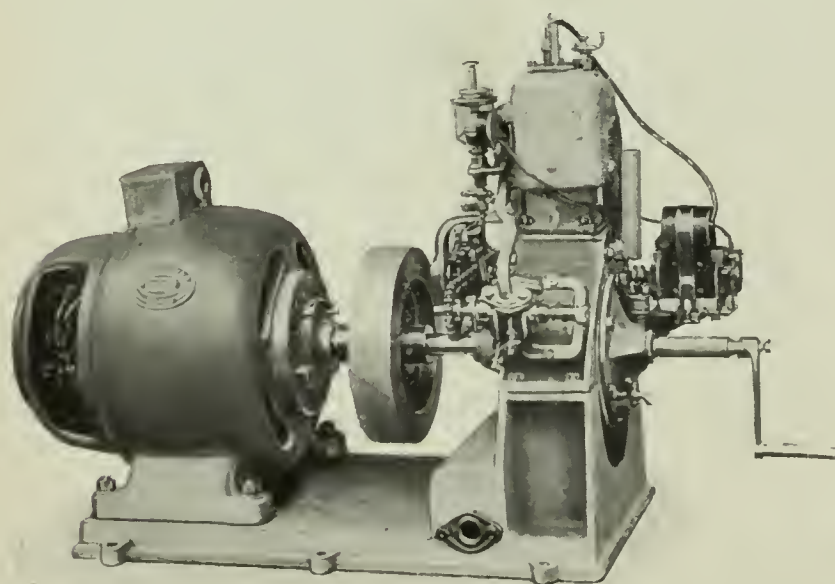


FIG. 41.—BROOKE 4-H.P. PETROL ENGINE AND DYNAMO.

crank case and driven by means of an eccentric and rod from the cam shaft; the pressure of oil in the system is always under observation on the gauge.

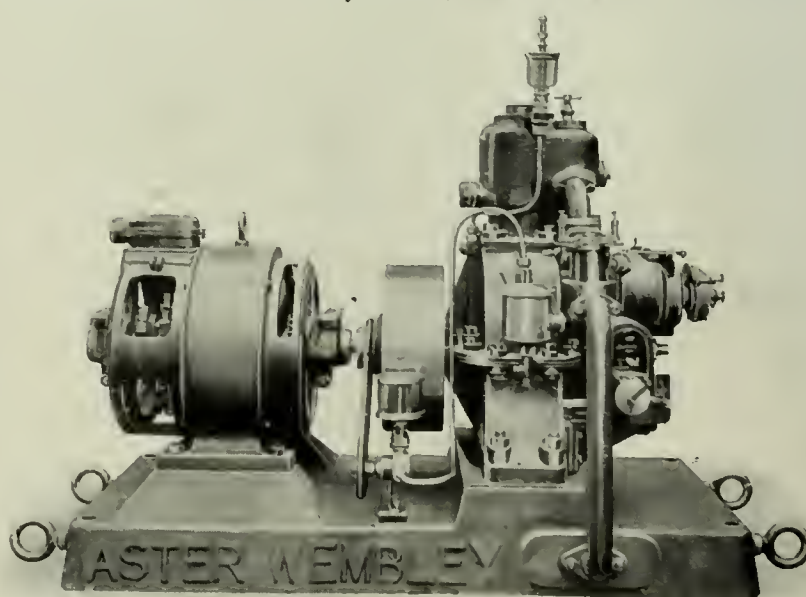


FIG. 42.—ASTER 1.4-KW. PETROL-ELECTRIC SET.

and an axial hole into the crank-shaft, which is pierced with oilways leading to the connecting rod big-ends, and eventually to the cylinders, from which it is returned through a filter to the



sump. A sensitive fly-ball type of governor running in oil is fitted, and Bosch H.T. magneto ignition; the engine is governed on the inlet and fitted with mechanically operated valves.

A feature of these small generating sets is the Aster flexible coupling, which greatly simplifies the erection of engine and dynamo,

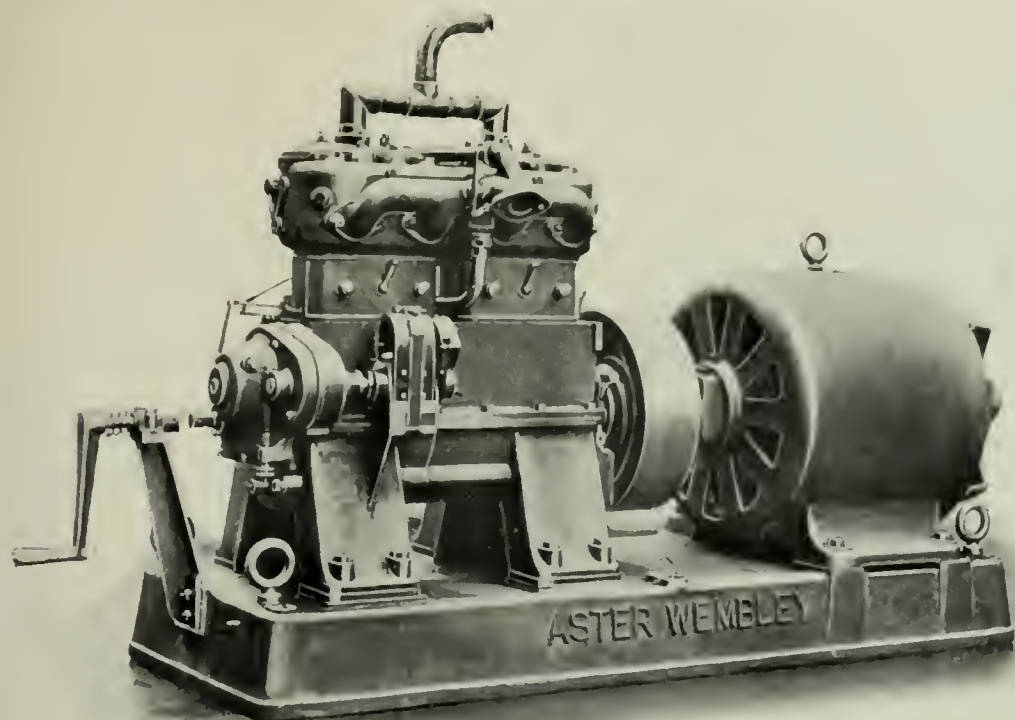


FIG. 43.—ASTER 35-H.P. ENGINE AND DYNAMO.

and provides sufficient elasticity to absorb shocks. These sets are designed for petrol or paraffin fuel, but are adaptable for use with gas.

Fig. 42 shows a single-cylinder generating set, with an output of 1.4 KW. at 1,200 R.P.M. A large number of these sets have been supplied for country house lighting purposes, for which they are well adapted owing to the smooth running obtained with the inside fly-wheels.

The magneto, and when necessary the water-pump, is driven off the main shaft by means of a skew-gear at right angles, all these gears being enclosed in oil-tight cases. The governor is driven off an extension of the cam shaft and actuates the throttle; it also is enclosed in an oil-tight case. The engine exhaust is utilised to heat up the air supply to the carburettor, which is supported on the air pipe as shown in our view.

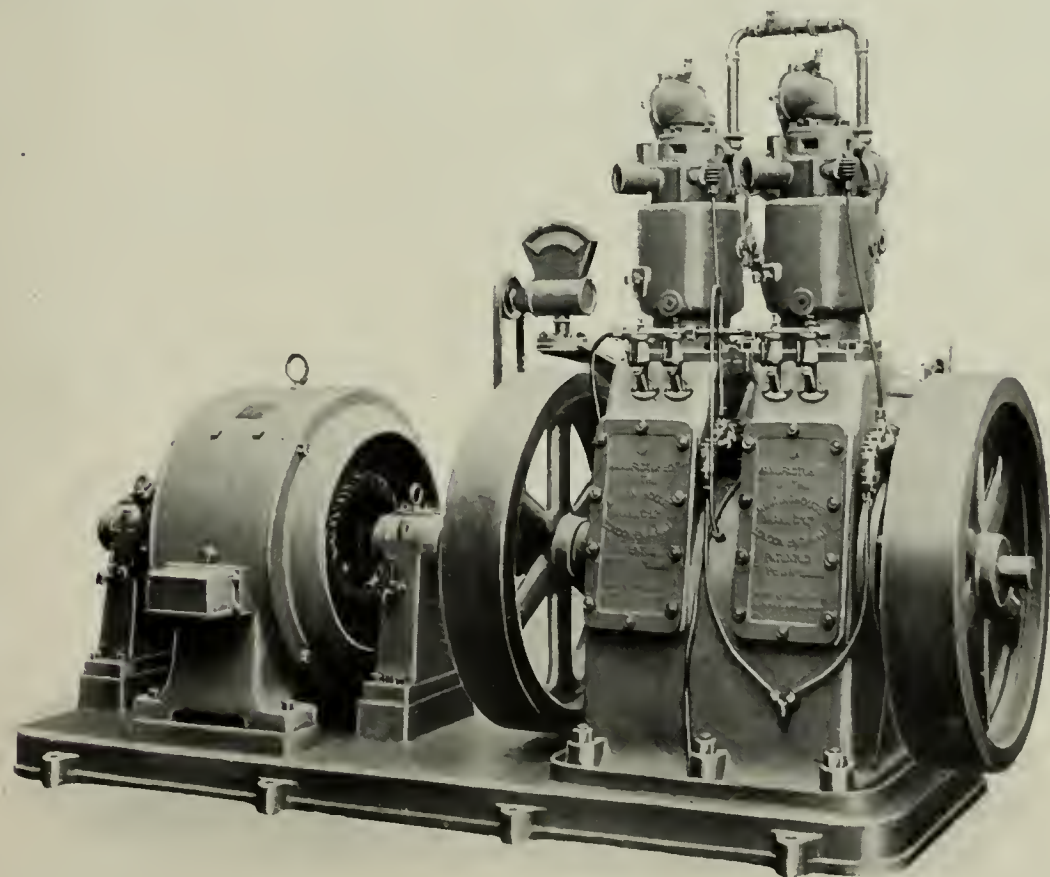


FIG. 44.—CROSS 20-H.P. OIL-ELECTRIC SET.

Aster portable sets mounted on a trolley with a canopy have proved very popular for cinematograph work, over 300 of them having been supplied for this purpose alone; the makers claim a generating cost of about 1½d. per unit.

#### The Cross Oil Engine.

A handy type of oil engine—known as the Cross oil engine—for operating on petroleum, kerosene, or even crude oils, is made by the Westinghouse Brake Co., Ltd., London.

This engine is of the vertical single-acting four-cycle type, designed for high speeds and making use of the heat of compression to ignite the fuel charge sprayed into the combustion chamber of the cylinder during ordinary running.

The upper end of the cylinder forms the combustion chamber, into which a small iron bulb, previously heated by a blow lamp, is screwed for the purpose of igniting the charge when first starting up.

The engine speed is controlled by a governor which varies the stroke of a small oil fuel pump, regulating the amount of oil sprayed into the cylinder at each power stroke.

The fuel injection is gradual, in order to obtain gradual combustion rather than explosion of the charge, this arrangement ensuring more even running and less severe stresses on the working parts. The engine valves are all mechanically driven from a cam-shaft running at half engine speed, and the bearings are of hard bronze.

The lubrication of the engine is positive and automatic—an oil pump being provided, which draws oil from an oil well in the crank chamber, and circulates it to the main bearings and to troughs for splash lubricating the connecting-rod ends, &c.

We illustrate in fig. 45 a sectional view of a 10-H.P. Cross engine from which the general arrangement can be seen, while fig. 44 shows a 20-H.P. two-cylinder set direct-coupled to a dynamo for country house lighting and similar purposes.

#### The Hindley Gas Engine.

As makers of a very successful short-stroke high-speed vertical gas engine. MESSRS. E. S. HINDLEY & SONS, of Bourton, have achieved some fame. Their engines are all built on standard lines and embody various constructional improvements more or less peculiar to the Bourton engines. The cylinders are each cast separate, but in one with the water jacket, which is

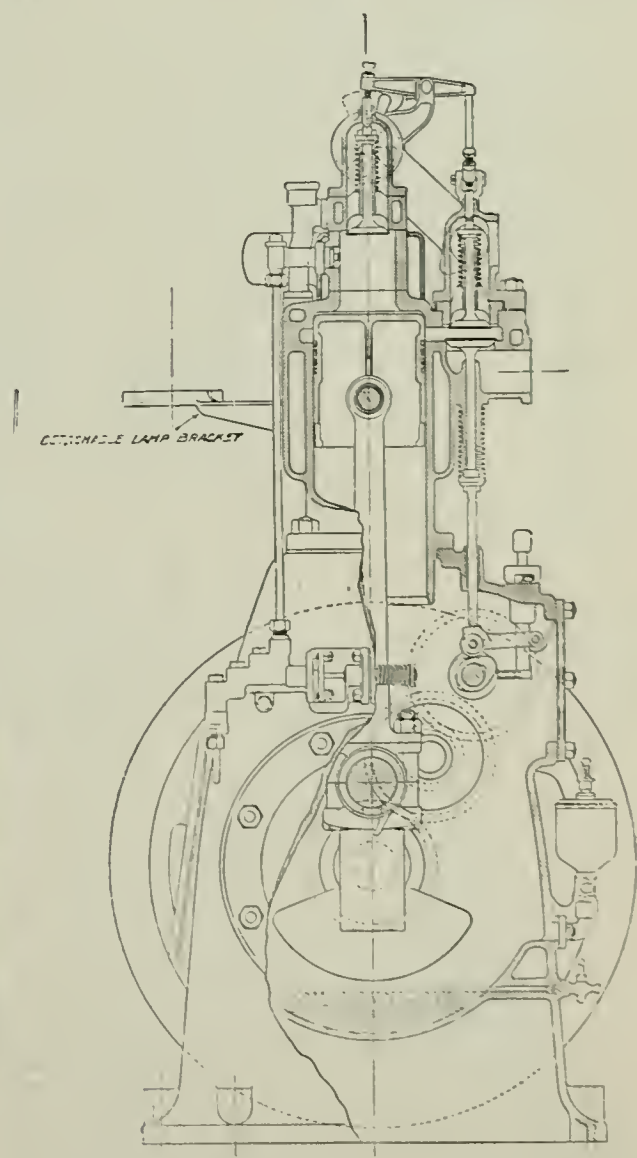


FIG. 45.—SECTION OF 10-H.P. CROSS OIL ENGINE.

corrugated and allows for unequal contraction of parts after casting.

The engines are provided with forced lubrication, throttle-governing—with a crankshaft governor and balanced mixture valve—L.T. magneto ignition, &c., with a trip-gear designed so as to avoid the possibility of accident should the engine be turned in the wrong direction. Messrs. Hindley have supplied many of their plants to foreign and Colonial users, and build suitable producer plants for use with all classes of fuel, including semi-bituminous coal, wood chippings, peat, &c.



**Maschinenfabrik Thyssen & Co., A.-G., Mulheim-Ruhr.**

In figs. 46-48 we illustrate some large gas engines recently constructed by MESSRS. THYSSEN & Co., of Mülheim-Ruhr, for driving electric generators. The engines shown in fig. 46 are twin-engines, but in details of construction these are identical with that illustrated in figs. 47 and 48, which is a single-crank engine erected at the Pluto Mine of the Gelsenkirchen Co., at Wanne, and runs on coke-oven gas. It has, it will be seen, two double-acting cylinders, arranged tandem fashion, the diameter being 1,150 mm. (45.3 in.), and the stroke 1,300 mm. (51.2 in.). The jacket, it will be seen, is cast in one with the cylinder, but it is fitted with a renewable liner of hard cast-iron, which takes all the wear. Both cylinder heads and pistons are water cooled, as is best shown in fig. 47, and the water-cooling of the exhaust valves and the casings has been amply provided for.

The gas supply to each end of each cylinder can be independently

throttle valve is provided at *c*, by means of which the proportion of air to gas drawn in can be adjusted by hand. Having these two adjustments, the engine can be run on all qualities of gas, since by varying the relative opening and closing of these valves on the

air and gas supplies, the proportion of air to gas can be varied through a practically infinite range. The ports which lead from these adjustable gas valves to the cylinder are, as will be seen on reference to fig. 47, provided with additional throttle valves at *f* and *g*. These are under the control of the governor by means of the link work, shown on the right hand of the cylinder in fig. 48.

The inlet valve, it will be seen, is double, there being a gas valve on the same spindle as the main inlet valve; and there is also a sleeve on the same spindle, which, when the valve is seated, covers the air port. Thus the opening to air is always proportional to the

opening for gas. These inlet valves are operated by an eccentric on the side shaft, and have a constant opening, the governing being effected, not by varying the lift or the duration of opening

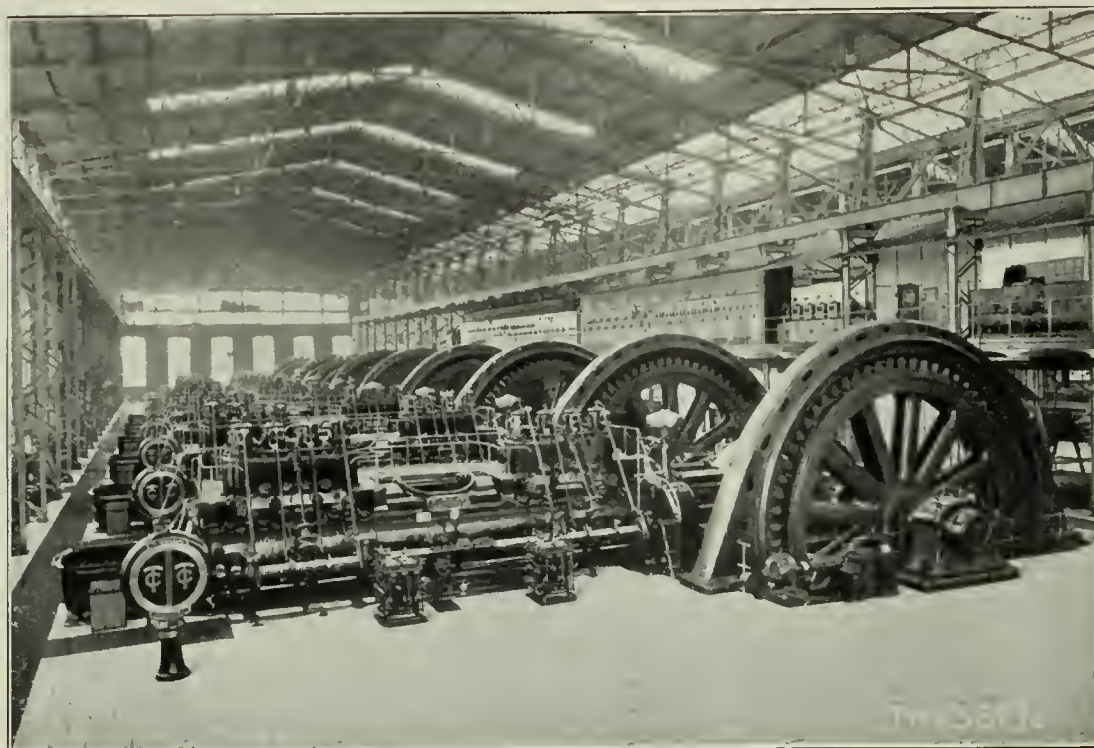


FIG. 46.—POWER STATION EQUIPPED WITH THYSSEN GAS ENGINES.

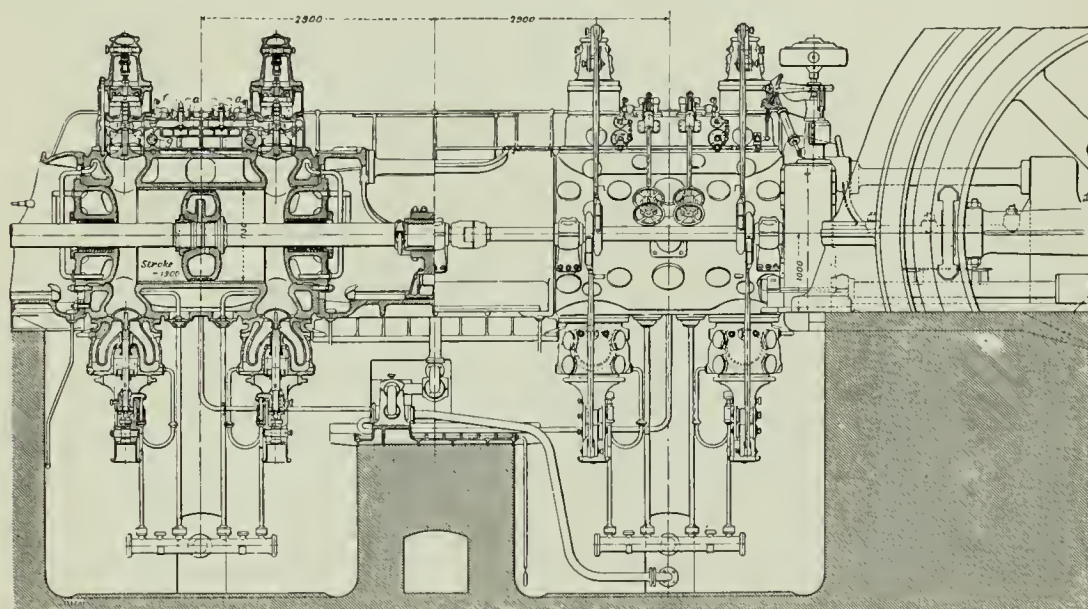


FIG. 47.—LONGITUDINAL SECTION OF THYSSEN ENGINE.

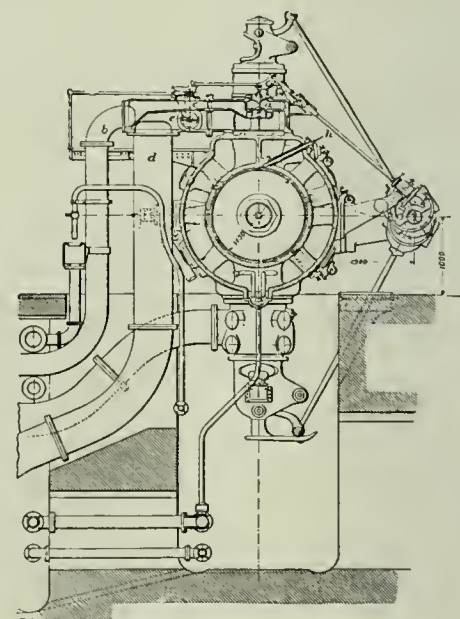


FIG. 48.—TRANSVERSE SECTION.

adjusted by means of the hand-wheels shown on the side of the right-hand cylinder in fig. 47, which actuate link-work by which may be opened or closed the valves, shown at *a* in both figures. This

of this valve, but by opening or closing the throttle valves at *f* and *g*. The exhaust valves are located below the cylinder, and are wholly contained in independent castings, which can readily be

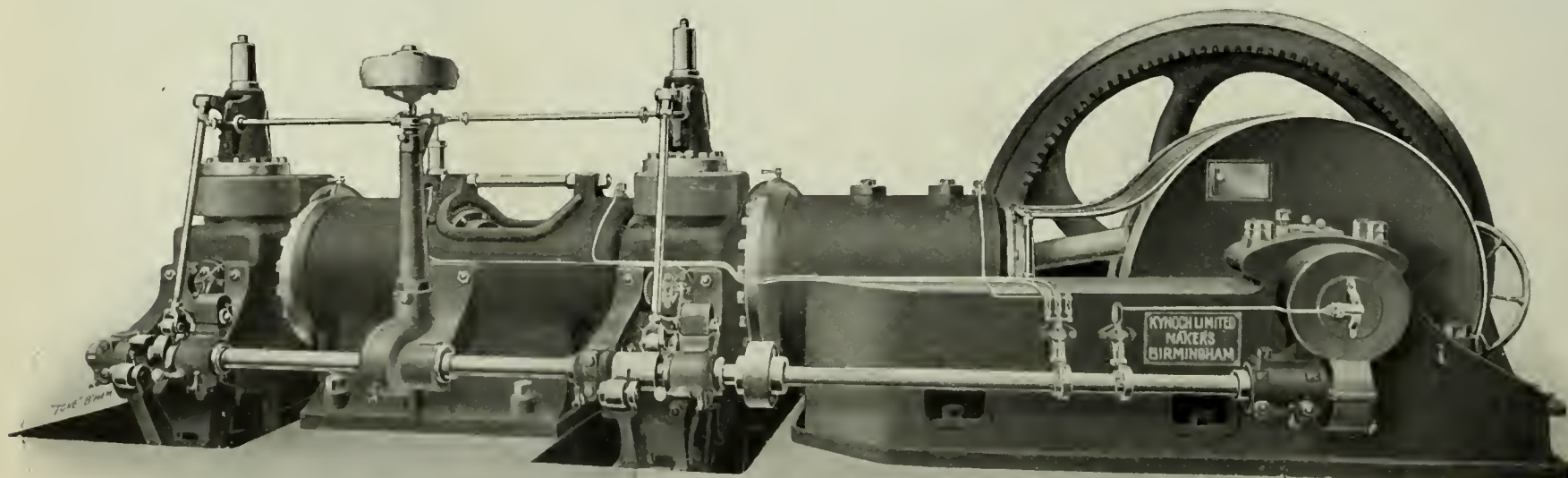


FIG. 49.—KYNOC STANDARD TANDEM ENGINE FOR ELECTRIC LIGHTING.

gas supply reaches the engine through the pipe shown at *b*, fig. 48, and, as indicated at *c*, a hand-hole is provided in the port leading to the gas valves, through which deposit can be removed if required. The air-supply pipe is represented at *d*, and, as will be seen, a

removed should the valves require examination or repair. As will be seen from fig. 47, a crosshead is fitted between the two pistons, and the left-hand cylinder has a tail-rod, also supported by a guide. Hence the weight of the pistons and rods is entirely taken



off the glands, which have thus no tendency to wear oval. The gland packings are of the metallic type.

As is shown in fig. 47, the two cylinders in tandem are connected at the top by steel stays supplementing the "tween" casting below. Similar stays lead from the first cylinder to the top of the main bearings, and the engine-framing is thus relieved from the bending strains which in the past have frequently proved disastrous.

The equipment for cleaning this gas is very complete, and as it enters the engines the gas does not contain more than 0.03 gramme of dust per cubic metre. As a consequence, it has been found possible to run the engines without cleaning them for from one-and-a-half to two years. The station load as a whole, is very steady, and the power factor is consequently high, reaching the very satisfactory value of 70 per cent.

#### Kynoch Gas Engines.

MESSRS. KYNOCH, LTD., of Birmingham, have developed a standard line of horizontal gas engine and producer plants specially adapted for electric lighting and similar purposes. The engines are built to gauge, and interchangeability of similar parts is assured; in size they range from 26 B.H.P. to 165 B.H.P. in the single-cylinder pattern, and from 220 to 660 B.H.P. in a tandem pattern, with speeds of from 250 to 160 R.P.M.

The principal constructional features of the Kynoch engine can be gathered from fig. 50, which shows the cylinder and valves in section. The cylinder-liner joint has no contact with either water or explosion, thus avoiding a frequent cause of leakage; hand-holes are provided for cleaning both cylinder and combustion chamber, and special water cooling for the piston is a feature of engines of 125 B.H.P. and over, this also applying to the exhaust valves in large engines. The three main valves are of the mushroom type, arranged vertically, and driven from the cam-shaft by a straight-line motion.

Other features are balanced cranks, marine type connecting rod, bearings removable without lifting crank, up-to-date lubrication, and

magneto ignition with a special slow-speed engagement of trip gear, so arranged that the point of ignition can be varied within very wide limits while the engine is running. We illustrate in fig. 49 one of the firm's standard tandem engines for electric lighting which embodies the above features, and has an impulse every revolution.

The Kynoch suction-gas plant for use with the firm's engines has also been carefully considered. The gas generator consists of a brick-lined steel plate shell built on a cast-iron base, with a special water bottom forming a reserve water supply for starting up. An external vaporiser is provided, through which the hot gases from the generator are passed, cooling them on the way to the scrubber. The hopper has a slide feed, and the fire can be poked while the plant is working. The fan for starting is fitted with an air shutter, which is closed when the engine is running, also an oil bath for the gearing.

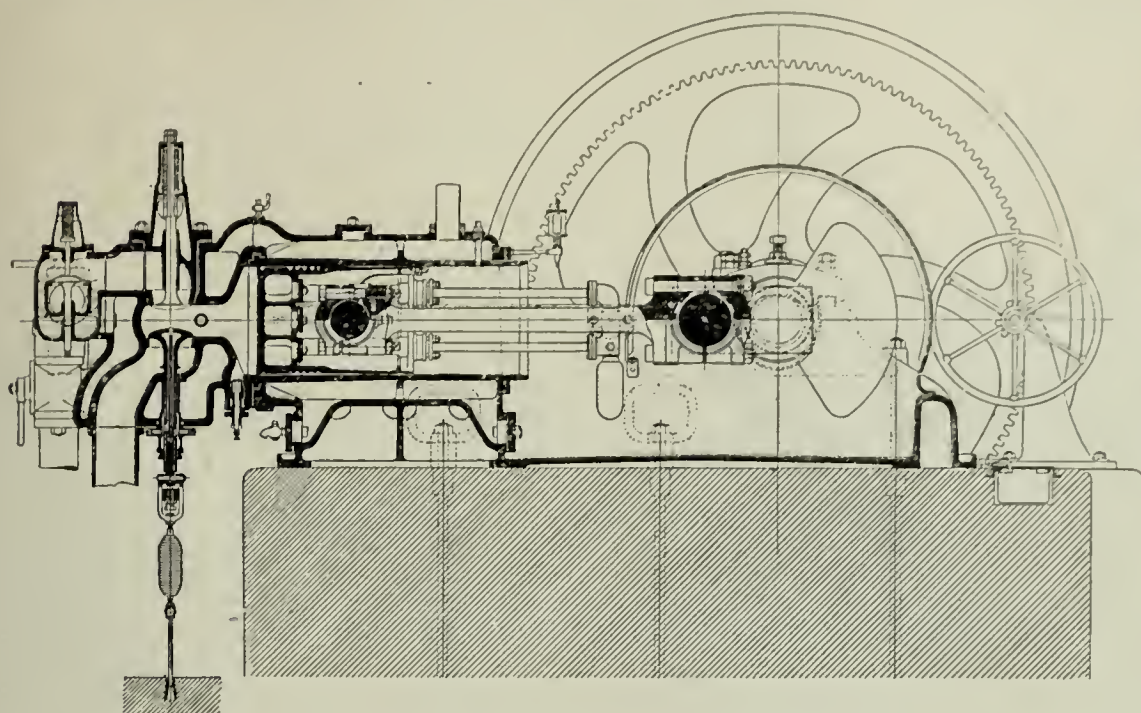


FIG. 50.—LONGITUDINAL SECTION OF KYNOCH ENGINE.

These stays, being of steel, occupy little room, and scarcely affect the accessibility of the glands and cross-head. Forced lubrication is fitted to the cylinders, oil being pumped in through a pipe passing through the water-jacket, as indicated at *h*, fig. 48. The engine operating on the four-cycle principle, the side-shaft has, of course, to be geared down. This is effected by spiral gearing located between the fly-wheel and one of the main bearings. This gearing is completely enclosed, and runs in an oil bath.

The crank-shaft has three bearings, that on the right hand having a spherical seat. The brasses are lined with white metal, and the

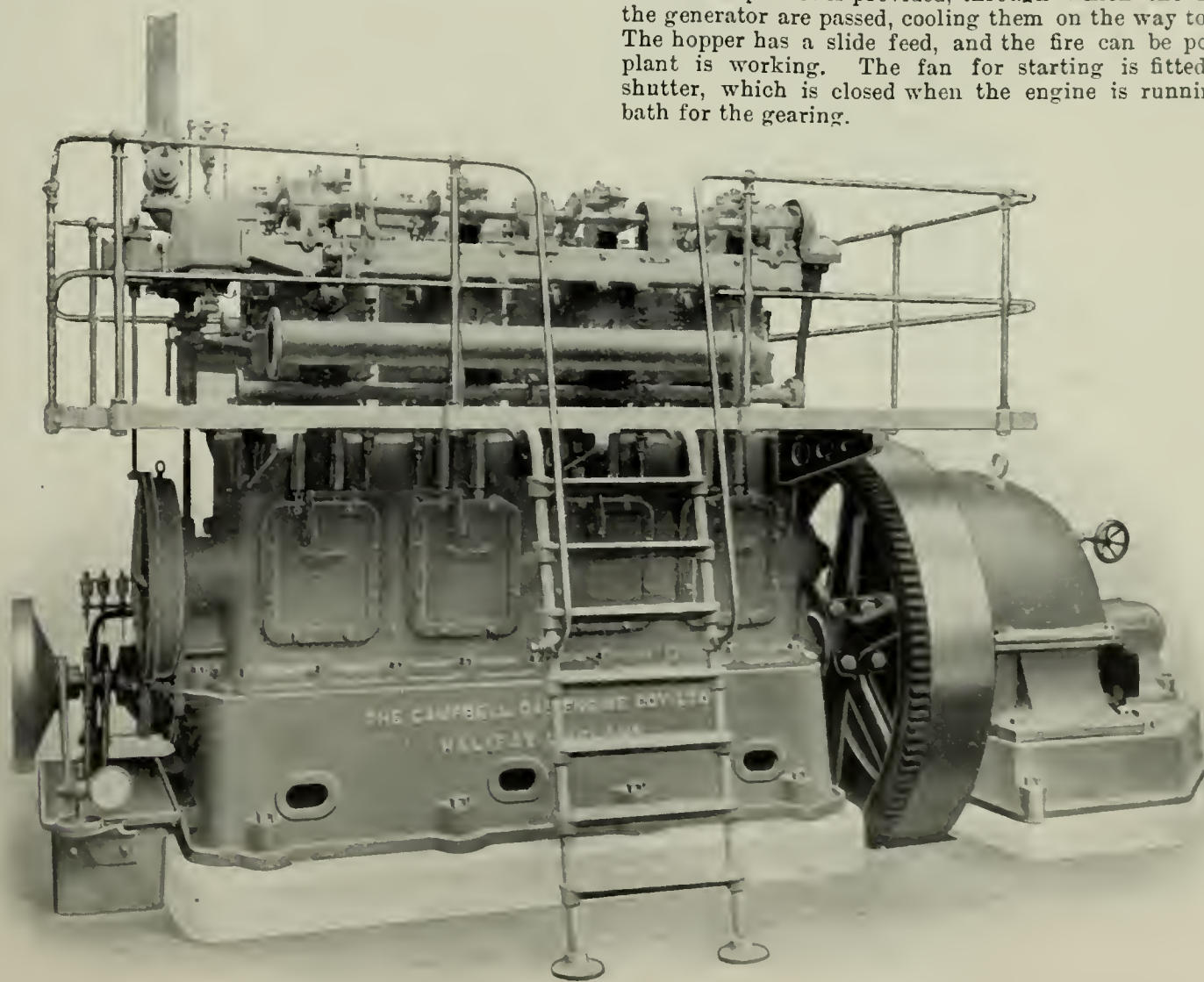


FIG. 51.—CAMPBELL FOUR-CYLINDER VERTICAL GAS ENGINE OF 150 B.H.P.

lubrication is forced, so that long continuous runs present no difficulty.

Messrs. Thyssen, we may add, have supplied the equipment for the largest gas-power station on the Continent of Europe, viz., that of the Gewerkschaft Deutscher Kaiser, in Bruckhausen. Here there are in all eight large blowing-engines and 12 large gas-engine generator sets, having an aggregate rated capacity of 60,000 B.H.P. The engines run on blast-furnace gas.

#### Campbell Gas Engines.

THE CAMPBELL GAS ENGINE CO., LTD., of Halifax, make both horizontal and vertical engines: the latter run to 575 B.H.P. with four cylinders on producer gas. Having been amongst the first to build vertical gas engines, the firm have acquired a lengthy and valuable experience in this line, and make a special feature of reliability. Many of their vertical engines have been installed in



electric power stations, where their economical working has been fully demonstrated.

The engines work on the four-stroke cycle, and the cylinders are entirely independent of one another, so that in case of need the engine can be run with one or more cylinders idle; the cylinder covers are not encumbered with valve gear, and can, therefore, be removed and replaced with facility. The valves are operated by a camshaft inside the crank case. All the main bearings are provided with forced lubrication, and the cooling water circulation is

built-up type. The crankshaft and camshaft bearings are provided with ring lubrication, and there is an independent forced system of lubrication to the other working parts.

### Westinghouse Gas Engines.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING Co., LTD., of Manchester, were early in the field of vertical gas-engine construction, and have developed this type to a high degree of perfection; they also make horizontal engines from 2 to 33 B.H.P. for electric lighting and other applications, one of which, directly coupled to a dynamo, is illustrated herewith (fig. 52).

The vertical engines are made in sizes from 100 to 915 B.H.P. with producer gas, and are of the tandem four-cycle single-acting type, giving one impulse per revolution on each crank. The top and bottom pistons are joined by a cast-iron sleeve, through which passes a steel bolt, and a stuffing-box is, of course, provided between the cylinders in the shape of a long hollow head, the connecting piston rod being provided with Ramsbottom packing rings where it passes through the head. The valves are made easily removable, and by taking off the cylinder cover it is easy to withdraw the pistons, lower cylinder head and connecting rod. The speed is regulated by a centrifugal shaft governor controlling the quantity of mixture admitted, the proportions of gas and air being constant at all loads. The engine runs at 200-325 R.P.M., according to size, and as there are usually several cranks, each receiving one impulse per revolution, the cyclic regularity of running is very high.

All important working parts and bearings are lubricated by force pumps, and the cylinders and heads are water jacketed, but even in the 1,000-H.P. size, neither the pistons, rods, nor the exhaust valves are water cooled. Starting is effected by compressed air acting in the bottom cylinder of each line; no half-compression cams or other relief devices are employed. Ignition is done with a high-tension coil.

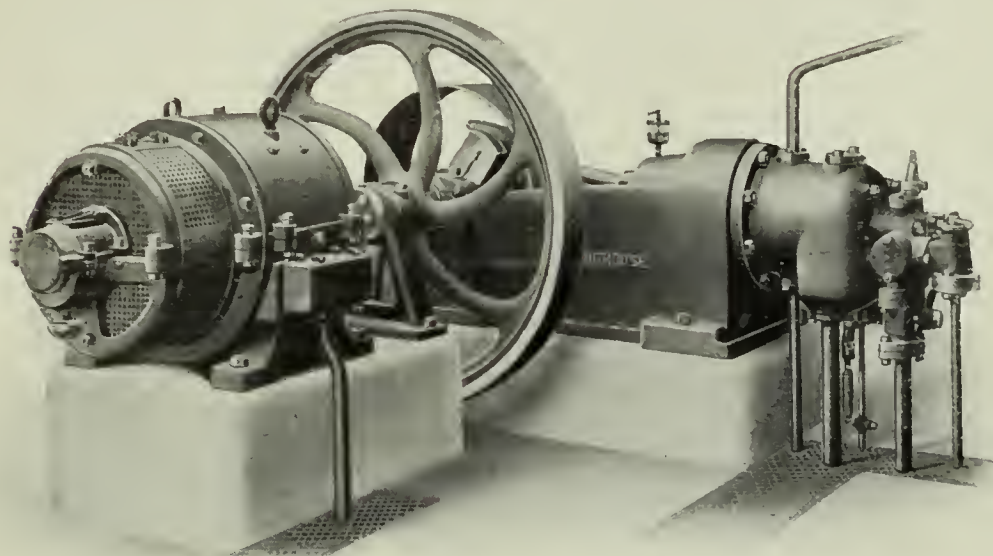


FIG. 52.—WESTINGHOUSE ELECTRIC LIGHTING SET, HORIZONTAL TYPE.

ensured by a centrifugal pump. The accompanying illustration (fig. 51, p. 641) shows a Campbell four-cylinder vertical engine of 400 B.H.P., directly coupled to a three-phase alternator. Among recent improvements effected in the design of the engine may be cited the following:—

The Campbell Co. now provide an entirely independent lubrication system to the cylinders, and each cylinder is lubricated independently by means of a small force pump, which delivers the oil at several points round the piston.

The company now throw the centre of the cylinders off the crank centres, thus reducing the angularity of the connecting rod during the impulse stroke. By this arrangement the thrust of the rod is reduced by about 20 per cent., with a corresponding reduction in wear and tear.

The exhaust branch pipe taking the exhaust from the four cylinders is now water-jacketed, thus avoiding trouble from corrosion, and also reducing the noise of the exhaust, and, as a subsidiary advantage, reducing the temperature of the engine-room.

These are the chief features of their latest design of vertical engine, which is more particularly suitable for small station work, and other places where economy in space is essential.

Where the horizontal type of engine is adopted, the company build engines of various types up to 850 max. B.H.P.; the ordinary type of single-cylinder engine has not been modified to any material extent of recent years, at least up to 150 B.H.P., but engines above this power are now supplied with an outer slipper guide. This arrangement is somewhat more expensive than the older design of engine, but is well worth the extra expense.

The makers have recently shipped an engine of 420 maximum B.H.P. of the side-by-side type, designed on these lines, to a large mining concern in Western Australia. This engine is provided with a fly-wheel grooved for a rope drive, the crankshaft being of the

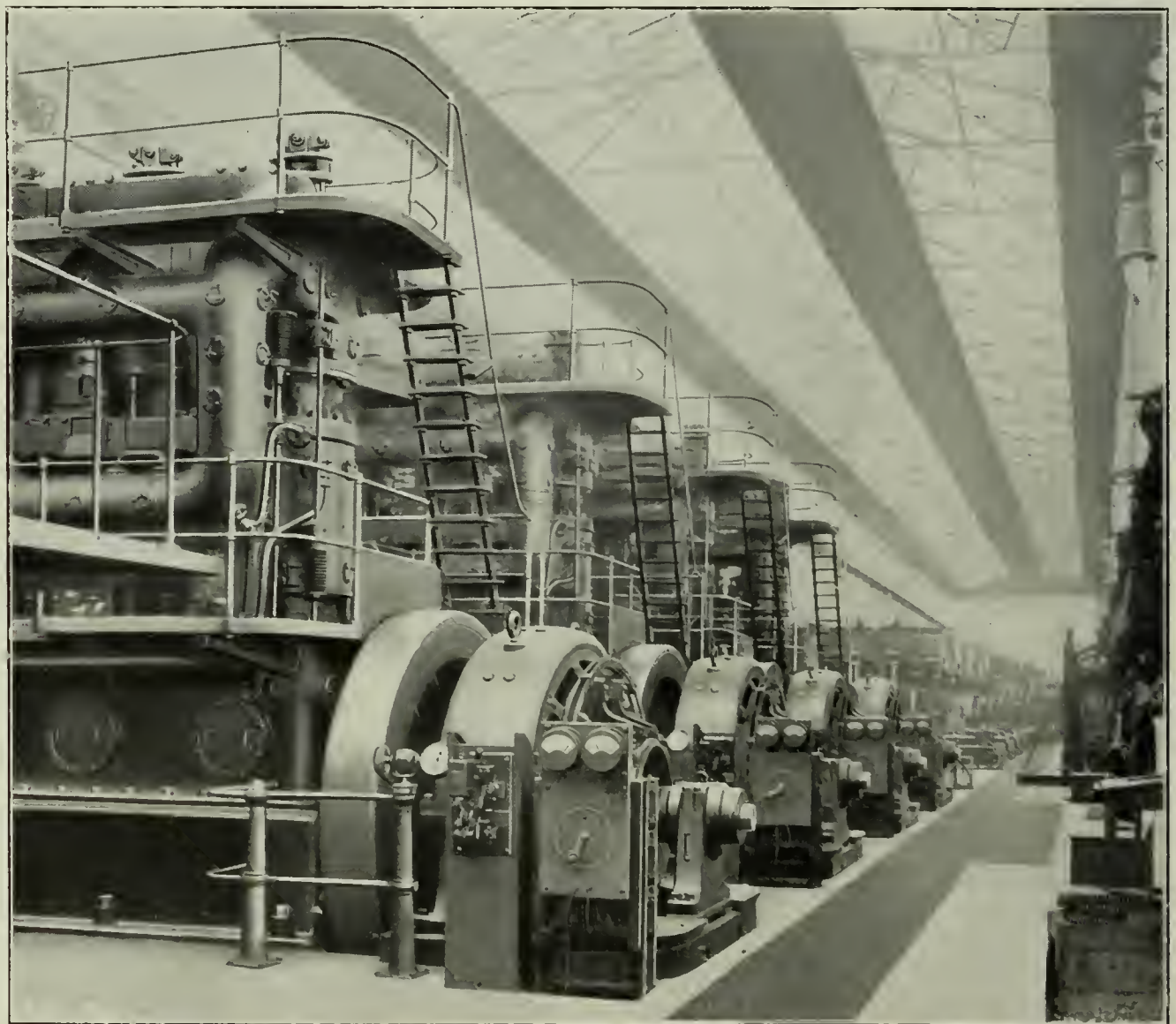


FIG. 53.—WESTINGHOUSE VERTICAL ENGINES AND DYNAMOS INSTALLED IN THE CASTNER-KELLNER Co.'s WORKS.

Many large electric power stations are equipped with these engines and Westinghouse generators; we illustrate one of these—at the works of the Castner-Kellner Alkali Co., Ltd., Runcorn—where four 500-kw. three-crank six-cylinder D.C. sets and two of 635 kw. are installed, working on producer gas. The plant is in continuous operation night and day, and the load factor attains to the remarkable value of 98 per cent.

We understand that Westinghouse vertical gas engines aggregating



about 300,000 B.H.P. have been installed, of which 60,000 H.P. is operating in this country. The company have also taken up the manufacture of the Diesel type of oil engine.

#### M.A.N. Engines.

THE MASCHINENFABRIK AUGSBURG-NÜRNBERG A.G. need no introduction to our readers; as engine builders they have attained a world-wide repute, especially in connection with the larger type of gas engine operating on power gas, and the Diesel engine using crude-oil fuel.

The Nuremberg horizontal double-acting four-cycle gas engine has been frequently referred to in our pages, and has been continuously improved during the past 10 years. In the old design a tandem engine had 12 valves with separate eccentrics and rods, while the present engines (shown in fig. 54) have only eight valves

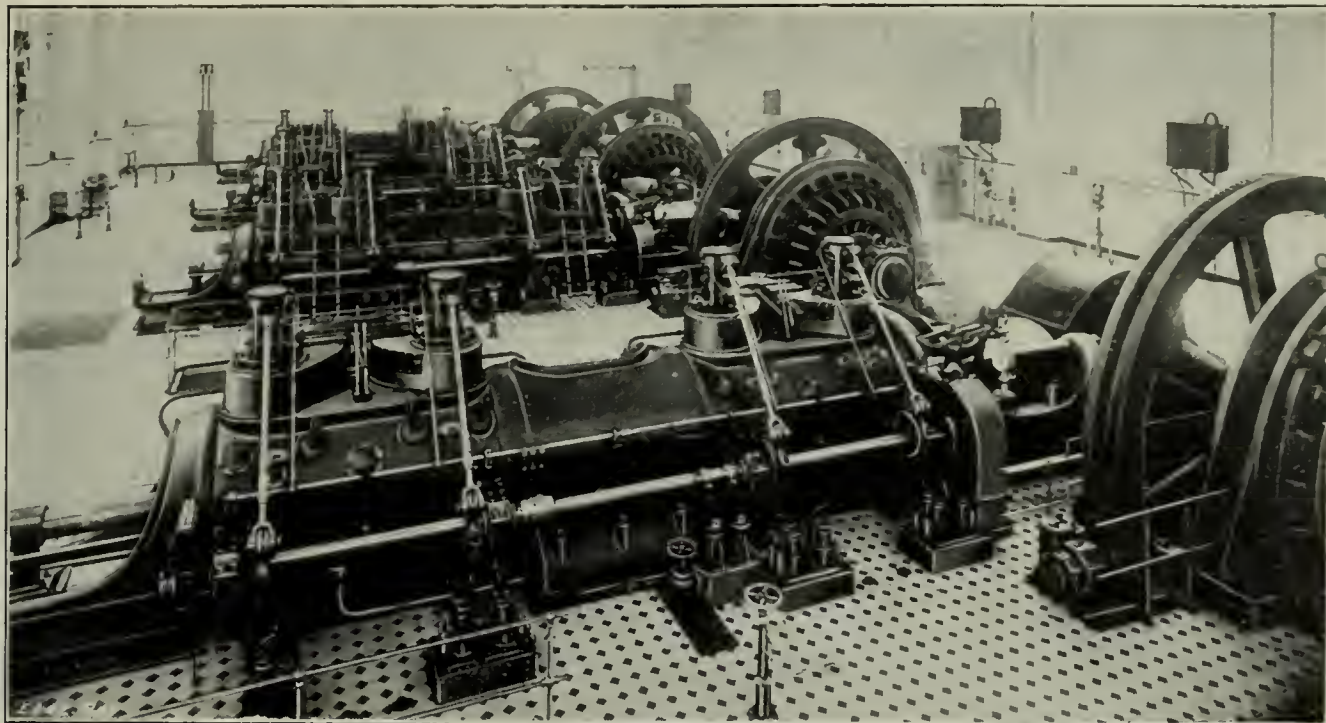


FIG. 54.—MODERN NUREMBERG GAS ENGINES, EACH OF 1,150 B.H.P., IN A GERMAN WORKS.

(four combined mixture and inlet valves and four exhaust valves) with four eccentrics and rods. Lengthy experience in design has also resulted in the production of perfectly reliable cylinder castings, despite the severe conditions under which these work.

The company is now regularly building cylinders for individual outputs of 1,200 to 1,500 B.H.P., giving outputs of 2,500 to 3,000 B.H.P. in a tandem engine.

When operating on blast-furnace and coke-oven gas (as in the case of the Bargoed installation in South Wales, described in these pages), the engines show astonishingly low working costs; the latter, exclusive of fuel costs, in the case of 10 electric power stations where 37 Nuremberg gas engines are employed, averaged 0.553d. per unit for wages, lubrication, cleaning material, repairs, and maintenance, &c.

Gas-engine power stations of this type, with capacities of 20,000 to 30,000 B.H.P., have now been successfully operated for some years, and a recent development, which deserves some attention, is the addition of Diesel engine plant in such stations to take the peak load, the gas engines meeting the normal steady demand.

Turning to the M.A.N. Diesel engine, we illustrate in fig. 55, one of the more interesting productions of the firm—a 1,600-2,000-B.H.P. horizontal Diesel engine driving a direct-current generator, and installed at the municipal electricity works at Halle. The engine is of the horizontal double-acting four-cycle type, and we understand that 15 similar engines of from 600 to 1,600 B.H.P. have been ordered from the company.

The peculiar merits of the horizontal type of Diesel engine, of which the M.A.N. Co. are the pioneers, are somewhat open to discussion at present; the firm has, of course, built many thousands of the vertical type of engine in all sizes, and can point to such

examples as the 13 Diesel engines of 4,500 B.H.P. operating the Kieff Tramways, and seven similar engines for the Saratov Tramways power house. An interesting internal-combustion engine power plant which the firm is equipping will contain both blast-furnace gas engines and two M.A.N. Diesel engines each of 2,000 B.H.P. and running on coal-tar oil. These engines will be of the horizontal two-cycle single-acting type, and it is worthy of note that electric power stations with four to six engines of this type, each of 2,000 B.H.P., are at present under consideration.

#### Britannia Oil Engines.

The illustration on page 644 shows a four-cylinder 50-B.H.P. paraffin oil engine built by the BRITANNIA ENGINEERING CO

(1910), LTD., of Colchester, for electric lighting purposes. Accessibility has been made the first consideration in the design of this engine, it being possible to remove the crank-shaft, pistons and connecting-rods without dismantling the engine. The casing is a light iron casting with very large doors and covers, but the cylinders are supported on steel columns, which relieve the casing of strains. The cylinders are cast in one piece with the water jackets, which are provided with exceptionally large openings for cleaning purposes. The bearings throughout are lined with white metal, and lubrication is effected by a special system; an oil reservoir is formed in the bed-plate, but the cranks do not dip into the oil. A pump circulates the oil to a

spraying device in line with each of the cranks, so that a fine spray of oil is maintained throughout the whole of the crank chamber, thoroughly lubricating all the working parts. This system has been found very successful. High-tension magneto ignition is used by preference. The engine illustrated is provided with a sensitive fly-wheel governor acting on the throttle for electric lighting work, and a plunger pump is employed to circulate the cooling water.

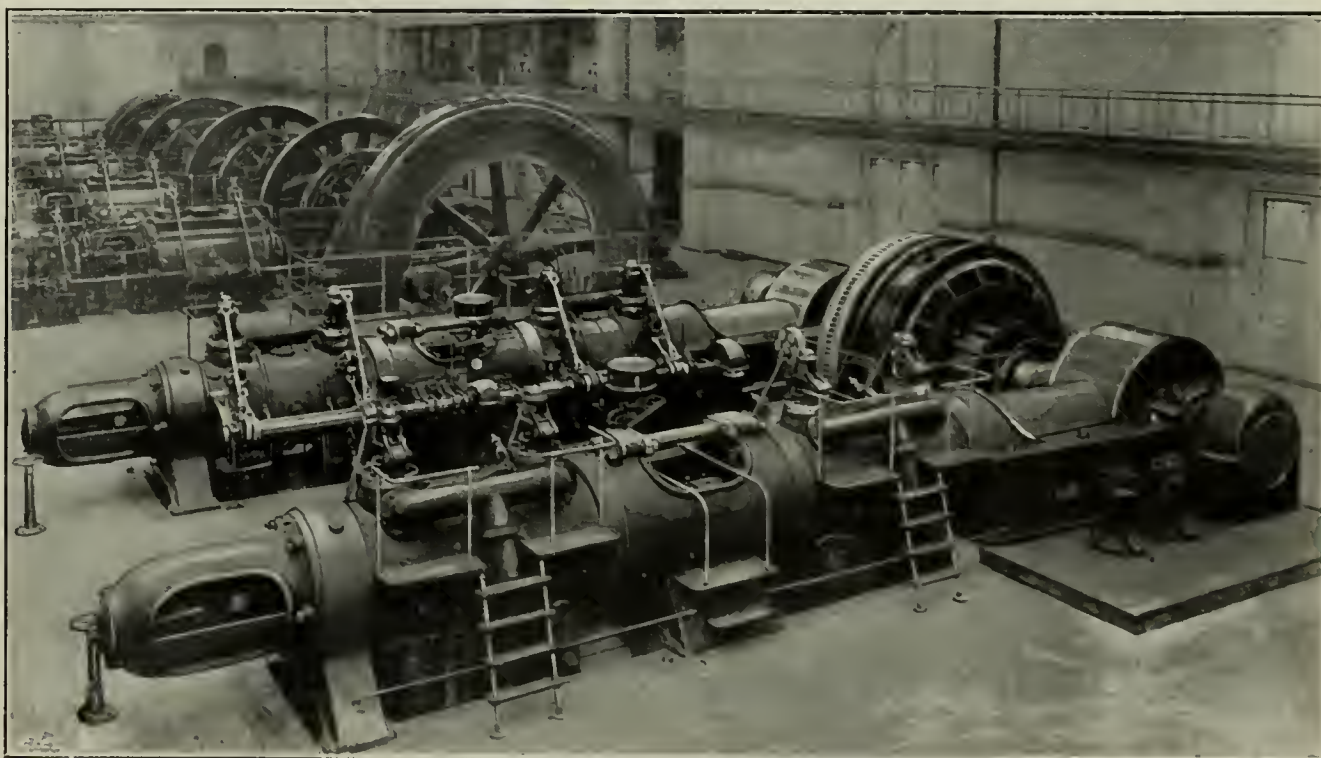


FIG. 55.—DOUBLE-ACTING FOUR-CYCLE M.A.N. DIESEL ENGINE OF 1,600 TO 2,000 B.H.P.: HALLE MUNICIPAL ELECTRICITY WORKS.

#### An Italian 1,000-H.P. Diesel Engine and Generator.

One of the striking internal-combustion engine exhibits at the Turin Exhibition last year was a 1,000-H.P. four-cylinder Diesel engine shown by the F.I.A.T. Co. of Turin, directly coupled to an alternator and exciter.

The engine operates on a two-stroke cycle, and has cylinders 550 mm. bore and 800 mm. stroke; the speed is 150 R.P.M., and for short periods a 10 per cent. overload is obtainable.



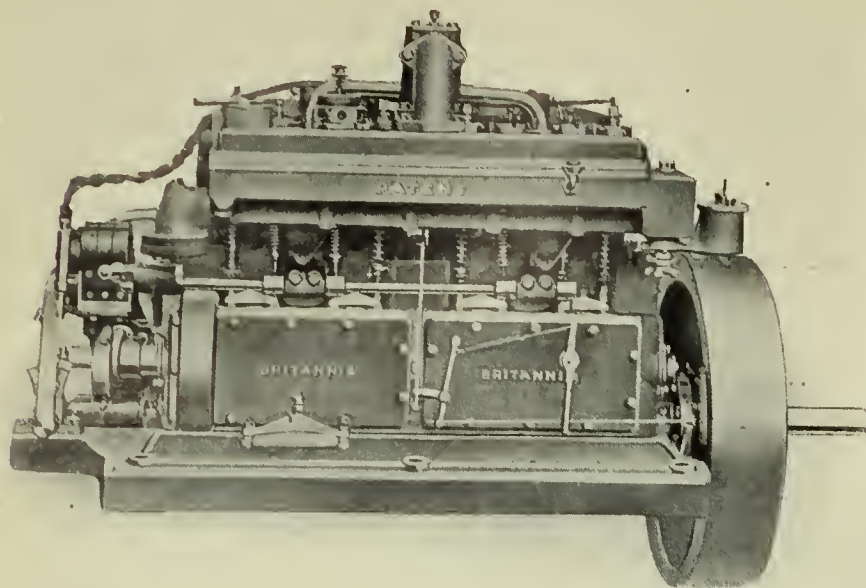


FIG. 56.—BRITANNIA TYPE V.H. FOUR-CYLINDER 50-B.H.P. OIL ENGINE (see p. 643).

The lower portion of the engine consists of an enclosed crank chamber arranged for cooling water circulation, and supporting an upper chamber forming a reservoir for the scavenging air, on which are carried working cylinders combined with scavenging air pumps.

The pistons are each constructed in two diameters, the smaller being the power piston, while the lower annular portion of larger diameter, forces scavenging air into the upper reservoir chamber from which it passes to valves arranged on either side of the injection and starting valves in the cylinder head, and escapes with the burnt gases through ports in the bottom of the cylinders.

The upper chamber also carries a two-stage compressor for supplying the air for starting and pulverising the injected fuel, driven off the main shaft.

The cylinders, covers and their water jackets form one casting, and the upper ends of the pistons are arranged for forced oil cooling; piston pumps, gear driven, are provided for both water and oil circulations.

The primary valves comprising the fuel injection and two scavenger valves in each cylinder head, are operated as a group by one eccentric per cylinder mounted on a horizontal shaft at cylinder level; the shaft also carries cams for operating the starting valves in each cylinder head, and is gear-driven through a vertical shaft from the main crank shaft.

The vertical shaft also drives an intermediate horizontal shaft in the crank chamber for operating a pair of piston valves situated in the upper chamber, and indicated by the bulges below the platform in our view; each of these valves regulates the admission and exhaust from the pair of adjacent single-acting scavenger pumps, which, due to the crank arrangement, are on opposite strokes at any one moment.

A fuel pump is fitted, with an adjustable distributor for the cylinders and hand and automatic regulation, the latter by means of a centrifugal governor.

In connection with the air compressor, arrangements are provided for feeding the air from the scavenger reservoir into the first cylinder of the compressor in order to increase the delivery of compressed air during the period of re-charging the compressed-air tanks for starting. A water-cooler and filter for the lubricating oil, and a filter for the heavy oil are provided.

This engine is started up when cold on light mineral oil or petroleum ('80—'82 density); if hot, it is started on heavy oil.

The fuel consumption, using heavy oil ('92—'94 density) with a calorific value of not less than 18,000 B.T.H.U. per lb., is: at full load, '50 lb. (230 gm.) per B.H.P.-hour; and at  $\frac{2}{3}$  load, '53 lb. (240 gm.) per B.H.P.-hour. The consumption of lubricating oil is '033 lb. (15 gm.) per B.H.P.-hour at full load.

The engine above described is of the heavy slow-running type, but the F.I.A.T. Co. has given much attention to the design of a high-speed type of Diesel engine for naval use more particularly, and a large number of such engines have been constructed. This type of engine is being used for electrical work, and it represents a considerable saving in weight per H.P. as compared with the low-speed type—the figures being 35 lb. to 45 lb. per H.P., as compared with 80 lb. to 100 lb.

The company is developing high-speed engines for electrical work in sizes of 500 H.P. to 1,000 H.P.; our second view shows a four-cylinder engine of this type, direct coupled to a dynamo, and having an output of 200 H.P. at 500 R.P.M. In constructive details it follows the larger low-speed engine, but it will be noticed that it is mounted high on a combined bed-plate, which carries the dynamo as well.

In conclusion, we are indebted to Messrs A. G. Graziani & Co., who are agents for the Fabbrica Italiana Automobili Torino in this country, and to the latter firm for our information.

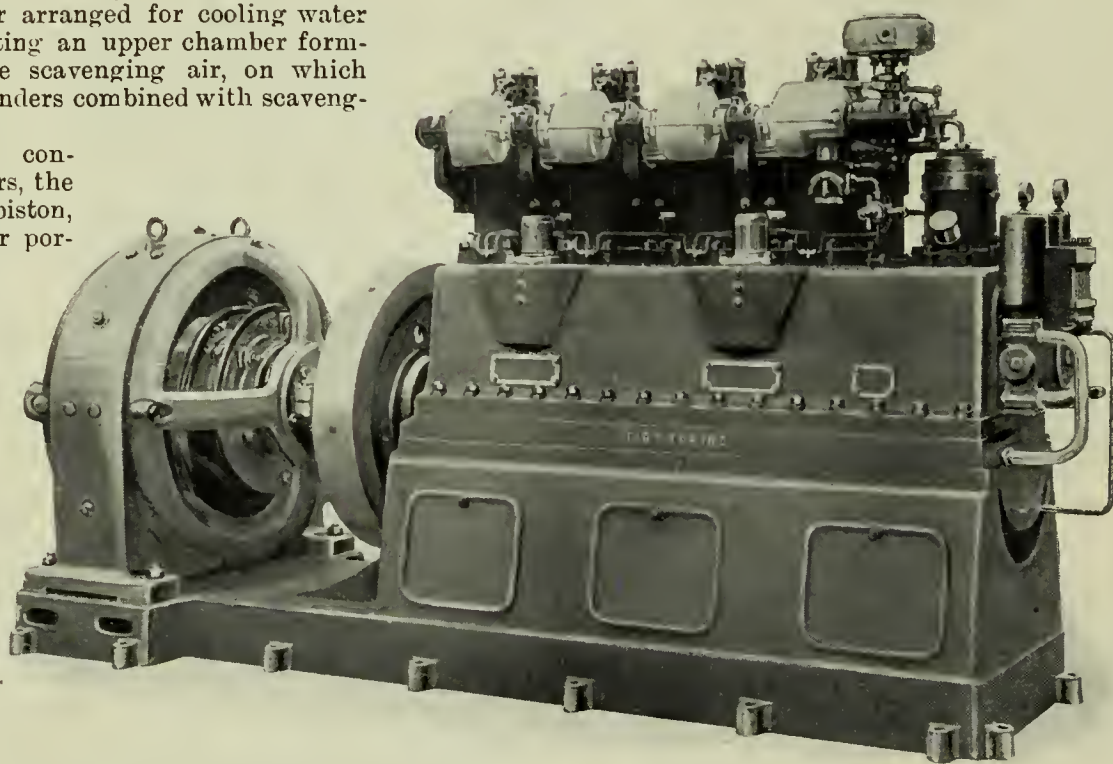


FIG. 57.—F.I.A.T. 200-H.P. TWO-CYCLE HIGH-SPEED DIESEL PLANT.

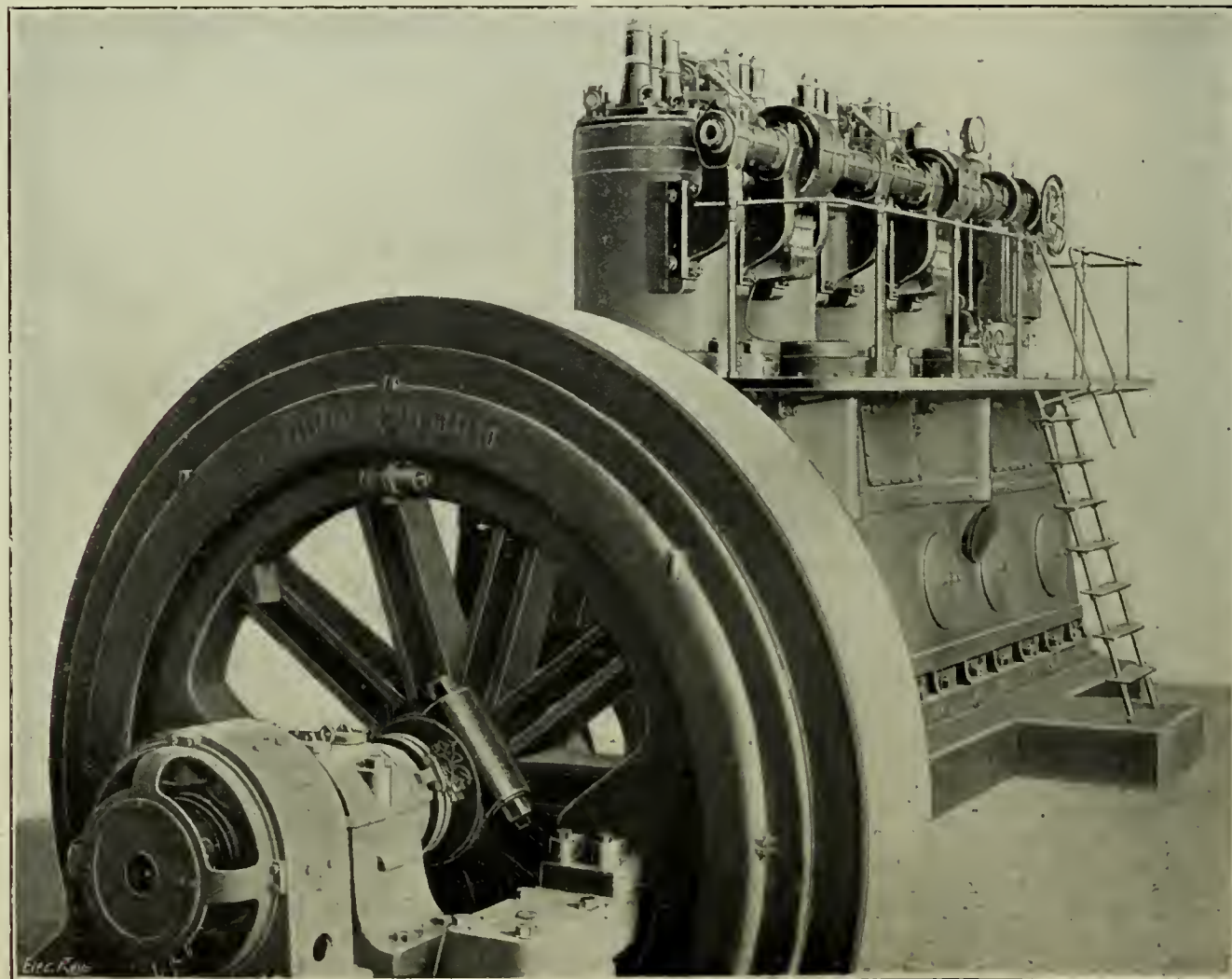


FIG. 58.—F.I.A.T. 1,000-H.P. TWO-CYCLE DIESEL ENGINE AND GENERATOR.



### The Lighting of a Scottish Village.

There was recently completed the first section of a scheme for lighting Roslyn Village, Bishopton, N.B. This scheme has been carried out successfully, and is a typical example of what may be done to promote comfort in remotely situated villages of comparatively small population.

Formerly the village had no source of lighting beyond ordinary paraffin lamps. Some years ago, however, a system of petrol gas was introduced, but unfortunately for the promoters, the unsatisfactory light produced created dissatisfaction, and ultimately ordinary paraffin lamps were again brought into use.

Since the introduction of metal-filament lamps, it has been found possible to erect a comparatively small generating station and run it at a profit to the promoters, notwithstanding that a highly efficient system of lighting is made available at a low cost per unit.

Roslyn Village being one of the residential districts of Renfrewshire, and within easy reach of Glasgow, Paisley and Greenock, by rail, the promoters of the village have done all in their power to open up the district for the business men of these towns. The great disadvantage has been the intolerable system of paraffin lighting, and this alone has greatly retarded the erection of new property. Electrical engineers will doubtless be flattered to learn that electric lighting has been the salvation of the landowners, in that it has created a decided demand for land. After the



VILLAGE LIGHTING: METHOD OF RUNNING O.H. LINES.

disappointing experience which the promoters had with other forms of illumination, they were rather reluctant to move in any new venture without absolute assurance of success, but after long deliberation with a Glasgow expert, the promoters got into touch with the makers of the Gleniffer electric lighting sets, MESSRS. JOHN SCOTT ENGINES, LTD., Lonend Motor Works, Paisley. This firm, who make a speciality of country house and estate lighting, went into the proposed electric lighting scheme, with the result stated. The power house at present erected consists of a substantial brick building and concrete work, and is divided into three sections, these being engine house, battery room and workshop.

The transmission cables are run overhead on poles, and the services are tapped where necessary *en route*.

The wiring of the residences, like the supply of the energy, lies entirely with the promoters, and Messrs. John Scott Engines, Ltd., have been responsible for this part of the work also.

During the past few months careful records have been kept, and in the result it has been found that the working cost has been about 1d. per B. of T. unit, including all charges, whilst the price obtained is 4½d. per B. of T. unit. The fuel employed is ordinary paraffin, and the consumption per brake-horse-power-hour is about 7 pint.

We understand that the firm named above have their engines at work in all parts of the world, and at present they have many months' work in hand, including a plant for another village lighting scheme, in England.

### CONTRACTS OPEN.

(Continued from page 624.)

**Bray (Ireland).**—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-KW. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" April 12th.

**Cape Town.**—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

A copy of the specification may now be seen at the Com. Int. Department of the Board of Trade in London.

May 9th.—Cape Town City Council.

A steam turbine-driven alternator and converter, the turbine to be capable of giving a continuous output of 2,000 K.V.A.

Approximately 24,750 yards of E.H.T. three-phase cable, joint boxes and disconnection pillars.

Green economiser.

Tenders are to be deposited at the City Hall, Cape Town.

**Falkirk.**—May 6th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

**Felixstowe.**—April 22nd. Replacing 40 arc lamps by glow lamps, for the U.D.C. See "Official Notices" April 12th.

**Glasgow.**—The Parish Council invites tenders for electric lighting and telephone installation for the new epileptic colony at Chryston. J. R. Motion, clerk.

**Gravesend.**—April 29th. Cables, for the Corporation. See "Official Notices" to-day.

**Heston and Isleworth.**—May 8th. 500-KW. steam engine, D.C. generator, balancer, &c., water-tube boiler, chain-grate stoker, pipework, &c., surface condenser, air pump, &c., for the U.D.C. See "Official Notices" to-day.

**Hoylelake and West Kirby.**—May 6th. One Lancashire boiler, with superheater, &c., vertical steam pump and self-acting re-starting injector, for the U.D.C. Electricity Works. See "Official Notices" to-day.

**Italy.**—April 30th. The Italian State Railway authorities in Rome are inviting tenders for 30 electric motors for the Rome-Trastevere railway workshops.

**Japan.**—H.M. Vice-Consul at Osaka reports that the appropriations for the financial year 1912-13 for the Osaka municipal electric tramways will permit of the extension of the system for about six miles, and that in order to carry out this work it will be necessary to place abroad large orders for material, the aggregate value of which is estimated at about £408,000. Some of the principal items will be rails, electric motors, brakes and other car stock (bodies are made in Japan), other machinery, insulated copper wire and insulating fabric, &c. Particulars, Board of Trade Commercial Intelligence Department.

**Leeds.**—April 20th. Eight miles of .2 sq. in. three-core cable, 6,600 volts, for the City Council. See "Official Notices" April 5th.

**Lincoln.**—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous current dynamo, or two 500-H.P. Diesel engines, with continuous current dynamos; one 120-KW. motor-generator and one switchboard, for the Corporation. See "Official Notices" April 12th.

**London.**—HACKNEY.—May 9th. High and low-tension cables, boxes, frames and covers, troughing, ducts, &c., for the B.C. Electricity Department. See "Official Notices" to-day.

ISLINGTON.—May 1st. Electrical fittings and sundries, for the St. Mary B.G. See "Official Notices" to-day.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Salford.**—April 22nd. Electrically-operated travelling jib crane, bulk weigher, and tray conveyor, for the Corporation Electricity Department. See "Official Notices" April 12th.

**Southampton.**—April 27th. Main cables, switchboard panels and electric lighting of the new buildings at Shirley Warren Poor Law Infirmary for the B.G. See "Official Notices" to-day.

**Southend-on-Sea.**—Stores for a year, for the Corporation Electricity Department. See "Official Notices" April 12th.

**Walsall.**—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" March 29th.

### CLOSED.

**Admiralty.**—A contract for all fuses required of 35 amperes capacity and above, and for a portion of their requirements of 10 to 30-ampere fuses, has been placed with the Electrical Apparatus Co., Ltd.

**Ashton-under-Lyne.**—The Corporation has accepted the following tenders for the tramway undertaking:—

British Insulated & Helsby Cables, Ltd.—Trolley wire.

Watlington & Co.—Overhead line material.

W. B. Haigh & Co.—Band saw.

**Clacton-on-Sea.**—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for lamps, &c., for lighting the sea front:—

Twenty 10-ampere arc lamps, £190; line resistances, £2; columns and cables, £1,004; less £25 if the contract as a whole is carried out at one time; total, £1,171.

**Croydon.**—The Corporation has placed the contract for carbon filament lamps (Ruby), tantalum traction lamps for car lighting, and "Wotan" metal filament lamps for the ensuing 12 months with Messrs. Siemens Bros. Dynamo Works, Ltd.

**Fleetwood.**—For oil and packing for the electricity works, the tender of Messrs. J. Preston & Sons has been accepted.



**Glasgow.**—In connection with the plant to be put down in the new sub-stations in the Whitevale, Trongate and Maryhill districts, the Electricity Committee recommends the acceptance of the following offers:—(1) by Siemens Bros. Dynamo Works, Ltd., for three 250-KW. rotary converters, with transformers, at £1,820; (2) by the British Westinghouse Electric and Manufacturing Co., Ltd., for one 500-KW. rotary converter, without booster, at £1,266; and (3) by the British Thomson-Houston Co., Ltd., for two 500-KW. rotary converters, with booster and transformers, at £2,649.

The Electricity Committee recommends the acceptance of the following:—

Storage battery.—Tudor Accumulator Co., Ltd.  
Motor generator and switchboard.—Crompton & Co., Ltd.  
Car motors.—British Westinghouse Co., Ltd.  
Dry cells.—Wm. McGeoch & Co., Ltd.

**Isle of Thanet.**—The Joint Hospital Board has renewed the contract with Messrs. Vitty & Hopper, of Ramsgate, for inspecting and maintaining the electric bells and ward telephones at the hospital.

**London.**—GREENWICH.—The B.C. has accepted the tender of Messrs. Frankland, Phillips & Co., of Poplar, for erecting lightning conductors on the mortuary chapels at the cemetery at Greenwich, and repairing that on the church at Charlton Cemetery.

**Londonderry.**—The Corporation has accepted the tender of the Reason Manufacturing Co. for the supply of fuse-boxes for the current year.

**Lowestoft.**—The tender of Messrs. Leipziger & Co. has been accepted by the T.C. for the supply of tramway rails at £8 3s. per ton.

**Sheffield.**—The tender of the British Electric Transformer Co., Ltd., has been accepted by the T.C., at £1,051 10s., for two sets of three-phase transformers.

**Southampton.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have received the Harbour Board contract for "Wotan" metal filament lamps, tantalum lamps, carbon filament lamps (high voltage), opal shades and enamelled iron shades.

**Stafford.**—The T.C. has accepted the tender of Messrs. Green & Sons for an economiser for the electricity works, at £231.

**Stockport.**—The T.C. has accepted the following tenders:—

Cotton & Rawcliffe.—Electric wiring (Gas Committee), £81 15s.  
E. Green & Sons, Ltd., Wakefield.—Two patent fuel economisers, £567.  
Alphons Custodis Chimney Construction Co., London.—Chimney for the electricity works, £869 10s.  
McClure & Whitehead.—Electric light installation at the hospital, £358 10s.  
W. A. Shaw & Co.—Telephone installation at the hospital, £28 5s., and electric bells for schools, £16 5s.  
J. W. Gray & Son, London.—Lightning conductors for schools, £24.

**Walsall.**—The T.C. has accepted tenders of the British Thomson-Houston Co., Ltd., and Brooks & Orton for the supply of a 3½-H.P. motor, including starter, and the necessary timber for tramway car tops at £15 and £94 respectively.

**Wednesbury.**—The T.C. has entered into an agreement with the Tudor Accumulator Co., Ltd., for the maintenance of the storage battery for 10 years from January 1st, 1912.

**West Bromwich.**—The T.C. has accepted the tender of Messrs. Richardsons, Westgarth & Co., Ltd., for a surface condenser for a 1,000-KW. turbo-alternator.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Friday, April 19th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m.  
Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.  
Saturday, April 20th.—Annual course of musketry, at Purfleet. Railway tickets and information regarding train service will be sent to members notifying their willingness to shoot on this date. Headquarters will be open for regimental business from 10 a.m. till 12 noon.  
Monday, April 22nd.—"A" Company. Infantry drill, 7.30 to 8.30 p.m.  
Technical work, 8.45 to 10 p.m.  
Tuesday, April 23rd.—"B" Company. Infantry drill, 7.30 to 8.45 p.m.  
Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.  
Thursday, April 25th.—"C" Company. Infantry drill, 7.30 to 8.45 p.m.  
Technical work, 8.45 to 10 p.m.  
Friday, April 26th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m.  
Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.  
(The infantry drill in all companies is in preparation for the Officers' Cup competition.)  
Saturday, April 27th.—Headquarters will be open from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adj.,  
For Officer commanding L.E.E.

## FORTHCOMING EVENTS.

**Royal Institution.**—Friday, April 19th. At 9 p.m. Discourse on "Electricity Supply: Past, Present and Future," by Mr. A. A. Campbell Swinton.  
Thursday, April 25th.—At 3 p.m. Lecture on "Synthetic Ammonia and Nitric Acid from the Atmosphere," by Prof. A. W. Crossley.

**Association of Engineers-in-Charge.**—Saturday, April 20th. Social. Bohemian concert.

**Faraday Society.**—Tuesday, April 23rd. At 8 p.m. At the I.E.E., Embankment, W.C. General discussion on "Magnetic Properties of Alloys."

**The "25" Club.**—Wednesday, April 24th. At 7.15 p.m. Dinner at the Waldorf Hotel, Aldwych, W.C.

**Institution of Electrical Engineers (Birmingham Local Section).**—Wednesday, April 24th. At 7.30 p.m. At the University, Birmingham. Paper on "Yellow Flame Arcs," by Mr. M. Solomon.

**Institution of Electrical Engineers (Students' Section).**—Wednesday, April 24th. At 7.45 p.m. Annual general meeting. Paper on "Homopolar Generators," by Messrs. E. W. Moss and J. Mould.

**Association of Mining Electrical Engineers (North of England Branch).**—Wednesday, April 24th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Fault Location on Mining Cables," by Mr. G. B. Burrows; and (time permitting) discussion on paper on "Motor Starters for Mining Work," by Mr. A. P. Drake.

**Royal Society of Arts.**—Wednesday, April 24th. At 8 p.m. Paper on "Technical Education in Ireland," by Mr. G. Fletcher.

**Institution of Electrical Engineers (London).**—Thursday, April 25th. At 8 p.m. Third Kelvin Lecture, by Prof. H. du Bois.

**Physical Society.**—Friday, April 26th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Solution of Network Problems by Determinants," by Mr. R. Appleyard; and "A Method of Measuring Small Inductances," by Mr. S. Butterworth.

**Junior Institution of Engineers.**—Saturday, April 27th. At 3 p.m. Visit to the engineering workshop and laboratory and the electrical laboratory of the Polytechnic, Regent Street, W.

## NOTES.

**To the Benevolently Disposed.**—Don't forget to attend the Festival Dinner of the Electrical Trades Benevolent Institution on Wednesday next at the Hotel Cecil! Tickets from the secretary. 10s. 6d. each.

**Electrical Strike at Earl's Court.**—A dispute having arisen between some of the members of the Electrical Trades Union and the Earl's Court Exhibition Co., regarding the rate of pay for work on Easter Monday, a strike has been in progress for some days in which the electrical workers have the sympathetic support of the London Building Industries Federation, and on Monday night 500 men working at the Exhibition handed in their notices. Mr. Webb, the Union Secretary, informs us that the men's case is as follows:—Members of the Union to the number of 70 out of about 100 electricians employed, worked on Good Friday and the following day, and were asked to do so on Easter Monday at ordinary time rates. As, however, the trade card says that time and a half must be paid for Bank Holidays, members declined to work. On presenting themselves on the Tuesday morning, known E.T.U. men to the number of 30 were locked out, and at a meeting held in the dinner hour, the remainder of the Union men came out in sympathy. We are informed by Mr. Webb that at a meeting between a deputation of the London Building Industries Federation and the Earl's Court directors on Thursday, last week, the directors agreed to reinstate all the Union members on the Friday morning, but on presenting themselves on that day only 15 were wanted. The men regarded this as a direct violation of the agreement, and they declined to work. The sequel was a meeting summoned for midday on Monday at Richmond Place, West Kensington, Earl's Court, for workmen "to consider whether they are prepared to work with scabs." The meeting was addressed by Tom Mann, and the upshot was that the 500 building trade workers "downed tools." Tom Mann, in a characteristic speech, said that the dispute gave another opportunity to demonstrate the solidarity of labour, and he urged the workers to take formidable action during 1912 against the employers. He said that there was no reason why any man should work more than six hours per day or receive less than 40s. a week.

As we go to press we learn that the strike was settled on Wednesday; all strikers were to be reinstated, and only union men to be employed.

**Appointments Vacant.**—Senior meter room assistant, for the Stepney B.C. Electricity Department; overhead wireman, for the Bolton Corporation Tramways; two test-room assistants, for the Marconi Co.'s Chelmsford Works; station fitter, for the City Electricity Department, Winchester (50s.). See our advertisement pages to-day.

**Erratum.**—In the second line of the last paragraph of Mr. Chas. Bright's article on "Trans-Atlantic Telegraphy," on page 564 of our issue of April 5th, the word "important" should have read "impartial."

**O.S.A. Smoking Concert.**—The second joint smoking concert of the Old Students of the Central Technical College and Technical College, Finsbury, will be held in the Crown Room, Holborn Restaurant, on Wednesday evening next, commencing at eight o'clock. Mr. R. J. Wallis-Jones will preside, and many well-known artistes, including Miss Katie Moss, Mr. Conway Dixon, Mr. Tom Kinniburgh, Miss Lois Barker, Mr. Bradley Alexander, Mr. Wilson Martell, Mr. Walter Walters, and others, will appear. Tickets, 1s. each, may be obtained from the concert secretary, Mr. John E. Raworth, Queen Anne's Chambers, 28, Broadway, Westminster, S.W.



**London Chamber of Commerce.**—The thirtieth annual general meeting of the London Chamber of Commerce was held at the Cannon Street Hotel, E.C., on Thursday, April 18th. The report submitted by the Council included the following dealing with the Electrical Trade Section:—

**National Insurance Bill.**—It was decided to co-operate with the Manufacturers' Section in this matter in view of the interests of the two bodies being identical. A resolution setting forth the undesirability of the Bill being pressed forward in the 1911 Session, was also adopted.

**International Electro-Technical Commission.**—The invitation of the International Congress on the Application of Electricity, to appoint representatives to attend the Congress, held at Turin in September, was accepted, and the chairman of the Section (Mr. C. P. Sparks), Mr. A. Bruce Anderson, and Mr. Leon Gaster were nominated to represent the Section. The report of the delegates will be received and considered at a future meeting of the Section.

**Electricity in Mines.**—The report of the Departmental Committee on Electricity in Mines was considered at a meeting of the Section. It was arranged that if a public inquiry took place, the Section would arrange for its views to be put forward by technical experts in a similar manner to action taken in previous years in connection with regulations relative to electricity in factories.

**Electrifying the East.**—Attention was called to the efforts made by the German electrical industry to secure the control of trade with China, Japan, and the Far East, and the Manufacturers' Section was requested to consider the questions raised in connection with the German enterprise in the electrical industry, it being further suggested that it was desirable that the Government should appoint Commercial Attachés to safeguard the interests of manufacturers of electrical plant and appliances.

**Other Matters.**—Many matters of interest to the industry were dealt with in correspondence with members, while the Section was represented on Special Committees appointed by the Council in connection with trade disputes and misrepresentations in trade.

**Institution and Lecture Notes.**—IRON AND STEEL INSTITUTE.—The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, May 9th and 10th. The president-elect is Mr. Arthur Cooper. On the Thursday the Bessemer Gold Medal for 1912 will be presented to Mr. J. H. Darby, and the president will deliver his inaugural address. A selection of papers will be read and discussed in the morning and afternoon, and at night the annual dinner will take place at the Connaught Rooms, Great Queen Street, W.C.

On Friday the Andrew Carnegie Gold Medal (for 1911) will be presented to Dr. P. Goerens (Aachen) and the award of Research Scholarships for the current year will be announced. A further selection of papers will then be read and discussed. The following are included in the list of expected papers:—

"On the Chemical and Mechanical Relations of Iron, Vanadium, and Carbon," by Dr. J. O. Arnold (Sheffield) and Prof. A. A. Read (Cardiff).

"The Influence of Carbon on Corrosion," by C. Chappell (Sheffield).

"The Corrosion of Nickel, Chromium, and Nickel-Chromium Steels," by Dr. J. N. Friend, J. Lloyd Bentley, and W. West (Darlington).

"On the Mechanism of Corrosion," by Dr. J. N. Friend, W. West, and J. Lloyd Bentley (Darlington).

"Modern Rolling-Mill Practice," by J. W. Hall (Birmingham).

"The Influence of Heat on Hardened Tool Steels," by E. G. Herbert (Manchester).

"Improvements in Electric Steel Furnaces and their Application in the Manufacture of Steel," by Dr. H. Nathusius (Friedenshütte, Upper Silesia).

**SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.**—At the annual general meeting on January 18th, it was reported that the total membership amounted to 270, an increase of 65 during the year, and the balance-sheet showed cash assets £168. Mr. J. H. Rider was re-elected president, and Mr. B. Price vice-president, the second vice-president elected being Mr. W. Elsdon-Dew. The president then gave a lecture on "The Electrical System of the London County Council Tramways," illustrated with lantern slides.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—The following are the Council's nominations for election of Council for the year 1912-13, which were announced at the meeting yesterday:—

*President.*

W. Duddell, F.R.S., New nominee.

*Vice-Presidents.*

W. Judd, C. H. Merz, New nominees.

Major W. A. J. O'Meara, C.M.G.; J. F. C. Snell, Remaining in office.

*Honorary Treasurer (retires annually and is eligible for immediate re-election).*

Robert Hammond, New nominee.

*Members of Council.*

F. Gill, A. Russell, D.Sc., W. Rutherford, A. H. Seabrook, Roger T. Smith, New nominees.

H. Dickinson, J. S. Highfield, H. Hirst, B. M. Jenkin, J. E. Kingsbury, P. V. McMahon, R. K. Morcom, S. L. Pearce, H. Faraday Proctor, C. P. Sparks, Remaining in office.

*Associate Members of Council.*

A. B. Anderson, New nominee.

S. Morse, H. E. Wimperis, Remaining in office.

**Legal.**—GOTT v. VERITYS, LTD.—On Wednesday the Court of Appeal, composed of Lords Justices Vaughan Williams and Fletcher Moulton and Mr. Justice Parker, disposed of an appeal by the defendants in this case from a ruling of Mr. Justice Lush. The action was brought by Mr. Arthur Edgar Gott, electrical engineer, of Southall, Middlesex, against Messrs. Veritys, Ltd., electrical engineers and manufacturers, of Aston, Birmingham. When the case

came for trial at the Birmingham Assizes, Mr. Justice Lush referred the whole matter to the Official Referee, at the same time, it was asserted, making a declaration as to the proper construction of the contract sued upon. It was against this so-called declaration by the learned Judge that the defendants now appealed, and asked that the action should be dismissed with costs.

The plaintiff's case was that by a contract contained partly in an agreement in writing, dated April 9th, 1907, between the parties and partly in two letters dated November 5th, 1908, from the defendants to the plaintiffs, it was agreed that the defendants should manufacture and sell certain patented articles of which the plaintiff was the inventor, and further pay the plaintiff certain royalties. It was a term of the contract, plaintiff said, that in the event of the defendants desiring to discontinue the manufacture and sale of any of the articles they should give the plaintiff three months' notice in writing to that effect. Plaintiff alleged that in November, 1908, the defendants, without giving notice, discontinued the manufacture of the articles, and subsequently discontinued the sales when the stock became exhausted, thereby causing him loss.

The defendants, while admitting the existence of a contract, denied that its terms were properly set out by the plaintiff. They further said that the contract properly construed did not impose on them any obligation to manufacture or sell the patented articles; and that, in fact, they gave proper notice determining the contract.

The appellants now contended that Mr. Justice Lush, in referring the action, was wrong in holding that the defendants were under any obligation expressed or implied to manufacture and sell the articles in question.

In the course of the arguments, Lord Justice Vaughan Williams said that, in his opinion, there was no declaration of law on the question of construction by Mr. Justice Lush, and he did not think that the learned Judge intended to make any declaration. In those circumstances there was no order which was being appealed against.

Mr. Hugo Young, K.C. (for the plaintiff), asked what was to become of Mr. Justice Lush's judgment.

Mr. Justice Parker did not think the judgment ought to be treated as binding on any matter of law.

Mr. Vachell, K.C. (for the defendants), agreed that when the case came before the Official Referee, Mr. Justice Lush's judgment, so far as it purported to construe the contract, ought to be put on one side altogether.

Mr. Justice Parker: The Official Referee can find the facts, and make his award in the form of a special case.

Lord Justice Moulton: Or report to the Court.

Mr. Hugo Young said that that would mean exposing the plaintiff to a good deal of expense when a possible result was that the Court, in the long run, would say that there was no case at all.

Lord Justice Moulton said that in the absence of any order declaring something as to the rights of the parties, this Court could not help the plaintiff.

Mr. Hugo Young: Would it not be advisable to get Mr. Justice Lush to draw up a declaration? At present I am deprived of my right to go before the Official Referee supported by the learned judge's judgment.

Lord Justice Vaughan Williams: It is possible that you will convince the Official Referee as successfully as you convinced Mr. Justice Lush.

After some further discussion, it was arranged that the case should go to the Official Referee, neither side being at liberty to refer to the judgment of Mr. Justice Lush or to the remarks which had fallen from the judges in this Court. Plaintiff was given leave to amend his pleadings as to the alleged breaches of contract, the same privilege being extended to the defendants, should it become necessary to amend their defence. The costs of the present appeal were made costs in the cause.

**Electrical Rifle Club.**—It has been suggested to us that it would be desirable to form a rifle club in connection with the electrical trade. We shall be glad to receive names and suggestions from those interested, which may be addressed to the Secretary *pro tem.*, The Electrical Rifle Club, at these offices.

**Parliamentary.**—In the House of Commons on Monday the Light Railways Bill was read a second time.

**The B.A. Meeting at Dundee.**—This year's meeting of the British Association takes place at Dundee from September 4th to 11th, with Prof. E. A. Schäfer, LL.D., F.R.S., Professor of Physiology at Edinburgh University, as President. Section A will be under the chairmanship of Prof. H. L. Callendar, LL.D., F.R.S., and the Engineering Section (G) will be presided over by Prof. A. Barr, D.Sc. Among the arrangements announced is an evening discourse by Prof. W. H. Bragg, F.R.S., on "Radiations Old and New."

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—At a smoking concert recently held at the Napier Arms Hotel, Mr. F. T. WOODWARD, commercial assistant to the Gillingham borough electricity department, was presented with a gold half-hunter watch, subscribed for by



the staff, workmen and others. Councillor Naylor presided, and among those present were Mr. A. D. Chalmers, borough electrical engineer, Mr. A. J. Ryan, deputy electrical engineer, and Messrs. F. Walker (secretary) and C. B. Nadaud, who represented the Kent Electric Power Co. Mr. Woodward, in responding, congratulated the Council upon having so loyal and contented a staff, which was one of the best assets that such an undertaking could have.

MR. HAROLD C. HOLROYD has resigned his position as engineer-in-charge at the Portsmouth Corporation electricity works in order to take up a post with Messrs. Willans & Robinson, Ltd., Rugby.

On April 4th, Mr. A. H. SMITH was presented by the staff of the Whitehaven Corporation electricity works with a travelling bag on the occasion of his leaving to take the post of shift engineer at the Crewe Corporation electricity works. On April 11th, Mr. R. H. SANDERSON, junior clerk, who is also leaving the Corporation service, was presented with a gold-mounted fountain pen.

MR. L. G. DIMMER, charge engineer at the Cheltenham electricity works, has resigned, and is leaving for Canada, and Mr. J. L. H. COOPER has been appointed in his place. MR. H. W. HARTNELL, the mains superintendent, who has, with the exception of 11 months, been in the employ of the Corporation ever since the undertaking was inaugurated, has also resigned, and is going to Canada. MR. C. G. SMITH, who has been charge engineer at the works for four years, and has had experience of mains work elsewhere, has been promoted to the post. The vacancy caused by Mr. Smith's promotion has been filled by the appointment of MR. G. WARING. MR. J. M. ROBB, assistant engineer, and MR. C. T. BASTIN, chief clerk and accountant, have both had their salaries increased.

The Doncaster T.C. has increased the salary of the electrical engineer by £25, with a further similar increase next year.

**General.**—MR. W. H. ALCOCK, engineer to Messrs. Jenkins & Co., engineers, &c., Cape Town, leaves South Africa by the Union Castle ss. *German* on April 22nd, for six months' holiday. Mr. Alcock's postal residential address will be, care of Mr. H. Davies, Stubenville, Llandudno, North Wales.

MR. B. L. TREGONING, late of the L. & Y. Railway power station, Formby, has accepted a position as constructional engineer with the Central Argentine Railway, Ltd., and sails on April 26th in the R.M.S. *Araguaya*.

The Sowerby Bridge U.D.C. has appointed MR. W. H. HOLROYD, of Carnforth, as electrician at the gas works.

The Salford Corporation has retained the services of MR. E. M. LACEY, consulting engineer, of Manchester and Westminster.

A correspondent writes:—"One of the passengers on board the *Titanic* was MR. W. H. M. PARR, of Horwich, near Bolton, who was formerly employed in the electrical department of the Lancs. and Yorks. Railway Co.'s locomotive works at Horwich. Some three years ago, Mr. Parr was appointed to a managerial position at Messrs. Harland & Wolf's shipbuilding works at Belfast, builders of the *Titanic*, and in that capacity had superintended the electrical equipment of the great liner. He was accompanying her on her maiden voyage as the representative of the builders to supervise the working of the electrical plant, having a staff of workmen with him."

In the *Times* list of the principal officers of the *Titanic*, the following electricians are mentioned: B. Sloan, 31, Southampton, chief electrician; A. S. Alsopp, 34, Southampton, second electrician; H. Jupe, 29, Southampton; A. Middleton, 26, Sligo; and A. Ervine, 22, Belfast, assistant electricians. F. G. Phillips, 24, Godalming, and H. St. Bride, 25, Southampton, telegraphists, were also on board.

According to the *Daily Mail*, a MR. SEDGWICK, formerly an engineer at St. Helens Electricity Works, who was going to Mexico to take up an appointment, was one of the passengers on the *Titanic*. He was married only a week before he left England, and left his wife at home.

## CITY NOTES.

### Indian Electric Supply and Traction Co., Ltd.

MR. J. G. B. STONE presided at the annual meeting held on Wednesday at the offices, Orient House, New Broad Street, E.C.

The CHAIRMAN, in moving the adoption of the report, said when they met last year he was able to report that material progress had been made; sales of current were larger, and an increased profit had been secured. He was in a position to-day to say that in both respects further advances had again been made, the sales of current had risen from 516,000 units in 1910 to 813,000 in 1911, and the gross receipts from £8,056 to £10,974. The connections to the mains increased during the year from the equivalent of 21,104 lamps to 28,739, and now exceeded 30,000. Owing to the larger proportion of current being supplied for power purposes, the average sale price per unit had receded from 2'84d. in 1910 to 2'69d. in 1911; but, on the other hand, the generating costs had fallen from 1'16d. to 1'03d. per unit. With regard to the small length of tramway, they had carried a larger number of passengers on a reduced number of cars, and the earnings per car-mile were 4'62d., as against 4'17d. On the other hand, maintenance was higher and, consequently, the net result was practically the same as last year. What they called the sales department, i.e., the wiring of customers' premises, sales of appliances, and income from the workshop, last year yielded a profit of £600—

this department was instituted on account of the lack of satisfactory wiring contractors in Cawnpore, and it had fully justified its existence, seeing that, apart from the actual profit earned, it had to a material extent assisted in the expansion of the business. The total profit for the year, including £402 received for interest on deposits with the bank and agents, was £7,388, of which £2,700 was required to meet interest on debentures, and there remained £4,687, which had been applied in reduction of the debit balance which had accumulated in profit and loss account during the early stages of the company's working. He must, however, remind them that no reserve on account of depreciation had yet been possible. The growth of the business was steady if somewhat slow, and there was a prospect of selling one or more large blocks of current for power purposes. During the year they had expended £4,151 on capital account. Of this, £1,658 represented the cost of a new boiler, and the remainder mains and house connections. They also purchased from the Government of India one of the 600-kw. Belliss-Siemens generating sets which had been used for a few weeks only at the Delhi Durbar, at about 60 per cent. of what it would have cost them to send out a similar set from England. Payment for this fell within the current year. It was probable that another boiler and some further expenditure in the generating station for condensing plant would be required, and also for a short length of tramway through a new street which was on the point of being opened up to Surseya Ghat. They would have noticed in the balance-sheet a contingent liability for three years track rent due to the Cawnpore Municipality, of £1,101. Since the report was issued they had heard that the Municipality were willing to reduce their claim for annual track rent from Rs. 2,250 and Rs. 1,500 per mile of double and single track respectively, to Rs. 1,000 to Rs. 700, with retrospective effect. Thus this contingent liability would be reduced to less than one-half. They were glad to say the general condition of the United Provinces was now one of material prosperity, and it was expected that the harvest for the present year would be a record one. This was an important factor, as it increased the spending power of the population which they served. The outstanding debentures fell due to be paid off at the end of the current year, and the board were giving this matter serious attention. Their object was to reorganise the finances of the company in such manner as to render available for distribution in dividends a portion of the steadily increasing profits.

MR. K. A. SCOTT MONCRIEFF seconded the motion, and the report was adopted without discussion.

### Canadian and American Westinghouse Companies.

—According to the financial Press, the report of the Canadian Westinghouse Co. for 1911 shows net earnings amounting to \$1,010,200, as against \$697,400 for 1910. The dividend has been raised from 7 to 8 per cent., while \$100,000 has been written off against depreciation reserve, a similar sum having been dealt with in this manner 12 months ago; \$50,000 is now transferred to inventories adjustment reserve, an increase of \$20,000, and a new item is the transfer of \$50,000 to insurance fund. There remains a surplus of \$160,000, of which \$135,800 has been written off in respect of property and plant, the corresponding figure at this time last year having been \$70,500, leaving \$324,200 to be carried forward, as against \$190,500 at the end of 1910. The directors of the American Westinghouse Electric and Manufacturing Co. have just declared a dividend of 1 per cent. on the common shares for 1911, being the first distribution on this issue since the reorganisation of the company in 1908. The directors will not consider the question of any further dividend until the expiry of six months. They have been induced to adopt this course in view of the uncertainties with which they are surrounded, while they have also to consider the obligations which will mature in due course, while, finally, in order to extend the business, it is necessary to conserve all available resources.

**Indo-European Telegraph Co., Ltd.**—The directors, subject to final audit, recommend a dividend for the six months ending December 31st, 1911, of 17s. 6d. per share (making, with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax. They also recommend a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts. The dividend, bonus and special distribution will be payable on May 1st. The transfer books are closed until April 26th.

**British Columbia Electric Railway Co., Ltd.**—The directors have declared an interim dividend at the rate of 8 per cent. per annum, payable on April 30th, on the deferred ordinary stock, for the half-year to December 31st, 1911.

**British Electric Traction Co., Ltd.**—It is announced that the directors have declared an interim dividend of 3 per cent. on the 6 per cent. cumulative preference stock on account of the year ended March 31st, 1912.

**Monte Video Telephone Co., Ltd.**—The directors have declared interim dividends for the half-year to January 31st at the rate of 5 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares.

**Montreal Light, Heat and Power Co.**—The directors have declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the quarter ending April 30th.



### Tynemouth and District Electric Traction Co., Ltd.

THE directors' report for 1911 states that the total revenue amounted to £14,070, as compared with £12,723 for 1910. After deducting all expenses chargeable to revenue, including repairs and maintenance, and interest on debentures, and placing a sum of £600 to renewals account, there remains a surplus of £5,245, plus £187 brought forward, making an available balance of £5,433. The directors recommend that there should be placed to reserve account £1,000, to sinking fund for debenture redemption £500, preference dividend, 5 per cent., £1,525, dividend on the ordinary shares at the rate of 4 per cent. per annum £1,856, carrying forward £551. The reserve funds of the company will then be:—Reserve account £8,000, sinking fund for debenture redemption £6,332, renewals account £2,900. The expenditure on capital account during the year was £78, making the entire outlay £97,993. As a result of the very fine summer the net revenue showed an increase of £326. One car was re-roofed and fitted with top seats and new staircases during the year. All the company's cars have now been entirely re-roofed.

	1910.	1911.
Miles open—Route miles .. ..	4.21	4.21
Single line .. ..	.59	.59
Double line .. ..	3.62	3.62
Passengers carried .. ..	2,056,390	2,093,959
Av. traf. rec. per passenger .. ..	1.53d.	1.53d.
Av. expen. per passenger .. ..	.88d.	.87d.
Proportion of expenses to receipts ..	58 %	56 %
Cars in stock, including water car ..	22	22

The meeting was held at the Electrical Federation Offices, Kingsway, W.C., on Tuesday, Mr. H. S. Day presiding.

The CHAIRMAN said that the revenue generally was up a matter of £340, and the expenses were also up slightly. The figure they had to look to, however, was the carry forward, which this year, after paying the same dividend as last year, was £551, against £187. The directors went carefully into the question of enhancing the dividend on the ordinary shares, but looking to the unrest there was in the country at present, and the fact that a very small margin would be left, they felt they would be wise to keep to the 4 per cent. until they were in a stronger position. The reserve fund and sinking fund, after giving effect to the recommendations in the report, would be £17,232. It was not as much as they would like to see, but, after all, it was very satisfactory, considering the competition they had to meet from the North-Eastern Railway. With regard to the strike, it was interesting to remark that it had actually helped their revenue, for they had pulled up £120 in the last few weeks in consequence of the shortage of the North-Eastern Railway train service.

MR. C. SHIRREFF HILTON seconded the motion, and the report was adopted.

The retiring directors were re-elected, and the remuneration of the board fixed at £50 for the chairman and £25 each per annum for the other members.

### Anglo-Argentine Tramways Co., Ltd.

THE annual meeting was held on Friday last, at Winchester House, E.C., Mr. J. B. Concannon presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 596), said that last year they carried 299,154,385 passengers, an increase of 22,728,311 over the previous 12 months. The gross receipts amounted to £2,631,836, an increase of £212,650, or within a fraction of 9 per cent., a remarkable achievement when it was remembered that 1910 was the Centenary year, and that the weather conditions during the last three months of 1911 were very unfavourable. The working expenses were more by £159,835. Of this increase £10,000 was due to their having debited working expenses and carried to the credit of the renewals fund £120,000, as against £110,000 in 1910. Apart from the natural increase in expenses due to larger mileage and heavier traffics, some of the heads showed exceptional additions, thus, the cost of current, owing to dearer coal, was more by £22,563, and the extra 12 per cent. tax on surplus traffic receipts over \$50,000 per km. of line open, added £21,389 to the municipal taxes; a further exceptional item amounting to £12,356, and one that would not recur, was caused by their having converted a deferred bonus payable to their employés into an increase of wages, thus, the figure he had mentioned, which represented the bonus payable for the last quarter of 1910, was charged to wages in 1911. It was interesting to note that but for these increases, which, in the aggregate, represented £56,000, the percentage of expenses to traffic receipts would have been 58.30, as against 59.10 in the preceding year. They expended £298,012 upon ordinary maintenance, and upon renewals £119,507, or a total of £417,519 applied to the all-important policy of preserving their property in the most efficient and up-to-date condition. The net profit amounted to £907,907, an increase of £52,815. The total amount at credit of net revenue account, including the carry over from 1910, was £920,952. After making provision for all charges and preference dividends, there remained a balance of £193,395, a very respectable margin of security for their pre-ordinary proprietors. An interim dividend of 4 per cent. had already been paid upon the ordinary shares, and a further dividend of 3½ per cent. was now recommended, making 7½ per cent. for the year, less income-tax, leaving a balance of £10,947 to be carried forward. At the request of his colleagues, he visited Buenos Ayres in September last, to represent the board at the inauguration ceremony to celebrate the commencement of active work on their first subway. The proceedings passed off most satisfactorily, and it was very pleasing to notice the

friendly comments of the public and Press upon the project. He took the opportunity of visiting all the depôts and workshops; he made a close examination of the permanent way and rolling stock, and he found the undertaking as a whole in very good order. He was much impressed by Mr. Pedriali's organisation, and the able and loyal support he received from the officials working under him. With regard to the immediate future, whilst they could not expect that the receipts for the current year would show the same rate of progress as those of the two previous years, yet notwithstanding the increasing congestion which they were experiencing, and would continue to experience, pending the opening of the subways, he thought they might look for a moderate improvement of traffic. On the other hand, various economies which they hoped to carry out, particularly in the consumption of current, would neutralise the effect that dearer coal would have on the cost of current per unit.

BARON L. JANSSEN seconded the motion, and the report was adopted without discussion.

MR. H. W. BIRKS, in moving the re-election of the auditors, said that on behalf of the shareholders he wished to congratulate the directors upon the splendid results they had put before them.

MR. PRYNNE in seconding the motion, which was carried, asked what was the amount of interest paid on unproductive capital during the past year.

The CHAIRMAN, in reply, said that the amount of interest charged against unemployed capital last year was £17,643.

### Swiss Electrical Companies.

*The Aluminium Industrie, A.G.*, of Neuhausen, realised net profits in 1911, including the balance forward, amounting to £131,000, as against £138,000 in the previous year. It is intended to pay a dividend of 14 per cent., this having also been the rate in 1910.

*The Motor Ges. für Angewandte Elektrizität*, of Baden, which is closely associated with Brown, Boveri, & Co., proposes to pay 6½ per cent. for 1911 on a paid up share capital of £800,000, being the same rate as in 1910. The share capital is now being increased to £1,200,000 by the issue of new shares for the purpose of acquiring an interest in the Olten-Aarburg Electricity Works, and for providing additional working capital.

*The Société Franco-Suisse pour l'Industrie Electrique*, of Geneva, which is chiefly, if not entirely, an investment company, reports net profits of £47,000 for 1911, as compared with £43,000 in the preceding year. It is proposed to pay a dividend of 4½ per cent. on the share capital of £1,000,000, as against 4 per cent. in 1910. The stock of shares and other investments is valued at £1,670,000, and the advances made to electrical undertakings total £500,000, while on the other hand the company has a loan capital of £900,000.

*The Akkumulatoren-Fabrik Oerlikon*, which has a share capital of £48,000, reports net profits of £12,400 for 1911, as contrasted with £12,300 in the previous year. A dividend of 20 per cent. is in contemplation, being the same rate as in 1910. According to the directors' report, the scope for portable accumulators, particularly for traction purposes, has considerably increased. The sale for automobiles is specially capable of expansion, and the company has therefore become interested in a firm at Feldbach.

The report for 1911 of the *Elektrizitäts Gesellschaft Alioth*, of Basle, states that the exchange of shares which was arranged with Brown, Boveri & Co. was completed by most of the shareholders, and the community of interests thereby created would become closer in the current year. The sales organisations in Italy, Austria, Holland and South and Central America had been taken over by Brown, Boveri & Co., whilst that in Germany had been discontinued, and the offices at Basle had been amalgamated with those at Baden. In the spring of 1911 the company's branch at Lyons was transferred to the Compagnie Electro-Mécanique Le Bourget in return for a share interest in the latter. This French company took over in June the whole of the Alioth Co.'s sales organisation in France, and this explained for a large part the reduction in the profits. During the year the company, which was well employed in transmission and railway work, delivered 1,135 transformers of 60,820 KW. and 4,388 generators and motors of 94,480 H.P., as compared with 1,746 of 109,693 KW., and 6,153 of 116,276 H.P., respectively in the preceding year. The gross profits amounted to £65,000, as contrasted with £95,000 in 1910, and the net profits were £19,000, as against £28,000. After devoting £6,700 to depreciation, as compared with £11,000 in 1910, the balance allows of the payment of a dividend of 4½ per cent. on share capital of £240,000, as against 6 per cent. in the previous year.

**Calcutta Tramways Co., Ltd.**—The directors' report for 1911 gives the following figures: Receipts, £202,548; working expenses, £114,385; revenue balance, £88,163; plus balance brought forward, £1,662; making £89,825. Interest on debenture stock and bank advances, and dividend on preference and ordinary shares paid absorb £44,945, leaving £44,880. Out of this it is proposed to pay a final dividend of 4s. 6d. per share, making 7 per cent. for the year, adding to the depreciation fund £10,000 and carrying forward £3,918. The *Financial News* says that the depreciation fund at the commencement of the year stood at £59,603. After adding £1,622 interest on investments and £10,000 proposed to be allocated as above, and deducting £7,088 written off for renewals during the year, the fund will stand at £64,136. The traffic receipts show an increase of £15,470 and the expenditure an increase of £8,030; the Howrah lines show an increase in receipts of £316 and in expenditure, of £936.



### Windermere and District Electricity Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1911, announces that Mr. A. H. E. Wood and Mr. George H. Pattinson have joined the board. The gross revenue shows an increase of £138, mainly due to larger receipts from the sale of current. The board's opinion, expressed a year ago, as to the falling off in receipts having come to an end was justified. Several new customers have been secured, and a moderate rate of improvement in the company's business may be looked for. A payment of 3½ per cent. on account of arrears of interest has been received on the Keswick Electric Co.'s debentures, and from this source £71 has been credited to the net revenue account, and the amount owing by the Keswick Electric Co. for arrears of interest has been reduced by £283. The amount spent on capital account for new mains, transformers and meters has been £173. The expenditure on revenue account has been £1,912, being a decrease of £35, as compared with the previous year. The balance of revenue account is £1,617, plus interest on Keswick debentures £71, and balance brought forward £10, making £1,698. Out of this has been paid debenture interest, bankers' charges, &c., £786; interim dividend of 1 per cent. on preference shares, £250; leaving a balance of £663; out of which has been transferred to depreciation reserve account £400; leaving for disposal £263. The directors have doubled the amount transferred to depreciation reserve account as compared with the previous year, and they recommend that a further dividend of 1 per cent., making 2 per cent. for the year, be paid on the preference shares which will absorb £250 and leave £13 to be carried forward. A proposal to introduce Diesel oil plant into the works is receiving the serious consideration of the board, as it is shown that a large saving in working expenses would result. The debenture stock is due for repayment on December 31st, 1912, and the subject of its renewal has the attention of the directors.

### German Electrical Companies.

*The Elektrochemische Werke*, of Bitterfeld, after writing off £4,900 for experimental work and £5,900 off investments, report net profits of £67,000 for 1911. A dividend at the rate of 10 per cent. is in contemplation on the ordinary capital of £275,000, being the same rate as in 1910. The company's chloride of potash works in Bitterfeld and Rheinfelden are leased to the Griesheim-Elektron Chemical Works, the former participating in one half of the profits.

*The Ver. Isolatorenwerke*, of Berlin-Pankow, report that a considerable increase took place in the volume of business in 1911, and the company was compelled to extend the manufacturing plant. It was, however, impossible to secure an improvement in prices, which were by no means satisfactory, and which still showed a falling tendency. After allocating £5,800 to depreciation, as compared with £2,700 in 1910, the accounts exhibit net profits of £6,200, as against £3,600 in 1910. It is intended to distribute 9 per cent., as contrasted with 4 per cent. in 1910. A good stock of orders was brought over into the new year, and the works are tolerably fully employed.

The accounts of the *Deutsche Kabelwerke*, of Berlin, indicate gross profits of £60,000 for 1911, as compared with £56,000 in the previous year. After providing for general expenses, taxes and interest charges, and setting aside £5,800 for depreciation as against £5,100 in 1910, there remain net profits of £24,000, as compared with £19,000. It is intended to pay a dividend of 7 per cent. on a share capital of £262,500 as against 8 per cent. on £175,000 in 1910. According to the directors' report, a further large increase in the turnover took place last year, but prices left much to be desired, whilst the new capital was not fully productive. The new financial year has been entered upon with an abundance of orders, and the volume of business already transacted is greater than in the corresponding period of 1911.

*The Gesellschaft für Elektrische Unternehmungen*, of Berlin, which is purely an investment company concerned with undertakings situated in Germany and other countries, states in the report for 1911 that the working results of the lighting and tramway enterprises in question made further progress as compared with the previous year. The sale of securities yielded a profit of £82,000, and, with the interest and dividends received on other investments, the accounts show net profits of £271,000 for 1911, as against £245,000 in 1910. It is intended to pay a dividend of 10 per cent. on the share capital of £2,250,000, as compared with 9 per cent. in the preceding year. The share capital is now to be increased to £2,500,000, so as to provide funds for pending transactions and the extension of existing undertakings.

The directors of *Voigt & Hueffner, Akt. Ges.*, of Frankfort-on-Main, state in their report for 1911, that in order to be able to meet the large demand it was necessary to enlarge the new buildings which were only brought into use for the first time in the previous year. The considerable increase in the turnover was fairly distributed over various countries, but prices were just as unfavourably low as in years of declining trade. As gross profits the accounts show the sum of £100,000, as compared with £72,000 in 1910; after providing for general expenses and depreciation to the extent of £12,000, as against £6,200 in 1910, the net profits and balance forward are returned at £45,000, as compared with £30,000. A dividend at the rate of 10 per cent. has been declared on the increased capital of £250,000, as compared with 10 per cent. on £150,000 in each of the four preceding years. At the recent meeting it was mentioned that the orders on hand in the new financial year were 60 per cent. greater than a year ago. It is now proposed to issue debentures for £100,000 to provide additional working capital.

*The Bergmann Elektrizitätswerke A.G.*, which has developed in recent years from a manufacturing undertaking for installation materials into one for the production of all classes of machinery and plant, is now confronted with the necessity of raising additional share capital of from £750,000 to £1,000,000 for the purpose of extinguishing the bank debt and providing additional working capital. Even the increase in the share capital to £1,450,000 and the emission in 1909 and 1911 of loans totalling £1,000,000 have been insufficient to cope with the large expansion which the undertaking has experienced, and the very high dividends paid in former years are now a matter of the past. The turnover in 1910 amounted to £2,500,000 and is said to have been advanced to £3,300,000 last year, but prices have not kept pace with the increased volume of business owing to the prevalence of severe competition. The dividends paid in 1910 was 12 per cent., but is estimated at from 6 to 7 per cent. for 1911. It is reported, although not for the first time, that a close connection may be formed with one of the larger companies.

### German-Netherlands Telegraph Co.

THE report for 1911 of the *Deutsch-Niederländische Telegraphen Gesellschaft*, of Cologne, states that, notwithstanding the political revolution in China, the telegraph traffic with the Far East experienced an increase, and it is assumed that the traffic there will further develop. On the other hand, the augmentation in Netherlands-India, which was brought about by the development in the rubber market in 1910 was not maintained, although the traffic between that part and other countries had an upward tendency, on the whole. The company's cables were free from interruption during the year.

It is mentioned that negotiations are pending with the German Government in regard to a scheme for connecting the most important German colonies in the South Sea with the world's telegraph system, by the establishment of wireless stations at Yap, Nauru, Rebaul in New Guinea, and Apia in Samoa. The company has participated in the negotiations because the proposed stations would presumably act as feeders to its cable traffic, and because it is important for the company to gain experience as to the efficiency of this means of communication. The Government is thinking of granting a joint concession to the company and the *Gesellschaft für Drahtlose Telegraphie*, of Berlin, for the purpose of forming a new company to undertake the establishment and working of the stations in question. The capital of the new company is to be £105,000, of which £65,000 will be in shares and £40,000 in the form of 4½ per cent. debentures, of which each of the promoting companies would subscribe one-half. An increase in the capital of the German-Netherlands Co. will not be necessary, as the money can be gradually withdrawn from the liquid funds. In the event of the concession being granted under suitable conditions, and the Government sanctioning assistance, the company intends to take part in the constitution of the new company.

The accounts, including the balance forward, show net profits of £40,700 in 1911, as contrasted with £38,000 in the previous year. It is proposed to pay a dividend of 6½ per cent. on the share capital of £350,000, being the same rate as in 1910.

### Oriental Telephone and Electric Co., Ltd.

THE directors' report for 1911 states that, including £18,100 brought forward from 1910, and after deducting the interim dividends of 3 per cent., paid on November 1st last, on both the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock of the company and other charges, as shown in the net revenue account, the amount to be dealt with is £48,681. The directors recommend a final dividend of 3 per cent. (less income-tax) for the year on the preference shares (£1,500), a final dividend of 5 per cent. (free of income-tax) on the ordinary shares issued, making 8 per cent. for the year, £8,966, transferring to reserve account £10,000, to reserve for contemplated staff pension scheme £1,000, and writing off expenditure on exchanges, &c., £3,500, leaving to carry forward £23,715. All the company's exchanges, as well as the whole of the subsidiary companies, show improvements in revenue during the past year. The Bombay Telephone Co., Ltd., has increased its dividend from 8 to 9 per cent., and the Bengal Telephone Co., Ltd., from 5 to 6 per cent. The Telephone Co. of Egypt, Ltd., and the China and Japan Telephone and Electric Co., Ltd., continue to pay their previous rates of 10 and 5 per cent. respectively. These dividends have been received in London, and are, as usual, included in the revenue account. Underground cabling extensions in Madras have now been completed, and similar work is in progress at Rangoon, from which it is expected additional revenue will accrue to the company. The extensions in the Island of Mauritius, referred to in the last report, are now nearly completed, and the sub-exchange at Curepipe will be working very shortly. After the conclusion of the ordinary business at the annual meeting on April 24th, extraordinary resolutions will be proposed regarding alterations in the memorandum and articles of association. These provide for the carrying on of a general import and export business within the Island of Mauritius, and other matters.

**Electricity for Ship Propulsion.**—The Electric Marine Propulsion Co. has been formed in Glasgow with a capital of £60,000, to acquire the interests of Messrs. Mavor & Coulson and Mr. Henry A. Mavor in inventions for the application of electricity to ship propulsion.



**Babcock & Wilcox, Ltd.**

IN our last issue we briefly announced the dividend declaration of this company. The directors' report for the year ended December, 1911, has now been received, and states as follows:—

The net profit during the year amounted to £379,224, plus £68,643 brought forward, making a balance of £447,867. After deducting the interim dividends paid October, 1911, of 3 per cent. on the preference shares, and of 12 per cent. on the ordinary shares, amounting to £102,600, there remains a balance of £345,267, from which the directors recommend that the dividends as stated by us last week be paid, absorbing £135,800. Of the remaining £209,467, there is placed to the reserve fund £130,000, bringing this fund up to £830,000, £10,000 is placed to the staff pension fund, and £69,467 is to be carried forward. The volume of business done last year showed an increase over that of the previous year. The constantly increasing cost of labour requires continuous extension of the firm's organisation and the employment of its capital resources and reserves to compensate for the tendency of the rate of profit on orders to be reduced. . . . Having regard to the fact that the extension of the business has required the reserve fund to be employed as working capital, the directors have under consideration a proposal that an amount equal to the existing ordinary capital of the company be taken from the reserve fund and added to the capital account. It is recommended to make the same provision for the staff pension fund as was made last year.

In a circular that accompanies the above report, the directors call an extraordinary general meeting for April 23rd to pass a resolution increasing the capital to £1,760,000 by the creation of 830,000 new ordinary shares of £1 each. The reason for this step is as follows:—

As has been stated at several annual meetings of the company, our trading has largely extended, and the profits have not only been earned by the use of the nominal capital of the company, but also by the use of the reserve fund and other assets, so that the rate of profit and dividend, although appearing high on the nominal capital, was much lower, taking the additional employment of the other assets into consideration. It is proposed to adjust this condition by adding the ordinary reserve fund to the capital account, thus increasing the latter to £1,760,000 (being £100,000 6 per cent. preference shares and £1,660,000 ordinary shares), and to issue to the ordinary shareholders in respect of the reserve fund one additional fully-paid £1 share for each such share now held. It follows that by this re-arrangement the portion of the profits appropriated to dividend would be distributed in future over the larger capital.

**Arbroath Electric Light and Power Co., Ltd.—**

Mr. George Balfour presided at the annual meeting of this company. The report showed a net profit of £1,028 for the year plus £978 brought forward, making an available balance of £2,006. This the directors proposed to apply as follows, viz.:—To reserve fund, £500; in payment of dividend at 2½ per cent., £563; leaving to be carried forward, subject to directors' and auditors' fees, £943. The chairman stated that the time was opportune for increasing the share capital of the company in order to pay off the bank loan, and provide for the further development of the company's business. They had come to the conclusion that it would be preferable to adopt this course rather than issue debentures, as originally intended, and accordingly it was proposed to increase the capital from £30,000 to £40,000, and to divide the same into 25,000 ordinary shares and 15,000 cumulative preference shares of £1 each. The preference shares, of which only 10,000 would be issued until further capital expenditure was necessary, would carry a cumulative preferential dividend of 5 per cent., increasing to 6 per cent. whenever the ordinary shares receive a like dividend, and it was considered that the preference shares would form an attractive investment, looking to the dividend-paying stage now reached by the company. The report was unanimously adopted.

**Prospectuses.**—*Newcastle and District Electric Lighting Co., Ltd.*—The list of applications was to close on Wednesday, 17th inst., in an issue of £150,000 6 per cent. second mortgage debentures at 99½ per cent. in denominations of £100 and £20.

*The Scottish Tube Co., Ltd.*—The list was also to close on Wednesday in an issue of £200,000 5 per cent. convertible mortgage debenture stock in this company, at par. The company has been formed to amalgamate a number of Scottish tube companies. The capital being issued is £506,955 (300,000 cumulative preference and 206,955 ordinary), which, except the shares allotted for cash to the subscribers of the memorandum of association, are to be allotted partly as fully-paid to the vendors in part payment of the purchase price, and partly to Messrs. Stewarts & Lloyd's, Ltd., for cash. It is stated in the prospectus that the tube trade has been generally prosperous for many years, but for the past two years severe internal competition has reduced profits. It is expected that the amalgamation will consolidate interests, reduce oncost and management charges, combine the practical knowledge of the directors and place the trade of the company on a sound and satisfactory footing. The price payable to the vendors for the various businesses, &c., is £646,255.

**Telephone Co. of Egypt, Ltd.**—The directors have declared a dividend of 6 per cent., free of income-tax, on the preferred and deferred shares for the half-year to December 31st, making 10 per cent. for the year. £1,000 is placed to reserve for staff pension fund and £85,955 is carried forward.

**Continental.**—FRANCE.—La Société d'Energie Electrique du Nord de la France is increasing its capital from £280,000 to £400,000. The report for the last financial year shows a profit of £28,686.

BELGIUM.—La Société Belge pour la Fabrication des Cables et Fils Electriques, of Brussels, is increasing its capital to £40,000.

**Italian Electricity Companies.**

THE financial results realised by the Italian subsidiaries of German and Swiss manufacturing or banking interests, which are of a fairly numerous character, are now in course of publication for the year 1911. Among those associated with the Schuckert group, a Milan correspondent states that the Società Sicula Imprese Elettriche, of Palermo, proposes to pay a dividend of 6 per cent., as compared with 5 per cent. in 1910, whilst the Società Industriale Elettro-Chimica di Pont St. Martin, which was unable to make any distribution in 1910 owing to damage caused to its hydro-electric works, intends to pay 4s. per share for the past year. The Società Toscana Imprese Elettriche, of Florence, contemplates the payment of 10 per cent. for 1911, being the same rate as in the preceding year. On the other hand, the Società Bergamasca Distribuzione Energia Elettrica is compelled to reduce the rate to 5 per cent., as contrasted with 6½ per cent. in 1910, in consequence of the decline in sales due to the crisis in the cotton industry. The electricity undertakings connected with the A.E.G. group and the Swiss Bank for Electrical Enterprises include the Officine Elettriche Genovesi, which supplies light and power for industrial purposes and power for the tramways in Genoa, and which intends to pay 10 per cent. for 1911, as was also the case in the previous year. The Unione Italiana Tramways Elettrici, which was able to increase the rate from 8 per cent. in 1909 to 8½ per cent. in 1910, is to raise the rate to 9 per cent. for the past year, whilst the Idroelettrica Ligure proposes to distribute 6 per cent., as against 5 per cent. in 1910. The Società Elettrica Riviera di Ponente, which is associated with the Swiss Electrical Industry Co., of Basle, intends to raise the share capital from £480,000 to £600,000, and to issue bonds of £240,000 for the construction of a power station on the Upper Roja.

**Midland Electric Corporation for Power Distribution, Ltd.**—The directors report (says the *Financier*) that the accounts for the year to December 31st show a balance at credit of net revenue account of £2,500. Under the agreement referred to in the report accompanying the accounts for 1909, the debit balance in revenue account of £4,239, shown in the balance-sheet of last year, has been discharged; the agreement terminated on December 31st last.

**STOCKS AND SHARES.**

Tuesday Evening.

BUSINESS in the Stock Exchange is waking up with a vengeance. Most of the markets, apart from those concerned with mining shares, are actively employed. Prices are good; there is a large volume of investment and a still bigger amount of speculation. The latter, in fact, has assumed such proportions that some of the cooler heads in the Stock Exchange deprecate it, and are already talking about a day of reckoning for the bulls when the latter shall least expect it. The various departments connected with electricity are sharing in the trade which is going on, and the difficulty of an Autolycus who writes notes on the different sections is not to find things to discuss, but to compress within reasonable limits the many factors of importance and interest which ought to be touched upon in such a column as this.

Home Railway stocks are in high favour. With the end of the coal strike has come a wild outburst of strength, in which Undergrounds and Kentish issues stand out with the greatest prominence. The Southern stocks are buoyed up by hopes of coal being discovered at last in Kent, and indiscriminate bullishness does not stop to consider what quality it may be, or anything so mundane as this. Amongst the Undergrounds, the feature of the week is a continuance of the rises in Metropolitans, Districts, and Underground Electric shares. On top of their rise of 2½ last week, Metropolitans have improved to the extent of 2½; while Districts, in addition to their previous rise of 4 points, have put on a further 1½, bringing the price up to 48½. Underground Electric shares rose no less than £1 at one time to 4½, receding later to 4½, at which the price still shows a gain of 12s. 6d.; while the 6 per cent. income bonds at 92 are 3 up. Central Londons have recovered part of their reaction, the Ordinary and Deferred both standing at 85, being higher this week. City and South London, on the other hand, eased off to 42½. Great Northern and City Preferred are 5s. down, but East London issues enjoyed big rises. The business being done in all of these is on a huge scale, and there can be no doubt that a good part of it is of the highly speculative order. London United Tramways Preference have risen ½, and British Electric Traction are a better market; there are two or three small rises in some of the issues. Metropolitan Electric Tramways Ordinary and Potteries Ordinary are both marked *ex* dividend, the deductions having little effect.

Another sensational rise in City of London Ordinary and Preference has been accompanied by reports to the effect that the City Corporation has signed an agreement by which the company's Ordinary shares will be taken over on the basis of £27 per share. All things are possible, of course, especially to the City of London Corporation; but it is difficult to see what justification there can be for this, and only the personal feeling which is known to exist between the Corporation and the London County Council gives colour to the report. Until further details are available, it appears superfluous to discuss the matter further. Metropolitans are ½



higher, and Charing Cross rose to the same extent. County of London put on a similar fraction, and if any of the shares on the list are cheap it would seem to be these. The new shares are still quoted at  $\frac{1}{2}$ - $\frac{3}{4}$  premium for special settlement. Other Lighting shares are steady. Holders may be advised to keep their shares, for there are active negotiations going on in at least two directions which may have a marked effect upon quotations if they materialise. In the provincial list, several of the principal shares are in demand, without dislodging a supply, and it may be said that the market as a whole is very hard.

Marconis have had a further jump, which can only be described as phenomenal, and the prophets who talked them to £10 a share are beginning to vaunt their prescience, for which, it must be frankly admitted, they have every reason. The parent shares show a rise of no less than 35s. on the week, and there have been substantial recoveries in Canadian Marconis and in Spanish, after both shares had experienced sharp falls as the weaker bulls were shaken out. The advent of a new company to deal with the American patents is daily expected, and the market is agog with excitement and curiosity to see at what price the new shares will be placed. The next item of interest in this department is a rise of 10 in National Telephone Deferred, bringing the price to 148. Reference was made here last week to the vague optimism with regard to the price at which the stock will be paid off by the Government. Dealing in National Telephones, however, is so risky as to be practically *caviare* to the ordinary investor, who is content, and rightly so, to leave the gamble to a small circle of speculators. The company's Third Preference shares have risen  $\frac{3}{4}$  to 5 $\frac{1}{2}$  middle.

West India and Panama shares are still a dullish market, although there was a recovery from the worst. Nothing of special interest has transpired to give the market a fillip, and there is still some fear as to what damage may have been done by the recent seismic disturbances reported from the Isthmus. The Eastern group is decidedly firm. Eastern Ordinary is 3 points better, and Eastern Extension shares are 10s. higher, following up their improvements of last week; while Globe Preference rose  $\frac{1}{2}$  to 13 $\frac{1}{4}$  in sympathy with the advance in Easterns. Great Northern Telegraphs are slightly easier, but Western Telegraphs are  $\frac{1}{2}$  up. The strength of the American Railway market led to a rise of 2 in Mackay Companies' common shares, and American Telephone Capital stock is a point better. A sharp rise occurred in Anglo-American Deferred, in which fresh speculative interest has just been kindled. The stock has been neglected for some time, and is now having a turn of strength.

United River Plate Telephones are better, and several other improvements have occurred amongst the purely investment issues. Indeed, the market, as a whole, displays considerable strength, with the investor on the search for sound securities which have not risen much up to the present.

In the Manufacturing group, Edison & Swan fell  $\frac{3}{4}$  to  $\frac{1}{2}$ , and the 4 per cent. Debenture stock lost a point, the former being pressed for sale. Callenders have gone ahead, and the price is up to 11, which is substantially better than it was a fortnight ago. On the other hand, India Rubber shares have gone back to their par price of 10. British Westinghouse 4 per cent. Debenture stock has again improved a little. The excellent report just published by the Babcock & Wilcox Company has had no further influence upon the price of the shares, which keeps at 6 $\frac{1}{2}$  middle, this, of course, including the recently-declared dividend.

In the Foreign Traction division business is very active. The principal rise is one of 6 $\frac{1}{2}$  in Sao Paulo Tramway shares, the quotation jumping to 210. Mexico Trams, allowing for the dividend, are 3 $\frac{1}{2}$  higher; while Rio Trams, also *ex* dividend, are up 3 points. Para Electric Ordinary rose 10s., and a number of similar rises have been secured by the popular issues, the appetite for which appears to be insatiable. Mexican shares and bonds are again in request, in spite of the contradictory news which is still received from the theatre of what is politely called the revolution. The impression gains ground that the United States have a larger hand in the movement than was at first supposed; and if the course of events runs in such a fashion as to give Uncle Sam a preponderating hand in Mexico, there can be no doubt that this would make for the ultimate prosperity of all the companies concerned, although, as we have pointed out before, its consummation may lead to further outbreaks in the meantime. A number of traction, light and power companies operating in the various parts of the United States are enjoying a run of speculative attention. As an instance, the Alabama Traction, Light and Power Company may be mentioned, the shares in which not long ago stood at 28 and are now 43 $\frac{1}{2}$ , while those in the Georgia Company have been run up from 30 to about 41. Without a doubt, there is enormous scope for such concerns, but when it is remembered that, in many cases, the shares are nothing more nor less than "water," it wants robust faith to buy them, except as highly speculative counters, at anything like current prices. One thing which is being largely tipped is the common issue of the Mexico Northern Power Company, the shares being about 28; but here again, it is just blind faith that will buy such shares.

The new issue of Newcastle and District Electric Lighting Debenture has been made this week, and of the success attending it there are no details available up to the time of writing. An example of the manner in which some new issues are introduced is afforded by the offer of 1 $\frac{1}{2}$  million dollars Empire District Electric Company 5 per cent. first Mortgage bonds. This will be made publicly some time hence; but, in the meantime, the bonds are being placed on terms by which the applicant takes them firm and receives 2 $\frac{1}{2}$  per cent. back again when the prospectus comes out. There was an eager demand for the privilege of advance subscription, which is different from underwriting inasmuch as the subscriber takes the bonds firm and guarantees to pay up the instalments as they become due.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen .. ..	April 10	2,624	+ 63	45	65,875	+ 8,467	14.4	..
Ayr .. ..	" 13	480	+ 50	48	13,973	+ 2.4	8	..
Bath .. ..	" 13	1,810	+ 447	15	10,604	+ 893	14.75	..
Birkenhead .. ..	" 14	2,107	+ 24	2	2,108	— 290	18.68	..
† Birmingham Corp.	Mar. 31	11,849	+ 5,755	52	473,917	+ 113,916	56.4	..
Blackburn .. ..	April 10	2,452	+ 491	2 $\frac{1}{2}$	2,678	+ 427	14.62	..
† Blackpool Corp. ..	" 11	1,806	+ 1,211	..	2,325	+ 1,518	11.87	..
Blackpool-Fleetw'd	" 13	1,011	+ 28	14	4,771	+ 553	8	..
Bournemouth .. ..	" 10	3,889	+ 1,874	1 $\frac{1}{2}$	3,059	+ 994	21.95	..
Bradford .. ..	" 6	9,756	+ 614	1	4,761	— 1,267	56	1.2
Brighton .. ..	" 14	2,073	+ 290	2	2,073	+ 73	9.5	..
Bristol .. ..	" 12	14,514	+ 3,235	..	92,695	+ 10,785	30.5	..
Brit. Elec. Traction Co.								
Airdrie .. ..	" 5	599	+ 191	14	3,889	+ 972	3.65	..
Barnsley .. ..	" 5	261	— 149	..	2,193	— 154	..	..
Barrow .. ..	" 5	740	+ 258	..	4,362	+ 1,189	5.87	..
Devonport .. ..	" 5	1,148	+ 286	..	6,905	+ 1,087	8.85	..
Gateshead .. ..	" 5	1,964	— 18	..	13,710	+ 1.9	11.25	..
Gravesend .. ..	" 5	305	+ 46	..	2,692	+ 272	6.5	..
Greenock .. ..	" 5	1,539	+ 212	..	9,833	+ 1,510	7.25	..
Hartlepool .. ..	" 5	506	+ 76	..	3,215	+ 318	6.72	..
Kidderminster .. ..	" 5	190	+ 22	..	1,242	+ 112	..	..
Leamington .. ..	" 5	292	+ 6	..	1,903	+ 114	..	..
Merthyr .. ..	" 5	306	— 73	..	2,478	— 40	2.9	..
Metropolitan .. ..	" 5	17,875	+ 2,463	..	113,989	+ 9,913	22	..
Middleton .. ..	" 5	618	+ 46	..	3,875	+ 35	8.5	..
Mid. Joint Com'tee	" 5	6,064	+ 426	..	40,004	+ 1,684	..	..
Oldham—Ashton ..	" 5	1,239	+ 177	..	7,641	+ 557	9.13	..
Peterborough .. ..	" 5	245	+ 42	..	1,572	+ 211	5.81	..
Potteries .. ..	" 5	2,712	— 1,120	..	24,275	— 1,504	29	..
Rotherham .. ..	" 5	124	+ 6	..	713	+ 84	2.75	..
Southport .. ..	" 5	516	+ 45	..	33,237	+ 120	8.17	..
S. Metropolitan ..	" 5	1,755	+ 436	..	10,006	+ 771	..	..
Swansea .. ..	" 5	2,056	+ 6	..	14,811	+ 620	12.5	..
Tynemouth .. ..	" 5	362	+ 69	..	2,029	— 30	3.75	..
Weston-s-Mare ..	" 5	61	+ 8	..	308	+ 96	8	..
† Worcester .. ..	" 5	516	+ 69	..	3,085	+ 142	5.75	..
Wrexham .. ..	" 6	216	+ 18	..	1,313	+ 99	..	..
Yorks. Wool. Dist.	" 5	1,929	+ 9	..	13,874	+ 455	17	..
Miscellaneous .. ..	" 5	432	+ 41	..	2,803	+ 191	..	..
Burnley .. ..								
Burnley .. ..	" 13	3,223	+ 262	..	..	..	11.73	..
Burton-on-Trent ..	" 14	551	+ 44	2	551	+ 43	6.6	..
Bury .. ..	" 14	2,912	+ 179	2	2,912	— 234	22.5	..
† Cardiff .. ..	Mar. 30	1,923	— 175	52	125,479	+ 8,672	17.35	..
Chatham and Dist.	April 11	2,161	+ 365	15	11,690	+ 637	14.98	..
Cork .. ..	" 11	908	+ 87	15	6,428	+ 78	9.88	..
Croydon .. ..	" 5	3,101	+ 389	7	1,325	— 127	11.6	75
Darlington .. ..	" 6	404	+ 16	1	204	+ 17	4.87	..
Darwen .. ..	" 5	486	+ 24	1	242	+ 9	4.86	..
Dover .. ..	" 6	440	+ 102	1	243	+ 17	4.76	..
Dublin .. ..	" 12	12,153	+ 1,960	..	79,599	+ 6,762	54.25	..
East Ham .. ..	" 13	2,213	+ 214	2	2,102	+ 311	7.87	..
Exeter .. ..	" 12	604	+ 13	2	575	+ 15	5.5	..
Glasgow .. ..	" 13	37,244	+ 219	..	855,296	+ 44,466	98	75
Hastings .. ..	" 11	2,612	+ 518	..	..	+ 789	19.3	..
Huddersfield .. ..	" 13	3,880	+ 147	2	3,883	+ 150	29.5	1
Hull .. ..	" 13	5,894	+ 225	2	5,689	— 583	13	1.5
Ikeston .. ..	" 13	414	+ 143	2	916	+ 275	10.5	..
Ipswich .. ..	" 13	266	+ 4	47	7,536	+ 471	4.26	..
Kilmarnock .. ..	" 6	2,816	+ 399	15	17,710	+ 356	89	..
Lancashire United	" 13	13,046	+ 793	2	14,447	+ 1,891	57.5	..
Leeds .. ..	" 13	4,206	— 299	..	..	..	20	..
Leicester .. ..	" 6	1,385	+ 304	46 $\frac{1}{2}$	30,291	+ 2,717	5.724	..
Liverpool .. ..	" 6	23,858	+ 1,567	13 $\frac{1}{2}$	160,205	+ 9,506	176	..
† L.C.O. .. ..	" 3	86,691	+ 4,268	..	2,310,906	+ 117,878	139.5	3
London United ..	" 6	12,622	+ 2,021	..	76,229	+ 3,095	..	..
Lowestoft .. ..	" 13	327	+ 30	28	4,397	+ 45	8.5	..
Manchester .. ..	" 13	33,811	+ 2,579	2	32,606	+ 4,305	1.05	..
Newcastle .. ..	" 13	8,675	+ 259	..	8,350	— 617	81.3	..
† Newport .. ..	Mar. 30	570	— 87	52	36,267	+ 954	7.26	..
Oldham .. ..	April 7	9,939	+ 364	2	3,949	— 264	28	..
Pontypridd .. ..	" 13	610	+ 210	2	610	+ 210	5.5	..
Portsmouth .. ..	" 6	4,014	+ 674	1	2,248	+ 664	15.25	..
Preston .. ..	" 10	1,665	+ 218	2	1,665	+ 218	10	..
Rotherham .. ..	" 11	1,229	— 20	14	1,105	+ 211	12	..
Salford .. ..	" 8	10,035	+ 1,158	1 $\frac{1}{2}$	6,017	+ 6.0	41	..
Sheffield .. ..	" 16	11,479	— 312	3	17,198	— 26	40	..
Southampton .. ..	" 10	1,835	+ 407	1 $\frac{1}{2}$	1,835	+ 427	11	..
Southend-on-Sea ..	" 10	1,588	+ 801	2	1,266	+ 598	7	..
South Shields .. ..	" 13	1,073	— 108	2	1,074	+ 28	10.25	..
Swindon .. ..	" 13	..	..	..	..	..	..	..
Tyneside .. ..	" 10	1,225	+ 424	15	6,483	+ 820	11	..
Wallasey .. ..	" 13	2,245	+ 260	14	2,146	— 31	8.72	..
Walthamstow .. ..	" 6	1,432	+ 394	..	..	..	9	..
West Ham .. ..	" 4	5,146	+ 400	1	2,559	+ 198	15.25	..
Wolverhampton ..	" 10	2,061	+ 337	..	..	..	18.75	..
Gen. London Rly. ..								
City & S. Lon. Rly.	" 13	7,422	— 2,500	15	72,158	— 7,814	6.82	..
Dublin-Lucan Rly.	" 14	5,648	— 1,025	15	48,953	— 2,724	7.26	..
G.N. and City Rly.	" 12	319	+ 74	15	1,730	+ 119	7	..
L'pool Overh'd Rly.	" 13	3,115	+ 148	15	25,197	+ 1,488	8.5	..
Llandudno-Col. Bay	" 14	8,015	+ 174	15	22,157	+ 1,413	6.6	..
Lond. Elec. Ry. Co.	" 12	583	+ 194	19 $\frac{1}{2}$	2,892	+ 419	6.5	..
Mersey Railway ..	" 13	25,875	— 980	15	217,280	+ 5,680	21.25	..
Metropolitan Rly. ..	" 13	4,155	— 106	15	30,712	— 27	4.5	..
Met. District Rly. ..	" 14	30,416	— 8,246	15	24,821	— 6,949	25.75	..
Met. Argentine ..	" 13	23,573	+ 585	15	187,915	+ 8,085	25	..
† Auckland .. ..	" 8	102,288	+ 1,928	15	719,718	+ 29,129	..	..
† Bombay (B.E.T.) ..	Mar. 17,463	+ 1,409	..	..	154,172	+ 12,457	23.8	..
† Brisbane .. ..	April 8	6,186	+ 221	11	32,899	+ 2,227	..	..
† Brit. Columbia Rly.	Feb. 6,700	— 1,575	8	23,734	— 15,101	..	..	..
Calcutta .. ..	April 18	7,986	+ 607	..	..	+ 7,280	..	..
Cape Electric T.L.D.	" 18	..	..	..	..	..	..	..
† Kalgoolie, W.A. ..	Mar. 8,884	..	3	8,952	..	20.5	..	..
† Lisbon .. ..	" 18	..	..	..	..	..	..	..
Madras .. ..	Mar. 81	1,898	+ 458	..	9,503	+ 647	..	..
† Montevideo .. ..	Mar. 81	498	+ 3,071	5	157,327	+ 16,407	..	..
† Perth (W.A.) ..	April 12	3,916	+ 679	15	28,476	— 4,261	29	..

\* Compared with the corresponding period of 1911.

+ One week only.

† Includes horse, steam and other receipts.

‡ One month.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 16th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 16th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	8½—9½	..	5 19 0	Kensington & Knightsbridge, Ord	5	9 9	7½—7½	—½	5 16 2
Do. 4½ % Pref. ..	10	4½ 4½	8½—9½	..	4 14 9	Do. 4 % Deb. ..	Stock	4 4	92—95	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100—102	..	4 8 3	London Electric, Ord. ..	8	2 2½	1½—2½	..	3 11 2
Brompton & Kensington, Ord. ..	5	10 10½	8½—8½	..	5 14 3	Do. 6 % Pref. ..	5	6 6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7 7	7½—8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	91—94	..	4 5 1
Central Electric Supply, 4 %	100	4 4	98—101	..	3 19 3	Metropolitan ..	5	5 4½	8½—4½	+½	5 17 2
Guar. Deb. }						Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5 5	4½—5	+½	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	101—104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½—4½	..	5 0 0	Do. 8½ % Mort. Deb. ..	Stock	8½ 8½	84—87	..	4 0 6
Do. " City Undertaking "	5	4½ 4½	8½—4½	..	5 2 10	Midland Electric Corporation	100	4½ 4½	96—98	..	4 11 10
Do. 4½ % Cum. Pref. ..	100	4 4	95—98	..	4 1 8	4½ % First Mort. Deb. }					
Chelsea, Ord. ..	5	5 5	4½—5	..	5 0 0	Newcastle-on-Tyne ..	5	4 4½	8½—3½	..	5 3 3
Do. 4½ % Deb. ..	Stock	4½ 4½	98—101	..	4 9 1	Do. 5 % Pref., Non-Cum. ..	5	5 5	3½—4½	..	5 14 3
City of London, Ord. ..	10	7 8	21—23	+3½	3 9 7	North Metropolitan Power Sup-	100	5 5	99—102	..	4 13 0
Do. 6 % Cum. Pref. ..	10	6 6	19—21	+5½	2 14 4	ply, 5 % Mortgages (Red.)					
Do. 5 % Deb. ..	Stock	5 5	117—121	..	4 2 8	Notting Hill, 6 % Non-Cum.	10	..	10—11	..	5 9 1
Do. 4½ % Second Deb. ..	100	4½ 4½	101—104	..	4 6 7	Pref. }					
County of Durham, 5 % First	Stock	5 5	87—89	..	5 12 4	Oxford ..	5	7½ 7½	5½—6½	..	5 13 9
Mort. Deb. }						St. James' and Pall Mall, Ord.	5	10 10	8½—9	..	5 11 1
County of London, Ord. ..	10	5 5	10½—10½	+½	5 10 4	Do. 7 % Pref. ..	5	7 7	6½—7½	..	4 16
Do. 6 % Pref. ..	10	6 6	11½—11½	..	5 3 0	Do. 8½ % Deb. ..	100	3½ 3½	85—87	..	4 0 6
Do. 4½ % Deb. ..	Stock	4½ 4½	107—109	..	4 2 7	Smithfield Markets, Ord. ..	5	Nil 2	1½—1½	..	..
Do. 4½ % Second Deb. ..	Stock	4½ 4½	101—104	..	4 6 7	South London, Ord. ..	4	5 5	2½—3½	..	6 8 0
Edmundson's, Ord. ..	5	Nil Nil	8—8	..	Nil	Do. 5 % First Mort. Deb. ..	100	5 5	99—102	..	4 13 0
Do. 6 % Cum. Pref. ..	5	Nil Nil	3—3½	+½	Nil	South Metropolitan, 7 % Pref. ..	1	7 7	1½—1½	..	6 1 0
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86—89	..	5 1 2	Do. 4½ % First Deb. Stock ..	100	4½ 4½	86—99	+1	4 11 0
Folkestone ..	5	6 6	4½—4½ xd	..	6 3 1	Urban, Ord. ..	5	5 ..	2½—3½	..	..
Do. 5 % Cum. Pref. ..	5	5 5	4½—4½ xd	..	5 5 3	Do. 5 % Cum. Pref. ..	5	5 ..	2½—3½	..	..
Do. 4½ % First Deb. ..	100	4½ 4½	93—96	..	4 13 9	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	85½—87½	+½	5 2 10
Hove ..	5	9 9	6½—7 xd	..	6 8 7	Westminster, Ord. ..	5	10 10	8½—9½	..	5 8 1
						Do. 4½ % Cum. Pref. ..	6	4½ 4½	5—5½	..	4 5 9

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	85—90	+½	5 11 1
Calcutta, Ord. ..	5	8½ 7½	6½—7½	..	5 17 8	5 % 1st Mort. Deb. }					
Do. 5 % Pref. ..	5	5 5	5—5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	208—213	..	3 15 2
Calgary Power, 1st Mort. Bds.	100	5 5	92½—94½	..	5 5 3	Northern, Lt., Power and Coal, }	\$500	5 ..	39—41	..	12 5 10
Canadian Gen. El. Com. ..	\$100	7 7½	116—120	..	5 16 8	5 % 1st Mort. Bonds }					
Do. 7 % Pref. ..	\$100	7 7	116—120	..	5 16 8	River Plate, Ord. ..	Stock	10 ..	252—262	..	3 16 4
Cordoba Lt., Power and T., Ord.	1	3 3½	7—1	—3½	3 0 0	Do. 6 % Non-Cum. Pref. ..	Do.	6 6	110—115	..	5 4 4
Do. 5 % Deb. ..	100	5 ..	93—98	..	5 2 0	Do. 5 % Deb. Stock ..	Do.	6 5	102½—104½	..	4 15 8
Eleo. Lt. and P. of Cochabamba, }	100	6 6	93—95	..	6 6 4	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	99—101	..	4 9 1
6 % Bonds }						1st Mort. Deb. }					
Eleo. Supply Victoria, 5 % 1st	100	5 5	83—86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4 5½	139—143 xd	..	3 9 11
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108—110	..	4 11 0
Elec. Dev. Ontario, 5 % 1st	\$500	5 5	91—93	..	5 7 6	Do. 4½ % Per. Deb. ..	Stock	4½ 4½	103½—105½	..	4 5 4
Mort. Bonds }						Toronto Power, 4½ % Deb. ..	Do.	4½ 4½	99½—101½	..	4 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	7—7½	..	Nil	Vera Cruz Lt., P. and T., 5 %	100	5 5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6 6	8—8½	..	8 0 0	1st Mort. Deb. }					
Kaministiquia Power, 6 % G. Bs.	\$500	5 5	110—112	..	4 9 3	Victoria Falls Power, Pref. ..	1	Nil 11½d.	7—1½	+½	..
Madras, Ord. ..	5	.. ..	2½—3	..	..	West Kootenay Power and Lt., }	100	6 6	104½—106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5 5	102—105	..	4 15 3	1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	84—86	..	5 16 3						
Mexican Lt. & Power, Common	\$100	4 4	84—86 xd	+2	4 13 0						
Do. 7 % Cum. Pref. ..	\$100	7 7	105—107	..	6 10 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	94½—96½	+½	5 3 8						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil 4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6 6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5 5	97½—99½	..	5 0 6	Do. 5 % Pref. ..	1	5 5	8½—8½	..	5 10 6
American Telep. & Telep., Cap.	\$100	8 8½	149—151	+1	5 6 0	National Telephone, Pref. ..	Stock	6 6½	99½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4 4	94—96	..	4 3 4	Do. Def. ..	Do.	6 6½	147—149	+10	4 0 6
Anglo-American Telegraph ..	Stock	8½ 8	65—67 xd	..	4 9 7	Do. 5 % Non-cum. 3rd Pref.	5	5 5	6½—6	+½	4 3 4
Do. 6 % Pref. ..	Do.	6 6	108—109 xd	..	5 10 1	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	102½—103½	..	4 7 0
Do. Def. ..	Do.	80/- 80/-	25½—26½	+½	5 14 3	Oriental Telep. and Elec. ..	1	8 ..	1½—1½	..	4 11 5
Anglo-Portuguese Tel., 5 %	100	5 5	100½—102½	..	4 17 7	Do. 6 % Cum. Pref. ..	1	6 6	1½—1½	..	4 16 10
Mort. Deb. }						Do. 4 % Red. Deb. ..	Stock	4 4	83—90	+½	4 9 0
Chili Telephone ..	5	7 ..	7½—7½	+½	4 13 4	Pacific and European Tel., 4 %	Do.	4 4	99½—101½	..	3 18 10
Commercial Cable, Stig. 4 % Deb.	Stock	4 4	84½—86½	—1	4 12 6	Guar. Debs. }					
Cuba Telegraph ..	10	6 6½	9½—10½	..	5 11 7	Reuter's ..	8	5 5½	11½—12	..	3 6 8
Do. 10 % Pref. ..	10	10 10	17—18	..	5 11 1	Submarine Cables Trust ..	Cert.	6 6	127—130 xd	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4 4½	8½—9½	..	5 6 8	Telephone Co. of Egypt, 4½ %	Stock	4½ 4½	99—101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10 10	7½—8½	..	6 1 3	Deb. Red. }					
Do. 4½ % Debs. ..	50	4½ 4½	99—101	..	4 9 1	United River Plate Telephone	5	8 8	7½—7½	+½	5 1 7
Direct United States Cable ..	10	4½ ..	7½—8½	..	5 9 0	Do. 5 % Cum. Pref. ..	5	5 5	5½—5½	..	4 8 11
Direct W. India Cable, 4½ %	100	4½ 4½	99—101	..	4 9 1	West Coast of America ..	2½	2½ 2½	1½—1½	..	3 11 5
Reg. Deb. }						Do. 4 % Debs., 1 to 1,500	100	4 4	97½—99½	..	4 0 5
Eastern Telegraph, Ord. Stock	Stock	7 5½	134—137	+2½	5 2 2	guar. by Braz. Sub. Tel. }					
Do. 3½ % Pref. Stock ..	Do.	8½ 8½	82—84	+1	4 3 4	West India and Panama Telep.	10	1½ 1½	4½—4½	—1½	..
Do. 4 % Mort. Deb. ..	Do.	4 4	101½—103½	+½	3 17 4	Do. 6 % Cum. 1st Pref. ..	10	6 6	10½—11½	..	5 8 0
Eastern Extension ..	10	7 5½	13—13½	+½	5 3 8	Do. 6 % Cum. 2nd Pref. ..	10	6 6	9½—10½	..	5 17 1
Do. 4 % Deb. ..	Stock	4 4	99½—101½	..	3 18 10	Do. 5 % Debs. ..	100	5 5	102½—104½	..	4 15 8
East and S. Africa Tel. 4 %	25	4 4	99—101	..	3 19 8	Western Telegraph, Ltd. ..	10	7 6½	13½—13½	+½	5 2 9
Mt. Db. Mauritius Sub. }						Do. 4 % Deb. ..	Stock	4 4	99—101	..	3 19 8
Globe Telegraph and Trust ..	10	5½ 6½	10½—11	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4 4	106—108 xd	+2	3 13 5
Do. 6 % Pref. ..	10	6 6	13—13½	+½	4 9 0	Do. 4½ % Fdg. Bonds ..	\$1000	4½ 4½	101—104 xd	+1	4 6 7
Great Northern Telegraph ..	10	18 18½	83—83	..	5 9 1						
Indo-European Telegraph ..	25	18 5½	57—59	+½	5 10 2						
Mackay Companies Common ..	\$100	5 5½	83—85	+1½	5 17 8						
Do. 4 % Cum. Pref. ..	\$100	4 4	70—73	..	6 9 7						
Marconi's Wireless Telegraph	1	5 ..	9½—9½	+1½	..						
Do. 7 % Cum. Partio. Pref.	1	16 ..	8½—8½	+1½	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 16th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 16th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	13 1/2 17 1/2	60 1/2 — 69	+2 3/4	2 14 4
Do. 5 % Pref. ..	1	5	5		6 13 4	Do. Surplus Lands ..	100	23 1/2 26 1/2	68 — 70		4 3 4
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	78 — 83		5 8 5	Do. 8 1/2 % Deb. ..	100	8 1/2 8 1/2	84 — 91		3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100		12 — 14	+ 1/2		Do. 8 1/2 % Pref. ..	100	8 1/2 8 1/2	86 — 88	+1	3 19 7
Do. Do. Deferred ..	100		8 — 10			Do. 8 1/2 % Con. Pref. ..	100	8 1/2 8 1/2	85 — 87	+1	4 0 6
Do. Do. 6 % Cum. Pr'f. ..	100		91 — 93	+ 1/2		Metropolitan District Ord. ..	100	Nil	48 1/2 — 49	+1 1/2	Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100		37 — 40	+1		Do. 6 % Deb. ..	100	6 6	144 — 146		4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5 5	93 1/2 — 96 1/2		5 3 8	Do. 4 % Deb. ..	100	4 4	96 — 98		4 1 8
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2 4 1/2	80 — 84		5 7 2	Do. 4 % Prior Lien ..	100	4 4	100 — 102		3 18 5
Central London Railway, Ord.	100	8 8	84 — 86	+1	3 9 9	Do. 4 1/2 % First Pref. ..	100	8 1/2 4 1/2	89 — 91		4 18 11
Do. Pref. ..	100	4 4	87 — 89		4 10 0	Do. 8 1/2 % Gtd. ..	100	8 1/2 8 1/2	76 — 78		4 9 9
Do. Def. ..	100	2 2	84 — 86	+1	2 6 6	Metropolitan Elec. Trams, Ord.	1	5 1/2 6	1 1/2 — 1 xd		6 0 0
Do. 4 % Deb. ..	100	4 4	101 — 103		3 17 8	Do. Def. ..	1	Nil			Nil
City & South London, Ord.	100	1 1/2 1 1/2	42 — 43	-1 1/2	3 15 9	Do. 5 % Pref. ..	1	5 5			5 10 5
Do. 5 % Pref., 1891 ..	100	5 5	118 — 110		4 11 0	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	99 — 101		4 9 1
Do. Do. 1896 ..	100	5 5	103 — 105		4 15 3	Do. 5 % Deb. ..	100	5 5	97 — 99		5 0 0
Do. Do. 1901 ..	100	5 5	102 — 104		4 16 2	Potteries, Ord. ..	1	2			
Do. Do. 1903 ..	100	5 5	102 — 104		4 16 2	Do. 5 % Pref. ..	1	5 5			6 19 3
Do. 4 % Deb. ..	100	4 4	101 — 103		3 17 8	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	89 — 92		4 17 10
Dublin United Trams, 6 % Pref.	10	6 6	10 1/2 — 11 1/2		5 2 2	South Metro. Trams, 6 % Pref.	1	6			6 17 2
Great Northern & City, Pr'f. Ord	10	Nil		- 1/2	Nil	Do. 4 % Deb. ..	100	4 4	72 — 77		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	3 1/2			Underground Elec. Railways	10		4 1/2 — 4 1/2	+ 1/2	
Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	71 — 76		5 18 5	Do. 4 1/2 % Bonds ..	100	4 1/2 4 1/2	99 — 101		4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	23 — 27		4 6 11	Do. 6 % Income ..	100	1 1 1/2	91 — 93	+8	
Do. 4 % Deb. ..	100	4 4	75 — 80		5 0 0	Yorkshire (West Riding), Ord.	5	Nil			Nil
Lancashire United, 5 % Deb. ..	100	5 5	83 — 85	+1	5 17 8	Do. 6 % Pref. ..	5	Nil	2 1/2 — 3 1/2		Nil
London Elec. Railw'ys, 4 % Deb.	100	4 4	97 — 99		4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2 4 1/2	80 — 84		5 7 2
London United Trams, 5 % Pref.	10	Nil		+ 1/2							
Do. 4 % Deb. ..	100	4 4	75 — 78		5 2 7						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2—5 1/2		5 2 4	La Plata Elec. Trms, Ord.	1					
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2—5 1/2		5 7 4	Do. Pref. ..	1	6	6	1 1/2—1 1/2		6 0 0
Do. 4 % Deb. ..	100	4	4	95—95		4 4 3	Lisbon Elec. Trams, Ord.	1	5 1/2	6 1/2	1—1 1/2		4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	102—104		4 6 7	Do. 6 % Pref. ..	1	6	6	1—1 1/2		4 16 0
Do. 5 % Deb. ..	100	5	5	103—105		4 15 3	Do. 5 % Deb. ..	100	5	5	95—99		5 1 0
Auckland Trams, 5 % Deb.	100	5	5	104—106		4 14 4	Madras Elec. Tr. (1904), Deb.	100	5	5	96 1/2—98 1/2		5 1 6
Bombay Elec. S. & Trams, Pref.	10	6	6	103 1/2—11 1/2		5 6 8	Manaos Trams & Lt., 1st Deb.	100	5	5	93—96		5 4 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98—100		4 10 0	Manila Elec. R. and Ltg., Bonds	\$1000	5	5	100 1/2—102 1/2	+1	4 17 7
Do. 5 % 2nd Deb. ..	100	5	5	98—100		5 0 0	Mexico Trams Com.	\$100	7	7	120—122 xd	+3 1/2	5 14 9
Brisbane Trams Inv't., Ord.	5	8	8 1/2	93—9 1/2		4 6 6	Do. Gen. Con. 5 % Bonds		5	5	96—98		5 2 0
Do. 5 % Pref. ..	5	5	5	48—5 1/2		4 15 3	Do. 6 % Bonds ..	100	6	6	101—103	+ 1/2	5 16 6
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103		4 7 5	Para Elec. Rlys. & Lt., Ord.	5	10	10	7 1/2—7 1/2	+ 1/2	6 13 4
B. Colum'ia Elec. Rly., Def.	100	8	8 1/2	141—144	+1	5 11 1	Do. 6 % Pref. ..	5	6	6	5—5 1/2		7 0 4
Do. Pref. Ord. ..	100	6	6	125—130		4 12 4	Do. 5 % 1st Deb.	100	5	5	98 1/2—100 1/2	+ 1/2	4 19 6
Do. 5 % Pref. ..	100	5	5	111 1/2—114 1/2		4 7 4	Perth (W.A.) Elec. Tr., Ord.	1	2 1/2		1 1/2—1 1/2		1 18 1
Do. 4 1/2 % 1st Mort. Deb.	40	4 1/2	4 1/2	98 1/2—101 1/2 xd		4 8 8	Do. 5 % 1st Deb.	100	5	5	101—104		4 16 2
Do. 4 1/2 % Vancouver Deb.	100	4 1/2	4 1/2	103—105		4 5 9	Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/2—5 1/2		5 6 8
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102 1/2—104 1/2	+ 1/2	4 6 2	Do. 4 1/2 % 1st Deb.	100	4 1/2	4 1/2	99—101	+1	4 9 1
Calcutta Trams, Ord.	5	6	6	6—6 1/2		4 16 0	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	123 1/2—124 1/2	+3	4 0 6
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2		4 16 5	Do. 1st Mort. 5 % Bonds		5	5	104—105	+ 1/2	4 15 3
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99—102		4 8 3	Do. 5 % Mort. Bonds	100	5	5	97 1/2—98 1/2	+ 1/2	5 1 9
Cape Electric Trams	1	Nil	2 1/2				Sao Paulo Tram, Lt. and P.	\$100	10	10 1/2	208—211	+6 1/2	4 14 9
City Buenos Aires Trams (1904)	5	5	5	5—5 1/2	+ 1/2	4 5 1	Do. 5 % 1st Deb.	\$500	5	5	104—106		4 14 4
Do. 4 % Deb. ..	100	5	5	101—103		4 17 3	Singapore Trams, 5 % Deb.	100	5	5	79—82		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93—98		5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95		5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100—103		4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2—6		6 1 11
Kalgoorlie Elec. Trams ..	1	Nil				Nil	Do. 6 % Pref. ..	5	6	6	5 1/2—5 1/2		5 11 7
Do. 5 % A Deb. ..	100	5	5	91—94		5 6 5	Do. 5 % 1st Deb.	100	5	5	101—104		4 16 2
Do. 6 % B Deb. ..	100	5	6 1/2	56—60		10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	103 1/2—105 1/2		4 5 4

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6				Dick, Kerr ..	1	5		27—28 1/2		5 3 1
Do. 6 % Pref. ..	1	9	6			7 2 2	Do. Pref. ..	1	6	6	1 1/2—1 1/2		5 12 11
Babcock & Wilcox	1	26	28	6 1/2—6 1/2		4 1 5	Do. Deb. ..	100	4 1/2	4 1/2	97—100		4 10 0
Do. Pref. ..	1	6	6	1 1/2—1 1/2		3 13 10	Edison & Swan, A, £3 paid	5	Nil				Nil
B.I. & Helsby Cables	5	10	10	6 1/2—7 1/2		6 18 0	Do. fully paid ..	5	Nil		1 1/2—2 1/2		Nil
Do. Pref. ..	5	6	6	6 1/2—6 1/2		4 16 0	Do. 4 % Deb. ..	100	4	4	70—74	-1	5 8 1
Do. Deb. ..	100	4 1/2	4 1/2	101—103		4 7 5	Do. 5 % Second Deb.	100	5	5	75—75		6 8 2
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	92—95		4 13 9	Electric Construction ..	2	Nil	2 1/2			
British Westinghouse, Pref.	3	Nil				Nil	Do. Pref. ..	2	7	7	1 1/2—1 1/2		7 9 4
Do. Deb. ..	100	4	4	53—66	+1	6 1 3	Greenwood & Batley, Pref.	10	7	7	7 1/2—8 1/2		8 5 8
Do. 6 % Prior Lien ..	100	6	6	99—102		5 17 8	Do. Deb. ..	100	5	5	94—96		5 4 2
Browett, Lindley, Ord.	1	Nil		1/6—2/6		Nil	General Electric, Pref.	10	5	5	9—9 1/2		5 5 3
Do. Pref. ..	1	Nil		5/6—6/6		Nil	Do. Deb. ..	100	4	4	85—90		4 8 11
Brush, Ord. ..	2	Nil		0—1 1/2		Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2—12 1/2		6 2 6
Do. 7 % Pref. ..	2	Nil		0—1 1/2		Nil	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2—5 1/2		4 6 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	54—59		7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	104—106		4 4 11
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	87—92		10 14 4	India-Rubber, G. & T. ..	10	10		9 1/2—10 1/2	- 1/2	4 17 7
Callender's Cable ..	5	15	10 1/2	103—11 1/2		6 13 6	Do. Pref. ..	10	5	5	9 1/2—10 1/2		4 15 2
Do. Pref. ..	5	5	5	6—5 1/2		4 15 3	Telegraph Construction ..	12	20	10 1/2	33—35		4 9 0
Do. Deb. ..	100	4 1/2	4 1/2	98 1/2—100 1/2	+ 1/2	4 9 7	Do. Deb. ..	100	4	4	99 1/2—101 1/2		4 9 0
Castner-Kellner ..	1	17 1/2	20	3 1/2—3 1/2		5 6 8	Willans & Robinson ..	1	Nil				Nil
Do. Deb. ..	100	4 1/2	4 1/2	105—109		4 10 7	Do. Pref. ..	5	Nil		1 1/2—1 1/2		Nil
Crompton & Co. ..	3	Nil	Nil			Nil	Do. Deb. ..	100	4	4	59—61		6 11 2
Do. Deb. ..	100	5	5	58—68		7 7 1							

\* Unless otherwise stated, all shares are fully paid, † Interim dividend.



## PROCEEDINGS OF INSTITUTIONS.

The Diesel Oil Engine and its Industrial Importance,  
particularly for Great Britain.

By DR. RUDOLPH DIESEL.

*(Abstract of paper read before the INSTITUTION OF MECHANICAL ENGINEERS, March 15th, 1912.)*

THE Diesel oil engine has been proved to be a most reliable engine when properly built, the working of which is quite as safe as that of any other system of prime mover; it is even more simple, since it does not require any auxiliary apparatus, and since the fuel in its natural and original form, without having previously undergone any transforming process, is directly converted into work in the cylinder of the engine. To-day the thermal or indicated efficiency reaches 48 per cent. in this engine, and the effective or brake efficiency reaches, in some cases, 35 per cent. of the heat value of the fuel.

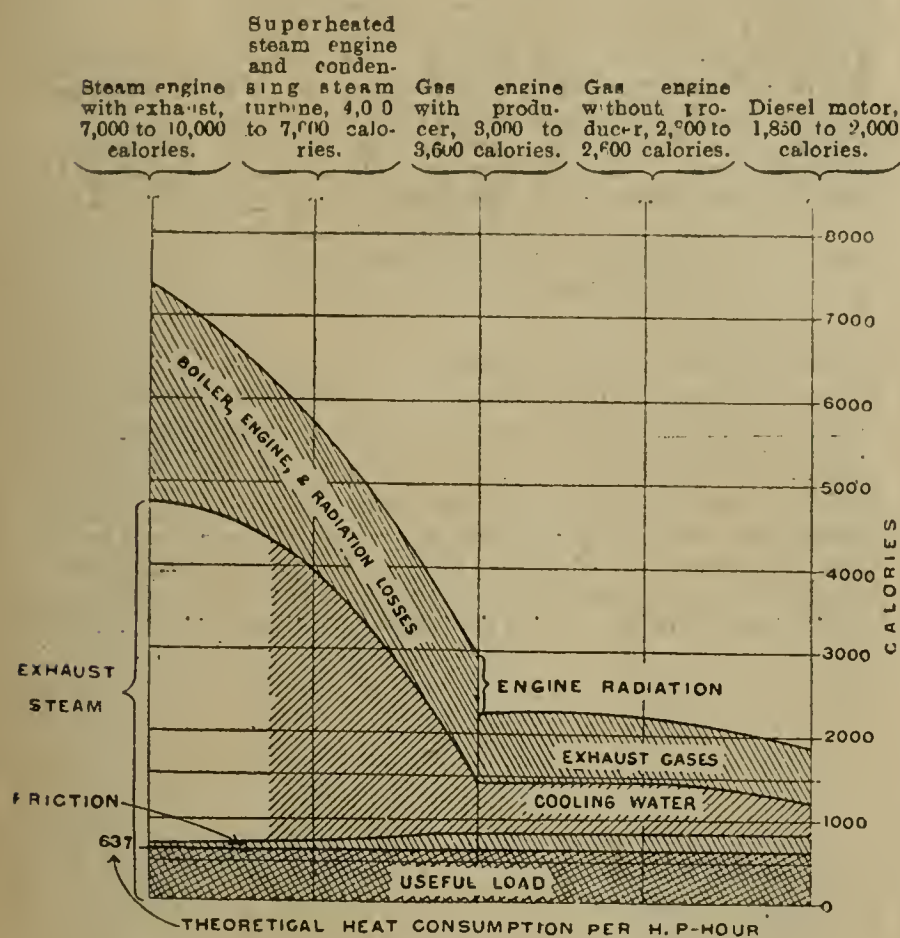


FIG. 1.—HEAT CONSUMPTION OF HEAT ENGINES.

Fig. 1 shows the heat utilisation for 1 B.H.P.-hour in the different kinds of prime movers known to-day. With our present scientific knowledge, any considerably higher efficiency in the process of transforming heat into mechanical work is not obtainable. Further progress seems only possible with some other method for transforming heat into work.

The Diesel engine is therefore the engine which converts the heat of the natural fuel into work in the cylinder itself, without any previous transforming process, and which utilises it as far as the present standard of science permits; it is therefore the simplest and, at the same time, the most economical prime mover.

These two facts explain its success; it lies in the new principle of the internal working process and not in constructional improvements or alterations of older types of engines. Further, the Diesel engine has broken the monopoly of coal, and has solved the problem of using liquid fuel for power production in its simplest form, making hitherto unutilised products of nature available for motive power. It has thereby exercised a far-reaching influence on the liquid fuel industry, and owing to the interest which petroleum producers have taken in this important question, new sources of petroleum are continually being developed and new oil districts discovered. It has been proved by recent geological researches not only that there is probably on the globe as much liquid fuel as coal, but also that it is more conveniently distributed as regards its geographical position (fig. 2). These facts, which are indisputable nowadays, have gradually silenced those who objected to too great a development of the Diesel engine for fear of lack of fuel.

The by-products of coal distillation and coke plants, such as tar and creosote oils, can be utilised with the same satisfactory results as with natural liquid fuels.

As tar and tar-oils are from three to five times better utilised in the Diesel engine than coal is in the steam engine, a much better and more economical utilisation of coal is obtained if, instead of being burned under boilers on grates in a wasteful way, it is first transformed into coke and tar by distillation. Coke is used for metallurgical and other general heating purposes; from a part of the tar the valuable by-products are first extracted, and undergo further processes in the chemical industry, whilst the tar-oils and combustible by-products, and a great part of the tar itself, are burned in the Diesel engine under extraordinarily favourable conditions.

It is also possible to burn vegetable and animal oils in the Diesel

engine. It has been proved that Diesel engines can be worked on earth-nut (Arachis or peanut) oil without any difficulty, and the author is in a position to publish, on this occasion for the first time, reliable figures obtained by tests: Consumption of earth-nut oil, 240 grammes (0.53 lb.) per B.H.P.-hour; calorific power of the oil, 8,600 calories (34.124 B.T.H.U.) per kg., thus fully equal to tar oil; hydrogen, 11.8 per cent. This oil is almost as effective as the natural mineral oils, and as it can also be used for lubricating oil, the whole work can be carried out with a single kind of oil produced directly on the spot. Thus, the engine becomes a really independent engine for the tropics.

The fact that oils from vegetable sources can be used may seem insignificant to-day, but such oils may, perhaps, become in course of time of the same importance as some natural mineral oils and the tar-products are now.

They make it certain that motor power can still be produced from the heat of the sun, which is always available for agricultural purposes, even when all our natural stores of solid and liquid fuels are exhausted.

The engines, which have been built in various factories and in various countries, still remain almost an exact copy of the old experimental engine.

A remarkable fact is that the first Diesel engines, built in 1897-98, are still working, without any change in their fuel consumption: also the first English engine built by the Mirrlees, Watson & Yaryan Co., at Glasgow, according to the author's design of 14 years ago is still working.

As the central electric stations took up the Diesel engine very early, the necessity for quicker running engines arose. This need, and the improvement in methods of construction and utilisation of materials, caused the gradual introduction of the quicker running four-stroke cycle engines, with speeds of from 300 up to 600 revolutions. The weight of the engines was reduced to about one-fourth to one-fifth of the weight of the old types, or to about 50 kg. (110 lb.) per H.P. Engines of this kind are now built up to about 700 H.P., and are especially suitable for driving dynamos, blowers and centrifugal pumps, and also as auxiliary engines on board large vessels, &c.

Small engines have recently been built in accordance with the author's designs. A 5 H.P. one-cylinder plant, designed in 1909, for 600 R.P.M., consumed 240 grammes (0.53 lb.) B.H.P., which is, therefore, not much more than with the old large engines of medium horse-power. At present the author is endeavouring to simplify and strengthen this small engine.

After vertical engines had solely been used for about 12 years, horizontal four-stroke cycle engines were built. The first horizontal engines were practically only vertical engines laid on their sides without any independent structural innovations; but gradually the designers freed themselves from the tradition of the vertical engine, and some details were altered in such a way that they were more suitable for the horizontal position. A type of engine was thus obtained which is hardly distinguishable from the horizontal gas engine. In the engine made by the Swiss Locomotive Works, Winterthur, the inlet valves are no longer placed in the cover, but on the side of the cylinder as in gas engines, and are directly driven from the longitudinal camshaft. A cross camshaft is no longer used. Only the fuel and exhaust valves are left in the cover, while the air compressor is arranged in another way



FIG. 2.—PETROLEUM FIELDS OF THE WORLD IN 1908.

These designs are to-day very often used for small plants of 20 H.P. and more. But the M.A.N. built such horizontal Diesel engines for very large horse-powers as double-acting four-stroke cycle engines with two or four cylinders arranged tandem. The largest engine of this kind so far is a double-acting four-stroke cycle tandem twin engine, of 1,600-2,000 H.P. or 400-500 H.P. per cylinder, with a speed of 150 R.P.M.

As very often stated by the author, the Diesel principle is essentially suitable as a two-stroke cycle engine, because the scavenging is not done with a fuel-air mixture, but with pure air, so that not only untimely ignitions but also fuel losses are avoided, and the scavenging can be done more effectively, and with almost any quantity of air desired.

Successful attempts to construct a two-stroke cycle Diesel engine on entirely new lines have been made recently by Messrs. Sulzer Bros., of Winterthur, working entirely on the original Diesel principle. The four-stroke cycle engine still has a better combustion and a more economical fuel consumption, and is



simpler in its method of working. It thus remains the standard engine, and still predominates for medium-sized stationary plants up to 500 or 600 H.P. On the other hand, the two-stroke cycle engine with its smaller cylinders has now come into favour for stationary plants of higher horse-power, and, as a marine engine, has become the only standard type.

Two considerably different fundamental types of two-stroke cycle engines have so far been competing. The first is the engine made by Messrs. Sulzer Bros., with separate scavenging pump. The second—the M.A.N. engine—was brought out much later; in it the scavenging pump, which has an annular piston, is placed underneath each combustion cylinder. Both engines are single-acting.

A two-stroke cycle engine of an entirely new type has been recently built by Prof. Junkers on the lines of the old Oechelhäuser gas-engine, with two pistons working in opposite directions in one cylinder but acting on the Diesel principle. A horizontal 1,000-H.P. engine of this kind is at present being tested.

At present it is generally agreed that the four-stroke cycle engine from 5 up to 600 H.P. may be regarded as the exclusive type for stationary plants; but it will probably not remain so much longer in spite of its perfection, in view of the development of the two-stroke cycle engine, especially of the double-acting type.

The use of the two-stroke cycle engine has increased slightly, but it is to be hoped that it will be still further extended. Although this engine may never equal the four-stroke cycle engine as regards thermal efficiency, its initial cost is so much lower that its slightly higher fuel consumption will be more than counter-balanced by the greater interest and amortisation on the higher-priced four-stroke cycle engine. When this stage is reached, the question is simply one of economy. In the author's opinion the two-stroke cycle engine will thus soon make headway for stationary plants.

As to the importance of the Diesel engine, especially for Great Britain, the three following facts must be borne in mind:—

1. Great Britain is an exclusively coal-producing country;
2. Great Britain has the largest Colonial Empire in the world; and
3. Great Britain is the greatest shipping nation in the world.

England has the greatest interest in replacing the coal-wasting steam engine by the more economical Diesel engine, first, because she can therewith effect enormous savings in her most valuable treasure—coal—and thus defer the exhaustion of her stock; and secondly, because she can run her coal industry and the independent chemical industries on more economical lines, when using the coal in the more rational and refined way, as already mentioned. Finally, she will also make herself free and independent of foreign markets for the supply of liquid fuels by using coal in this way, that is, by working the tars and tar-oils in the Diesel engine.

The Diesel engine is the predestined Colonial engine, because only about the fourth or sixth part of weight in fuel has to be transported for it to the Colonies and their hinterlands, as compared with the steam engine. For a Colonial engine the cost of freightage for fuel is generally the determining factor. Further, the transport of these liquid fuels is considerably easier and more convenient than the transport of coal, especially when tank-vessels and pipe-lines are used.

If one also considers that the Diesel engine can utilise vegetable oils, entirely new prospects are brought to light for the cultivation and expansion of industry in the Colonies, which are for no other country of such eminent importance as for Great Britain.

Finally, Great Britain is the greatest shipping nation in the world. The captains who have had Diesel engines on their vessels report on the great security and comfort in working; shipbuilders publish the figures of their savings. It is unquestionable that one of the greatest evolutions of modern industry will be connected with this development of the Diesel engine, and that Great Britain, as the greatest shipping nation of the world, will derive the greatest advantage from it.

#### APPENDIX.

##### *Suitable Oils.*

From tests and examinations already made, power oils have been divided into the following three classes:—

##### 1. *Normal oils which can always be used:*

- |                                                 |                                                                                                                                                 |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) Mineral oils freed from benzene (gas oils). | { Hydrogen over 10 per cent.<br>Calorific power over 10,000 cal. (39,680 B.T.H.U.).<br>No solid impurities.                                     |
| (b) Lignite tar oils.                           | { Hydrogen over 10 per cent.<br>Calorific power over 9,700 cal. (38,489 B.T.H.U.).                                                              |
| (c) Fat oils from vegetable or animal sources.  | { Scarcely any researches have been made on these. Earth-nut oil has 11.8 per cent. hydrogen, and calorific power 8,600 cal. (34,124 B.T.H.U.). |

##### 2. *Oils which can be used only with the aid of special apparatus:—*

- (a) Pit coal-tar oil.
- (b) Vertical-oven water-gas and oil-gas tars, probably also coke-oven tars.

General characteristics: Hydrogen not over 3 per cent.; amount of free carbon not over 3 per cent.; residue on coking not over 3 per cent.; calorific power not under 8,600 cal. (34,124 B.T.H.U.).

##### 3. *Oils which cannot be used:—*

- Tars from horizontal or inclined retorts.

#### The Individual Electric Drive for Looms.

A MEETING of the Lancashire Section of the British Association of Managers of Textile Works was held in the Victoria Hotel, Manchester, on March 30th, when a paper was read by Mr. J. F. CROWLEY on this subject. The author described the installation at the Wellfield Mill, Bradley Fold, consisting of 700 individually-driven looms; the entire electrical equipment was carried out by Messrs. Siemens.

Careful and elaborate tests of individual electric driving against steam driving and group electrical driving having been carried out by the proprietors of the shed, Messrs. Frears, Lord & Brother, a decision was arrived at that an increase had been obtained of 10 per cent. in production by means of individual motors, and another shed had been similarly equipped in consequence. It was claimed for the shed (which took power from the mains of the Lancashire Electric Power Co.), that owing to the lighter walls, lighter roof, fewer pillars, &c., it had cost £8 per loom less to erect and equip than a steam-driven shed of the same capacity. In addition to the reduced capital outlay and to the increased production, which had a marked effect upon the profits, it was claimed that an improved material was produced, and that the operatives worked in a clearer atmosphere with a better light and with reduced risks.

Five or 10 years ago it was doubtful if a motor was sold in this country, of the size required to drive a loom, of greater efficiency than 70 per cent., whereas the motors at the Wellfield Mill had shown efficiencies as high as 88.5 per cent.

When the loom was considered, it was found that the average speed could be increased if a regular drive were provided, while it was also possible to improve the efficiency of the loom itself, which in a steam-driven shed was usually assumed at 75 per cent. The individual drive effected both of these improvements.

Loom efficiencies as high as 87 per cent. had been obtained on test, and this in cases where the weavers had no previous experience with the drives.

He had worked out the increased profit resulting from, say, a 10 per cent. increase in production, and found that profits were increased considerably over 30 per cent. He therefore claimed that electrical engineers had done something for the textile industries.

In replying to the discussion, MR. CROWLEY said he had made his comparison with group drive because the case was much stronger against steam, as he assumed it was now generally admitted that group driving was superior to steam. A quick start had disadvantages where a warping frame was concerned, and it was to be avoided, but where a loom was concerned the reverse was the case: the acceleration did not damage the warp, as the propelling of the shuttle absorbed the bulk of the power.

#### Electrical Progress in Russia.—The *Financier's*

Russian correspondent writes as follows:—"Almost any application of electricity finds a ready welcome in Russia. As an industrial country she may be said to have come into prominence with the advent of industrial electricity, and a study of the country will show that whereas the application of coal gas is on a very limited scale indeed, the number of electrical stations, both for lighting and power, east, west, north and south, can be counted in hundreds. A very large proportion of these is public property, although many of them belong to private individuals, and the foreigner's share of these is remarkably large. It is astonishing to read the large number and importance of electrical concessions, principally for and including tramway exploitation, that are held by Belgians, who are said by some patriotic Russians to hold the Russian tramway industry, with a few notable exceptions, practically under their control. Without referring to the already well-established telegraph system by wire, there is a remarkable tendency to extend the telephone system all over the country, mostly under the control of public authority. Although electricity is so largely used in the direction indicated above, it is not so firmly established as a source of power for factories. It is, however, more widely applied amongst the mines than is generally imagined."

#### South African Contract.—A Cape correspondent writes:

—"On Feb. 22nd the Kalk Bay Municipality called for tenders for five sections:—Transformer pillars, meters, cables, poles, and feeder panel. Tenders were to be in on March 7th, and it was then found that delivery on most of the stuff was uncertain owing to the coal strike. Up to the time of writing only two sections have been definitely settled. The transformer pillars and switchboard extensions will be carried out by the South African General Electric Co., the pillars themselves being made locally by the Clyde Engineering Works, Cape Town. Most of the switchgear, &c., will be supplied from Johannesburg stock, so that a fairly early delivery has been promised."

#### Under False Pretences: Sentence.—At the Surrey

Quarter Sessions, Walter Charles Edward Hagreen (20), engineer, of Atherton House, Ham, was sentenced to 18 months' hard labour for having obtained by false pretences (1) a gas engine from the National Gas Engine Co., valued at £19 10s.; (2) an electric clock from Frank Hope Jones; (3) and two motor tires from Dennis Gayford. According to the evidence given, prisoner posed to be trading under the name of W. C. E. Hagreen & Co., specialists in motor-car and launch lighting. None of the articles were paid for by prisoner, who had sold them much under cost.



## REVIEWS.

*Liquid Fuel and Its Apparatus.* By W. H. BOOTH.  
London: Constable & Co., Ltd. Price 8s. 6d. net.

Mr. Booth's book, which is based on his larger work dealing with liquid fuel, comes at a time when more attention is being paid to the subject than has ever previously been the case, and for that reason, if for no other, a warm welcome will be accorded to this volume.

Mr. Booth has divided his book into three parts, in the first of which he deals with theory and principles, and in the second with practice, while the third contains a series of useful tables. As is perhaps somewhat natural in a work which has to some extent been adapted from a larger treatise, the book lacks continuity in certain parts, but this has not prevented the author from including a really enormous amount of valuable information, particularly in the section relating to practical operation. It is true that in some places Mr. Booth seems to have gone too much into elementary detail, but no doubt this was done in order to make the book more complete.

Plenty of comparisons are given between the use of coal and oil under various circumstances for firing marine, locomotive and stationary boilers, and in almost every case the comparisons are adduced by weight. Such figures are the only ones of use for scientific purposes, but some instances might have been given with advantage, as to the actual financial economies which have been effected by the employment of liquid fuel instead of coal, taking into consideration original cost, repairs and running charges.

The chapter on the storage and distribution of liquid fuel will be found particularly valuable and accurate in all its details, although some mention of the difficulties involved in carrying fuel oil in the double bottom of a ship might have been described; the question of the relative advantages of steam and compressed air for atomising the oil is very ably dealt with. In the last chapter, Mr. Booth discusses the question of liquid fuel for oil engines, and might with advantage have written at much greater length on this matter, in view of the importance which the oil engine, particularly of the Diesel type, has now attained. If this be done when a further edition of the work becomes necessary, it will certainly appeal to a much wider circle of readers, and one which is increasing rapidly every day.

The tables which are given at the end of the volume will be found of much practical value, dealing, as they do, with the properties of many classes of fuel oil, and the idea of grouping all such tables together in a compact form is much to be commended.

*An Introduction to the Study of Fuel.* By F. J. BRISLEE.  
London: Constable & Co., Ltd. 1912. Price 8s. 6d. net.

This book is one of the publishers' series of outlines of industrial chemistry. Being concerned with the chemistry of fuel it fittingly made its appearance on the day when Great Britain was face to face with a fuel famine. Until within quite a few years ago very little was known of the chemistry of fuels outside the narrow circle of metallurgy. To-day so many men are imbued with a sense of the importance of purchasing fuel by its calorific capacity that there is no small danger of this important factor being overweighted to the neglect of other matters, in their way equally important. The value of a fuel is not the same to every user, for so very many factors enter into the problem.

In the book under review the writer does not so much take up the practical side, except so far as concerns the chemistry of fuel, the determination of temperatures, the analysis and volumetric calculation of the products of combustion, and the explanation of the various instruments used for the above purposes. The first six chapters are given to chemistry and physics, and the reader will find in Chapter V explanations of pyrometers and general high-temperature determinations.

In Chapters VII and VIII the natural and the artificial solid fuels are treated of. American tests of briquette fuel are said to have shown less smoke than natural or untreated coal, which is somewhat contrary to the experience

on this side, especially in the case of the fuels used for Continental locomotives, which are excessively fuliginous.

Three chapters are given to gaseous fuels, their occurrence, manufacture and theory, and one chapter to gaseous explosion and the so-called explosion engine. The final chapter on liquid fuel is brief, and is preceded by three chapters on air supply and draught, furnace efficiency and fuel economy, and boiler testing. There are five brief appendices.

Students of the gas producer will be interested in the treatment of this apparatus whose produce, in its ratios of output of CO and CO<sub>2</sub>, is governed by the temperature which is allowed. Engineers generally will perhaps more especially value the section on temperature measurements. In the table on page 101, there is surely a mistake in the figures in the first line?

The engineering student will find this book very useful in bringing into view the general principles involved in the combustion of fuel and other matters pertaining to combustion. To the engineer who has not made a youthful study of the chemistry of fuel it will be useful also, owing to the efficient way in which the subject is presented to him.

## NOTES ON MAINTENANCE OF THE DIESEL ENGINE.

[CONTRIBUTED.]

THERE are so many Diesel engines now in use that the following notes may be of interest to brother engineers.

After two years' experience of this class of engine, the writer has no hesitation in saying that such engines are quite reliable for central-station work; any trouble experienced at first was entirely due to lack of experience on the part of those in charge.

Unless the valves, &c., are kept in practically perfect condition, trouble will be experienced in starting, as the engine depends entirely on the compression for firing the charge; some engineers will consider this an advantage, but it is a serious matter for a supply station should an engine fail to start when the load is rushing on.

Where one engine only is installed, the question of the starting air is of great importance, and a small compressor, driven independently of the engine, is almost a necessity. Where there are more engines than one, it is not likely that all will be out of order at the same time, and the supply of air is practically assured.

The engine most likely to fail to start is the single-cylinder type, the multi-cylinder engine being almost certain to run on one cylinder unless allowed to get into a very bad state. Therefore, the question of the supply of air is not so serious in this case.

In a residential district the noise of the exhaust may be objected to; while it is by no means excessive, the persistent rap is objectionable, especially at night.

In a case with which the author is familiar this was overcome by taking the exhaust into a pit, 10 ft. by 6 ft. by 6 ft. deep, which was available, the outlet being through the silencer supplied with the engine, and it is now almost impossible to tell when the engine is running. In addition to the reduction of noise the back pressure on the engine was considerably reduced.

The engine ran for some time without trouble, the first failure to start being due to the exhaust valve buckling slightly, making it impossible to get the compression high enough for ignition.

The exhaust valve casing worked loose several times, and when it was tightened down hard the casing itself buckled; each of these events meant failure to start and loss of air. In one case the air pressure was as low as 200 lb. in one starting receiver and 450 lb. in the reserve, while there was 650 lb. in the blast receiver; even with this low pressure it was possible to start up on pure paraffin.

This trouble was overcome by having the shoulder of the valve casing turned down a little from the top of the seating.

The exhaust valve soon gets pitted and scored, and it requires grinding in about every three months on an engine running



six or seven hours per day. It is only a matter of a quarter of an hour to change this valve, a spare valve and casing being supplied with the engine and a split lever allowing this to be removed without disturbing the other valve gear.

The air valve has given very little trouble, although it requires occasional grinding in, and once was badly "gummed up" with imperfectly consumed fuel; the cause of this is mentioned later.

As regards the fuel valve, the makers appear to consider that it requires more attention than other parts, but during two years' working this valve has given no trouble. It has been regularly cleaned and rubbed in once or twice with knife powder when overhauling the engine.

The starting valve stuck open several times when starting up and completely emptied one of the air receivers. This was found to be due to an accumulation of moisture in the receiver being carried into this valve and causing the spindle to rust and stick in its casing. The trouble was overcome by giving careful attention to the draining of the inter-cooler while the engine is running, and regularly draining the air receivers each day.

The lubrication of the compressor gave some trouble at first, because of the high-pressure valves occasionally sticking and causing a shut-down owing to the falling of the blast pressure, and the air pipe from compressor to intercooler becoming blocked by carbonised oil; the makers recommended that the oil supply to the high-pressure piston should be discontinued altogether, except for a few minutes after starting up, and this was found quite sufficient for lubrication and completely overcame the trouble.

The lubrication of the engine has given no trouble except for the piston, which requires careful attention. In most vertical-type engines the oil is pumped into an annular space round the cylinder and reaches the piston through some six very small holes in the cylinder liner; these appear to be very liable to get blocked up and as it is necessary to dismantle the whole of the valve gear and draw the piston, to enable an inspection to be made, they are liable to be overlooked.

The piston has run dry twice in the two years, although drawn every six months for inspection, and in each case two of the holes were found blocked up. Fortunately the driver noticed the trouble before any damage was done to the piston.

The fuel pump valves require careful attention, and particularly the suction valve, as any leakage past this will prevent the engine developing full power. Failure to start has resulted more than once through the suction valve casing working loose on its seat; this was not an easy fault to locate the first time it occurred.

The cooling water must be carefully watched, and it is suggested that the circulating pump, driven from the engine, is not sufficient, but that a supply should be available to continue a flush of water through the engine for about fifteen minutes after shutting down. The reason advanced is that the heat of the piston and cylinder walls is sufficient to bake any sediment left by the water into a hard scale. This assumes that the water runs out of the engine when the pump is stopped.

A cracked cylinder cover was another unexpected trouble, and the writer believes that this has occurred on more than one engine of this type. The only reason which has been suggested for this is that the engine must have been seriously overloaded or that scale had formed in the water passages, and the latter point will be definitely settled by opening up the damaged cover.

The crack was so slight that some difficulty was found in locating the trouble. The engine failed to start and the usual examination was made, all valves were ground in and rocker lever clearances set. The engine started up sluggishly on pure paraffin and ran as usual, but refused to start on ordinary fuel oil.

Indicator diagrams were taken (the engine again being started on paraffin) and the compression was found to be very low. A careful examination revealed a tiny crack on the seating for the exhaust valve casing, extending through to the seating of the fuel valve casing. On one side of the crack the seating was slightly raised, preventing the exhaust valve casing from bedding properly.

During the few hours the engine was running on this

low compression, the whole of the valves and cylinder head were gummed up with imperfectly burned oil.

It will generally be found that the engine will be somewhat sluggish in starting when anything is getting out of order, it is therefore a simple matter to get things right before a failure to start occurs. Naturally one must have practical experience of the peculiarities of Diesel engines to ensure their absolute reliability.

The freedom from accumulation of carbonised material on valves, piston, and cylinder, is remarkable, and very little trouble is experienced in cleaning up when overhauling. The maintenance cost is also low, and is chiefly confined to the pipes and valves dealing with the compressed air. The high pressures used cut the valves at a rather serious rate.

There has been no falling-off in efficiency, and the ease with which the exact cost per unit can be ascertained each day is very different to the practically guesswork method of the smaller steam power stations.

More lubricating oil is required than with a steam engine only, but if the auxiliaries of the steam plant are included, there is little difference; it will be found better not to depend too much on oil filters, as they do not appear to separate out the carbon properly.

The writer cannot speak from experience of long non-stop runs, the longest coming under his personal observation being of 120-hours duration. There is no reason to doubt that very long runs are possible, the only limit being the length of time the exhaust valve would remain good enough to retain the high compression necessary.

No mention has been made of fuel costs, as these are so well known, and it is sufficient to say that the maker's guaranteed figures are still maintained under working conditions.

---

## OIL ENGINES FOR DRIVING SMALL GENERATORS.

---

[CONTRIBUTED.]

IN connection with a large number of private electric lighting installations, such as are supplied for lighting country houses, farms and similar purposes, the use of the vertical high-speed oil engine direct-coupled to a small electric generator has become standard practice. Although it may be safely said that this constitutes one of the simplest types of power plant, from the operating and maintenance point of view, that could possibly be applied to such a purpose, and although it is admirably suited for isolated positions, on account of the ease of getting fuel, without incurring a very heavy capital cost for plant, there are one or two practical points in the running of even such a simple plant as this, which may possibly with advantage be related for the benefit of other engineers in charge of similar installations.

It will very often be found that insufficient care has been taken in an installation such as is mentioned above for, say, country house lighting to secure a proper location for the generating plant. It will sometimes be found that the oil engine and dynamo, together with the main switchboard, are stuck away in some outhouse, which is only suitable for the purpose because there is a roof over it. It is hardly to be expected that even well-made plant will run continuously when the scale of attention paid to it is on a par with this accommodation. In one such plant which was installed in the above-described type of outhouse, considerable difficulty was experienced in starting-up the engine, more especially in cold weather, and this was ultimately traced to the fact that moisture formed on the sparking plugs owing to the damp nature of the room in which the engine was placed. The condensation of water on the porcelain insulators was abundant evidence that the engine was kept in a place that was damp, and as the building was not artificially heated it became necessary to rig up some sort of arrangement to prevent the deposition of moisture on these insulators, as it was quite a business to start



the engine up. It was at first thought that it might be worth while to put a slow-combustion stove in the building, but apart from the doubt whether the man told off to look after the place would stoke often enough to keep the room at a moderate and uniform temperature, there was also the question whether some fumes would not escape from the stove into the room, and get at the exposed metal of the engine and dynamo. As, however, there was a storage battery in connection with the plant, used for day load, an electric convector was obtained and placed close to the engine so that the hot stream of air passed near the magneto, and presumably near the rest of the electrical fittings of the engine. The current taken by the convector was not excessive, but was sufficient to maintain the engine room at a moderate degree of warmth even in the coldest weather, and this put an end to trouble from deposition of moisture.

Another incident which may be of interest in this connection, and which at first was thought to be due to the weather, was as follows: It was found on starting-up a small oil-driven generating set in the morning that a certain amount of water was ejected from the exhaust, more especially for the first few strokes. No notice was, at first, taken of this, as it was put down to condensation in the silencer of the engine. As, however, it seemed to persist, and indeed grew a little worse day by day, it was decided to take down the engine and see what was really the matter. On examining the water jacket, it was found that there was a slight leak in it, which would probably in course of time have developed to disaster if the thing had been allowed to go on for long. From this it may be learnt that any large quantity of water coming from the exhaust of such engines may possibly indicate a fault either in the castings or in the connecting-up of the water-cooling system.

One of the chief causes of trouble in these small oil-engine generating plants is the gradual loss of power due to the lowering of the compression, and this, again, is simply due to lack of attention, as the loss of compression becomes inevitable if the valves become uneven or pitted on their surfaces. In order to prevent this trouble from becoming serious, a rule should be made that the valves must be taken out and ground in on their seatings periodically, so as to preserve them in a gas-tight condition between the head and the seatings in the cylinder. After removing the valves, all the carbon deposit which will be found on both the valve and its seating should be carefully scraped off, and then a small amount of emery powder mixed with oil should be applied to the valve. This, when replaced in the cylinder without the spring being fitted, should then be turned briskly round and round with a screw motion, the valve being occasionally lifted from its seat while the grinding is in progress. When this has been done and the valve and seating has been brought up to a true surface again, care should be taken to remove all traces of emery from the valve, seating, and guides by washing them out with paraffin oil or petrol. In some cases carborundum powder of the finest grade has been adopted in place of emery for this purpose, as it cuts more quickly than emery, and some engineers, therefore, prefer it. Only a very little of the carborundum mixture should be used at a time, or it will be found that a bad surface will be obtained. If, on opening up the engine, which has shown signs of very bad compression, it is found that the valve and seating are in a very bad state, due to inattention, it is best not to rely upon hand-grinding as above, but to place them in a valve-truing and seating tool, several types of which are at present on the market for this purpose. If, however, great care is taken to see that the valves are periodically ground up true, there will be no need for drastic measures. It will be found, on the average, that the exhaust valves will have to be reground twice as often as the inlet valves, probably on account of the fact that the hot gases, in their escape, have a scouring action on the surfaces of the valve and seating.

There are, however, not very many things to go wrong with the small oil-engine-driven plant such as is used for small power generating purposes, provided that ordinary care and attention are paid to the running. The above notes may be of sufficient interest to warrant attention on the part of those who might otherwise think that they had got hold of a perpetual-motion machine.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### "Adams Igranic" Multiple Toggle-Joint Lever Starter.

To start a motor whose normal full-load current is 1,000 amperes demands a very special starting switch. Sliding contacts are useless for this purpose, for the reason that however carefully the starting handle is moved, there must necessarily be a moment on cutting out each section of resistance when contact is made on an inadequate area, with consequent heating and burning of the surfaces. In the "Adams Igranic" multiple-lever starter (fig. 1), made by the ADAMS MANUFACTURING CO., LTD, Bedford, no sliding contact at all is used. At each step contact is made by pressing a laminated copper brush against a hard-rolled metal surface, with the result that when any contact at all is made, it is over the whole surface. Partial contact is impossible. The switches are closed, one after the other, by toggle-joint levers, thus enabling a large brush to be thoroughly pressed home with a

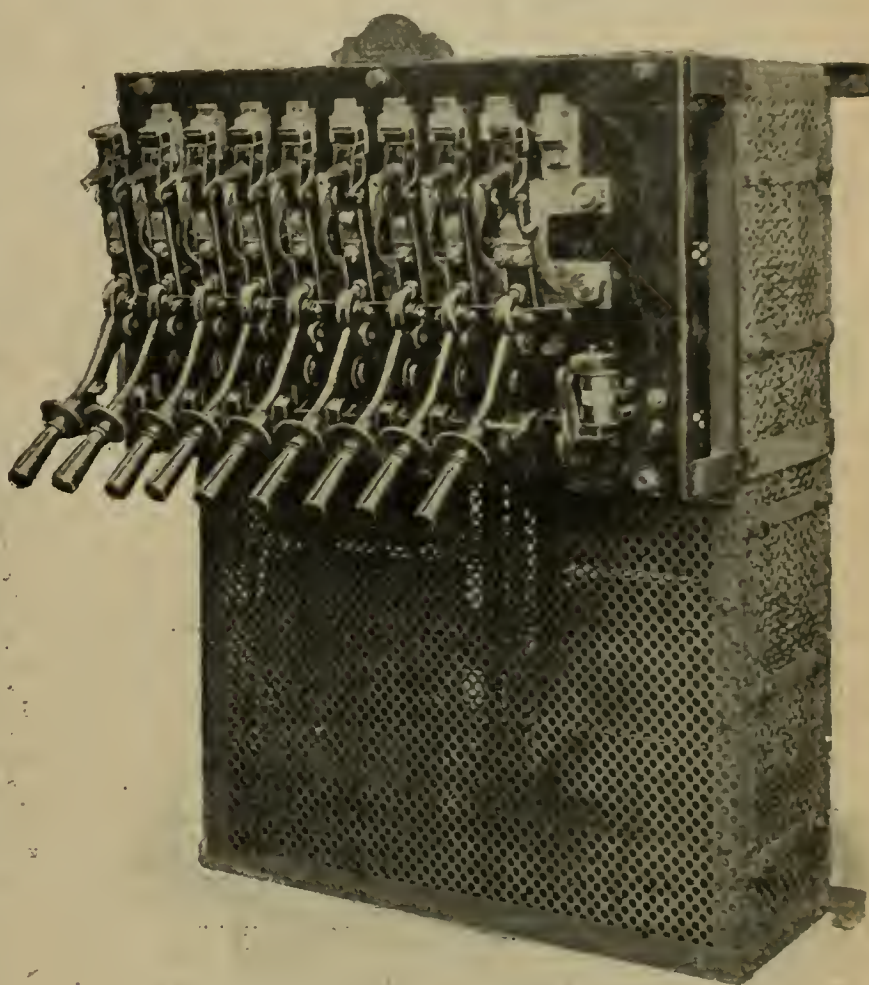


FIG. 1.—"ADAMS IGRANIC" STARTER FOR 600-H.P. 500-VOLT MOTOR.

comparatively slight physical effort. Each switch has a heavy auxiliary sparking contact which thoroughly protects the laminated brush against damage. Each switch when closed short-circuits a section of the starting resistance, and the switches are all mechanically interlocked in a way that makes it impossible to close them in any but the proper order. As each switch has to be held in till the next is closed, the operator is compelled to manipulate the starter with a hand-over-hand action, which effectually prevents too rapid starting. The final lever is held in by a magnetic detent, which releases and lets all the switches open on a failure of voltage. Starters of this type are standardised up to 10,000 amperes capacity.

### Electric Lamps for the Police.

The objections to the use of oil lamps by policemen—the smell and fumes, and damage to the clothing—are so obvious that the superiority of the portable electric lamp for their purposes is undeniable. In view of the high quality of the latter as now manufactured, and the durability of the accumulators (some police forces are still using the same electric lamps that were supplied four years ago, and the cost of renewals of parts shows a saving on the cost of oil alone), there can be no doubt as to the wisdom of adopting the electric lamp for police work.

MESSRS. L. E. WILSON & CO., of 20, Cross Street, Manchester, have made a special study of this class of work, and have recently introduced a new type of lamp which is being adopted by some of the police forces of this country. The lamp as illustrated, fig. 2, is fitted with a 2-volt unspillable accumulator, which will give a continuous light for from 15 to 20 hours on one charge. The light is far brighter, more penetrating, and, if necessary, more concentrated, than that given by oil; moreover, the light can be noiselessly flashed or permanently retained at will. A specially designed switch provides these facilities, and a screw-thread on the bull's-eye supplies the focusing requirements. The strong enamelled case is fitted with a wire-spring belt attachment, with handles if required, and the hinged front is secured by a spring-clip fastener; by this means the accumulator (which is securely fixed by a suitable spring)



can easily be removed from the case, and the few contacts are at once accessible. We are informed that several important police



FIG. 2.—THOMSON ELECTRIC POLICE LAMP.

forces have entirely abandoned the oil lamp in favour of the Thomson electric lamp illustrated, and many other police forces have the lamps on test.

#### E.A.C. Lift-Control Gear.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.E., have introduced a new control gear for rope-operated electric lifts. This gear consists primarily of a reversing switch, worked direct by the rope, and a patent combined automatic starter and solenoid main switch. The two pieces of apparatus may conveniently be mounted back-to-back, as shown



FIG. 3.—E.A.C. LIFT-CONTROL GEAR.

in the illustration herewith, to form a single self-contained unit. The reversing switch has substantial plunger contacts, with coil compression springs and mica insulation. It never makes or breaks the main current, this being done on the automatic starter, which has a special solenoid main switch for this purpose. The main feature of the combined automatic starter and solenoid main switch is the operation by one solenoid of both the quickly-moving main switch and the slowly-moving starter arm.

#### A New Gem Lamp.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, have added to their range of Gem lamps a 30-watt lamp of 10 C.P. Three sizes of Gem lamps are now available—viz, 30-watt, 10 C.P.; 45-watt, 16 C.P.; 50-watt, 20 C.P.; and their average lives are 1,000, 1,500, and 800 hours respectively. These lamps are supplied to operate singly on 100 to 130-volt circuits, and in series on 200 to 260-volt circuits. For tramway service they can be used five in series on 500 to 600-volt circuits.

### NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 7,810. "Apparatus for the utilisation of atmospheric electricity." H. EMENS. April 1st.
- 7,812. "Ignition for internal-combustion engines." J. S. EVERARD. April 1st.
- 7,858. "Electrical time switches for advertising and other devices requiring special timing conditions for two or more purposes." J. E. OLVIS and H. F. JOEL, JUN. April 1st.
- 7,885. "Electric recording apparatus." W. WHITE and A. E. LANGLEY. April 1st.
- 7,888. "Relays, microphones, or other sensitive contact devices." P. O. PEDERSEN. April 1st. (Complete.)
- 7,889. "Electric apparatus for recording the discharge of materials from wagons." J. WASOESTIAN. April 1st. (Complete.)
- 7,903. "Method of regulating the alteration in lines loaded according to the Pupin system for vibrations of various periodicities." F. A. BECKER. (Addition to 65, 1911. Convention date, March 8th, 1911, Germany.) April 1st. (Complete.)
- 7,906. "Automatic switch for working electric relay switches and devices." A. E. CARTER. April 2nd.
- 7,910. "Supports of overhead electric telephone and telegraph wires and the like." G. BULL. April 2nd.
- 7,928. "Clutches operated by electromagnetic coils." G. RICHARDS. April 2nd.
- 7,949. "Receivers of telephones." D. EVANS. April 2nd.
- 7,959. "Device for ensuring that power handle on controllers of electrically-driven vehicles pause at each notch." J. T. KEENAN and E. J. FORSTER. April 2nd.
- 7,964. "Electric lamps for vehicles." E. R. RYMAN. April 2nd.
- 7,972. "Electric insulators." A. R. MÜLLER. April 2nd.
- 7,977. "Process for the manufacture of incandescent metallic filaments." R. JAHODA and ELEKTRISCHE GLÜHLAMPENFABRIK "WATT" VORM. SCHARF, POTI & LATZKO (Convention date, September 30th, 1911, Austria.) April 2nd. (Complete.)
- 7,992. "Electrically propelled motor-cars." ALLMANNA SVENSKA ELEKTRISKA AKTIE-BOLAGET. (Convention date, April 12th, 1911, Sweden.) April 2nd. (Complete.)
- 7,996. "Gripping and shearing grapple for raising submarine telegraph cables." W. HENSMAN. April 2nd.
- 7,999. "Manufacture of electric accumulator electrodes and means for use therein." R. PAPE. April 2nd. (Complete.)
- 8,017. "Unipolar, non-polar or homopolar dynamo." P. HAYNES. April 3rd.
- 8,039. "Arrangement for indicating the interruption of a circuit in electric lighting installations on motor-cars or like vehicles." C. A. VANDERVELL and A. H. MIDDLEY. April 3rd. (Complete.)
- 8,040. "Dynamo electric machines." C. A. VANDERVELL and A. H. MIDDLEY. April 3rd.
- 8,050. "Thermoelectric heating and cooling body." E. ALTENREICH and G. GEHLHOFF. April 3rd.
- 8,058. "Electric incandescent lamps with bipartite bulb." P. WEISSE. (Convention date, April 6th, 1911, Germany.) April 3rd. (Complete.)
- 8,063. "Voltage regulators for electric generators." A. H. OLMSTED. (Addition to 28,747, 1911.) April 3rd.
- 8,070. "Regulation of the frequency produced by polyphase induction generators." SIEMENS SCHUCKERWERKE G.m.b.H. (Convention date, April 3rd, 1911, Germany.) April 3rd. (Complete.)
- 8,075. "Electricity meters." ISARIA ZÄHLERWERKE AKT.-GES. (Convention date, April 3rd, 1911, Germany.) April 3rd. (Complete.)
- 8,086. "Electric lamps." P. C. HEWITT. (Convention date, April 8th, 1911, United States.) April 3rd. (Complete.)
- 8,087. "Electric lighting apparatus." F. DUSSAUD. (Convention date, April 6th, 1911, France.) April 3rd. (Complete.)
- 8,088. "Ferro-concrete pole especially for supporting electric conductors." P. ROSE and A. OLDENBURG. April 3rd. (Complete.)
- 8,108. "Arrangement for starting and regulating direct-current electric motors." F. CUMONR. (Convention date, June 29th, 1911, France.) April 3rd. (Complete.)
- 8,118. "Telegraph and like cable conductors." W. E. HITCH. April 4th.
- 8,129. "Shade-holders for electric glow-lamps." G. E. CROWTHER. April 4th.
- 8,140. "Electric arc lamps." W. SCHAFFER and A. HEIDMANN. April 4th.
- 8,144. "Process of manufacturing spiral resistances and of mounting same in position within tubular supports for electrical heating apparatus." C. O. BASTIAN. April 4th.
- 8,151. "Long-distance telephonic apparatus." P. ST. G. KIRKE. April 4th.
- 8,152. "Electro pneumatically operated brakes." W. V. TURNER. (Convention date, July 18th, 1911, United States.) April 4th. (Complete.)
- 8,158. "Controlling arrangements for electric cranes." SIEMENS SCHUCKERWERKE G.m.b.H. (Convention date, April 12th, 1911, Germany.) April 4th. (Complete.)
- 8,183. "Prevention of sparking in the control of electric circuits." W. A. PRICE. April 4th.
- 8,193. "Electric furnaces." JÖSSINGFJORD MANUFACTURING CO., A/S. (Convention date, April 4th, 1911, Norway.) April 4th. (Complete.)
- 8,196. "Improvements in or relating to high-frequency apparatus and also to induct on coils." W. DUBILIER. April 4th.
- 8,197. "Method of and apparatus for producing high-tension currents." W. DUBILIER. April 4th.
- 8,206. "Spark plug for internal combustion engines." M. RIESZ. (Convention date, April 5th, 1911, Hungary.) April 4th. (Complete.)
- 8,207. "Animated coloured pictures." FULMOTOGRAF SYNDICATE, LTD. O. FULTON, and T. T. BAKER. April 4th.
- 8,222. "Conversion of electrical energy." W. A. PRICE. April 4th.
- 8,224. "Electric switches." H. LEITNER. April 4th.
- 8,226. "Electricity motors." ISARIA ZÄHLERWERKE AKT.-GES. (Convention date, April 7th, 1911, Germany.) April 4th. (Complete.)
- 8,234. "Electric arc lamps." A. OOLVY-WEBB, J. D. WHITE, and R. O. A. REINECKE. April 4th.
- 8,240. "Electric arc lamps." J. WETTER. (Ges. für Maschinen-und Metall-Industrie m.b.H., Germany.) April 4th. (Complete.)
- 8,242. "Electric arc lamps." F. M. LEWIS. April 4th.
- 8,250. "Osmo regulator apparatus for regulating the degree of hardness of Röntgen ray tubes." C. REGAUD. (Convention date, April 24th, 1911, Germany.) April 4th. (Complete.)
- 8,268. "System for transmitting and recording orders, signals and the like by electrical and mechanical means." F. CROFT and H. SWALY. April 4th.
- 8,278. "Means for and method of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to No. 8,233, April 10th, 1911.) April 6th.
- 8,285. "Electric cooker." W. H. SCOTT. April 6th.

**Sevenoaks Lighting.**—At the last meeting of the U.D.C. it was decided to take the necessary steps for transferring the Council's Electric Lighting Order to Crompton & Co., Ltd. For the purpose of having a supply available within 12 months, permission is to be given to the company to commence operations at the earliest possible date, subject to their accepting such conditions in the Order as the Council may think fit. The Council is to take no liability in the event of the Order not being transferred.



# THE ELECTRICAL REVIEW.

VOL. LXX.

APRIL 26, 1912.

No. 1,976.

## ELECTRICAL REVIEW.

Vol. LXX.]

CONTENTS: April 26, 1912.

[No. 1,796.

	Page
The New Articles of the I.E.E. ... ..	661
The I.E.E. Presidential Election ... ..	662
The Loss of the <i>Titanic</i> ... ..	662
Australian Labour Questions ... ..	663
Electrical Engineers and State Employment in Germany ...	663
Westinghouse Petrol-Electric Car for the G. C. Railway Co. (illus.) ... ..	664
Electricity Supply at Mexborough (illus.) ... ..	665
Notes from Canada ... ..	667
Correspondence:—	
Fraudulent Tests ... ..	667
The New Articles of the I.E.E. ... ..	668
Review of "Electric Mains" ... ..	668
Electricity direct from the Coal Mine ... ..	669
Midland Electrical Exhibition ... ..	669
Architects and Engineers ... ..	669
The Lake Coleridge Power Plant, N.Z. (illus.) ... ..	670
Parliamentary ... ..	671
Legal ... ..	672
The "Ideal Home" Exhibition ... ..	673
New Electrical Devices, Fittings and Plant (illus.) ... ..	673
Business Notes ... ..	674
Olympia Electrical Exhibition, 1911 ... ..	681
Notes ... ..	681
City Notes ... ..	684
Stocks and Shares ... ..	688
Market Quotations ... ..	688
Share List of Electrical Companies ... ..	689
Exports and Imports of Electrical Goods during March, 1912	691
An Electrolytic Sterilising Plant (illus.) ... ..	692
Some Second Thoughts on Publicity ... ..	693
Australian Tramway Companies and their Employés ... ..	694
Proceedings of Institutions:—	
Notes on Power Station Working (illus.) ... ..	695
Electrical Furnaces ... ..	696
Domestic Electricity ... ..	697
Trade Statistics of Jamaica ... ..	699
Expiring Patents ... ..	699
New Patents Applied For, 1911 ... ..	700
Abstracts of Published Specifications ... ..	700
Contractors' Column ... ..	Advertisement pages xxiv and xxvi

## THE NEW ARTICLES OF THE I.E.E.

THE new Articles of Association of the Institution of Electrical Engineers have now been circulated to the members, and notice has been given that an extraordinary general meeting will be held on May 9th, before the ordinary meeting, to consider the adoption thereof. If approved, the new scheme will come into force on July 1st.

In the main, the revised version follows the lines of the Articles proposed in November last, when the short time allowed for their consideration, and the drastic changes involved for which the minds of the members had not been adequately prepared, led to an ebullition of criticism and objection that necessitated the withdrawal of the proposals. Since then the President and Council have afforded the members both in London and at the provincial centres abundant opportunity for thoroughly thrashing out the matter and expressing their views, and the various suggestions made by the members have been taken into account in formulating the new version.

Although it was both unexpected and undesired, the animated discussion which arose has undoubtedly borne fruit. Never before, it would seem, has the Institution been so deeply moved throughout its mass, or have its Articles been so keenly scrutinised and debated. We may safely say that the members know a great deal more about their association than they ever did previously, and the result has been a magnificent advertisement for its aims, its benefits, and its possibilities. Allowance must be made for the beneficial influence of the broader policy inaugurated by Mr. Ferranti, the effects of which upon the membership began to make themselves felt a year ago: but it cannot be doubted that a considerable proportion of the great increase in the number of members during the past six months is due to the agitation over the new Articles. Thus, that which seemed a misfortune at the time has proved to be a blessing in disguise; and the very fact that new members have been rapidly enrolled, in the face of the certainty that a new code of Articles not greatly differing from the earlier proposals would shortly be adopted, is satisfactory evidence that the latter were framed approximately on the right lines.

As all the members of the Institution have doubtless received copies of the revised version of the Articles, we need not review these in minute detail, except in so far as may be desirable for the information of non-members, especially those who may be prospective members. The new classification has been adopted practically as proposed, except that for "Licentiates" has been substituted the title "Graduates," admittedly an unsatisfactory term, but apparently the last resource. Candidates for Associate Membership may be required to pass an examination: they need not be actually engaged in electrical engineering, provided that they have been properly trained as electrical engineers

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

**OFFICE:—4, LUDGATE HILL, LONDON, E.C.**

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

**ADVERTISEMENT RATES ON APPLICATION.**

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

**BY FAR THE LARGEST CIRCULATION**

of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

**Binding.**—Subscribers' numbers bound, including case, for 4s. each volume.

**Cases.**—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

**Foreign Agents.**—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**

**4, Ludgate Hill, London, E.C.**



and are engaged in some branch of engineering. Electrical engineers can no longer enter the Associate class, which will be reserved for eminent persons connected with electrical engineering: special facilities are given for others who are now in that class to be transferred to the class of Associate Members or Graduates, according to their qualifications, and all proposals for transfer will, in future, be submitted to a ballot of the members as in the case of election of new candidates.

Important modifications are made in connection with subscriptions. All existing Members, Associate Members and Associates will pay half a guinea more after this year, and all admitted after December 31st will pay one guinea more than the present rates. Graduates will pay two guineas. Whilst abroad Members, Associate Members and Associates will contribute somewhat less than home members, but no distinction is made between town and country members. The new scales of fees are in fair accordance with those of the Institutions of Civil and Mechanical Engineers. Members elected after July 1st in any year will in future pay only half the subscription for that year. The entrance fees are raised all round, from January 1st, 1913. Life Compositions in future will be on a sliding scale varying with age.

An important change is made in the procedure of election of Council. Facilities are provided for external nominations, but in any case the Council's own nominations must exceed the number of vacancies by two names at least, rendering a ballot obligatory: moreover, a postal ballot will be taken. Thus for a lifeless formality, whereby to all intents and purposes the old Council nominated the new Council, will be substituted a real election, and it cannot be doubted that the interest of the members will be greatly stimulated thereby, while in addition the successful candidates will feel that they truly represent and are directly responsible to the members—a valuable result, which under present conditions is not attained.

Other changes are made, which less closely affect the prospective member, being of a more or less domestic nature. Reviewing the whole scheme, we feel that a very satisfactory compromise has been effected, which should command the approval of the members. We formed and expressed a favourable opinion on the original proposals, with the exception of certain items, and in the revised code the latter have been amended. We hope that the scheme will go through, and that the Institution will enter upon a new era of prosperity, thanks in great measure to the splendid efforts of the President to arouse the Institution to a realisation of its magnificent possibilities.

We understand that the election this year, as it happens, will not lack the interest of a contest, for Mr. W. Pollard Digby has been nominated as candidate for the Associate Member's seat on the Council, necessarily in opposition to Mr. A. Bruce Anderson, the official nominee. Mr. Digby is proposed by Messrs. F. E. Benest, of the India Office, and Julius Frith, of Manchester, and supported by a number of well-known engineers. Incidentally we notice that such nominations, whether under the existing or new Articles, can only be made and supported by full Members, so that the Associate Member and Associate classes, which also rank as Corporate Members, and will have each three seats on the Council, will be debarred from nominating their own representatives. This appears to be a rather unfortunate disability.

It is not the intention of Mr. Digby's supporters to carry on a vigorous election campaign, so that the issue will be quietly determined by the members according to their individual inclinations; nor do we propose to express any opinion respecting the merits of the rival candidates. We welcome the fact of an external nomination, however, con-

ducted on these lines, as a foretaste of the conditions that will obtain under the new Articles; the contest will appeal to the sporting instincts of the members, and the result will not, as usual, be absolutely devoid of interest.

### The I.E.E. Presidential Election.

As we announced in our last issue, the Council of the Institution of Electrical Engineers has nominated Mr. W. Duddell for election to the Presidential chair in succession to Mr. S. Z. de Ferranti. We greatly regret that an electrical contemporary has thought fit, in commenting on this, to make an unwarranted attack upon Mr. Duddell, and to urge that Mr. Ferranti should have been re-elected for a third term of office.

In saying this, we would not be misunderstood. The policy inaugurated by Mr. Ferranti has commanded our whole-hearted support, and we cordially trust that it will continue to be followed by the Council until his aims have been fully attained. But those who know with what assiduity of labour, and at what cost in the sacrifice of precious time and personal convenience, Mr. Ferranti has sustained the burden of office during the past two years, cannot but recognise that to call upon him to undergo a third term would be a gross imposition upon the good nature and public spirit of a man to whom the industry is already most deeply indebted. While we heartily endorse all that our contemporary says in his honour, we feel that Mr. Ferranti has earned a rest.

But as regards his successor, who has been a vice-president of the Institution for some years and has repeatedly presided at the ordinary meetings, we unhesitatingly join issue with our contemporary, which suggests that Mr. Duddell is practically unknown to the electrical world, and that his nomination to the presidency represents "a decided check to the 'broader policy' movement." Those who are better informed than the writer of the article in question are aware that the President-Designate, though comparatively young, already has a distinguished career behind him, and has attained an international reputation as a scientific but essentially practical engineer and inventor; moreover, as a man of culture and *savoir-faire*, a linguist of exceptional ability, and a ready speaker, he possesses admirable qualifications for the presidential chair; and from the businesslike way in which he has conducted the proceedings whilst acting as chairman at the meetings of the Institution, there is every reason to anticipate that efficiency and expedition will be the dominant features of his *régime*. The Council has abundantly manifested its approval of the policy inaugurated by Mr. Ferranti, and has thereby earned the approbation of the general body of the members, and we see no reason whatever to suppose that the election of Mr. Duddell will in any way tend to the reversal of that policy. Our contemporary grudgingly admits at the end of its diatribe that all may be well in spite of its gloomy forebodings, and we think it unfortunate that the latter should have found expression.

### The Loss of the "Titanic."

THE desolating catastrophe which has befallen the *Titanic* has created the profoundest sorrow and dismay in every section of the general public; and in all ranks and classes of engineers these expressions of regret are intensified by the circumstance that the calamity has descended upon ship-building at the very hour of its supreme triumph. In order to keep pace with the world's industrial development, trade demanded ocean-going vessels of increased speed and capacity. The skill and energy of mankind were accordingly concentrated upon the task, and in the natural process of evolution, under modern conditions of technical knowledge, a fleet of mammoth high-speed liners has been made and launched. There is no stemming back the tide of this constructional evolution, for it is overwhelming. Deep calleth unto deep, and the forces denoted by that cry and by the response to it are continuous and, in the measure of



man, invincible. They are nothing less than the life forces of engineering and industry. For the moment they have been rudely checked, and it is desirable at such a time to revise opinions and to take bearings. It may be necessary, for other reasons than the loss of the *Titanic*, to moderate the dimensions of ocean-going liners, and to reform the departments responsible for the issue of rules and regulations affecting the safety of passengers at sea; but the disaster must not be hurriedly construed as an argument against the policy of constructing big ships. The real point at issue is whether, upon the basis of the whole passenger traffic, such vessels result in greater or less safety to passengers. Legislation formulated upon bad exceptions makes exceptionally bad law. Future policy regarding shipbuilding should therefore be governed upon principles deduced from the broad results of experience over a term of years. Let it be remembered that the *Titanic* did all that is to be expected of a vessel in such dire circumstances—she floated and she kept a sufficiently level keel for ample time to have enabled her passengers and crew to be transferred to boats, if boats had been available. The ice dealt her a murderous blow, probably ripping up her side, along her most vulnerable line, near her bilge-keel, and extending probably between several bulk-heads, letting the water into her limbers. It was a hurt that neither storm, shot, rock nor collision could perhaps have done to her, and against which all the skill of designers must necessarily have failed. It brings home to us the proportionality of things, and the fact that the sea-going life and wealth of the world to-day depends, for the most part, upon a few rivets and a film of mild steel.

#### Australian Labour Questions.

At the eight annual conference of the Associated (Australian) Chamber of Manufacturers recently held at Sydney, some interesting figures as to the position of Australian manufactures at the end of the year 1910 were given. With a population of 4,425,083, the number of factories was 13,822, and the total persons employed were 286,831, or an average per factory of about 29 persons. The salaries and wages paid were £23,874,959, an average of about 32s. per week. The total value of the output was £120,770,674, so that the wage bill represented about 20 per cent., or one-fifth of the total sum.

During the conference a discussion took place on the "Preference to Unionists" principle which is being actively advocated by the Trade Unions of the Commonwealth. The particulars which we give in another column as to the conditions of labour amongst tramway employes show to what lengths labour demands may be carried. Mr. Martyn, who opened the discussion, stated at the outset that manufacturers would, doubtless, sympathise with the aim of the old Trade Unionism, which had for its basic principle the preservation of the interests of the men. It was, however, a far cry from this to the present labour policy, which demanded a controlling interest in industrial undertakings without taking any corresponding risks. In his opinion, the existing system was nothing more or less than handing over the government of the country to miners taken from the mine and carpenters from the bench, men who had no experience in economics or in matters of government. While no business men would entrust the conduct of their own businesses to such untrained leaders, they were given the control of national policy. He felt that the enforcement of the present demands of Trade Unionism would ultimately mean a general increase of prices to the consumer, while at the same time it would impair the personal liberty of opinion of the individual.

We are not surprised at this expression of opinion. The claims of the Trade Unions to dominate the conditions of employment could only be justified if they were prepared to participate in the risks of commercial competitive enterprises, and there is up to the present no evidence that they are willing to look upon the industrial problem from this standpoint.

A further resolution was adopted, stating that in regard to work carried out by Federal and State Government depart-

ments, it was absolutely necessary in the public interest that a proper system of recording costs should be adopted, and that in all cases when Government Departments competed with private enterprise, profit and loss accounts should be annually published, in which allowances were made for depreciation of plant and buildings, interest on invested capital and other usual business charges.

We are of opinion that such balance-sheets are wanted, not only in Australia, but nearer home, for while some of our own publicly-owned undertakings would come unscathed, or indeed with enhanced reputation, out of the ordeal, there are many which would be proved to be utterly unsound financially. A clear statement of facts would prevent much of the generalising as to the advantages of State and municipally owned enterprises which is so prevalent to-day.

#### Electrical Engineers and State Employment in Germany.

A COMPLAINT is being made in electrical engineering circles in Germany because electrical engineers who have obtained diplomas at the Technical High Schools are not permitted to enter for the government examination for the class of technical officials who are termed "regierungs baumeister." It would seem that only those who have passed this examination may hope for employment in technical work for the government in connection with the State railways, workshops, lighting and power plant, potash and coal mines, &c. In 1909 the government of Saxony approached the Prussian Minister of Public Works on the question of the admission of diploma-holding electrical engineers to the State examinations for baumeister, but the reply received intimated that mechanical problems preponderate in the electrical services of the State, and that the possibility of transference to another department has to be reserved in the case of the high technical officials.

It is, however, contended in electrical circles that as the construction of electrical machinery has in the meantime developed into a substantial portion of the total business in machine construction, the former now has a just claim for special consideration in the matter. As far as the education of future State technical officials is concerned, it seems that up to the time of the preliminary examination for a diploma, the intending mechanical engineer and the electrical engineer receive exactly the same course of instruction at the Technical High Schools; and also after this particular examination, the difference between the two is not one of quality but one of quantity in the number of subjects. The mechanical engineer is then concerned more with the thermodynamic branches of machine construction, whilst the electrical engineer is naturally more interested in electrotechnical matters.

In any case the situation of the matter and the whole course of improvement at the Technical High Schools are such, it is held, as to render it desirable that equal rights should be granted to both classes, although it is agreed that the admission of electrical engineers to the examination for State technical officials would not carry with it any claim for Government appointments, as the latter would have, as hitherto, to be filled according to requirements. It is urged that the gradual transformation of steam lines to electric traction that is now taking place renders it all the more justifiable that electrical engineers should be received into Government service. The system adopted at present by the Prussian State Railway authorities, who have no certificated electrical engineers at their disposition, is to send baumeister in machine construction (mechanical engineers) to the large electrical firms in order to familiarise them with the construction of electrical machinery.

It is, however, urged that this system will be untenable in the long run, as these officials unconsciously become inculcated with a special preference for the types and methods of working of particular firms; and that it would be far better to admit electrical engineers to the examination in question, and for them, having a preliminary knowledge and capable of critical contemplation, to be sent to the manufacturing works of the large firms for the purposes of the Government.



## WESTINGHOUSE PETROL-ELECTRIC CAR FOR THE G. C. RAILWAY CO.

THE Great Central Railway Co. have recently ordered a standard 90-h.p. petrol-electric passenger coach from the British Westinghouse Co., Ltd., which has been under trial on the company's South Harrow line.

The car measures 41 ft. 6 in. over the headstocks, is 8 ft. 6 in. wide over the pillars, and has a clear inside height of 7 ft. 6 in. : it is divided into four compartments—an engine compartment which contains the engine, generator, controller, instrument, brake and lighting set, together with the necessary fuel and water tanks, two middle passenger compartments to accommodate 50 passengers seated, with a middle entrance, and a small compartment for the driver's use containing only the controller, instruments and brake levers, although it can, of course, be used in addition for the storage of small articles of luggage.

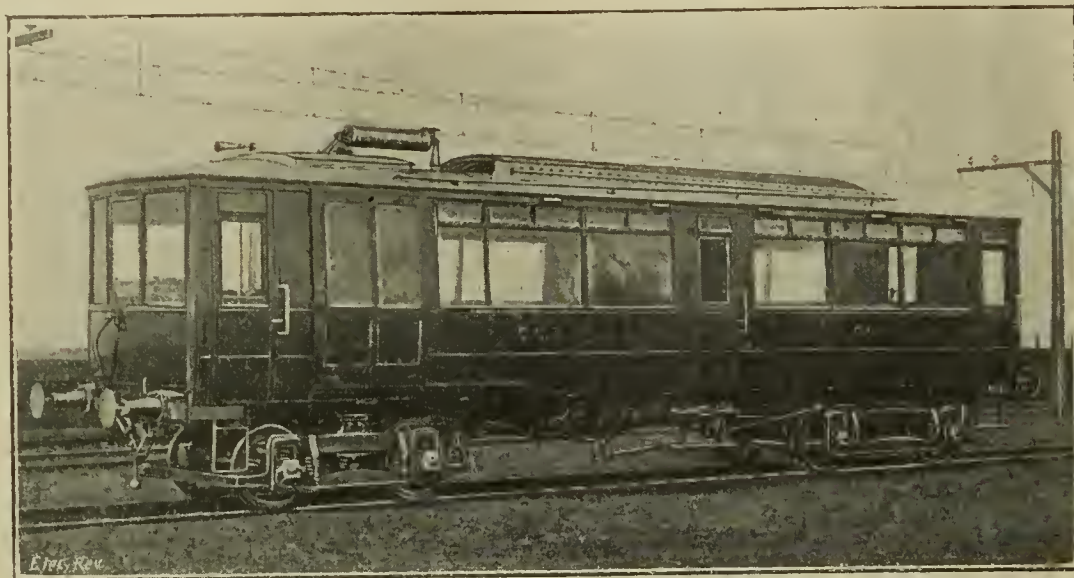
The engine operates on the four-cycle principle, has six cylinders of 140 mm. bore  $\times$  160 mm. stroke, and is

both engine and generator. The usual reverse lever is provided for reversing the direction of motion when necessary. An attachment is provided which renders it necessary for the driver to hold the controller handle continuously ; if it should be released the power would be cut off from the motors. An advantage of this, often known as "dead man" control, is that should the driver be suddenly seized with illness or leave his position, power is cut off.

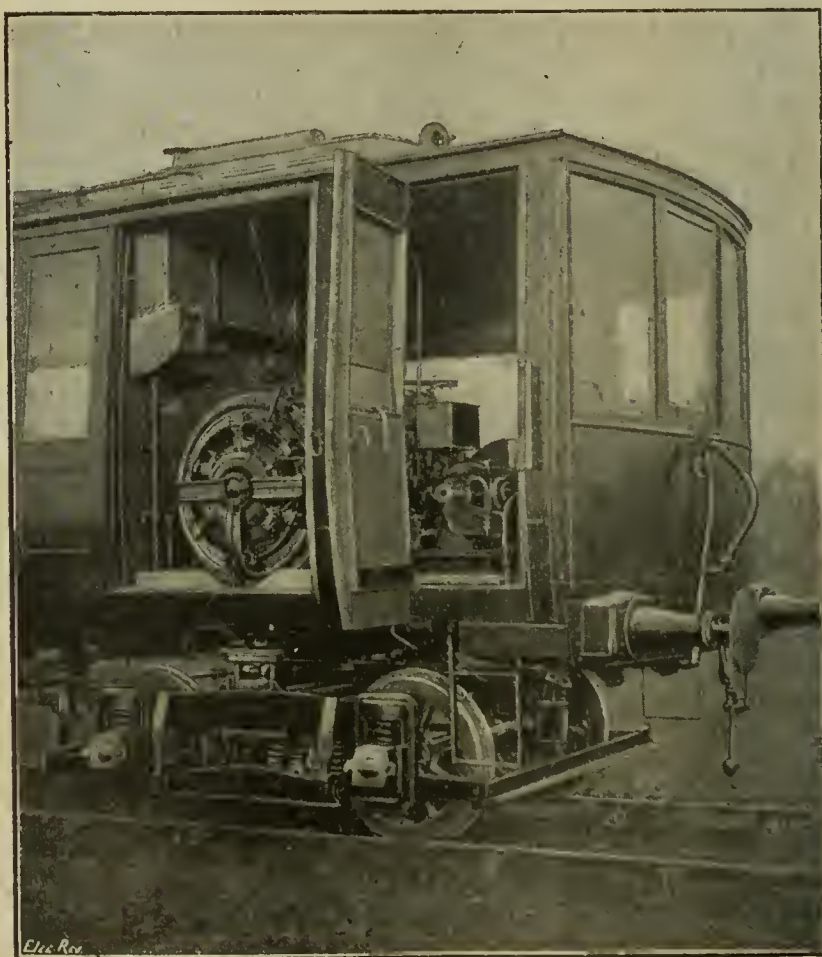
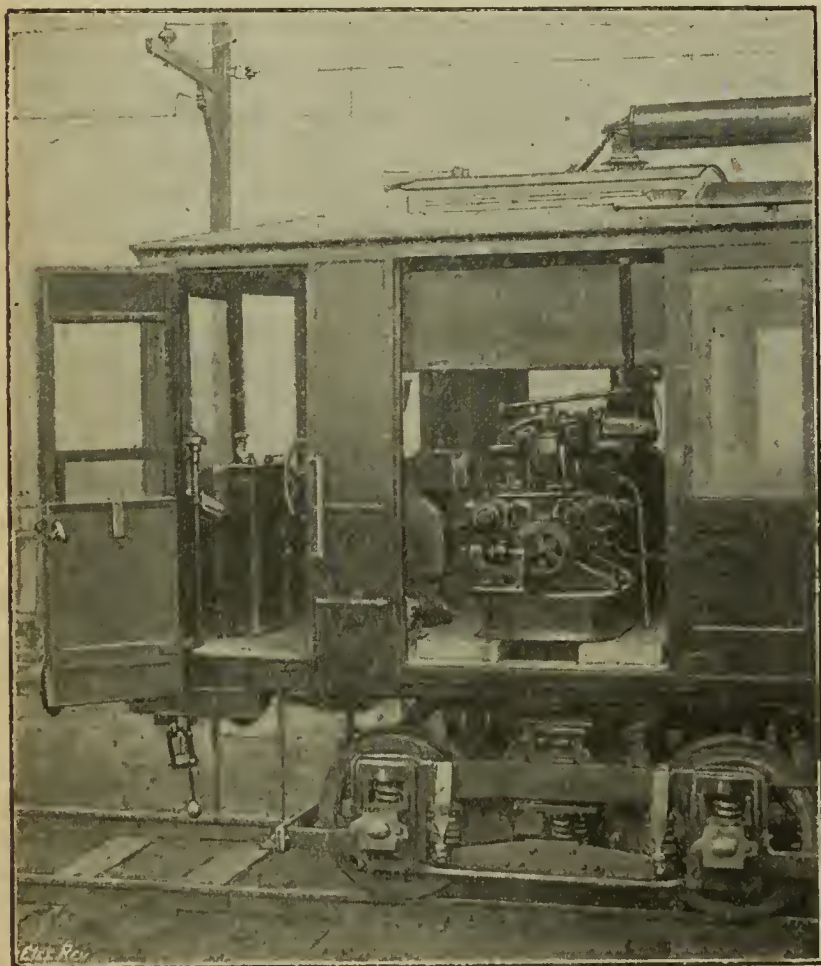
The control is capable of meeting the varied needs of the service without the use of series resistances, the regulation being entirely on the field of the generator, thus securing the maximum economy throughout the run. A single instrument is used for indicating the generator output in amperes, volts, and kilowatts. This is arranged very neatly by means of crossed

fingers, and gives all the desired information in a very easily understood and exceedingly clear manner. A circuit-breaker in the motor leads will trip the circuit in case of excessive overload.

The drive may be made from either end of the car, and one man is sufficient for attending to the engine and for driving, thereby saving the cost of the additional man needed for stoking in a steam-propelled vehicle.



WESTINGHOUSE PETROL-ELECTRIC COACH FOR THE G.C.R.



VIEWS OF THE MACHINERY COMPARTMENT, WESTINGHOUSE PETROL-ELECTRIC COACH.

designed for a normal speed of 950 R.P.M., at which it is capable of developing approximately 90 H.P. It is of robust construction, and arranged with a view to having all the parts as accessible as possible. A suitable governor is provided, and a flexible coupling connects the engine with its generator, which is of the shunt-wound type specially designed for this service, and provided with interpoles.

The control of the car is very simple, and is entirely by one handle. The controller has fingers and contacts of the tramway type, but is arranged so that the handle controls

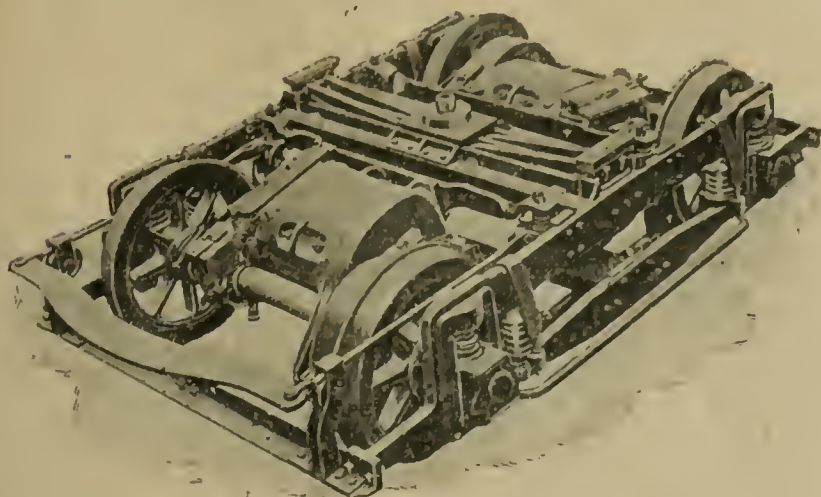
Two motors are employed driving on the axles of the rear bogie, each rated at 64 H.P. on the usual railway rating. The motors are totally enclosed, series-wound, and of the usual type supplied for direct-current railway working.

A separate petrol set is used for operating a vacuum exhaustor and driving a small generator, which serves for providing electric lighting for the coach. This generator supplies current at 24 volts to the bus-bars of a small lighting board, provided with switches, fuses, and voltmeter, and the lamps are wired directly on to this in several circuits.



The car is not designed for higher speeds than 40 miles an hour, but will easily attain a speed of about 35 miles an hour on the level, and on the Harrow line, we understand it was allowed to reach a speed of 45 miles an hour.

An important advantage of this system is that during the starting period the full output of the engine may be obtained. This means a very heavy torque during starting and slow



REAR BOGIE, WITH MOTORS, WESTINGHOUSE PETROL-ELECTRIC CAR

running, resulting in rapid acceleration, a highly desirable feature for suburban and other short distance work.

The layover losses are entirely avoided, and the useful range of the vehicle may be anything desired, since fuel, for very long journeys may be carried and the full power maintained continuously.

## ELECTRICITY SUPPLY AT MEXBOROUGH.

THE town of Mexborough (S. Yorkshire) has a population of about 14,000, mainly composed of colliers and tradespeople supplying the needs of the inhabitants and the surrounding locality. As will be seen later, the field for electrical enterprise is by no means favourable, yet development has exceeded all expectations, and the two 50-KW. generating units originally installed in 1902 are now replaced by four 100-KW. sets, which are, in turn, approaching their maximum output.

The present equipment comprises two three-crank Willans compound engines, direct-coupled to Mavor & Coulson six-pole dynamos, and two Belliss compound engines direct-coupled respectively to Mavor & Coulson and Siemens generators. The Willans engines exhaust to atmosphere *via* a feed heater (boiler feed being at 80° F.), but an ejector condenser can be coupled to either or both of the Belliss sets. Steam is supplied at 150 lb. per sq. in. from two Lancashire boilers, working in conjunction with a 100-KW. Meldrum destructor.

Owing to the cheapness of coal in the district, household ashes are seldom riddled, hence the town refuse is particularly rich in burnable material. Unfortunately, this advantage is at present offset by the peculiar daily load curve of the station which necessitates the destructor standing idle, with banked fires, for 14-16 hours per diem. From 3 a.m. or 4 a.m. in summer, or 8 a.m. in winter till 3 p.m. or 5 p.m., the whole station output is drawn from the storage cells. From 2 p.m. to 4 p.m. the destructor is brought to full heat, and then works at full load till about 12 p.m. During this shift one or two of the Willans engines and one of the Belliss sets are running, but from midnight to 8 a.m. one Belliss set supplies the external load and charges the battery. One set is at present available as spare plant. The low load-factor of the station (15.1 per cent.), hardly justifies the fitting of condensers to all the engines, but the condenser installed is always connected to the running Belliss engine, and is thus in use for 16 hours per day.

Water supply for condensing and feed purposes is taken from an adjacent canal (see fig. 1); before passing to the feed heater it is purified and softened in a Paterson plant treating 2,000 gallons per hour.

The original A.B.P. storage battery, after five years' satisfactory service, was replaced in 1907 by a set of Chloride cells, which, with the exception of a cleaning and the replacement of 100 negative plates, has required no attention since its installation. A 10 years' maintenance contract for 600 ampere-hours' capacity (at 6 hours), has been concluded with the makers. The actual present capacity is about 750 ampere-hours.

The 25-ampere booster-balancer, installed at the time the station was opened, has long been overloaded; it speaks well for its construction that over 80 amperes maximum out-of-balance current has been successfully handled by this machine for some time past. A 100-ampere Crompton booster balancer is, however, now being installed.

During the year ending March 31st, 1911, the maximum load recorded at the station was 240 kW., and considerable extensions of supply have been realised since that date, so that plant extensions cannot long be deferred. The unexpected growth of the undertaking has already filled the original engine room (40 ft. × 29 ft.), and further extensions will necessitate the erection of additional buildings, for which there is ample ground available. (see fig. 1). The engine room will probably be extended towards the canal, good foundations being available, without pile driving, at a depth of 4 or 5 ft. A 500-KW. turbo-unit will probably be adopted as the next extension set, though Diesel engine developments are being closely watched with a view to avoiding, if possible, the capital outlay required by additional boiler equipment. Despite careful lagging, there is considerable condensation loss in the present long lengths of steam piping traversing exposed spaces between the destructor and boiler house and the engine room.

During the year ending March 31st, 1911, 363,756 units were generated: the total connections amounted to about 380 kW., and the maximum demand recorded at the works was 280 kW.

Street lighting accounts for one-fourth of the total sales; and the cost of this service averages 2.91d. per unit, including repairs and switching, or 2.30d. per unit including only capital and energy costs. Four 3-ampere and twelve 5-ampere J. & P. enclosed arcs have been in use for some

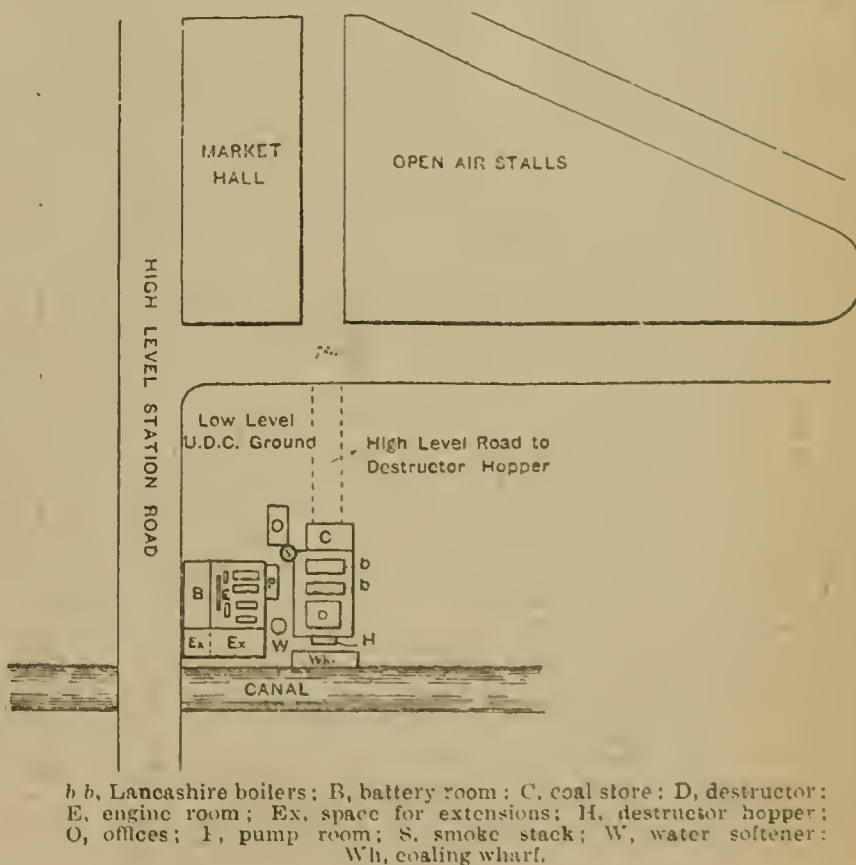


FIG. 1.

time, and to these have lately been added six British Westinghouse magazine flame arcs. The remainder of the nine miles of streets are electrically lighted, chiefly by Holophane prismatic globes containing pairs of 16 C.P. or 25 C.P. 220 v. Sunbeam "tubular" lamps.

The latter have cylindrical bulbs with side pips, and contain two U-loops of carbon-filament—the longer one supported by a horizontal bracket and loop, the other hanging freely from its ends. The reasons for the present adherence to these carbon lamps (of which 50 of 50 C.P. and 183 of 32 C.P. are now in use) are:—(1) The excellent lighting obtained. A pair of 16-C.P. tubular lamps in a



prismatic globe are equivalent to two 32 or 50-C.P. "pear" lamps in a clear lantern. (2) After 3,000 hours in service, these lamps show remarkably little blackening, and a service life of 6,000 hours is not unusual. (3) No metallic lamps are yet available which will properly utilise the existing glassware.

Separate three-wire cables (220-440 volts) supply the street lamps. The lamps in each lantern are across opposite sides of the supply mains, and at 11 p.m., one lamp on each standard, and half on each side of the three-wire net-

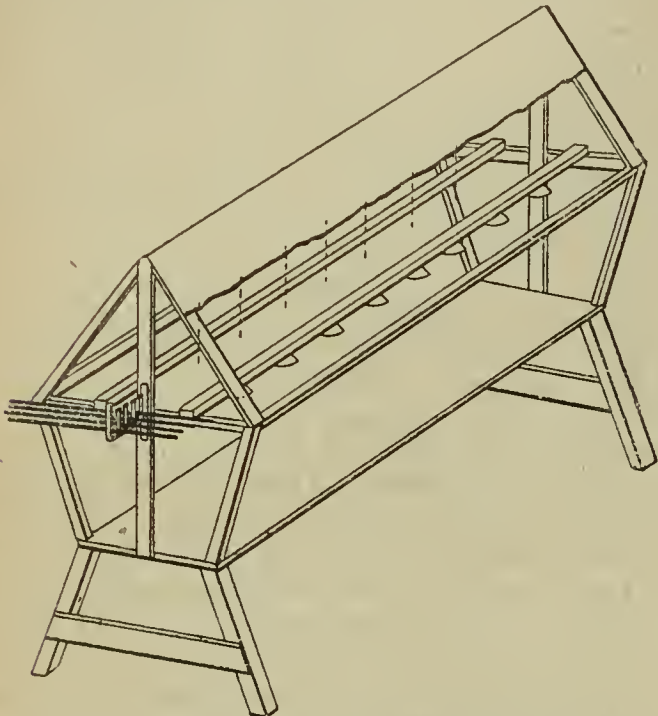


FIG. 2.—SHOWING LAMP BATTENS ON STALL.

work, are switched off from six control points (about 40 lamps per point). The remaining lamps burn till dawn. Each switching "round" occupies one man for about 40 minutes.

Public houses and places of amusement account for a large total load. Four "picture palaces," now in operation, each average 15-20 amperes demand at 440 volts (motor-generators being in use near the lanterns). This demand, being practically constant between 7 and 11 p.m. nightly, is most valuable in flattening the evening peak (the summit of which is reached at about 8 p.m.). Shop lighting constitutes the major portion of the "private" load. Only about 40 residences are supplied; these require about 2 miles of special distributing mains, and do not form a profitable load. Throughout the system, shop and street lamps are supplied by independent cables.

The metallic-filament lamp "crisis" was never severe in this area, and its effect is now more than compensated by the increased number of lamps connected. There is here no prospect of important electric heating and cooking developments, and the present motor load is insignificant, totalling only 60 H.P. for the whole supply area.

A most interesting system of market lighting is in vogue on the open-air market stalls. Prior to the introduction of the present equipment, some four years ago, paraffin flares were used for lighting the stalls. Eightpence per lamp per night was charged for hire and paraffin, but so objectionable and dangerous were the lamps that the proposal to provide two 25-C.P. tantalum lamps at 6d. or 4d. each per evening (Saturday and Monday markets respectively), and additional lamps at 3d. or 2d. each, received instant approval.

TABLE I.—TYPICAL DEMAND IN MEXBOROUGH MARKET LIGHTING SCHEME.

Side of three-wire system.	—Number of stalls requiring—				Total 25-C.P. tantalum lamps.
	Two lamps.	Four lamps.	Six lamps.	Eight lamps.	
Positive...	14	12	3	2	110
Negative	16	11	2	1	96
Total on 61 stalls ...					206

A three-wire feeder is run from the supply station to distributing boards placed in an archway beneath the Market Hall (fig. 3). Thence eight overhead rubber-insulated cables (four per side of the three-wire system), are run, on market evenings, through reel brackets placed on the stalls (fig. 2) to 2 in. x 2 in. wood battens supported between the end frames of the stalls as shown. These battens are permanently cabled

with cased-in wires and fitted with bayonet lamp-holders and white enamelled reflectors. One or two battens per stall and two, four, six or eight lamps per batten are provided according to the requirements of the stall holder (see Table I); 110-volt tantalum lamps are run two in series. A fuse box is provided in each row of stalls, and adjacent rows are connected to different service branches, so that, in case of a fuse blowing, the stalls affected are sufficiently lighted from neighbouring rows. Connection between battens placed end to end in a row of stalls is effected by lengths of cable with adaptors fitting into the end lampholders of the battens.

So far, only trivial repairs have been required in the distributing leads (which are stored on drums when not in use), and lamp breakages, with an average of 200 lamps in use, average two per week. Two men can erect or dismantle the whole temporary equipment in one hour, and an assistant is always in attendance at the distributing boards to replace lamps, fuses, &c. The convenience and hygienic value of the electrical system cannot be exaggerated, and a simpler and more effective system could hardly be desired. The lamp-hiring fees are collected with the stall rents.

The Market Hall is well lighted by groups of three Osram lamps in reflector lanterns, and stall holders are provided with 55-watt lamps at 4d. per evening.

Considering the small output of the station and the poor day load at present available, the generating costs are exceptionally low at Mexborough, and the financial position of the undertaking is very satisfactory. The costs of production per unit for the year ending March 31st, 1911, amounted to 0.76d. per unit, and the total costs to 1.37d.

Prepayment meters are employed in a few cases, but the standard flat rate for lighting supply is 4d. per unit to houses and shops alike, with a sliding scale of discounts to large consumers.

A flat rate of 3d. per unit, with discounts, will probably be made in the near future. Supply for power purposes is at from 2.5d. to 1d. (net) per unit, according to the total consumption. The average revenue per unit sold being 3.10d., a balance of 1.73d. per unit was carried to net revenue account in 1910-11, as against 1.62d. in 1909-10

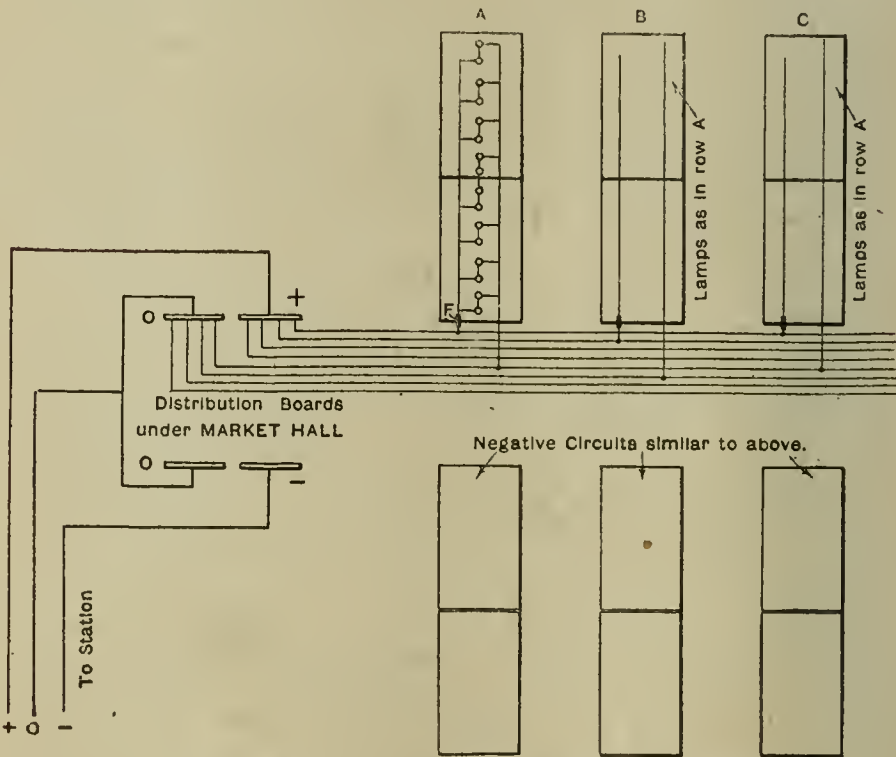


FIG. 3.—ARRANGEMENT OF WIRING, MEXBOROUGH MARKET.

Consistent endeavours have been made to curtail capital expenditure, and, of the £23,900 of loans sanctioned to date (£59.75 per kw. on the present station capacity), £1,644 remains unexpended and £6,619 has been repaid. The undertaking realised 10 per cent. gross, and 2.5 per cent. net profit during 1910-11, and is fortunate in having accumulated a handsome depreciation and renewals fund.

In this small community, the "satisfied consumer" is an invaluable asset to the supply station. The whole of the street lighting is already in the hands of the electricity department, and there is every prospect of continued rapid development of private supply.

Within the last 12 months the Mexborough and Swinton Councils have acquired joint ownership of the hitherto company-owned gas works supplying the two areas. This



change is not likely to affect the electricity department otherwise than by restricting the capital available for its extension, and by postponing for a time the realisation of a scheme of "unlimited use" contracts for four-light cottage supply, which had been drafted.

There is an admirable field for trolley-buses in the Mexborough district, and it is very probable that these will be adopted in the near future. The efficiency of the station would then be greatly improved by the advent of an important day load. Could a joint board be arranged to supply electrical energy from the Mexborough station to the neighbouring Wath and Swinton areas, and to run a trolley-bus service over the Mexborough, Bolton, Goldthorpe, Wath and Swinton districts, residents in the latter would be rendered a service no less than the economic advantage accruing to the administrative authorities concerned.

In concluding these notes, we must express our indebtedness to Mr. J. Senior, the resident electrical engineer, for his courtesy and assistance in explaining the conditions and working of his undertaking.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

AN Association called the Ontario Municipal Electric Association has recently been formed, and it is intended that the various municipalities represented by it, which all take current from the Hydro-Electric Power Commission of Ontario, shall act in concert and assist the Commission in furthering all matters connected with the development of water-powers, and the use of electricity generated thereby, throughout the Province. As Ontario is one and one-fifth times the area of the British Isles and she possesses abundant water-powers, it will be seen that there is plenty of scope for the efforts of the Commission and of the municipalities referred to.

A recent report on the natural resources of Northern Ontario states that there are 20 million acres of good agricultural land to be settled in that part of the province. Besides this there are extensive mining regions which are steadily advancing in importance.

The geological survey branch of the Department of Mines, in one of its reports, gives some interesting details as to the mineral wealth of Canada.

The coal supply of Nova Scotia has been estimated at 6,000 million tons.

Iron is found in most parts of the country, but it is not yet mined on a very large scale; notable expansion is expected.

Gold is mined in British Columbia, the Yukon, Ontario, Nova Scotia and Quebec.

Silver is found in abundance in Northern Ontario and in British Columbia, and it is said that the silver districts of Cobalt and the Montreal River occupy the premier position in the world.

Lead, though mined only in British Columbia, occurs in other provinces.

Copper is found in British Columbia, Ontario, and Quebec.

Nickel is said to be one of the most important metallic products of the Dominion.

Manganese, mercury, platinum, tin, arsenic, antimony, and graphite, are all to be found in various parts: while asbestos, gypsum, mica, and corundum, are extensively mined at the present time. Asbestos is the chief mining product of Quebec, the deposits in that province being the most important in the world.

The foregoing minerals will be mined in increasing quantities as time goes on, and as the population of the country increases, and will add enormously to the wealth of Canada. Though the information given is not of direct interest to electrical engineers, it will serve to give some slight idea of the wonderful possibilities of this vast section of the British Empire—incidentally there should be some interest in the fact that coal and other mines are sure

to use electrical appliances to an increasing extent every year.

As a Britisher in Canada your correspondent was very interested in the recent article on "Colonial References," dealing with conditions in South Africa. Conditions over here are somewhat different from those prevailing in that country, and though it may be doubtful whether a man returning home after good experience here would have much chance of finding suitable employment, there is no doubt that a good man with a few years of Canadian experience behind him would be worth his weight in gold to any firm determined to work up a business connection here, as he would be able to advise them on subjects, and in ways, in which home engineers are, necessarily, entirely ignorant. Any good British firm, acting under the advice of such a man and having a capable representative in this country, should be able to do a profitable business.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Fraudulent Tests.

I have read with considerable amusement the protest of "Modulus" against the article on "Fraudulent Tests" in your issues of the 5th and 12th inst. If ever there was a case of a "forlorn hope," it is that of your correspondent to uphold the sanctity, the respectability—I nearly said the honour—of some of our British manufacturers.

With "Modulus," I can claim 15 years' experience in test rooms of some of the foremost manufacturers of the day, and, absurd as it is, among the most reputable. In addition, I have represented consulting engineers for official tests in some of the leading works. The only difference between my own experience and that of the contributor of the article is that the tests that I have carried out for manufacturers, and witnessed for consultants, have been purely electrical. I can fully endorse the conclusions of the writer of the article that most official tests are "faked."

"Modulus" says that he would not "dare have the effrontery to attempt to befooled by most of the obviously crude and certain-to-be-found-out so-called tricks of the test bed" mentioned by the writer of the article. Um! he's not much use in a test room, then, that's all.

The experience of "Modulus" as to Admiralty overseers is 14 years of his life wasted. What will he say when I tell him that I have pushed a universal galvanometer shunt over by one stop to get a test passed, and that directly under the nose of the overseer?

Such practices may be "bad policy." That is not the point; they are adopted. The methods may be "insane," but they are adopted, and the firms adopting them pay dividends.

It is useless for "Modulus" to grumble that the conclusions of the article are not that "All men are Liars," but liars all the time. He must face facts. Test-room men are all liars, and liars all the time, and then some—as the Americans have it—where official tests are concerned.

I can assure "Modulus" that some of the amusement of the test man's life is the tricking of inspecting engineers. Just as some men find pleasure in risking their necks in riding dangerous horses, driving cars over dangerous places, or dare-devil feats in aeroplanes, so the test man gets his fun in skimming as near as he can on "official tests." Bah! they are not worth the paper they are written on.

I could multiply up cases in which I have participated *ad nauseam*, could any good come of it. It is useless. It was ever thus, and thus in these commercial days it will ever be.

The denial of "Modulus" that falsified instruments exist is piffle. The fact that he cannot conceive "that any sane engineer would attempt such impossible methods" merely argues lack of knowledge. Such "impossible" methods are used—and succeed. Finally, if "Modulus" will detach himself from his exalted rank in a works and



carry out an official test he will soon be initiated into the mysteries of these plausible fakes or—lose his job.

As a certain amount of my bread and butter comes from my being “a liar,” and “a liar all the time,” I must ask you to withhold my name, and, although a liar has for once spoken the truth, will subscribe myself

Pluto.

“Modulus” has already replied to the article under the above title, and doubtless those in authority in the testing departments of responsible firms could give even more complete replies. I only wish to refer to one or two minor points. I had the honour of spending some time in the testing department of a large electrical engineering firm, and so the statement that “any experienced tester could add to the list,” appeals to me. During my time I worked on many official tests, and a variety of fakes were certainly adopted, but nearly all in order to shorten the time of test, and to avoid overtime, very few indeed to pass a bad machine. The only fault that I, as a tester, had to find with an official inspector, was that he arrived late in the morning, and then wanted a day’s work done, thus keeping the tester—usually a college man unused to early rising—up late with the prospect of rising early next day; and also completely upsetting his social arrangements. Under such circumstances, it was natural that all possible should be done to complete the test without delay, with no desire to hustle the inspector into passing a bad machine. It should be remembered that all machines for official tests are tested beforehand, and all faults rectified in anticipation of a strict inspector. This is as great a safeguard as the subsequent “on site” test.

Personally, I would absolve the firm from all responsibility for test-bed fakes. I never received, nor ever heard of any of my colleagues receiving instructions to falsify tests; and certainly no “adjusted” instruments were ever employed.

I do not intend to add to the list of means of falsification—I do not wish to destroy the innocence of the tester of the present day—nor do I intend to refer in detail to the means suggested. Just three of these I would criticise. The first is the removal of load while the inspector is at lunch. This is an obvious method, but if a curve be taken of the temperature of the stationary parts—stator or series field windings—such an action is easily detected. This curve should certainly always be taken. Then the temperature rise should always be checked by taking hot and cold resistances, and calculating increase of temperature from the known temperature coefficient. This is a far more reliable check than might be imagined.

The use of a second rheostat in series with the field is new to me, but it would be easily checked by a reading of the field current. In every regulation test I ever did, whether official or otherwise, the field current was taken, as well as the line volts, and any variation in the resistance of the field circuit would be easily detected.

R. S. T. V.

London, S.W., April 22nd, 1912.

#### The New Articles of the I.E.E.

Among the recent proposals of the Council for the amendment of the Articles of Association of the Institution of Electrical Engineers, those for the modification of the conditions of membership and the formation of the new class of Licentiates encountered very determined opposition. The proposals in question seem to be held, at the present moment, in abeyance, presumably while the Council examines the matter further. If this be so, then I would suggest that the suggested alterations of the constitution of the American Institute of Electrical Engineers, which are put forward by the governing body of that society be taken into serious consideration by our Council, as I am of the opinion that the alterations proposed by the American Institute, while attaining a similar end to the Institution’s suggestions, are not open to the same objections as are these.

The opinion has been expressed by many that the above-mentioned proposed alterations of the conditions of membership of our Institution will result in a levelling down of the status given by membership. The American proposals, on

the other hand, are certainly of the nature of a levelling up. They consist, in short, of the formation of a new class at the top—viz., higher than the grade of “Member” and designated “Fellow.” To this class engineers only will be admitted who possess certain stringent qualifications. Below this will come the class of full member and the associate.

I will not take up your space to point out the advantages of this scheme as compared with our own, but respectfully submit the same to the decision of the Council of the Institution.

Charles C. Garrard.

Sutton Coldfield, April 17th, 1912.

#### Review of “Electric Mains.”

It is generally inadvisable for an author to comment on an unfavourable review, but I think this rule may be safely broken in face of the extraordinary attack made by your reviewer, in the issue on April 12th, on the publishers of “Electric mains and distributing systems” (The *Electrician* Publishing Co., Ltd.)

First of all he should not have forgotten that, by the courtesy of the publishers, one of the earliest copies was placed at his disposal. No list of errata had then been inserted, but this was done very shortly afterwards. This list contained practically all the instances of error mentioned by your reviewer.

The authors do not agree that uniformity of symbols is at all necessary in a book of this kind. The diagrams are so simple that it is preferable for the reader to turn to them from the adjoining text, instead of trying to remember pre-arranged symbols.

It is a little amusing to note that in the solitary algebraical expression which the reviewer himself employs, the setting up is not beyond reproach.

The redundant and omitted words referred to must depend on ideas of style of which the reviewer alone possesses the secret. To suggest that the book is practically useless because of lightly printed fraction lines and sundry printer’s errors, obvious to a first year student of algebra, is to make a statement which stultifies itself by its wild extravagance. It would be pleasant to return the compliment, the authors were paid on their “fearless and straightforward” criticisms, but the reviewer’s statements on the get-up of the book cannot unfortunately be described in such gentle and innocuous terms.

J. R. Dick.

Reading, April 22nd, 1912.

Anticipating that the authors would not be delighted with my review of “Dick and Fernie,” I endeavoured to express therein, as clearly as possible, my disappointment at having to write as I did about it. I will deal with Mr. Dick’s letter as briefly as possible.

Every reviewer is aware that the volume he receives is an early copy, but I consider that the length of time that elapsed between the first publication of the articles in the *Electrician* and the appearance of the book was quite sufficient to allow of the removal of all serious defects.

Perhaps uniformity of symbols is not exactly necessary, but that it is desirable, I think, no one will deny. Do we not have an international committee to provide uniformity? Why, then, should Mr. Dick object to keeping to one set of symbols? Surely it would be easier for himself.

Mr. Dick is welcome to the “little amusement” (precious little, I should think) that he gets out of the setting up of the algebraical expression referred to. Your setting is at least not incorrect, and the idea of comparing a text-book, produced very much at leisure, with a weekly journal produced under pressure of time, is remotely verging upon the extreme confines of coolness.

Mr. Dick’s comments on the reviewer’s “secrets of style” are not for me to answer.

He is scarcely complimentary to his colleague and himself when he suggests that “errors obvious to a first-year student of algebra” were passed in the proofs. I have yet to meet, however, the first-year student of algebra who deals with the putting of differentiated expressions equal to zero.



I cannot see that Mr. Dick has made out any case for departing from the excellent rule which he mentions in his first sentence. If he is satisfied with the get-up of the work, I suppose it is no business of mine to grumble, but I can only say that I should never have allowed any work of mine to reach a reviewer's hands in the state in which this reached mine.

I gave my considered opinion on the book as a literary and as an engineering work, and I have nothing to add to it, and nothing to withdraw from it. I am not concerned with whether or not it is agreeable, either to the authors, or to the publishers whom Mr. Dick seems to be so anxious to defend.

Your Reviewer.

#### Electricity Direct from the Coal Mine.

In your issue of the 12th inst., there is an editorial discussing Sir W. Ramsay's suggestion as to producing gas direct from the coal mine without hewing the coal. The difficulties connected with this method of working are very correctly pointed out, and you propose that these difficulties might be overcome by hewing the coal and converting it into gas at the base of the shaft, from which point the gas would be brought to surface and there used to generate electricity.

I have delayed suggesting another alternative feeling sure that it would be made by others and appear in your issue of the 19th inst. I have had it many years in mind, as doubtless have other engineers, but I do not remember having seen it published.

My proposition is that the coal should be used at the base of the up-cast shaft to work a steam operated power plant there situated, from which point electricity could be easily and conveniently transmitted.

The up-cast shaft would be used as a smoke flue for the boilers; how far this would serve as an automatic ventilator for the whole mine would depend upon circumstances, but the practice of ventilation by means of fire at the base of the up-cast shaft is old and well known, whilst the draught could be increased if necessary by an air propeller, as is common in modern boiler houses.

In your issue of the 19th inst., you state various reasons why gas engines have been less successful than steam engines in this country; it is unnecessary, therefore, for me to reiterate these in support of my proposition. Either alternative saves the cost of bringing the coal to bank, but my scheme *inter alia* obviates using much of the valuable shaft area which gas pipes would occupy.

I venture to suggest to the engineers of the different Kent coal companies, that the comparative proximity of their mines to London renders this proposition particularly worthy of their full consideration.

W. Geipel.

London, S.E., April 22nd, 1912.

#### Midland Electrical Exhibition.

With reference to the above Exhibition which it was proposed to hold at the Bingley Hall, Birmingham, from October 7th to 26th, I regret to inform you that the British Electrical and Allied Manufacturers' Association has declined to allow its members to take space at this Exhibition. They suggest an alternative by which the whole cost and hazard of the Exhibition would be thrown upon the shoulders of the local authorities, whilst the manufacturers, whose goods would be exhibited and sold at the Exhibition, would pay nothing whatever beyond a trifling contribution towards the general expenses; this alternative the Executive Committee are unable to accept.

They consider that, as any benefit which would result from the Exhibition would be first felt by the manufacturers whose goods are shown, these manufacturers should at least be prepared to bear a fair share of the cost. Moreover, a much larger proportion of the profit derived from an increase in business would be obtained by the manufacturers than by the local authorities and companies who provide electrical energy. When it is remembered that before any electrical energy can be employed, plant must be purchased for its generation, mains laid for its distribution and elec-

trical machinery for its employment purchased, it will be obvious to everyone that the expenditure which passes into the pockets of the manufacturers is much more substantial than that obtained by the undertakers, who are selling the current.

The promoters of the Exhibition deplore the attitude which the Manufacturers' Association has taken up; they consider that a valuable opportunity for demonstrating to the manufacturers and residents of one of the richest and most prosperous industrial districts in the country the superior advantages to be derived by the employment of electricity has been lost.

They have had so many private assurances from members of the Association that they are confident that, had the Manufacturers' Association left their members free to take space upon the terms usual under such circumstances, a splendid and representative Exhibition would have been obtained.

The Council of the B.E.A.M.A. includes representatives of firms who manufacture steam plant and large generating plant, to whom an Exhibition of the kind proposed does not appeal, and apparently their influence has been thrown in the scale against the desires of those manufacturers who would benefit, with the result that a grave error of judgment has been committed. This is additionally unfortunate, as, in view of the recent conditions in the neighbourhood of Birmingham arising out of, and in consequence of, the coal strike, the opportunities of introducing and pushing the employment of electrical apparatus are unusually favourable, and with reasonable courage and enterprise on the part of the manufacturers, a substantial increase in their employment could have been secured.

Howard Foulds,

Hon. Sec., the Midland Electrical  
Exhibition Executive Committee.

Birmingham, April 23rd, 1912.

#### Architects and Engineers.

I suppose the Association of Consulting Engineers is dead, or was it stillborn? But if Mr. James Swinburne and his young men are still alive, cannot they turn their attention to the poaching that goes on by architects who build hospitals, large asylums and other institutions?

The amount of pure engineering work, besides electric lighting, which is in the hands of plumbers and hot-water "engineers"—each architect having usually his pet firm—is very large, though but a small percentage of the total upon which the architects charge their commission; and, in cases where an engineer is called in to advise, the commission on the engineering work, or a portion of it, has to be shared.

If an engineer attempts to build a bridge, without calling in an architect, what a row is kicked up in and out of Parliament; and why should not the Association of Consulting Engineers, if it exists, try to be useful?

Fair Play.

London, April 20th, 1912.

**Public Clocks for Southport.**—After exhaustive trials of several systems of electric clocks extending over the last 12 months, the Corporation of Southport has now announced its decision regarding the proposed municipal time service for the borough. It has adopted the "Synchronome" method of electrical impulse dials, of which, to begin with, 15 will be erected for the most part on trolley posts and arc lamp standards at points widely distributed throughout the town. The controlling pendulum will be placed in the chief office of the Borough electricity and tramway engineer, connection to the dials in single series circuit being by means of upwards of seven miles of wire, most of which is underground. Where overhead line is used, special precautions are being taken to avoid an interruption of the service in the event of breakdown. The dials are of high temperature enamelled metal, with movements and hands totally enclosed in hermetically-sealed weatherproof cases of the same material. The installation is fundamentally a duplicate of that at Marble Arch, but carried out on a much larger scale, by the SYNCHRONOME CO., of Clerkenwell, and capable of indefinite extension.



## THE LAKE COLERIDGE POWER PLANT, N.Z.

WORK has recently been commenced on the first of the hydro-electric power schemes of the New Zealand Government to be put in hand under the Water Power Act of 1903. The provisions of this Act vest the right to all water power within the Dominion



FIG. 1.—THE LAKE COLERIDGE (N.Z.) ELECTRIC SUPPLY AREA.

of New Zealand in the Government, and confer on the Minister of Public Works the necessary powers to construct and operate hydro-electric installations.

A report was obtained in 1904 from Mr. L. M. Hancock, of the California Gas and Electric Corporation dealing with the subject

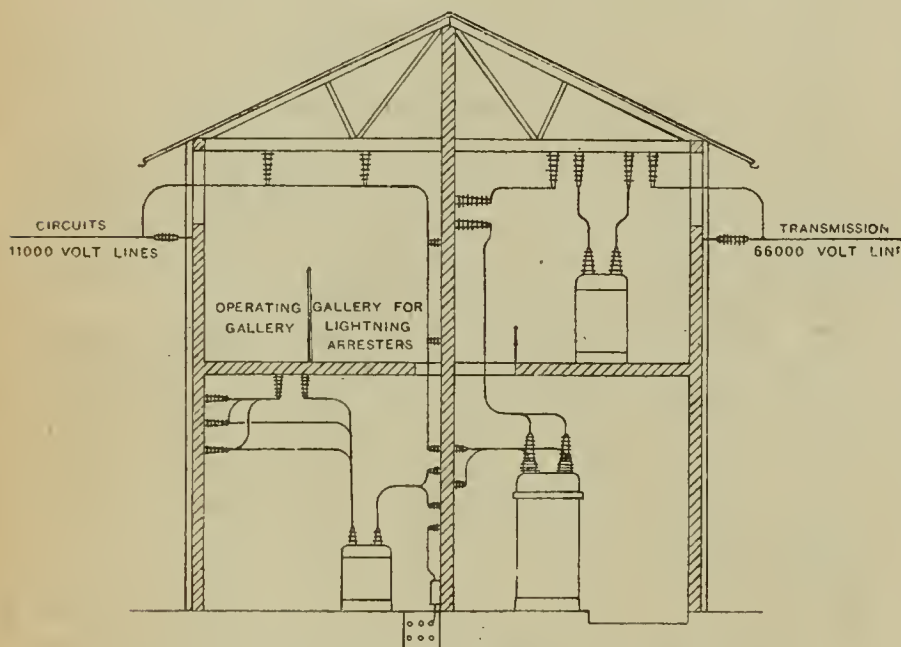


FIG. 2.—PROPOSED SUB-STATION ARRANGEMENT.

in a comprehensive manner. The Public Works Department, at the same time, investigated all the available sources of power within the Dominion, gauged the rivers and instituted a system of recording the rainfall and the flow of the most important rivers. A full report was prepared by the late Engineer-in-Chief, Mr. P. S. Hay, dealing exhaustively with the available sources of power, which has formed the basis of all subsequent investigations on the subject.

After considerable discussion the Government decided to carry out the development works themselves in preference to leasing them, and the "Aid to Water Power Act" of 1910 authorised the Government to raise loans not exceeding £500,000 per year for five years for this purpose. A special branch of the public works department was established to carry out the work and was placed under the charge of Mr. E. Parry, assisted by Mr. L. Birks.

The first scheme to be put in hand is the Lake Coleridge installation for the supply of Christchurch and the Canterbury Province. The head-works for this development are now in hand, and specifications have been prepared and tenders invited for the necessary plant and equipment.

The approximate area of supply is shown in fig. 1,

Lake Coleridge is situated in the Southern Alps, about 70 miles to the west of Christchurch. Its surface is 1,667 ft. above sea level; it is 10 miles long and 2½ miles wide, with an area of 14 sq. miles. In spite of its altitude the lake does not freeze, and its shores are entirely free from driftwood or other refuse. The outlet of the lake is at the western end, where the waters discharged from the lake and the Harper and Wilberforce Rivers unite to join the Rakaia River further down. The latter river flows eastward parallel to the lake shore, and separated from it by a ridge ranging from 1½ to 2½ miles wide, consisting of soft shale covered with glacial drift in a matrix of clay. The river beds have an average fall of 30 ft. to the mile, and a length from the lake outlet to a point in the Rakaia opposite the eastern end of the lake is 16 miles. The gross head available at this point by piercing the separating ridge is 494 ft., the flood level in the Rakaia River being 1,173 ft. above sea level.

The lake is fed by four streams, and owing to the enormous storage area the flow in the stream is very steady.

The power available from the present outflow of the lake is thus 5,000 kw. for continuous working, or 10,000 kw. on a 50 per cent. load factor. This is ample for the present purposes, but for future developments it can be increased indefinitely.

The ultimate capacity of the development can be increased as required to 50,000 kw. for continuous operation or double this amount on a 50 per cent. load factor.

The water will be conveyed from the lake to the river bank by a tunnel 110 chains long, the maximum flow provided for being 270 cb. ft. per second. In order to provide for future developments, the crown of the tunnel at the inlet will be 12 ft. below lake level, the tunnel being worked under this pressure. The entrance to the tunnel will be provided with duplicate gates and screening chambers so designed that the screens will be accessible at any time without cutting off the supply, and that the pressure on the gates can be equalised before raising. The tunnel is provided at the outlet end with a surge chamber 30 ft. square, and with gates and screens operated on the same principle as at the inlet. This arrangement entirely dispenses with costly mechanism, and yet gives complete control of the flow in the tunnel. The surge chamber is designed in conjunction with the governors, fly-wheels and reactances of the generating sets so as to minimise, as far as possible, the disturbances arising from changes in the load, and to enable the output to respond automatically to the requirements of the service.

A vertical shaft midway along the tunnel will also serve as an additional surge chamber to assist in taking up the fluctuations of energy and adjusting the velocity of the water in the tunnel more rapidly to the exigencies of the service.

Provision is made in the power house for an ultimate equipment of six main generating units of 1,500-kw. capacity each, and two hydraulically-driven and one motor-driven exciter unit of 150-kw. capacity. These will be supplied from the surge chamber by three penstocks half a mile long: each main penstock will branch at the lower end supplying two turbines.

The pipes will mostly be laid underground with a cover of earth, and to prevent corrosion will be coated inside and outside with a high quality of bitumen compound, the outer surface being further protected with a serving of Hessian laid on while the bitumen coating is still soft. The exciters will be supplied from a 15 in. bus pipe, which will connect the three main penstocks at the lower end. In order to further equalise the flow in the main penstocks they will be connected in ordinary operation at their lower end by means of this bus pipe.

The main turbines will be of the Francis reaction type, of 2,150 B.H.P. normal output and 2,700 B.H.P. overload capacity, and the exciter wheels will be of the Pelton type, of 225 B.H.P. normal output and 270 B.H.P. overload capacity.

The main generators will be three-phase alternators of 1,500 kw. normal capacity at a pressure of 6,600 volts and 50 cycles. The exciters will be 150 kw. 110-volt direct-current generators. The motor for the motor-driven exciter will be of the synchronous type motor operated direct from the 6,600 volt bus-bars. In addition to the exciter generators a battery of 56 cells, each of 800 ampere hours capacity, will be installed to ensure a supply of energy for excitation under any emergency which may arise.

The present installation will include two penstock pipes, three of the main generating units and one hydraulically-driven exciter.

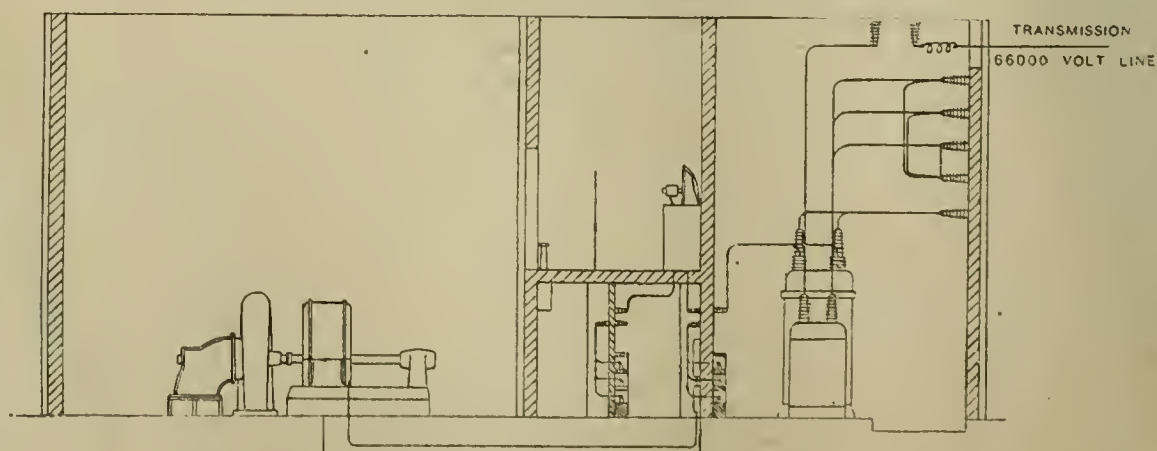


FIG. 3.—PROPOSED SWITCH ARRANGEMENT AT POWER HOUSE.

The ultimate output of the complete plant of six units is based on the capacity of five units at rated load or four units at 25 per cent. overload, that is, a maximum of 7,500 kw.

The output of the station will be controlled by a switchboard consisting of six main generator panels, two main transformer and



feeder panels, two synchronous motor panels, and one centre synchronising and inter-connecting panel.

All switches will be of the remote-controlled oil-filled type placed in a gallery behind the switchboard, and provision is made by means of interconnecting switches for dividing the whole installation electrically into two independent systems, each supplying one of the duplicate banks of main transformers and transmission lines, thus reducing the risk of stoppage to a minimum.

The exciter switchboard will be mounted with separate exciting and power house supply bus-bars with double-throw exciter generator and battery switches, thus allowing the exciting voltage to be regulated by means of a Tirrill regulator, so as to compensate for the ohmic and reactive drop in the transmission line, and ensure a steady pressure at the main sub-station.

The step-up transformers will consist of two banks, each of three 1,500-kw. single-phase oil and water-cooled transformers, raising the pressure from 6,600 to 66,000 volts for transmission.

The transmission lines from the power station to the main sub-station at Christchurch, a distance of 70 miles, will consist of two independent pole lines, each carrying three conductors, consisting either of 7/12 S.W.G. copper or 7/135 aluminium cables carried on four shell-pin insulators, and spaced triangularly 6 ft. apart.

At the Christchurch sub-station the pressure will be reduced by two banks of step-down transformers identical with the step-up transformers, but star connected on their secondary side to give 11,000 volts three-phase for the primary distribution. A branch of the 66,000-volt transmission line will also be run to Timaru—a flourishing seaport 100 miles south of Christchurch—and ultimately in a northern direction also, with sub-stations at intervals transforming down to 11,000 volts, at which pressure the energy will be distributed throughout the province. The energy will be supplied in bulk by means of underground cables to the Christchurch Tramway Board and the Christchurch City Council for retail distribution. It will also be distributed by means of overhead cables to the suburban boroughs and country towns, large meat works, woollen mills and other industries in the district as required.

It is estimated that a capital expenditure of about £375,000 will be required to install the full 9,000-kw. plant with distributing mains to all the main centres of population in the province. But only three out of the six units are included in the present installation.

The estimates indicate that power will be available at £6 10s. per H.P. per annum at the consumers' terminals.

Arrangements are being made for converting the portion of the railway between Lyttleton and Christchurch to electric working, the determining factor being the difficulty of ventilating the Lyttleton tunnel, and it is confidently anticipated that after gaining the experience of electric working on this section, it will be extended to the main lines.

A supply will also be required for the electric haulage through Arthur's Pass Tunnel, now in course of construction. This tunnel, which will be five miles long, forms the connecting link of the Christchurch-Greymouth line, between the east and west coasts of the South Island. With two tunnel sections operated electrically, it is probable that the remainder of the line will be converted in the early future.

A large and comprehensive scheme is now under consideration for the supply of electrical energy in the North Island with the object of making it generally available to all the towns and districts throughout the Island, and it is anticipated that advantage will be taken of the facilities offered to work the railways by electricity and to promote a system of light railways throughout the country districts now suffering from lack of communication because of the difficulty of obtaining stone for surfacing the roads.

**Foreign Languages for Commercial Men.**—About 18 months ago an Association was formed, called the "Institute of Linguists," for the purpose of promoting greater interest in the study of foreign languages—more especially in regard to commercial men. The Council of the Institute is strong and representative, including the French, Russian and Spanish Ambassadors, the Earl of Denbigh, Mr. Francis Storr (Editor of the *Journal of Education*), Sir Gilbert Parket, M.P., Mr. E. C. Jerningham, Sir James Yoxall, M.A., Sir Henry Wood, M.A., and other persons well-known in the literary and commercial world. A number of examinations have been held, and the next, which is fixed for August 2nd and 3rd, 1912, will be, as heretofore, under the direction of the University of London. This examination is open to both men and women, is divided into two sections, commercial and literary, and sets up a high standard of proficiency.

It is the aim of the Institute to convert the heads of business firms to the idea that all their clerks ought to be efficient linguists, and that they should demand that every candidate for a position in their business should be able to produce a certificate of proficiency. If this were generally done, England would soon be placed on an equality with other countries on this important point, the ability to speak other languages besides one's own.

The Council has already been able to supply large business houses with efficient foreign correspondents, and hopes shortly to establish an employment bureau; and it is desirous of building a properly-equipped institute in London, and establishing a correspondence course in connection with it. All this requires money, and an appeal is being made to the public for support. The hon. treasurer, Mr. W. Lacon Threlford, will be glad to answer any inquiries and accept monetary assistance at 120, London Wall, London, E.C., the headquarters of the Institute (*pro tem.*).

## PARLIAMENTARY.

### Birmingham Corporation Tramways.

On April 16th, a Select Committee of the House of Commons, presided over by Sir E. A. Cornwall, commenced the consideration of the Bill of the Birmingham Corporation, which provides for considerable extensions of the tramway system.

Mr. Balfour Browne, K.C., Mr. H. Lloyd, K.C., and Mr. Jeeves appeared for the Corporation; Mr. C. C. Hutchinson, K.C., and Mr. H. H. Joy represented frontagers and property owners in Edgbaston and Harborne; Mr. G. J. Talbot, K.C., Mr. L. Maccassey, and Mr. A. Mains were for the London and North-Western Railway Co., and there were other petitioners not represented by counsel.

MR. LLOYD, K.C., opened the case, and said that both in 1901 and 1907 the Corporation promoted tramways for Harborne and failed. The proposal now was to construct a tramway along the Hagley Road to Harborne. This was a different route from that proposed before. It was a road along which there was a great deal of traffic, and a five minutes' service of three-horse omnibuses. At present people could get to the city by train, but the service was not frequent and was unpunctual. There was a distinct demand for tramways along the route, and there could be no doubt it would be a financial success. Fifty years ago Harborne was a quiet rural district, but there was now a population of 14,000, and it was increasing rapidly. With regard to Edgbaston, the question to consider was whether the ultimate good of the whole district did not require that tramways should be constructed.

MR. ALDERMAN BEALE, chairman of the Works Sub-Committee of the Tramways Committee, gave evidence as to the proposed Harborne route, and said the Corporation had for several years had pressure put on them to make a tramway along the Hagley Road. He did not think the road would be depreciated by the tramways, and it was a very noisy road now.

In cross-examination, WITNESS said the situation had altered considerably since 1907 by the annexation of Quinton, which was undeveloped. The question must arise whether the tramways should go there and create development, or whether it should wait until there was a development for tramways. His opinion was that they would have to develop Quinton by a possibly unremunerative tramway.

Answering the CHAIRMAN, WITNESS said that the Town Planning Committee and the Tramways Committee were working together with regard to the tramway scheme.

MR. ALFRED BAKER, general manager of the Corporation tramways, said the length of the system at present was 102 miles, and there were 460 electric cars in daily service. The capital invested represented nearly £2,000,000. Last year 85 million passengers were carried. As, however, two further important lines were taken over by the Corporation in June last, it was probable that during the current year 135,000,000 passengers would be carried. The fares in Birmingham were probably cheaper than in any other town in the United Kingdom, the average being 2½ miles for a 1d. After paying expenses and setting aside a considerable amount for reserve contingencies and depreciation, the Tramways Committee paid over £41,103 last year in relief of rates. He considered the Hagley Road an ideal one for tramways, and believed no loss would result from the working of the proposed tramway. He estimated that the Hagley Road route would produce a revenue of £9,247 a mile, and it would be a considerable relief to the Dudley Road tramways. The Harborne route would not be so valuable, but he thought the traffic carried would be sufficient to make it pay and leave a surplus.

Answering a member of the Committee, WITNESS said he did not think motor buses would live side by side with tramways in Birmingham, for the tramway fares were very much cheaper than the motor buses could adopt on account of their heavier expenses.

Replying to the CHAIRMAN, WITNESS said he did not believe the opposition to the tramways came from Harborne at all, but from the people at Edgbaston, who did not want the tramways to go through their district. They could not go to Harborne without going through Edgbaston.

A number of witnesses were called, resident in the districts proposed to be served, in favour of the scheme.

MR. H. E. STILGOE, the city surveyor, who had prepared the estimates and plans for the proposed tramways, said the roads were suitable as regarded gradients and widths. Some widenings and street improvements would be carried out, and the tramways account would be debited with half the cost.

In cross-examination, WITNESS said the cost of the tramways on the Hagley Road would be £34,532, which amount included street works, tramways, and land, but it did not include the cost of cars and a proportion of the depot. On the Harborne route the cost would be £77,643, including street works, tramways, and land, but exclusive of the cost of cars, and a proportion of the depot.

MR. JOY addressed the Committee for the opponents resident in Harborne, and asked that the tramways should be stayed until the proposed town planning scheme for Harborne and Quinton had become an accomplished fact. He protested against the picturesqueness of old Harborne being destroyed by trolley poles and wires.

On Friday, April 19th, the Committee deliberated in private, and the CHAIRMAN subsequently announced that the Committee felt that the matter under discussion was a very limited proposition. Subject to what the opponents might say, the Committee were of opinion that better means of access to the centre and other parts of the city should be provided for the Harborne and Quinton residents, but in view of the proposal to make the Hagley Road route (which they were disposed to accede to), and in view also of



the town planning scheme under consideration, the Committee considered that tramways 3 to 9, which comprise the route from Chad Road through to Harborne should be struck out of the Bill.

MR. BALFOUR BROWNE, K.C., acquiesced on behalf of the Corporation in the Committee's decision, and Mr. Hutchinson, on behalf of the Edgbaston residents, and Mr. MACASSEY, on behalf of the London and North-Western Railway Co., intimated that they would defer their opposition to the Hagley Road route till the Bill was before the House of Lords Committee.

The clauses were then adjusted, and the Bill was ordered to be reported for third reading.

## LEGAL.

### OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

ON Monday, April 22nd, Mr. Justice Warrington, in the Chancery Division, commenced the hearing of this action. Plaintiffs are the registered legal owners of letters patent 23,899 of November 4th, 1904, for improvements relating to the manufacture of incandescent electric lamps granted to Dr. Alexander Just and Franz Hanaman; also letters patent 18,622 of August 20th, 1906, for an improved method of producing metallic incandescence bodies for electric glow lamps, granted to Philip Middleton Justice; also letters patent 8,563 of August 30th, 1906, for an improved process for the manufacture of metallic illuminating bodies adapted for electric incandescence lamps granted to the Deutsche Gasglühlicht Aktiengesellschaft. The defendants, it was alleged, had infringed and threatened to infringe the said letters patent, and plaintiffs asked for an injunction restraining the defendants, their agents, or workmen from so infringing, or offering for sale in this country any of the lamps complained of; damages or accounts of profits and delivery up of all infringing articles.

Mr. Astbury, K.C., and Mr. A. J. Walter, K.C., Mr. Colefax, Mr. Gray and Mr. Lunge for the plaintiffs; Mr. T. Terrell, K.C., Mr. Frost and Mr. Swann for the defendants.

MR. ASTBURY, in opening the case, said the action related to three letters patent connected with the production of those metal-filament lamps which had taken the place of the old carbon lamps. The first two patents, Nos. 23,899 of 1904 and 18,622 of 1906, dealt with certain chemical arrangements as to the production of the filaments and the other patent No. 8,563 of 1906, referred to the physical method of producing the best kind of filament. Dealing with the first two patents, COUNSEL went through them at considerable length and in great technical detail. He pointed out that the lamps manufactured by plaintiffs were absolutely supreme, and it was only natural there should be a fight about them. These patents were the result of the labours of chemists of considerable repute, Dr. Alexander Just, Mr. Franz Hanaman and Philip Middleton Justice, and had regard to the incandescing of electric lamps—an incandescent body composed of tungsten. This metal had been applied to carbon filaments in the form of a coating with the object of preventing the disintegration of the carbon. The invention was the selection of this common tungsten metal with all its difficulties, which people thought could not be surmounted, and its direction to subject that metal to a treatment which in part was known from other bodies and part was unknown, but, as a whole, it was the selection of tungsten with the particular mode of decarbonising it. It was necessary in the making of a perfect filament, to get the carbon in the filament and then get it out again. If the carbon was left in the finished filament, then the filament would disintegrate, and would not be of any use. It was absolutely essential to get the carbon out of the completed filament. It was previously got rid of in various ways, but what was done in one would not do in another. In the process of getting the carbon out, it had to be done in such a way as not to oxidise the tungsten, which was like iron and would rust very easily. This seemed a difficult thing to do, but hydrogen was the protective atmosphere for tungsten or other oxidisable metal. What the plaintiffs claimed here was incandescing bodies for incandescent electric lamps consisting of tungsten. That meant incandescent bodies for incandescent electric lamps, viz., filaments consisting of tungsten, which were made not by trying to get carbon with tungsten and not by trying to substitute any other body or metal, but those which were manufactured in this particular process in accordance with claim one of the first patent. In regard to the second patent, that claimed the process for chemically removing the carbon. In this particular case, counsel submitted, the defendants had infringed absolutely, because they utilised steam and hydrogen as described in the specification. The first claim was, therefore, for the filament which had to be made by a building-up process, as distinguished from any one of the other processes. The words "substantially and in the manner described" in the claim enabled one, when the question of infringement was come to, to say what departure, if any, had been made, and whether it was one of substance or not. There was no doubt as to infringement, as plaintiffs obtained from defendants some filaments—fine ones—about two dozen, for lamps that were an infringement of the plaintiffs' lamps, together with an admission that defendants were making similar lamps for sale in this country. Defendants made lamps of all sorts and sizes, and plaintiffs alleged that they infringed by all of them. It was at first difficult to detect the infringement with the lamps in question, as they had such very delicate filaments, and plaintiffs

endeavoured to secure some thick ones, but defendants refused to supply them. It might be necessary even now to have to ask his Lordship for an order at some stage of the proceedings to allow the plaintiffs to inspect the thick ones.

MR. ASTBURY here handed up to his Lordship one of the lamps in question and said his Lordship would see by placing some white paper at the back, that the filament could just be perceived. From that his Lordship would appreciate how difficult it was for plaintiffs to ascertain how far defendants had infringed. Describing the defendants' process, counsel said what defendants did was this—they took the filament when it came out from being carbonised and treated it in a jar and put it in a protective hydrogen atmosphere. There were no steps taken to avoid the natural moisture of the jar, and the moisture could be seen during the process. That process lasted for a certain number of seconds, and during that time they did precisely and in terms what was described in plaintiffs' patent—they subjected it to a current in an atmosphere of steam and hydrogen and then raised it to a high temperature, and by that process it was oxidised. Prior to mounting it in the globe, they painted phospham and phosphorous on to the stem and then attached the globe to a vacuum pump, and during the first two minutes they subjected the outside of the glass to a baking temperature of about 300° C., which was just under the softening point of glass. That was done to get rid of any oxygen in the bulb—the presence of phosphorous assisting that process. They then turned on the current and kept the filament at a red glow, at which the temperature was somewhere between 600° and 800°, and that was kept up for about 10 minutes. That rendered it definitely impossible for any trace of oxygen to be left. They then put on a strong current, bringing it up to about 2,000°, which was kept going for about 20 minutes, still using the pump. Plaintiffs said that during that 10 minutes, and certainly during the 20 minutes, there was, in fact, a reduction of the carbon in the filament. There was, however, still '02 of carbon still in the filament, instead of '08 when the lamp was completely finished. During the last 20 minutes of the process, defendants could not say there was no carbon to act upon. Why did so many eminent men worry about other various metals in endeavouring to arrive at the results plaintiffs had obtained with tungsten? The reason was because it never occurred to any of them.

HIS LORDSHIP: It was only by experiments that you could find that a metal would do what you wanted it to.

MR. ASTBURY continuing, said with regard to the third patent, it was necessary to appreciate certain chemical facts to understand it properly. This patent was to do a thing that if one did not know that it would do it, would be absolutely idiotic. The invention had altered the whole trade in metal filaments, and plaintiffs were turning out lamps with these filaments at the rate of hundreds of thousands per week. By the invention, it was possible to get a metal filament to burn on a 200-volt circuit, and give a 16-c.p. light. It was only necessary to be told that nature would allow this thing to be done. The invention was to put a weight on the filament before the decarbonisation was begun, and it would go through that operation. It was possible to put a weight on heavy enough to make them go to an acute angle, and still it did not pull them apart—and the maker got no wasters at all. They were dead straight and had a perfect point, so that it was possible to cut them with perfect precision, so that all the lamps could be standardised. In this case infringement was admitted. The only contest here was that defendants said there was no subject matter, because plaintiffs put a weight on for a purpose at a different period. For years, said counsel, after the metal-filament making was started, and before this patent was brought out, plaintiff used to do that operation without a weight, and lost enormously through it.

MR. TERRELL said infringement was admitted in this sense. The lamps that they had alleged in the particulars of breaches were operated on by weights. Before the issue of the writ, the weights were abandoned and never had been used since.

HIS LORDSHIP: That means that you admit that you did infringe.

MR. TERRELL: Yes, that we did infringe the patent in the lamps that are complained of in this action.

HIS LORDSHIP: That means that there was an infringement of the patent, but at the date of the issue of the writ you were not threatening and intending to infringe.

MR. TERRELL: As a matter of fact, we do admit infringement because we did put the weights on the lamps. But since that we have abandoned it, and before the issue of the writ. On that statement, we are guilty of infringement.

MR. ASTBURY: I cannot accept that statement for the purposes of this case, because the writ is dated June 30th, 1911, and on January 19th, 1912, there was an admission by counsel for the defendants in Court, on which plaintiffs did not get any further order, that defendants had infringed.

HIS LORDSHIP: I will hear Mr. Terrell on the point, but *prima facie* it would seem you were entitled to an injunction if the patent is right.

(To be continued.)

**Correction.**—With reference to the case of *Webb v. Booker*, reported on page 619 of our last issue, two errors unfortunately crept in. It was stated that Mr. Booker was manager of J. & H. GREVENER, Eldon House, Eldon Street, E.C. We learn that Mr. Booker is an engineer in one of the firm's departments, and not manager. Furthermore, their present address is not Eldon Street, but 40, Southwark Street, S.E.



## THE "IDEAL HOME" EXHIBITION.

THOSE who have not already paid a visit to this beautiful show at Olympia, ought not to let the opportunity slip—it remains open until the 30th inst., and is certainly one of the prettiest and daintiest displays we have seen. It is also extremely popular, and it appeals to the very class of people that the electrical contractor and the supply station manager want to get hold of. It is all the more regrettable, therefore, that so meagre a display of electrical apparatus is on view, and that the opportunity was not seized by the Publicity Committee and its allies, to repeat the success attained last month at the Agricultural Hall. Indeed, we say without hesitation that it would have been far better for their joint exhibit to be at the Ideal Home Exhibition than at the Smoke Abatement Exhibition—if a choice had to be made; but best of all, to be at both.

We learnt from the few electrical exhibitors that they had done very satisfactory business, and the fact that to one petrol-electric country house lighting set, no fewer than seven "sold" tickets were attached, speaks for itself. We trust that the lesson will not be thrown away, and that next year, or whenever the Ideal Home Exhibition recurs, the electrical industry will be present in strength.

Of the electrical exhibits, precedence must be given to the stand of Messrs. Duncan Watson & Co., the only one, we believe, which gives a comprehensive display of the leading features of electricity as applied to domestic purposes. Besides a complete electric lighting plant for a country house, and a smaller one for lighting a cottage or bungalow, the company show a variety of tasteful fittings of their own design and manufacture, their electric vacuum cleaners, radiators and cooking appliances—the last in charge of a skilled lady cook, who appears to be indefatigable and enthusiastic in demonstrating the excellencies of electric cooking. A special display is also made of "Stannos" wiring, which the company are using extensively, and with very satisfactory results. Our congratulations and thanks are due to Mr. Duncan Watson for upholding the honour of the electrical industry.

But several other firms have excellent, though less comprehensive, exhibits. Messrs. Tredegar & Co. also show a country-house lighting plant, and their surface wiring system, in which Stannos wire is employed, and a variety of their own wood and metal electric lighting fittings. Messrs. Elkington & Co., Ltd., show their beautiful plate, and the Galvanit Manufacturing Co. and the Silver Replating Powder Co. their home replating processes. Vacuum cleaners are legion; electrical cleaners are shown by the British Vacuum Cleaner Co., Ltd., the Imperial Electric Co., Ltd., the Wizard Dust Extractor Co., Ltd., Daisy Vacuum Cleaners, and last but not least, Magic Appliances, Ltd., who as usual have a special attraction, in the form of a negro in white uniform manipulating their suction cleaners.

The Harvey Electro-Chemical Co., Ltd., show their process for electroplating china and glass ware, which we recently described.

The Perfectophone, Ltd., show a gramophone with an automatic electric stopping device, to prevent over-running and consequent injury to the instrument.

Messrs. Hammond & Champness, Ltd., have an electric lift conveying passengers to the gallery, and electric service lifts. Demonstrations of electric cooking are given by Messrs. Frank Staines and Co., Ltd., and Ozonair, Ltd., show their ozone generators in operation. Electric lighting apparatus and fittings are included in the exhibit of Messrs. Strode & Co., and the Foster Engineering Co. show their metal-filament lamps. Messrs. Edmundson's Electricity Corporation, Ltd., and Messrs. R. A. Lister & Co., Ltd., have automatic electric lighting plant for country houses, &c., the latter having several "Lister-Bruston" sets in operation, one of which is labelled sold to Mr. H. H. Asquith, while another—not working—is of 10 H.P., and is suitable for bioscope shows.

The Dowsing Radiant Heat Co., Ltd., exhibit a variety of their radiators, electric light baths, &c. In the Dutch Village Messrs. E. C. Sparkes & Co. show the Stokvis electric fittings. The effect of high-frequency electric oscillations on the growth of chickens is demonstrated at a chicken farming stall, by the *Daily Mirror*.

In the British Furniture Section electric fittings are shown by Messrs. Charles Spooner, J. Brandt and A. Romney Green.

The whole of the electrical fittings for the "Ideal House" itself, the dominating feature of the Exhibition, were supplied by Messrs. F. & C. Osler, Ltd.—for, of course, the ideal house must be lighted with electricity—and a Lister-Bruston generating plant supplies the necessary current, this being mounted on a layer of "Korfund" to prevent vibration. Messrs. John Barker & Co., Ltd., were the contractors for the furnishing and decoration, including the electrical installation.

While we have thus touched upon the electrical features of the Exhibition, we should point out that gas lighting, cooking and heating apparatus are extremely well represented; automatic installations for country houses are prominently shown, and it must be admitted that, in spite of the difficulties and drawbacks inherent to the use of gas in any form, our rivals make a very interesting display. All the more reason, therefore, for us to see to it that our industry is more adequately represented on the next occasion.

It is interesting, and somewhat amusing, to note that for the "Seal'ed gas oven" which is exhibited the makers claim all the advantages claimed for electricity, and notably "*minimum of wastage of food cooked—saving upon ordinary system.*" Comment, in the stock phrase, is superfluous.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Rectifier for Converting A.C. to D.C.

A simple and ingenious device for converting alternating current to direct has been introduced, in the shape of "rectifying nets," by MESSRS. C. SCHNIEWINDT, of Neuenrade, Westphalia, Germany. These nets are placed in glass jars filled with water, in each of which is placed a small quantity of bicarbonate of soda, which are afterwards connected up like cells. The special nets are composed of iron and aluminium wires woven with asbestos, as shown in fig. 1. Only that current impulse of an alternating current up to 100 volts will be transmitted, for which the iron wires are the

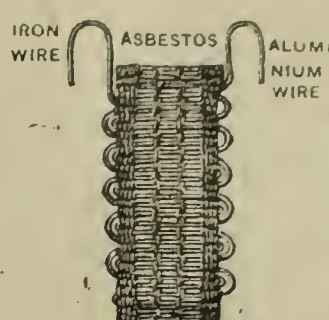


FIG. 1.—SCHNIEWINDT "RECTIFYING NETS."

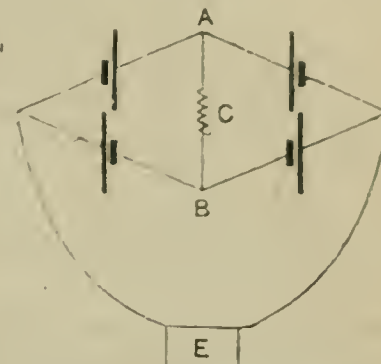


FIG. 2.—CONNECTIONS TO GIVE CONTINUOUS CURRENT.

positive electrodes, so that half of the rectified alternating current is obtained in the circuit as direct current. By connecting the cells as in the diagram, fig. 2, in which the short dashes represent the aluminium wires, and the long dashes the iron electrodes, it is possible to obtain between the points A and B a direct current of 75 per cent. efficiency, the heating of the electrolyte accounting for the deficiency; E represents the source of supply, and C the consuming circuit. These "rectifying nets" can be used for converting A.C. to D.C., in connection with the charging of accumulators, and for numerous other purposes.

### Rhadoonit.

We have received from MR. CHARLES A. MÜLLER, of 10, Arcade, Westgate, Bradford, a sample of "Rhadoonit," a new insulating material which he is introducing into this country. It is a hard black material, but we are informed that it is easily worked, fire-proof, absolutely non-hygrosopic, and does not warp; it has a very high insulation resistance. Tests made at the P.-T. Reichsanstalt, Charlottenburg, with plates of Rhadoonit 23 mm. thick, at 10,000 volts, showed an insulation resistance of 1 million megohms in the dry state, and 800,000 megohms after immersion in water for 24 hours; there was no appreciable increase in the weight of the plates after immersion, and they were not pierced with a pressure of 36,000 volts (the highest available) applied for half an hour, before and after immersion in water.

One of its principal uses is as a substitute for marble and slate, as base plates for electrical apparatus, &c., it being made in slabs from 10 to 40 mm. thick, of any size up to 3 ft. 6 in. x 5 ft. It resembles enamelled slate, and takes a high polish.

Amongst other users in this country is the Bradford Corporation Electricity Department.

### Witton-Kramer Electro-Magnetic Clutches.

The accompanying illustration, fig. 3, shows a magnetic clutch, manufactured by the WITTON-KRAMER TOOL AND HOIST CO., for whom the General Electric Co., Ltd., act as sole selling agents; it consists of a thick disk of high permeability steel, keyed to the main shaft, carrying pole pieces to which the magnetic coils are fitted. The ends of the coils are connected to suitable slip-rings to which the current is conveyed by means of brushes. A sheet-iron cover is

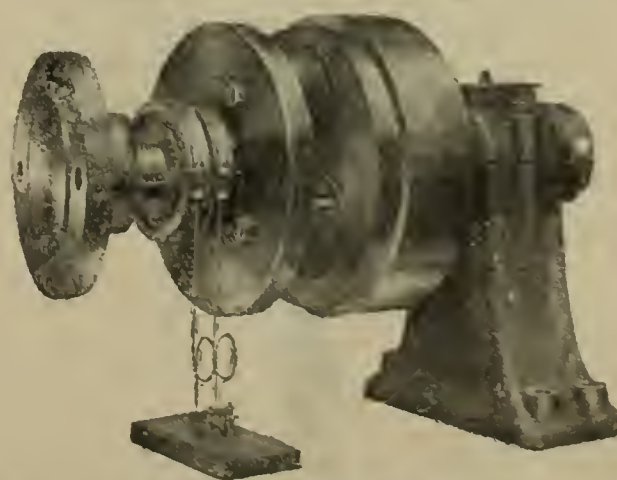


FIG. 3.—WITTON-KRAMER ELECTRIC CLUTCH.

provided to protect the coils from external injury (this cover being removed in the illustration to show the coils). To the pulley or driven shaft a soft wrought-iron disk is fitted, and when the



magnet coils are excited this disk is attracted to the pole shoe and thus caused to rotate with the main portion of the clutch. In this design the power consumption does not average more than about 3 watts per H.P. transmitted, and is an almost negligible item. The clutches are made in varying sizes to transmit from  $\frac{1}{2}$  H.P. up to 1,000 H.P. They are wound for continuous current only.

#### Combined Cord-Pull Switch and Ceiling Rose.

MESSRS. A. P. LUNDBERG & SONS, of 477 to 487, Liverpool Road, Islington, N., inform us that they have had a combined ceiling rose and pull switch on the market for about six months.

Fig. 4 shows one use of this accessory. The flex comes through an insulation-bushed hole in the cover, the latter being fixed by the

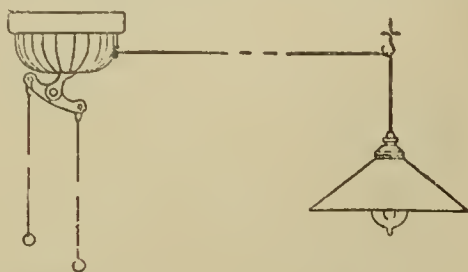


FIG. 4.—COMBINED CEILING ROSE-SWITCH WITH LAMP.

makers' patent locking-ring method. Fig. 5 shows the interior of the combined switch and rose; right in front are the holed projections on the porcelain base through which the flex is threaded. The switch in this case is for hand manipulation, the feed wire coming from below, and the flex would run up the wall therefrom.

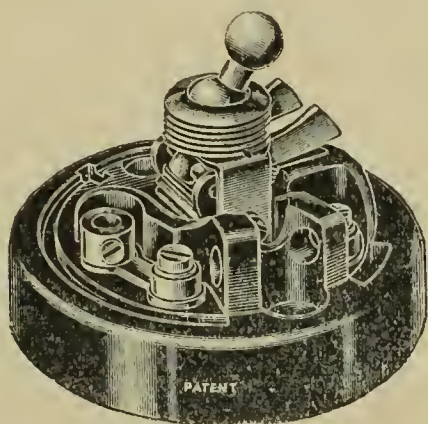


FIG. 5.—COMBINED SWITCH-ROSE FOR WALL FIXING.

Messrs. Lundberg now have in hand, to meet the demand, a special pattern having a groove in the base, to enable the combination to be used with twin-lead and similar surface wiring.

#### Loxley H.V. Patent Ceiling Rose.

An entirely new departure in ceiling roses has been marketed by MESSRS. LOXLEY & Co., Ltd., Basinghall Street, Leeds. As shown in fig. 6, the brass parts of the rose are completely sunk in the china

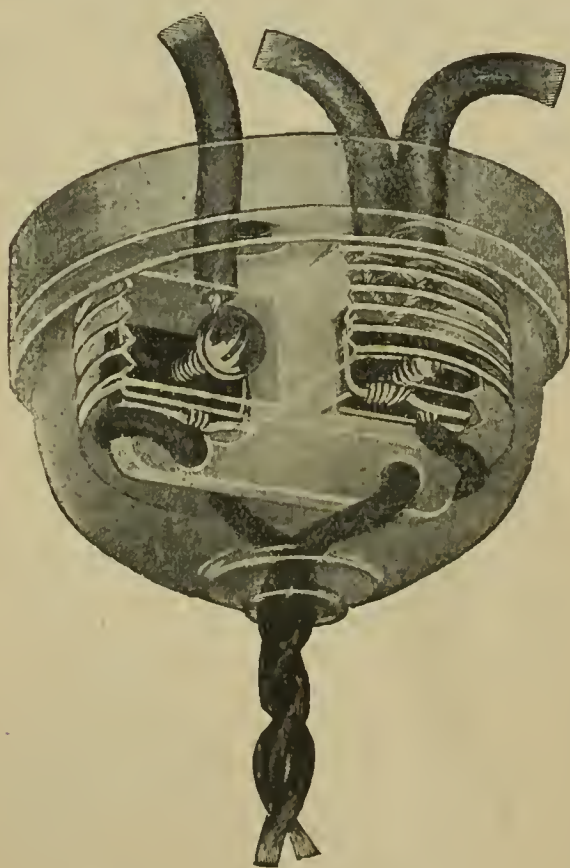


FIG. 6.—LOXLEY CEILING ROSE.

base. The terminal consists of two upright plates clamped together by a long screw and washer, passing through the china. One plate is thick and one thin, so as to form a close springy contact. The cable and flexible are clamped into the same clip. The ceiling rose,

in fact, consists of two pairs of plates, two screws, a china cover, and body. It is entirely English made, and is suitable for high-voltage work, as all metal parts are well sunk. It has no metal parts on the back, no dumb-bell plates, pillar contacts or weak flexible connections.

Under actual test this ceiling rose has supported a load of 56 lb. hung from the flexible, whereas an ordinary ceiling rose tested under similar conditions failed to support a load of 21 lb. We have verified the fact that main force is required to tear the flexible out of the rose.

The makers claim that it is quicker, easier and cheaper to fix than the ordinary ceiling rose, and its size,  $2\frac{1}{8}$  in. diameter  $\times$   $1\frac{1}{8}$  in. high, makes it a neat and small ceiling fitting, which can be placed on a  $2\frac{1}{2}$  in. block. It costs no more than the ordinary English ceiling rose.

#### Electric Reflector Stove.

MESSRS. F. A. WILKINSON & PARTNERS, LTD., of Harpenden, Herts., have brought out a combined Reflector stove, toaster and radiator, shown in fig. 7. The apparatus is made in polished aluminium throughout, and consists of a reflector fitted with an expanded steel top and clip ring. The heating element is similar



FIG. 7.—ELECTRIC REFLECTOR STOVE.

in appearance and size to an ordinary incandescent lamp, but is fitted with pins for connecting to a plug base within the reflector casing, thus being instantly removable. The apparatus forms a quick boiler, a rapid toaster and an artistic radiator. The heating element is made for any standard voltage, the consumption being 700 watts working at bright red heat. Ordinary household utensils are used.

## BUSINESS NOTES.

**Electric Clocks.**—The following are some electric clock installations which MESSRS. GENT & CO., LTD., of Leicester, have in hand:—

India Office.—Thirty inside clocks, and one two-faced turret clock with 4-ft. dials.

Hartlepool Customs House, for N.E. Railway.—One four-faced turret clock, with waiting train movements, and a large number of indoor clocks.

New Locomotive Offices, Darlington, for N.E. Railway.—Fifty indoor clocks.

David Colville & Son, Ltd., per Edward & Son, Glasgow.—One four-faced turret clock, with waiting train movements, and a number of indoor clocks.

Torquay Town Hall.—One four-faced turret clock with waiting train movements, 5 ft. 6 in. dials, and a number of ornamental indoor clocks.

Blackburn Police and Sessions Court, per T. Burton & Co., Blackburn.—Transmitter, controlled from Greenwich, and a number of indoor clocks.

Pretoria Railway Station, S.A.

Cavendish High School for Girls, per W. R. Saunders, Buxton, for the Derbyshire Education Committee.

Sir David Salomons, Bart.—Prime transmitter, and a number of sub-control transmitters.

Canadian Pavilion, Festival of Empire.—Turret clock, with four 5-ft. dials.

Glamorgan County Hall, per Ellis & Ward, Cardiff.—One transmitter with 21 clocks.

Cadbury Bros.—Repeat orders.

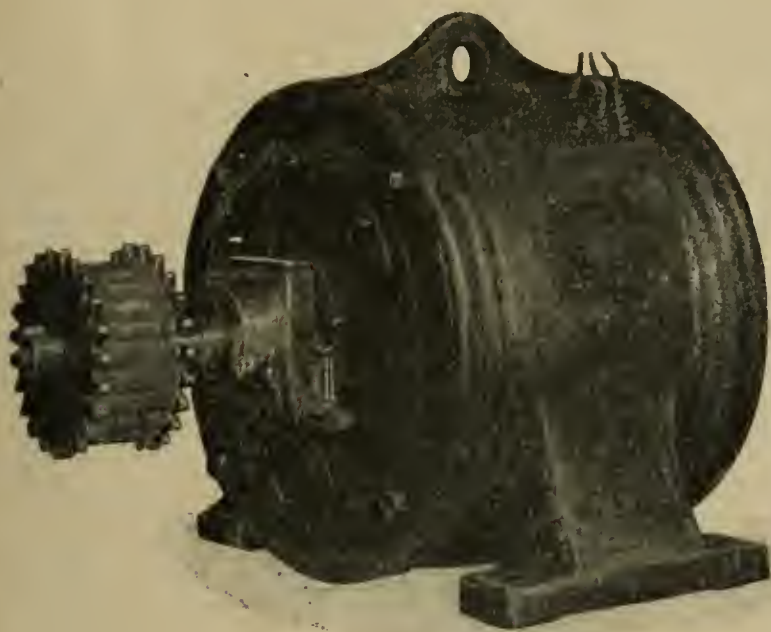
Dun Echt House, Aberdeenshire.—Illuminated turret clock, and several house clocks, per the Aberdeenshire Electrical Engineering Co., Ltd., Aberdeen.

**Advances in Prices.**—MESSRS. MAVOR & COULSON, LTD., of Glasgow, announce that, owing to the increase in the cost of raw materials, selling prices are increased from April 15th by a reduction of the discounts on their price lists for generators and motors by 10 per cent.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., announce that, owing to the continued serious rise in the price of all classes of raw material, they are obliged, as from April 22nd, to raise prices of wires, cables, insulators, ironwork and medical coils by 10 per cent. This advance includes the items excluded from the firm's notice published in our issue of March 29th, and the 10 per cent. advance will now apply to the whole of the Bell Section of their catalogue (items listed under "S").



**A Tough Motor.**—MESSRS. T. W. BROADBENT, LTD., of Huddersfield, who attach some importance to the robustness of design and construction—electrically, in particular—of their "N" type three-phase motors, have sent us an instance of the way in which these motors will stand up to their work under conditions of abnormal overload. A 15-H.P. "N" type motor running at 955 R.P.M. and working on a three-phase 400-volt, 50-cycle circuit, was employed for driving some pumping machinery through a raw-hide pinion. The pinion was  $7\frac{1}{2}$  in. pitch diameter by 4 in. wide over flanges. For some reason the pump must have jammed or one of its bearings seized, but, as is often the case in practice, the fuses were heavily wired, and the motor evidently continued to run for some little time after this occurrence, before its load became sufficient to cause the circuit breaker on the switchboard to throw out. The condition of the motor when taken for repair is shown in the illustration, and is evidence that it had been working against an overload that would probably have injured the stator windings and insulation, and the rotor connections of any motor not constructed on very substantial lines. The shaft was badly twisted and bent, and the



A TOUGH MOTOR.

teeth of the pinion had been completely stripped off, only the teeth on the gun-metal flanges remaining. The spur wheel into which the pinion was geared appears to have fouled the outer flange of the pinion and the rotor shaft had been forcibly drawn in the direction of the pump. This forced the driving end bearing bush of the motor outwards, the bush being badly ploughed up by the set-pin, which had held it in position. Notwithstanding the abnormally heavy overload that must have been put on the motor, the stator and rotor windings were wholly uninjured by the accident. The insulation resistance of the stator winding was found to be four megohms, and a pressure of 1,000 volts alternating was then applied between the windings and frame of the motor. After the rotor shaft had been straightened and a new bush fitted to the driving end bearing, the motor was tested, and returned to its owner; and it is now running as usual. No repair of any kind was made to either the stator or rotor windings. This, Messrs. Broadbent say, serves to support their claim that their "N" type three-phase motors are practically indestructible even under extraordinary working conditions.

**Catalogues and Lists.**—THE BRITISH L.M. ERICSSON MANUFACTURING CO., LTD., Byron House, 82, 85, Fleet Street, London, E.C.—We have received the A. C. section (about 100 pages) of the firm's new catalogue of telephone instruments. Excellent half-tone blocks, brief descriptive notes, weights, dimensions, and code-words, are given of the following lines:—Section A (1) magneto telephones:—Wall instruments (ordinary and mine telephones; telephone with special protection against H.T. currents; telephone and sounder combined, for use on telegraph lines; automatic call-boxes; meter; telephone and automatic call-box combined). (2) Table telephones (ordinary telephones; extension telephone without generator or bell; intermediate wall telephones; intermediate table telephones; extension switches with chart). Section B, battery ringing telephones:—Wall and table types; wall telephones for railway work; extension switches. Section C, common battery telephones:—Wall and table types; intermediate and sub-station telephones; extension switches. Accompanying the section is a separate eight-page price list, very clearly setting out the prices for the above-named instruments.

MESSRS. BALCKE & CO., LTD., Broadway Court, Broadway, London, S.W.—New 20-page catalogue (No. 303) containing full information, accompanied with numerous illustrations, regarding their "Unic" steam traps which are built on new principles. A table of prices and dimensions is included.

ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT, Berlin.—Pamphlets describing electrical point-shifting devices, and the 400-H.P. "Abraum" locomotive of the A.E.G.

MR. CHAS. E. MILLER, 97-103, Reade Street, New York.—256-page catalogue (No. 22 of 1912) giving illustrated particulars, with prices, of supplies for automobiles, motor boats and cycles and motor planes.

THE FOSTER ENGINEERING CO., LTD., Wimbledon.—Leaflet giving some particulars of the Foster electric geyser for alternating current. It is supplied in "small" and "bath" sizes respectively. In the smaller one two pints of water can be raised per minute from 55° to 110° F. The water-containing vessel is of solid copper, and all insulation is by the Foster special fire-proofing process. The switch plug at top is mounted on a polished hardwood base. Prices are stated.

THE CRYPTO ELECTRICAL CO., 149 and 159, Bermondsey Street, London, S.E.—Lists with brief specification and prices of the following:—Crypto small transformers; combined motor-generator; new pattern combined A.C. to C.C. transformer; standard pattern A.C. to C.C. transformers for battery charging and cinematograph arc lamp lighting.

THE CARRON CO., Carron, Stirlingshire.—A very attractive and effective showcard (19 in. × 14 in.) has been issued, showing the Carron electric cooking range and the satisfaction of the cook therewith.

MESSRS. HAES & EGGERS, LTD., 163, Clarence Street, Sydney, N.S.W.—This firm has favoured us, as in recent years, with one of its desk blotting pads with right hand diary. The latter is interleaved with blotting, and the opening pages contain illustrated information respecting the manufactures of firms for whom Messrs. Haes & Eggers, Ltd., hold Australian agencies.

MESSRS. BERRY, SKINNER & CO., 78, Upper Thames Street, London, E.C.—Leaflet relating to electric driving in textile factories showing a cotton-doubling mill driven by 60 Wright & Wood three-phase squirrel-cage motors.

ALLGEMEINE ELEKTRICITÄTS GESELLSCHAFT.—Pamphlets on the cost of electrical work in agriculture, on electric ploughs, and on pumps for liquid manure.

MR. C. SCHNIEWINDT, Neuenrade, Westphalia.—Leaflet relating to "Cord" resistances for electric heating elements.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Mailing Card No. 184, gives particulars of the firm's new flexible desk standard.

**Liquidations.**—THE STASSANO ELECTRO STEEL AND FURNACE CO., LTD.—This company is winding-up voluntarily, with Mr. Augustus Hobbs, 4, Sotheby Road, Highbury, as liquidator.

WINCHESTER ELECTRIC LIGHT AND POWER CO., LTD.—A meeting is to be held at Broad Sanctuary Chambers, Tothill Street, Westminster, on June 5th, to hear an account of the winding-up from the liquidators.

**The Proposed Aluminium Syndicate.**—It is announced from Paris that the representatives of the French, Swiss, English, and American makers of aluminium met recently in that city to further discuss the question of reviving the International Syndicate which collapsed in October, 1908. An agreement in principle was reached by the establishment of a basis for a new combination, and the negotiations are to be continued in June or July, when it is thought the syndicate will be brought into existence. The resumption of the negotiations last year has been followed by a hardening of prices, as the price in Germany in October last ranged from 54 marks to 57½ marks per cwt., whilst at present the rates are from 62½ marks to 66½ marks per cwt., according to quantity.

**Private Meeting.**—WILLIAM KIRTLEY and THOMAS OLIVER DUNFORD, trading as Kirtley & Dunford, electrical engineers, 14, Tower Street, West Hartlepool. The creditors of the above were called together recently when a statement of affairs was presented showing ranking liabilities of £466. The indebtedness to the trade was £333, and there were unsecured cash creditors for £134. There were fully secured cash creditors for £346, the charge held consisting of certain land and buildings at West Hartlepool. The National Provincial Bank were also creditors for £200, their security consisting of the deeds of a house. There was another fully-secured cash creditor for £46, who held certain furniture valued at a like amount. The assets were estimated to produce £211, less £23 for preference claims, leaving net assets of £188, or a deficiency of £278. After discussing the position a resolution was passed in favour of the estate being wound up under a deed of assignment with Mr. White, of West Hartlepool, as trustee. A Committee was also appointed, consisting of the representatives of Messrs. Hanson, Brown & Co., Ltd., Messrs. John Pounder, Ltd., and the General Electric Co., Ltd.

**Meeting of Creditors.**—THE BRADFORD ELECTRICAL CO., LTD.—At the statutory meeting of creditors, held at the offices of Mr. J. H. Haley, incorporated accountant, Bradford, last week, creditors representing £724, out of a total unsecured indebtedness of £796, were present. A statement of affairs showed assets amounting to £468. After deduction of £18 for preferential creditors' claims, a deficiency was shown as regards creditors of £347, the deficiency as regards shareholders being £612. Mr. Haley explained that the business was acquired from the old company in January, 1910, and that it had been unprofitable from the commencement. The total trading loss amounted to £328. The turnover had averaged about £2,500 per annum. The directors had not received any fees for their services. It had been decided that unsecured trade creditors should be paid their accounts subject to a special discount of 15 per cent., which had been accepted by many of them prior to the liquidation. The creditors in the liquidation also were to be paid an amount equivalent thereto, which meant that the shareholders, in addition to losing their share of the capital, would provide a sum approximating at least £300 to enable this to be done. The appointment of Mr. Haley as liquidator was confirmed.



**Book Notices.**—"Proceedings of the American Institute of Electrical Engineers." Vol. XXXI, No. 4. April, 1912. New York: The Institute. Price \$1.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 4. April, 1912. Philadelphia, Pa.: The Institute. Price 50 c.

"The School of Mines Quarterly." Vol. XXXIII, No. 3. April, 1912. New York: Columbia University. Price 50 c.

"Transactions of the Concrete Institute." Vol. IV, Part 1. March, 1912. London: The Institute.

"Central Station Heating." By Byron T. Gifford. 1912. New York: Heating and Ventilating Magazine Co.

"Bulletin of the Massachusetts Institute of Technology." 1912. Vol. XLVII, No. 2. Boston: The Institute.

"Post Office Electrical Engineers' Journal." Vol. V, Part 1. April, 1912. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Annales des Postes, Télégraphes et Téléphones." March, 1912. Paris: A. Dumas. Price 6 fr.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland." 1911-12. Glasgow: The Institution.

"Journal of the United States Artillery, with Index to Current Military Literature." Vol. 37, No. 2. March-April, 1912. Fort Monroe, Va.: Coast Artillery School Press.

"Studies in Terrestrial Magnetism." By C. Chree. 1912. London: Macmillan & Co. Price 5s. net.

MESSRS. S. RENTELL & CO., LTD., are now selling a new American text-book entitled "Telephony," by Messrs. Saml. G. McMeen and Kempster B. Miller, who are acquainted with the very latest developments in this branch of electrical science. It is published in this country at the price of 17s. net.

**Trade Announcements.**—MR. JOHN G. MACKINTOSH, electrical engineer, 1, North Street, David Street, Edinburgh, has purchased the business carried on by Messrs. D. T. Neil & Co., electrical contractors, 166, Great Junction Street, Leith. He will continue the latter business under the same name and at the same address.

MESSRS. S. BILL & CO., of Park Road, Hockley, Birmingham, have amalgamated with the Premier Cabinet Co., of Hunter's Vale, Hockley. Both businesses will, in future, be carried on under the style of S. Bill & Co., Ltd.

THE CORONA LAMP WORKS, LTD., Ascham Street, St. Pancras, London, N.W., have appointed Mr. Frederick S. Dinenage, of Birmingham, as their provincial representative. Mr. Dinenage has been associated for some years with the Edison & Swan United Electric Light Co., Ltd., and established the Ediswan Nottingham branch, prior to his appointment as Birmingham district superintendent and manager of the Birmingham depot of the Edison and Swan United Electric Light Co., Ltd., which he is relinquishing at the end of this month to take up his new position with the Corona Lamp Works, Ltd.

**Australia.**—H.M. Trade Commissioner for Australia reports that an electrical engineer who has had considerable experience in the electrical trade in Australia and New Zealand, is shortly visiting England with a view to obtaining the agencies of British manufacturers. Apply to Commercial Intelligence Branch of the Board of Trade.

**Bankruptcy Proceedings.**—The first meeting of creditors was held on Wednesday last week at the London Bankruptcy Court, under the failure of HENRY JOHN WRIGHT, 211, Upper Thames Street, London, E.C.—The debtor, who filed his own petition, was for some seven years before 1908, engaged as a salesman by Croggon & Co., Ltd. In August, 1909, he became manager of the Ferabin Lamp and Electrical Accessories Co., Ltd., of 118, Queen Victoria Street, E.C., and financed the same to the extent of £300, all of which he borrowed, being allotted shares to the same amount in the company. The chairman stated that the company only lasted 10 months; the debtor's shares were never of any value, and were now charged in favour of creditors. The debtor had been pressed for the balance of the money that he had borrowed on its behalf, and being unable to pay, he was advised to file his petition. At the present time he was engaged as a traveller, and he attributed his failure to his having borrowed money as before mentioned. A statement of affairs had been lodged showing liabilities £485, of which £305 were returned as expected to rank against the estate, and assets nil. The chairman added that no proposals for the payment of a composition had been lodged by the debtor, who had consented to an order of adjudication. The case was left in the hands of the Official Receiver.

## LIGHTING and POWER NOTES.

**Abercarn.**—The B. of T. has informed the U.D.C. that it has granted it a prov. order authorising the transfer of the undertaking to the South Wales Electrical Power Co.

**Accrington.**—Messrs. Higham Bros., a large firm of cotton manufacturers, have decided to equip their new shed at Woodnook on the individual-drive system—a separate electric motor to every loom. The new mill will be driven by 500 motors, and the

consumption will average nearly half a million units per annum. The majority of the looms are large and heavy, requiring extra large motors. The order for the motors has been given to the Scorch Electric Co.; this is stated to be the first undertaking of the kind in this part of Lancashire, but several firms in East Lancashire are experimenting with the individual-drive system.

**Ardsey.**—The B. of T. has granted a prov. order to the Electrical Distribution of Yorkshire, Ltd., for electric supply within the area of the Ardsley U.D.C.

**Argentina.**—The *Review of the River Plate* publishes the following list of cities and towns which have electric light stations, or in which concessions have been granted. It does not guarantee the list as correct. La Plata, Florencio Varela, C. de Patagones, Mercedes, Chivilcoy, Dolores, Pergamino, Necochea, Carmen de Areco, Lujan, Bahia Blanca, Punta Alta, San Fernando, General Alvear, Coronel Vidal, Campana, San Pedro, Zarate, San Nicolás, Moron, Junin, Chacabuco, Navarro, 25 de Mayo, Saladillo, Chascomus, General Belgrano, Las Flores, Dolores, Azul, Olavarría, La Madrid, Coronel Suarez, Pigué, Dorrego, Tres Arroyos, Mar del Plata, Balcarce, San Martín, Tandil, Ayacucho, Maipu, Pringles, Suipacha, Bragado, Avellaneda, Lomas, Trenque Lauquen, City of Buenos Ayres, Corrientes, Goya, Monte Caseros, Mercedes, Curuzú-Cuatí, Posadas, Paraná, Victoria, Concepcion, Concordia, Gualaguay, Gualaguaychu, Catamarca, Rioja, San Juan, San Luis, Villa Mercedes, Mendoza, Salta, Santiago del Estero, La Banda, Jujuy, Tucumán, Cordoba, Villa Maria, San Francisco, Bell Ville, Rufino, Santa Fe, Rosario, Coronda, Galvez, Refaela, Esperanza, Reconquista, San Carlos Centro.

The Rosario Electric Light Co. has just completed its new power station at Sorrento, one of the near suburbs of the town, and it is hoped to have it in thorough working order before long.

The Municipality of Trenque Lauquen has signed a contract with Mr. Breemana for the installation of electric light in that town.

**Barnsley.**—The borough electrical engineer has been authorised to purchase 50 metallic-filament lamp cluster fittings, 600-C.P. size, at an estimated cost of £125, and these will be substituted for 50 of the existing arc lamps in the borough.

**Bexhill.**—The Council has decided to purchase an electric commutator grinder from the Brush Co.

The question of holding a demonstration of electrical cooking and heating apparatus has been under the consideration of the Corporation. The matter has been referred to a Sub-Committee. It is proposed to hold the exhibition in June.

**Canada.**—A Bill has been introduced in the Provincial Legislature of Ontario, conferring on the Hydro-Electric Commission the following powers, amongst others:—To take over existing power transmission lines and to improve water powers, by assisting municipalities and others in the storage of water, making of sluices, &c. To regulate the installation of electrical equipment and of wires in all buildings, including private houses. To control absolutely light and power rates charged by municipalities, whether these municipalities take power from the Commission or not. To direct the disposal of surpluses earned by municipal power plants supplied by the Commission. To order all wires under its jurisdiction to be laid underground in cities and towns. With the co-operation of the Dominion Railway Commission to order to be laid underground all wires in streets where the municipalities construct tunnels or conduits to carry such wires.—*Board of Trade Journal*.

**Continental Notes.**—AUSTRIA.—The proprietors of large cotton mills at Tannwald, Bohemia, have decided to establish an electricity generating station near Steinhühle for the supply of the energy required for lighting and power purposes in the mills.

FRANCE.—The region of which the large city of Besançon is the centre is to be supplied with electricity from a hydro-electric station which is to be built on the River Loue. A society concerned with the utilisation and regulation of various rivers in the Département du Doubs is the promoter of the undertaking.—*Revue Pratique de l'Electricité*.

A company has lately been formed at Orleans with a capital of £180,000 and the title La Compagnie Electrique de l'Orleanais to supply electricity for lighting and power purposes in the Orleans district.

For the past three or four years the electricity supply of Paris has been in the hands of the Compagnie Parisienne de Distribution Electrique, familiarly known as the C.P.D.E. Commencing with January 1st, 1913, the scale of charges, which was lowered in 1908, will be further reduced, it being anticipated that the reduction will give an impetus to the demand for current. In view of this, the C.P.D.E. is at present engaged in entirely remodelling its system, nothing being overlooked in order to secure a modern organisation. A notable feature of the transformation work is that it is being effected almost without the existing consumers knowing it, there being no interruptions in the supply. One by one the old generating stations are disappearing, and by next year the whole of the current required in Paris will be supplied from two immense power stations—one of 75,900-KW. capacity at Saint Ouen, near the Seine, and another of 25,000-KW. capacity at Issy-les-Moulineaux.

HOLLAND.—Much activity is now being shown in the erection of generating stations in various parts of Holland. Among the towns concerned in such schemes are Zuidhorn and Ulrum, in the province of Groningen; Borger, in the province of Drenthe, and Achtkarsse, in Friesland. Electric lighting is also to be adopted along the high roads from Rotterdam to Overschie, and thence to Schiddam, a distance of about 8 km.



**PORTUGAL.**—A scheme for the establishment of a central electric lighting station in the town of Penafiel is at present under consideration.

**Dewsbury.**—The General Purposes Committee of the Corporation recommends that a new turbo-generator, &c., be purchased at an estimated cost of £10,000, and that application be made to the L.G.B. for sanction to borrow that sum, in addition to £4,500 for distribution and service cables.

**Falkirk.**—The engineer has reported as to the sum required to be borrowed for the extension of the electricity works, and it has been agreed to apply for authority to borrow £15,000.

**Golborne.**—The B. of T. has informed the U.D.C. that it has decided to forthwith revoke the E.L. order, 1905.

**Llandudno.**—The Lighting Committee of the U.D.C. has been requested to consider a scheme for lighting the proposed extension of the Promenade.

**London.**—**HAMPSTEAD.**—A local paper states that the B.C. has decided to negotiate with Mr. E. Sayer (late chief assistant engineer), with a view to settling his claim for three months' salary in lieu of notice. The Finance Committee, which has been considering the expenditure on converting 2,359 street lamps for electric lighting, has made certain recommendations with a view to obtaining effectual control over the expenditure of the electricity department in the future. The Committee has also recommended that in future the work of the department should be under the direction of four heads of departments, and suggests that a chief engineer and manager (£750 per annum, with bonus of 2 per cent. on net profits about £4,500) be advertised for; that Mr. Leadbeater be appointed station engineer (£380 per annum, and bonus of 1 per cent.); that Mr. Durley be appointed electricity accountant (at £220 per annum and two-thirds of 1 per cent. bonus) he to remain a member of the borough accountant's department; that a mains engineer be advertised for on the salary basis last mentioned; and that Mr. Fox be appointed commercial manager also on the last-mentioned salary basis. A special meeting of the Council to consider the above was to be held to-night.

**MARYLEBONE.**—The Electric Supply Committee reporting with regard to the advisability of continuing the Sales and Publicity Department on the present lines, states that the district auditor objected:—(a) To arrangements being made with only one contractor; and (b) to the particular method of dealing with the contractor's men; the department having, in the opinion of the auditor, been issuing its orders too much to the men direct and not enough through the contractor, at the same time he intimated that he would be perfectly satisfied by the adoption of a proposal made by the general manager, Mr. Seabrook, to the effect that each of the eight districts of the borough should be allocated to eight leading contractors in the borough, and in the event of there being more than eight contractors, the larger districts to be further divided, the arrangement, first of all, applying to all hire wiring work which would be sub-let entirely to contractors—both labour and materials, while the Council's district representative in charge of each district would be instructed to collaborate with the contractor who took each district, and the work done either on an agreed price or time and material basis. In order to meet the auditor's views, the Committee had been in correspondence with the Electrical Contractors' Association. At the last meeting held with the Association the following terms were suggested: (1) Wiring work to be offered to 25 selected contractors, distributed over the eight districts, to whom the work should be given in rotation; (2) the method of distribution to be agreed; (3) work to be done as a sub-contract for the department on terms to be agreed, possibly on the basis of a percentage on the cost of labour and materials; (4) the department to supply the materials at a scheduled rate, the contractors being paid the agreed percentage thereon as profit, but the latter having the option of obtaining such materials (being of equal quality) from any source, but would be paid at the same rate as though obtained from the department; (5) the department to be quite prepared (if desired) to pay weekly on account to within 20 per cent. of the work done, that the contractors would insure and as against third party risk; (6) contractors invited to bring their customers to the Council's showrooms to inspect fittings or apparatus, there to be no risk of the department intervening between the contractor and his customer; (7) facilities to be offered the contractors' men to attend meetings of the department's staff to be coached in business getting; (8) commission to be the same as paid to the department's representatives for getting consumers on the Telephone system. These terms, the Committee was under the impression, were approved of by the Association, but a reply had been received after it had further considered the matter, refusing to come to any working arrangement and reverting to the earlier position that the Sales Department should be closed down entirely. Notwithstanding the Association's decision, the Committee considered it expedient to pursue the original scheme, that it should be empowered to arrange with eight contractors to work on the lines put forward by Mr. Seabrook. The Committee, after going into the history of the Sales Department, states that the future development of the undertaking was very much dependent upon two things: (1) the increase in the sale of current for cooking and heating, and (2) the supplying of the poorer areas. It is quite obvious, the Committee continues, that the canvassing of the poorer districts for the small wiring jobs that have to be tackled, would not be worth the while of any contractor. With regard to heating and cooking—in the first place, the cost of getting the business in the early stages, and the knowledge of the business required, are

such that the ordinary contractor could not reasonably be expected to undertake it. Therefore, if the department was to continue to develop and to earn a net profit, and so be able to reduce the general price of current, it was, above all things, necessary that these two branches of the work should be undertaken thoroughly, and this could only be done through its own staff. Concluding, the Committee states that, notwithstanding that it has frequently been stated that the department never cut prices, the turnover had been quite considerable, and was now over £20,000 per annum (including hire and hire-purchase scheme). This in itself showed that the consumers appreciated the convenience of having a sales department to deal with, and that it filled a public want. Being of opinion that the successful management of the undertaking rendered it essential that the sales department should be continued, it recommended accordingly, subject to the modification as to the method of sub-contracting referred to. At the last Council meeting this matter was not reached.

**ST. PANCRAS.**—The Electricity Committee reports having considered a report from the chief electrical engineer in regard to the necessity of further extending the generating and transforming plant. He stated that since the installation of the last 2,000-kw. set it would be possible to install in the same space sets having a capacity of 5,000 kw. Although there would be some increased space necessary for condensing plant, instead of being able to put, as originally intended in the lay-out of the last extension, 6,000 kw. in the space, it would be possible to put in two 5,000-kw. sets, plus the existing 2,000-kw. sets, making a total of 12,000 kw. The cost of installing a 5,000-kw. set the engineer estimates approximately at £14,200, including switchboards and the necessary condensing plant and special foundations. In addition to this, the engineer considers it necessary to extend the machinery at the Tavistock Place sub-station by the installation of a further 1,000-kw. transforming set, similar to the one now at King's Road station, which he estimates at £2,400, including switchgear and foundations. He further advised the addition of a similar 1,000-kw. transforming set at the King's Road station. The adoption of these suggestions will incur an outlay of £19,000. The Committee being satisfied that the growth of the demand upon the undertaking is such that it is necessary to install the additional machinery suggested by the engineer, has decided to invite tenders for the supply thereof.

**HAMMERSMITH.**—Agreements are to be entered into with the New Olympia Co., Ltd., and J. Lyons & Co., Ltd., for periods of seven and five years for the supply of current to Olympia and to the company's premises in the borough, respectively.

**Manchester.**—The Electricity Committee has considered its estimates for the year and offered £19,013 to the rates, or nearly £5,500 less than it gave last year. The £19,013 represents 1 per cent. on the outstanding mortgage debt, and the Committee would like to establish that basis for future contributions, but neither the Finance Committee nor the City Council has shown any disposition to approve such a basis. The Committee will again ask for £1,200 from the rates for street lighting, and it expects to spend on capital account a total sum of £74,000 next year as compared with an actual expenditure of £57,571 last year. Last year the Committee offered in their estimates £19,496 for the rates, but the City Council increased this to £24,500, which was actually paid.

**Perth.**—Conferences have taken place between the promoters of the Loch Eicht Electric Power Bill and representatives of the County Council, which has lodged objections to the scheme. There is a prospect the parties may come to terms. It is expected that the Bill will be read a second time in the House of Commons before the end of May.

**South Africa.**—The municipal authorities of Pietermaritzburg are obtaining sanction to borrow £50,000, of which £42,500 would be utilised for the purpose of extending the electric supply undertaking at that place.—*Board of Trade Journal.*

## TRAMWAY and RAILWAY NOTES.

**Aldershot and Farnborough.**—The Light Railway Co. has applied to the B. of T. for an extension of time until June 4th, 1913, for commencing or completing the works authorised by the Light Railway Order, 1909.

**Argentina.**—The construction of the electric tramways in Mendoza is being rapidly pushed ahead, 12 km. of the 16 have already been completed. It is expected to open the system for public service on July 9th.—*Review of the River Plate.*

**Belfast.**—The work in connection with the extension of the tramways was begun of the 17th inst., by the contractors, Messrs. Dick, Kerr & Co., London. The first section taken in hand is that which proceeds from the present Ligoniel terminus to Wolfhill, and it is expected that the Donegall Road extension from Shaftesbury Square to Falls Road will be taken up in the course of a few days. Following then will come the extensions on the Oldpark Road, the Ravenhill Road, the Beers Bridge Road and Bloomfield Road, the Castlereagh Road, and Botanic Avenue and University Avenue. The track throughout will be double, and Thermit welded, and the distance covered will be 7 miles. The



contract price is £100,000, and the work is to be completed within six months. The overhead equipment is being carried out by the city electrical engineer. Messrs. Dick, Kerr & Co. are also the contractors for the doubling of the track of the Cavehill and Whitewell tramway.

**Birkenhead.**—At the Council meeting last week, the Electricity Committee promised a continuance of the amount of £1,500 to the rates, while the Tramways Committee was able to place £2,672 to the renewals fund instead of having to make a draft on the rates, as has been the case in three of the past four years. Since the inception of the undertaking more than ten years ago, the ratepayers have had to find the sum of £4,403 to defray deficits. The traffic receipts for the past year showed an increase of £2,600 over 1910-11.

**Bradford.**—The City Tramways Department has now publicly announced its intentions as to reduced fares, which after May 1st will be in full operation. Half-penny fares are to be allowed for young workpeople, between the ages of 12 and 16, who are to have special passes which will be issued for use at particular times of the day.

A new tramway brake, which has been invented by Mr. C. J. Spencer, the manager of the city tramways, was shown last week to a deputation from Ayr, who visited the city for a general inspection of the Bradford tramway system. The new brake is one which grips both track and wheel, and is very prompt and effective in operation. The test was made down the Church Bank route, a notoriously steep and awkward track with a dangerous turn at the bottom.

**Cardiff.**—The tramway men recently passed a resolution threatening to strike unless their demands, including the restoration of the full service, and an allowance for three-quarter time worked during the coal strike, were conceded. They allege that the Corporation saved thousands of pounds on the curtailed service while the men lost wages. The men stopped work on Wednesday, but a limited service is still maintained.

**Colwyn Bay.**—The deadlock that has existed between the U.D.C. and the Llandudno and Colwyn Bay Electric Railway Co., Ltd., is in a fair way to be removed. It was reported at a meeting of the Colwyn Bay Council on April 16th, that the directors of the Tramways Co. would confer with the Council or a Committee of the Council as to the terms and conditions on which they will extend the electric tramway from the present terminus at Colwyn Bay to Old Colwyn. Mr. T. E. Purdy assumed the Council would adhere to the terms which it had previously as a Council decided to require the company to enter into.

**Continental Notes.**—**FRANCE.**—The line of railway from Luchon to Montréjean is shortly to be converted to electric traction. According to the engineer of the Compagnie du Midi, electric driving will be established on the portion of the Toulouse-Bayonne line comprised between Montréjean and Pau and on all the Pyrenean branches thereto dependent, or on about 270 km. of lines at present in working. Preparations are afoot to build two large water-power works, the first producing 21,000 H.P. and the second 20,000 H.P. Single-phase current at a pressure of 15,000 volts will be generated and distributed to five transformer stations for supplying the trains.—*Revue Pratique de l'Electricité*.

**Leeds.**—The figures of the past year's working of the City tramways undertaking, submitted last week, showed a very large surplus available for the relief of rates, amounting, indeed, to a sum of £61,163, as compared with £51,888 in the previous year. The gross profit, amounting to £197,806, was a record, and an increase of £22,708. The total receipts were £395,320, an increase of £24,919, or 6.72 per cent. An expenditure of only £2,211 was involved in the earning of the extra profit. The total power expenditure was £24,914, being an increase of £1,386, largely due, it is stated, to an additional expenditure on fuel of £600, owing to the coal strike. The number of car-miles run during the year had been 8,527,957, an increase of 219,518, whilst 86,021,943 passengers had been carried, making an increase of 5,215,673. The receipts per mile had averaged 11.125d. The Tramways Committee decided to set aside the sums of £3,823 and £1,764 to wipe out outstanding loan balances on plant at the power station, and to contribute towards capital outlay a sum of £3,421 for a rotary converter and new brakes.

**London.**—The Central London Railway has decided to discard the mechanical signals at present in use, and has placed a contract with the McKenzie, Holland & Westinghouse Power Signal Co. for the equipment of the whole of the Central London Railway with automatic signalling.

**Manchester.**—The Tramways Committee of the Corporation has decided to allocate £85,000 towards the relief of the rates. The receipts during the past year amounted to £46,000 above the estimate, and running costs decreased. The large increase was due to some extent to the abnormal weather during the summer. The City Council may ask the Tramways Committee to contribute £100,000, it being stated that a belief is held in some quarters that the department can afford to contribute more than £85,000.

**Nelson.**—The tramway manager reports that the income during the past year constitutes a record. This is mainly attributable to the fine summer. Instead of the estimated loss of £273, there has been a profit of £998. In regard to railless trolley cars, Mr. Helm reports that it would be unwise to attempt a tramway

scheme for the Walverden district, but it would be well worth while to consider the advisability of a railless system, having regard to the fact that those authorities which had installed the system, spoke highly of it as an auxiliary to the tramway undertaking.

**New Zealand.**—The Municipality of Palmerston intends to place before the ratepayers a proposal to raise a loan of £69,000 for the installation of an overhead electric tramway system. The length of line will be about 5½ miles.

**West Hartlepool.**—The B. of T., while approving the tramways extension scheme generally, has modified the proposals to the extent of permitting the Elwick Road lines to go only as far as Eldon Grove, and the Hart Lane lines as far as Welbeck Road—the Serpentine Road and Wooler Road portions thus being cut out of the scheme.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—An injunction has been granted at the instance of the Maritime Wireless Co., restraining the Australasian Wireless Co. from threatening users of Father Shaw's system (adopted by the Commonwealth Government for the stations at Melbourne and Hobart) with prosecution for infringement of patent rights.

**Directive Wireless Telegraphy.**—It is reported that the system which Marconi's Wireless Telegraph Co. has been engaged in developing is the Bellini-Tosi Directional System, and that Mr. Bellini has joined the engineering staff of the company. The apparatus, as fitted on the ss. *Mauretania*, is said to have proved highly satisfactory, and the company is now ready to install it on other vessels.

**Germany.**—A large wireless station is to be erected at Neumünster, near Wilhelmshaven, which will far exceed in power that at Nauen. Three towers, each 150 m. high, will be begun in May, and four similar towers will be added later on.—*Zeit. für Electrotechnik und Maschinenbau*.

**Hythe.**—The T.C., which so vehemently demanded the removal of the National Telephone Co.'s poles in The Grove a few months ago, has received notice that the Post Office desires to erect telephone poles in the North Road. Thus Amurath an Amurath succeeds.

**Marconi Wireless Telegraphy in the U.S.A.**—The Marconi Wireless Telegraph Co. has made arrangements with the Marconi Wireless Telegraph Co., of America, to construct for that company a number of long-distance wireless stations, and the two companies have signed a working agreement with the Western Union Telegraph Co. of the State of New York, and with the Great North-Western Telegraph Co. of the Dominion of Canada, which provides that the Marconi companies shall have the full benefit of those companies' landline stations for the receipt and delivery of their messages throughout the United States and Canada upon the most favourable cable rate terms. The agreement provides that the Marconi Co. shall affix a Marconi signboard to all those of the Western Union Co. The Western Union and the Great North-Western Telegraph companies have in all about 25,000 telegraph offices throughout the United States and Canada.

The Marconi companies are about to erect new long-distance wireless stations providing direct communication between New York and London, and preparations are in hand for the construction of a number of stations to give communication with the East from San Francisco to the Hawaiian Islands, the Philippines, China, and probably Japan. The American company's programme further provides for a second long-distance station to be erected in the immediate vicinity of New York to communicate with Cuba, Panama and South American countries.

The shareholders of the Marconi Wireless Telegraph Co., of America, have resolved to increase their capital to \$10,000,000 in shares of \$5 each.

**Post Office Servants.**—A Select Committee has been appointed to inquire into the wages and conditions of employment of Post Office servants.

**Turkey.**—It is reported that the Turkish wireless station at Kelemish has been destroyed by Italian warships.

**Wireless at Sea.**—We are informed that Mr. Harold Bride, one of the wireless operators on board the *Titanic*, who is, happily, amongst the survivors, and Mr. Harold Cottam, chief operator on the *Carpathia*, were both trained at the British School of Telegraphy, Ltd., Clapham Road, London, S.W.

The confused and contradictory messages regarding the fate of the *Titanic*, which were recorded during the day following the wreck, have attracted universal attention to the subject of wireless communication, especially in the United States, where amateur operators abound. The false reports that the *Titanic's* passengers were all safe, and that she was slowly steaming towards Halifax, in particular, have been ascribed to inaccurate reception by some unauthorised person, who communicated them to the Press. The *Times* correspondent in New York stated that the Department of Justice repudiated the theory of Mr. Marconi, attributing the messages to amateur operators, and was of opinion that they "were sent in a deliberate attempt to postpone knowledge of the wreck



in order to give time for the reinsuring of the *Titanic's* cargo." The White Star line, however, was not accused of being a party to sharp practice of any kind.

A Bill is to be introduced into Congress to regulate the practice of wireless telegraphy in the United States. In this country, of course, there is no possibility of similar trouble, the erection of wireless apparatus having been for years controlled by the Government, which issues licences only sparingly, and after due inquiry. The operators on British ships are required to hold a Post Office certificate of efficiency.

A memorial is to be erected at Godalming to the heroism of Mr. John George Phillips, the chief wireless operator in the *Titanic*, who was a native of the town.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-under-Lyne.**—May 1st. Two sets of counter-current jet condensing plant with steam-driven pumps, and one natural-draught wooden chimney cooler, for the Borough Electricity Department. See "Official Notices" April 12th.

**Australia.**—VICTORIA.—May 1st and 8th. Cable for P.M.G.'s Department.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" to-day.

May 6th.—Arc lamp carbons for the Melbourne City Council. See "Official Notices" April 19th.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

June 4th.—1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays. See "Official Notices" April 12th.

May 28th.—Deputy P.M.G., Melbourne. 100 tons bronze wire, 262 tons of hard-drawn copper wire, 188,500 copper binders, 11,500 sleeves, and 126,000 copper tapes (Schedule No. 686). Specification can be seen at the Board of Trade Commercial Intelligence Dept.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9½ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—June 18th. 15½ miles of paper-insulated lead-covered cables.—Apply, High Commissioner in London for Australian Commonwealth.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

**QUEENSLAND.**—May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

**WESTERN AUSTRALIA.**—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

**TASMANIA.**—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

**N.S.W.**—Three centrifugal pumps (12,000 gallons per minute), five 350-KW. transformers, A.C. motors, for White Bay power house, for N.S.W. Government Railways and Tramways Department. Electrical Engineer's office, 61, Hunter Street, Sydney.

**Bedford.**—Electrical plant (100 lights) for the Powage Press, Ltd. See "Official Notices" April 19th.

**Birkenhead.**—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" to-day.

**Bray (Ireland).**—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-KW. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" April 12th.

**Bristol.**—May 6th. One 1,000-KW. three-phase to D.C. converter, for the Corporation (British manufacture preferred). See "Official Notices" to-day.

**Cape Town.**—May 9th. For the City Council.

A steam turbine-driven alternator and converter, the turbine to be capable of giving a continuous output of 2,000 K.V.A. Approximately 24,750 yards of E.H.T. three-phase cable, joint boxes and disconnection pillars. Green economiser.

Tenders are to be deposited at the City Hall, Cape Town.

May 15th.—Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal*.

A copy of the specification may now be seen at the Com. Int. Department of the Board of Trade in London.

**Constantinople.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Dundee.**—The T.C. invites tenders for the supply of sub-station converting machinery and extra-high-tension switch-

gear. Tenders are also invited for demolition of the present buildings on the site and for construction of a sub-station, and for supply of an overhead travelling crane for new sub-station at the docks. Mr. H. Richardson, Corporation Electrical Engineer.

**Falkirk.**—May 6th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" April 19th.

The Corporation Electricity Committee will receive tenders for the following:—Manhole frames and covers, lubricating oils, ironmongery and tools. Harold Ranson, resident electrical engineer.

**Glasgow.**—May 10th. Substation switchgear, for the Corporation Electricity Department. See "Official Notices" to-day.

**Gravesend.**—April 29th. Cables, for the Corporation. See "Official Notices" April 19th.

**Grimsby.**—May 16th. Continuous-current motor-generator with switchboard panel, and an automatic reversible booster with switchgear, for the Corporation. See "Official Notices" to-day.

**Heston and Isleworth.**—May 8th. 500-KW. steam engine, D.C. generator, balancer, &c., water-tube boiler, chain-grate stoker, pipework, &c., surface condenser, air pump, &c., for the U.D.C. See "Official Notices" April 19th.

**Hoylake and West Kirby.**—May 6th. One Lancashire boiler, with superheater, &c., vertical steam pump and self-acting re-starting injector, for the U.D.C. Electricity Works. See "Official Notices" April 19th.

**Lancaster.**—Tenders for installation of electric light at the Gregton Institute in Christ Church parish, Lancaster. The Vicar.

**Lincoln.**—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous current dynamo, or two 500-H.P. Diesel engines, with continuous current dynamos; one 120-KW. motor-generator and one switchboard, for the Corporation. See "Official Notices" April 12th.

**London.**—HACKNEY.—May 9th. High and low-tension cables, boxes, frames and covers, troughing, ducts, &c., for the B.C. Electricity Department. See "Official Notices" April 19th.

**ISLINGTON.**—May 1st. Electrical fittings and sundries, for the St. Mary B.G. See "Official Notices" April 19th.

**L.C.C.**—May 8th. Electrical installation at the Malmesbury Road Central School. See "Official Notices" to-day.

**Manchester.**—April 30th. 16-26-H.P. four-cylinder motor car suitable for heavy town work. Specification from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

**Newcastle-on-Tyne.**—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" to-day.

**Newcastle-under-Lyme.**—Extensions and alterations to switchboard, for the Corporation. See "Official Notices" to-day.

**New Zealand.**—May 1st and July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Southampton.**—April 27th. Main cables, switchboard panels and electric lighting of the new buildings at Shirley Warren Poor Law Infirmary for the B.G. See "Official Notices" April 19th.

**Southend-on-Sea.**—Stores for a year, for the Corporation Electricity Department. See "Official Notices" April 12th.

**Spain.**—May 4th. The municipal authorities of Oviedo are inviting tenders for the concession for the electric lighting of the municipal buildings and also of a part of the town during a period of ten years.

### CLOSED.

**Australia.**—According to the *Australian Mining Standard* the P.M.G.'s Department at Victoria has placed an order for electrically-controlled clocks, required for use in connection with the Telephone Exchange, Lonsdale Street, Melbourne, at £118 with Messrs. Ingram Bros., of Melbourne.

**Aylesbury.**—The U.D.C. has accepted the tender of Messrs. Mackrill & Sons, of Aylesbury, for electrical work for a year.

**France.**—The French Post and Telegraph Authorities in Paris have just placed a contract with the company Le Matériel Telephonique, of Paris, for the supply of 100 km. of 28-pair telephone cable, each copper conductor to be insulated by paper tape, and the core enclosed in a lead tubing.

**Northampton.**—The Corporation has placed with Messrs. E. Bennis & Co., Ltd., a repeat order for mechanical stokers and self-cleaning furnaces for the tramway power station.

**Perth.**—The Corporation Electricity Committee has accepted the offer of Messrs. Callender's Co., London, at £4,184, for the extension of mains to carry current to the new premises of Messrs. John Dewar & Sons, the new infirmary and other buildings.



**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named :—

**ADMIRALTY : CONTRACT DEPARTMENT.**

Lanterns.—Chloride Electrical Storage Co.

**WAR OFFICE.**

Dynamos, &c.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Electric Construction Co., Ltd.

**INDIA OFFICE : STORE DEPARTMENT.**

Armatures.—J. Stone & Co.  
Carbons and cells.—Siemens Bros. & Co.  
Engines, &c.—British Westinghouse Electric, &c., Co.  
Insulators.—Bullers, Ltd.  
Pipettes.—Chloride Electric Storage Co.

**CROWN AGENTS FOR THE COLONIES.**

Stay-rods, &c.—Siemens Bros. & Co., Ltd.  
Twin-core submarine cable.—Telegraph Construction and Maintenance Co.  
Telegraph posts, &c.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.

**GENERAL POST OFFICE.**

Loading coils.—Western Electric Co., Ltd.  
Flexible cords.—London Electric Wire Co. & Smiths, Ltd.  
Portable generating sets.—Lancashire Dynamo and Motor Co., Ltd.  
Meters.—Automatic Telephone Manufacturing Co., Ltd.  
Telephones.—Gent & Co., Ltd.  
I.R., V. and C. cable.—Johnson & Phillips, Ltd.; Ward & Goldstone.  
Paper-core cable.—Johnson & Phillips, Ltd.; Western Electric Co., Ltd.  
S. and C.C. cable.—Western Electric Co., Ltd.  
Submarine cable.—Henley's Telegraph Works Co., Ltd.  
Insulators.—Taylor, Tunnicliff & Co., Ltd.  
Lightning protectors, &c.—British L. M. Ericsson Manfg. Co., Ltd.  
Copper wire.—British Insulated and Helsby Cables, Ltd.; T. Bolton and Sons, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.; J. Wilkes, Sons and Mapplebeck, Ltd.  
Electric lift at Birmingham Head P.O.—Turner, Atherton & Co., Ltd.  
Telephone exchange equipment, Lincoln.—Peel-Connor Telephone Works, Ltd.  
Ditto, Sevenoaks.—Western Electric Co., Ltd.

**London.—ST. PANCRAS.**—The B.C. has accepted the following tenders :—

Sloan Electrical Co., Ltd.—\$60,000 open-type arc lamp carbons, £568. (14 tenders received with prices ranging from £499 to £901.)  
G. Braulik.—18,000 carbons for Oriflame arc lamps, £23.  
General Electric Co., Ltd.—6,000 carbons for Angold arc lamps, £13.  
W. Geipel & Co.—12,000 carbons for duplex Excello arc lamps, £70; 3,000 carbons for Luna arc lamps, £11; 2,000 carbons for single Excello arc lamps, £13.

The following tenders were received for supplies of cable :—

R. R. Todd .. .. .	(accepted)	£2,840
Electrical Engineering Co., Ltd. .. .. .		2,931
Standard Cable Co., Ltd. .. .. .		3,051
Western Electric Co., Ltd. .. .. .		8,208
Johnson & Phillips, Ltd. .. .. .		3,217
British Insulated and Helsby Cables, Ltd. .. .. .		3,225
Siemens Bros. & Co., Ltd. .. .. .		3,227
Henley's Telegraph Works Co., Ltd. .. .. .		3,248
Callender's Cable Co., Ltd. .. .. .		3,270
W. T. Glover & Co., Ltd. .. .. .		3,316
Union Cable Co., Ltd. .. .. .		3,452
Connolly Bros., Ltd. .. .. .		3,818
Aubert Grenier & Co. .. .. .		3,961

Mr. Todd's tender is for cable manufactured by Felten & Guilleaume, and the offer is subject to a rise or fall in the price of copper and lead, and is based upon copper at £74 per ton and lead at £16 per ton.

The tender of the General Electric Co. has been accepted, at £132, by the Metropolitan Water Board, for the supply of electrical fittings required in connection with the installation of electric lighting plant at Surbiton station.

The Metropolitan Asylums Board has accepted the tenders of Messrs. W. J. Fryer & Co., at £33 and £63, for the provision of electric charging plant and lighting at the Brook and North-Western Ambulance Stations.

**Pontypridd.**—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained the contract for the supply of tantalum and "Wotan" lamps for 12 months to the U.D.C.

**Roumania.**—Owing to the failure of response to the public invitation to submit tenders, the T.C. of Constantza is negotiating a contract with the firm of Ganz, of Budapesth, for the lighting of the city and suburbs, the plans of which are now under the consideration of the Minister of the Interior.—*Revue Pratique de l'Electricité.*

**Southampton.**—The B. of G. has accepted the tender of Messrs. H. J. Cash & Co. for carrying out the heating and other work at the Infirmary, which includes alterations and additions to the electric light for the entire scheme; £5,855 is to be expended.

**Southend-on-Sea.**—The T.C. has accepted the tender of Messrs. J. Brown & Co., of Clydebank, at £66, for 24 driving-wheel tires and 12 axles for tramcars.

The Council has also accepted the tender of Messrs. E. & B. H. Davey, of Southend, at £1,362, for car-shed extensions.

**Sunningdale.**—Messrs. John Drake & Co., of Sunninghill, have secured the contract for the electric light installation at the Old and New Dormy House.

**Swansea.**—The T.C. has accepted the tender of the British Thomson-Houston Co., at £9,270, for two B.T.H. turbo-alternators, with Cole, Marchant & Morley condensing plant.

**Swindon.**—The T.C. has accepted for the current year the tender of the Reason Manufacturing Co., Ltd., for 3, 5, and 10-ampere electrolytic meters, also for complete installation sets.

**Wolverhampton.**—The Board of Management of the Wolverhampton and Staffordshire General Hospital have placed their order for the complete electrical installation of the King Edward VII Memorial Wing with the District Electric Co., Ltd., of Wolverhampton.

**Woolwich.**—The B.C. has decided to extend for a further period of 12 months the contracts with Messrs. Siemens Bros. & Co., Ltd., for the supply of low-tension cables, and with the Oliver Arc Lamp, Ltd., for the supply of 65,000 pairs of 7-mm. and 6'35-mm. yellow flame carbons, and 17,000 pairs of 7-mm. yellow flame A.C. carbons.

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, April 26th. At 5 p.m. At the Imperial College Science, South Kensington. Papers on "The Solution of Network Problems by Determinants," by Mr. R. Appleyard; and "A Method of Measuring Small Inductances," by Mr. S. Butterworth.

**Institution of Civil Engineers (Students' Meeting).**—Friday, April 26th. At 8 p.m. Lecture on "The Principles and Practice of Accountancy in Relation to Engineering Design and Work," by Mr. T. Frame Thomson.

**Junior Institution of Engineers.**—Saturday, April 27th. At 3 p.m. Visit to the engineering workshop and laboratory and the electrical laboratory of the Polytechnic, Regent Street, W.

**North-East Coast Institution of Engineers and Shipbuilders (Graduate Section).**—Saturday, April 27th. At 7.15 p.m. At Bolbec Hall, Newcastle. Paper on "Oil Engines," by Mr. A. T. Thorne.

**Royal Society of Arts.**—Monday, April 29th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture I.)

**Institution of Electrical Engineers (Manchester Local Section).**—Tuesday, April 30th. At 7.30 p.m. At the University, Manchester. Annual general meeting. Lecture by Dr. R. Thury.

**Institution of Civil Engineers.**—Tuesday, April 30th. At 8 p.m. Annual General Meeting of Corporate Members.

**Royal Institution.**—Wednesday, May 1st. At 5 p.m. Annual meeting.

**Institution of Electrical Engineers (London).**—Thursday, May 2nd. At 8 p.m. Adjourned discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes."

**Institution of Mechanical Engineers.**—Friday, May 3rd. At 8 p.m. Discussion to be resumed by Prof. J. O. Arnold on "The Tenth Report to the Alloys Research Committee on the Alloys of Aluminium and Zinc."

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, April 29th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, April 30th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction for those not passed out by Adjutant, 7.30 to 10 p.m.

Thursday, May 2nd.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, May 3rd.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction for those not passed out by Adjutant, 7.30 to 10 p.m.

Saturday, May 4th.—Headquarters will be open for regimental business, from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,  
For Officer commanding L.E.E.

**Newspapers and the Law of Libel.**—The editor of every paper, however technical, the publisher of every book, however dull, is bound to show some fealty to the law of libel. No newspaper man can afford to ignore the existence of this branch of English jurisprudence. Nor can he, as a rule, afford the time to peruse the mighty tomes which contain the last erudite word on the subject. He may, in the course of his journalistic career, have picked up a few smatterings of the law, but it is not easy to recall nice legal distinctions in the early hours of the morning, or to hunt for libels on press day when the printer's devil is knocking at the door for corrected proofs. In practice, the editor must needs trust his contributors in a large measure; and speaking for ourselves, we have found that the trust has seldom, if ever, been misplaced. But where, it may be asked, is the journalist to ascertain the law? Hitherto he has had but little teaching, except in the school of experience, where the fees are high. They take the form of damages for libel. So high are the fees that journalists are about to attempt an invasion of the monopoly. The University Extension Board of the London University, acting in concert with the Council of the Institute of Journalists, have arranged for a course of lectures to journalists on "The Law of Libel," to be delivered at the Institute of Journalists on May 1st, 8th, 15th, 22nd, and June 5th. The lecturer is W. Valentine Ball, barrister-at-law. The lectures are to deal with libels generally; construction and truth of libels; explanation of fair comment; privilege; practical hints on reporting, &c., the statutory protection of newspapers, criminal libels, &c.



## ELECTRICAL EXHIBITION, OLYMPIA, 1911

## NOTES.

THE report of the Finance Committee of this Exhibition has issued its balance-sheet, which shows a balance of £10,940 divisible between International Trade Exhibitions, Ltd., and the B.E.A.M.A. This amount has been disposed of as follows:—

International Trade Exhibitions, Ltd., 40%	=	£4,376	
Less 5 % rebate to members of B.E.A.M.A.		229	
			£4,146
B.E.A.M.A., 60 % of profit ... ..	=	£6,564	
Less commission to secretary ...		£328	
Rebate to exhibitors ... ..		£2,340	
„ to B.E.A.M.A. members		£439	£3,127
			£3,437
			£7,583

The details of income and expenditure are as under:—

## EXPENDITURE.

Rent of Olympia and offices ... ..	£2,123
General expenses ... ..	943
Postage ... ..	120
Stationery and printing ... ..	223
Catalogue ... ..	205
Advertising ... ..	1,393
Decorations ... ..	557
Entertainments... ..	301
Electricity ... ..	3,205
Insurance ... ..	57
Legal expenses ... ..	30
Travelling expenses ... ..	69
Stand fittings ... ..	56
Secretary's salary ... ..	200
Bank charges ... ..	2
Audit fee ... ..	15
Balance carried down, divisible:—Inter-	
national Trade Exhibitions, Ltd., 40 per	
cent., £4,376; British Electrical and	
Allied Manufacturers' Association, 60	
per cent., £6,564 =	10,940

£20,439

## INCOME.

Space rentals ... ..	£11,897
Gate money, £2,157; Tickets sold, £2,118 =	4,275
Catalogues and programmes ... ..	457
Sale of electricity, gas and water ... ..	3,371
Automatic machines receipts... ..	30
Lavatory and photographic concessions ...	90
Commissions, &c. ... ..	202
Bank interest ... ..	100
Discount ... ..	17

£20,439

The report accompanying the above accounts makes the following comparison of the accounts of the Olympia Exhibitions of 1905 and 1911:—Rent in 1911 cost £670 more, and the Association had no income from refreshments. General expenses in 1911 were lower by £245. Stationery and printing in 1911 were lower by £356. The catalogue cost was £208 less. Advertising cost £327 more in 1911 owing to display of posters. Entertainments, banquets, band, &c., show a saving of £697. Travelling expenses and commission were less by £291.

In regard to income:—Space rentals were better by £3,172 in 1911. Gate money and tickets were better by £1,083. Donations were £1,480 less, there being none in 1911. Catalogues and advertisements in same produced £152 less. Lavatory and photographic concessions improved by £60, and bank interest by £73.

The supply of electricity to exhibitors showed a loss of £2,000 in 1905, and only S.P., A.C., was available. In 1911 all kinds of supply were available, and though the price paid for current to the proprietors of Olympia was 50 per cent. more, both ends have been made to meet in respect of this item.

The organising managers, in a statement issued by them, show that the economies effected in expenses (primarily under their control) are considerably greater than the accounts show, for the increased extent of the Exhibition, as compared with that of 1905, would have implied a proportionate increase on that year's figures.

**Electric Lamp Frauds.**—At the High Court of Justiciary, Edinburgh, last week, a man named William Taylor pleaded guilty to two charges of having obtained by fraud 100 and 41 electric lamps from an Edinburgh firm and a Coatbridge firm respectively, and of having attempted to obtain in a similar way 78 electric lamps from a firm in Glasgow. It was pointed out that prisoner had been employed by different firms of electrical engineers. Lord Cullen repeated Taylor's last sentence of five years' penal servitude.

**Football.**—Kirkcaldy and Dundee tramway men played a football match last week, when the Fife men won by 3 goals to 1.

Our report of the German tour of the Football Section of the Osram and Robertson electric lamp works social club is held over until next week.

## Dinner to the Engineer-in-Chief of the Post Office.

—The engineer-in-chief to the Post Office, Mr. W. Slingo, was entertained by his former students on Saturday last, at the Connaught Rooms, Kingsway, London. The company present, numbering 140, had gathered from all parts of the country to do honour to the founder and principal of what was, in the zenith of its career, the largest and most successful school of its kind in the kingdom. The Telegraphists' School of Science was founded by Mr. Slingo in 1876 with only five students; its membership steadily rose until no fewer than 850 students were upon its rolls, when it had to be broken up and its members transferred to the various technical institutions which had in the meantime been formed. The Telegraphists' School of Science can claim to have been practically the pioneer of that branch of science which has developed perhaps more rapidly than any other within the past quarter of a century. Congratulatory telegrams were received from various parts of the world during the evening.

Mr. G. F. Mansbridge, who occupied the chair, after the usual loyal toast, proposed the health of the "Guest of the Evening." He said that on behalf of the assembled company of ex-students of the School of Science, he offered the very heartiest and most cordial welcome to their old friend, colleague and mentor. Their regard and esteem for Mr. Slingo had always been great, but as the years slipped by they learned to appreciate him still more, and understood more fully how great was the debt of gratitude they owed to him. His appointment to the highest engineering position in the Post Office was, therefore, a source of intense gratification to his old students and assistants.

Mr. MacEwan dealt in an interesting and humorous way with the early career of his able colleague, now engineer-in-chief, and Mr. A. W. Martin said that any progress he might have made had its origin in the great encouragement and kindly advice given him at an early age by their honoured guest; many, or all of them, had had opportunities of hearing most of the famous lecturers, but so far as his experience went, not one of them excelled him as a teacher able to show men "how to think"; to do which should be one of any teacher's highest aims. This ability by no means ceased when the Telegraphists' School of Science passed from his able charge: for all who now came in contact with him in their daily work could still learn from him the way to think. There was no man more willing to place his knowledge at the disposal of others.

Mr. J. Newlands, C.I.E., paid a high tribute to the value of technical education for those who desired to advance in the service, and Miss E. Bennett expressed her indebtedness to the Telegraphists' School of Science for opening its doors to the section of the staff she represented.

Mr. H. A. Miles, in supporting the toast, expressed the hope that their one-time Professor might remain with them as engineer-in-chief sufficiently long to add still further lustre to his name, a name which would be remembered in the annals of the Post Office as that of a chief who was one of his staff, who had personally trained his staff, who climbed from the foot of the ladder to the topmost rung by sheer merit and dogged perseverance alone, unaided by any backstairs influence, and without even the hypothetical advantages supposed to be conferred by a 'varsity education.

Mr. Brooker said Mr. Slingo had not climbed into his office by trading on other men, but had got there by straightforward, hard work, the greatest compliment that he could pay him. In scientific telegraphy he had made a revolution in the present mode of life to-day.

After the various supporting speeches the chairman, in concluding his address, pointed out that the general *motive* of the remarks of all the speakers was the kind of spirit of human nature which distinguished the character of their guest, and he believed it was this, quite as much as his high technical attainments, which had raised him so high in their esteem. The toast was received with great enthusiasm, and was accompanied by musical honours.

Mr. Slingo, in responding, said that he was deeply touched by the way in which the assembly had been called together, as well as by the very cordial manner in which the toast had been proposed and supported by the several speakers. He did not think that it would diminish, in any way, the compliment to himself if he regarded the meeting as an indication of the satisfaction which the C.T.O. had experienced in his appointment. He was very glad to notice that no fewer than 96 old students of the Telegraphists' School of Science were at present holding important positions in the engineering department, that a number of others were similarly situated in the stores and factories departments, and a few were in the secretary's office, the surveyors' department, and the London Telephone Service. So far as the C.T.O. was concerned, the controlling staff was, with very few exceptions, composed of old students. He was very sorry that the school had been closed, for had his proposal that it should be carried on officially been adopted, there would not now have been any dearth of capable engineering officers, nor would it have been necessary to invite the assistance of the universities. He was not without hope that the work would be taken up where he left off, and carried to a proper and natural culmination.

Mr. F. L. Henley proposed "The Chairman," who, in his reply, thanked those associated with him in carrying out the successful re-union.

An excellent musical programme was provided by Mr. Willie Rouse, assisted by Miss Emilie Hayes and Mr. Stanley Holloway. The evening was brought to a close by the singing of "Auld Lang Syne," in which the whole of the company joined.



**Educational Notes.**—GOLDSMITH'S COLLEGE, New Cross, S.E.—A number of short evening courses in engineering and building subjects, including a course of eight lectures on electric traction, are to be held during May and June. Particulars may be obtained from Mr. W. Loring, Warden of the College.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—The new course commences on Wednesday, May 1st. See our advertisement pages to-day.

The Summer Term at UNIVERSITY COLLEGE in the Faculty of Engineering begins on Tuesday, April 30th. On May 10th at 5.30 p.m. Mr. Leslie Robertson will deliver a public lecture on "The Importance of the Business Side of Engineering," at University College. Mr. A. H. Barker will begin again his lectures on "Heating and Ventilating Engineering," on Wednesday, May 1st, at 7 p.m. Particulars can be obtained from the Secretary of University College.

**Social Events.**—The first annual dinner in connection with the Aberdare Electricity and Destructor Works was held at the Boot Hotel, Aberdare, on 12th inst. The chief engineer and manager (Mr. A. J. Abraham) presided, and amongst others present were the chairmen of the Council and the Electricity Committee respectively. The aforesaid chairmen both responded to a toast. The chairman of the Electricity Committee referred to the public electric lighting, and stated that the town was obtaining three times as much light as it formerly had with gas, and yet it saved as much as £1 ls. per annum per lamp post. During the recent coal strike the department had not been put to the slightest inconvenience; the normal supply of electricity could be maintained for an almost unlimited period, as the energy was generated by steam obtained from the destructor department. A vote of thanks proposed by Mr. G. F. Soars, of the B.T.-H. Co., was accorded to Mr. W. T. Hilder, mains superintendent, for presiding at the piano, and Mr. G. D. Morgan, commercial assistant, was also thanked for making all arrangements for the dinner, he having acted as hon. secretary and treasurer.

On Monday, the L.C.C. Tramways Electrical Staff held a smoking concert at Anderton's Hotel; there were between 40 and 50 present, and Mr. J. Shepherd was in the chair, supported by the following officials: Mr. Thorn, Mr. Good, Mr. Perry (Northern Section), and Mr. Thomas (Southern Section). Mr. Pope would have been present if possible. The success of the evening was greatly due to the Misses Lock, who both had many encores. The gathering terminated with a hearty vote of thanks to the chairman (Mr. Shepherd), proposed by Mr. Thorn, and due thanks were tendered to Mr. Jones (North Side), for the able manner in which he had got up the entertainment.

**Copper.**—The consumption of copper, as set forth in Messrs. H. R. Merton's statistical circular, is one of the most encouraging signs of trade revival to be found. In spite of the apparently universal idea that limitation of output leads to increase of input, the consumption of copper for the past half month is sufficient to indicate a healthy determination to keep some industries open, in the face of the logical conclusion of the above doctrine. The withdrawal from stocks during the half month has been 741 tons. The decrease is mostly under "Afloat from Chile," and a less quantity from Australia, Liverpool and Swansea also losing a certain amount. France increases her stock by 73 tons. Rotterdam has dropped 250 tons, to 3,050 tons; Hamburg is estimated to have remained stationary at 7,600 tons. The detailed returns show supplies from North America to England and Havre just average; to other European ports one-third below. From Spain and Portugal England received rather less than one-third the average quantity, but at a rate considerably higher than for last month. Shipments from Chile are above average, from Australia about one-tenth below. Total deliveries are 18,616 tons, a quantity which, if doubled, will be equal to the deliveries for last June or September, only one of which was directly affected by strikes.

The stock in American producers' hands for the end of March was 27,843 tons, a decrease of 255 tons only on the preceding return. The combined visible supply for the end of March is 78,018 tons (excluding Holland and Germany). Since American visible supplies began to fall steadily—i.e., since May last, the quantity has been reduced by 46,262 tons, an average of 4,626 tons per month. A very large withdrawal was made in January last, but February only withdrew 1,491 tons, and March, as above, 255. The world's stocks have decreased 76,574 tons since March 31st, 1911, or at the rate of 6,380 tons per month. Stocks in England and France decreased in the same period 32,092 tons, or an average withdrawal of 2,674 tons per month. At the present rate, therefore, England and her neighbour have 18 months' stock in hand. The revival of trade which would follow a renewed sense of security in industrial conditions would probably increase this considerably.

**Engineering Trades Agreement.**—The *Times* reports that in the hope of preventing stoppages of work in shipyards and engineering establishments owing to disputes between workmen arising from claims to do certain classes of work, an agreement to be known as the Demarcation Agreement, 1912, has been drawn up between the Shipbuilding Employers' Federation, the Engineering Employers' Federation, and the Shipbuilding and Engineering Trades Federation, to which 20 of the trade unions in the engineering industry are affiliated. A ballot is now being taken. The agreement, which is to come into force on July 1st, in the districts of Aberdeen, Dundee, East of Scotland, Clyde, Tyne, Wear, Tees and Hartlepool, Barrow, Liverpool, Birkenhead and Hull, provides that there shall be no stoppage of work nor shall men be paid off in consequence of disputes on demarcation questions.

**The "Daily Mirror" on Haulage in Mines.**—A remarkable statement was made in the *Daily Mirror* of April 15th, in the course of an article on the use of ponies in pits—namely, that "England, for some extraordinary reason, is one of the few countries where mechanical traction does not exist. The law rigorously forbids the use of electricity or petrol in mines." The paper had previously asked why it was that "no mechanical contrivance had ever been devised or utilised for hauling the coal trucks about the dark corridors underground." To our readers the utter absurdity of these passages is too obvious to need pointing out. It is unfortunate that writers on the daily Press do not take the trouble to ascertain the facts before they tackle a technical subject, instead of madly charging windmills which to them appear to be giants. Clearly, the writer in the *Mirror* is unaware that the use of mechanical haulage—usually with electric power—has attained to a very high degree of development and extended adoption in British coal mines, and has been common practice for very many years.

**The Batti-Wallahs' Society.**—This Society held its last smoking concert for this winter at the Holborn Restaurant on Friday last. A representative muster of members turned up, and a very enjoyable evening was spent. The artistes, as usual, were provided by Mr. Harry Heap, under the direction of the hon. entertainment secretary, Mr. Robinson. The president, Mr. F. J. Collis, who was in the chair, suggested that a collection should be made in aid of the widows and orphans of those lost in the *Titanic*, the result of which was some £7 ls. The last of the informal evenings was to be held on the 24th inst., taking the form of a dinner at the Victoria Mansions Restaurant, followed by an amateur concert.

**20,000-Volt Shock.**—The *Cape Times* Johannesburg correspondent states that, on April 2nd, an electrician had a shock at 20,000 volts, and was not killed. "His name is Ernest J. Horack, and the accident occurred at the Robinson Deep Mine. His hand came in contact with a wire carrying the above voltage, and he was flung to the ground in great agony, being a mass of burns from head to foot. He is now in hospital, conscious, but in a critical condition."

**Revised Russian Lamp Duties.**—A Bill has recently been introduced into the Russian Duma which proposes to increase the duties on incandescent electric lamps with *metallic* filaments to 65 roubles per pound (3s. 9½d. per lb.) if mounted, and to 90 roubles per pound (5s. 3d. per lb.) if unmounted. The duties at present levied under Sec. 169 (3) of the Russian Customs Tariff on incandescent electric lamps (30 roubles per pound if mounted and 60 roubles if without mounting) are to be retained in the case of incandescent electric lamps with *carbon* filaments.—*Board of Trade Journal*.

**Institution and Lecture Notes.**—ROYAL SOCIETY OF ARTS.—A short course of four lectures on "Heavy Oil Engines," by Captain H. Riall Sankey, R.E. (ret.), M.Inst.C.E., will be given before this Society, under the Howard Bequest, commencing on Monday evening, 29th inst., at 8 p.m. The following is a syllabus of the lectures:—

Lecture 1.—April 29th.—The oil engine is an internal combustion engine—Difference between light and heavy oil engines—Difference between Diesel and other heavy oil engines—Brief history of the Diesel engine—Theoretical thermal efficiency—Heat and other losses—Actual thermal efficiency—Efficiency ratio—Thermal efficiency compared with other internal combustion engines and with external combustion engines—Cycle of operation of a four-stroke and of a two-stroke Diesel engine, and essential parts to produce these cycles.

Lecture 2.—May 6th.—Various types of Diesel engines—Considerations affecting design—Design of various parts, such as cylinders, valves, pistons, connecting rods, crank-shafts, frames, air compressors, &c., for four-cycle and for two-cycle engines—Materials used for the various parts—Number and arrangement of cylinders for vertical and horizontal engines.

Lecture 3.—May 13th.—Description of Diesel engines manufactured by various makers—Sizes in current manufacture and future possibilities—Speeds and weight for land and marine engines—Various kinds of oil available for Diesel engines; their characteristics, calorific value, and sources of supply.

Lecture 4.—May 20th.—Economical results in respect of fuel and of total annual cost—Comparison of Diesel, gas and steam engines, in respect of capital cost, fuel cost, and total annual cost—Various applications to land and marine purposes—Other heavy oil engines—Semi-Diesel engines.

Admission to the lectures is free to non-members of the Society on production of a member's order, or by the personal introduction of a member.

**THE COLD STORAGE AND ICE ASSOCIATION.**—Mr. J. T. Milton, the Chief Engineer Surveyor of Lloyd's Register of British and Foreign Shipping, has been elected president of this Association, for the year ending March 25th, 1913. The thirteenth anniversary dinner of the Association will be held at the Hotel Cecil on Monday, May 13th, when the guests of the evening will include Sir Richard Solomon, K.C.B., K.C.M.G., the High Commissioner for the Union of South Africa, and Sir J. Alfred Ewing, K.C.B., Director of Naval Education.

**TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.**—The annual congress will be held at Swansea on June 26th to 28th, the headquarters of the Association being at the Langland Bay Hotel, Mumbles.

**INSTITUTION OF ELECTRICAL ENGINEERS (DUBLIN LOCAL SECTION).**—A conversazione was held at Leinster House on Saturday last, the guests being received by the chairman, Mr. S. L. R. Price, and Committee. An excellent musical programme was provided, and the function was much enjoyed.

**Appointments Vacant.**—Shift engineer, for the Neath R.D.C. (25s.); switchboard attendant, for the Stretford U.D.C. electricity works (20s.); electrical engineer, for a Mexican power plant (£350—£400); Permanent and general assistant, for the Bexley Council Tramways (35s. to 45s.). See our advertisement pages to-day.



**Large Turbo-Dynos.**—The largest turbo-generator yet placed in service is the 15,000-kw., 6,600-volt, 750-R.P.M. unit (one of three such ordered from the General Electric Co., U.S.A.), which has replaced a number of 3,500-kw. reciprocating-engine sets in the Water-side station of the New York Edison Co. This machine has been in satisfactory operation since last November. A six-stage Curtis turbine is supplied with steam at 180 lb. per sq. in. and 55° C. superheat; exhausting to a vacuum of 724 mm. (95 per cent.), the steam consumptions at various loads are:—

Load in kw. ... ..	10,000	15,000	20,000
Kg. steam per kw.-hour	6.81	6.54	6.81

The machine is mounted 10 ft. above the level of the vault floor, and occupying a floor space of about 17 ft. 3 in. × 16 ft. 9 in., stands 35 ft. 3 in. high overall. The heaviest single piece of the machine weighs 110 tons; the rotor weighs 108 tons, and the total weight is 415 tons. The old reciprocating engine sets occupied 890 sq. ft., as against 288 sq. ft. occupied by the turbo-set, which thus yields about 18 times greater output on a floor space basis. The turbine runners are 3.9 m. in diameter, and the number of blades is 7,200, while the various consumptions per 24 hours on full load are:—7,180,000 lb. steam; 395 tons coal; 5,000,000 gallons of circulating water; 115,000,000 cb. ft. of ventilating air (*i.e.*, 80,000 cb. ft. per minute).

**Inquiry.**—A correspondent is inquiring for the makers of the "Uniflux" reflector.

**The Electrical Trades Benevolent Institution.**—The annual Festival Dinner was held on Wednesday evening. The President, Mr. S. Z. de Ferranti, was in the chair, and there were nearly 100 present. During the evening annual subscriptions were promised amounting to £182 10s. 6d., and donations amounting to £249 18s. 6d., a total of £432 9s. Last year the total was £258 17s. 6d. Our report of the function will appear in our next issue.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—MR. H. H. DENTON, the borough electrical engineer, Crewe, has, on the occasion of his marriage, which took place on April 18th, been the recipient of a case of cutlery from the officials of the Crewe Corporation. The presentation was made by the town clerk, Mr. H. S. K. Feltham, during a smoking concert held at the Imperial Hotel under the auspices of the Crewe Municipal Officers' Guild. Mr. Denton has also been presented with a smoking cabinet by the electricity works staff and employés, the presentation being made by Mr. J. Hooley, chief assistant engineer.

An Australian contemporary states that MR. H. J. SPENCER, electrical engineer, Redfern, N.S.W., has returned to the position he previously held as electrical engineer with the Hobart Gas Co., Tasmania.

**Tramway Officials.**—The Tramway Committee of the Doncaster T.C. has appointed MR. A. M. STRACHAN, of Dundee, as traffic superintendent. Mr. Strachan has held a similar position at Dundee for three years. There were over 90 applicants.

**General.**—The marriage took place at St. Augustine's Church, Preston Park, Brighton, on April 18th, of MR. HARRY HOLLIDAY, A.M.I.E.E., of Torquay, and Miss Gladys M. Hamilton Durn, daughter of Mr. E. Durn, of 5, Beaconsfield Villas, Brighton.

A Cape Town correspondent informs us that MR. JOHN DENHAM, who was for many years Government electrician and railway electrical engineer to the Cape Government, leaves very shortly for England by the East Coast route on a six months' holiday. On his return Mr. Denham will take up his new duties under the Union Government as inspector of machinery on the Rand.

MR. SHERARD COWPER-COLES informs us that he severed his connection some time ago with the Cowper-Coles Galvanising Syndicate, and that he is in no way connected with the Magnet Galvanising & Plating Co., Ltd., which has been formed to acquire the business of the Cowper-Coles Galvanising Co., Ltd.

The *Australian Mining and Engineering Review* states that MR. LASCELLES PARRINGTON, late Victorian manager for the electric light department of the Welsbach Co., has resigned that position, with a view to practising as a consulting electrical engineer.

COL. SIR HERBERT JEKYLL, R.E., K.C.M.G., has been elected a director of the Underground Electric Railways Co., of London, Ltd.

MR. F. DOUGLAS WATSON, the general manager and secretary of the Constantinople Telephone Co., arrived in England last week and will be returning to Constantinople in about a fortnight's time.

MR. ARTHUR W. SPEAR, for many years connected with the Edison & Swan United Electric Light Co., Ltd., has now joined the staff of Messrs. W. & R. Jacobs, specialists in glass shades and electrical novelties and general electrical accessories, being their resident representative for the North and Midlands.

With reference to a "Personal" note appearing on page 344 of our issue of March 1st, a Cape Town correspondent states that the latter part of the paragraph is not correct. He continues:—

"There is still a Local Section of the Institution of Electrical Engineers at Cape Town, and the new officers are:—Chairman, W. F. Long; vice-chairman, W. Hudson; and the following Committee:—Dr. Beattie, A. G. Simpson, A. Vaux, with Prof. Bohle as hon. secretary; and Mr. Pickering as hon. local secretary to the Institution."

MR. G. E. WRIGHT, chief electrical engineer to the North-Western Railway, India, is at present in this country on leave. His address, for correspondence only, is "Longstone," Shalford, near Guildford.

**Obituary.**—The death took place at Leeds on April 15th, after a short illness, of MR. ROBERT HUDSON, who was well known in electrical engineering circles in Yorkshire. In 1892 he became one of the directors of the House-to-House Electricity Co., which was the forerunner of the present municipal electricity undertaking at Leeds, and which was taken over by the Corporation six years later. Afterwards he joined the board of the Yorkshire Electric Power Co., Ltd., a position he retained until his demise. Mr. Hudson, who was in his 73rd year, was the founder and head of the firm of Robert Hudson & Sons, engineers, of the Gildersome Foundry, Morley.

Among the passengers who lost their lives in the *Titanic* disaster was MR. B. Case, managing director of the Vacuum Oil Co., Ltd., who came to England from the States in 1886, in the interests of the company. Returning to America in 1891, he came once more to England in 1899, since when he has had control of the company's interests. He was 48 years of age.

## NEW COMPANIES REGISTERED.

**Automatic Manufacturing Co., Ltd.** (121,352).—This company was registered on April 11th, with a capital of £50 in £1 shares, to carry on the business of owners of patents and inventions, contractors for electric lighting, advertising agents, &c. The subscribers (with five shares each) are:—J. E. Olvis, 139, Edgware Road, W., engineer; E. Granville-James, 27, Queen Victoria Street, E.C., secretary. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first: qualification, £25; remuneration, £25 each per annum (chairman, £35). Registered office, 27, Queen Victoria Street, E.C.

**Electric Marine Propulsion Co., Ltd.** (8,209).—This company was registered in Edinburgh on April 4th, with a capital of £60,000 in £1 shares, to acquire the interests of Mavor & Coulson, Ltd., engineers and electricians, Glasgow, in inventions for applying electricity to ship propulsion. The subscribers (with one preference share each) are:—H. A. Mavor, 3, Windsor Circus, Glasgow, engineer; W. C. Warden, 66, Gordon Street, Glasgow, merchant; R. Robertson, 154, West George Street, Glasgow, civil engineer; W. A. Coulson, 47, King Street, Mile End, Glasgow, electrical engineer; G. T. Beilby, 11, University Gardens, Glasgow; Lord Inverclyde, of Wemyss Castle; G. B. Hunter, Wallsend-on-Tyne, shipbuilder; S. Mavor, 47, Broad Street, Mile End, Glasgow, engineer. The first directors (to number three) are to be elected by the preference shareholders; qualification, 100 shares. Registered by John Oswald & Sons, Edinburgh.

**Electro-Chemical Developments, Ltd.** (121,504).—This company was registered on April 19th, with a capital of £20,000 in 19,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each, to carry on the business indicated by the title. The subscribers (with one share each) are:—R. B. Cannings, 36, Lausanne Road, Peckham, S.E., clerk; G. Rowson, 17, Chapel Street, N.W., clerk; A. W. Read, 11, Ironmonger Lane, E.C., solicitor; P. Rowson, 17, Chapel Street, N.W., clerk; G. W. Lomax, 25, Moore Street, W., clerk; W. H. Brown, 5, Shouldham Street, W., clerk; J. R. Pakeman, 11, Ironmonger Lane, E.C., solicitor. Minimum cash subscription seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Remuneration as fixed by the company. Registered by Pakeman, Son & Read, 11, Ironmonger Lane, E.C.

**"Safetee" Controlling Appliances Co., Ltd.** (121,392).—This company was registered on April 12th, with a capital of £7,000 in £1 shares (5,000 preference), to take over the business carried on at Langley Street, Luton, by A. L. Weekes, as the "Safetee Controlling Appliances Co.," and to carry on the business of manufacturers of electrical controlling gear, switch fuses, cooking, heating and domestic appliances, motor starters and regulators, &c., and to adopt an agreement with A. L. Weekes. The subscribers (with one preference share each) are:—Mrs. A. M. Weekes, Brooklands, Lansdowne Road, Luton, Beds.; W. J. Coom, 195, Castle Street, Luton, Beds., secretary; A. E. Ralph, 36, Conway Road, Luton, Beds., engineer. Private company. A. L. Weekes is the first directors; qualification, £100. Secretary (*pro tem.*): A. E. Ralph. Registered by T. Cannon Brookes, Norfolk House, Norfolk Street, W.C.

## CITY NOTES.

### Hastings and District Electric Tramways Co., Ltd.

THE directors' report for the year ended December, 1911, includes the revenue account of the statutory company for the same period, with the corresponding figures for 1910. The latter account shows that there has been an increase in the traffic receipts of £650. The expenditure side of the account shows a net increase of £1,200, principally due to the cost of upkeep of permanent way, and to the payment of increased wayleaves to the Corporation of Hastings. The revenue account, after crediting receipts aggregating £21,018 and debiting administration expenses amounting to £1,386, shows a balance of £19,632, plus £1,849 brought forward. Deducting £10,504 for interest charges, there remains an available sum of



£10,977. Out of this an interim dividend of 3 per cent. on the preference shares was distributed in October last, and it is now proposed to pay a final dividend of 3 per cent., making the full 6 per cent. for the year. From the balance of £6,177 then remaining the directors propose to transfer £4,000 to depreciation account, making the total of that account £24,000, and to carry forward £2,177. The balance-sheet gives effect to the scheme of arrangement approved by the shareholders in April last, and subsequently confirmed by the Court.

The annual meeting was held on Tuesday at the offices 1, Queen Victoria Street, E.C. MR. GEORGE KITCHIN presided, and said that dealing first with the expenditure, power costs showed a decrease of £361, mainly owing to the saving on fuel, consequent upon the adoption of a new and reliable form of meter, which was installed on all the cars in February, 1911, and which had resulted in an economy in the use of current by the motor men. Traffic expenses showed an increase of £243, principally due to the provision of new uniforms for the staff during the year. Maintenance and repairs had increased by £1,143, occasioned by extra cost incurred in the upkeep of the permanent way. The physical conditions prevailing at Hastings made the efficient maintenance of this part of the system at all times both difficult and expensive; but last year the difficulty was aggravated, as large tracts of the old macadam got simultaneously into a condition requiring renewal. To cope with this and put their track again into first-class order, it became necessary to considerably augment their permanent way staff. The increase under this heading was no less a sum than £1,311. There still remained a good deal of this work to be done, the cost of which would come into this year's accounts; but the effect of this expenditure would make itself felt in improved conditions of running, and, later on, in the reduction of maintenance costs to a normal figure. The increase of £203 in general expenses was principally due to additional payments for wayleaves under their agreement with the Corporation of Hastings. This agreement provided that such payments—in respect of some of the lines—should be increased after they had been worked for five years; the idea apparently having been to give the company time to develop its traffic and place its capital on a dividend-paying basis. When the period of five years was expiring, they wrote to the Corporation pointing out that the company, owing to various causes outside its control, had not been able to establish itself upon this footing, and asking that the increased charge might be deferred for, say, a further period of five years; but, he regretted to say that the Corporation, without giving any reason, declined to accede to their request. The receipts showed an increase of £732, of which £630 was due to improved traffic. Although the weather conditions were generally excellent, the effect was neutralised to a large extent by the railway strike, which was in progress during the time when their receipts should have been largest. The result for the year was an available balance of £10,977, which after allowing for the full dividend of 6 per cent. on the preference shares, and the allocation of £4,000 to depreciation, bringing that account up to a total of £24,000, left £2,177 to be carried forward. During the year the scheme for reconstruction sanctioned by the shareholders was passed by the Court, and the balance-sheet had been remodelled in accordance with that arrangement, unrealisable assets having been written off to the amount of £127,057. The directors congratulated the shareholders in having now what might be described as a clean balance-sheet, a depreciation fund which was gradually assuming its right proportions, and a reasonable prospect of the regular payment of at least the preference dividend. As regarded the current year's operations, the coal strike had affected them in common with all the transport companies, having necessitated their running a modified service as from March 20th. They managed, however, to run the full service during the four days of the Easter holidays, but owing to the curtailment of the railway services the result compared unfavourably with that for the corresponding days of last year. The branch of their line that ran from Bexhill to Cooden Bay had always been run at a loss, but it was satisfactory to know that extensive developments were now taking place on Earl de la Warr's estate at Cooden, comprising the laying out of residential building plots, the erection of a large hotel, the licence for which had already been granted, the construction of a golf course and tennis courts. All of those would be near to the Cooden terminus of lines, and should eventually make this line a benefit to the company instead of a drawback.

MR. E. C. MORGAN seconded the motion, and the report was adopted.

### Callender's Cable and Construction Co., Ltd.

THE directors' report states that the accounts for the year ended December 31st, 1911, show a balance at the credit of profit and loss account of £76,835, plus £40,073 brought forward, making together £116,908; from this must be deducted interest on debenture stock £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, £8,338; written off office furniture, £289; making £32,127, leaving an available balance of £84,781, which it is proposed to deal with in the following manner:—Dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, being 10s. per share, whereof 5s. less income-tax, was paid on November 1st, and 5s. less income-tax, will be paid on May 16th, £17,500; a bonus of 5s. per share, less income-tax, to be paid also on May 16th, £8,750, carrying forward £58,531. The profit for 1911 shows a substantial increase, being no less than £20,978 more than those of 1910. The

directors consider this result to be highly satisfactory. In spite of many difficulties due to labour unrest, the business of the past year showed a gratifying increase, the employment of electricity (and consequently of cables) having steadily advanced. The company's export business has been extended in many directions, and there has been a large demand for cables both in the overseas trade, and for the Continent, where the use of electricity is expanding at a still more rapid rate than in this country. Since the close of the year now under review, several important foreign contracts have been secured, one order especially, for the City of Tokio in Japan, being of unusual magnitude. The telephone cable department has now been centred at Erith, and is completely installed and running in a satisfactory manner. Important orders have been received from the British Government, from various Colonial authorities, and from abroad. Developments have also taken place in the company's engineering department, resulting in new branches of manufacture being undertaken, producing a larger turnover and better results than in the previous year. In all departments the factory at Erith was fully occupied, especially during the latter part of 1911. This healthy condition of affairs continued into the present year, but for a time less new home business was placed as a result of the interruption to trade in all parts of the country from the unfortunate strike of the miners, which is, however, now happily at an end. Owing to arrangements made in the early months of this year it has been possible, in spite of the strike, to continue the operations of the cable department without any curtailment, and large orders are in hand and in course of manufacture. Some reduction in the running hours of the engineering department has, however, been necessary, but it is expected that at an early date normal conditions will again be resumed in these shops. It is to be regretted that the steadily improving trade in the electrical industry has been interrupted just at the time when prospects were brighter than they have been for many years past. The operations of the Anchor Cable Co., in which this company holds a substantial interest, have again been satisfactory. The turnover has been increased, the scope of the business has been extended in several directions, and the profits realised have been in excess of those of any previous year, the dividend for 1911 having been 15 per cent. As usual, all machinery, plant, and appliances at the factory and on outside contracts at home and abroad, have been maintained in the highest possible state of efficiency, the cost having been debited against the year's profits. The arrangements referred to last year with reference to the Uxbridge and District Electric Supply Co., Ltd., were duly completed, and the results obtained have been fully in accordance with the expectations of the directors. The increase in the volume of foreign business to which reference has been made, has of necessity involved the employment of large sums of money. In order to cope with the situation thus arising, and to obviate the necessity of making a further issue of the capital or debentures, arrangements have been made for the formation of a subsidiary investment company to be called Callender's Share and Investment Trust, Ltd. A sale of a considerable amount of the company's holdings in other undertakings will be made to the new company in exchange for funds to be used in the immediate expansion of the business. Full details of these arrangements will in due course be submitted. An amount of £10,000 hitherto standing in the balance sheet to the credit of a suspense account now disappears; this sum has been written off share investments. A portion of the amount at credit of machinery renewal account has been applied in reduction of patterns. Owing to the extension of the company's business, Mr. Petersen, one of the assistant managers, who has filled the post of acting secretary during the past year, has found it impossible to combine both duties, and the directors have therefore appointed Mr. Walter Allnutt, who has been in the service of the company for several years, to the post of secretary.

### Indo-European Telegraph Co., Ltd.

IN their report for 1911, the directors remind the shareholders that the company's Persian Concession has already been extended to 1945, and they state that terms have now been agreed both with the Postmaster-General and with the Imperial German Telegraph Administration for a similar extension, which will, they hope, shortly be embodied in formal agreements. The agreement with the Postmaster-General will, it is hoped, include the provision for the company's use of an additional cross-Channel cable wire, which has so long been urgently needed to enable the company to deal effectively with increasing traffic. Negotiations with the Imperial Russian Telegraph Administration with a view to a similar extension of the company's concession from the Russian Government are in active progress, but no definite announcement can be made at present. The company's revenue from message account and other sources, as shown in the revenue account, amounts to £172,427, as compared with £155,549 for 1910, showing an increase of £16,878. The expenses are, on commercial and general account, £55,714, and on maintenance account, £30,372, making a total of £86,087 as against £80,869 for 1910, showing an increase of £5,218. The revenue account, therefore, shows a balance of £86,340, which is carried to profit and loss account, 1911, and after deduction of income-tax paid is reduced to £81,770. To this is added the balance of profit for 1910 brought forward of £11,327, making a total of £93,098. £35,000 has been placed to reserve, and £3,454 has been provided to meet the depreciation of the company's securities to date. Deducting these sums and the interim dividend of £10,625 already paid, there remains a balance available for distribution of £44,019. The directors now



propose to declare a dividend for the six months ending December 31st, 1911, of 17s. 6d. per share (making, with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax, carrying forward £12,144 to the credit of 1912. They also propose to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of income-tax.

### Anglo-Portuguese Telephone Co., Ltd.

THE directors, in their report for the year ended December, 1911, state that the assets and liabilities in Portugal have been made up at the exchange ruling on that date. Provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £57,045, of which operating, management and general expenses absorbed £29,884, and royalties to the Portuguese Government, £1,634, leaving a gross profit of £25,526. After providing for debenture interest, £2,278, sinking fund, £1,322, and income-tax, £767, and appropriating £12,500 to the reserve fund, which now amounts to £50,000, the amount available for disposal, including £4,723 brought forward from the previous year, is £13,382. In November last the directors paid an interim dividend of 3 per cent., free of income-tax, amounting to £3,000. They now recommend the proprietors to declare a final dividend of 5 per cent., free of income-tax, making a total distribution of 8 per cent. for the year 1911. This will absorb a further £5,000 and leave £5,382 to be carried forward. As in previous years, the profit and loss account was credited only with the proportion of subscriptions for which the company had actually rendered service during the year. The proportion of the year's subscriptions unearned at December 31st, amounting to £24,229, has been treated in the balance-sheet as a liability of the company. During the year, considerable additions and improvements were made in the company's central offices in Lisbon and Oporto, which have had the effect of improving the service in both places. In order to provide funds for carrying out important contemplated extensions of the company's business, the directors ask the shareholders to authorise the increase of the capital of the company to £150,000.

The twenty-fifth ordinary general meeting of the shareholders of the above company was held on Monday, at 48, Cannon Street, E.C., Mr. Herbert Allen presiding.

The CHAIRMAN, in proposing the adoption of the report, said there was an agreeable monotony about the figures which he had referred to on previous occasions. Each year seemed to show an improvement on the profit of its predecessor. There had been a net increase of 233 subscribers in Lisbon and 133 in Oporto, or a total increase of 366. These increased subscribers had given them an additional gross revenue of £2,654. Having regard to the political conditions which prevailed in Portugal throughout the year, he thought that increase in revenue of nearly £3,000 could not but be regarded as satisfactory. They had succeeded in effecting a reduction of £1,339 in the operating expenses, and he thought he might claim that, as regarded ratio of expenditure to receipts, the company compared very favourably with any similar undertaking. After payment of the royalties and providing for the debenture interest and sinking fund and income tax they had a net profit of £21,160, in comparison with £17,330 for the previous year; or an increase of £3,830. Adding the balance of £4,722 brought into the accounts they had at their disposal a total of £25,882. Of that they had placed £12,500 to the general reserve; the 8 per cent. dividend, free of income-tax, would absorb £8,000, and they carried forward £5,382. The sum placed to reserve was £2,500 in excess of the sum carried to the same account in the previous year, and the carry forward was £660 better. Reverting to the condition of affairs in Portugal, whilst the political changes had not brought about the success which was anticipated in some quarters, and though there was general depression in the business of the country owing to the striving of the opposing political parties, the business of their company had suffered very little, as was proved by the continued growth of subscribers and revenue. Whatever the political situation, the feeling of the board was that the shareholders need have no misgivings as to the future prosperity of the company. The total number of calls over their lines in the year 1911 in Lisbon and Oporto was 14½ millions, an increase of three million over 1910. The total number of the company's employes was 269. As a result of the recommendations of the managing director after a visit to Portugal, they had made many minor improvements in the service. They had given a good deal of attention to the welfare and comfort of their operators and other members of the staff. He was glad to say that the effects of the strike in 1910 seemed to have entirely disappeared, and their employes were now working quite contentedly. The company had now completed 25 years of its existence, and looking back he was surprised to find what a small beginning it had in 1887. Its gross income for that year was only £4,000 odd, and the profit on working was £1,695. At the present time the gross income was £57,000, and the profit on working had gone up to £25,000 odd. Making another comparison, during the last seven years which dated from the time he became associated with the company as a director, he found that extremely satisfactory progress had been made in that later period. Prior to 1905 the finances of the company were in rather a chaotic condition, but as the outcome of what his colleagues did at that time, they had got the finances on a thoroughly sound footing. Previous to 1905 they had been paying small dividends, varying from 2½ up to 4 or 5 per cent. on a small capital of £51,000. The effect of the re-arrangement of the finances was to increase the share capital to £100,000, besides which they had

to issue £50,000 of debenture stock. In the seven years from 1904 to 1911 the gross revenue had grown from £25,000 odd to £57,000 odd, and the net profit had increased from £10,000 odd to £25,000 odd. In the same period they had got the dividend up to 8 per cent., and there they seemed to stick. The present was the third or fourth occasion on which they had paid an 8 per cent. dividend, and there seemed to be a sort of unwritten law that telephone companies should not exceed that dividend. The expenditure last year on capital account was £9,465, which was rather below the average of recent years. Since 1905 they had expended on capital account £66,000 odd, and during that period they had issued neither shares nor debentures; on the contrary, they had reduced the debenture debt by £5,975 out of profits. In the same period they had built up a general reserve fund of £50,000, and they had also formed an exchange fluctuation account of £4,000. As regarded the future, they had had to seriously consider the question of providing further facilities for the Lisbon public. There was only one alternative to enlarging and increasing the capacity of their existing exchange (which could only be done at a very great outlay), and that was to open a second exchange in Lisbon, and that they had practically decided to do. If that proposition was carried into effect they expected that the number of subscribers in the vicinity of the exchange would increase; but quite apart from that, they considered it very desirable that they should have this new exchange. It would lead to an increase in the business, and, he hoped, to a substantial increase in their profits. It would cost a very considerable sum, and they had other prospects in view for the future which could not be borne by revenue, and that was why they proposed to increase the capital of the company.

MR. CHARLES WOOLLEY seconded the motion, and the report was adopted.

Subsequently a resolution was unanimously adopted increasing the capital to £150,000 by the creation of 50,000 new shares of £1 each, the CHAIRMAN remarking that it depended very largely upon the arrangements which the company came to with the Portuguese Government whether or not the new capital would be issued.

### Lancashire Power Construction Co., Ltd.

THE directors' report for the year ended December 31st, 1911, says that the company's contract with the Lancashire Electric Power Co. for the extension of their generating station has now been completed; this extension consists of buildings designed to accommodate three generating sets, with a total capacity of about 10,000 KW., together with a first unit of 2,500 KW. and the necessary boilers and other auxiliary plant. The Parliamentary Co., in order to meet increasing demands, has found it necessary to proceed with the installation of a second unit, and the order for the plant, which is to have a normal full-load capacity of 3,500 KW., has been placed with this company. The necessary capital for the above extension was provided by an issue in June last of £50,000 of 5 per cent. prior lien bonds, which issue was fully subscribed. This company's revenue is derived entirely from the Lancashire Electric Power Co., of which they are the sole owners, and the trading profit of that company for 1911 was £10,695. This result is considered satisfactory, after taking into account the labour troubles and railway strike, the effect of which in the manufacturing district of Lancashire has been very keenly felt. The amount standing to the debit of the company's revenue account, after payment of debenture interest, &c., is £7,737, which will, given normal industrial conditions, be written off out of the profits for the current year; if this anticipation is realised the debit balance of £17,194, shown in the company's balance-sheet of 1909, will have been entirely written off out of revenue. From the following comparisons it will be seen that the growth of the company's business during the year 1911 has been well maintained, in spite of the adverse conditions brought about by the unsettled state of the labour market:—

	1909.	1910.	1911.
Units generated .. ..	9,251,831	13,646,307	17,771,936
Max. load in kw. ....	3,830	4,690	5,590
H.P. connected .. ..	7,710½	10,600	13,600
Receipts.... ..	£15,294	£24,952	£32,726
Expenditure .. ..	£15,164	£18,467	£22,031
Trading result .. ..	£130	£6,485	£10,695
	Profit	Profit	Profit

The receipts from the six districts in which the company operates electric lighting orders have shown a marked increase, the actual figures being £468 for 1910, and £1,368 for 1911. The capital expenditure on these six orders amounts to £10,697. Several important contracts came into operation during the year under review, and the demand from collieries and textile works has been particularly encouraging. The new weaving shed referred to in last year's report was completed during the summer of 1911, and the system of driving—viz., a separate motor for each loom—is giving great satisfaction to all concerned. This development has been followed very closely by those interested in the weaving industry, and numerous inquiries in connection with the system adopted have been received by the company. With regard to the present year, the consumption of energy for the first two months has shown a considerable improvement over 1911, and it is confidently anticipated that the rate of increase in the profits will not be less than in 1911; the fact that at the beginning of 1912 over 2,600 H.P. had been contracted for but not yet connected, as against 1,100 H.P. at the beginning of 1911, fully justifies this anticipation. Messrs. T. O. Callender and H. C. Levis, the retiring directors, offer themselves for re-election.

The annual meeting was held on the 18th inst., at Salisbury House, London Wall, E.C., Dr. Parshall, the chairman, presiding.



In proposing the adoption of the above report, the CHAIRMAN said there had been an issue of £50,000 5 per cent. prior lien bonds last June, for the purpose of providing for the extension to the power house. He was glad to say that the extension had been completed under the estimates, and it was working satisfactorily. The money also provided for the large generating unit placed on order to enable them to cope with the new business in sight. The Lancashire Electric Power Co.'s results, and the growth of the business, were fully set out in the report. The growth had taken place, although the general industrial conditions had been greatly disturbed. The profit (£10,695) was somewhat less than they anticipated, owing to the railway strike and other labour conditions having reduced the output during the year below the normal; but, considering all the circumstances, he thought it must be conceded that the result was a satisfactory one. They had gone through the coal strike, and kept up a supply to their customers without raising the price, and they had received many congratulatory letters from satisfied customers. As the shareholders knew, the directors had been trying year after year to get permission to give a supply to Radcliffe, which was adjacent to their power station. There was a large demand for power in that district, but the local authority had an absolute veto, and up to the present they had not been able to get permission to give a general supply. This year the Radcliffe Council applied to the Local Government Board for an additional loan, and the company, as ratepayers, opposed the application on the basis that they could give a supply more economically than the Council, and that if it were done by the latter it could only be at the expense of the rates. It came out in the inquiry that Radcliffe proposed to take a bulk supply from Bury, and that if the supply were given at the price that would enable Radcliffe to compete with the power supply of their company, Bury would be at a very substantial loss over a period of 10 years. Whether the Local Government Board were going to consent to Radcliffe embarking in the power business at the expense of Bury, remained to be seen.

SIR ROBERT A. HAMPSON seconded the motion, and the report was adopted.

### London United Tramways, Ltd.

A MEETING of the first mortgage debenture stock-holders of the above company was held on Friday last at Winchester House, Old Broad Street, E.C., Lord Revelstoke, one of the trustees, presiding. The CHAIRMAN proposed the following resolutions:—

1. That Clause 22 of the said trust deed be varied, so that in addition to the modes of investment authorised by such clause any moneys which, under the trusts of the said deed ought to be invested, may be invested in the names or under the legal control of the trustees in the said first mortgage debenture stock of the company, and that the trustees be, and they are hereby, authorised and empowered to invest any such moneys accordingly, and to execute such supplemental trust deed or other documents, and do all such things as may be necessary to give effect to this resolution. (2) That the proposal of the company to abandon the existing horse tramway and the powers to construct an electric tramway in Kew Road, Richmond, Surrey, be, and the same is hereby, approved, and that the trustees be authorised to execute and do all such releases, acts and things as they may deem necessary to give effect thereto.

He said the object of the first resolution was to enable the company to invest moneys coming into their hands under the terms of the trust deed, and particularly moneys coming from the L.C.C. in respect of the purchase of certain tramways belonging to the company within the borough of Hammersmith, in the redemption of first mortgage debenture stock, in addition to the other ways which were authorised under the trust deed. He thought it must be a self-evident proposition that such an investment as this by the company in its own debenture stock was beneficial to all parties. The second resolution gave them power to abandon the existing horse tramway and the powers which the company had to construct an electric tramway in Kew Road, Richmond. It was clear that the horse tramways could only be run at a considerable loss, and that the only method by which they could be electrified would not allow of their being a financial success. Under the circumstances, it appeared to him (Lord Revelstoke) and his co-trustee, Sir George White, that it would be in the interests of the debenture stock-holders to sanction the abandonment of a part of the concern which could only be run at a substantial loss.

MR. W. H. BROWN seconded the resolution.

MR. J. CATER SCOTT, chairman of the company, said that the question of the abandonment of the Kew and Richmond tramways was an old one. They had been working it at a loss for a great many years, and had always contemplated that it would be electrified sooner or later. From the first they had seen that the only way in which it could be worked successfully as an electric road was by the trolley system, and even then they had grave doubts as to whether it would be a great success. The Richmond Corporation, however, had insisted that the company should adopt the conduit system, which meant a much heavier cost, under which the line could never be a financial success. Under the circumstances they were going to Parliament to ask them to extend the time for the construction, but that was of very little value because their intention undoubtedly was to abandon the line if they could, and he hoped they might be able to arrange that. They would save money which they were losing every year, and they would get rid of the liability of having to spend a considerable amount in the electrification of the line.

MR. SCOTT, in reply to questions, said that by the award, the L.C.C. was to pay the company £254,000, but the Council was appealing against it on certain points, and it must not be taken that the £254,000 was the amount they would receive. It might be subject to certain deductions. There was no compulsion for holders of the debenture stock to do anything at all. The trustees would

buy the stock in the open market from such holders as wished to sell. With regard to extensions, the company at present had no intention of building further tramways; but of course they did not know what might happen in the future. The trustees could not pay the debentures off; they could only buy them in the market. The resolutions were carried unanimously.

**Prospectuses.**—*The Hydro-Electric Power and Metallurgical Co., Ltd. (Tasmania).*—Messrs. Parr's Bank, Ltd., have been offering for subscription £145,000 5 per cent. first mortgage 30-year debentures; 70,000 preference shares (5 per cent.) of £1 each have been issued and subscribed for in cash in Australia. The prospectus contained a report by Messrs. Merz & McLellan (consulting engineers to the company), stating that the power available is 85,000 H.P., and that the first portion of the company's development comprises headworks for 40,000 H.P., channels and transmission line for 20,000 H.P., and electrical generating machinery for the first 9,000 H.P. The estimated net profit from 3,000 H.P. is stated to be sufficient to cover the interest on the debentures more than three times over. Within easy transmission distance of the station, power station machinery for 32,000 H.P. is installed, which, it is said, can be advantageously supplied by the company. The construction work commenced last summer, and the weir and channels are now nearing completion. The works are estimated to cost £165,000. The list was to close on Wednesday.

*The Mexican Midland Light and Power Co., Ltd.*—The list was to close yesterday in the sale of \$3,000,000 (£616,438) in 5 per cent. first mortgage 50-year gold bonds at 88 per cent. A bonus of 25 per cent. in fully-paid shares is to be issued to each subscriber upon payment of his final allotment. The company has been formed to acquire the whole of the share capital, one million \$1 shares, of a company incorporated in Mexico, under the title of the Compañia Hidro-Eléctrica Mexicana S.A., which has a number of Mexican electrical concessions. Construction contracts have been entered into with the French Thomson-Houston Co. and Messrs. Johnson and Phillips, Ltd., of London, where under the company expects to be in a position to supply current within 18 months from commencement. The contracts for power stations, plant, transmission lines, &c., for 65,000 H.P. per annum will be £949,181. The proceeds of the present issue, together with the proceeds of \$5,000,000 bonds sold in Paris, will amply suffice to provide this sum and to pay interest on the bonds during construction. Mr. J. MacGregor, managing director of Johnson & Phillips, Ltd., is a director of the company.

*Compañia Hidro-Eléctrica de Tucuman (Argentina).*—This company has been offering £300,000 5 per cent. first mortgage debentures (£100 each), and £100,000 in shares of \$100 each. The company was formed in 1910 to supply electric energy in the entire province of Tucuman. The first section, to develop 4,000 H.P., will be completed and put into operation in September next. It is proposed to immediately extend by putting down another power station farther up the river, to provide a further 3,000 H.P., next year. £227,000 had been expended up to January last. The list was to close on Wednesday.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Birmingham Electrical Case Co., Ltd.  
British-Bitumen, Ltd.  
Cyclops Asbestos Co. (Liverpool), Ltd.  
Durite, Ltd.  
General Power Development Co., Ltd.  
Hooghly River Electric Power Co., Ltd.  
London Electric Hot Air Baths (Greville's System), Ltd.  
North-Eastern Electrical Stores, Ltd.  
North Lancashire Electrical Treatment Co., Ltd.  
Ozonia Co., Ltd.  
Pyrenees Electrical Society, Ltd.  
Railway and Tramway Development Co., Ltd.  
Scandinavian Asbestos Lubricating Co., Ltd.  
Universal Electrical Supply, Ltd.  
Variable Electric Lamp Syndicate, Ltd.  
Werner-Stuart Steam Generator Syndicate, Ltd.  
Wireless Telephony (Entertainments) Co., Ltd.

**Stock Exchange Notices.**—The Committee have appointed special settling days as under:—

Thursday, May 2nd.—Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid (Nos. 1 to 100,000); and 200,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 200,000).

And ordered the undermentioned securities to be quoted in the Official List:—

Automatic Telephone Manufacturing Co., Ltd.—200,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 200,000).

Calcutta Electric Supply Corporation, Ltd.—Further issue of 88,012 5 per cent. cumulative preference shares of £5 each fully paid (Nos. 180,371 to 198,382).

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

South American Light and Power Co., Ltd.—£150,000 5 per cent. first debentures of £100 each (Nos. 1 to 1,500).

**Calcutta Electric Supply Corporation, Ltd.**—The directors have decided, subject to audit, to recommend a final dividend on the ordinary shares for the half-year ended December 31st last, at the rate of 10 per cent. per annum, making 8½ per cent. for the year, the same as for 1910.



### Victoria Falls and Transvaal Power Co.

THE MARQUIS OF WINCHESTER presided on Monday, at Salisbury House, E.C., over an extraordinary general meeting of the above company, for the purpose of considering, and, if thought fit, passing the following resolution:—

"That the directors be, and they are hereby authorised, in addition to the £3,000,000 already borrowed for the purposes of the company, to borrow amounts not exceeding in the aggregate £2,000,000, and to secure the repayment of the sum or sums so borrowed in such manner and upon such terms and conditions in all respects as they think fit."

The CHAIRMAN, in moving the resolution, said the shareholders were invited to sanction an increase in the borrowing powers of the company by £2,000,000 in excess of the £3,000,000 which, as they were aware, had been already issued, and the greater part of the proceeds of which was represented by the plant upon the Witwatersrand already in commission, while the balance was required for plant now under construction. They had Simmer Pan and Brakpan for supplying Victoria Falls consumers, and Rosherville and Robinson Central for the supply of the Rand Mines power consumers, all working at their full capacity. By August next the Vereeniging station should be in operation to the extent of 50 per cent. of its present proposed capacity, and the balance should be in commission at the commencement of 1913. The demands of their customers under long-term contracts fully exceeded the capacity of their present stations, including the Vereeniging station. It was proposed to ask the shareholders to consent to the increase in the borrowing powers by £2,000,000, by the creation of £2,000,000 5½ per cent. second debentures, but it was only proposed to issue at the present time £1,000,000. If they sanctioned the borrowing powers asked for, the arrangements for the issue negotiated with certain strong financial groups would be concluded. The provision of these future financial resources would be to add strength to the undertaking, and they were confident the issue would improve the prosperity of the holders of the preference and ordinary stock.

MR. J. BRAKPAN seconded the resolution, which was carried without discussion.

### Peterborough Electric Traction Co., Ltd.

THE directors' report for 1911 states that the total revenue amounted to £6,961, and after deducting expenses chargeable to revenue, £4,568, and debenture interest, £945, the profit was £1,448, plus £52 brought forward. The directors recommended that £750 be allocated as provision for renewals; preference dividend for the six months ended March 31st, 1909, absorbed £660; and £90 is carried forward. The total expenditure on capital account, including preliminary expenditure, has been £62,912. There was an increase in the traffic receipts of £667, as compared with 1910, mainly due to the improved state of trade, also to the opening of the new agricultural show ground on the line of route. The net profit for the year increased by £495.

The annual meeting was held on Tuesday, at the Electrical Federation offices, Kingsway. LORD VAUX OF HARROWDEN, who presided, said the traffic receipts had been very satisfactory. The net result of the parcels business was slightly better, while the advertising receipts were up £56. The decrease in the sundry receipts of £66 was owing to their having sold less scrap. The expenditure had increased by about £174, which was partly due to the extra car-mileage run during the year under review, and to the general upkeep of the permanent way, cars, &c. They had carried 130,769 more passengers, and the average expenditure per passenger had dropped from '90d. to '84d. or '06d., while the proportion of expenses to receipts had decreased by 5 per cent. The directors recommended that £750 be placed to a provision for renewals account, in order to meet renewals which would have to be faced during 1912. During the present year they had made satisfactory arrangements with the various local authorities for the upkeep of the company's track within and without the borough for the next five years. Their traffic receipts were gradually improving, which tended to show that they had not been, so far, adversely affected by the coal strike.

MR. E. A. PARIS seconded the motion, and the report was adopted.

**River Plate Electricity Co., Ltd.**—The directors announce that the net revenue for 1911 was £37,200, against £35,026. A dividend on the ordinary stock of 10 per cent. is recommended, and £15,000 is placed to reserve, against £14,000 last year, making that fund £100,000; £7,659 is carried forward, against £5,888 last year.

**Continental.**—SWITZERLAND.—"Motor" Société pour les Applications de l'Electricité, of Baden, is increasing its capital to £1,200,000.

BELGIUM.—The Bell Telephone Manufacturing Co., of Antwerp, is declaring a dividend of 5 per cent. for the last financial year.

FRANCE.—The balance-sheet of La Société Française des Câbles Electriques, Système Berthoud, Borel & Co., of Lyons, for the last financial year, shows a net profit of £18,470, as compared with only £9,923 in the preceding 12 months.

### Rangoon Electric Tramway and Supply Co., Ltd.

—The directors' report states (according to the *Financier*) that the permanent way, cars, overhead, and tramway equipment, have during the past year been maintained in an efficient state. During the year to December 31st, the company's cars travelled 1,417,118 miles, a decrease of 25,353 miles, and carried 9,569,922 passengers, an increase of 288,105, the receipts being Rs. 842,033, a falling off of Rs. 37,212. This decrease has been mainly brought about by the financial and economic troubles with which Rangoon has been visited during the past year, severely affecting that portion of the population from whence the tramway traffic is chiefly derived. A considerable improvement is shown in the private lighting and power department, the receipts for current supplied being Rs. 3,89,710, an increase of 33'83 per cent., while the working expenses were 46'13 per cent., a decrease of 5 per cent. The returns from the house-wiring department also again show an improvement. The profits were £2,021, as compared with £769 for the previous year. It is, however, obvious that the work of installing light and power has its limitations. It is satisfactory to note that the falling off in the tramway receipts has been met by the increase in the profits of the departments already referred to, the gross profits from all sources for the past year being £50,733, as compared with £46,177 for the previous year. This result has been obtained without a corresponding increase in the working expenses. The gross profits for the year were £50,733; add transfer fees and interests on deposits, £310; together, £51,043. Deduct:—Interest on debenture stock, £8,770; provision for redemption of debenture stock, £5,619; depreciation on live stock, harness, furniture, &c., in Rangoon, £1,225; transfer to reserve for renewals account, £10,000; and fees of directors and trustees and expenses in London, £2,057; leaving £23,371, plus £822 brought forward, making £24,193. Deduct preference dividend to December 31st, £15,000; formation expenses, balance written off, £500; leaving available for dividend to holders of ordinary shares, £8,693. From the above amount the directors recommend a dividend on the ordinary shares of 4½ per cent. for the year, free of income-tax, which will absorb £7,965, and £728 will be carried forward.

**Johnson & Phillips, Ltd.**—The directors' report for the year ended December, 1911, states that the profit for the year on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £6,000 for maintenance of buildings, plant, &c., amounted to £18,400, plus £2,154 brought forward. From this the following have to be deducted:—Remuneration of directors, auditors' and trustees' fees, £1,370; interest on debenture stock, £7,115; reserve *re* debenture sinking fund, £5,797; interest on second debentures to December 31st, 1911, £1,750; depreciation on machinery and plant, &c., £3,139; interest on loan, £351; carrying forward £1,038. The directors report that the loan of £34,660, appearing in the last balance-sheet, and for which £50,000, short term second debentures were given as security, has been repaid, and that issue of debentures cancelled. A new issue of £50,000 second debentures has been created, and £30,000 of these have been issued. Mr. W. Claude Johnson offers himself for re-election as a director.

## STOCKS AND SHARES.

Tuesday Evening.

THE fever of the gambling spirit that has been so much in evidence in the Stock Exchange for the past few weeks has spent some of its force, and with severe falls in certain of the leading speculative securities, there has come a pronounced check to business everywhere. Some stress was laid on the foreign complications that might ensue through Italy's action in connection with the Dardanelles, but nobody took this matter very seriously, and what has brought about the decline more than anything else has been profit-taking on the part of those who recently were such avid buyers. Besides the securing of profits, there may have been cutting of losses; but in any case, it is no bad thing that the speculative movement for the time being should have received a check.

The Home Railway market reflects the general condition of caution in falls that have occurred amongst the Underground issues, of which a 2½ drop in Districts is the most prominent. Underground Electric Income bonds fell 2, but recovered the loss, while the shares eased off to 4½. Metropolitans lost 10s.; Great Northern and City Preferred have again fallen 5s. Nothing has changed in the intrinsic condition of any of the companies so far as can be ascertained, but people have been buying more than they could carry, and with the advent of the settlement some of the holders elected to part with their stock. It is surprising, in the circumstances, that the reaction should have been so slight, considering the rises which took place previously.

Central London Deferred, with a rise of 5, has proved a brilliant exception to the prevailing dulness, while the Ordinary put on 2. This is due to persistent rumours that two or more of the larger companies are angling for control of the line, the current idea being that whichever company succeeds will pay a guaranteed dividend to the Central London, the amount being stated in some quarters as high as 5 per cent., which certainly appears to be an extravagant estimate. City and South London Ordinary, after being up to 43½, reverted to 42½, but there has been further inquiry for the company's 5 per cent. Preference stocks, with the result that the 1901 and the 1903 issues are both a point higher. District 4 per cent. 1st Preference is also better to the same extent.



A smart rise in London United Tramways Preference carried the price up to 4½, at which it shows an advance of 12s. 6d. on the week, while the Debenture stock is 1 higher at 77½. This is the result of the award whereby the London United Tramways Company receives £254,000 in respect of 5 miles of tramway in Hammersmith, and already hopes are being held out that the shares may be within sight of resumption of dividend payments—which, by the way, have been suspended since December, 1908. Other home tramway descriptions are steady, with rises in Bath shares and in British Electric Traction non-cumulative Preference, the declaration of the half-yearly dividend on the 6 per cent. cumulative Preference, having attracted attention to the junior issues.

In the English Electricity division the feature is a drop of 30s. in City of London Ordinary, bringing the price down to 20½; while the Preference at 17 have lost £3 of their 5½ jump of last week. The 5 per cent. Debenture stock, however, is 2 up. The company published last week a contradiction of the statement that the Corporation had entered into negotiations with it for the acquisition of the undertaking, and this brought in sellers with a rush. Nevertheless, there are not wanting some who declare that the deal will go through as they have been predicting all along, but manifestly it is unsafe to deal in the shares at the present time without inside information. In this connection, the cynical epigram may be recalled that more money has been lost over early news and inside information than over any other causes. County of London Ordinary, with a rise of ½, justified the hint given here last week that these shares could be accounted cheap at their then price. The Preference shares are higher, and so is the First Debenture stock, while the new Ordinary hardened up to 10s. premium for special settlement. London Electric Ordinary went back ½, but Notting Hill at 10½ are ¼ higher, and Westminster Preference improved the turn of the market. A good deal of attention is being paid to the position that is likely to face the lighting undertakings in 1931, but so many cross-currents enter into the question that the man in the street will do well to take with a pinch of salt most of the loose assertions which are being made on the point.

The Telegraph market displays a certain amount of hesitation. West India and Panama have been supported, but the price reacted after an advance, and the First Preference are ½ easier. Western Telegraphs fell ½, and Anglo-American are easier, although Direct United States shares at 8 are ½ higher. Eastern Preference and Eastern Extension shares have drooped a little, while West Coast of America gained 2s. 6d. The market hardly knows how to take the deplorable loss of the *Titanic* as a market factor. It is argued, on the one hand, that after this all ocean-going ships will have to be fitted with Marconi apparatus. On the other hand, the catastrophe is held to show that the wireless system is still far from perfect. Marconi shares themselves have had a severe fall, the first for many weeks. Last Friday the shares of the American Marconi Company were introduced to the market amidst scenes of wild excitement, and the price touched 4, slumping to 2½ three days later, from which there was some recovery. Gambling of this sort threw discredit upon the market in the parent shares, and led to a scuttling-out of bulls, who feared that the end of the Marconi boom was at hand. It may be taken for granted, however, that Marconis will be the centre of extensive dealings, both for speculative and investment purposes, for a long time to come; and the prospective purchaser must take his choice between two contentions—one that the shares will go to 10, and the other that they will go to 5. Canadian Marconis dropped to 30s., and recovered to 32s.; Spanish and General, after being 1½, picked up to 2½, these movements showing the violence of the fluctuations. There have also been sharp movements in National Telephone Deferred stock, though on balance the net result is small. Attention has been drawn to the Third Preference shares as being under-valued at 6 if the Deferred stock should be worth 150, but here again the change on the week is a mere ¼ rise.

Foreign Traction and Power shares have been sold pretty freely, possibly to pay differences incurred elsewhere. It is rather surprising to notice how steady the Mexican varieties keep in face of disquieting news from the country. Mexico Trams are down 2, but this followed a rise of nearly twice as much last week. Mexican Light and Power issues have not moved. There was a sharp break in Shawinigan Water in consequence of a fall in Canadian Railway shares, but the company's bonds are ½ up. Kaministiquia Fives are 7 points down, and Montreal Common fell 4. Holders of Rio Trams have been selling pretty extensively, with the result that the price is 1½ down, but here also the bonds are remarkably firm. Calcutta Trams are better to the extent of ½, but Madras Electric Ordinary dropped ½. Bombay Preference rose ¼, the contradictory movements in these Indian shares arousing interest and not a little perplexity. The Anglo-Argentine group is steady, with the Debenture stocks in demand, and it may be worth pointing out that the second Preference can now be obtained at a trifle over 5, giving a yield of practically 5½ per cent. on the money.

Manufacturing shares are characterised by a drop of 1 in India-rubbers, which has lowered the price to 9, while Edison & Swan 4 per cent. Debenture at 68 shows a loss of 4. Henleys and Callenders are both rather firmer, and Aron Ordinary attracted attention, with the result that the price is better by a few pence. Babcocks eased off a shade, and the rest of the market is steady. The Hydro-Electric Company of Tucuman, has been offering issues of Debentures and shares, and the River Plate Electricity Company, on this, pointed out that the City of Tucuman is already supplied with electric light and power. The River Plate Company is about to offer £30,000 ordinary share capital to proprietors of the existing ordinary stock.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	" Nitric .. .. per lb.	22/-	..
a	" Oxalic .. .. per lb.	2½d.	..
a	" Sulphuric .. .. per cwt.	5/6	..
a	Ammoniac Sal .. ..	42/-	..
a	Ammonia, Muriate (large crystal) per ton	£29 10	..
a	Bleaching powder .. ..	£5 10	..
a	Bisulphide of Carbon .. ..	£18	..
a	Borax .. ..	£16 10	..
a	Copper Sulphate .. ..	£24 15	5/- inc.
a	Lead, Nitrate .. ..	£26 10	..
a	" White Sugar .. ..	£25 10	..
a	" Peroxide .. ..	£32	..
e	Methylated Spirit .. .. per gal.	2/6	..
a	Potassium, Bichromate, in casks per lb.	3½d.	..
a	Potash, Caustic (88/90 %) .. per ton	£22 10	..
a	" Chlorate .. .. per lb.	3½d.	..
a	" Perchlorate .. ..	4½d.	..
a	Potassium, Cyanide (98/100 %) ..	7½d.	..
(for mining purposes only)			
a	Shellac .. .. per cwt.	75/-	7/- inc.
a	Sulphate of Magnesia .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. ..	£6 10	..
a	" Recovered .. ..	£5 10	..
a	" Lump .. ..	£5 5	..
a	Soda, Caustic (white 70/72 %) ..	£10 5	..
a	" Chlorate .. .. per lb.	3½d.	..
a	" Crystals .. .. per ton	£3 5	..
a	Sodium Bichromate, casks .. per lb.	3d.	..
METALS, &c.			
b	Aluminium Ingots, in ton lots .. per ton	£67	..
b	" Wire, in ton lots .. ..	£102	..
b	" Sheet, in ton lots .. ..	£120	..
p	Babbitt's metal ingots .. ..	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis) per lb.	8½d.	..
c	" Tube (brazed) .. ..	10½d.	..
c	" (solid drawn) .. ..	9d.	..
c	" Wire, basis .. ..	8½d.	½d. inc.
c	Copper Tubes (brazed) .. ..	11½d.	½d. dec.
c	" (solid drawn) .. ..	10½d.	½d. dec.
g	" Bars (best selected) .. per ton	£86	..
g	" Sheet .. ..	£86	..
g	" Rod .. ..	£86	..
d	" (Electrolytic) Bars .. ..	£74 10	5/- inc.
d	" Sheets .. ..	£91 10	5/- inc.
d	" Rods .. ..	£79 10	5/- inc.
d	" H.C. Wire .. per lb.	9½d.	..
f	Ebonite Rod .. ..	5/3	..
f	" Sheet .. ..	4/9	..
n	German Silver Wire .. ..	1/11	..
h	Gutta-percha, fine .. ..	..	..
h	India-rubber, Para fine .. ..	4/9	½d. dec.
i	Iron Pig (Cleveland warrants) .. per ton	53/7	1,5½ inc.
i	" Wire, galv. No. 8, P.O. qual. ..	£14	..
g	Lead, English Pig .. ..	£17 to £17 2s. 6d.	10/- inc.
m	Manganin Wire No. 28 .. .. per lb.	6/6	..
g	Mercury .. .. per bot.	£8 12 6	..
e	Mica (in original cases) small .. per lb.	6d. to 2s.	..
e	" " " medium .. ..	2/6 to 4/-	..
e	" " " large .. ..	4/6 to 8/6	..
p	Phosphor Bronze, plain castings ..	11d.	..
p	" " rolled bars & rods ..	1/0½	..
p	" " rolled strip & sheet ..	1/1	..
o	Platinum .. .. per oz.	185/-	..
d	Silicium Bronze Wire .. .. per lb.	10½d.	½d. inc.
r	Steel Magnet, in bars .. .. per ton	£55	..
g	Tin, Block (English) .. ..	£207 to £209	£7 inc.
n	" Wire, Nos. 1 to 16 .. .. per lb.	2/4	..
p	White Anti-friction Metals .. per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.) ..	£29 15	10/- inc.

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p .. ..
h Edward Till & Co.	r W. F. Dennis & Co.

**City Electric Light Co., Ltd. (Brisbane).—**The directors, in their report for the half-year ended January 31st, 1912, which was adopted at the meeting on March 12th, stated that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal replacement and contingencies account, there remained a credit balance of £6,215, which with the balance brought forward from last half-year, made £8,125 to be disposed of. The directors recommended that a dividend be paid of 3 per cent. on the preference shares and of 5 per cent. on the fully-paid ordinary shares, and of 5 per cent. on the contributing shares. The payment of the above-mentioned dividend together with the dividend duty absorbs £5,740, leaving a balance of £2,386 to be carried forward. During the half-year the directors had evidence of the value to the company in most of the employees becoming shareholders thereof.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 23rd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations April 23rd.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	8½—9½	..	5 19 0	Kensington & Knightsbridge, Ord	5	9	9	7½—7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½	4½	8½—9½	..	4 14 9	Do. 4 % Deb. ..	Stock	4	4	92—95	..	4 4 8
Do. Second 6 % Pref. ..	10	6	6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½	4½	100—102	..	4 8 3	London Electric, Ord. ..	8	2	2½	1½—2	—½	3 14 11
Brompton & Kensington, Ord. ..	5	10	10½	8½—8½	..	5 14 8	Do. 6 % Pref. ..	5	6	6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7	7	7½—8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4	4	92—95	+1	4 4 3
Central Electric Supply, 4 %	100	4	4	98—101	..	3 19 3	Metropolitan ..	5	5	4½	8½—4½	..	5 17 8
Guar. Deb. ..	5	5	5	4½—5	..	5 0 0	Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	4½	4½	4½—4½	+ ½	4 14 9	Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	101—104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	5 2 10	Do. 8½ % Mort. Deb. ..	Stock	8½	8½	84—87	..	4 0 6
Do. "City Undertaking"	5	4½	4½	8½—4½	..	4 1 8	Midland Electric Corporation	100	4½	4½	96—98	..	4 11 10
Do. Do. 4 % Deb. ..	100	4	4	95—98	..	5 0 0	4½ % First Mort. Deb. }						
Chelsea, Ord. ..	5	5	5	4½—5	..	5 0 0	Newcastle-on-Tyne ..	5	4	4½	8½—3½	..	5 3 3
Do. 4½ % Deb. ..	Stock	4½	4½	98—101	..	4 9 1	Do. 5 % Pref., Non-Cum. ..	5	5	5	3½—4½	..	5 14 3
City of London, Ord. ..	10	7	8	19½—21½	—1½	3 14 5	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.) }	100	5	5	99—102	..	4 13 0
Do. 6 % Cum. Pref. ..	10	6	6	16—18	—3	3 6 8	Notting Hill, 5 % Non-Cum. Pref. }	10	..	6	10½—11½	+ ½	5 6 8
Do. 5 % Deb. ..	Stock	5	5	119—123	+2	4 1 4	Oxford ..	5	7½	7½	5½—6½	..	5 13 9
Do. 4½ % Second Deb. ..	100	4½	4½	101—104	..	4 6 7	St. James' and Pall Mall, Ord.	5	10	10	8½—9	..	5 11 1
County of Durham, 5 % First Mort. Deb. }	Stock	5	5	87—89	..	5 12 4	Do. 7 % Pref. ..	5	7	7	6½—7½	..	4 16 7
County of London, Ord. ..	10	5	6	10½—11½	+ ½	5 6 8	Do. 8½ % Deb. ..	100	8½	8½	85—87	..	4 0 6
Do. 6 % Pref. ..	10	6	6	11½—11½	+ ½	5 2 7	Smithfield Markets, Ord. ..	5	Nil	2	12—17	..	..
Do. 4½ % Deb. ..	Stock	4½	4½	108—110	+1	4 1 10	South London, Ord. ..	4	5	5	2½—3½	..	6 8 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	101—104	..	4 6 7	Do. 5 % First Mort. Deb. ..	100	5	5	99—102	..	4 13 0
Edmundson's, Ord. ..	5	Nil	Nil	3—8	..	Nil	South Metropolitan, 7 % Pref. ..	1	7	7	1½—1½	..	6 1 0
Do. 6 % Cum. Pref. ..	5	Nil	Nil	3—3½	..	Nil	Do. 4½ % First Deb. Stock ..	100	4½	4½	96—99	..	4 11 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86—89	..	5 1 2	Urban, Ord. ..	5	5	..	2—3	..	..
Folkestone ..	5	6	6	4½—4½	..	6 3 1	Do. 5 % Cum. Pref. ..	5	5	..	2½—3½	..	..
Do. 5 % Cum. Pref. ..	5	5	5	4½—4½	..	5 5 3	Do. 4½ % First Mort. Deb. ..	100	4½	4½	80—88	+ ½	5 2 3
Do. 4½ % First Deb. ..	100	4½	4½	93—96	..	4 13 9	Westminster, Ord. ..	5	10	10	8½—9½	..	5 8 1
Hove ..	5	9	9	6½—7	..	6 8 7	Do. 4½ % Cum. Pref. ..	5	4½	4½	5½—5½	+ ½	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6	6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5	5	88—90	+ ½	5 11 1
Calcutta, Ord. ..	5	8½	7½	6½—7½	..	5 17 3	5 % 1st Mort. Deb. }						
Do. 5 % Pref. ..	5	5	5	5—5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7	8	204—209	—4	3 16 7
Calgary Power, 1st Mort. Bds.	100	5	5	92½—94½	..	5 5 3	Northern, Lt., Power and Coal, }	\$500	5	..	39—41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7	7½	116—120	..	5 16 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. ..	\$100	7	7	117—121	+1	5 15 8	River Plate, Ord. ..	Stock	10	..	252—262	..	3 16 4
Cordoba Lt., Power and T., Ord.	1	8	3½	1½—1½	—½	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110—115	..	5 4 4
Do. 5 % Deb. ..	100	5	..	93—98	..	5 2 0	Do. 5 % Deb. Stock ..	Do.	5	5	103—105	+ ½	4 15 3
Elec. Lt. and P. of Cochabamba, }	100	6	6	93—95	..	6 6 4	Roy. Elec. Co., Montreal, 4½ % }	100	4½	4½	99—101	..	4 9 1
6 % Bonds }							1st Mort. Deb. }						
Elec. Supply Victoria, 5 % 1st }	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4	5½	136—104xd	—3	3 11 5
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	108½—110½	+ ½	4 10 6
Elec. Dev. Ontario, 5 % 1st }	\$500	5	5	91½—93½	+ ½	5 6 11	Do. 4½ % Per. Deb. ..	Stock	4½	4½	103½—105½	..	4 5 4
Mort. Bonds }							Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Kaloorlie Elec. P. and L., Ord.	10/-	Nil	..	7—8	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6	6	8—8	..	8 0 0	1st Mort. Deb. }						
Kaministiquia Power, 5 % G. Bs.	\$500	5	5	103—105	—	4 15 3	Victoria Falls Power, Pref. ..	1	Nil	11½d.	½—1	+ ½	..
Madras, Ord. ..	5	..	..	2½—2½	—	..	West Kootenay Power and Lt., }	100	6	6	104½—106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102½—105½	+ ½	4 14 9	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84—96	..	5 16 3							
Mexican Lt. & Power, Common	\$100	4	4	84—86xd	..	4 13 0							
Do. 7 % Cum. Pref. ..	\$100	7	7	105—107	..	6 10 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½—96½	..	5 8 8							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5	5	97½—99½	..	5 0 6	Do. 5 % Pref. ..	1	5	5	3½—3½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8½	148½—150½	—½	5 6 4	National Telephone, Pref. ..	Stock	8	6½	99½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4	4	94—96	..	4 3 4	Do. Def. ..	Do.	6	6½	149—151	+2	3 19 6
Anglo-American Telegraph ..	Stock	3½	8	65—67xd	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ..	5	5	5	5½—6½	..	4 2 6
Do. 6 % Pref. ..	Do.	6	6	107½—108½xd	—½	5 10 4	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	—	4 7 2
Do. Def. ..	Do.	80/-	80/-	25½—26	—½	5 15 5	Oriental Telep. and Elec. ..	1	8	..	1½—1½	+ ½	4 8 3
Anglo-Portuguese Tel., 5 % }	100	5	5	100½—102½	..	4 17 7	Do. 6 % Cum. Pref. ..	1	6	6	1½—1½	+ ½	4 13 8
Mort. Deb. }							Do. 4 % Red. Deb. ..	Stock	4	4	83—90	..	4 9 0
Chili Telephone ..	5	7	..	7½—7½	+ ½	4 12 7	Pacific and European Tel., 4 % }	Do.	4	4	99½—101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	84—86	—½	4 13 0	Guar. Debs. }						
Cuba Telegraph ..	10	6	6½	9½—10½	..	5 11 7	Reuter's ..	8	5	5½	12½—12½	+ ½	3 4 0
Do. 10 % Pref. ..	10	10	10	17—18	..	5 11 1	Submarine Cables Trust ..	Cert.	6	6	127—130xd	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4	4½	3½—3½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	99—101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10	10	7½—8½	..	6 1 3	Deb. Red. }						
Do. 4½ % Debs. ..	50	4½	4½	99—101	..	4 9 1	United River Plate Telephone	5	8	8	7½—7½	..	5 1 7
Direct United States Cable ..	10	4½	..	7½—8½	+ ½	5 9 1	Do. 5 % Cum. Pref. ..	5	5	5	5½—5½	..	4 8 11
Direct W. India Cable, 4½ % }	100	4½	4½	99—101	..	4 9 1	West Coast of America ..	3½	2½	2½	1½—1½	+ ½	3 6 8
Reg. Deb. }							Do. 4 % Debs., 1 to 1,500 }	100	4	4	97½—99½	..	4 0 5
Eastern Telegraph, Ord. Stock	7	5½	5½	134—137	..	5 2 2	guar. by Braz. Sub. Tel. }						
Do. 8½ % Pref. Stock ..	Do.	3½	3½	81½—83½	—½	4 3 10	West India and Panama Teleg.	10	1½	1½	4½—4½	—½	..
Do. 4 % Mort. Deb. ..	Do.	4	4	101½—103½	..	3 17 4	Do. 6 % Cum. 1st Pref. ..	10	6	6	10½—11	—½	5 9 1
Eastern Extension ..	10	7	5½	12½—13½	—½	5 5 8	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10½	..	5 17 1
Do. 4 % Deb. ..	Stock	4	4	99½—101½	..	3 18 10	Do. 5 % Debs. ..	100	5	5	102½—104½	..	4 15 8
East and S. Africa Tel. 4 % }	25	4	4	99—101	..	3 19 3	Western Telegraph, Ltd. ..	10	7	6½	13—13½	—½	5 3 8
Mt. Db. Mauritius Sub. }							Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3
Globe Telegraph and Trust ..	10	5½	6½	10½—11	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4	4	106—109xd	..	3 13 5
Do. 6 % Pref. ..	10	6	6	13—13½	..	4 9 0	Do. 4½ % Fdg. Bonds ..	\$1000	4½	4½	100—103xd	—1	4 7 5
Great Northern Telegraph ..	10	18	18½	33—33	..	5 9 1							
Indo-European Telegraph ..	25	13	5½	57½—59½	+ ½	5 9 3							
Mackay Companies Common ..	\$100	5	5½	83—85	..	5 17 8							
Do. 4 % Cum. Pref. ..	\$100	4	4	70—73	..	5 9 7							
Marconi's Wireless Telegraph	1	5	..	7½—8½	—1½	..							
Do. 7 % Cum. Partio. Pref.	1	16	..	7½—7½	—1½	..							

\* Unless otherwise stated, all shares are fully paid. + Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 23rd.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 23rd.	Rise + or Fall	Present Yield p.c.	
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.	
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	1s	17	68 — 68½	— ½	2 14 9
Do. 5 % Pref. ..	1	5	5		6 8 0	Do. Surplus Lands ..	100	2s	22½	68 — 70	..	4 3 4
Do. 4½ % Deb. ..	100	4½	4½		5 8 5	Do. 8½ % Deb. ..	100	8½	84 — 91	..	8 16 11	
Brit. Elec. Trac., 6 % Pref. ..	100	..	..		..	Do. 8½ % Pref. ..	100	8½	86 — 88	..	3 19 7	
Do. Do. Deferred ..	100	..	..		..	Do. 8½ % Con. Pref. ..	100	8½	85 — 87	..	4 0 6	
Do. Do. 6 % Cum. Pr'f. ..	100	..	..		..	Metropolitan District Ord. ..	100	Nil	46½ — 46½	— 2½	Nil	
Do. 7 % Non-Cum. Pr'f. ..	100	..	..		..	Do. 6 % Deb. ..	100	6	144 — 146	..	4 2 2	
Do. 5 % Perp. Deb. ..	100	5	5		5 3 8	Do. 4 % Deb. ..	100	4	96 — 98	..	4 1 8	
Do. 4½ % 2nd Deb. ..	100	4½	4½		5 7 2	Do. 4 % Prior Lien ..	100	4	100 — 102	..	3 18 5	
Central London Railway, Ord.	100	8	8		3 8 2	Do. 4½ % First Pref. ..	100	8½	90 — 92	+ 1	4 17 10	
Do. Pref. ..	100	4	4		4 10 0	Do. 8½ % Gtd. ..	100	8½	76 — 78	..	4 9 9	
Do. Def. ..	100	2	2		2 4 5	Metropolitan Elec. Trams, Ord.	1	5½	1 — 1 xd	..	6 0 0	
Do. 4 % Deb. ..	100	4	4		3 17 8	Do. Def. ..	1	Nil	..	..	Nil	
City & South London, Ord.	100	1½	1½		3 15 9	Do. 5 % Pref. ..	1	5	..	..	5 10 6	
Do. 5 % Pref., 1891 ..	100	5	5		4 11 0	Do. 4½ % Deb. ..	100	4½	99 — 101	..	4 9 1	
Do. Do. 1896 ..	100	5	5		4 15 3	Do. 5 % Deb. ..	100	5	97 — 99	..	5 0 0	
Do. Do. 1901 ..	100	5	5		4 14 4	Potteries, Ord. ..	1	2	..	..	..	
Do. Do. 1903 ..	100	5	5		4 15 3	Do. 5 % Pref. ..	1	5	..	..	6 19 3	
Do. 4 % Deb. ..	100	4	4		3 17 8	Do. 4½ % Deb. ..	100	4½	89 — 92	..	4 17 10	
Dublin United Trams, 6 % Pref.	10	6	6		5 2 2	South Metro. Trams, 6 % Pref.	1	6	..	..	6 17 2	
Great Northern & City, Pr'f. Ord	10	Nil	..		Nil	Do. 4 % Deb. ..	100	4	72 — 77	..	5 4 0	
Hastings Trams, 6 % Pref. ..	5	Nil	3½		..	Underground Elec. Railways	10	..	4½ — 4½	— ½	..	
Do. 4½ % Deb. ..	100	4½	4½		5 18 5	Do. 4½ % Bonds ..	100	4½	99 — 101	..	4 9 1	
Isle of Thanet Trams, 5 % Pref.	5	2½	2½		4 6 11	Do. 6 % Income ..	100	1	91 — 93	..	..	
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil	..	..	Nil	
Lancashire United, 5 % Deb. ..	100	5	5		5 17 8	Do. 6 % Pref. ..	5	Nil	..	..	Nil	
London Elec. Railwys, 4 % Deb.	100	4	4		4 0 10	Do. 4½ % Deb. ..	100	4½	80 — 84	..	5 7 2	
London United Trams, 5 % Pref.	10	Nil	..		..							
Do. 4 % Deb. ..	100	4	4		5 1 3							

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5½ — 5½	..	5 2 4	La Plata Elec. Trms, Ord.	1	..	..	..	..	..
Do. 2nd Pref. ..	5	5	5½	5½ — 5½	..	5 7 4	Do. Pref. ..	1	6	6	..	..	6 0 0
Do. 4 % Deb. ..	100	4	4	94 — 95½	+ ½	4 3 9	Lisbon Elec. Trams, Ord.	1	5½	6½	1 — 1½	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	102 — 104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb. ..	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	5	95 — 99	..	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	104 — 106	..	4 14 4	Madras Elec. Tr. (1904), Deb.	100	5	5	98 — 100	+ 1½	5 0 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	+ ¼	5 4 4	Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % Deb. ..	100	4½	4½	98 — 100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	100½ — 102½	..	4 17 7
Do. 6 % 2nd Deb. ..	100	5	5	99 — 101	+ 1	4 19 0	Mexico Trams Com.	\$100	7	7	118 — 120 xd	— 2	5 16 8
Brisbane Trams Inv., Ord.	5	8	8½	97 — 98½	+ ½	4 5 4	Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	..	5 2 0
Do. 5 % Pref. ..	5	5	5	48 — 5½	..	4 15 3	Do. 6 % Bonds ..	100	6	6	101 — 103	..	5 16 6
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	..	4 7 6	Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7½	— ½	6 15 7
B. Columbia Elec. Rly., Def.	100	8	8½	141 — 144	..	5 11 1	Do. 6 % Pref. ..	5	6	6	5 — 5½	..	7 0 4
Do. Pref. Ord. ..	100	6	6	125 — 130	..	4 12 4	Do. 5 % 1st Deb.	100	5	5	99 — 101	+ ½	4 19 0
Do. 5 % Pref. ..	100	5	5	111½ — 114½	..	4 7 4	Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1½ — 1½	..	1 18 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½ — 101½ xd	..	4 8 8	Do. 5 % 1st Deb.	100	5	5	101 — 104	..	4 16 2
Do. 4½ % Vancouver Deb.	100	4½	4½	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5½	..	5 6 8
Do. 4½ % Con. Deb. ..	100	4½	4½	103 — 105	+ ½	4 5 9	Do. 4½ % 1st Deb.	100	4½	4½	99 — 101	..	4 9 1
Calcutta Trams, Ord.	5	6	..	6½ — 6½	+ 1½	4 13 2	Rio de Janeiro Trams	\$100	4½	5½	122 — 123	— 1½	4 1 4
Do. 5 % Pref. ..	5	5	5	4½ — 5½	..	4 16 5	Do. 1st Mort. 5 % Bonds	..	5	5	104½ — 105½	+ ½	4 15 0
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	+ 1	4 7 5	Do. 5 % Mort. Bonds	100	5	5	97½ — 98½	+ ½	5 1 6
Cape Electric Trams	1	Nil	2½	..	..	..	Sao Paulo Tram, Lt. and P.	\$100	10	10½	207 — 210	— 1	4 15 8
City Buenos Aires Trams (1904)	5	5	5	58 — 58½	..	4 5 1	Do. 5 % 1st Deb.	\$500	5	5	104½ — 106½	+ ½	4 13 11
Do. 4 % Deb. ..	100	5	5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101 — 104	+ 1	4 16 2	Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 6 % Pref. ..	5	6	6	5½ — 5½	— 1½	5 12 11
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb.	100	5	5	101 — 104	..	4 16 2
Do. 6 % B Deb. ..	100	5	6½	56 — 60	..	10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103½ — 105½	..	4 5 4

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	..	+ ½	..	Dick, Kerr ..	1	5	..	87 — 87½	..	5 8 1
Do. 6 % Pref. ..	1	9	6	..	..	7 2 2	Do. Pref. ..	1	6	6	1½ — 1½	..	5 12 11
Babcock & Wilcox	1	26	28	6 — 6½	— 1½	4 2 2	Do. Deb. ..	100	4½	4½	97 — 100	..	4 10 0
Do. Pref. ..	1	6	6	1 — 1½	..	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	..	..	Nil
B.I. & Helsby Cables	5	10	10	6 — 7½	..	6 18 0	Do. fully paid ..	5	Nil	..	1½ — 2½	..	Nil
Do. Pref. ..	5	6	6	5 — 6½	..	4 16 0	Do. 4 % Deb. ..	100	4	4	66 — 70	— 4	5 14 4
Do. Deb. ..	100	4½	4½	101 — 103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
British Thomson-Houston, Deb.	100	4½	4½	91 — 94½	— ½	4 15 3	Electric Construction	2	Nil	2½	..	..	..
British Westinghouse, Pref.	8	Nil	..	..	..	Nil	Do. Pref. ..	2	7	7	1½ — 1½	..	7 9 4
Do. Deb. ..	100	4	4	68 — 66	..	6 1 3	Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	99 — 102	..	5 17 8	Do. Deb. ..	100	5	5	94 — 96	..	5 4 2
Browett, Lindley, Ord.	1	Nil	..	1½ — 2½	..	Nil	General Electric, Pref.	10	5	5	9 — 9½	..	5 5 8
Do. Pref. ..	1	Nil	..	5½ — 6½	..	Nil	Do. Deb. ..	100	4	4	85 — 90	..	4 8 11
Brush, Ord. ..	2	Nil	..	0 — 1	..	Nil	Henley's, Ord.	5	15	10½	11½ — 12½	+ ½	6 0 0
Do. 7 % Pref. ..	2	Nil	..	0 — 1	..	Nil	Do. Pref. ..	5	4½	4½	4½ — 5½	..	4 6 9
Do. 4½ % Deb. ..	100	4½	4½	54 — 59	..	7 10 6	Do. Deb. ..	100	4½	4½	104 — 106	..	4 4 11
Do. 4½ % Second Deb.	100	4½	4½	87 — 42	..	10 14 4	India-Rubber, G. & T.	10	10	..	8 — 9½	— 1	..
Callender's Cable ..	5	15	10½	10½ — 11½	..	6 10 5	Do. Pref. ..	10	5	5	9½ — 10½	..	4 17 7
Do. Pref. ..	5	5	5	5 — 5½	..	4 15 3	Telegraph Construction	12	20	10½	33 — 35	..	6 15 2
Do. Deb. ..	100	4½	4½	98½ — 100½	..	4 9 7	Do. Deb. ..	100	4	4	99½ — 101½	..	4 9 0
Castner-Kellner	1	17½	20	3 — 3½	..	5 6 8	Willans & Robinson	1	Nil	..	..	..	Nil
Do. Deb. ..	100	4½	4½	105 — 109	..	4 10 7	Do. Pref. ..	5	Nil	..	..	..	Nil
Crompton & Co. ..	8	Nil	Nil	..	..	Nil	Do. Deb. ..	100	4	4	59 — 61	..	6 11 2
Do. Deb. ..	100	5	5	58 — 68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3½ per cent., February 8th, 1912.



EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1912.

CONTRARY to what one might have expected, the returns of electrical business for March reached a very satisfactory total.

A huge telegraphic export, such as occurs periodically, resulted in the exports reaching the large amount of £821,976, a figure which has only once been exceeded in our returns. Although this total includes nearly £450,000 worth of telegraphic material, the other exports amounting to £372,000 were still some £22,000 better than the comparable figures of the previous month.

The month was a good one for the machinery exporters, whose share of the business reached £160,000 in value, while the cable exports were very little less than in February.

The imports amounted in value to £248,651, as compared with

£222,714 in February, showing a general improvement, but particularly in the machinery lines which reached over £100,000 in value. The re-exports reached £23,374 in value, or somewhat more than usual, the previous month's total being £18,129.

Of our customers, Egypt for once takes the first place, its total including £380,000 of telegraphic material (submarine cable), although activity in telegraphic matters is shown in several other directions. India, Japan, Australia, &c., were also prominent buyers.

Amongst the importers into this country, Germany, as usual, was most prominent, and it may be worth noting that glow lamp imports principally from that country, reached a total of over £35,000.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	£ 972	£ 1,471	£ 266	£ 31	£ ...	£ 440	£ 5,209	£ 2,473	£ 43	£ ...	£ 226	£ 646	£ 11,777
Germany ...	1,628	491	...	32	603	25	391	280	25	...	25	198	3,698
Netherlands, Java and Dutch Indies ...	1,568	866	130	...	...	153	1,123	664	...	...	16	32	4,552
Belgium ...	297	210	72	16	578	32	4,438	1,679	...	...	1,334	171	8,827
France ...	1,655	...	1,486	...	28	...	12,479	676	...	...	174	135	16,633
Portugal ...	73	176	18	35	...	...	632	...	4	...	228	...	1,166
Spain, Canary Isles and Spanish N. Africa...	661	25	91	11	20	630	1,203	111	4	...	...	213	2,969
Switzerland, Italy and Austria-Hungary ...	1,233	14	118	39	95	...	3,234	681	...	...	117	602	6,133
Greece, Roumania and Turkey ...	149	153	1	50	...	...	24	...	281	...	113	1,679	2,450
Channel Isles, Gibraltar, Malta and Cyprus...	78	23	29	75	...	172	203	...	45	...	19	23,080	23,724
U.S.A. and Cuba ...	152	...	16	1,210	22	17	2,259	...	3	49	...	706	4,434
Canada and Newfoundland ...	1,072	4,009	403	2,078	135	2,465	6,366	86	1,382	...	466	1,229	19,691
British West Indies and British Guiana ...	106	...	7	334	...	...	140	...	42	14	120	297	1,060
Mexico and Central America ...	5	...	...	15	...	20	276	...	...	...	14	44	374
Peru, Uruguay and Paraguay ...	412	...	21	66	...	306	417	...	7	...	907	125	2,261
Chile ...	339	250	513	217	64	738	1,332	719	4,436	113	74	505	9,300
Brazil ...	234	1,782	187	102	...	135	2,970	1,377	59	13	169	2,054	9,082
Argentina ...	2,891	8,064	405	1,266	180	1,231	7,946	1,064	1,362	15	7,500	72	31,996
Colombia, Venezuela and Bolivia ...	24	...	...	17	...	43	444	...	...	...	10	...	538
Egypt and Persia ...	319	558	169	94	101	3	2,072	255	505	...	50	380,364	384,490
British West Africa and St. Helena ...	409	337	135	145	...	29	1,026	5	14	...	59	210	2,369
Rhodesia, O.R.C. and Transvaal ...	2,264	242	584	1,530	24	377	5,663	55	525	...	181	1,496	12,941
Cape of Good Hope ...	1,599	2,410	290	922	...	339	2,729	487	1,283	...	150	317	10,526
Natal ...	705	6,098	493	1,201	47	11	2,199	1,456	8	162	175	726	13,281
Zanzibar, Brit. E. Africa, Mauritius & Aden	39	65	79	166	...	71	502	10	4	...	702	18,682	20,320
Azores, Madeira, Portuguese Africa, &c. ...	504	892	223	95	43	116	1,584	2	155	...	...	10,025	13,639
French African Colonies and Madagascar ...	...	...	...	...	...	...	106	587	...	...	...	38	731
China and Siam ...	644	313	180	333	...	...	5,540	525	655	...	222	168	8,580
Japan and Korea ...	711	...	492	...	...	5,953	19,101	3,153	2,138	284	5,669	...	42,501
India ...	2,832	12,441	3,336	4,479	485	581	11,204	1,549	2,649	118	3,479	745	43,898
Ceylon ...	272	317	105	156	...	10	270	203	120	...	245	183	1,881
Straits Settlements, Fed. Malay States and Sarawak ...	688	821	290	33	...	257	344	289	56	213	307	386	3,684
Hong Kong ...	607	820	459	341	1,246	159	906	...	62	255	721	...	5,576
West Australia ...	221	...	420	509	...	337	2,556	...	1,767	...	336	589	6,735
South Australia ...	378	2,664	181	192	...	324	1,141	...	124	...	1,806	12	6,822
Victoria ...	2,646	6,285	662	1,813	...	822	6,517	3	2,012	...	5,469	2,274	28,503
New South Wales ...	3,503	9,547	264	928	271	195	12,268	1,515	782	...	5,529	18	34,820
Queensland ...	793	60	53	223	...	300	811	100	79	...	171	1,781	4,371
Tasmania ...	20	502	...	...	...	...	...	...	...	...	783	...	1,305
New Zealand and Fiji Islands ...	1,340	3,504	802	717	...	317	3,625	3,627	136	...	161	109	14,338
Total, £	34,043	65,410	12,980	19,471	3,942	16,608	131,250	28,631	20,767	1,236	37,727	449,911	821,976

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark ...	42	...	...	105	...	20	9,573	...	434	...	7,045	17,219
Germany ...	2,340	7,815	1,783	30,896	7,442	2,506	72,907	5	937	7,495	30,607	164,733
Holland ...	...	...	...	1,427	334	...	12	...	...	16	12	1,801
Belgium ...	568	945	22	6	12	...	2,244	1,474	79	963	8,407	14,720
France ...	248	35	1,309	2,151	1,119	472	801	106	1,684	3,291	501	12,017
Switzerland ...	193	830	14	...	...	...	852	...	...	...	...	1,889
Italy ...	16	104	...	...	...	...	...	31	...	...	4,949	5,100
Austria-Hungary ...	30	484	...	446	120	...	48	...	...	860	616	2,604
United States ...	2,603	383	299	581	2,598	14	9,690	10,996	659	145	200	28,168
Total, £	6,040	10,596	3,427	35,612	11,625	3,012	96,127	12,912	3,793	12,770	52,337	248,251

Additional imports : New South Wales, machinery, £49 ; Canada, machinery, £136 ; Spain, carbons, £215.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,247	828	...	2,093	408	...	7,345	...	430	650	373
----------------------------------------	--------	-----	-----	-------	-----	-----	-------	-----	-----	-----	-----

TOTAL EXPORTS : £821,976.

TOTAL RE-EXPORTS : £23,374.

TOTAL IMPORTS : £248,651.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.



## AN ELECTROLYTIC STERILISING PLANT.

A NOVEL and interesting application of electrolysis to the industrial sterilisation of water has been carried out at a textile mill in the north country. At this mill, which is devoted to the woollen dyeing and finishing processes, a supply of water is obtained from moorlands on which cattle are grazed, so that there is some slight contamination from this source; the result was formerly the rapid growth of algae in the storage reservoirs, which filled up the supply pipes. Grids were useless, as the fine silky threads lay across the grids in a felted mass which had to be removed with rakes every half-hour, and the threads thus broken and released got into the mill and on the goods, whence they were irremovable.

Chloride of lime solution destroyed the weed, but hardened the water; the result was that scale formed in the boilers and curdled the soap used in the fulling and finishing of the woollens, so the use of this chemical had to be abandoned, and the weed soon reappeared. Copper sulphate was tried, but this at once affected the dyes.

Mr. Toyne, the consulting chemist, was acquainted with Dr. Samuel Rideal's investigations into the subject of water purification, wherein the use of electrolytic sodium hypochlorite was advocated, and as a last resource he tried the electrolyser made by Messrs. Ernest Grether & Co., of Manchester. After three days' trial this proved entirely successful; the weed was killed, and the water—which had previously been tinged slightly yellow, owing to the infiltration of peaty matter—was changed to the ordinary blue-green of pure river-water. The proper strength of chlorine to effect the purpose was ascertained by experiment, and amounted to about two parts chlorine to 1,000,000 parts water. The little "Manchester" electrolyser which was used is illustrated in diagram herewith. A couple of planks were thrown across the little stream which fed the reservoir, and the apparatus was mounted on these, so that the electrolytic sodium hypochlorite, as made, trickled into the brook, and was thus intimately mixed with all the water that entered the reservoir. An automatic feed tank was provided at a higher elevation, and a hogshead of brine higher still, as shown, so that, after filling the hogshead once a day, the operation of the plant was entirely automatic. A little roof, not shown in the diagram, protected the apparatus from the weather. Current was provided from the mill-lighting circuit at 110 volts by means of an overhead line; the current amounted to about 8 amperes, and the outflow from the electrolyser was at the rate of 1 litre per minute, with a strength of 3 grammes active chlorine per litre. The brine had a strength of 4 per cent.

When the amount of chlorine required had once been determined, it did its work in the reservoir, and spent itself on the organic matter therein; there was no chlorine present at the outflow. Daily chemical tests failed to show either chlorine or nitrogenous matter, and the dyes were not affected. If any free salt was present, the quantity was too small to be detected, and in any case it was harmless. The water was excellent for drinking purposes, and, in fine, the experiment was a great success from every point of view.

The subsequent development of this experiment is even more interesting: as winter set in, it was decided to stop the electrolyser, as no growth of algae takes place in cold weather; at the end of a fortnight complaints were made of the reappearance of peculiar markings, or stains, on the material in course of treatment, which excited comment, seeing that this old trouble had been absent during an exceptionally hot summer. The bacterial action of the water was at once suspected, and the electrolyser was restarted, when

the fungoid growths at once disappeared. Needless to say, instructions were issued to run the electrolyser henceforth summer and winter.

Further experiment has shown that in winter, when the growth of vegetation is suspended, the amount of electrolytic sodium hypochlorite may be reduced to 1 part per million, the contaminated water thus treated refusing to show any action on gelatine plates.

The importance of this later discovery calls for special emphasis, for it appears to have a much wider bearing than the original application of the system to prevent the growth of algae. The bacterial growth or mildew above-mentioned has long been a source of continual trouble in many bleach works, and has previously been ascribed to local infection, such as contact with old wood on floors or stillages infected with mildew, inferior sizing materials, &c., whereas it is now traced to the true cause—contaminated water supply—and simultaneously the remedy has been revealed, in the shape of the electrolytic steriliser.

The cost of working was estimated as follows:—Taking the cost of energy as derived from the mill at about  $\frac{1}{4}$ d. per unit, and running the plant at 8 amperes for 10 hours a day, the consumption of energy was  $110 \times 8 \times 10 = 8.8$  units, costing, say, 2d. a day. The brine used amounted to 132 gallons of 4 per cent. density per day, requiring 52 lb.

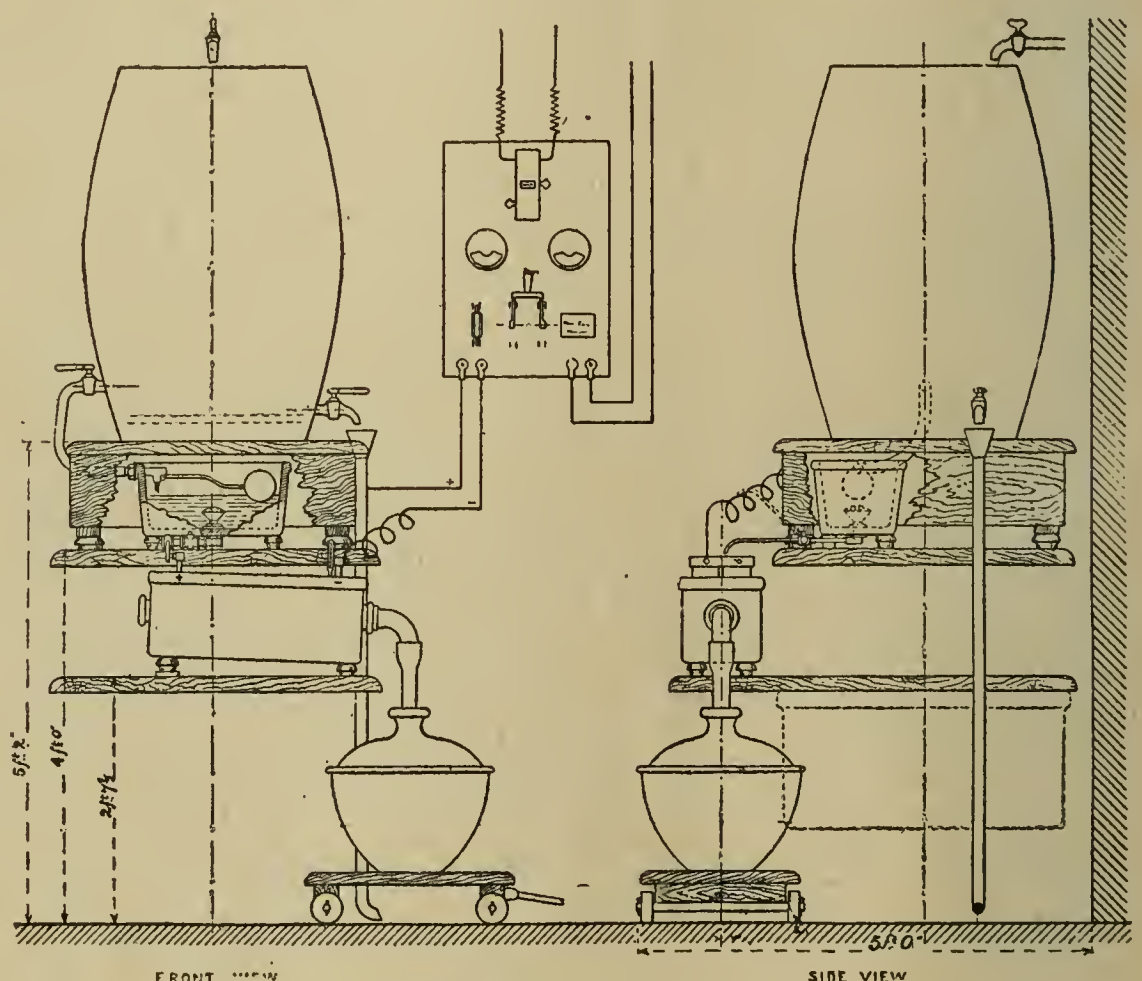


DIAGRAM OF ELECTROLYTIC SODIUM HYPOCHLORITE STERILISING APPARATUS.

of salt, which, at the price paid by the dye-house, cost 5d. The labour and attendance required was negligible, and the total cost thus came to about 7d. a day.

The installation was at work all last summer during the exceptionally hot season, and has been in operation for nine months, to the entire satisfaction of the owners of the mill. The system is, of course, applicable to a great variety of cases in which water is contaminated with organic impurities—for example, it can be used to purify the water of swimming baths, as is already done at Poplar by Dr. Alexander, with excellent results.

**An Improved Accumulator.**—It is reported that Prof. Hannover, of Copenhagen University, has invented a method by which it is possible to charge an accumulator with five times as much electrical energy as any other existing accumulator of the same size.

**Electric Clock Installations.**—Installations are to be carried out by the Magneta Time Co., Ltd., at the Imperial Hotel, London (380 dials), and the Marconi Co.'s new premises, Strand. The apparatus will be identical with the equipments installed throughout the Chief Postal Buildings, London.



## SOME SECOND THOUGHTS ON PUBLICITY.

By R. BORLASE MATTHEWS, M.I.E.E.

It has often been stated that second thoughts are best, possibly because there is generally more time for consideration, or perhaps more likely they are looked upon from a different and broader view point. In the issue of the *ELECTRICAL REVIEW*, dated April 12th last, an article, by Mr. C. H. Wordingham, entitled "Some Thoughts on Publicity" was published. The present article is written with the view of getting the readers of the aforementioned "Thoughts" to entertain some second thoughts, which, it is hoped, will be less pessimistic and much more practical, concerning the possibilities of stimulating a more extended use of electricity for domestic purposes. The point of view should not be the narrow and conservative one which so many central station engineers advocate, but rather the broader one of successful general commercial enterprise. If a leaf be taken from the book of a successful man of business, the theme of "Publicity" will be found writ large upon it. But, as may be inferred from Mr. Wordingham's article, there must be a proper interpretation of what is covered by the term "Publicity." It can be, perhaps, best expressed as "Good salesmanship," in the best sense of the term, where it is a case of once a customer always a customer, and not an instance of "sold again" and a dissatisfied buyer.

The principal reason preventing the general use of electricity for domestic purposes can be summed up as due to lack of publicity organisation, to the non-existence of salesmanship of any kind, and to unbusinesslike methods in retailing apparatus of all descriptions. The present somewhat high cost of certain apparatus, which is undoubtedly a drawback to its sale, could be greatly reduced if the retailing were carried out on sounder lines—lines which would, of course, include an educational campaign for the instruction of the general public. Given good salesmanship, the price of current within reason is not really a serious item, as the average householder has no idea as to the comparative costs of gas, coal, or electricity for lighting, heating and cooking. We require the good results obtained from good service, and if an electricity supply undertaking is properly managed, that good service can be given without cutting the price per unit. It is but a poor salesman who secures orders on price alone. The present medium for retailing is either through the central station or the contractor. Unfortunately for the electrical industry as a whole, neither of these sources is anywhere like as efficient as it might be. There are, of course, a few brilliant exceptions, but their very existence emphasises the lack of businesslike aptitude on the part of the majority.

If electricity is going to be more largely used for domestic purposes, each central station should have one man at least who would devote his entire time to the commercial side of the business, a man who is capable of organising a sales department that compares with those of first-class business houses.

The operation of a central station does not present a tithe of the difficulty which is encountered by the ordinary business house, for it is monopolistic in character and is confined within a limited territory that is extremely easy of access. An objection may be raised to the effect that this employment of a special business manager is a costly method. He is, however, an employé that an ordinary business house would not do without, and he will be of vital importance to the central station, for he will ensure its prosperity. An energetic man in such a position is an invaluable asset, and the day is rapidly approaching when such men will occupy premier positions in central station management, because the engineering problems have now been practically solved, and it is of far more importance to increase the sales, and thereby the output of the station, than to effect some fractional saving in the coal consumption.

An insignificant amount of advertising and educational work has been done by central stations, as they do not seem to be far-sighted enough to realise to the full advantages that would accrue to them if this matter were properly followed up. The Publicity Committee of the London Elec-

trical Supply Undertakings are certainly to be commended for their attempts to secure co-operation in this direction, and it is pleasing to note that some 250 undertakings now use the literature they supply. It is, however, but a mild expression to say that the Committee is merely playing at the business. Considering the difficulties under which they are working—the Committee is a body of gentlemen who have to snatch a brief interval from an already overcrowded business day, to advise and consider matters upon which they are not experts—they must be warmly congratulated upon their success. Surely, however, it would be to the best ultimate advantage of supply undertakings to employ a permanent staff who were specialists in publicity.

Pending the adoption of the principle by central stations that they must have a commercial manager, it is essential that the gap be partially covered by those central station engineers who have not already done so, following the so-called publicity "fashion," and acquiring more definite and practical information about the various applications of electricity, and then seeing that this information is disseminated in the best possible manner among their present and prospective consumers. A difficulty, of course, is the compilation of the required information. There is a lot of most useful information available, but it is not in a collected form, with the exception of the handbook entitled "Electricity for Everybody," which has been specially prepared for the assistance of central station engineers, their assistants and canvassers. Such a compilation should be edited jointly by the Committee of the London Electricity Supply Undertakings, the Municipal Electrical Association, and backed up by the co-operation of the British Electrical Manufacturers' Association, and, if feasible, fathered by the Institution of Electrical Engineers. An idea of this kind has already been carried into effect in the United States with very beneficial results.

As a typical instance of the lack of knowledge on the part of central station engineers as to the practical details of domestic applications, the electric oven may be cited. Very few central station engineers have any idea as to the style, capacity and size of oven required. As another example, the possibility of the use of small motors, or preferably the universal motor, for alleviating the household work is practically an unknown factor.

Reference was made during the early portion of these remarks to the matter of good salesmanship being of more importance than the actual price for current. In this connection an excellent illustration is the advantage to be gained by cooking meat by electricity over any other method. To put the matter concisely, the statement may be made, and honestly made, that if coal or gas cost nothing, and the price of electricity were twice as much as is actually the case, it would still be cheaper to cook a joint of meat by electricity.

Take for example:—To obtain 12 lb. weight of meat ready cooked and available for serving, it is necessary to put 13 lb. 10 oz. into an electric oven, but if the cooking is to be done in any other way, at least 17 lb. 2 oz. will have to be put into the oven, showing an economy in weight of 3 lb. 8 oz., or in hard cash, 2s. 11d., whereas the actual cost of cooking the joint either by electricity or gas would only be in the neighbourhood of 3d. This, then, is an illustration of the sort of way in which a consumer's attention should be drawn to the advantages of electricity. In themselves the facts are convincing, and they are emphasised by their direct appeal to the householder's pocket.

Very few central station engineers or contractors fully realise the enormous possibilities of electric cooking as a means of greatly increasing the sales of electrical energy. Hence, it behoves those who are interested, to get their information and data in such shape that they will be able to cope with the big demand for electric cooking apparatus that has now undoubtedly well started. There are many fears expressed to the effect that distributors will be overloaded. However, before there is a likelihood of this occurring, undoubtedly other changes will have taken place. When speaking at the last meeting of the Institution of Electrical Engineers, Mr. A. H. Seabrook made the statement, that, notwithstanding the enormous increase in demand for current for cooking and heating in their district, they had not yet had to increase their distributors.



Reverting more definitely to the article referred to at the commencement of this one, it is evidently assumed that there is very little discrimination on the part of central station engineers as to what apparatus should be recommended. In dealing with the possible applications of electrical energy in the ordinary English household, the comments made are very antiquated, and do not indicate an intimate acquaintance with practical domestic applications or requirements. The vacuum cleaner does not merely replace the dust-pan and broom, for it does work that these time-honoured domestic tools cannot do. Where a good vacuum cleaner is regularly employed, only a negligible quantity of dirt will be found under the carpets at spring-cleaning time. One maker alone sells about 50 vacuum cleaners per week; obviously he could not sell this number unless they accomplished something that could not be done more effectively and cheaply in another way.

Capital cost does not necessarily prohibit the purchase of things for the furnishing of a home, or else the makers of piano-players, would never sell an instrument. Servant troubles are getting more and more serious in this country, hence housework must be facilitated by mechanical aids, so that the work may be done without too much labour during a temporary interregnum. The time is not far off when good servants will only take a situation where they can get mechanical assistance in their work.

To sum up: Education is still lacking in the application of electrical energy to domestic purposes and publicity is the means whereby that education is to be provided; it is not a fad or a fashion, but a necessity.

## AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—I.

THE relations between the Australian tramway companies and their employés have, during the past six months, formed a principal rallying point in the industrial struggle now proceeding in that Continent between capital and labour. In Brisbane that struggle has caused a general stoppage of work extending over a considerable period, and in Adelaide it threatens a similar condition of affairs. These general stoppages are, of course, caused by the Federated Trade Unions of the various States making the tramway-men's case their own, and in no sense do they mean that the industrial life of a city is dependent upon the maintenance of an uninterrupted tramway service.

The Commonwealth of Australia have established an Arbitration Court specially to hear and adjudicate upon labour disputes, and this Court deals with and recognises employers and associations of employers, and workers and associations of workers or Trade Unions. Legal representation is not allowed the parties in this Court, the production of evidence and examination of witnesses having to be carried out by the employers or their representative officials and by the officials of the Trade Unions. The Court is empowered to intervene and act in the case of trade disputes in which the President has held a Conference and no agreement has been reached, and which have then been referred by him to the Court. Such disputes must extend beyond the limits of any one State. Further, in the case of such a dispute, if work has ceased as a result of either "strike" or "lock-out," such case has precedence over all other cases, and is heard and decided on at once.

For some years there has been a tendency on the part of the tramway employés in the various States to form Trade Unions, and in November, 1910, the Australian Tramway Employés, embracing the various State Unions, was formed. It is stated that the membership of this Association is about 3,600, excluding New South Wales, distributed as follows:—Victoria, 1,750; South Australia, 500-600; Queensland, 480; West Australia, 180; Tasmania, 68. The formation of these Unions was discouraged by the tramway companies, who in some cases, notably at Brisbane, favoured the formation of workers' Unions confined to their own employés. These Unions, called by the workers Companies' Unions, have small memberships, and are bitterly resented by the members of the larger Unions. Feeling runs high between the majority and minority of the employés, and this feeling is to a large extent shared by the Trade Unionist section of the general public.

In February, 1911, three months after its formation, the Australian Tramway Employés Association decided that a distinctive badge should be worn by its members, and in August these were ready. In May, Mr. Badger, the manager of the Brisbane Electric Tramways Co., had issued a regulation forbidding the wearing of any badges other than those provided by the company, when the men were on duty or in uniform.

Meantime, the new Association had prepared a long claim covering rates of pay and general conditions of service, which they lodged with the Arbitration Court in October, citing eleven of the principal

tramway companies in Australia as respondents, amongst them being the Brisbane Tramways Co. One of the claims made in this suit was the right to wear the Union badge when on duty. It will be necessary to refer to this claim later; it came up for hearing in the Federal Arbitration Court on March 4th last.

The tramway employés in Brisbane commenced on January 18th last to attach their Union badges to their watch-chains, and wear them while on duty. This act was considered by the manager of the tramway company a breach of his regulation, and some of the men were suspended. No notice was given the men, and as they refused to give up the badge, they were stopped from duty, and the tramways for a time practically ceased working.

This, on February 1st, was the signal for a general strike in the city, which has greatly disturbed the trade of the city. The men's Union then brought an action in the Federal Arbitration Court impugning the legality of Mr. Badger's prohibition of the wearing of the badge, on the ground that it was contrary to the Commonwealth law under which the Association was registered.

A strike being in progress, this case had precedence over others, and the hearing was commenced before Mr. Justice Higgins, in Melbourne, on March 16th last. The case occupied six days, and judgment was given on the 27th of the same month. Great public interest was aroused, the leading newspapers giving full reports of the evidence.

At the commencement exception was taken by Mr. Badger to the jurisdiction of the Court on the ground that the disturbance was confined to one State. This was overruled by the Judge, who pointed out that it formed a part of the general case affecting all tramways awaiting trial.

Many witnesses were examined on both sides, and the ill-feeling existing between the members of the opposing Unions was clearly proved. The attitude of the tramway company towards the men's Union was explained by Mr. Badger. A recreation room had for a long time been maintained by the Tramway Co. for all its employés. After the formation of the men's Union, the smaller Union composed of the company's employés only was brought into existence, and the company restricted the privilege of using this recreation room to the members of the smaller Union. This seems to have caused considerable resentment, and explained a good deal of the strained feelings between the parties.

It was argued that the wearing of the badge was intended to intimidate wearers into joining the Union, and to make the position of those who refused intolerable. On the men's side this was denied, and it was stated that its object was to enable members to recognise one another and to converse together on Union matters. It was pointed out that well-known societies were in the habit of distributing badges to be worn by their members.

Three weeks after the dispute commenced it was stated that out of 482 men locked out by Mr. Badger, only one had returned, while their places were being filled up by the company, who were gradually restoring the normal service.

The Judge gave a decision in favour of the men, holding that the regulations forbidding the wearing of the badge were illegal. This judgment affected not merely the Brisbane company, but also the Melbourne and Adelaide companies, who had issued similar prohibitions. In using the powers conferred upon him by the company's articles of association, Mr. Badger had not obtained either the approval of the Governor or published it in the *Gazette*. The judge also decided that an employé has a right to wear what he likes so long as it does not offend against decency, and that a tramway company has at law no more right to decree what his employé may not wear than he has to demand he shall attend a particular church or wear any particular make of clothes.

So far as the wearing of the badge was concerned the gain lay with the men, but the Court pointed out that they had no power to force the Brisbane Co. to reinstate the men out of work. It would seem, therefore, that the men have won a rather Pyrrhic victory, as the right to wear a badge at work when they have no work to do is rather a barren possession.

The question, however, is to be further contested by the companies, but in the meantime an injunction has been granted enforcing the judgment.

**Football.**—On the well-appointed ground of the "Hartonians" F.C. at Lea Bridge on the 13th inst., the Staff and works employés of the Hart Accumulator Co., Ltd., met in friendly rivalry, and after a hard-fought encounter the "Clerics" were successful by the odd goal in 7. Play during the opening moiety was very even, and it was half an hour before the score was opened, Kempen and Elliott then notching points for the Staff in quick succession. The works men responded gamely, and a misunderstanding between the backs enabled Gullen to reduce the lead, whilst following a run by the same player, a Staff half-back kindly obliged by putting through his own goal, thus equalising matters. In the homeward journey the Staff early took the lead with a long shot by Bourke from half-back, and Elliott then placed a corner so well that the Works goalie fisted through in a vain endeavour to clear his lines. In the closing minutes the Works rallied, Ingram netting with the best shot of the match, but despite strenuous endeavours they were unable to further improve their position. A draw would have better reflected the play, as although the Works were more together than their opponents they were not so dangerous in front of goal. The game was very fast and cleanly contested, and was fought out with the best of feeling. Mr. Benham enhanced his reputation by the manner in which he undertook the duties of referee.



## PROCEEDINGS OF INSTITUTIONS.

## Notes on Power Station Working.

By J. W. JACKSON.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Newcastle-on-Tyne, March 25th, 1912.)

TO-DAY we find that the mechanical side of a station requires exactly the same close attention that it always did, and that the electrical side of a station very nearly takes care of itself. The immediate future should intensify this difference still further when it is remembered that switchboards are being built of the ironclad type, with which it is almost impossible for accidents to the roof or failings of the guarding against vermin, &c., to affect the switchboard. The present-day design of high-class oil switch appears to be not very far from perfection from a general commercial point of view. The protection gear for the cables is also working out in very much the same way. A few years ago a breakdown on a big system would seriously affect a good deal of that system, and very often the whole of it. To-day we find balanced protective relay gear of a very high discriminating value, so much so that when cables break down it is seldom that any other portion of the system is affected than that fed by the particular cable. Even this difficulty is reduced where anything approaching a ring main is in service. Further, because the relay gear has become so discriminating, the present-day oil switches are made to operate at such a high rate of speed that the shock to the generating station becomes comparatively small. This point is borne out by the evidence of the breakdown of the cable. Faults on cables are often difficult to locate because the rupture on the broken-down portion is such a small one that it often seals itself up again, whereas in the past there was very little chance of a cable again becoming insulated.

A very real and solid advance has been made in steam turbo-alternator design and operation. Short turbines have many advantages over long ones; they are cheaper to build, safer at fine clearances, no less efficient if run at suitable speed, and they can deal with highly superheated steam.

The difficulties of the pure reaction type are due to increased length with size, coupled with fine clearances, both of which are necessary to give the maximum possible efficiency. This makes unwieldy machines above a certain capacity. Above a certain size the speed must be reduced, thus calling for a turbine still bigger and longer. The impulse-compounded and the impulse-reaction types shorten the machine to a reasonable length and allow of its being built inside one casing.

Turbines are now built that can be put to work for a whole year at a time dealing with ordinary service conditions without requiring to be opened out, and at the end of that period this is done for inspection purposes only.

It would appear from present practice that the turbines to meet general commercial purposes most successfully must be of the mixed type—that is, of the reaction and impulse types combined, the favourite design at present being known as the disk and drum. Nearly all turbine builders are building it, with very encouraging results.

Several different types of condensers have been put on the market in recent years, owing to the demand of the turbine for superior vacuum. It has now been found possible to design a condenser so that the section of its effective body is of the shape of an isosceles triangle (fig. 1). One very successful condenser of this type is of the triangular principle, but arranged in the usual circular body (fig. 2), so that the triangle is cut up into three portions. With a first cost very little higher than a simple condenser, this allows of the condensed water being withdrawn at a temperature within a very few degrees of the exhaust steam entering, while producing the vacuum of about 1.25 in. to 1 in. mercury of absolute pressure. With the simple type of condenser the same vacuum can be obtained, but the condensed water is of a temperature from 20° to 30° lower than that of the exhaust steam entering.

It now seems certain that for nearly all purposes the centrifugal pump will displace the ram pump. The efficiency is very high, the maintenance charges are very low, and the reliability is considerable. The main reason for this is that the centrifugal pump takes its water in a manner that is almost entirely free from shock. This action reflects itself throughout the system, as where a centrifugal pump is used, little danger is experienced with non-return valves, check valves, starting of pipe joints, cracking of cast-iron pipes, &c., and in the event of a stop valve being shut down by mistake against a centrifugal pump, there is very little danger of the pipes or pump being wrecked, as is the case with a ram pump.

Centrifugal pumps are now being used for extracting the condensed water from condensers operating under high vacuum. Provided they are of proper design in the first instance, if the suction side of the pumps is kept clear of air, very little difficulty will be experienced. Many pumps in this country have been running for a year and upwards under such conditions.

A still later development of the centrifugal pump is the rotary air pump. Owing to its special design of impeller and casing, it is able to build up a vacuum and give better all-round results, from maintenance and efficiency points of view, than the old-fashioned plunger pump. This rotary pump can be made of generous capacity for its work and yet occupy a very small space. One make of this pump is assisted by a steam jet, operating in series with the pump. The steam jet deals very effectively with an "air"

overload in the shape of the leaks which occasionally occur. Combination sets of this type have a most promising future before them.

Centrifugal pumps have also for some years been used for pumping the feed water into boilers, and for this work it is very difficult to imagine a better type of pump.

Almost all big power stations now employ water-tube boilers only. A boiler with straight tubes that are nearly vertical must surely be the best boiler for all-round purposes. With the best of boiler arrangements and feed-water filters, a considerable amount of mud is found in the boiler water as a result of the completion of the water softening taking place in the boiler. With straight vertical tubes this mud has a chance of slipping into the bottom drum, which should be of fairly large capacity, and so settling to a place where it can be dealt with. Wherever tubes approach anything like the horizontal line, there is always a danger of their being choked with mud at that point where the water is first subjected to the heat treatment which completes the final softening. It is very seldom indeed that trouble from this direction is found on a horizontal tube where that tube is in the front line of steam generation. The circulation set up in this case by ebullition

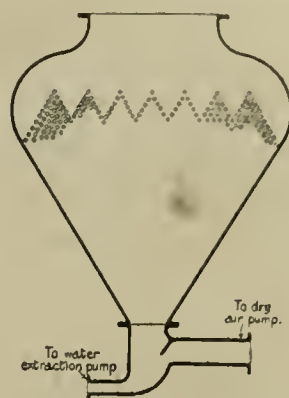


FIG. 1.

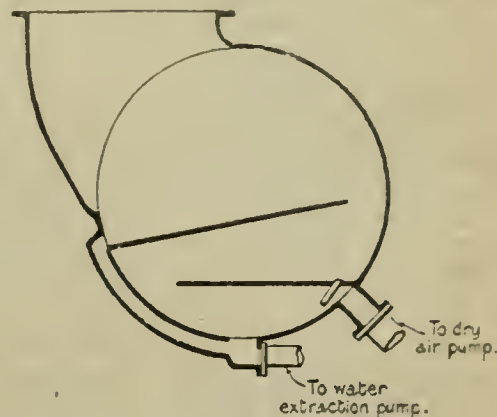


FIG. 2.

is sufficient to remove all solid matter in the ordinary way, except where the water has been insufficiently softened, in which case a hard scale forms on the tubes. A vertical tube does not offer a surface that soot can readily cling to, and this is a very important consideration.

This type of boiler calls for a number of drums into which the tubes are expanded directly, and this arrangement has much fewer joints to make and keep tight than most of the various horizontal tube boilers. This makes inspection a comparatively simple job.

A straight-tube boiler has a considerable advantage over a bent-tube boiler of almost any make. For replacement a comparatively small stock of tubes is needed, and all straight-tube boilers have tubes usually of the same diameter and length, whereas with bent-tube boilers an almost equal number of each type of tube needs to be kept in stock, some boilers having as many as 20 different types of tubes.

Close attention to economisers is well repaid in prolonging the life of the metal as well as keeping the economiser casing airtight. By looking after air-leaks on a boiler and economiser combined in regular commercial service, it is possible to reduce heat losses going up the chimney to about 10 per cent., whereas a neglect of precautions will allow these losses to rise to as much as 30 per cent., and still afford little evidence of what is going on by observation of the colour, which, of course, means the temperature of the flame in the furnace.

The economiser of the future undoubtedly is one built on the Contraflo principle. The water will enter at the gas outlet end, passing in series through groups of sections until it reaches the gas inlet end. Experiments have already been carried out on these lines, showing a higher efficiency than with the economiser arranged as a simple economiser. The cost need not be higher than that of the simple economiser.

The frequent blowing down of boilers is a very important matter, and the only safe course to adopt where steam turbines are used is to have the boiler water analysed quite frequently, and the density of solids kept down so low that there is no danger of priming. Almost any boiler on the market will prime badly if the solids are allowed to reach a sufficiently high figure. Dangers from priming with a reciprocating engine are well known, but with a turbine other kinds of trouble follow. One trouble which is well worth mentioning here is that the blades may become choked with mud, usually at a point where the pressure of the steam in the turbine is about atmospheric. When turbines are run with the boilers in a dirty condition for long periods, this matter gradually fills up all available spaces, and its presence cannot but affect the efficiency of the turbine.

A great number of the mechanical stokers which are regularly advertised to-day are really first-class in their particular line of work. Each coal requires a set of conditions which will be settled by its particular requirements.

Where it is possible to run with a high CO<sub>2</sub> in the furnace, which means a high temperature in the furnace, the outlet gases will be reduced to an appreciably lower temperature than would be the case if exactly the same amount of load was being dealt with, with a lower CO<sub>2</sub> in the furnace. Also a smaller amount of power, owing to a reduced water gauge, is absorbed by the induced-draught fan when a high CO<sub>2</sub> is being maintained.

By keeping the casing tight, a comparatively low CO<sub>2</sub> can be run in the furnace and still give a fairly high efficiency. If, however, it is possible to run the temperature up, which corresponds to higher CO<sub>2</sub>, a very high efficiency can be carried in commercial service.



One of the best means for overcoming any difficulty due to low  $\text{CO}_2$  in the furnace is having two distinct systems of draught, one an induced-draught system which will always be able to give a sufficient amount of draught to keep the middle portion of the gas space of the boiler at atmospheric pressure, and the forced-draught system, which will blow air, preferably heated air, into the furnace at those positions only where it is required. By this means, there is no possibility of cold air being drawn into the furnace at places where it cannot be utilised, and if leakages from the furnaces do occur, the gas will escape through the boiler casing and show itself up readily, whereas where the boiler is working on a purely induced-draught system, very serious leakages may occur, and can only be discovered by means of an analysis of the gases at various portions of the boiler.

Furnace linings have always given a considerable amount of trouble, and it is still a very difficult matter to find the firebrick that will withstand satisfactorily the high temperatures desired for high-efficiency working. Many manufacturers of first-class firebricks will not guarantee that their firebricks will withstand a working temperature of  $3,200^\circ \text{F.}$ , and very few bricks indeed will withstand a temperature of  $3,500^\circ \text{F.}$

After all the latest improvements have been collected together to build up a first-class generating plant, there is still a very important element to be reckoned with, namely, the human element. Earlier in the paper it was pointed out that, by varying the  $\text{CO}_2$  in the furnace, or, in other words, allowing want of attention, the heat losses going up the chimney may vary between 10 per cent. and 30 per cent. of the total value of the fuel. Allowing a shortage of steam on the turbine neck glands will cause the vacuum on the condenser to drop by quite  $\frac{1}{2}$  in. This means about  $2\frac{1}{2}$  per cent. increased consumption of steam.

#### DISCUSSION.

MR. GERALD STONEY said that the paper was of special interest, as the author was station engineer at Carville, where he had introduced many improvements. In his opinion the disk and drum type was merely a passing fashion; it was not cheaper to build, and its steam consumption was certainly not so good as that of the pure reaction type. The disk and drum type had a certain field, however, where small turbines running at a high speed were necessary, and also in moderate sizes running on very high-pressure steam which could not be taken full advantage of by pure reaction blading. The Parsons turbine had no difficulty in dealing with highly superheated steam, and further, in the pure reaction turbine there was no danger of cutting of the blades, such as sometimes occurred in the impulse type, where there were very high steam velocities. All the recent machines built by his firm (Messrs. Parsons) were of the tandem reaction type with pure Parsons blading, and some of these machines were rated up to 20,000 kW. His experience of condensers led him to believe that a single baffle was as good as three. Where rotary air-pumps were used it was essential that they should be able to stand up to a considerable drop in the vacuum, such as might occur in the event of a large air leakage. Some pumps gave a lot of trouble in this respect. He had often wondered why marine boilers were not more largely used in land practice. The great drawback of the water-tube type lay in the cost of renewals of brickwork and in the large standby losses.

MR. F. O. HUNT strongly favoured some means of automatically checking the amount of  $\text{CO}_2$  in the furnace, and pointed out the importance of reducing air leakages. Knowing exactly what was going on inside the furnace, one could afford to use inferior fuel.

MR. W. M. SELVEY could not agree with Mr. Stoney that the disk and drum type of turbine was merely a passing fashion. A good reason for adopting the disk, apart from a mechanical and superheat point of view, would be found if one calculated the leakage of the first two expansions of a Parsons turbine. He agreed that for large machines the pure reaction type would continue to hold the field. The absence of brickwork about a boiler made it impossible, on a power station load, to get above  $6\frac{1}{2}$  per cent. to 7 per cent. of  $\text{CO}_2$  without producing black smoke. It was possible to over-do the production of  $\text{CO}_2$  as one eventually turned the furnaces into a coal distillery, and in a recent case this had resulted in the flues being blown down, when the doors were opened. The cost of renewing the brickwork had to be balanced against the economy resulting from a high percentage of  $\text{CO}_2$ , and up to a certain point it was cheaper to burn the arches down. In the same way the Germans believed that it paid to push superheats up to  $350^\circ \text{C.}$  and over, at the expense of frequent renewals of the tubes.

MR. C. S. VESEY-BROWN could not agree that a rotary air pump was the best thing to depend upon to keep a station running. Under breakdown conditions the jet condenser might give a vacuum of 1 in. only, but still, that was better than nothing. One great advantage of the water-tube boiler was that it could follow variations of load, due to fog or other causes, and, if necessary, it could be forced without fear of collapse.

MR. JACKSON (in reply) agreed that the pure reaction turbine would hold its own in the larger sizes. The great advantage of the disk and drum type was that it allowed the boilers to be worked at a high superheat, and this was important when one remembered that every  $10^\circ$  of superheat meant an increase of 1 per cent. in the efficiency. He considered that the disk and drum type was best up to 5,000 kW. He had had some years' experience with vacuum augmenter air pumps, and had found that they were as efficient as many rotary air pumps, and quite as good on overloads. The reciprocating air pump was heavy to maintain, and, on the other hand, the kinetic air pump, as described in the paper, would deal with heavy air overloads and still maintain a high vacuum. Marine boilers were not suitable for variable loads on

account of the difficulty in getting up the circulation, and it was impossible to get a high duty without producing black smoke. He agreed that the records from  $\text{CO}_2$  machines were very valuable, but, unfortunately, the latter were difficult to keep in order.

#### Electrical Furnaces.

On January 27th, a paper was read on this subject by MR. CECIL MYERS, before a joint meeting of the MANCHESTER ASSOCIATION OF ENGINEERS and the INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER LOCAL SECTION). The author dealt only with electric furnaces as applied to the manufacture of steel and steel alloys, and said that the users of the different types of furnaces claimed now to be making tool steel, structural steel, war materials, high-silicon dynamo steel, drawn tubes, steel castings and high quality rails, &c. He explained that the energy of an electric current might be converted into heat in various ways, all really by putting a resistance in its path, and the heat might be concentrated at a special part of the circuit by making the resistance of other parts small in comparison. This was the principle on which electric furnaces were built. If the resistance was a solid or liquid then the process was called resistance heating, but if the resistance consisted of gases only, it was called arc heating. The author then described the electric furnaces employed in the manufacture of steel, and said that in June, 1910, there were about 118 furnaces of all types, of which 70 were in use, 10 not working, and 38 being built. There were 77 of the arc furnace recorded, of which 29 were Heroult, 17 Girod, 13 Stassano, 6 Keller, and 9 others. There was one furnace at Domnarfvet, Sweden, for the production of 2,500 tons of pig-iron per annum; also one in Norway, and one at Trollhattan, Sweden, both in course of construction, and each designed to produce about 7,500 tons of pig-iron annually.

Of the Heroult furnaces, the total capacity per charge of those working was about 80 tons, of those in course of construction about 50 tons. The total capacity of the Girod furnaces (the great competitors of the Heroult) was recorded at about 30 tons for those in work and 26 tons for those being built. Similarly, the figures for the Keller were 13 tons and 8 tons, and for the others 20 tons and 13 tons respectively.

Of the induction furnaces, the Kjellin furnaces erected totalled 14, with 35 tons capacity; and the Kochling-Rodenhauser 15, with 30 tons. That gave a total capacity of about 250 tons for the 11 arc furnaces, and 100 tons for the induction, or a grand total of 350 tons per charge for all electric steel melting furnaces.

In September, 1911, there were 43 Heroult furnaces, with a total capacity of about 242 tons.

The output of electric steel in Germany, the United States, Austria and Hungary, in 1910, amounted to about 112,000 tons, an increase of 63,000 tons over the figures for 1909.

Before the beginning of 1911, the Heroult furnace at Edgar Allen and Co.'s, in Sheffield, was the only arc furnace in steady operation. In January three Heroult furnaces were commenced in England, at Messrs. Vickers and Thomas Firth & Sons, Sheffield, and at Lake & Elliott's, Braintree, Essex. A Kjellin furnace, for demonstration and manufacturing purposes also, started at about the same time in Sheffield, and the output of England for 1911 should amount to about 13,000 tons.

A 15-ton Heroult furnace was now working, or just about to do so, at Skinningrove, and was expected to turn out 200 tons per day. Kjellin induction furnaces also had been working during this period satisfactorily at Messrs. Vickers and at Messrs. Jessop's, in Sheffield, and an experimental furnace at the University of Sheffield. Great progress was expected to be made in Germany with electric furnaces during this year, when Heroult furnaces of 25 and 22 tons capacity per charge were to be constructed. In September, 1911, the largest size was two 15-ton Heroult furnaces at South Chicago and Worcester, belonging to the United States Steel Corporation, who had recently acquired the Heroult patents for America and would probably erect several more furnaces shortly.

Dealing with the chemical actions that took place during the refining, the dephosphorising and the desulphurising of the steel in the bath, the author said:—

The action takes place in two stages; in the first, which is the oxidation period, the carbon, silicon, manganese and phosphorus are oxidised, and in the second, which is the deoxidation period, the metal is dead melted and the sulphur eliminated. The first action is arrived at by adding to the charge certain quantities of lime and oxide of iron, which under the influence of the high temperature oxidise the carbon, silicon and manganese and remove the phosphorus as calcium phosphate. The slag after this operation is removed from the bath and further quantities of lime (and sometimes carbon) are added: this is the second stage, when the sulphur passes into the slag as calcium sulphide, which is not soluble in the metal bath. In the open-hearth furnace this calcium sulphide would very readily be oxidised into calcium sulphate, which would combine with the iron to form sulphide of iron and so go back into the steel. In the reducing atmosphere of the electric furnace this cannot take place, so that it is possible to remove the sulphur to almost any extent.

There is very little doubt that for many purposes in steel making, the electric furnace is the furnace of the future. There is no doubt now in the minds of steel makers who have had actual experience with up-to-date furnaces, that it is possible to make steel equal to the best ever produced in Sheffield at less cost than it can be done in the crucible.

Mr. F. W. Harbord, one of the leading metallurgists of the day, wrote even in 1909 the following:—



"Under favourable conditions as to cost of raw materials, especially if a surplus of blast furnace gas is available for generating energy, ferro-silicon and similar alloys can be produced at a cost to compare favourably with imported material produced from water-power. With regard to pig-iron, this can be produced of any grade and of satisfactory quality, but the electric furnace cannot compete commercially with the blast furnace under the conditions existing in this and other countries, where fuel is cheap; but there is a considerable field for its development in countries where cheap water-power is available, and where, owing to suitable fuel for the blast furnace being unobtainable and other conditions, the latter is impossible."

## DISCUSSION.

MR. J. P. BEDSON said there was not much to choose between the electric and open-hearth methods except perhaps that the electric process was more under control. Regarding quality of metal, he had made tests on both processes and found very little difference in the results. As a user of high-grade steel, he thought the electric furnace had a future. Electric methods were employed for tempering steel card wire with excellent results.

MR. CRAMP said that in connection with the Rochling-Rodenhauer furnace, mention was made of the rotation of the metal due to the three-phase current, and he would like to ask whether, though that might be a very valuable thing from the point of view of mixing the metal, it might not also result in reduced temperature, since it was well known that directly the metal began to rotate, the eddy currents would be reduced therein. There would be some sort of limit to rotation as far as efficiency was concerned. He would also like to know the frequency of the current supplied to the furnace and the frequency of rotation obtained.

MR. F. FOSTER said that his own firm, Messrs. Galloway, and their German friends, Messrs. Ehrhardt & Sehmer, had installed large gas engines supplying current to electric furnaces in this country and abroad. In connection with a recent inquiry, a very careful investigation had been made into the cost of power for similar purposes, the data obtained from the above plants being used as a basis. The figures obtained were carefully checked by independent authorities, and showed that it was possible to generate electric current at a total cost of 0.15d. per unit, when using gas producers and ammonia recovery, with coal at 8s. 6d. per ton. With blast furnace, coke oven, or other waste gases, the total cost of generation fell to about 0.1d. per unit. These costs included capital outlay charges on the whole plant on a very liberal scale, and all labour, repairs, stores, water, fuel, &c. In connection with the electric steel furnaces, a certain amount of transmission and transformation apparatus would be required, and in general the plant would not be running continuously at full load 24 hours a day. These facts would, of course, increase the total cost of electric power, but after making due allowance for these factors, it ought to be possible, with furnaces of large capacity, to deliver electric power at the furnaces at a cost of 0.25d. per unit when using producer gas and 0.2d. per unit when using waste gases. Assuming the higher figure, and that 240 kW.-hours were required for refining 1 ton of steel, the cost of power for refining would amount to 5s. per ton. He found that in general steel of equal quality could be obtained by the older fuel-fired furnace methods. He had always understood, however, that the electric furnace could be more accurately and readily controlled than the ordinary open-hearth or crucible furnace, and that, therefore, it was easier to obtain a high-class product from inferior materials. Thus, in several instances basic steel made from cheap ores was being successfully refined in the electric furnaces so as to give a product fully equal to the best grades of acid steel. This particular process had a further advantage in that the phosphoric slag was a valuable by-product.

MR. J. FRITH said that in general he thought it would pay better to have a separate generating plant for furnace work rather than take energy for it from a public supply; if that were done advantage could be taken of the peculiar conditions of the load to design an alternator which would be much cheaper for its output than the more usual types, which were limited by the necessity for a good pressure regulation. What was wanted for furnace work was constant kW. output rather than constant pressure; this would more than counter-balance the increased cost due to the low frequency which suited furnace work best.

MR. E. C. IBBOTSON said that in his experience the consumption for a given amount of refining was practically the same for the arc and induction furnace. From a design point of view, the induction furnace with the plain roof was perhaps better than the arc furnace with carbon electrodes projecting through the roof. Against the higher power factor obtained in the arc over the induction furnace, the latter had the advantage of no sudden changes of load to which arc furnaces were liable. In the speaker's opinion the high temperature of the arc had a bad effect upon the quality of steel, particularly high-carbon steels. The metallic loss was greater in the arc than in the induction furnace. In the case of the arc furnace a pressure of less than 100 volts was required, whereas any pressure could easily be adapted to the induction furnace. Single-phase supply seemed to give the best results. Regarding the starting of furnaces, the arc would start from cold, but in the case of the induction furnace a start was made from a wrought-iron ring which was used initially to dry the roof. Usually some of the charge was left in the furnace for starting except in the case of furnaces using liquid fuel, which could be run dry and recharged without difficulty.

MR. C. K. EVERITT said he had had considerable experience with the Héroult arc furnace with a fair measure of success. The supply used was from the Corporation mains at 2,000 volts, 50 cycles, this

being converted to 100 volts, 28 cycles, for furnace working. The fact that the electrodes penetrated the roof of the furnace was an advantage, as the direct radiation from the arc was more on the carbon electrodes than on the roof lining. A refining furnace roof usually lasted three to four weeks. In England electrical furnaces were suitable for refining only, as they were most uneconomical as melting furnaces. One furnace under the speaker's observation employed a slag on the top of the molten metal, which could be taken off or replaced as required. This slag cover was a great help, especially in making alloy steel, where it was necessary to introduce certain percentages of other metals. The speaker had not encountered any sign of danger owing to the high temperature of the arc. It was to be remembered that the arc did not play directly on the metal, but upon the slag covering the metal.

MR. C. MYERS, in reply, said he was of opinion that steel could be made as good in the electrical furnaces as in the ordinary furnaces. The electric furnace could make a very high quality of steel with a low quality of raw material. The idea in making a high quality of steel in most processes was to get as near as possible to pure iron.

MR. C. W. JOHANSEN (Communicated):—The electric steel furnaces will be of the greatest importance for countries like Norway and Sweden, but particularly Norway, which possesses large quantities of low grade ore containing about 30-36 per cent. of iron. During the last few years extensive works have been put up in order to concentrate this ore to contain about 67 per cent. of iron for export. However, since the electric furnace has proved to be a technical and probably a commercial success, considerable interest and capital have been devoted to this subject, in order to export the finished product in the form of steel instead of the concentrated ore. Contrary to the conclusion the author came to, that the electric steel furnace could only compete with the crucibles in refining the steel, but not with the Bessemer and Martin furnaces themselves, the opinion seems to prevail in Norway that steel somewhat superior in quality to the Bessemer or Martin steel can be manufactured with profit in electric steel furnaces directly from pig-iron, and consequently a better price can be obtained for the same than is usually paid for Bessemer or Martin steel. New works which have recently been put up have based their calculations on a selling price of £7 15s. per ton, delivered at an English port, for their steel in the form of billets. Two steel works have recently come into operation in Norway, and further plants are under construction. In the above plants pig-iron is made in one electric furnace from ore and the refining process takes place in another. Water-power stations have in many instances been built at a cost of about £11 per electrical horse-power, which means slightly more than £1 per H.P.-year, making ordinary allowances for interest, depreciation and maintenance; this is for power delivered at the works. An instance has also been quoted where the electrical power cost 16s. per H.P.-year. A prominent Norwegian metallurgist has come to the conclusion that 350 million tons of low grade ore is available in Norway, without going to any considerable depth. The Commission appointed by the Norwegian Government came to the conclusion that the most suitable periodicity will be found by a compromise between cost of electrical plant and reasonable power factor, and will have to be considered for each special case. An electric blast furnace has been in operation for some time in Norway, and is giving good results. Ore of 46-48 per cent. iron was used and the size of furnace was 500 H.P.: 460 tons was produced, and an average selling price of £3 12s. to £3 15s. per ton was obtained for the product. Based on this experiment, the Tinfos Iron Works, Ltd., was organised early in 1911, and will shortly come into operation.

## Domestic Electricity.

(Second Informal Discussion at the INSTITUTION OF ELECTRICAL ENGINEERS, London, April 18th, 1912.)

MR. W. M. MORDEY, the first speaker, said he wished to remove any impression that the extension of the use of electricity was not being maintained satisfactorily. Its progress could best be gathered by a comparison between the results obtained by groups of similar sized undertakings (taking six in each class) for the years 1908 and 1910-11. In the case of the London local authorities the average consumption per head in 1908 was 25 units; it was now 39 units. The comparative prices were 2.45d. and 1.96d. per unit. In the case of the London supply companies these figures were 52 units and 75 units per head, and 3.1d. and 2.4d. per unit respectively. Taking groups of towns, and excluding tramways supply:—

- Six large towns show an increase of 54 % in consumption.
- " " a decrease of 27 % in price.
- Six medium towns show an increase of 32 % in consumption.
- " " a decrease of 6 % in price.
- Six small towns show an increase of 40 % in consumption.
- " " a decrease of 20 % in price,

over the same years as were taken for London. These figures were, he considered, very satisfactory for three years' progress.

MR. FRANK BAILEY said cheap electricity supply was an essential to its extended use: he traced briefly the influence of the companies' early installations of plant in keeping the price higher than it would otherwise have been, owing to the necessity of "scrapping," pointing out the difficulty of obtaining new capital, which might possibly be remedied if we possessed industrial banks or similar institutions. He thought the time had arrived when supply authorities could hire out apparatus with confidence. There were now 5,000 or 6,000 electric radiators in use in the City



of London, and although the price for such supply (2½d. per unit) seemed high, it competed with the coal fire in offices, and was favoured by architects owing to the simpler buildings which could be used.

MR. HUGO HIRST agreed with the first speaker as to the progress which had been made, but it seemed that we might do better. In his opinion, one principal hindrance to rapid development of the electricity supply had been municipal ownership, which had led to development on narrow lines, within artificial boundaries, and irrespective of the engineering or commercial aspects of the case. The many small stations and different supply systems of political (not engineering) origin, hindered both electricity supply and manufacturing, and a broader policy was required. We could not expect the same co-operation as in America, but we ought to make a combined effort to further electricity supply, and the promised industrial committee could do a great deal to facilitate this.

MR. F. C. RAPHAEL, in the course of a spirited speech, deprecated the custom of depreciating electrical affairs, and exaggerating possible deficiencies, which appeared to prevail amongst electrical men—instancing many remarks made during the previous discussion. One possible reason for this was that we were “amateur” commercial men. The central station man complained of the overlapping of cooking and lighting loads, but he (the speaker) thought he hardly appreciated the position, instancing the fact that gas cookers came into use owing to their convenience during the warm weather, when fires were not wanted. The electrical cooker which would be used in the same way, would be in evidence during the period of lightest load on the supply station, and he failed to grasp the objection to it. Of the various systems of charging for energy the one propounded by Mr. Lackie was ideal, although it might possibly be improved on. He advocated the hiring out of cooking apparatus at competitive rates, and pointed out that the objection sometimes made to extra wiring for an electric stove, also applied to a gas stove, which needed special piping in the first instance. He thought straightforward advertising in the daily papers was the best method of getting at possible consumers, but felt that much of the Publicity Committee’s energy was being applied in the wrong direction.

MR. A. H. SEABROOK considered that lack of conviction and knowledge on the part of electrical men were the greatest hindrance to extended electricity supply. He deplored the fact that so much rubbish was spoken and written on the subject by electrical engineers. At the Smoke Abatement Exhibition the electrical restaurant had supplied 4,000 people with meals in 11 days, and the metered energy, which was freely used for lamps, radiators, cooking and hot water supply, only amounted to 3,600 units, so that the cost of energy was not worth worrying about. A firm of commercial caterers in Marylebone were supplying 500 people daily with three-course meals electrically cooked at 4d. each, in view of which it did not appear that this method could be expensive. The more he saw of the incidence of the lighting and cooking loads, the more he felt that engineers who offered very low secondary rates (including Southampton and Sunderland, where the secondary charge was ½d. per unit) were in the right. Touching on the question of carrying capacity of existing wiring, he had never yet had to increase any cable sizes where electrical heating or cooking was adopted in Marylebone.

MR. B. M. JENKIN considered that the maximum-demand system of charging was the curse of supply work from the consumers’ point of view. As was intended by the engineer, it did keep the small short-hour consumer off his mains. But the engineer was wrong; what was wanted was a diversity indicator, and Mr. Lackie used an ampere-hour meter for this purpose. It was discouraging to a prospective consumer to have to purchase outright apparatus and run wiring on a separate meter, without knowing the ultimate cost of the venture; the cost of energy per unit was no guide; what was wanted was the overall cost per quarter, together with a free trial of apparatus.

MR. R. W. HUGHMAN said supply engineers displayed a lack of enthusiasm for their own commodity, but electricity was always the best although not always the cheapest. If they reversed matters, and imagined themselves members of the gas industry looking at the progress of electricity, he thought it would be agreed that that progress was very great indeed. He believed that a combined “publicity week” movement, supported by the Institution and leading electrical associations, would have a very great effect.

MR. C. P. SPARKS made a comparison between the early days of power supply work, when very similar causes to those now operating against electrical heating and cooking, held back power supply. Factors such as high cost of apparatus, lack of knowledge, tariff, &c., were then the drawbacks, but apparatus for power work now cost only one-quarter to one-third of what it did then. He did not agree with the views expressed on newspaper advertising or with picture postcards, but regarded the permanent showroom demonstration as the most efficient way of reaching the public. In the motive power business a special effort was made with suitable terms in order to get the early consumers, and in this way some knowledge of the business was gained. He did not consider it financially safe to hire out cooking apparatus in its present state of development on similar lines to the motor, while as to cost of energy, this was not so material to the domestic consumer as the question of comfort and convenience. He concluded by advocating co-operation between the supply engineer and manufacturer in regard to apparatus and the institution of suitable showrooms for displaying it and demonstrating its use.

MR. H. FARADAY PROCTOR said ignorance and lack of enthusiasm were the greatest bar to progress now, and a remedy would be to allow all supply authorities to provide any kind of apparatus which the consumer might ask for. One drawback in the case of muni-

cipal supply work was the mixed constitution of electricity committees and the influence which outside matters had on their work. He suggested that this could only be overcome by transferring such undertakings to the management of local trusts composed of men with no particular axes to grind.

MR. W. E. WARRILOW deduced from the fact that £400,000 per annum was spent annually in the States on newspaper advertising, that a satisfactory standard of apparatus had been obtained there. He also urged the co-ordination of advertising effort in the electrical business, something on the lines of the British Commercial Gas Association’s work.

MR. L. L. ROBINSON (Hackney) said many engineers had to spend more time in pushing on their committees than in pushing the supply. The West Ham undertaking was an example of what enthusiasm could do in a few years; the load factor there was 31.9 per cent. Amongst other things, the electrical contractor was to blame for the restricted development of electric heating and cooking. The wiring contractors had succeeded in getting a clause inserted in the Hackney Bill, which quite prevented the local supply authorities from quoting suitable hire rates for cooking apparatus, and they had, incidentally, lost a great amount of wiring work thereby. On the question of price, it had required Mr. Merz to show London how much the price could be reduced for power purposes, and bankruptcy had not yet resulted from this.

MR. A. F. HARRISON, of the Publicity Committee, defended its work, pointing out that it had 250 of the 500 authorities on its books, as well as customers in India, Australia, and Canada. Evidently, therefore, the Committee’s work was appreciated. The Committee would be glad to co-operate with the other Associations and the Institution, and it had done so at the Smoke Abatement Exhibition with great success. He thought, perhaps, a travelling exhibition on similar lines to that would be useful. The Committee was about to start in new premises, conveniently situated, with a small permanent exhibition of apparatus. Newspaper advertising was purely a matter of money, and he hoped the next appeal for funds would meet with more generous support than the last.

The PRESIDENT here announced that as there were many more wishing to speak on this subject, a third evening—May 2nd—would be given up to it.

---

**Wireless Telegraphy and Aviation.**—From time to time we have reported various experiments which have been made concerning the transmission of messages from, and the reception of signals by, air-ships of different types. The importance of being able to effect such intercommunication hardly needs explanation; in the case of dirigibles, ability to rapidly convey precise instructions as to preparations to be made for landing may well be the means of avoiding a serious disaster, and for military and naval purposes, half the value of an air-vessel, of whatever kind, is lost if the information gathered during a reconnaissance cannot be quickly transferred to headquarters. In case of foggy weather, or during night flights, an aeroplane will undoubtedly, in future, be able to keep its bearings by the interchange of wireless signals with headquarters, and a little consideration will suggest innumerable other contingencies in which the utility and safety of airships—indeed, the very practicability of flight—depend on communication which, so far as we are able to judge, can be provided by no other means than wireless telegraphy. Slow but steady progress has been made in the design of apparatus for use on board dirigibles and aeroplanes. In either case, there is no special difficulty in receiving messages from a land station, but in order that messages may also be transmitted, a very simple, robust, and powerful equipment must be employed, and particularly in the case of aeroplanes, weight must be kept to an absolute minimum.

Among the exhibits at the recent Airship Exhibition at Berlin, were a number of wireless sets specially designed for this service, and including:—(1) Receiving apparatus of specially low weight, so constructed that the most delicate parts were well protected from accidental injury (especially by the shock of a bad “landing”); (2) a complete transmitting and receiving equipment for aeroplanes, in the design of which primary importance was attached to simplicity, lightness, compactness and strength; (3) a dirigible equipment, similar to the last, but heavier, and of greater effective range; (4) the “Telefunkenkompass,” designed to aid the navigation of air vessels.

Daily demonstrations were carried out with the latter instrument in the Exhibition hall, the bearings of a station at Spandau being determined. The system employed involves no special receiving apparatus, and necessitates no calculation or other involved process to determine the bearings of the land station from the signals observed. The only additional equipment required by the aviator is a stop-watch. At the land station which is acting as a bearing point for the air-vessel, a number of horizontal antennae are arranged as the radii of a “star,” and each in turn is connected with the sending apparatus by means of a rotating contact. Special signals are emitted from the aerials lying in the north-south direction and by observing the time between these signals and the time at which the intensity of the received signals is a maximum and minimum (respectively corresponding to the moments in which the direction of the “active” aerial coincides with, and is perpendicular to the direction of the air-vessel from the land station), the aviator can work out mentally an approximate bearing.



## TRADE STATISTICS OF JAMAICA.

THE following figures, showing the imports of electrical and similar goods into Jamaica during the year 1910, are taken from the official trade statistics recently issued; the figures for the year 1909 are given for purposes of comparison, and notes of any increases or decreases are added.

	1909.	1910.	Increase or decrease.
<i>Electrical apparatus for lighting, and parts thereof.—</i>	£	£	£
From Great Britain ... ..	885	503	382
„ United States ... ..	6,768	6,706	62
„ Germany ... ..	156	7	149
Total ... ..	7,809	7,216	593
<i>Steam engines, other than agricultural.—</i>			
From Great Britain ... ..	6,604	3,852	2,752
„ United States ... ..	5,029	1,448	3,581
„ Germany ... ..	251	—	251
„ Other countries ... ..	105	—	105
Total ... ..	11,989	5,300	6,689
<i>Machinery, other than steam engines, and not agricultural.—</i>			
From Great Britain ... ..	4,261	2,084	2,177
„ United States ... ..	5,266	3,270	1,996
„ Germany ... ..	60	—	60
„ Other countries ... ..	11	109	98
Total ... ..	9,598	5,463	4,135
<i>Railway rails.—</i>			
From Great Britain ... ..	—	3,861	3,861
„ United States ... ..	108	395	287
„ Germany ... ..	—	384	384
Total ... ..	108	4,640	4,532
<i>Telegraph and telephone wires and apparatus.—</i>			
From Great Britain ... ..	275	448	173
„ United States ... ..	569	995	426
„ Other countries ... ..	15	—	15
Total ... ..	859	1,443	584
<i>Earthenware, china-ware, and porcelain.—</i>			
From Great Britain ... ..	6,913	8,417	1,504
„ United States ... ..	881	432	449
„ Germany ... ..	1,526	766	760
„ Other countries ... ..	61	301	240
Total ... ..	9,381	9,916	535
<i>Scientific instruments.—</i>			
From Great Britain ... ..	1,526	1,412	114
„ United States ... ..	495	323	172
„ Other countries ... ..	45	44	1
Total ... ..	2,066	1,779	287
<i>Lamps, &amp;c.—</i>			
From Great Britain ... ..	1,487	1,393	94
„ United States ... ..	2,861	2,981	120
„ Germany ... ..	111	137	26
„ Other countries ... ..	28	60	32
Total ... ..	4,487	4,571	84

## EXPIRING PATENTS.

WE are informed by MESSRS. W. P. THOMPSON & Co. that about 530 complete applications for electrical patents were filed during the year 1898. Only 54 of the patents granted on these applications have been maintained for their full term, viz., 14 years, and these being of considerable value, we give short abstracts of them below:—

121. January 3rd, 1898. "Measuring electricity." E. BATAULT. Relates to Meters.—An a.c. motor meter has spindle geared to a counter, carrying a conducting disk in the spaces in a stationary laminated iron circuit. The magnet is excited by a shunt coil, and its poles are slotted radially to receive series coils, which enclose only part of the section of the iron. The poles may be divided equally or unequally in section, and the series windings may enclose parts both on one side of the magnet, as shown, or one part only, or parts symmetrical about the axis. The arrangement shown, in which the series windings produce like poles at both ends of the magnet, has the advantage that currents induced in the two series coils act oppositely on the disk, so that this is not rotated when no main current is passing.

591. January 9th, 1898. "Microphones." A. GRAHAM. Microphones are constructed so as to be waterproof and to be capable of resisting shocks when used in exposed positions, such as on ships, by divers, &c. A disk of vulcanised fibre carries in a recess a carbon cup with a backing of paper, felt, &c. A carbon and metal diaphragm closes the front of the carbon cup and has its edges preferably soldered to a metal ring. A protective sheet is set in the mouthpiece. The joints are all made good by solder, shellac, or other suitable means.

809. January 11th, 1898. "Calling devices for telephone exchanges." STROWGER AUTOMATIC TELEPHONE EXCHANGE. (W. P. THOMPSON.) Relates to calling apparatus by which a subscriber can select any other subscriber wanted on an automatic telephone exchange. A finger disk is mounted on the front end of a tubular shaft which on its inner end carries an escapement disk with pins corresponding to the numbers on the disk. A coiled spring holds the disk in its normal position and allows it slowly to return under the action of an escapement lever after it has been moved through any predetermined angle. The slow return at the same time operates a spring switch to send a number of impulses to line corresponding to the number of pins.

1,535. January 19th, 1898. "Electric Lamps." C. A. RITTER VON WELSBACH. Relates to incandescent lamps. Filaments are made of osmium, or alloys of this with ruthenium, rhodium, or other platinum metals, or these metals alone, and may be coated with oxides, preferably of thorium or zirconium. They are mounted in bulbs which are exhausted or contain reducing gases, and under these circumstances may be heated to extremely high temperatures, so as to emit a large proportion of lighting rays. An osmium filament may be made by coating a wire of platinum, or other metal having a high melting point, by warming it electrically in an atmosphere containing a volatile osmium compound and a suitable reducing gas, such as a mixture of hydrocarbons and water vapour drawn from the middle of a Bunsen flame; the wire is afterwards slowly heated more highly to consolidate the osmium coating, and finally until the platinum has evaporated, leaving a coherent tubular filament of osmium, which may contain a little platinum. The osmium coating may otherwise be deposited by electrolysis, or by repeatedly painting the wire with a solution containing osmium, preferably made into a paste with finely divided metallic osmium or an osmium compound, and a binding material.

1,589. January 19th, 1898. "Lamps." J. GUNNING. Relates to means for extinguishing electric lights after a predetermined time. The invention is described and illustrated in connection with gas lights. To extinguish some of the gas lights before the others, the gas cock has a longitudinal channel communicating with two transverse channels. Arms are fixed at predetermined intervals on the disk of the clockwork mechanism, a shoulder on the disk turning the cock so that the channels respectively register with the gas supply pipes. The clockwork then turns the cock sufficiently to close the channel and extinguish the lights supplied by the pipe.

5,034. March 1st, 1898. "Measuring Electricity." C. O. BASTIAN. Relates to quantity meters. An electrolytic meter consists of a glass tube containing acidulated water and two platinum electrodes by which the current to be measured or a known fraction of it, is passed through the liquid. The tube is fixed in a case near a scale adjustable vertically and clamped by a nut for setting the zero mark to the top of the liquid when the tube is refilled. The glass frame is made with a vertical centrerod and foot. In one arrangement the electrodes are connected with platinum wires sealed in the tube, the seals being protected by gutta-percha or the like applied outside. In a modified form the glass frame is attached to a tube in which the connecting wires are sealed and insulated.

5,449. March 5th, 1898. "Measuring Electricity." W. DUNDELL. Relates to current meters, applicable for measuring rapidly varying currents or potential differences, and especially for showing or recording alternating-current wave forms. The current is passed in opposite directions through two parallel thin strips, stretched in narrow spaces between the pole-pieces of a strong magnet. The strips are held on fixed supports above and below the pole-pieces, and at their centres carry a mirror, the deflection of which is measured by that of a light ray, and if small is proportional to the current passing. A thin iron partition is placed between the strips and cut away to receive the mirror: non-magnetic blocks complete spaces which are filled with viscous liquid, to damp the vibration of the strips. For showing alternating wave forms, the light ray from the mirror is reflected by another mirror rotated by a synchronous motor, so as to give a stationary curve on a transparent screen placed near it. This curve may be drawn or photographed. When two quantities are to be observed simultaneously, the instrument is provided with two adjacent measuring strips and mirrors.

6,024. March 11th, 1898. "Conduits for electric conductors." W. SYKES. Conduits are formed of earthenware sections in which a number of circular tubes are formed parallel. The sections fit by spigot-and-socket joints on to and into which have been cast linings, preferably of bituminous material. When the tubes are fitted without previously formed joint liners, a centring mandrel is employed and the joint is made good with cement. In a further modification the ducts may be in the form of troughs which are filled with bituminous material and covered with flat lids after the cables have been laid.

6,989. March 22nd, 1898. "Measuring electricity." E. WESTON. Relates to current meters. Two instruments are mounted on the base and provided with two scales or one common scale on which their needles indicate independently, so that both are readable at the same time. The instruments may be voltmeters or ammeters. The coils are pivoted between insulated non-magnetic bridges and enclose iron cores between the pole pieces of two parallel magnets. The coils carry the pointers and counterweights, and are connected to terminals by flat spiral springs.

6,991. March 22nd, 1898. "Measuring electricity." E. WESTON. Relates to current meters having pivoted coils, movable about fixed cylindrical cores between the pole pieces of permanent magnets, said meters being provided with several improvements in details of construction. The pivots, to engage in bearing jewels, are supported on the movable coil. Each support is made by turning down the end of an aluminium bar to two smaller diameters drilling the end to receive the pin, which is forced into it, screw threading the smallest part to receive a nut and milling flat sides on the intermediate part to receive a pointer; a thin piece of the end of the bar is then cut off, forming a plate which can be cemented on the coil.

6,991A. March 22nd, 1898. "Pointers for instruments." E. WESTON. Electrical and other measuring instruments are provided with light metallic pointers which can be accurately counterbalanced so as to remain in definite positions in any position of the instrument. A cross-piece is cut from aluminium sheet, with four narrow arms, and a central slot to fit the spindle of the instrument. In one form three arms are screw threaded to carry adjustable balance weights. Each weight is a short tube screw threaded internally at one end, the plain part serving as a guide in placing it on the arm; the screw-threaded part is either made of smaller bore than the plain part, or is split and compressed. In a modification the point is formed of a piece of thin sheet aluminium which is stamped with a corrugation to stiffen it.

7,196. March 24th, 1898. "Explosion engines." F. R. SIMMS. Relates to the ignition of internal combustion engines. An electrical contact is broken by a snail cam, and the angular position of the cam on the shaft is altered to control the speed. The half-speed counter-shaft drives another shaft at same speed. This shaft carries the snail cams for operating the contact breakers, and has a helical feather that works in the wheel, so that by moving the shaft longitudinally its angular position is altered. A wheel on the shaft gears with a long pinion of half its size, turning freely on the shaft, and carrying an eccentric that actuates synchronously with the contact-breakers the oscillating envelope between the fixed armature and field magnets of a dynamo.

7,298. March 25th, 1898. "Relates to lighting and extinguishing gas." G. LENTSCHAT. The gas supply is controlled by a rotary disk valve actuated by the armature of an electromagnet. The disk valve is formed with series of ratchet teeth and holes, and at each passage of the electric current is turned to the extent of one tooth by a pawl on the pivoted armature. When the holes coincide with the channels the gas is on, and when the wheel is moved one tooth the channels are closed by the solid parts of the disk, and the gas is cut off. By varying the number of holes relatively to the number of teeth a number of street or other lamps may be either ignited simultaneously and extinguished in consecutive groups, or ignited in consecutive groups and extinguished simultaneously.



7,470. March 28th, 1898. "Electrolysis." W. L. WISE. (Solvay & Co.) Relates to the electrolysis of alkaline chlorides and other salts by the use of mercury cathode. The tank is provided with a layer of mercury which continuously overflows at the adjustable weir, carrying with it the amalgam formed, and thereby always presenting a clean surface. It then passes to another which may be a similar electrolytic apparatus in which the mercury is regenerated. The mercury is raised by an elevator or a pump and enters the well at the opposite end to the weir. This circulation is continuous. When it is desired to clean out the cell, one end may be raised by a screw. The electrolyte is preferably caused to continuously flow in the same direction as the top mercury layer.

7,471. March 28th, 1898. "Electrolysis." W. L. WISE. (Solvay & Co.) For the purpose of obtaining the maximum output in the electrolysis of an alkaline chloride by means of a mercury cathode, the electrolyte is composed of two layers. The lower one, of great density, lies on the mercury and is practically free from chlorine. The upper one, of small density, lies on the former layer, contains the anode or anodes, and becomes saturated with chlorine.

8,274. April 7th, 1898. "Electric bells." H. OPPENHEIMER. A bell for use in mines, chemical works, dye works, breweries, &c., has the armature and hammer mounted on opposite ends of a pin which is passed through the base, gas-tight and liquid-tight, either by grooving and packing the pin or passing it through a gland stuffing box. The cover is packed with a paraffined cord, &c., and the terminals are insulated in a cast-iron box filled with paraffin wax, and provided with a cover. The armature is held clear of the magnet by a spring and is balanced by the hammer.

8,832. April 15th, 1898. "Electricity measuring clocks." C. E. O'KEENAN. Commutator motor meters are made with disk or cylinder armatures, containing no conducting materials except their coils, and no moving iron. These move in constant magnetic fields produced by permanent or electromagnets, the latter being laminated for use with alternating currents. The armatures are connected in parallel with fixed resistances, which are made non-inductive and of material having small temperature variations. Friction is compensated by placing a resistance in series with the armature, and connecting a point between this resistance and the armature through another resistance with the second supply main, so that a small current passes constantly through the armature. To register merely the time during which current is supplied, the field of a quantity meter may be produced by an unsaturated electromagnet carrying the main current so that the armature has the same velocity with any current. A quantity meter may be supplied with current from a battery of constant voltage to serve as a clock. On a constant current supply system a quantity meter may be connected between the mains, a high resistance being used in parallel with the armature. Other energy meters may be constructed similarly to the quantity meters, the fields being produced wholly or partly by unsaturated electromagnets connected between the mains; the armatures carry the main currents. Such an instrument may be used with continuous or alternating current as a lamp hour meter.

(To be continued.)

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 8,286. "Electric leakage indicators." R. M. MARSHALL. April 6th.  
 8,327. "Electric igniters." J. BORN. (Convention date, April 7th, 1911, France.) April 6th. (Complete.)  
 8,340. "Ignition apparatus." O. SCHLICK. April 6th. (Complete.)  
 8,352. "Electric telegraph transmitting systems and apparatus therefor." E. R. BARKER. April 9th.  
 8,443. "Means for leading electric and other power into revolving structures." R. H. S. BACON and F. W. H. SHEPHERD. April 9th.  
 8,491. "Electric charging apparatus." J. D. OLIGNY. April 10th.  
 8,526. "Planimeters." BRITISH THOMSON-HOUSTON Co., LTD. April 10th.  
 8,542. "Sparkling plugs." R. F. HALL. April 11th.  
 8,559. "Arrangement for determining position by means of electromagnetic waves." W. P. THOMPSON. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) April 11th. (Complete.)  
 8,561. "Apparatus for the electric lighting of railway trains and like purposes." J. R. JOHNSTONE. April 11th.  
 8,566. "Arrangement and sealing of electric conductors into mercury vapour electric apparatus and the like." BRUSH ELECTRICAL ENGINEERING Co., LTD., G. T. WOOD and A. E. SALISBURY. April 11th.  
 8,569. "Protective devices for electric distribution systems." BRITISH THOMSON-HOUSTON Co., LTD., and E. B. WEDMORE. April 11th.  
 8,571. "Manual and semi-automatic telephone exchange systems." F. R. McBERTY. (Divided application on 17,211/11. Convention date, July 27th, 1910, United States.) April 11th. (Complete.)  
 8,572. "Automatic or semi-automatic telephone exchange systems." F. R. McBERTY. (Divided application No. 17,211/11. Convention date, July 27th, 1910, United States.) April 11th. (Complete.)  
 8,573. "Automatic or semi-automatic telephone exchange systems." F. R. McBERTY. (Divided application on 17,211/11. (Convention date, July 27th, 1910, United States.) April 11th. (Complete.)  
 8,579. "Electric induction furnaces." H. G. SOLOMON. April 11th.  
 8,590. "Automatic protection device for electric circuits." P. M. LEVY and H. T. GEORGE. April 11th. (Complete.)  
 8,611. "Electric motor control systems." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) April 11th.  
 8,637. "Sparkling-plug for motors, aeroplanes, and the like." J. DUDLEY and J. HUMPAGE. April 11th.  
 8,640. "Slip-ring collector devices for electrical instruments and machines." A. DENNY and F. T. EDGEcombe. April 12th.  
 8,677. "Electric cigar-lighters." L. T. DIXON. April 13th.  
 8,678. "Electromagnetically operated switches, particularly adapted for controlling electric motors." E. SCHATNER. April 12th. (Complete.)  
 8,682. "Electrical geysers and the heating elements for same, which same elements can also be applied to other types of electrical heating and radiating apparatus." C. R. BELLING. April 12th.  
 8,695. "Memorandum pad for use with table telephone instruments." J. G. HAY. April 12th.  
 8,714. "Electric signal switch." C. BECK and A. BECK. April 12th. (Complete.)  
 8,719. "Electric soldering irons." A. FLETCHER. April 12th.  
 8,724. "Electrical measuring instruments." B. THOMSON-HOUSTON Co., LTD., and F. HOLDEN. April 12th.  
 8,728. "Construction of electric lamp holders." R. N. CUNNINGHAM. April 12th.  
 8,740. "Construction of electro-magnets, transformers or induction coils." R. S. WRIGHT. April 13th.  
 8,745. "Electric resistances or dimmers for use in governing the flow of current through incandescent lamps." E. T. MIDDLEMISS. April 13th.  
 8,746. "Electrotype and process for the production thereof." J. MURAY. April 13th.

- 8,757. "Tungsten powder for the production of incandescent bodies and a process of manufacturing same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany.) April 13th.  
 8,758. "Tungsten or the like metal-filament and a process of manufacturing same." J. HUBERS. (Julius Pintsch Akt.-Ges., Germany.) April 13th.  
 8,767. "Form of zinc for galvanic batteries." E. E. MOORE. April 13th.  
 8,790. "Electric refining crucibles." E. C. R. MARKS. (Patents Purchasing Co., United States.) April 13th. (Complete.)  
 8,791. "Electric arc furnaces." E. C. R. MARKS. (Patents Purchasing Co., United States.) April 13th. (Complete.)  
 8,793. "Telephone relays and repeaters." F. A. STIRRUP. April 13th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

SELF-REGULATING DYNAMO-ELECTRIC MACHINES. A. H. Vandervell and C. A. Midgley. 29,493. December 30th. (Patent of Addition not granted.)

### 1911.

- IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering. 5,902. March 9th. (March 12th, 1910.)  
 APPARATUS FOR GENERATING ELECTRICITY ON MOTOR-DRIVEN VEHICLES AND THE LIKE. H. F. JOEL and J. TAYLOR. 6,257. March 13th.  
 CONTROL SYSTEMS FOR ELECTRIC HOISTING APPARATUS. Allgemeine Electricitäts Ges. 6,293. March 13th. (March 12th, 1910.)  
 MULTIPLE TELEPHONY. E. RUHMER. 6,549. March 15th. (March 16th, 1910.)  
 ELECTRICAL SIGNS, ADVERTISING DEVICES AND THE LIKE. G. WALLACE and J. E. GRAHAM. 6,863. March 18th.  
 ELECTRODES FOR FLAME ARC LAMPS OR THE LIKE. Oliver Arc Lamp, Ltd., C. OLIVER and W. M. D. PELL. 6,986. March 20th.  
 ELECTROSTATIC MEASURING INSTRUMENTS. G. L. ADDENBROOKE. 9,077. April 12th.  
 APPARATUS FOR REMOVING BOILER-SCALE AND THE LIKE. Electric Safety Boiler Cleaner, Ltd., and W. ARDILL. 9,567. April 19th.  
 ELECTROMAGNETIC LEVITATING AND TRANSMITTING APPARATUS. E. BACHELET. 9,573. April 19th.  
 REMOTE CONTROL SYSTEMS FOR ELECTRICALLY-DRIVEN VEHICLES. Electromotoren Werke Hermann Gradenwitz. 10,550. May 1st. (May 27th, 1910.)  
 METHOD OF FEEDING LOW-VOLTAGE LAMPS AND OTHER LOW-VOLTAGE ELECTRICAL DEVICES IN A HIGH-VOLTAGE NET. L. NEU. 10,965. May 6th. (July 7th, 1910.)  
 TELEPHONE INSTRUMENTS. H. G. MATTHEWS. 12,730. May 26th.  
 ELECTRICAL ACCUMULATORS FOR IGNITION, TRACTION, LIGHTING AND OTHER PURPOSES. J. BAYLEY and S. WOOD. 13,266. June 2nd.  
 ELECTRIC RELAYS. W. R. SYKES'S Interlocking Signal Co., J. C. SYKES and R. W. TARRANT. 14,615. June 20th.  
 ELECTRIC IGNITION FUSES. Schaffler rekte Glössl and D. WEISS. 15,219. June 29th.  
 CIRCUITS FOR TELEPHONE INSTRUMENTS. British Insulated and Helsby Cables, Ltd., and J. B. REDFERN. 15,502. July 4th.  
 ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 15,841. July 7th.  
 TELEPHONE EXCHANGE CIRCUITS. Western Electric Co. (Western Electric Co.) 18,649. August 18th.  
 ELECTRICAL TELL-TALE APPARATUS FOR WATCHMEN AND THE LIKE. H. LAKE. (F. WILLIAMS.) 19,313. August 29th.  
 IMPULSE TRANSMITTERS FOR AUTOMATIC EXCHANGE TELEPHONE SYSTEMS. G. A. BETULANDER. 19,661. September 4th. (September 5th, 1910.)  
 ELECTROMAGNETIC VALVES FOR GAS APPARATUS. E. TELLIER and Compagnie Anon. des Allumeurs Extincteurs du Gaz a Distance Systeme Gote. 20,402. September 14th.  
 ELECTROLYTIC DEPOSITION OF METALS, PARTICULARLY UPON IRON AND STEEL SURFACES. Q. MARINO and P. MARINO. 22,141. October 7th.  
 MEANS FOR OPERATING TRAMWAY POINTS OR SWITCHES. M. RENNER. 24,531. November 4th.  
 BUFFER MACHINES USED IN CONNECTION WITH ELECTRICAL BUFFERS. Siemens-Schuckertwerke Ges. 24,744. November 7th. (November 8th, 1910.)  
 METHOD AND FURNACE FOR REDUCTION OR SMELTING OF ORE WITH ELECTRIC CURRENT. Aktiebolaget Elektrometall. 25,862. November 20th. (November 25th, 1910.)  
 GAS-DETECTING APPARATUS FOR PORTABLE ELECTRIC HAND-LAMPS. G. J. RALPH and J. H. HOLMES. 6,364. March 14th.  
 STERILISING LIQUIDS BY MEANS OF ULTRA-VIOLET RAYS. M. von Recklinghausen. 6,759. March 17th.  
 INCANDESCENT ELECTRIC LAMPS. J. T. ROBIN. 6,856. March 18th.  
 ELECTRODES FOR FLAME ARC LAMPS. Oliver Arc Lamp, Ltd., C. OLIVER and W. M. D. PELL. 6,984. March 20th.  
 ELECTRIC LAMP HOLDERS. L. M. WATERHOUSE. 7,161. March 22nd.  
 MAGNETO TRIP MECHANISM FOR INTERNAL-COMBUSTION ENGINES. K. E. L. GUINNESS. 7,376. March 24th.  
 CONTROLLERS FOR ELECTRIC MOTORS. J. SMITH. 10,219. April 27th.  
 INTERCOMMUNICATION TELEPHONE SYSTEMS. Sterling Telephone and Electric Co. and F. G. BELL. 11,237. May 9th. (Addition to 1,631 of 1910.)  
 TELEPHONE SIGNALLING SYSTEMS. C. H. ELLISON and C. M. JACOBS. 12,175. May 20th.  
 PLUG AND SOCKET CONNECTIONS, ELECTRICAL. A. P. LUNDBERG, C. C. LUNDBERG and P. A. LUNDBERG. 12,235. May 20th.  
 ELECTRICALLY OPERATED OR CONTROLLED INDICATING APPARATUS FOR USE WITH SIGNALLING APPARATUS ON RAILWAYS. A. H. JOHNSON and J. P. O'DONNELL. 12,833. May 29th.  
 ELECTRICALLY OPERATED OR CONTROLLED INDICATING APPARATUS FOR USE WITH SIGNALLING APPARATUS ON RAILWAYS. J. T. RUSSELL and C. S. SAUNDERS. 12,941. May 30th.

### 1912.

- SAFETY FUSES FOR ELECTRICAL INSTALLATIONS. Appareillage Gardy (S.A.). 3,121. February 7th. (February 23rd, 1911.)  
 SANITARY PROTECTORS FOR TELEPHONE TRANSMITTERS. C. ADAMS. 2,336. January 29th.  
 WATERTIGHT TERMINAL FOR ELECTRIC CABLES. Firm of Robert Bosch. 3,026. February 6th. (February 20th, 1911.)



# THE ELECTRICAL REVIEW.

VOL. LXX.

MAY 4, 1912.

No. 1,977.

## ELECTRICAL REVIEW.

## TRADE WITH CANADA.

Vol. LXX.]	CONTENTS: May 3, 1912.	[No. 1,977.
		Page
Trade with Canada ...	...	701
The Restrictive Covenant ...	...	702
Concentration in Germany ...	...	703
The Capacity of Small Air Condensers ( <i>illus.</i> ) ...	...	703
Motor-Generators for Cinematograph Supplies ( <i>illus.</i> ) ...	...	704
The Cost of Train Lighting ...	...	705
Notes from Canada ...	...	705
Correspondence:—		
City Guilds Examinations and Easter Holidays ...	...	706
The I.E.E. Students and the New Articles ...	...	706
Ideal House, Olympia ...	...	706
Legal ...	...	706
The Electrical Trades Benevolent Institution Festival Dinner	...	712
Business Notes ...	...	713
Proposed Bankruptcy Legislation ...	...	720
Notes ...	...	720
City Notes ...	...	724
Stocks and Shares ...	...	727
Electric Tramway and Railway Traffic Returns ...	...	728
Share List of Electrical Companies ...	...	729
Re Davis Electrical Co., Ltd. ...	...	731
Copper: Its Present Position as regards Production and Price	...	732
Australian Tramway Companies and their Employés.—II ...	...	733
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	733
Proceedings of Institutions:—		
On the Power Factor and Conductivity of Dielectrics ( <i>illus.</i> ) ...	...	736
Parliamentary ...	...	737
Foreign and Colonial Tariffs on Electrical Goods ...	...	739
Expiring Patents ( <i>continued</i> ) ...	...	739
New Patents Applied For, 1911 ...	...	740
Abstracts of Published Specifications ...	...	740
Contractors' Column ...	Advertisement pages xxiv and xxvi	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

**Binding.**—Subscribers' numbers bound, including case, for 4s. each volume.

**Cases.**—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

**Foreign Agents.**—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

For some years, as our readers know, we have devoted much attention to the subject of British trade with Canada, and we have repeatedly published articles pointing out the immense possibilities, both present and future, of this outlet for our manufacturers, as well as letters from correspondents possessed of special knowledge of the conditions obtaining in this market. Briefly recapitulating, we may say that the principal facts thus demonstrated have been the following:

Canada is undoubtedly advancing with rapid strides; her natural resources are almost unlimited, her population is increasing in a high ratio, and she offers a magnificent field for engineering enterprise in connection with the development of her abundant water-power, the provision of transit facilities, and the establishment of industries. Moreover, her people are alert and up-to-date in their ideas, and are eager to take advantage of the latest improvements in machinery and plant, while the use of electricity is practically universal. The Dominion is separated from the United States over a length of more than 2,000 miles by a merely imaginary boundary line, yet she is willing and anxious to trade over-seas with this country, and even offers us a preferential tariff—the recent rejection of the proposed reciprocity treaty is fresh in memory. But our manufacturers, for various reasons, have not hitherto availed themselves of their opportunities in Canada to any considerable extent; a certain amount of business is carried on directly, and many firms have agencies there, but neither method has more than scratched the surface of the soil. First-hand trading is possible only in certain lines, and has little tendency to develop beyond its existing boundaries.

Agencies are notoriously unsatisfactory; the customer feels that he is dealing with an unsubstantial shadow, the agent has little inducement to push British wares rather than those of American firms which he may also represent, and the manufacturer never gets into touch with local conditions and requirements. On the other hand, the establishment of a branch office, in charge of a representative vested with the requisite authority to treat with clients at his own discretion, involves an outlay which cannot be contemplated without the strongest grounds for anticipating a large demand, and to be effective, necessitates the organisation of a large number of sub-offices, to cover so enormous an area as that of the Dominion. As regards the quality of our manufactures, it is admitted that they are at least as good as those of the United States—often better—and if the demand for them were sufficient, our manufacturers would willingly modify their designs to satisfy local conditions and national predilections. In spite of the seeming nearness of the United States, we are little, if at all, handicapped by distance, either in time of delivery or in cost of freight, for our goods are largely water-borne, even to the heart of Canada, and can actually be delivered at Vancouver more

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



cheaply than goods from the Eastern States. Further, in point of cost of production we are undoubtedly in a better position than our rivals, without considering the benefit of preference both by tariff and by national sentiment, which must not be ignored. We have against us the efficiency of the American salesmen who abound in Canada, and who, being familiar with the customs and modes of thought of the country, are in a better position than Englishmen to push their wares, while their local knowledge enables them, time and again, to offer incredible guarantees with the certainty that their professions will never be put to the test, and to grant long credit where a British firm would feel compelled to stipulate for cash with order. Again, American practice has largely imposed itself upon Canadians—many of whom have been trained, more or less, in American Institutions—and their apparatus are, therefore, more readily adapted to Canadian needs than ours. Lastly, there undoubtedly exists in Canada an impression, which loses nothing from American efforts, that this country lags behind the times, and cannot produce the newest and most modern goods. Add to this that, owing to the demand for engineers in Canada, many men in highly responsible positions have had no technical training to speak of, and are very much in the hands of clever and voluble American selling agents. These are the conditions, and it will be seen, on summing them up, that in many respects they are in our favour: while, where the contrary appears to be the case, it is largely due to misconception, or ignorance of our capabilities, to the lack of intimate communication between manufacturer and purchaser, and to the want of a suitable organisation to bring our products directly before the Canadian people. There are other factors—such as the difficulty of obtaining spare parts at short notice, the tendency of manufacturers to give priority of urgency to home orders, and so on—which need not be dwelt upon at the moment.

All these points, and other, we have dealt with from time to time, and we have consistently urged our manufacturers to tackle the question seriously, before it is too late. It is, therefore, with sincere pleasure that we have learnt of the formation of an organisation designed to promote British engineering trade with Canada, which appears to be admirably adapted to cope with the difficulties we have mentioned, and to be worthy of cordial support. The scheme originated with Mr. Leonard Andrews, who is already well known in electrical engineering circles, and played a prominent part in the establishment of the manufacture of large gas engines in this country. Mr. Andrews's attention was drawn to the Canadian market two years ago—we were then publishing an extended serial examining the various promising markets under the title "Notes on Trade Abroad"—and as the result of a tour in that country he was so deeply impressed with the scope it offered for trade with Great Britain, that he has since devoted most of his time to the elaboration of a plan to surmount the difficulties of the case. During that visit he made the acquaintance of Mr. W. A. Martin, assistant manager of the Toronto Electric Light Co., one of the largest undertakings of its kind, and last year he made a second tour through Canada in company with Mr. Martin, with the result that his first impression deepened into conviction. Negotiations with British manufacturers showed that the latter would gladly avail themselves of the facilities for trade provided by the scheme, which is roughly out-lined below.

A company is about to be formed, with sufficient capital to command the confidence both of British manufacturers and of Canadian bankers and purchasers; offices will be established in the chief centres of the Dominion, each in the charge of a director of the company, who will deal directly with the purchaser and accept full responsibility for the prompt delivery and fulfilment of guarantees of all goods supplied. A staff of experts will be maintained in Canada, available for consultation wherever required, and a larger staff of local representatives will be distributed throughout the country, to act as an intelligence department and to seek business. Thus, the customer will be sought out, provided with expert advice—often very necessary—and enabled to negotiate directly across the table with one of the principals of the company, vested with full authority to enter into contracts (in conjunction, of course, with the managing director) for the supply of the goods. On this side there will also be a complete organisation to deal with the manufacturers, and equally armed with full authority; being in effect the actual purchaser, the company will be in a position to keep deliveries up to the mark, to demand the fulfilment of guarantees, and, by virtue of its financial stability, to obtain a reasonable allowance of credit. The company will be able to make itself fully conversant with local conditions, and where these necessitate modifications in our standard designs, to explain the necessity to the manufacturers, who are perfectly willing to meet the requirements where good cause is shown. A number of our most important engineering firms have already given their adhesion to the scheme, which provides precisely what they need to enable them to cater for this huge market on efficient and economical lines; but the company is not tied to these firms only. In the first instance, at any rate, engineering work alone will be handled by the company, but later other departments may be formed; there is abundant scope in this field to occupy all its attention for some years to come. The constitution of the undertaking has been framed upon conservative lines, with a view to commencing with a moderate capital, and increasing it when the results of its operations are manifest and better terms can be commanded. We shall return to the subject when details are available; in the meantime we commend the matter to our readers as being well worthy of their close attention, and we cordially welcome a venture, the success of which would be of the greatest benefit to the British and Canadian peoples.

---

#### The Restrictive Covenant.

It is often necessary for men who are taking persons into their service, to consider the propriety of introducing what is known as a restrictive covenant. Such a covenant is necessary to prevent a servant making undue and improper use of the knowledge which he acquires of his employers, customers, and concerns. It is, however, part of the law of England that a covenant in restraint of trade is illegal. How, then, do the Courts ever lend their aid to enforce restrictive covenants? It has been held that a covenant which is reasonably necessary for the protection of the employer will be upheld: and the numerous cases which have been decided in relation to these covenants generally turn upon the question whether they are reasonable or not. For instance, a covenant whereby a man undertook not to carry on the trade of a "wireman" anywhere for the rest of his natural life, would clearly be void as being unreasonable. But an agreement not to undertake employment as traveller for any firm dealing in electric fittings within a mile of St. Paul's, would be upheld as



being reasonably necessary for the protection of the late employer, whose customers might be induced to leave him at the instigation of his late employé. A case which was heard recently in the King's Bench Division shows that a covenant must be certain as well as reasonable. The facts were that a man entered the employment of the Provident Clothing and Supply Co. upon the terms that he would not "within three years after the termination of his engagement . . . be in the employ of any firm . . . carrying on a similar business . . . within 25 miles of London where the company carry on business." The employé having in fact canvassed for another firm within 25 miles from London, the company sought an injunction to restrain him. A County Court judge granted an injunction; but the Divisional Court, on appeal, discharged the injunction on the ground that the covenant was too vague. Mr. Justice Pickford said: "The words 'within 25 miles of London where the company carry on business,' were words to which the Court could attach no intelligible meaning, as the company had about 15 shops in different parts of London." This case draws attention to the importance of having the terms of a covenant of this kind accurately and clearly stated. No doubt this particular clause was drafted when the company had only one place of business in London. In that case it would have afforded the company protection.

#### Concentration in Germany.

A FURTHER step in connection with the process of concentration in the German electrical industry is now taking place by the establishment of a community of interests between the Siemens-Schuckert Works and the Bergmann Electricity Works Co. To some extent the scheme represents a countermove to the association of the A.E.G. with the Felten & Guillaume Co., which took place some time ago. The undertaking of the Bergmann Co. has been developed beyond its financial resources, and the question of the future of the company has for some time past been under the consideration of the directors, and of the banks connected both with the company and the Siemens-Schuckert group. It has now been agreed to raise the share capital of the Bergmann Co. from £1,450,000 to £2,600,000 by the issue of new shares of £1,150,000. Of these the Deutsche Bank, the Disconto Gesellschaft, the Schaffhausen Bank Verein, and other banks, will take over £725,000 and offer the shares to existing proprietors at the price of 110 per cent., whilst out of the balance the Siemens-Schuckert Works will subscribe for £400,000 at the same price. The Siemens & Halske Co., which is part proprietor of the Siemens-Schuckert Works, is making an issue of £1,000,000 in bonds, partly for the purpose of participating in the Bergmann Co. It is significant that the Siemens-Schuckert Co., as a consequence of newspaper reports of the proposed formation of a monopoly in the electrical industry, recently published a statement submitting that both that company and the Siemens & Halske Co. had always expressed themselves against efforts to constitute an electrical trust, as the creation of such a combination would deprive the industry of the technical progress which is requisite if the industry is to continue to maintain its leading position in the world. It is contended that an electrical monopoly could never assume a permanent form, as the industry does not control the necessary raw materials, and competition could, therefore, be revived at any time. The Siemens group would, consequently, greatly regret the disappearance of the Bergmann Co. as an independent undertaking, and it has therefore been decided to comply with the request to co-operate in the maintenance of the latter. The amount of the financial interest taken will not give the Siemens-Schuckert group a dominating vote in the affairs of the Bergmann Co., and an amalgamation of the interests of both companies is, therefore, out of the question. On the other hand, some of the German newspapers contend that this new association will really mean an abatement, if not a cessation, of competition by the Bergmann Co., and that there are now left only two groups, which frequently join hands in the carrying-out of large enterprises.

#### THE CAPACITY OF SMALL AIR CONDENSERS.

By CHAS. E. HAY.

IN calibrating small air condensers recently it was observed that the capacity appeared to be different when the condenser was reversed in the circuit. The same phenomenon presented itself some considerable time ago when measuring very small inductances with alternating current at a frequency of 2,000 periods per second by means of resistances and an air condenser. The phenomenon was not looked into then owing to more urgent work, and to the fact that

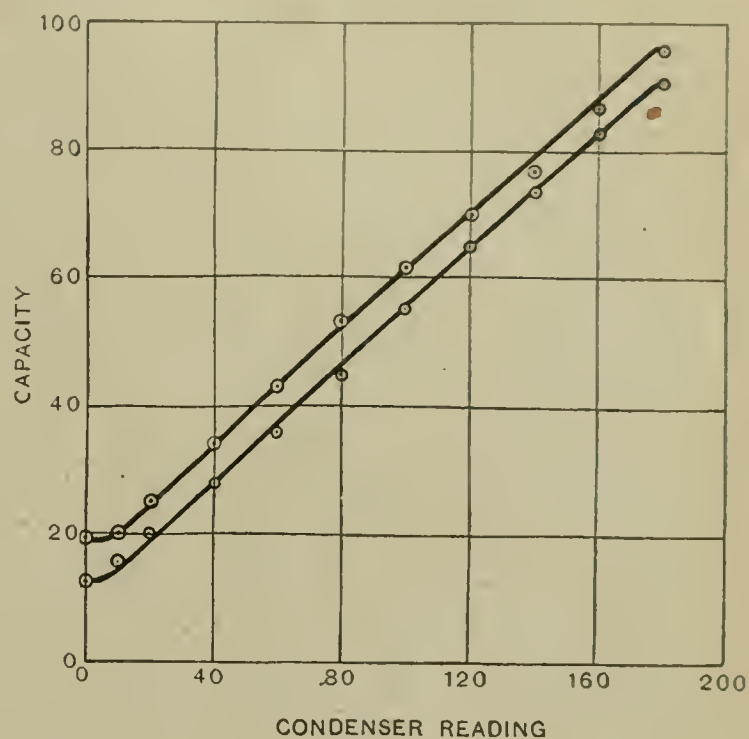


FIG. 1

when the air condenser was joined up in one particular way the inductance measurements agreed with the calculated results to one part in one thousand, which was quite close enough for the purpose in hand. On the phenomenon again appearing, very careful measurements were made by direct E.M.F. of about 1,500 volts and a ballistic galvanometer. The results

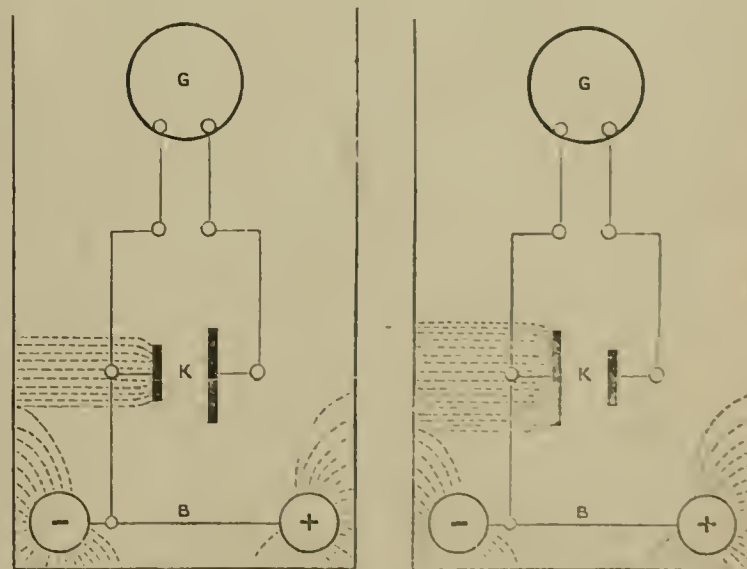


FIG. 2 (a).

FIG. 2 (b).

of these measurements are shown in fig. 1. One of the curves represents the capacity when the air condenser was joined up in one direction, and the other when the connections to the air condenser were reversed. Fig. 2 shows the electrical connections of the circuit when the measurements were made, that is, one pole of the battery was kept joined to one plate of the condenser when the discharge was passed through the galvanometer, as is usually the case when an ordinary discharge-key is used. Fig. 2 also represents approximately the electrostatic field when the condenser was discharged through the galvanometer. For convenience and clearness, the potentials of the battery are shown as being concentrated at the ends of the battery connections, and the capacity of



the other parts of the circuit as being entirely located in the condenser, the leads and galvanometer being supposed not to have any capacity to earth. The condenser is shown as having plates of unequal area so as to represent unequal capacities to earth, as it is only in this type of air condenser that the phenomenon appeared. In fig. 2 (a) the smaller plate of the condenser is kept joined to the negative pole of the battery when the condenser is discharged through the galvanometer, and the electrostatic field depicted represents approximately the state of the field after the discharge has taken place. Of course, the larger plate also becomes charged negatively in this condition, but this is not shown. The electrostatic fields which existed between the plates of the condenser and the larger plate and earth before the condenser was joined to the galvanometer, have disappeared, sending through the galvanometer a quantity of electricity which is proportional to the capacity between the condenser plates and the capacity between the larger plate and earth. Reversing the battery will obviously not affect the quantity of electricity passing through the galvanometer, but only the direction of its flow. In fig. 2 (b) the larger plate is kept joined to the negative pole of the battery; the electrostatic fields between the plates of the condenser and between the smaller plate and earth have, in this case, disappeared, sending a smaller quantity of electricity through the galvanometer, and hence indicating a less capacity than before.

It is clear, therefore, that the difference in the capacity of the condenser, depending upon the way it is joined up, is due to the fact that one set of plates had a greater capacity to earth than the other set.

In all the small air condensers tried this phenomenon appeared. It was difficult to observe it with direct E.M.F. in some cases, as the difference in the capacity to earth of the two sets of plates was small; but with alternating E.M.F. at a frequency of 2,000 periods per second it was easily observed in all cases. The practice of screening small air condensers by enclosing the whole condenser in a metal receptacle joined to one set of the plates increases the difference in the capacity of the condenser very markedly. The experiments show that in the design of small air condensers, especially for high-frequency work, whether screened or unscreened, the capacity to earth of each set of plates should be equal.

### MOTOR-GENERATORS FOR CINEMATOGRAPH SUPPLIES.

[BY A CONSUMER'S ENGINEER.]

IN these days, when almost every town which can lay claim to be termed a town has its picture house or houses, it is interesting, from an electrical engineer's, as well as a company promoter's point of view, to know what proportion the cost of electrical energy for the cinematograph lantern bears to the total cost of running the picture house. It will be found that the bill for electricity is an extremely heavy item of expenditure, no matter what the method of utilising the energy may be, and much attention should therefore be directed to the apparatus in order to economise the current as much as possible.

Where a supply of electricity is given by a supply authority at a pressure exceeding 100 volts at the terminals, it is common practice to feed the current for the arc through a number of resistance coils, thereby limiting the current to that value necessary for the particular intensity of light required for the lantern lens. This method is simplicity itself, and naturally commends itself to the average theatre electrician whose aspirations tend more towards reducing his daily tasks than working his apparatus more economically.

But when it is pointed out that the efficiency of this method may be as low as 20 per cent. on a 250-volt circuit,

the necessity for providing a more efficient arrangement becomes apparent to the proprietors of the theatre; and although the installation of a motor-generator may involve additional capital expenditure, the consequent saving in the electricity consumption will, in most cases, be found to defray the extra expenditure in a few months' time, depending on the voltage to which the arc has previously been connected.

Assuming that, in a cinematograph theatre open from 6 p.m. to 11 p.m. on six evenings per week, the arc takes an average current of 30 amperes, and that the supply voltage is 250 volts, the monthly account for electricity at 3d. per unit will be £11 5s. Fully three-fourths of the energy represented by this sum has been expended in heating the resistance coils connected in series with the arc, the

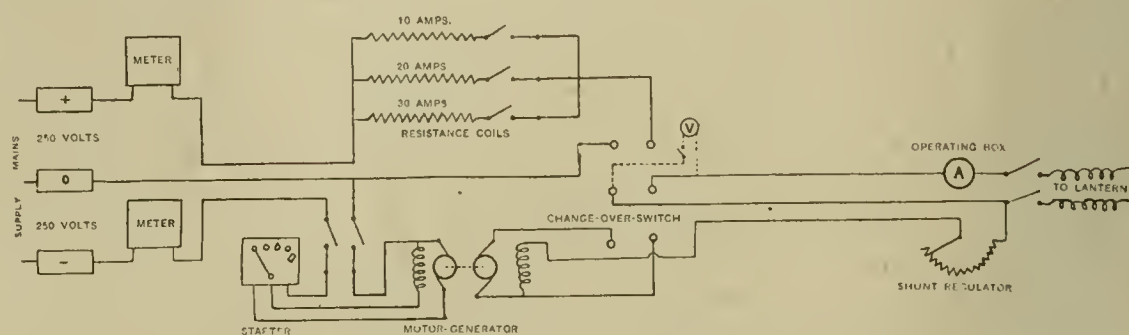


DIAGRAM OF CONNECTIONS FOR CINEMATOGRAPH SUPPLY.

remaining one-quarter embodying the energy actually utilised in the lantern.

If a motor-generator be employed, the efficiency of the system may reach as high as 80 per cent., and, assuming this efficiency, the monthly bill in the foregoing example would then amount to about £3 5s.—a saving of approximately £8 each month. Some supply companies and municipal undertakings, while they do not grant special rates for cinematographs, will, nevertheless, allow the energy consumed by motor-generators to be charged at power rates. A further economy may be brought about if this concession be obtained.

A number of manufacturing firms have placed motor-generators for cinematograph purposes on the market, at prices ranging from £50 upwards, and these can be constructed with their motors wound for any supply voltage, and the generator machines designed to deliver current for the arc up to, say, 70 amperes at 50 to 70 volts. To vary the current taken by the arc, a shunt regulator may be fixed in the fireproof compartment and connected to the field coils of the generator.

The motor-generator will, of course, require some attention in the matter of oiling, cleaning and renewals of brushes, and the risk of breakdown will obviously be slightly greater than with the other method. For emergency purposes, therefore, it is advisable to retain the resistance coils, connected up so that the operation of a change-over switch will throw the arc on the supply voltage through the resistance coils.

The diagram above shows the connections for this arrangement on a three-wire supply. The machine and resistance coils have been placed in the basement of the theatre, while the shunt regulator, D.P. switch and ammeter are fixed on an iron panel in the operating box. A pair of 19/18 cables and a 3/22 lead are required between the basement and the box, and the whole arrangement conforms in every respect to the Cinematograph Act.

**Museum of Safety Appliances.**—Mr. Wardle recently asked in Parliament whether any arrangements had yet been made for a museum of safety appliances in this country. Mr. McKenna said the Government had decided to establish such a museum, and the arrangements were in hand. The selection of the site had taken a little time, but the offer of a suitable site in a central position in Westminster had now been accepted, and provision had been made in the Estimates for commencing the erection of the building in the course of the present year.

**The Johannesburg Gas Engines.**—Under the heading "The Gas Engines Again," the *South African Mining Journal* for April 6th says: "The notorious Johannesburg municipal power station gas engines have been repurchased by Messrs. Beardmore, and are now under option to a well known South African financier. It is on the cards that they will figure in a new electrical power scheme at an early date."



## THE COST OF TRAIN LIGHTING.

By C. TOONE.

THERE can be no doubt that electric lighting is the safest possible means of illuminating railway passenger vehicles, and there are now so many excellent systems of energy production, or transport, and of distribution of current from coach to coach, that a suitable arrangement is to hand for every class of railway, and, apart from discussions as to the illuminating "qualities" of the various sources available, the adoption of electric lighting turns mainly upon the question of annual cost. A number of authorities have estimated the latter for various lighting systems. Dr. Jakob, of Baden, has collected the latest available data concerning five large Continental railways, using respectively:—A, oil gas and ordinary mantles; B and C, ordinary coal gas and inverted mantles; D, electric lighting from accumulators; E, electric lighting from carriage dynamos. The chief of the results derived are given below, together with simple formulæ for estimating the total annual costs of the various systems considered (see also *Elektrotech. Zeit.*, January 11th, 1912).

As a basis of estimate and comparison, assume a mixed second and third class eight-wheeled coach, running 62,500 miles per annum at an average speed of 30 M.P.H.; then the running hours per annum average 2,000, to which may be added 20 per cent. to cover stoppages and lighting in stations before and after arrivals. An allowance of 300 C.P. per coach and burning hours equal to half the total running hours is assumed. Gas or accumulator equipment may have 24 hours, and the battery in a dynamo equipment 10 hours' capacity.

Including capital, maintenance and energy charges (and all wages reasonably chargeable to this account), the lighting and total costs per annum, in the cases referred to above are given in francs as follows:—

Case.	A.	B.	C.	D.	E.
Actual lighting ...	182.0	103.1	86.6	177.5	59.4
Total annual cost "K" of lighting equipment ...	492.3	493.0	526.6	652.8	376.5

From these figures it will be seen that the total costs of the above lighting equipments average 500 fr. for the gas systems, 650 fr. for electric lighting from accumulators, and 375 fr. for electric lighting from train dynamos. Depreciation and maintenance constitute the chief items of expense in the accumulator system; depreciation costs are rather higher in the dynamo than in the gas equipments, but the former effects very important economies in maintenance and the actual cost of current production.

A general formula for the total annual cost (K frs.) of a lighting system is—

$$K = C_1 + C_2 W + C_3 B,$$

in which,  $W$  = the annual track miles traversed, expressed in 100,000's of kilometres;  $B$  = lighting period, expressed in 1,000's of hours;  $C_1, C_2, C_3$  = constants depending on the lighting system employed.

For gas lighting:— $K = 150 + 125 W + 194 B$ , and  $h = 0.065 + 50/1,000 \cdot B + 41.25 W/1,000 \cdot B$  ( $h$  = centimes/C.P.-hour).

For accumulator lighting:— $K = 171.25 + 155 \cdot W + 272.5 \cdot B$ , and  $h = 0.0912 + 57.5/1,000 \cdot B + 51.25 \cdot W/1,000 \cdot B$ .

For dynamo lighting:— $K = 152.5 + 158.75 \cdot W + 55.75 \cdot B$ , and  $h = 0.0175 + 51.25/1,000 \cdot B + 52.5 W/1,000 \cdot B$ .

The fixed charges and those dependent on the distance travelled, are much the same in each case, but the 1,000-hour value of those depending on the lighting hours are about 200 fr. for gas lighting, and 272 and 54 fr. for electric lighting by accumulators and dynamos respectively. Lighting by accumulators alone, is always very costly.

If the fixed costs be equal, the cost of lighting by gas and by dynamo is the same when  $B/W = 1/4$ , i.e., when one hour's lighting is required for every 400 kms. train miles (about 8 hours' run). For longing lighting periods per train mile, the dynamo system is the cheaper.

On very long journeys, such as are common on Continental and American railways, it may be necessary to carry a double supply of gas or two sets of accumulators. Such a necessity at once enhances the relative superiority of the dynamo system and the new equations for  $K$  become:—

$$\begin{aligned} \text{Gas} \quad \dots \quad \dots \quad K &= 150 + 169 \cdot W + 194 \cdot B \\ \text{Accumulators} \quad \dots \quad K &= 275 + 244 \cdot W + 275 \cdot B \\ \text{Dynamo} \quad \dots \quad \dots \quad K &= 150 + 150 \cdot W + 56 \cdot B \end{aligned}$$

and dynamo lighting shows considerable economy even for small values of  $B$  (the lighting hours). The general conclusion to be derived from the above notes is that dynamo lighting is always preferable to accumulator lighting for trains, and that the former will usually show a greater or less economy over ordinary incandescent gas lighting.

## NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

ATTENTION is drawn in a Canadian engineering paper to failures of the casings of water turbines, several of which have, apparently, occurred recently. It is pointed out that, although theoretical knowledge of turbine design is advancing, the number of accidents of the kind referred to is on the increase. Long penstocks are blamed for the trouble, combined with insufficient provision for relieving pressure therein when extra strain comes on owing to variations of load. Hydraulic engineers are advised to pay more attention to making ample provision to relieve the turbines and penstocks from excessive strain or pressure.

The Canadian Pacific Railway intends to use oil fuel on its locomotives in Vancouver Island, the idea being that there will be less likelihood of starting forest fires with this fuel than with coal. In the interior provinces of the country, however, as in many parts water-powers are available, it is not unlikely that electric power may be utilised in the future, especially as both coal and oil are expensive on account of the cost of freight.

The Canadian National Exhibition, which is held annually in Toronto, is to be open this year from August 24th to September 9th. In a pamphlet issued by the management it is stated that the exhibition has been held annually since 1879. The year 1912 is to be "Imperial" year, according to announcement, as "H.R.H. the Duke of Connaught will officiate at the opening ceremonies . . . and the special attractions will be such as to reflect the glory of the British Empire." The Dominion Government has granted \$100,000 this year for certain buildings. Visitors come from all parts of Canada, and large numbers of Americans patronise the exhibition. The buildings are mostly of a permanent character, as they are required each year. The grounds cover 264 acres, situated on the shore of Lake Ontario. The exhibit space of some of the larger buildings amounts to over 410,000 sq. ft. Many of the streets of Exhibition City are paved, and the electric lighting plant is capable of supplying 20,000 lamps. In 1909, 752,000 persons visited the exhibition, while last year the number rose to 926,000. Allotments of space are being made now, an entrance fee equivalent to practically £1 being charged, but only firms having representatives in Canada are allowed to exhibit. Sketches or descriptions, indicating the character of exhibits and materials to be used in their construction and decoration, must be submitted to the manager for approval.

The writer would like to see all British electrical engineering and, for the matter of that, mechanical engineering firms who are represented here combine their forces and endeavour to form a British section in the exhibition. This would be much more imposing and would attract a great deal more attention than if, as seems at present to be the case, each firm applies for space independently, their exhibits being scattered about the building indiscriminately. If principals at home would ask their representatives over here to communicate with your correspondent, he would be glad to make every endeavour to carry this scheme into effect by approaching the management on the subject; and even were such efforts not entirely successful this year,



the way would be paved for their more complete realisation next year. The writer has already ascertained that the exhibition authorities would give facilities for the carrying out of such a scheme as far as they could.

Another matter demanding the most serious attention of British electrical engineering firms is that of obtaining better recognition of their products by the fire insurance companies here; the remark applies more particularly to cables and wires, switches, fuses and general accessories, rather than to motors and generators. It is a strange thing that in one of the most important parts of the British Dominions, it is almost impossible to introduce many articles of first-class design and construction although no valid objection on the score of their being unsafe, can be raised, as is proved by their efficiency in England.

The difficulty appears to lie in the fact that the only rules for electrical work at present in force are those of the Fire Underwriters, whose headquarter laboratories are in Chicago, where everything is gauged by purely American standards. These rules are all right for U.S. manufacturers, but why should first-class British goods be debarred from a British Possession by American regulations?

The only reply one can get here is, that what is all right in the old country is no good here. To a very limited extent this may be true, but is it not plain to anyone that it is in the interests of the American manufacturer to foster this idea? The sooner united action is taken by home firms and their representatives here the better. It is difficult to see why the great fire insurance companies of England, who are all represented here, should not be perfectly willing to accept the materials and apparatus used at home when it comes over to this country; perhaps the B.E.A.M.A. could induce them to do so. The effort is well worth making—nay, it is absolutely essential that something shall be done, and done at once, if Great Britain wishes to obtain, not the lion's share, but any share at all, of the trade of the Dominion, so far as the electrical industry is concerned.

The trade returns for 1911 show, under the heading "Electric Apparatus," total imports into Canada of the value of \$4,972,881, of which \$4,615,968 is credited to the U.S., and only \$393,563 to the United Kingdom—a state of affairs which, without any doubt, is due in large measure—though not, of course, entirely—to the fact that the British manufacturer is seriously hampered in the manner already indicated.

The formation of a Canadian branch of one of the British electrical organisations, as suggested in a recent editorial in the ELECTRICAL REVIEW, would be an excellent thing, for combined action, having real power behind it, could be taken on both sides of the water; but the time for it to be formed is *now*—not next year or the year after; active steps should be taken at once.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### City Guilds Examinations and Easter Holidays.

There would not, at first sight, appear to be much connection between the above, but there is really a very serious one.

At certain Institutions Easter holidays, extending over three or four weeks, are allowed to intervene between the work of the classes and the examinations. This is surely a very serious state of affairs, and it passes my understanding that the City and Guilds of London Institute should allow it.

It is obviously unfair to both students and teachers, and it seems to indicate the overshadowing of technological education by University methods. Is it not a fact that the work of the City and Guilds Institute is to be absorbed by the Board of Education? Perhaps it is already so? Anyway, remembering the status and aims of the majority of the

students attending these classes, the fees they have paid—often with some effort—and the anxiety of most of them to pass their examination, it seems a direct slight to them to break the continuity of their work at the most critical part of the session. The Christmas break (sometimes two or three weeks) is bad enough.

I sincerely hope this matter will be thoroughly ventilated.

d'Auvergne.

### The I.E.E. Students and the New Articles.

I have read with interest your article in this week's ELECTRICAL REVIEW concerning the proposed alterations of the Rules of the I.E.E., and would take this opportunity of emphatically protesting against the practice in vogue at the present time in this Institution whereby the one class of members, which, in my opinion, will suffer most by the new Articles if they are passed, and also one which the Institution has of necessity in the future to chiefly depend on for its support, is altogether ignored. Needless to say, I refer to the Student members.

Already repeated attempts have been made for a long time past to persuade those responsible to print the lectures given by the Students before the Student Section, but without success; and now alterations are brought forward for adoption affecting this particular class of member more than any other, and the Students are treated with entirely undeserved contempt, are not consulted in any way at all.

Can it be wondered at that difficulty is experienced at the different Technical Colleges in getting Students to join?

Is it too late for the students as a body to organise a protest which could be sent to the President before the meeting on May 9th next?

H. Douglas Steers.

Rugby, April 26th, 1912.

### The Ideal House, Olympia.

I notice in your article dated April 26th, 1912, on the Ideal Home Exhibition you state that Messrs. John Barker and Co. were the contractors for the furnishing, including the decorating and electric light fittings.

As the architect for the House, I should like it made known that the decorations were carried out by Messrs. H. and G. Taylor, of Parklangley, Hayes Lane, Beckenham, and that the electric light installation was carried out by Messrs. R. A. Lister, Ltd., of Dursley, Gloucestershire.

Reginald C. Fry.

London, E.C., April 27th, 1912.

[We regret the error pointed out by Mr. Fry—who, by the way, was the winner of the *Daily Mail* Ideal Homes Competition, his design being adjudged the best out of 700 submitted. The official statement was "The Ideal House is equipped throughout by the decorative and furnishing experts at Barkers," and no mention was made of any other contractors except the builders, Messrs. H. and G. Taylor.—EDS. E.R.]

## LEGAL.

OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(Continued from page 672.)

MR. JUSTICE WARRINGTON then asked Mr. Astbury to call his attention to the specification of 1907.

MR. ASTBURY said the complete specification was No. 8,653 of 1907, and it said: In the manufacture of illuminating bodies such as those for electric incandescence lamps from tungsten, by subjecting raw filaments composed of finely divided particles cemented together, to a sintering process, a very strong contraction took place. This contraction did not always take place uniformly, and the resistance of the illuminating bodies consequently fluctuates within certain limits. In the first sentence his Lordship would notice that what he called a raw filament was a filament in its form prior to sintering.



It had been found that this contraction proceeds more uniformly if the filaments treated were subjected to a gentle pull, or put in slight tension during the process, whereby they were caused to contract. Means for affecting this pull or tension, such as the loading of a stirrup or loop-shaped filament, by a small weight attached to the stirrup or loop were known of themselves, and had been used for the purpose of drawing out filaments already into a pointed form. The new process consists in acting upon or loading the raw filament while in the course of manufacture. By that means several advantages were secured. Firstly, the disadvantage of irregular contraction already mentioned was avoided. In addition to that considerable commercial advantage was attained, inasmuch as a simplification of the manipulations required for the formation of the finished filament was affected, as well as a saving in the plant required, in so far as the shaping by pointing out of the filament, did not necessitate a second operation. Finally, the number of useless filaments produced was materially lessened, as filaments which were deformed during the sintering process, in consequence of deficient quality or careless handling without being loaded, yielded when loaded serviceable finished filaments. The process consisted therefore, broadly, in subjecting raw filaments of tungsten, or tungsten composition, while preferably in a loop form, and whilst acted upon by a load to a process, such as the sintering treatment which turned them into finished filaments, whereby the chemical actions—that was the decarbonising, and physical operations or reactions—that was the welding together—which took place, converted the filament, whilst under the expanding or stretching action of the load. The load might consist of a small weight of any desired kind, as, for instance, a small hook of metallic tungsten. The difference in the claims was quite obvious when they were read. The first claim was a process for the manufacture of illuminating bodies of tungsten or tungsten composition, according to which a raw filament was provided with a load and was then subjected to operations or reactions adapted to complete the formation of a finished filament, substantially as set forth. The next claim was limiting that to a small hook of tungsten. The third patent was a process for the manufacture of metallic illuminating bodies for electric incandescent lamps, according to which a raw loop-shaped filament consisting of finely divided particles of tungsten cemented together was loaded with a small weight attached to the loop, and was then subjected to a sintering treatment adapted to convert the raw filament into a finished filament, substantially as set forth. The difference between the first and the third was that the first one included the decarbonisation as well as the sintering, and the third was the subjection to a sintering treatment.

Dealing with the plaintiffs' third patent, COUNSEL said he was not quite sure of the category in which he put the invention. He thought that when his Lordship came to consider the anticipations on which defendants relied, he would come to the conclusion that they were really the steps that helped plaintiffs to build up that which showed the value of this invention. Dealing with the anticipation—there was the carbon filament, which, after being built up and squirted through the die, only went through one subsequent process, which was the baking or carbonising. It was in that process that the filaments jumped about and cockled up. After they came out of the oven they ought to have been filaments, ready to put straight into the lamp. When the metal filaments came along, for years they did not weight them during the carbonising, and there were many reasons why they did not. One was they put the filaments lying down into trays all touching, and they were pushed into a red-hot furnace-tube, which had a protective non-oxygen atmosphere in it, and what happened was that the hydro-carbon was volatilised out by heat. In that process they did not all jump and cockle about. After that process was finished they were subjected to something which the carbon filaments were never subjected to—decarbonising—and the result was beads, but not beads as was generally understood by the word, because the particles were as fine as flour, and the object of putting in a binder was because manufacturers knew that this metal sand could not hold together by itself, and in order to be able to squirt it out, a certain gummy substance was used to hold it together. It was also known, that there must be a period when that was burning out rather than sticking the metal together by fusion, and the extraordinary fact was that the inventor found out what he did by hanging a little weight on when it was in that gummy condition. He knew the weight in the carbon case, because he could test it by its then ability to stand the strain, but in the other he could not because he knew that it was going through a process of disintegration. When the filament was put into the jar, it began to shake about as soon as the current was turned on. The two sides first straightened out. Then it began to glow and then to contract, and the sides to grow straight. When the point of fusing was arrived at as distinct from mere decarbonising, the bottom portion thinned out to a point, the weight pulling it to an acute angle, and the filament was finished absolutely straight. The weight, said counsel, was a little bit of wire, the weight of which must be such as would not pull through and break. Before this invention and after the carbon filaments, experts deliberately set themselves to find out when and how they could put this load on, in order to make the thing the shape they must make it. They were, however, never able to make it anything like so thin as plaintiffs made it under this patent. What they did was, when the decarbonising was finished, to adopt an entirely new process. They put the thing back into a jar, then put a weight on and turned on the current, making it as hot as they dare and then tried to melt it up again and strain it with a weight. He did not think any objection had been raised to the specification, as that was quite plain. The first page of the specification plainly told of the disadvantages of the

previous method, viz., that the irregular contraction was saved plus the added labour of doing it after the filament was sintered. It then told: "The process consists of, broadly speaking, in subjecting raw filaments of tungsten or tungsten compositions—that was the carbonised filament—" while preferably in a loop form, and whilst acted upon by a load to that process, such as the sintering treatment, which turns them into finished filaments." The word "sintering," remarked Counsel, was used as the complete thing. Reading on, "Whereby the chemical and physical operations (the decarbonising and the welding together), or reactions, which take place convert the filament whilst under the stretching or expanding action of the load," and so on. He thought he need not trouble his Lordship with anything further, and he now proposed to call evidence. With regard to the evidence, defendants had taken the view that they were entitled only to show plaintiffs the very finest class of filaments which they made. Plaintiffs were suing them for infringement with regard to the whole of the manufacture of their filaments, and sooner or later would want to know how they made their thicker filaments, and what the different percentage of gases were, and what the times were which they used in connection with the thick filaments. Further, they asked that their process should be divided *qua* those their filaments into two, and that plaintiffs' experts should generally only see the filaments made down to the time when they were put through what he might call their first sintering process, and that they should not see the remaining completed process which took place in the lamp bulb before it was sealed. That second process was only seen by Dr. Passmore, and that gentleman had to say whether, in his opinion, it was relevant to infringement. Of course, he had no doubt about it the moment he saw it, and he so reported that it was proposed to call him first, so that his Lordship should be in possession of the facts *qua* that. He would, no doubt, have to ask his Lordship to afterwards determine how and when plaintiffs should see how defendants made their filaments.

Evidence was then called.

DR. FRANCIS WILLIAM PASSMORE, under examination, said the usual way to make a carbon filament by squirting was to dissolve cellulose—cotton-wool (which was the carbon), or something of that kind—in a solvent such as zinc chloride, the latter being mostly used for that purpose now. That solution of cellulose was then squirted through an orifice, which coagulated the cellulose and removed the greater part of the zinc chloride. The filaments are then washed and dried, and heated to a temperature at which the cotton-wool was decomposed, leaving the carbon only.

From 1880 until 1898, practically there were nothing but carbon filaments?—The first metallic filament was osmium.

MR. WALTER (to WITNESS): Dealing with osmium, to what class of metal does that belong?—The precious metals, and it is a very expensive metal, and extremely rare.

Dr. Welsbach suggested coating metallic wire with osmium by saturating a carbon filament with osmium?—That is so.

He did that by taking finely powdered osmium, and mixing it with collodion and squirting it?—Yes.

From 1898 to the date of the patent in 1904 have you examined the whole of the specifications which have been set out in the particulars of obligations?—I have done so.

Do you find certain suggestions as to the treatment of tungsten?—Yes.

Do you find a process suggested for compressing tungsten?—Yes.

The first one I think is Kellner, No. 19,785 of 1898, and that suggested the use of thorium, titanium, chromium and wolfram, by moulding the metals with metallic oxides?—Yes.

Asked as to Tibbit's specification, No. 6,104 of 1889, WITNESS said that dealt with a strengthened carbon filament. It was not a metallic filament at all. In the same way as tungsten was used to strengthen steel, so it was suggested to be used here for strengthening the carbon filament. Tungsten was largely used for the strengthening of steel. In this process tungsten was to be deposited on carbon for the purpose of strengthening the carbon filament.

MR. WALTER explained that by this process a coating of tungsten was deposited on the carbon filament. More or less of the tungsten penetrated into the pores of the carbon and filled them up, thereby imparting greater strength. Then, said Counsel, there was the Lodyguine, that was an American specification of 1897. That was a fillet patent.

WITNESS, examined as to this specification, said it was for depositing various metals, amongst them being tungsten, upon another metal, which acted as a holder. It also mentioned platinum and said that carbon might be used. There was no method described by which the fillet could be removed—that remained a permanent part of the filament.

Take carbon with a tungsten deposit; would that be of any value as a filament?—No; that is what Just and Hanaman refer to in the first part of their specification.

Then there is also Siemens No. 20,277, of 1904, which suggested the use of metals, including tungsten, in the form of drawn wires?—Yes—first of all fusing the metal.

Taking tungsten itself?—It is practically impossible to work it. There are no directions given here to work it, and I do not know how to work it.

There are modern ways which indicate how tungsten can be treated?—I have heard so.

MR. WALTER: The specifications Nos. 12,156, 12,157, 12,159, of 1902, are all patents for vanadium, tantalum and niobium.

His LORDSHIP: Were they drawn-wire patents?

WITNESS: No—powdered metal or oxide was mixed with paraffin and moulded.

MR. WALTER: The actual practical tantalum lamp. I think, was a drawn-wire lamp?—Yes.



With regard to the squirting process, was the art of squirting bodies (in 1904) with various binding agents so as to make filaments from them, a well-known art in the first instance?—Yes, but mainly from the osmium patent.

Was there more than one solution known in respect of binding agents?—Practically any sticky organic solution would answer the purpose.

Was it known what solutions could be used and what could not be used for squirting?—The making of filaments generally was a well-known industry at that time.

As regards the process of destructive distillation, the carbonising process, were the methods of carrying that out well known?—Certainly they were.

MR. WALTER: Reading the whole of the literature up to that time, is there anything that would suggest to you the use of tungsten for the purpose of a filament and the process of its manufacture?—Certainly not. There was much in the literature that would have warned me that tungsten was not suitable.

With regard to the specification No. 23,899 of 1904, that invention has reference to incandescent electric lamps, and has for its object the production of an incandescent body composed of wolfram (tungsten), the names being interchangeable?—Yes, that is so.

The object sought to be attained was to prevent the disintegration of the carbon?—Yes.

WITNESS further said that tungsten in the presence of carbon and high temperature formed carbides; carbides were a class principally worked on by Moissan, the French chemist.

With regard to the carbides relative to conductivity, do they act in the same way as the metal itself?—Yes, to a large extent.

For the manufacture of filaments of this finely divided kind referred to in the specification in the squirting process, is the question of fine division important?—The division must be fine enough to prevent any blocking of the very fine orifices.

Is the fineness dependent on the thickness of what you are going to get?—Yes.

What is tungstite?—It is the anhydride of tungstic acid  $WO_3$ . It is found in Cornwall, but only in very small quantities.

MR. WALTER: Then there is tungstic acid?—Yes, that it is a term applied to a whole series of bodies going out from the anhydride, containing more or less water of hydration, or more or less water of combination. There are quite a series of acids derivable from the anhydride. Witness, continuing, said tungstic acid was a term which was applied to quite a series of commercial articles, some of which were more or less insoluble in ammonia, and some were more soluble. In regard to tungstic sulphide, that was a combination of tungsten and sulphur. That was  $WS_2$ —that was the tridulphide, and the most common one. In addition to the binding medium referred to in the specification, collodion was a solution of cellulose in chloride of zinc or cuprous ammonia oxide or the like—there were other bodies used for binding agents such as gums and sugar.

MR. WALTER asked witness to deal with the time when the filament was squirted. The tungsten or tungsten-compound was mixed with a ductable binding agent, and then squirted. In that condition it is a flexible body with no carbon but hydro-carbon?—Yes, or carbo-hydrates?

Asked to describe what then took place in the carbonisation, WITNESS said the carbonaceous compounds were decomposed or destroyed, exactly in the same way as distilling coal. The hydro-carbon bodies in the coal were broken down with a formation, if not entirely of carbon, at any rate of carbon and compounds of carbon and hydrogen, which were very slightly volatile.

So to put it in a simple way there was a coke thread?—Yes.

Holding in its pores the metal?—Quite so.

Is it at all brittle?—Yes, but it is astonishing what an amount of pliability there is.

MR. WALTER: Then the carbon which has served only as a binding medium is removed by subjecting the filaments to a passage of current in an atmosphere of steam and hydrogen, thus raising it to a high temperature.

Asked to describe what one would see when the filaments were subjected to the passage of current in an atmosphere of steam and hydrogen, WITNESS said there would be no effect until one got the faintest red glow. As the current was increased the temperature got higher; but if there was carbon present in such an atmosphere with the same voltage the temperature would fall again. That was due to the fact that the carbon had been burnt out, and there was better conductivity. Consequently, the voltage of the current must be raised in order to keep the temperature up. The temperature was raised as high as possible, in order to remove all the carbon. The removal of the carbon left interstices between the sand and the metal, which as the temperature increased contracted instead of the filament falling apart as one might expect when the carbon was removed. The result of the contraction was that the filament shortened. The condition at the end was a continuous thread.

And is the whole thing melted, or is it a surface action?—No, it is not a true melt; but, of course, it has softened, and become adherent.

COUNSEL, referring to the passage—"By this process the carbon is completely oxidised so as to form carbonic oxide, and a filament of tungsten is left." It is suggested, said Counsel, that that passage does not give sufficient instructions to enable anyone to carry out the process?—I have tried it with as little and as much steam as I can get in at all temperatures, and it always answers.

With dies as now used, and filaments as now used, what is your experience as regards the filaments as they actually come from the first process. Do they require equalising, or are they equal as they stand?—Under the microscope they appear to be equal.

If it was necessary to equalise them, there is that process to deposit tungsten as described—tungsten on the surface?—Yes.

With regard to the passage: "Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we wish it to be understood that we are aware of the German patent No. 154,262."

WITNESS (interrupting): That is the substitution process of tungsten for carbon.

It then goes on: "and of the English patents, 19,785 of 1898 (the Kellner patent) and 20,277 of 1904 (drawn-wire patent of Siemens)."

Have you read through the earlier specifications which are said to anticipate this invention?—Yes.

Do you find the invention in any of those earlier documents.—No?

Now, coming to the defendants' specification, 18,622: "This invention relates to an improved method of producing metallic incandescence bodies for electric glow lamps. In a previous application, 19,379, of 1905, my correspondents have described a method for producing incandescence bodies for electric glow lamps from common heat-resisting metals, such as molybdenum, tungsten, vanadium, tantalum, consisting in first producing crude incandescence bodies containing carbon (such as are pressed from a powdered metal with the addition of an organic binding material) and then heating same in an atmosphere that simultaneously reduces or preserves the metals and oxidises the carbon until the metals have been freed from carbon or contain only such a minute residue of carbon as not to injure the quality of the incandescence body. The object of the present invention is, whilst retaining the reducing gases, to replace the oxidising gases by such gases as remove the carbon, though not in the form of a compound of carbon and oxygen, that is by oxidation, but in another form." The reducing gases referred to, what is the meaning of that?—The gas which will reduce tungsten oxide to tungsten metal.

MR. WALTER: The substantial effect is protective?—If the tungsten oxide had been there in the first place, and had not been fully reduced in the carbonisation process, the reducing gas would reduce it to metal.

"In carrying the invention into effect, the removal of the carbon is effected by the use of gases containing no oxygen, and especially in the presence of nitrogen, which is used either in the form of a mixture containing a large proportion of reducing hydrogen, or better still, in the form of gaseous ammonia"—ammonia is a compound of nitrogen and hydrogen?—Yes, one part nitrogen, and three of hydrogen.

Does nitrogen ever, when obtained from ammonia or when in the presence of hydrogen, operate to remove the carbon in the way described in the specification?—Yes, but nitrogen alone will not.

Assume you have these gases present and also carbon, and then raise it to a high temperature—does a chemical change occur?—Yes, to the extent to which cyanide forms.

Assuming you had enough carbon, what temperature would be required?—Somewhere about 1,400 or 1,500°. For the formation of cyanides it is higher.

Is it within the temperature that you get out of an incandescent lamp?—Yes.

It is, however, below the temperature which you get when you incandesce the metal filament with electric current?—Yes.

There are a large number of specifications referred to also with regard to that. Have you read through those referred to in the pleadings?—Yes.

And do you find the invention described there?—No.

It is alleged that it is not useful. What do you say to that?—I have seen a large number of filaments which have been made in that way in every-day use.

Is it in fact of every-day use?—Yes.

As regards the sufficiency of the specification, do you find any difficulty, or any want of instructions, in the specification?—Not at all.

Asked as to certain experiments, WITNESS said he had seen the operation repeated with the actual apparatus supplied by the defendants. The process, as he saw it, was the removal of the carbon in an atmosphere of hydrogen and water vapour. Describing the experiments, witness said the internal part of the lamp was prepared—the stem. Then there was a certain amount of mixture painted on the centre rod. That mixture consisted of a mixture of phospham and amorphous phosphorous 7 per cent., mixed with alcohol and ether into a paste. The girl operator had a little basin containing this mixture by her side exposed to the open air, and on each stem she painted a certain quantity of the mixture.

His LORDSHIP pointed out that witness had omitted some details.

WITNESS said he had. The lamps were sealed on to the pumping apparatus, which was connected with two pumps forming a rough vacuum and a fine vacuum. First of all the rough vacuum was turned on for a few seconds to take out the bulk of the air in the lamp, then the fine vacuum was turned on. At the same time the gas was lit around the bulbs, which were hooded over so that the temperature round the outside of the bulbs was raised. The bulbs were heated from the outside immediately the fine vacuum was turned on. Eventually, the temperature outside, the witness was told, reached 300 or 360°. The fine pumping, continued witness, was continued for a varying period which was determined by the disappearance of the phosphorescent discharge in a Geissler tube, which was attached to the pumping circuit. Then they turned a low-voltage current on through the filament for a 220-volt lamp. After four or five minutes the voltage was increased to 80, and at intervals the voltage was gradually increased to 100, and 120, and so on up to 220.



The operation varied with the number of lamps which were being pumped. During the first 10 minutes the filament was a cherry red, and as the voltage was increased it became more red. Then the gas and current were turned off, and the lamps allowed to cool, and they were then sealed. The small thing at the bottom of the globe was where it was sealed off to maintain the vacuum. The object of the outside heating was to drive away the moisture on the inside surface of the glass bulb. In the preliminary heating the phospham was being acted upon by the heat, and ammonia was being developed. Water vapour would all be sucked away during the first two minutes. As the phospham began to decompose, ammonia would be given off, but there would be slight traces of moisture still. No one could say the exact point when all the water was removed. After the first ten minutes there would certainly be no water vapour there. He had had samples of the filaments at the time they were put in the lamps. In the estimation of carbon in such matters, Witness said he preferred to have a special expert to make the analyses, because the quantity was so small; he handed them to Sir James Dewar. The result as regards the proportion of carbon contained in the filaments before they were put in the lamps (not the same filament, but the same batch) was '081 per cent. From the filaments which witness took out of the lamps the percentage was '019. He had made tests to detect the presence, if possible, of cyanogen and hydrocyanic acid, but he was not able to, although he found ammonia. During the 20 minutes while the heating was taking place the nitrogen and hydrogen would be removing some carbon. He had made a number of experiments as to the action of ammonia on the various carbon filaments. Although he could not detect cyanides coming from a closed bulb, he had no difficulty in tracing cyanides when he passed nitrogen and hydrogen over carbon filaments in a stream. Even when he put filaments in the lamps as a matter of experiment with a large amount of carbon in to start with and put phospham on the stems and treated them in the same way, he could not detect the cyanide then, though he was quite sure cyanide must be formed. It appeared that he had to have a current of gas to wash the cyanide away in order to be able to detect it, otherwise it was decomposed again.

MR. WALTER said that the third patent 8,563, said: "In the manufacture of illuminating bodies, such as those for electric incandescent lamps from tungsten, by subjecting raw filaments composed of finely divided particles cemented together to a sintering process, a very strong contraction takes place. This contraction does not always take place uniformly, and the resistances of the illuminating bodies consequently fluctuate within certain limits." You have seen a good many filaments treated, just simply the baked filament, sintered without any weight?—Yes, thick filaments behave all right. As soon as you come to fine filaments, they simply float about, touching one another. Each one that I saw failed.

COUNSEL reading on: "It had been found that the contraction proceeded more uniformly if the filaments treated be subjected to a gentle pull. Means for affecting the pull such as the loading of a stirrup or looped-shaped filament by a small weight attached, are known of themselves, and have been used for drawing-out filaments already finished into a pointed form." Have you seen that process carried out?—Yes, it does not produce the same shape. Witness, continuing, said, in the first place, sometimes one leg was more bowed than the other, and the same sharp point was never obtained. These matters were of importance for the purpose of manufacturing electric lamps. Mr. Walter, reading further: "The new process consists of acting upon or loading the raw filament while in the course of manufacture. By this means several advantages are secured. First, the disadvantage of irregular contraction is avoided. In addition, considerable commercial advantage is obtained as a simplification of the manipulations required for the formation of the finished filament is effected as well as a saving in the plant required, in so far as the shaping, by pointing out of the filament, does not require another operation. Finally, the number of useless filaments produced is considerably lessened as filaments which would be deformed during the sintering process in consequence of deficient quality or careless handling without being loaded, yield, when loaded, serviceable finished filaments." Does that accord with what you have seen?—Exactly.

"The process consists, therefore, broadly, in subjecting raw filaments of tungsten or tungsten compositions while preferably in a loop form, and whilst acted upon by a load to that process, such as the sintering treatment which turns them into finished filaments, whereby the chemical and physical operations or reactions which take place convert the filament whilst under the expanding or stretching action of the load. The load may consist of a small weight of any desired kind, as, for instance, a small hook of metallic tungsten." You have read through the whole of the various documents alleged to anticipate that.

Do you find anything there which describes the invention, or anything that would lead you to do this?—No, the last three or four patents had been granted to men who were trying to make shaped filaments. They were men of experience who apparently had not dared to put on a weight at an earlier stage.

It is also said that the invention is not useful. Does it enable filaments to be manufactured?—As regards fine filaments it is positively essential.

Cross-examined by MR. TERRELL, WITNESS said that the Delabine process was not necessary; he had made tungsten filaments without it. The Delabine process was well known for obtaining tungsten in a finely-divided form, and was known prior to the date of the patent somewhere about 1899. Next came a process of calendering. There were two steel rollers with very fine surfaces very highly pressed one against the other, and one travelling faster than the other. The result was the same as would

be got with a pestle and mortar, only much better. He had never heard of the term "a hard paste process." The paste was driven through a die at a great pressure. Counsel suggested that it was the use of this hard paste combined with a high state of calendering that enabled commercially the very fine filaments to be made which can be worked on the 200-volt circuit. Witness said he was sure all filament lamps were not made by that process. The filaments are then placed in trays, and placed in a furnace with a partial vacuum, and the temperature was raised to about 1,600°. Volatile matter was formed before that temperature was reached and carbide of tungsten. The next step was the "sintering" process, which he called the decarbonising process. The filaments were attached to clips for the purpose of conducting the current. These filaments were now raised for about two seconds to a very high voltage current in an atmosphere of hydrogen at a pressure of about 70 millimetres. Having put the filaments on a holder, a globe was placed over them and nine-tenths of the air was pumped out and hydrogen slightly turned on, till an equal volume of hydrogen to the air which was left in, was admitted, the pressure increasing to 140 millimetres. The tap leading to the vacuum pump was then turned on and the hydrogen was left flowing the whole time, washing out the jar to a certain extent. He had made experiments with a view to ascertaining what the contents of the bell jar were as regarded the moisture, in the Osram works. A little of the moisture came from the hydrogen, but mainly he thought from the sides of the jar and from the rubber disk at the bottom of the jar. They sintered for about two seconds for each filament. Those filaments had been made by the "Z" Co., and they also tried it with some of their own. The diameter was about '03 millimetres; they were thinner filaments. First the filaments glowed red as the current passed through; then as the temperature was raised gradually by an increase of the voltage to about 1,800°, the filaments all shrank. By sintering he meant getting rid of the carbon and closing up the texture of the fibre.

COUNSEL said that first of all they had a filament containing carbide, and that the carbon was in the form of a carbide there. The filament got to a high temperature there, when it got hotter the carbon was volatilised and left the tungsten behind free from carbon, and during that process there was a partial fusion, which was the result of the process of sintering, and without which effective sintering could not be done!—WITNESS replied that immediately one had a red heat, the steam began to operate, and one had carbon being removed in the form of carbon monoxide, with a resulting better conductivity of the filament and resulting decrease in the filament.

Do you know if you treat a filament with steam and hydrogen, you do not get sintering or shrinkage as described in the specification of Just and Hanaman?—I say I do.

MR. TERRELL: When you treat by this process, which is described in the patent being sued upon—the Patent 23,899—do you know that what happens is that the whole of the carbon is eliminated chemically by the action of oxygen upon the steam?—Yes.

Is it a fact that these filaments will not sinter at all, but remain friable whatever you do?—They do sinter. I have not been able to get rid of the carbon without producing contraction at the same time, more or less.

And is not that because it is not removed by oxidation, but by volatilising the carbon, a semi-fusion of the carbide tungsten which produces the sintering?—No.

You know that the bell jar soon gets coated with carbon, and that it has to be wiped out, as it is so thick that the operator cannot see what is being done?—I have seen a little sometimes, and have occasionally washed them out.

WITNESS said that the proportion of carbon was about '8 per cent. before they began the sintering process, and the filament loop weighed somewhere about a milligram. Part of the steam came from the hydrogen which was incompletely dried, but the greater part came from the sides of the bell jar and from the rubber bottom. The water particles could be plainly seen when the vacuum was turned on. The atmosphere of the bell jar was changed at the rate of 400 litres an hour, as measured by an instrument inserted in the connection between the hydrogen cylinder and the bell jar.

HIS LORDSHIP: I understand that for this purpose you have tried it on thicker filaments?—Yes, because it is absolutely impossible to determine everything with the fine ones. He heated the larger filaments in a current of hydrogen saturated with vapour at about normal temperature. To find out if the carbon had been removed, he determined the carbon monoxide in the gases that came off.

You do not suggest here in this case that there is water vapour introduced for the purpose of removing the carbon by the "Z" company, do you?—Certainly, as the process was explained to me.

Dealing with certain specifications alleged as anticipations, witness agreed that Welsbach started by using osmium, which then cost about 4s. per gramme.

COUNSEL suggested that a gramme would make about 1,000 filaments, and that the cost of the metal was practically insignificant, while the cost of osmium was to that of tungsten as 3s. to 1d., or something less.—WITNESS: Much less; it is about one-fortieth of 1d.

MR. TERRELL: Welsbach was working on osmium. He says in his specification:—"My invention relates to the manufacture of incandescence electric lamps, and has for its object the production of illuminating conductors for such lamps, which can be worked at a high temperature, and which give forth a brilliant light." The metal filament lamp owes its success to high temperature, and it will bear a higher temperature than a carbon lamp?—Yes, but that is only one reason; the other reason is that it conducts less as it



gets hotter. You could get more light with the same amount of current with the metal-filament lamp than you could with the carbon-filament lamp.

The specification goes on:—"By one part of my invention I accomplish this result by constructing the illuminant substantially of the metal osmium, a substance which when pure can endure without melting or volatilising a temperature as high as even the volatilising temperature of iridium if placed *in vacuo* or in certain protective gases."

Another passage says: "It cannot be formed into wires either by drawing or pressure. It is necessary, therefore, to devise special methods by which it can be made into filaments suited for use in incandescence electric lamps."

WITNESS agreed that it was known in 1898 that tungsten could be made into a wire, and that the problem Welsbach had was how to make a continuous wire out of a thing he could not draw.

MR. TERRELL said he relied as an anticipation on the second method and the preliminary paragraph he had referred to.

"The principle of this method is to take a carbonaceous filament and to cover or saturate it with an osmium compound, and then by electrically heating the conductor so formed in a suitable protective atmosphere to burn out the carbonaceous matter, and thus leave a coherent filament of osmium. Instead of a carbonaceous filament being taken, I may use the equivalent method of a carbonaceous binding material."

WITNESS agreed that this was the same process as the plaintiffs used. The only difference between them being that Welsbach was using osmium and plaintiffs used tungsten.

Another passage in Welsbach's specification says: "This method, as well as the first method, may be employed to form filaments of highly resistant metals of the platinum group and their alloys for the purpose of being used in the way hereinafter set forth in connection with the portion of my invention that relates to the use of refractory oxides." There he tells you exactly the chemical process used and the chemical action used by Just and Hanaman?—Except that it is osmium instead of tungsten.

Welsbach thought there were carbides of osmium?—There is a distinction. Tungsten forms carbide quite readily, osmium does not. That is one reason why you cannot say, because steam and hydrogen act upon one, they can act on the other.

MR. TERRELL: There is no chemical action now at all in the plaintiffs' specification is there?—Yes, I think there is, because there is a double reaction. Of course there is nothing new as regards the oxidising carbon, but it is doing two things at one time.

There is nothing new as regards the protection of the metal?—There is something new in protecting the metal in the presence of steam.

Welsbach had protected the metal by a hydrogen atmosphere in the presence of steam from the oxidising effect of the steam, when he was using osmium?—Yes, but osmium was an oxide which was very readily reduced by hydrogen—tungsten is not. Then, again, osmium is a metal which does not combine with carbon—tungsten does. You can get the osmium reduced in a comparatively small proportion of hydrogen, but with tungsten it is necessary to have a large proportion of hydrogen.

I have shown you now by going through the Welsbach specification, that you have got exactly the same process for the same purpose applied to osmium, and by referring to this I have shown you that long before the use of the metal, tungsten as a useful filament was recognised?—Yes.

And that the properties of tungsten were known as far as this was all concerned?—Some of the properties of tungsten were known.

There is a passage in Lodyguine's specification that my attention is drawn to as follows:—"In practice it is necessary that the illuminant should be capable of enduring a very high temperature, especially because the energy consumed per candle-power decreases very rapidly with increase of temperature. It was found that platinum fused at a temperature lower than that which is required to produce a commercially efficient lamp. Metal possesses inherent qualities which render it a more desirable material for forming an illuminant than carbon. Thus, the loss of heat by radiation at a given temperature is found to vary considerably with the character of the surface. A carbon filament loses a large amount of heat by radiation, and this detracts materially from the amount of light emitted. A metallic illuminant affords a surface of a much brighter and better character for light radiation, and a less opportunity for heat radiation than is usually obtainable from a carbon filament. For this reason a metallic filament has advantages over a carbon filament." Then he describes a process for making a tungsten filament? He makes those remarks not particularly as to tungsten, but as regards a number of metals. As to some of those metals, he has not proved correct.

Do you know that the process of Lodyguine works perfectly well?—Perfectly well as regards the deposition of tungsten, but as regards making a lamp, No. He had tried it, and could make a lamp of sorts, but it would blacken, because the fillet was left in. He said it might be removed, but he did not say how it was to be done.

MR. JUSTICE WARRINGTON: I do not see any directions for removing it. It is merely permissive to remove it. I see in each case he says "containing a fillet."

MR. TERRELL (to witness): I will take you now to a specification of Just and Hanaman, 154,262—a German specification.

His LORDSHIP: It is one which they disclaim, is it not?

MR. TERRELL: Yes. It says, "Tungsten and molybdenum belong, amongst others, to the metals which are particularly suitable for incandescent bodies in consequence of their high melting

points and high volatilising points." That is probably at the date of this patent. It goes on: "The idea of utilising tungsten and molybdenum for incandescent bodies is by no means new, and there already exist various processes for the production of particular coatings of these metals of platinum filaments or carbon filaments. The present invention relates to the manufacture of incandescent filaments of pure tungsten or molybdenum metal. As is well known, the oxyhalogen compounds of these metals—for instance, the oxy-chlorides—are reduced by hydrogen at a red heat with the formation of metal, hydrogen-halogen compounds and water. If, therefore, a glowing metal filament or carbon filament was brought into an atmosphere of tungsten oxy-chloride vapour and excess of hydrogen, the reduced tungsten was metallically deposited on the carbon or metal filament, with the result that an incandescent body was produced, consisting of a core of metal or carbon and a coating of tungsten or molybdenum." All that is what was well known. Now, he is going on to what he invented. "Careful experiments have now shown that under certain conditions the reaction proceeds quite differently. If a carbon filament is subjected by means of an electric current to a high temperature in the vapour of tungsten oxychlorides, in the presence of only very little hydrogen, a most remarkable reaction occurs. The carbon filament is gradually transformed completely into a filament of pure tungsten, a process which has already been employed in an analogous manner for the manufacture of osmium filaments by glowing carbon filaments in an atmosphere of osmium tetroxide. The carbon combines in the present case with the oxygen of the oxychloride, with the formation of carbon monoxide or carbonic acid, the chloride is reduced by hydrogen to hydrochloric acid, and the tungsten is deposited in the place of the carbon in accordance with the equations. When the carbon has been completely replaced by tungsten it is of advantage to increase the current of hydrogen and the tungsten is now deposited on the tungsten filament formed, strengthening and equalising it in accordance with the equations. Conditions for the attainment of these reactions in which the carbon is replaced by tungsten are—excess of oxychloride, the presence of very little free hydrogen and a high temperature of the carbon filament. In case of excess of hydrogen and a too low temperature of the filament, the other known reaction occurs in which the oxychloride is reduced exclusively by hydrogen without the carbon taking part in the reaction. When using molybdenum the reactions proceed quite analogously. In order to produce incandescent bodies in accordance with the present invention, one evaporates tungsten oxychlorides in a vessel in which the carbon filament is inserted whilst hydrogen is passed through the vessel in a very slow current. The carbon filament is now burnt to a bright heat by means of an electric current passed through it, whereby the above-mentioned process of the substitution of tungsten for carbon proceeds. When the carbon has been completely consumed and replaced by tungsten, the tungsten reduced by the hydrogen alone is then deposited on to the filament, as can be seen by the sudden and progressive fall of the resistance. It is now the time to increase the current of hydrogen in order to obtain an even deposit of the metal and an equalisation of the resistance, which can be here regulated at will, as in the treatment of carbon filaments." Going so far, the exact commercial process referred to in the plaintiffs' specification is given to you by Welsbach. The use of tungsten is said in this very specification of Just and Hanaman to be an idea of utilising tungsten and molybdenum for incandescent bodies, which is by no means new?—Yes, but this does not give a pure filament; that is the reason why he struck it out of his specification. You cannot get the carbon removed; the tungsten seems to deposit more quickly than the carbon can get out.

I now come to specification 10,815 of 1899. Menges. Do you say the second part of this reaction which is mentioned here—that the filaments can be formed as described in Just and Hanaman, 154,262—will not work?—I have not tried that process.

Why do you say that this gaseous tungsten cannot keep on acting on the carbon in the filament?—Because it is a very heavy vapour which is continually depositing metallic tungsten on the filament.

But it can only do that so long as it is removing the carbon?—No, you need not have any carbon at all, and you can get metallic tungsten deposited.

Then you did get a coating of tungsten?—Yes, that is what Lodyguine did.

Then the coating of tungsten stands between any further action on the carbon?—Yes, substantially.

You would not say that it is impossible to make a tungsten filament according to the directions given?—No, following the directions given here, I could not.

The next specification is No. 14,411 of 1901, Sanders patent—the second one. He says: "The present invention relates to improvements in the manufacture of conductive bodies for the production of electric light and heat. The purpose of the invention is to provide filaments, rods or bodies of any other shape, which can be used for the production of electric light by using, as a base for the manufacture of the filaments, electrically conductive bodies containing metals for the manufacture of electrically conductive bodies"—not "for the manufacture of filaments."

His LORDSHIP: The manufacture of filaments and other conductive bodies.

MR. TERRELL: I ought to have read it that way.

WITNESS: It must have originally stood "electrically conductive bodies."

COUNSEL questioned Witness in detail in regard to the process and said: they describe exactly the process which the defendants do in their manufacture, do they not?—As regards the making of a plastic mass and squirting into filaments.



And sintering?—Carbonising. Heating in hydrogen?—Yes. By electric current?—Yes. Commencing at a low heat and ending up with a very high heat?—Yes. There is nothing said there about steam. If they do this, according to you, they inevitably will get steam in?—Yes, they take no precautions to exclude it.

According to you, if he carried out this process he could not help having moisture?—If he had moist hydrogen.

Not if he had moist hydrogen, but if he had a moist bell jar, which he could not help having according to you?—I agree.

According to you, he could not help having moisture?—He could if he dried it completely.

His LORDSHIP: He does not take any means of excluding it?—No.

(To be continued.)

#### SMOKE NUISANCE PROSECUTION: APPEAL.

ON April 25th the Lord Chief Justice and Justices Pickford and Amory, in the King's Bench Divisional Court, heard the appeal of the Greenwich Borough Council from a decision of a stipendiary magistrate. The respondents were the London County Council, and it appeared that on November 9th, 1910, the Borough Council summoned the London County Council for causing a smoke nuisance from their electric generating station at Greenwich. An order was made on the Council that they should at once abate the nuisance and prevent a recurrence of it. That was done, but on April 9th, 1911, another nuisance was caused by smoke, and a summons was at once taken out, the allegation being that the County Council had made default, and had not complied with the order to abate the nuisance. The magistrate, however, dismissed the summons, holding that there had not been a recurrence of the nuisance which would allow him to say that the County Council had been guilty of default.

MR. BODKIN, for the appellants, argued that the magistrate was wrong, and delivering the judgment of the Court the Lord Chief Justice said there was no question here whether the County Council could have put in better appliances for the abatement of the smoke nuisance, for it was admitted that they had the most up-to-date machinery. There was a distinct lapse of four months between one offence and the other, and the Court could not agree that there had been a default of the order, or that there had been a recurrence of the nuisance.

The appeal was accordingly dismissed.

#### TRAMWAY ACCIDENT CLAIM.

MR. JUSTICE LUSH and a common jury, in the King's Bench Division on April 25th, heard an action in which a baker and confectioner of Southfields, Wimbledon, claimed damages for personal injury against the London United Tramways. The plaintiff's case was that on August 23rd last, he was riding a bicycle in Hayden's Road, when he was knocked down by a passing tramcar. The evidence as to the cause of the accident was conflicting, but the medical evidence agreed that the injuries were of a serious character. The jury found for the plaintiff, with £120 damages.

#### BAXTER & CAUNTER v. PERFECTA SEAMLESS TUBE AND CONDUIT CO., LTD.

THE plaintiff firm, of 86, Charing Cross Road, W.C., were before Mr. Edward Pollock, High Court Official Referee, on April 26th in an action against the defendant company, of Aston Manor, near Birmingham. They claimed to have an account taken of commission and moneys alleged to be due and owing to them from the defendants under an agreement of May 23rd, 1906, entered into between the parties.

MR. RALPH BANKES, K.C., and Mr. Whateley appeared for the plaintiffs, and Mr. Hollis Walker, K.C., and Mr. Whadcock represented the defendants.

MR. BANKES said his clients' case was that they were entitled to commission on orders obtained for the defendants for tubings and fittings previously to the termination of the agency. Plaintiffs also contended that they should have commission on orders coming in after that date, as those arose from plaintiffs' introduction of business.

MR. L. G. CAUNTER, one of the members of the plaintiff firm, stated in the course of evidence that they had acted as agents for the defendants for some years prior to the agreement of May 23rd, 1906. They entered into the written contract of May 23rd, 1906, which expired in the ordinary course on January 31st, 1909. The witness mentioned that, as a matter of fact, when they first took the agency over, the defendants had no electrical business at all. "We introduced the whole of that business for them," he added.

Evidence was called on behalf of the defendants.

MR. A. E. HILLS, managing director of the defendant company, stated that they had furnished the plaintiffs with an account of all commissions and money due to them. The witness added that they had never withheld any information from the plaintiffs. The witness further stated that this tube business formed but a small part of the defendant company's operations.

Legal arguments were advanced on both sides.

The learned OFFICIAL REFEREE, giving judgment, referred to the fact that orders obtained from a firm named Taylor and also the Office of Works figured in this claim. In the case of Taylor, the specification provided that Perfecta tubes alone should be

supplied, with the result that whoever had to comply with these specifications must go to the defendants to obtain their tubing. In the other case, that of the Office of Works, the specification provided for Perfecta, "or some equally good tubing." The engineer might be perfectly satisfied with tubes other than the Perfecta. In that case it was clear that the defendant company were supplying them, in competition with others, and therefore, they made their prices in conformity with the lowest price. In the other case, however, they might make their own bargain, and obviously sell their goods at a much better price. Plaintiffs were claiming to be paid commission upon the basis of those cases where Perfecta tubes alone were specified. It seemed to him that the onus was on plaintiffs to satisfy him (the Referee) in respect of these cases where they claimed commission on Perfecta tubes alone specified. It was not for the defendants to show that they were not liable. He must come to the conclusion that regarding the Office of Works, plaintiffs had not proved their case. There would be judgment, on the other point of the claim, for the plaintiffs of £7 10s. above £69 14s. 7d. paid into Court.

On the question of costs, MR. HOLLIS WALKER argued that the case could have been tried in the County Court, as there was no reason to take an account.

MR. POLLOCK said he doubted if a County Court judge could have taken this case, and, accordingly, he gave plaintiffs costs on the High Court scale.

#### METALITE, LTD.

IN the Chancery Division (Companies Winding-Up Court) on Tuesday, Mr. Justice Swinfen Eady dismissed the petition, without costs, of A. B. Reckitt and three other shareholders of Metalite, Ltd., for a compulsory order to wind up the company.

MR. F. RUSSELL, K.C., and Mr. Tomlin appeared for the petitioners; and Mr. Gore Browne, K.C., and Mr. Wells for the company and £94,000 in value of shareholders, in opposition to the petition.

HIS LORDSHIP said the company, whose business was the manufacture of lamps and metal filaments, appeared to have been promoted by a company formed for that purpose, the Electrical Trust, Ltd., which was to underwrite £150,000 worth of shares, and it had not 150,000 pence. This company—the Metalite, Ltd.—had been crippled in its resources by not having sufficient working capital. There had been grave irregularities in the way in which the directors had dealt with the company's money. But the fact that there had been grave irregularities in the management of the company's affairs was not necessarily, and alone, sufficient cause for winding up. It was said the substratum of the company was gone. But the facts appeared to be that the company had a well-equipped factory, that it was continuing to manufacture lamps and filaments, that it was making a profit on its trading, and that its business was increasing. It was engaged in placing debentures, and, moreover, it had two debts from the vendor companies in respect of unpaid shares. Under these circumstances, he was of opinion that the petitioners had not made out a case for a winding-up order.

#### DISPUTED ELECTRICITY ACCOUNT.

AT the Wolverhampton Police Court, on Saturday, Elijah Stott, licensee of the Golden Cup, Navigation Street, was summoned for non-payment of £5 17s. 8d. for electricity consumed in the June, September, and December quarters of 1911. Mr. J. Atkinson (town clerk's department) prosecuted. Defendant disputed the claim, and was defended by Mr. T. P. Haslam. The chief clerk for the Corporation electricity department said that at the beginning of last year, defendant's meter was, at his own request, tested and found to be working correctly. Witness had pointed out to defendant that in the past he had benefited by an old meter. In answer to Mr. Haslam, witness said that the suggestion that he had told defendant that they were only "getting their own back," was preposterous. The distribution engineer said that defendant had been using a larger number of lamps than was recommended by the Corporation. Defendant, said Mr. Haslam, was anxious to pay his account, but he only wished to pay for what he had consumed. In 1910, said defendant, he made a complaint with respect to the increase in his accounts, and an arc lamp was removed, but the accounts still rose. On a second complaint, he was advised by a Corporation official to have a slot meter. The Bench decided that the account should be paid in full, and the chairman (Alderman Bantock) added that they wished the electricity department to understand that they did not like accounts to run into arrears. Complaints should be promptly dealt with.

**Labour Unrest.**—In the April issue of the *Engineering Magazine*, Mr. J. B. C. Kershaw commences a series of articles on "Labour Unrest in the United Kingdom." The introductory article commences an analysis of the various causes that have led up to the present position of affairs, and it is the author's intention to discuss the significance of these causes in their relation to the social and industrial welfare of the community, concluding by indicating what, in his opinion, is the most hopeful method of avoiding strikes, and of regulating the future relations between capital and labour.



## THE ELECTRICAL TRADES BENEVOLENT INSTITUTION FESTIVAL DINNER.

ON Wednesday last week, the annual festival dinner of the Institution was held at the Hotel Cecil. The President, Mr. S. Z. de Ferranti, occupied the chair, supported by Mr. Justus Eck, deputy-chairman, and Mr. Hugo Hirst, and about 100 members and their friends were present. After the loyal toast, the President proposed "The Electrical Trades Benevolent Institution," remarking that the object of the dinner was to make a special appeal for subscriptions, and to get them to give all that they could to this most meritorious Institution. The electrical industry was a big and far-reaching one, but it had been sorely handicapped by various restrictions, and had not prospered as it might have been expected to. This made the necessity of many of its members all the greater. There was fearful competition in the electrical industry, the margin between success and failure was very narrow, and they incurred many risks, which all contributed to bring about the unfortunate cases they would like to help. It was a fallacy, as Mr. Hirst pointed out last year, to suppose that if a man was down it was necessarily his own fault, even if he were constitutionally deficient; and what a blessing it was to be able to lend a helping hand to him, to enable him to tide over his difficulties! He had himself been prejudiced in the past by the existence of two such funds—that of the Institution of Electrical Engineers and that of the Benevolent Institution—which, he had thought, would militate against the success of either; but the secretary, Mr. Hawes, had pointed out that two beggars were better than one. He did not say that it would be better to combine, but those interested might with advantage consult together so as to attain the best results, widening the scope of the funds and making them more effective. The Benevolent Institution was at present progressing satisfactorily; the life subscribers numbered considerably more than last year, and things were looking healthy, but they were troubled by the smallness of the amount available to meet the demands that would arise in the future. In the absence through ill-health of Sir W. H. Preece, a great amount of work had fallen upon the deputy-chairman, Mr. Eck, and the energetic Committee, all of whom had done good work. His hearers also could be of great assistance, both by themselves giving and by getting their friends to contribute to the fund.

Supporting the toast, Mr. G. Harland Bowden said that he had been deeply impressed with the great amount of self-sacrificing labour accomplished by Mr. Eck, and had determined to do his utmost to help him. He suggested that the Committee should address an explanatory letter regarding the position of the Institution and the results of its work to every employer of labour in the electrical trades in Great Britain, and ask them to call meetings of their employes and explain to them what it meant to become a member of the Institution. The big manufacturers were in a position to organise their own benevolent funds, but the smaller ones could not carry them on, owing to the heavy working expenses and the disproportionately heavy risks incurred; but the Institution provided the necessary organisation, and he thought many employers were not aware of the facilities which it afforded. The objects of the Institution were clearly defined on its letter paper; the persons described belonged to a class not provided for by trade unions, and many of them had incomes over the £160 limit of the Insurance Act. By paying 10s. a year, these persons could qualify for a pension, and the Institution wanted funds to provide those pensions. He pointed out that a subscription or collection of ten guineas gained a vote for life, and suggested that they should all agree to take collecting books and each qualify for a vote by Whitsuntide.

Mr. J. Hunter Gray also supported the toast. He said that no "inducements" were necessary to support the Benevolent Institution; it was the bounden duty of every member of the industry to support it. It was not entirely due to the innate ability of his hearers that they occupied their present comfortable positions; they had had, and had taken advantage of, their chances. Others had missed their chances and fallen into difficulties. This was not a "charity" dinner, but one to remind them of their duties; the electrical industry must look after its own members.

The President, in summing up, announced that grants had been made since January 1st, 1912, of £11 10s., £6 16s. 6d., £2 and £6—total, £26 6s. 6d. He regretted the unavoidable absence of Lord Vaux of Harrowden (Vice-President), who was also to have supported the appeal. He then gave the toast, expressing the hope that they would afterwards fill up the subscription forms with which they had been provided.

Proposing the health of the President, Mr. Hugo Hirst expressed his regret at the absence of Mr. E. Garcke, who was to have given the toast, more especially because his absence was due to indisposition. There were many associations connected with the industry, and it might be a good thing for them to address the committees instead of individuals and gain their assistance. But the campaign need not be confined strictly to the electrical industry: while their own dividends had been poor, they had greatly benefited a variety of other industries, and might very well invite them to help in the good work. He regretted the smallness of that gathering, in view of the honour done to them by the presence of Mr. Ferranti, whose name was one of which the industry might well be proud, and would live with that of Kelvin as representing the best work that their generation had done. His spirit had permeated the whole electrical industry, and they believed that better times were coming, largely due to the optimism which he had inspired.

The toast was drunk with enthusiasm, and was accompanied with musical honours. In responding, Mr. Ferranti announced that the subscriptions obtained at the dinner amounted to £182 10s. 6d., and the donations to £249 18s. 6d., a total of £432 9s., which compared very favourably with £258 17s. 6d. collected at the dinner last year. That was a good omen for the success and rapid growth of their undertaking.

A programme of music was performed during the evening by Messrs. G. Benson and C. Dixon and the Misses Annie Rees and Ethel Wynne, with Mr. W. J. Petty at the piano.

The statement of accounts for the year 1911 shows on the revenue side, from dividends and interest, £72; subscriptions, £82; donations, £474; legacy of the late Mr. G. Byng, £100; balance of amount from Olympia Exhibition (1905), £379; balance from Festival Dinner, £1; total, £1,108. The expenditure was for printing, &c., £65; auditors' fee, £1; salaries and office expenses, £122; five grants, £35; total, £223; leaving a balance of £885. The balance-sheet showed investments in various 3½ per cent. stocks of £3,248, and cash in hand and at bank £165, making a total of £3,413, from which a sum of £62 due to the secretary is deducted, leaving a net balance of £3,351.

We have received the following letter on the subject of the Institution's affairs:—

"The excellent record-breaking response in subscriptions and donations to the eloquent speech of Mr. S. Z. de Ferranti at the Festival Dinner on the 24th inst. is most gratifying, but it would be a pity to allow such a wave of enthusiastic support to die down.

"In the addresses made to the assembly on the same occasion by Mr. G. Harland Bowden and Mr. J. Hunter Gray, suggestions were made as to the desirability of every man in a responsible position in the industry immediately securing a collecting book and (before Whitsuntide) turning into the funds a small but definite sum of money, thereby either becoming a life subscriber or securing free membership for the year, and also as to its being the bounden duty of every man interested in the electrical trade to secure membership by paying in his very small annual subscription.

"The Committee would be deeply indebted to you if, by insertion of this letter or otherwise, you would bring it home to your many readers that the collecting books are now ready for issue, and will be issued by the Institution's Secretary, Mr. F. B. O. Hawes, 18, Park Mansions, South Lambeth Road, S.W.

"There are, as stated at the Festival, hundreds of electrical firms who would like to see their employes members of the Institution, and thus given the protection which a large body can, and a small business cannot, give.

"Will the principals and managers of all electrical firms select the names of one or more nominees for the collecting books, and immediately transmit them to the secretary? A small meeting in or immediately after office hours was suggested by Mr. Harland Bowden as a means of explaining the objects of the Institution, and the rules formed for its working, and to enable the most enthusiastic responsible and capable collectors to be chosen and at the same time secure support from the most distant parts of the country in an economical manner.

"The new books of rules are available upon application to the secretary, and contain very interesting information as to the work done in the past and the prospects of the future. Let every electrical man know what we are doing, why it must be done, how he can help, and give to the Electrical Trades Benevolent Institution that co-operative help which costs him little, but does much for a good and enduring cause.—Yours faithfully,

"JUSTUS ECK, *Deputy-Chairman.*"

These suggestions are admirable; it is wonderful what can be done with a collecting book, by the aggregation of many small items. It seems very probable, too, that the existence and objects of the Benevolent Institution have not yet been made known to the persons who are most interested in its work—those who fall within the definition of eligible beneficiaries, and who, being unassisted by trade unions, would gladly become members of the Institution if given the opportunity. We trust, therefore, that all employers who have the interests of their staff at heart will take steps to carry out these simple proposals.

**Municipal Employment.**—At the meeting of the Lancaster Town Council on the 24th ult., a discussion arose in respect of the dismissal of A. S. Bretherton, an electrician, who had been employed as a switchboard attendant. It was urged that his dismissal was due to his having asked for overtime rates when he was put on a double shift in the works, but in the absence of the chairman, members of the Committee said Mr. Bretherton had been guilty of insubordination, refusing to work unless he got overtime pay. The action of the Electricity Committee was eventually confirmed.

**Marconi Cricketers.**—The Marconi Athletic Club held an enjoyable smoking concert on Saturday, April 27th, to mark the termination of a successful football season, and to inaugurate the cricket season. The club have acquired a first-class ground at Acton town, where they are erecting a commodious pavilion. The first match of the cricket season will be held on Saturday, May 11th. The Marconi club have a few vacant dates during the forthcoming cricket season, and they are anxious to arrange for home matches with electrical or engineering works clubs.



## BUSINESS NOTES.

**Consular Notes.—Turkey.**—The British Consul at Constantinople reports that the concession for lighting Constantinople and supplying electric power has been granted to a group composed of the Hungarian firm Ganz & Co., the Société Havraise d'Energie Electrique, the Société d'Application Industrielle, of Paris, the Banque Suisse de Chemins de Fer, and the firm of Giros and Loucher. There is talk of a trust to be formed by this group with a number of German and French banks to control the electrification of the tramways and the lighting of Constantinople. The trust would have its headquarters in Brussels, and would command a capital of £4,000,000. The concession for the installation and working of a telephone system in Constantinople and its suburbs was granted to an Anglo-American group, which has formed an Ottoman company, called the Société Ottomane des Telephones de Constantinople, with a capital of £300,000. It is stated that the telephonic communication will be established 18 months after work is begun. A scheme for an electric railway from Constantinople up the Bosphorus, put forward by Messrs. Lentz & Co., of Berlin, is now before the Council of State, after being approved by the Council of Ministers. The length is 21·7 kiloms., and there are to be 18 stations. The line requires 4·7 kiloms. of tunnels and the same length of viaducts, and must prove a very costly undertaking.

**Ecuador.**—The British Consul at Guayaquil reports that the Electric Light and Car Co. has now two long and important car lines in the city. A new line is also in course of construction, and will shortly be opened. The effect of these lines has been disastrous for the old Cia de Carros Urbanos, with mule traction. The works were very well advanced at the time of writing; the tunnels and pipes conveying the water of the Chimbo to the turbines were nearly completed, and it was expected that the completion of the works could be looked for early in 1912. The transmission-line towers from Bucay (Victoria) to Doran were also nearly all put up. A very successful future was promised as a result of this enterprise, as there should be between the different sugar estates and industries along the line and in Guayaquil, ample employment for all the power which the turbines can produce, and at very remunerative rates.

**Morocco.** The British Consul at Tangier reports that the wireless telegraph system between Tangier and the ports at present seems to be working in a most unsatisfactory manner. On all sides complaints are being made by the merchants that, even though they mark their messages "urgent," and in consequence have to pay treble rates, yet frequently two, and sometimes three, days elapse before these messages reach their destination. Naturally the French military authorities have the first call on the system, but it is to be hoped that it will be put on a more business-like footing without delay. A wireless installation has also been established at Fez, which, if worked properly, should prove of great value to merchants.

**Russia.**—The Austrian Consul at St. Petersburg, in a recent report, states that even if the Russian electrical industry is not as yet capable of satisfying the total home demand, it has made rapid steps in that direction during recent years. The largest electro-technical works in Russia are those of the Allgemeine Electricitäts Gesellschaft, in Riga, and Siemens, in St. Petersburg. On a somewhat smaller scale are the Volta Works in Reval, and the Westinghouse Works in Moscow; apart from these, there are also some smaller works which have not up to the present been of any very great importance. The extension of municipal electrical undertakings in St. Petersburg, and in other smaller towns, during the last year or two, has been such as to call for increasing supplies of electrical material, so much so that Siemens, at least, have found it necessary to erect new dynamo works in St. Petersburg in order to produce high-tension machines. The Volta Works, also, have decided to extend their plant. Another branch of the Russian engineering industry which has rapidly developed, is that concerned with the production of petroleum motors. The construction of these motors of the Diesel type, is carried on by the Russian Diesel Motor Co., to which belong the Ludwig Nobel Works in St. Petersburg, Felsen & Co., in Riga, and the Chantier Naval, in Nicolaieff. The number of motors produced by this company for Russia has increased from seven in 1899, to 127 in 1909, and the power from 180 H.P. in 1899, to 14,557 H.P. in 1909. Apart from the ordinary Diesel motor for coupling to dynamos, the Ludwig Nobel Works also construct motors for ships. Petroleum motors find an increasing demand in Russia for electric power stations for ordinary industrial uses, and for other purposes. The cheapness of petroleum is the main cause for the popularity of these motors, which, it is anticipated, will lead to an ever-increasing demand.

**Brazil.**—The Austrian Consul at Rio de Janeiro, reports an increasing trade in electrical machinery and apparatus due to the growing use of electrical power for lighting and industrial purposes. Forty per cent. of the trade is in the hands of American firms, while Great Britain and Germany take 10 per cent. each. In electrical wire there is a very large importation from Germany and the United States; Great Britain also does a fairly large trade in locomobiles and motors for the South of Brazil. Sao Paulo and Santos are the chief distributing centres, and the largest trade is in British hands; the United States and Germany also compete. In lighting materials, in spite of the development of the local industry, there is a large import trade. The chief supplier is Germany, with Great Britain and the United States competing.

Dealing with telegraphic communication in Brazil, the Consul states that the Federal telegraph system was substantially extended in 1910. New stations to the number of 33 came into being, so that at present there are in all 629. In addition, there are 1,514 railway telegraph stations. The receipts amounted to 9,628,497 milreis, as against 8,305,991 milreis in the previous year, and the expenditure to 13,415,661 milreis as against 12,108,898 milreis in the previous year. Apart from the ordinary telegraph service, the Government has not failed to appreciate the importance of wireless telegraphy. The Babylonia station of the Federal capital has been working since 1909, and it was arranged to install stronger apparatus. Since July and November respectively of 1910 the Amaralina station (Bahia) and the Orlanda (Pernambuco) station have been working, and in addition the Fernando Noronha station, which, under favourable circumstances, can communicate with Dakar. In the course of 1911, it was proposed to put into operation stations on the south coast, one—a powerful station—at Rio Grande do Sul, and two less powerful at Florianopolis and at Mont Serrat (Santos). In the Acre territory three stations were to be opened in communication with Porto Velho and Manhous stations, which had been working since May. Further stations were proposed at Ceara, Maranhao and Para, of which the latter were to be in communication with a station at Amapa, and another on the Rio Branco. With a powerful station on the mouth of the Amazon, it would be possible to communicate with equally powerful stations on the European and American coasts. The number of telegrams sent by the National Telegraphs in 1909 were 2,470,458, with 41,786,401 words. The figures for 1908 were 2,316,491 telegrams, 40,413,693 words, and for 1907 1,929,705 telegrams, 32,632,405 words.

The Austrian Consul at Sao Paulo reports that the imports of machinery and apparatus for electric lighting and power have improved with the general development of the district, and in 1910 amounted to 2,861,129 milreis; the imports from Germany have increased over 100 per cent. as compared with the previous year, and those from the United States over 50 per cent. The imports from the United States amounted to 1,504,121 milreis, those from Germany to 1,024,381 milreis, while Great Britain took third place with only 224,658 milreis. In the cable trade Great Britain appears more satisfactory; the total imports were 386,640 milreis, of which Great Britain supplied 254,246 milreis, the United States 65,054 milreis, and Germany 49,948 milreis. The great demand for cables is caused by the general electrification of all undertakings, even in the outlying townships. Motors using electricity, petrol, gas, &c., were imported to a value of 622,348 milreis from Germany, United States and Great Britain. The telephone system of Sao Paulos has been widely extended in recent years, and at the present time connects with nearly all towns and villages and many of the larger "fazendas." Moreover, the Companhia Telefonica Bragantina was authorised some time ago to extend its system to the municipalities of Limeria, Araras, Pirassunanga, Descalvado, Santa Cruz, Palmeiras, Santa Rita do Passo Quatro, S. Simao, Cravinhos and Ribeirao Preto.

The Austrian Consul at Curitiba reports that the imports of electrical machines, lighting materials, motors, meters, &c., are chiefly from France, Germany, United States and England, but as the electrical works which supply Curitiba with light and power have recently passed into French hands, it may be anticipated that a great proportion of the trade will pass to French and Belgian firms in the near future.

**Lamp Prices.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, announce reductions in the list prices of Wotan lamps, as follows:—20 to 30 volts, 5, 10, and 16 c.p., pear-shaped bulbs, 2s. 1d. each; round bulbs, 2s. 4d. each.

**Dissolutions and Liquidations.**—KEVAN ELECTRIC CO., LTD., 88, Charing Cross Road, London, W.C.—First and final dividend 2s. 7½d. in the £, payable at Official Receiver's Office, 33, Carey Street, W.C.

R. A. AULT & SONS, plumbers and electrical engineers, &c., 71 and 73, Talbot Street, Southport.—Messrs. J. E. Ault and R. A. Ault have dissolved partnership. Mr. R. A. Ault will attend to debts, &c.

**Catalogues and Lists.**—THE WHITE ELECTRICAL INSTRUMENT CO., 2 and 4, Gloucester Street, Clerkenwell, London, E.C.—28-page illustrated catalogue, giving particulars and tabulated prices and reference numbers of many patterns of ammeters, voltmeters, &c., manufactured by them. Further reference to the White instruments appears in our "New Devices" to-day.

THE FREDK. CRANE CHEMICAL CO., of Armoury Close, Bordesley Green, Birmingham, have issued a catalogue of their frosting and coloured lacquers suitable for electric lamps used for illuminating purposes at public and private social gatherings, entertainments, &c.

MESSRS. E. C. SPARKES & CO., 118-120, Wardour Street, London, E.C.—16-page catalogue (No. 148), showing a collection of excellent designs of electric lustre fittings made by Mr. W. J. Stokvis, of Arnhem, for whom the firm are agents. Prices are tabulated in a four-page loose list.

THE HARRIS PATENT FEED-WATER FILTER (1910), LTD., 24 Grainger Street West, Newcastle-on-Tyne.—Two leaflets, one giving illustrations (half-tone and line) of the Harris-Anderson water softeners and oil eliminators; the other giving information regarding, and a list of users of, the Harris-Anderson patent condenser tube protector for preventing corrosion.

MESSRS. J. H. HOLMES & CO., Portland Road, Newcastle-on-Tyne.—28-page catalogue containing illustrations of their machinery and manufactures for use in connection with mines and collieries. These show steam engine driven dynamos and alternators, Holmes-



Clayton three-phase motors, "Castle" motors, electrically-driven pumps, motor-driven endless rope haulage, motor-driven air compressors, mining switch cabinets, enclosed switchgear, switch pillars, &c.

THE ELECTRICAL CO., LTD., 122, 124, Charing Cross Road, London, W.C.—April stock list of D.C. motors from  $\frac{1}{2}$  to 23 H.P., and single, two and three-phase A.C. motors from  $\frac{1}{2}$  to 10 B.H.P.

MESSRS. ALFRED PHILLIPS & CO., Atlas Works, Tipton.—Eight-page pamphlet showing chains for a variety of service, chain cables, crane hooks, shackles, swivels, stretching screws, &c.

MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deansgate, Manchester.—Price leaflet of india-rubber valves, washers and sheets, and asbestos goods, &c.

MESSRS. FALK, STADELMANN & CO., LTD., 83 to 87, Farringdon Road, London, E.C.—40-page catalogue (No. 338) containing illustrations with brief particulars and prices of a variety of "Efesca" electric cooking apparatus, including kettles, water and milk boilers, boiling pans, toasters, sterilizers, hot-plates, hot-plate cooking ranges, grills, hot cupboards, heavy ovens, rapid boilers for screwing at side of oven, laundry and domestic irons, and so on.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—April catalogue of new and secondhand electrical and other machinery for sale or hire.

MR. G. BRAULIK, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—A number of pamphlets giving prices, weights and particulars of a variety of goods made by Mr. Paul Firchow Nachfgr, of Berlin, for whom he has been appointed sole selling representative for these manufactures in this country and for export. The information in the lists relates to time-switches, distance time-switches, float and compressor switches, automatic switches for electric signs, remote control switches, &c.

**Important South African Railway Workshops Scheme.**—The METROPOLITAN RAILWAY CARRIAGE BUILDING CO., of Birmingham, has recently been making inquiries at different South African centres with a view to establishing an extensive branch of its works in the country. A representative of the company, Mr. Peyton, visited Bloemfontein a short time ago in connection with the matter, and it is understood that he is convinced that this is the most naturally suitable site for the proposed works. Mr. Peyton has also visited Durban and Cape Town in the course of his investigations. In February, Mr. C. L. Botha, M.L.A., heard of his presence in the country and of his mission. Mr. Botha interviewed him, and outlined the advantages which Bloemfontein could offer, and put him into touch with the local municipality. After visiting Natal, Mr. Peyton went on to Bloemfontein and discussed the matter with the Mayor. He was received with the greatest cordiality and in a proper business spirit, and definite offers of a favourable nature were made to him on behalf of the Town Council—as regards a long lease of certain land at a purely nominal rental, cheap water and cheap electric light and power. If the works are established, it is understood that they will be commenced on a huge scale, as it is said to be the object of the company not only to cater for the South African trade, but to make the branch a manufacturing and distributing centre for the markets throughout the southern hemisphere—for India, Australia and South America. At the present time the Metropolitan Co. does an enormous foreign and Colonial business in railway and tramway carriages and fittings, and work of a similar nature. It is stated that the South African works would give employment to at least 1,000 men at the commencement, of whom about 400 would be artisans. It is believed that, should the company establish a branch in this country, the Government would be prepared greatly to reduce the scope of the present railway workshops, leaving most of the construction work to private enterprise, from which better prices would be forthcoming, and confining themselves almost entirely to ordinary repair and maintenance work.—*South African Mining Journal*.

**"Mazda" House.**—A few days ago we had the privilege of paying an inspection visit to the new "Mazda House," which has risen, to some extent Phoenix-like, out of the ashes of the one that was damaged by fire and water some time ago. It is a commanding building, at 77, Upper Thames Street, E.C., and all things considered, is admirably placed and well laid out for a central depôt for electric lamps and wiring supplies. A building of eight floors, including basement, with an artistic frontage, with a floor space of 20,000 ft., the entire scheme has been conceived and carried out for storing, and conducting the sales of, B.T.-H. manufactures with the utmost facility and convenience which will doubtless both admirably serve the purposes of contractors and the trade, and enable the company to rapidly handle a huge turnover of lamps and wiring materials.

The basement is reserved for glassware and heavy wiring supplies such as steel conduits, lead-covered cables, wood-casing, insulators, iron and wood-conduit fittings and similar accessories. The ground floor is equipped with a clever and expeditious arrangement of sales counters, so that purchasers will procure what they desire with a minimum of delay or trouble. At the first counter Mazda lamps will be sold; at the second the "Gem" and B.T.-H. Edison carbon lamps; and at the third, various accessories and wiring supplies.

The first floor is devoted chiefly to general offices, which will deal with lamp and wiring supplies only, the main offices of the company remaining, as hitherto, at 83, Cannon Street, E.C. On the first floor the typists and clerical staffs will also be accommodated, and seeing that the company specialises in scientific illumination, what it regards as the correct lighting principles have been adopted throughout the buildings. This first floor will afford a good example of their work. The general scheme of decoration of the offices is white, so as to secure the best illumination effects from both natural and artificial light. Mazda Holophane units fixed on the ceiling are the main lighting sources. In

the private offices much use is made of "The B.T.-H. eye-rest system," of inverted lighting, by means of which the light is uniformly diffused with the source of light hidden and an absence of glare and shadows. On the second floor there are the publicity department, illuminating engineering department, conference and travellers' rooms, mailing room, stationery stores, telephone exchange and filing room; the third floor is to be devoted to cables, wires, flexible cord and the stock of accessories of the lighter kind, such as switches, fuses, lampholders, &c.; and on the fourth floor is the carbon lamp stock room in which will be stored all types and sizes of B.T.-H. Edison carbon lamps, radiator lamps, and the new "Gem" lamps which the company have recently put on the market. The fifth floor will be the Mazda lamp stock room, where all types and sizes of these lamps, with drawn-wire filaments, in the various wattages and voltages will be stored in quantities sufficient to meet any demand. On this floor, also, the packing will be done, and the storekeeper and despatch department's staff are situated in a suitable office. The sixth floor will be chiefly used as a general storage room, and as the cases required will be made on the premises, a carpenter's shop is to be provided on this floor. The building is electrically-fitted throughout; it is lighted entirely by electricity, has provision for the electric heating of private offices, its cranes are worked by electricity, and a well-appointed automatic push-button electric lift, driven by a B.T.-H. lift motor, runs to every floor. The premises are protected by an electric fire alarm system, and an installation of "Grinnell" sprinklers (477 points), and there is a complete service of electric bells and intercommunication telephones, and a private telephone exchange with three trunk-line connections for outside calls.

The London demand will be adequately cared for in respect of every type, size, voltage, and wattage of Mazda lamp. The need for this large addition to the company's facilities has been made very pressing by the orders for the Mazda drawn-wire lamps having been far in excess of anticipations. But as we have already had occasion to state in our pages, extension of works, as well as extension of stores and offices, occupies a great deal of thought in the B.T.-H. problems of 1912. From the company's report, published on another page, it will be seen that it is putting down a lamp factory at Willesden. At Rugby, since we first visited the works when they were started 10 years ago, the growth has been remarkable. At that date the works covered a floor space of a little over 200,000 sq. ft. They now occupy some 25 acres of land, the floor space having been increased to upwards of 500,000 sq. ft., and they turn out practically anything electrical, from a meter to a turbo-generator. The company gives employment to-day to upwards of 3,000 hands. We have no hesitation in saying that the new buildings, which, as will have been gathered, will well repay a visit, form a worthy and imposing metropolitan representation of one branch of the activities of one of the largest electrical manufacturing undertakings in the provinces.

**Bankruptcy Proceedings.**—J. TIZZARD, electrical engineer, Hill Crest, Abbey Road, Torquay, Devonshire.—The public examination of the above debtor took place at The Castle, Exeter, on Thursday, April 25th. Examined by the Official Receiver, debtor stated that he was accused of leaving Torquay with the intent to delay and defeat his creditors, and that that constituted his act of bankruptcy. Having surrendered, he found that his liabilities amounted to £343, and his assets to £87. The latter consisted entirely of trade debts. In his preliminary examination he made a rough guess of his assets, and put them at £190, or £160 net. Before beginning business on his own account he was a journeyman electrician and a salaried partner in a firm of electricians in the North. While in Newcastle he was separated from his wife under a magistrates' order, and had to pay her £1 a week alimony. He left Torquay on January 28th last, because he received an anonymous letter which stated that his housekeeper no longer meant to keep house for him, and that he would have to look for another establishment. It upset him very much, and after looking over his petty cash book and considering he was solvent, he collected some debts and went away. He did not think he collected so much as £35, as when he arrived in London he had only £21. His liabilities included £180 due to a Mrs. Moss. He wrote to Messrs. Kitson, solicitors, of Torquay, to act for him and collect his debts, but they refused to do so. He gave them no address, and received a bankruptcy petition in Lincoln from his wife, to whom he had sent the alimony while away. Mrs. Moss, in the witness box, said debtor owed her practically £340, without reckoning rates and taxes. The examination was adjourned in order that Mrs. Moss's account might be filed.

**A Chile Hydro-Electric Concession.**—A correspondent at Santiago writes:—"A very valuable concession has been granted to a group of the most prominent financial and social gentlemen in Chile for a hydro-electric scheme, using the entire water of the Maipo river, which has a minimum water flow of 18.5 cb. m. About 40 km. of land goes with the concession, having a width of 50 m., the land traversing the already surveyed proposed canal, which gives for a distance of 17 km. about 140 m. of effective head, 24 km. at 220 m. head, and 37 km. at 310 m. head effective. With the concession goes a Government (not municipal) electric concession to supply the entire city and suburbs of the capital (Santiago), which has a population of over 500,000 people. At the present time (without any soliciting) not less than 18,000 H.P. can be disposed of in the city and suburbs, not including another 15,000 H.P. in factories, railways (including the State railways), local 20-km. steam railways owned by one of the concessionaires, coppermines, near-by towns, &c. The electric concession is for overhead and underground, no limit of the length of overhead being given, no technical mention of any kind being made so that the concession is an ideal one. Where the 320 m. effective



head is planned, only 30 km. of transmission line is required to reach the centre of the capital (Santiago). The concessionaires are anxious that this important scheme, which has already cost them, for engineers' fees, &c., in surveys and studies, close on £10,000, shall be placed in the hands of British engineers and financiers, principally because their experiences with Britishers have been always the most reliable. Their concessions have been placed into the hands of a very prominent engineer, but any information regarding the scheme and its value can be obtained through the office of the Minister of Chile (Don Agustin Edwards), London. The water concession is for 35 years, and the electric concession for 20 years, which can always be renewed (this being the maximum allowed time in Chile). The plant entire always belongs to the owners, and never goes to the Government, as is the case in other South American countries, such as Brazil. If British capitalists and manufacturers lose this opportunity of securing this hydro-electric scheme, which is described as the largest and most profitable electrical undertaking in the country, their opportunity for gaining any foothold will be lost, and will fall entirely into the hands of Germans, who are hot after these concessions, and are already operating here under an English name, but trading with Germany."

Another correspondent writing on the same subject sends us the following:—"Mr. W. T. Taylor, M.I.E.E., representing Messrs. Preece, Cardew, Snell and others, has been studying in Santiago the concessions of Senor Subercaseaux for the development of a hydro-electric scheme on the river Maipo, near Santiago, and the supply of light and power to that city and its suburbs. According to the studies made by Senor Lagarrigue, a distinguished Chilean hydraulic engineer, the canal should be developed from El Injenio to San Juan de Pirque, a distance of 37 km., and the final power house placed there, at a distance of 22 km. from Santiago. It is proposed to begin the scheme by developing 10,000 H.P. at San José, a distance of 20 km. from the intake at El Injenio. The representative of Messrs. Preece, Cardew & Snell is understood to be highly pleased with the whole scheme and the freedom of the concessions from any complications, as the whole of the people in connection with it are substantial and prominent men. It is to be hoped that British engineers and capitalists will find on investigation that this scheme is a sound one, and can be safely taken up by British capital."

**For Sale.**—MESSRS. WHEATLEY KIRK, PRICE & CO., will, on May 31st, sell by auction at the Station Hotel, Newcastle, the works, plant, machinery, goodwill, &c., of Messrs. Ernest Scott and Mountain, Ltd. The Blackburn Corporation has for disposal a quantity of steam and electrical plant. See our advertisement pages to-day.

**Patent Application.**—Application for restoration of patent No. 14,229, of 1906, for "Improvements in Gramophones and the like," has been made by B. S. VARNALS.

## LIGHTING and POWER NOTES.

**Aylesbury.**—The B. of T. has informed the U.D.C. that a prov. order for electricity supply has been granted to the Council.

**Batley.**—For some time a special committee of the T.C. has had under consideration a scheme for the extension of the electricity works. The Sub-Committee now recommends an outlay of £8,000 on new plant and machinery (including a 750-kw. reciprocating-engine set, and £8,000 on cable extensions. This recommendation has been approved. It is estimated that the modernisation of the plant and the cable extensions will enable the electrical department to show a profit of about £1,200 a year.

**Biddulph.**—In connection with the lighting scheme for the district, it is suggested that expert advice be obtained as to the relative cost of gas and electricity.

**Birkenhead.**—The Electricity Committee has decided to apply for sanction to borrow £14,230 for generating plant, condensers, pumps, &c., and £20,000 for feeder and distributing mains and service cables, estimated to be required during the next three years.

**Blackburn.**—The borough treasurer reports a profit on the electricity undertaking last year of £1,985, compared with £697 for the preceding year and £1,387 for 1909-10. The income from revenue was £39,037. Ordinary consumers paid for current £22,417; the sale for public street lighting amounted to £1,966; tramways, £10,642; and other Corporation departments, £1,840—a total of £36,920. A sum of £1,262 was allowed for discount. The total expenditure out of revenue was £18,583.

**Bridlington.**—The T.C. has received from the L.G.B. sanction to a loan of £1,900 for mains and £300 for a C.M.B. balancer.

An exhibition of electrical cooking appliances is to be held during the week commencing May 13th.

**Burnley.**—The new impulse turbo-generating plant, supplied by the British Westinghouse Co. to the order of the Corporation, was started on April 27th. The machine is of 2,100 I.H.P., and coupled to two D.C. generators in tandem.

**Burton-on-Trent.**—The electricians and other tradesmen of the town, writes a correspondent have passed a resolution protesting against the proposal of the Corporation Gas and Electricity Committee to convert the old police station into a showroom for fittings and appliances for use in connection with gas and electricity. It is contended that already tradesmen engaged in this line of business are subjected to very keen competition from the Corporation, and it is thought that, should the showroom be established, although no goods would be sold therefrom, all orders forwarded to tradesmen would be accompanied by a requisition for a 10 per cent. premium. The resolution of protest has been sent to the local Chamber of Trade.

**Bury (Lancs.).**—The T.C. has received from the B. of T. sanction for the use of overhead lines for the supply of electricity in bulk to the weaving shed of the Co-operative Wholesale Society, and to the Radcliffe electricity works.

**Bushey.**—The U.D.C. has received a communication from residents in Bushey Grove Road intimating that they wished to approach the Watford U.D.C. for a supply of energy for lighting, and asking the Council to sanction the laying of cable in the district.

**Carlingford (County Louth).**—It is reported that some experiments have been made in the mountains of this locality with a view towards using the streams for generating electrical power which would be used for the lighting of the town and in the district generally.

**Continental Notes.**—ITALY.—La Societa Cotonificio Trevigiani, of Treviso, has applied for a concession to put down plant to utilise certain available water-power at Revé di-Soligo in the generation of electrical energy for lighting and power purposes.

AUSTRIA.—The A.E.G. Union Electricitäts Gesellschaft, of Vienna, is interested in a scheme for the establishment of a central station at Michelsburg, Bohemia, for the electric lighting of the town and district.

HUNGARY.—In view of the fact that a central electric lighting station, which is being established in Buda-Pesth by the municipal authorities, will not be ready for some time, it is proposed to purchase the existing plant of the Hungarian General Electric Co.

**Coventry.**—The Tramways Committee has been informed that it can be supplied with electrical energy on the same terms as are granted to the largest consumers, viz., 75d. per unit.

**Derby.**—The Electricity Committee of the T.C. has recommended the application being made to the L.G.B. for a loan of £10,750 for the following purposes:—Mains, £4,500; services, £500; motors, £1,500; transformers, £600; boiler, with chain grates, superheater, and electric feed pump, £2,420; piping, £250; condensing water screens, £280; balancers, £300; and building extensions, £400.

**Dundee.**—The manager of the Tayside Electric and Gas Light Co., Ltd., Wormit, recently issued a circular in which it was proposed to increase the rates of those having contracts by 15 per cent., and to charge those supplied by meter at 6d. per unit. The circular also invited consumers to become corporate with the company so as to form "a solid combine against adverse influences," and ensure united action when necessary. To encourage this class of customer, 20 per cent. was to be added to those holding contracts, and 30 per cent. to those charged by meter, the addition to form a capital charge on the assets of the company, and to be converted into debenture stock at 5 per cent. The contract system, it was pointed out, had increased by 10 per cent., whilst the current consumed had increased by 100 per cent. At a meeting of consumers last week, the circular was criticised, and the legality of the manager's action in increasing the charges without adequate notice was questioned. It was agreed to meet the manager and discuss the whole question with him, a hint being thrown out that the fairest system would be to charge according to rental.

**Edinburgh.**—The Electric Lighting Committee of the Corporation recommends that of the £2,796. balance of last year's surplus on the electric lighting accounts, £2,500 be contributed to the King Edward Memorial Fund, and the remaining £296 for improvements at Saughton Park. The Council has already disposed of £5,000 of the surplus.

**Erith.**—On April 25th a L.B.G. inquiry was held respecting the application of the U.D.C. for a loan of £11,971 for electricity purposes—viz., mains, cookers and heaters, and bunkers at the station. There was no opposition.

**Fife.**—Messrs. W. Lumsden & Son, of Freuchie, have decided to install several hundred "Schorch" loom motors and motors for driving preparation machinery, these replacing the present steam engines and shafting drives. It is stated that Messrs. Lumsden have exhaustively tested a number of motor-drives before adopting the Schorch Electrical Co.'s proposal.

**Finchley.**—At a special meeting of the U.D.C. the Finance Committee reported that for the electricity undertaking last year it estimated a profit of £1,045, but that was owing to abnormal circumstances, one being the alteration of the date of payment of a capital charge from March 31st to April 2nd, an alteration which threw the payment from one year to another: the Committee is only estimating a net profit of £262 for the coming year.



**Gravesend.**—The T.C. has secured new consumers in the firms of the Thames Metal Works and Messrs. Henley's Telegraph Works Co., Ltd. The extension in the latter case will necessitate an expenditure of £1 550.

**Heston—Isleworth.**—The earliest printed statement of accounts received for the year ending March 31st last (from Mr. Rycroft) shows that a net profit of £150 was made on the Council's electricity undertaking. The output for the year was 1,040,774 units, or only 64,000 less than during the previous period of 15 months. It is satisfactory to see that the consumers and load factor are both on the up grade, and that the cost of production, which has been falling for some years, is now only very slightly over 1d. per unit.

**India.**—Preparations are in progress for an electric installation in Lahore, under the auspices of the Lahore Electric Supply Co., Ltd. Mr. Jenson, who erected the Durbar power house at Delhi, is the engineer in charge. Arrangements are being made for the supply of electric power on a large scale for all sorts of purposes.—*Indian Textile Journal.*

**Llantwit Fardre (Glam.).**—The B. of T. has notified the local authorities that a prov. order for electric supply has been granted to the South Wales Electrical Power Distribution Co. for the supply of current in the parishes of Llantwit Fardre and part of the parish of Llantrisant.

**London.**—**POPLAR.**—Sixty-nine gas lamps are to be converted into electric lamps. This will secure a saving in maintenance of £23 per annum. Electric cooking appliances are to be supplied on hire to consumers at a rental equivalent to 12½ per cent. on the price of the apparatus, no installation to exceed £15 in cost.

**KENSINGTON.**—The Infirmary Committee of the Guardians reports having received a letter from the L.G.B. approving generally the guardians' proposal to install electric light at the infirmary.

**Lytham.**—The B. of T. announces its revocation of the 1907 prov. order.

**Manstfield.**—At the T.C. meeting last week, Mr. Collins, presenting the report of the Electricity Committee, stated that it was proposed to hand over £600 to the relief of the rates from the profits of the undertaking, in addition to placing a substantial balance to the reserve fund.

**Peterborough.**—The T.C. has decided to extend the electricity supply along Park Road and to replace the street gas lamps on the section with electric lamps. The city engineer reported a revenue from the electricity supply for the past month of £715 and a surplus of £294.

**Rawtenstall.**—The Council's electricity department showed a total revenue for the year of £9,145, and after meeting all expenditure there remained a satisfactory surplus of £2,359, which it is proposed to place to renewals. During the year 1,498,000 units were generated, as compared with 864,000 in the previous year.

**Rochdale.**—It was reported at the meeting of the Corporation Electricity Committee that two applications had been made by large industrial concerns for supplies of energy amounting to over 2,000,000 units per annum. These applications are for a quantity quite half as large as the present total output of the works for all purposes, and if accepted will call for a substantial increase of generating plant additional to the new plant for which tenders, at an outlay of £8,000, have recently been accepted.

**Rothsay.**—The T.C. has approved of a scheme of electric light decoration for the esplanade gardens to cost about £800. The scheme includes festoons of fairy lamps for the flower gardens and illumination of the bandstand and enclosure. The Corporation has accepted the offer of the tramway company for the supply of energy.

**Salford.**—The Electricity Committee has decided to supply Messrs. Norris, Midwood & Co. with energy, subject to the company (1) guaranteeing a minimum consumption of 200,000 units per annum for all purposes, (2) paying an all-round price of 75d. net per unit for all current consumed, and (3) to the company entering into a five-years agreement. A coal clause is also inserted.

Messrs. J. Mandleberg & Co., whose rubber works are situated in Salford, have appointed Mr. E. M. Lacey as their consulting engineer.

**Southampton.**—The electrical engineer has been instructed to extend the electricity main from Shirley Road, at an estimated cost of £850. Sanctions have been received from the L.G.B. for permission to borrow £11,600 for generating plant and motors, £5,000 for mains and £3,500 for services; the Board asks the Council to re-consider its application as to borrowing £1,500 for meters and £1,000 for radiators, having regard to the resolution of the Council that meters should be paid out of revenue, and expressing the opinion that this course should also extend to radiators. After September 30th current supplied through slot meters is to be charged at 3½d. per unit and the meter rents discontinued.

**Taunton.**—The R.D.C. has consented to the T.C. supplying current to premises in the parishes of Taunton St. James's Without, Staplegrove, Norton, Fitzwarren, and Trull.

**Tunbridge Wells.**—A L.G.B. inquiry was held on April 22nd into the application of the T.C. for a loan of £6,000 for mains extensions. There was no opposition.

## TRAMWAY and RAILWAY NOTES.

**Blackburn.**—The tramways recorded a profit of £276 last year compared with a loss in the previous year of £181. The traffic revenue was £60,283. The number of passengers carried was 11,164,915, and the mileage 1,125,036. Parcel receipts came to £1,995, and the gross income to £63,129. Expenditure included traffic expenses, £14,541; general expenses, £4,755; general repairs and maintenance, £11,295; and power expenses, £10,642. Interest on capital absorbed £5,950, leaving £15,940, out of which £6,022 was devoted to repayment of loans, £8,628 for sinking fund, and £1,000 for permanent way renewal.

**Blackpool.**—Some interesting figures were submitted to the Tramways Committee, on April 25th, the manager reporting that the profit balance for disposal was not less than £10,053. The tramways receipts totalled £65,340, which is easily a record. The working expenses were £40,234, including £12,889 under the head of general repairs and maintenance. The sum was over £5,500 more than was allowed for in the estimates. Interest on capital amounted to £8,721, and redemption of loans to £6,332, leaving a disposable balance of £10,053. The capital outlay to the end of March was £295,985, sinking fund was £102,855, and reserve fund £11,200.

**Cardiff.**—The tramway strike was settled on Friday afternoon last, the men deciding to accept the terms of a resolution passed by the Tramways Committee to the effect that the City Council be recommended to grant the nine hours a day and the extra pay demanded by the men for working the Bank Holidays, Good Friday, and Easter Monday, irrespective of the hours worked. It was for this extra pay that the men struck work.

**Continental Notes.**—**FRANCE.**—A scheme for the construction of an electric tramway in the town of Dieppe is reported to be under consideration.

**GERMANY.**—A concession has lately been granted for the construction and working of an electric tramway in the town of Wilhelmshaven (Hanover).

**Glasgow.**—The General manager has recently reported on a proposal to run an all-night service of cars. He finds that the expense of such a service would be out of all proportion to the traffic, and that it would seriously interfere with the routine repairs, which are carried out at night. The T.C. has remitted back the proposal for further consideration.

**Greenock.**—The Tramways Committee is considering the question of providing tramway facilities for the upper parts of the town. Railless traction has been suggested, but the Corporation has before it a scheme involving the laying down of rails, and it is to consult with the tramways company on the matter.

**Haslingden.**—At the meeting of the T.C. on April 25th, Councillor Waddington, in moving the tramways minutes, stated that the next scheme they would consider was that of running railless trolley cars, whereby Helmshore could be made more accessible. He thought that for £4,000 they could put up the equipment and purchase three cars, and thereby develop a growing part of the borough. Other speakers also heartily endorsed the proposal, and the Mayor intimated that the scheme will be considered.

**Keighley.**—The Tramways Committee of the T.C. is applying to the B. of T. for a further extension of time for the construction of the tramways from Dale Street to Stockbridge, and for the commencement and completion of the lines authorised by the order of 1909.

**Lancaster.**—The Tramways Committee has had under consideration a scheme for lighting the tramcars with metal instead of carbon lamps, which, it is thought, would result in a considerable saving to the Committee. It was resolved that, as a test, one of the cars be fitted during the summer months with metallic lamps, and that the engineer report further after such experiment.

**London.**—**L.C.C.**—The total revenue of the electric tramways for the year ended March 31st last amounted to £2,231,945, and the total tramway revenue to £2,292,301, as compared with £2,175,282 in the previous year. The Highways Committee is at present trying a railless trolley vehicle at Abbey Wood.

**Preston.**—At the T.C., on April 25th, the chairman of the Tramways Committee, said the receipts during last year amounted to £40,643. It was the first time they had ever reached £40,000. They had carried 9 million passengers, or half a million more than had ever been carried before. The working expenses amounted to £24,008, and the gross profits to £16,635, leaving £6,201 to be carried to the reserve. They had now a gross reserve fund of £31,426. The receipts from the parcel service were £437. This was a gradually growing business, which made a profit sufficient to pay the rent of the new office premises.

**Rawtenstall.**—The year's working of the tramways shows that 4,669,522 passengers were carried, as compared with 3,236,730 in the previous year. Working expenses amounted to £13,667, while the total expenditure, including financial charges,



amounted to £25,345, or £51 less than the total receipts. The latter amount, together with a rate contribution of £1,500, is to be credited to a renewal fund.

**Rotherham.**—The report of the tramways manager for the past year shows that, in comparison with the preceding year, the receipts have increased from £33,346 to £35,856, and the number of passengers from 6,960,178 to 7,813,922, while the gross profit was £10,612 as against £8,892. The net profit available for appropriation account is £3,725, as compared with £3,057 last year.

**Sutton.**—The South Metropolitan Electric Tramways and Lighting Co. has under consideration the establishment of a service of railless cars through Sutton High Street to Belmont. The matter was considered by the U.D.C. at its last meeting on a letter from the secretary of the company, and the Clerk was instructed to reply that the Council was not at present prepared to give it any support.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—Approval has been given to the purchase for £1,660 of another wireless outfit from the Maritime Wireless Telegraph Co., for the new station to be erected in the north of Australia to connect with Papua.

In connection with the proceedings which have been instituted by the Marconi Wireless Co. against the Commonwealth, claiming damages for alleged infringement of patent, application has been made to the Chief Justice of the High Court for an order to inspect and examine, through experts, any plant or apparatus erected or to be erected by the Government.

**British Gold Coast.**—Marconi's Wireless Telegraph Co., Ltd., have contracted to supply and erect a radio-telegraph station at Accra, a port on the Gulf of Guinea about 80 miles east of Cape Coast. The station will be equipped with a 5-kw. set driven by an oil engine. Five masts will be provided, the main mast being 200 ft. in height, and the remaining masts each 60 ft. in height, arranged symmetrically around the main mast. The main aerial will be of the umbrella type, and the second of the twin type. A motor will be driven by a battery of 64 cells, and will drive a disk discharger. The transformer will be designed to afford a transformation ratio of either 300 to 10,000, or 300 to 5,000, as desired. There will also be provided a transmitting jigger and aerial tuning inductance, and the manipulating gear will consist of a Morse hand key actuating an electro-magnetic relay key in the transformer primary circuit. The receiver will be of the standard telephone magnetic detector pattern working in conjunction with the multiple tuner, the combination being capable of syntonising the receiving circuits to all wave lengths between 100 and 2,300 metres. The station will be employed mainly for communication with ships.

**France.**—The French Government is considering a scheme for the establishment of a system of wireless telegraphy connecting with all the French Colonial possessions. The system would extend from Paris to Timbuctoo in the Sahara, to the Marques Islands and to Martinique. All the French war vessels are to be equipped with outfits, and it is expected that all the large French steamship companies will follow the example.

**Morocco.**—A system of telegraphs is being established in Morocco, and it is stated that the Sultan is about to grant a concession for the erection and working of telephone exchanges giving communication between the principal towns.

**New Cables.**—The Portuguese Government proposes to lay two new submarine cables, one from Horta Azores to North America, and the other to Europe.

**Panama Canal.**—The U.S. Government has commissioned Major G. O. Squier to visit the Panama Canal zone and select sites for five local wireless stations, as well as for a high-power station. Major Squier will also represent the United States at the International Wireless Convention in London.

**Underground Telegraph Cables.**—From a recent statement by the P.M.G., it appears that the telegraph cable between Newcastle and Middlesbrough has proved unsatisfactory in use, and that it has not been possible to rely upon it for the main service.

**Wireless Telegraph Patents.**—The shares of the High-Frequency Machine Co., of Berlin, are at present the object of speculation on the Berlin Stock Exchange, owing to expected developments in wireless telegraphy, the price having fluctuated between 140 per cent. and 200 per cent. since the disaster to the *Titanic*. The company owns the foreign patents of the high-frequency generator devised by Prof. R. Goldschmidt, of Darmstadt, but does not manufacture on its own account, as the plant of the Lorenz Co., with which it is closely associated, is utilised for practical work. Negotiations for the sale of foreign patents have been proceeding for some time past, although it does not appear that the Marconi Co. is concerned with the matter. The High-Frequency Co. has just made a call upon the 75 per cent. unpaid share capital for the purpose of defraying the cost of further experiments. It is intended to erect a station near Berlin, on the one hand, and one in the United States, on the other, and to equip them with high-frequency generators.

**Wireless Telegraphy at Sea.**—It is stated that since the beginning of 1909, that is during a period of three years, the passengers on no fewer than 22 shipwrecked vessels have owed their lives to the fact that the ships were equipped with a wireless telegraph system, and were consequently able to send out messages for assistance.

**Wireless Telegraphy in German Colonies.**—Some information concerning wireless telegraphy with and in German Colonies was recently given by Count Arco, director of the Berlin Wireless Telegraph Co., before a meeting of the Technical Committee of the German Colonial Economic Committee. It was mentioned that in order to carry out trials, a receiving station with a large antenna was erected at Togo, and the station at Nauen, near Berlin, was considerably enlarged. The trials began at the opening of the present year, and were in progress at the time the Nauen station was blown down. The Minister of Posts and Telegraphs stated previously to the disaster that it had been possible to receive at Togo a portion of the messages transmitted from the Nauen station. The Duala station in the Cameroons has been completed to the order of the Imperial Post Office authorities, the principal object of which is to establish communication with ships passing at great distances. The telegrams from Duala are received with great facility at the Togo station, which is 620 miles distant. In South-West Africa two smaller stations—one at Luderitz Bay and one at Swakopmund—have been erected for communication with passing vessels and for mutual exchange day and night. The latter is finished, and fully meets the requirements, but the former is awaiting the arrival of a generator, and has, therefore, not yet been used as a transmitting station. It is possible at times, under favourable conditions, to receive signals at Swakopmund at night, even from the Duala station, which is 1,860 miles distant. A constant service has been maintained for a long time past between both stations on the Victoria Nyanza, in East Africa. It is now proposed to connect the South Sea colonies by the erection of stations at Yap, Rabaul, Nauru and Apia.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-in-Makerfield.**—May 14th. The U.D.C. is inviting tenders for Contract 5.—10 centrifugal pumps and motors for driving the same, and 11 other motors for driving sundry machinery. Contract 6.—Overhead electric power cables from Gerard Street to the pumping station and disposal works, also switchboards and power wiring, and electric lighting wiring and accessories. Specifications and forms of tender, £1 (returnable), from the engineers, Banks, Fairclough & Stephen, Leigh, Lancs.

**Australia.**—VICTORIA.—May 8th. Cable for P.M.G.'s Department.

June 4th.—1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" April 26th.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9½ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—Apply, High Commissioner in London for Australian Commonwealth.

June 18th.—50½ miles of cable for the P.M.G.'s Department. See "Official Notices" to-day.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

A notice appears in our advertisement columns to the effect that the Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. The tenders now invited, we understand, will cover plant for the equipment for electrical working of about 300 miles of single track, including the construction of a generating station of a capacity of 60,000 kw., substations for supplying current to the trains, and the electrical equipment for a large amount of rolling-stock; each part of the work may be tendered for separately. Tenderers may submit proposals for the supply of either continuous-current equipments or single-phase equipments; and in the case of the power station, tenders may be submitted for turbo-alternators of either 10,000 kw. or 20,000 kw. capacity each. The Victorian Government have arranged with Mr. Charles H. Merz, the consulting engineer for the work, to leave England as soon as the tenders have been received, in order to advise them in connection with the placing of orders for the different works.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

**Barlborough (near Chesterfield).**—Tramway, railway siding, &c. Mr. C. Robinson, Westfield Lodge, Barlborough.



**Birkenhead.**—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" April 26th.

**Bray (Ireland).**—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-kw. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" April 12th.

**Brighton.**—The Corporation is about to invite tenders for electric lamp requirements for a year—about 4,500. Each lamp will have to be marked "Brighton Corporation."

**Bristol.**—May 6th. One 1,000-kw. three-phase to D.C. converter, for the Corporation (British manufacture preferred). See "Official Notices" April 26th.

**Constantinople.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" to-day.

**Dewsbury.**—The Corporation Electricity and Tramways Committee is inviting tenders for renewal of economiser at Bradford Road Electricity Works. Specifications and forms of tender, £1 1s. (returnable), from Mr. R. H. Campion, engineer.

**Dublin.**—May 8th. The Corporation Technical Education Committee is inviting tenders for various mechanical and electrical machinery for the technical school. Specifications from the secretary, Mr. L. E. O. Carrell, Lower Kelvin Street, Dublin.

**Edinburgh.**—The Corporation invites tenders for the electric lighting installation at the Clydesdale Bank, Royal Exchange. Mr. F. A. Newington, Corporation engineer.

**Falkirk.**—May 6th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" April 19th.

**France.**—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

**Glasgow.**—May 10th. Sub-station switchgear, for the Corporation Electricity Department. See "Official Notices" April 26th.

**Gloucester.**—Forty-five street-lighting lanterns for high candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" to-day.

**Grimsby.**—May 16th. Continuous-current motor-generator with switchboard panel, and an automatic reversible booster with switchgear, for the Corporation. See "Official Notices" April 26th.

**Halifax.**—May 13th. One 360-tube fuel economiser, for the Corporation Tramways and Electricity Committee. See "Official Notices" to-day.

**Heston and Isleworth.**—May 8th. 500-kw. steam engine, D.C. generator, balancer, &c., water-tube boiler, chain-grate stoker, pipework, &c., surface condenser, air pump, &c., for the U.D.C. See "Official Notices" April 19th.

**Hoylake and West Kirby.**—May 6th. One Lancashire boiler, with superheater, &c., vertical steam pump and self-acting re-starting injector, for the U.D.C. Electricity Works. See "Official Notices" April 19th.

**Huddersfield.**—May 20th. 1,000 single-phase meters, for the Corporation. See "Official Notices" to-day.

**Kimberworth.**—May 16th. Electrical wiring at the Smallpox hospital, for Rotherham T.C. Borough Engineer.

**Leicester.**—May 17th. One 750-kw. single-phase motor-alternator, for the Corporation Tramways and Electricity Department. See "Official Notices" to-day.

**Leigh.**—May 13th. Telephone installation at the Union Workhouse, for the B. of G. See "Official Notices" to-day.

**Lincoln.**—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous-current dynamo, or two 500-H.P. Diesel engines, with continuous-current dynamos; one 120-kw. motor-generator and one switchboard, for the Corporation. See "Official Notices" April 12th.

**London.**—HACKNEY.—May 9th. High and low-tension cables, boxes, frames and covers, troughing, ducts, &c., for the B.C. Electricity Department. See "Official Notices" April 19th.

**L.C.C.**—May 8th. Electrical installation at the Malmesbury Road Central School. See "Official Notices" April 26th.

**Manchester.**—May 14th. The Corporation Tramways Department is inviting tenders for (a) tramway rail bonds (b) hard-drawn copper trolley wire (c) steel tramway poles (d) span wire, brackets. Specifications and forms of tender (e) and (f), £1 1s. (returnable), from Mr. J. M. McElroy, general manager.

May 8th.—Electrically-driven boiler feed pump. Specifications and forms of tender from Mr. F. E. Hughes, secretary, Electricity Department, Town Hall

**Newcastle-on-Tyne.**—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" April 26th.

**Newcastle-under-Lyme.**—Extensions and alterations to switchboard, for the Corporation. See "Official Notices" April 26th.

**New Zealand.**—July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Nuneaton.**—May 14th. Main switchboard, for the Corporation Electricity Department. See "Official Notices" to-day.

**Pembroke.**—May 8th. Extension of existing 1,500-ampere-hour battery, for the U.D.C. Electricity Department. Clerk, Town Hall, Ballsbridge, Co. Dublin.

**Rotherham.**—May 18th. Two automatically-controlled electrically-driven motor and pump sets, each set to be capable of raising 100 gallons per minute against a head of about 60 ft., for the T.C. Borough Engineer.

**Walthamstow.**—Tenders are to be invited for doubling the tramway track at Bell Junction.

**West Ham.**—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

## CLOSED.

**Batley.**—The tender of Messrs. N. Hainsworth, Ltd., Batley and Dewsbury, amounting to £224, for electrical work in connection with the extension of the Boys' Grammar School, has been accepted.

**Belfast.**—On a report from the electrical engineer regarding the tenders for the supplying of two 750-kw. turbo-alternators and condensing plant, it was decided to accept the tender of Messrs. Richardsons, Westgarth.

**Bolton.**—The contract for the steel work for the battery and booster house at the Electricity Works has been secured by Messrs. John Booth & Sons.

**Bridlington.**—The T.C. has accepted the tender of Messrs. Ledward & Beckett, Ltd., for the extension of the condenser at the Electricity Works, at £1,425.

**Constantinople.**—The Constantinople Telephone Co. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for supplying and laying telephone cables and conduits. The value of the contract approximates £100,000.

**Croydon.**—The Council has placed a contract for electric cables for a year with Messrs. Callender's Cable and Construction Co., Ltd., and has also accepted the tender of the British Westinghouse Electric Co., Ltd., for the supply of A.C. meters for the ensuing 12 months.

**Derby.**—The E.L. Committee of the T.C. has accepted the tender of Messrs. F. W. Brackers & Co., Ltd., for condensing water screens, at £278.

**Glasgow.**—The T.C. Tramways Committee has accepted the following offers:—

Mica.—Micanite and Insulators Co., Ltd.; British Mica Co., Ltd.  
Copper contacts for H.T. breakers.—British Westinghouse Electric Co., Ltd.  
Collector brushes for rotaries.—Estler Bros.  
Wood paving blocks.—Millars' Karri & Jarrah Co., Ltd.  
Peacock brakes.—W. C. Yuille & Co., Ltd.  
Toocom brake attachments.—Dryers, Ltd.  
Copper rail-bonds.—United States Steel Products Co.

**Gravesend.**—The T.C. has accepted the tenders of Messrs. Ferranti, Ltd., and the Electrical Apparatus Co., for ordinary house meters; and those of Messrs. Ferranti, Ltd., and the Electrical Co., for two-rate meters.

**Halifax.**—The Electricity Committee has accepted the following tenders:—

Worthington Pump Co., Ltd.—Worthington condenser and pump, £8,054.  
British Thomson-Houston Co., Ltd.—Turbo-alternator, £6,633.

**Huddersfield.**—The Corporation has accepted the tender of the United Electric Car Co., Ltd., for the supply of six top-deck covers.

**Hull.**—The Corporation Electricity Committee has accepted the tender of Messrs. S. Heywood & Co. for an overhead crane for the Sculcoates works; and that of the British Westinghouse Electric Co., Ltd., for a new switchboard.



**London.**—L.C.C.—The Stores and General Committee has accepted tenders for iron castings for permanent way, &c., for the tramways department for one year :—

T. Butler & Co., Ltd.	£1,155
S. Griffith	217
J. Martin & Son	2,044
Summerscales, Ltd.	75

The Highways Committee has accepted the tender of the Lilleshall Co., Ltd., at £7 7s. 6d. per ton, for special rolled steel bar for magnetic brake shoes (25A and 26A types) :—

	Prices per ton both sections, delivered.	
	Within the specification radius.	At siding.
Lilleshall Co., Ltd.	£7 7 6	£7 7 6
Earl of Dudley's Round Oak Works, Ltd.	7 12 6	7 12 6
Frodingham Iron and Steel Co., Ltd.	7 16 0	7 13 6
P. & W. MacLellan, Ltd.	7 16 3	7 16 3
Cammell, Laird & Co., Ltd.	8 0 0	8 0 0
Henry Bessemer & Co., Ltd.	8 0 0	8 0 0
Patent Shaft and Axletree Co., Ltd.	25A Section.	
	8 15 0	8 15 0
	26A Section.	
	9 0 0	9 0 0
Bayliss, Jones & Bayliss, Ltd.	9 10 0	9 10 0
The District Iron and Steel Co., Ltd.	9 10 0	9 10 0
George Schultz & Co.	9 16 6	9 13 6

**STEPNEY.**—In connection with the conversion of the two double-current turbine-driven sets into alternators at Limehouse station, Messrs. A. Reyrolle & Co., Ltd., are to carry out alterations to the high-tension switchgear to accommodate panels for the new generators, at £49 5s. per panel (total £197), and to provide two new power-factor meters for £18, making the total cost £215.

**North Riding of Yorks.**—The Territorial Force Association has accepted the tender of Messrs. Graham Bros., of Middlesbrough, for aerial telephones on eight ranges, at £20 per range.

**Portsmouth.**—The B. of G. has accepted the tender of Messrs. Waygoods, Ltd., for two electric lifts for the Infirmary, at £730.

**Salford.**—The following tenders have been accepted by the T.C. :—

#### TRIENNIAL SUPPLIES.

W. T. Glover & Co., Ltd.—Paper-insulated single cables (approximate value of contract) £2,100.  
Sykes & Sugden.—Joint boxes, £90.  
Eckstein, Heap & Co.—Ammeters, £219  
G. Bateman & Co.—Arc lamp globes, £35.  
Reason Manufacturing Co., Ltd.—Maximum demand indicators, £55.

#### ANNUAL SUPPLIES.

W. T. Glover & Co., Ltd.—Bare copper wire, fuse wire, and twin flexible.  
Aubert, Grenier & Co.—Paper-insulated multiple-core cables, £900.  
H. R. Mansfield.—Stoneware pipes and conduits, £250.  
Albion Clay Co.—Stoneware pipes and conduits and cable protectors and bearers, £361.  
Brush Electrical Engineering Co., Ltd.—Carbon filament glow lamps.  
J. H. Tucker & Co.—Switches.  
General Electric Co., Ltd.—D.C. meters, £264; combined meters and maximum demand indicators, not stated.  
Ferranti, Ltd.—A.C. meters, £316.

**Siam.**—The *Bangkok Daily Mail* contains the following paragraph :—“His Excellency Chow Phya Yomaraj has approved of the decision of the committee (Messrs. F. B. Shaw, E. G. Gollo and A. Odent) appointed to report on the tenders for the Government power station, and the following are the firms whose tenders have been accepted :—A.E.G. (Germany), B.T.H. (England) and G.E.C. (America), so that it will be seen that the building and plant, when completed, will be quite international in character. The amount of the tender of the amalgamated firms was £54,154. The tender for the Husk conveyors and elevators has not been included in the above, since no tender has been presented which comes within the estimated price. The department should feel much satisfaction in the combination of three such important firms, since, as we understand, each is supplying the section of which it makes a speciality.”

**Southampton.**—The T.C. has accepted the tender of Messrs. Day, Summers & Co., at £65, for the supply of an oil cooler in connection with the turbine at the electricity works.

**Stalybridge.**—The Stalybridge, Hyde, Mossley and Dukinfield Tramways Board has given a repeat order for six mechanical stokers and self-cleaning furnaces for the generating station, Tame Valley, to Messrs. Ed. Bennis & Co., Ltd.

**Walthamstow.**—The U.D.C. has accepted the following tenders for annual supplies of stores to the Electricity and Tramways Department :—

W. T. Henley's Telegraph Works Co., Ltd.—Cables, compound for glands, compound tape and jointing metal.  
Liverpool Electric Cable Co., Ltd.—India-rubber-covered wires.  
Johnson & Phillips, Ltd.—Flexible cords.  
Dussek Bitumen Co.—Box compound.  
British Electrical Manufacturing Co.—Chatterton's compound, pure rubber tape, soldering fluid and lead fuse-wire.  
Siemens Bros. & Co.—White linen tape and resin.  
R. W. Blackwell & Co.—P. and B. tape and paint.  
Pryke & Palmer.—Plumber's metal and fine solder, petroleum jelly, zinc rods, porous pots, glass jars and sal ammoniac.  
Callender's Cable and Construction Co., Ltd.—Lead sleeves and lead sealing-ends.  
Siemens Bros. Dynamo Works, Ltd.—Switches, lampholders and carbons.  
General Electric Co.—China bridge fuses and ceiling roses, adaptors and wall plugs, dust shot, steel conduit, &c., key switch-holders, arc lamp books, insulated hooks, staples, phosphor-bronze and bell wire, Sinclair insulators, chimney brackets, roof brackets, pole steps and strain lamps.

British Westinghouse Co., Ltd.—Cables and counterweight sets and teak blocks.  
Baxter & Caunter, Ltd.—Opal shades, enamelled-iron shades and green-back opal shades.  
British Thomson-Houston Co., Ltd.—Teak blocks, recessed and traction lamps.  
Ward & Goldstone.—Tinned-copper (no wire).  
Hloan Electrical Co., Ltd.—Conrad's carbons.  
Ship Carbons, Ltd.—Carbons for electrodes.  
Chamberlain & Hookham, Ltd.—Electricity meters and prepayment meters for pennies and shillings.  
Ferranti, Ltd.—Electricity meters and prepayment meters for pence.  
Electrical Co.—Hour meters and Nernst lamps.  
Sunbeam Lamp Co.—Incandescent lamps and Sunbeam lamps.

#### CAR ACCESSORIES.

British Westinghouse Co., Ltd.—Gear wheels and armature coils.  
F. W. Rowlands & Co.—Pinion wheels, trolley heads and trolley-head globes.  
W. Wood.—Trolley heads, trolley-head bushes, trolley-head globes, and brass terminals.  
Imeson Finch & Co., Ltd.—Trolley wheels, controller fingers, whipcord and galvanised span-wire.  
Brecknell, Munro & Rogers, Ltd.—Rubber sleeves, rubber cap, and trolley booms.  
L. Andrew & Co.—Steel wire and trolley cord.  
John Baker & Co. (Rotherham), Ltd.—Steel tires.

The following tenders have also been accepted for electrical plant :—

Babcock & Wilcox.—Boiler feed pump and circulating pipes, £3,051.  
Richardsons, Westgarth & Co.—Turbo-alternators, £2,390.  
Bruce Peebles & Co., Ltd.—Motor-generators, £2,40.  
British Westinghouse Co.—Rotary converters, £1,151.  
British Thomson-Houston Co.—High-tension switchgear, £1,960.  
Crompton & Co., Ltd.—Low-tension switchgear, £549.

**Wigan.**—The Tramways Committee has accepted the tender of Mr. G. P. Trentham, Handsworth (Staffs.), for the construction of new tramway loops in Wallgate, Scholes, and Station Road.

**West Hartlepool.**—The T.C. has accepted the following tenders :—

Turbo-alternators.—Richardsons, Westgarth & Co., Ltd.  
Rotary converters.—British Westinghouse Co.  
Battery.—The Tudor Co.  
High-tension switchgear.—Reyrolle & Co.

## FORTHCOMING EVENTS.

**Institution of Mechanical Engineers.**—Friday, May 3rd. At 8 p.m. Discussion to be resumed by Prof. J. O. Arnold on “The Tenth Report to the Alloys Research Committee on the Alloys of Aluminium and Zinc.”

**Society of Engineers.**—Monday, May 6th. At 7.30 p.m. At the I.E.E., London, W.C. Paper on “The Effect of Intermittency in Limiting Electric Traction for City and Suburban Passenger Transport,” by Mr. W. Y. Lewis.  
Saturday, May 11th.—At 6.30 for 7 p.m. At the Criterion Restaurant, London, W. Annual dinner.

**Royal Society of Arts.**—Monday, May 6th. At 8 p.m. Howard Lecture on “Heavy Oil Engines,” by Capt. H. Riall Sankey. (Lecture II.)

**Institution of Electrical Engineers (London).**—Thursday, May 9th. At 8 p.m. Papers on “The Behaviour of D.C. Watt-Hour Meters, especially in Relation to Traction Loads,” by Messrs. S. W. Melsom and W. H. Eastland; and “Electrical Meters on Variable Loads,” by Prof. D. Robertson.  
An extraordinary general meeting for Members and Associate Members only will be held, at 7.30 p.m., in connection with the proposed new Articles of Association.

**Institution of Electrical Engineers (Dublin Local Section).**—Thursday, May 9th. At 8 p.m. Meeting at the New Royal College of Science, Dublin.

**Physical Society.**—Friday, May 10th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on “A Method of Measuring Small Inductances,” by Mr. S. Butterworth; “The Conversion of Starch into Dextrin by X-rays,” by Messrs. H. A. Colwell and S. Russ; “Calibration of Wave-Meters for Radio-Telegraphy,” by Prof. G. W. O. Howe; and demonstration of “Apparatus for Showing the Generation of Electricity by Carbon at High Temperatures,” by Messrs. J. A. Harker and G. W. C. Kaye.

**Junior Institution of Engineers.**—Friday, May 10th. At 8 p.m. At the I.E.E. Paper on “Notes on Telephone Exchange Equipment,” by Mr. A. J. Hayes.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, May 6th.—“A” Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, May 7th.—“B” Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit training for those not passed out by Adjutant, 7.30 to 10 p.m.

Wednesday, May 8th.—All Companies. Annual course of musketry at Purfleet. N.C.O.'s and men leaving Fenchurch Street Station by a later train than 1.48 p.m. will not be able to fire.

Thursday, May 9th.—“C” Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, May 10th.—“D” Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit training for those not passed out by Adjutant, 7.30 to 10 p.m.

Saturday, May 11th.—Headquarters will be open for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) J. H. S. PHILLIPS, Major.  
For Officer commanding L.E.E.

**Electrical Trades Benevolent Institution.**—The meeting was held at the Institution of Electrical Engineers on Wednesday afternoon, for the purpose of confirming the resolution already passed adopting the new rules



## PROPOSED BANKRUPTCY LEGISLATION.

By GEORGE JOHNSON.

THE Bill to amend the law with respect to bankruptcy and deeds of arrangement, as introduced into the House of Lords by Lord Granard on December 15th last, proposes to give effect, with some modifications and additions, to the recommendations of the Departmental Committee on Bankruptcy Law and its administration which reported in 1908. It is impossible within the limits of the present sketch to criticise the Bill in detail, but the more important amendments of the law now proposed may be cursorily noticed.

1. Prosecutions for bankruptcy (and Debtors' Act) offences must at present proceed by indictment and be conducted by the Public Prosecutor. Whilst maintaining this procedure for use in the graver cases, it is proposed to give courts of summary jurisdiction power to dispose of these offences, and to enable the Board of Trade to undertake prosecutions before such courts through their solicitor or through the Official Receivers.

2. Commercial offences not now criminal—viz.: (a) failure to keep trading accounts; (b) failure to explain disappearance of assets; and (c) insolvency brought about by gambling.

Such conduct is at present punishable only by refusal or suspension of discharge. The Committee thought these offences should, in the case of bankrupts engaged in trade or business, be made criminal, and as regards (b) and (c) the Bill follows their recommendation. In regard to (a), the Bill makes failure to keep accounts criminally punishable only in the case of a trader who has on a previous occasion been insolvent.

3. After-acquired property of an undischarged bankrupt.—At present all such property is claimable by the trustee in the bankruptcy. Under the Bill (a) protection will be given to *bona fide* purchases of real (as is now the case with personal) property of this nature, and (b) if an undischarged bankrupt again becomes bankrupt, his assets acquired since the earlier bankruptcy will be distributed *pro rata* between the new and the old creditors.

4. All married women engaged in trade are made amenable to bankruptcy proceedings upon a bankruptcy notice following judgment.

5. Marriage settlements. Additional restrictions are imposed on the power to place property out of reach of creditors in case of bankruptcy by means of covenants in such settlements.

6. General assignments of book debts are to be void against a trustee in bankruptcy unless registered.

It is also proposed to extend the control of the Bankruptcy Courts over foreigners in this country through agents or partners, and to take away the powers of landlords to distrain after bankruptcy for rent payable in advance; whilst Sec. 21 of the Bill is designed to meet the devices sometimes adopted by moneylenders to evade the provision (Sec. 23 Bankruptcy Act, 1890) by which claims for interest in excess of 5 per cent. are to be postponed until all other claims against bankrupt estates have been paid in full.

With regard to the question of the discharge of a bankrupt, it is thought by the promoters that the amendment proposed in the law as to after-acquired property will greatly diminish such commercial danger as at present arises from the existence of a large class of undischarged bankrupts, and that the increased stringency of the disabilities attaching to undischarged bankrupts (which may increase the number of applications for discharge) will afford additional protection to persons having dealings with them.

Part II of the Bill, which deals with deeds of arrangement, is marked by several objectionable features, and unless Secs. 25 and 27 are vitally amended, the conditions sought to be imposed will, in the opinion of the writer, certainly have the effect of legislating deeds of arrangement out of existence. Such also appears to be the opinion of the Parliamentary Committee of the Council of the Society of Incorporated Accountants, which has recently issued a memorandum of the result of its deliberations on the Bill under the name of its able secretary, Mr. James Martin.

## NOTES.

**New Tests for Insulated Wire.**—The *India-rubber World* quotes the revised set of electrical regulations issued in 1911 by the Electrical Department of New York City, which provide that the insulation shall be of rubber or other homogeneous compound which has been approved, and specify a definite thickness for each size of wire. As a protection against too soft an insulation, the rules stipulate certain tests, among which is the following:—The braiding is carefully removed from a portion of the sample, and the copper wire is connected with one terminal of an electric circuit, of which a testing tool forms the other terminal. The portion of the sample from which the braiding has been removed is placed on a flat surface, and the tool edge, which is placed across the sample, is pressed down on to the insulating cover with a pressure of 5 lb., which is maintained for about a quarter of an hour. The electric current, which must be at least 100 volts alternating, is then turned on, and the tool edge must not sink far enough through the insulation to touch the copper wire and complete the electric circuit—a pretty hard test for a small wire, but one to which the best manufacturers have agreed.

**A Football Club's German Tour.**—We learn that the tour in Germany organised by the Football Section of the Osram and Robertson Electric Lamp Works Social Club proved very successful in every way, and the party returned to London on Thursday, April 11th, thoroughly satisfied with their holiday. Leaving London on Thursday, April 4th, they arrived at Bremen on Friday, where they were billed to play against the Werder F.C. The match was played before an attendance of over 2,000 people, but was, unfortunately, marred by the weather. It rained continuously, and the wind was blowing almost a gale. Under these conditions the play was, of course, of a scrambling nature, and the Werder team won luckily by 3—1. From Bremen the party travelled to Hanover, where they stayed for the night, and started early on Saturday for Berlin. Arriving at Berlin about midday, they were met by representatives of the German Osram Lamp Works, who conducted them to the works, where they were entertained to dinner. After dinner they journeyed to the ground of the Maggi F.C. to fulfil an engagement with them. The weather conditions were the same as at Bremen, but the O. and R. players adapted themselves better to the conditions, and won very comfortably by 6—0. After the match they were the guests of the German Osram Lamp Works Club, who had arranged a dinner, followed by a concert and dance. This programme was thoroughly enjoyed by the party, who, by special request, sang several national songs. When the dancing commenced they had some difficulty with the German dancing, which is much faster than in this country. Their German friends, however, were bent on making the visitors feel thoroughly at home, and soon had things going merrily. Sunday morning was spent in seeing some of the sights of Berlin, and in the afternoon the English club journeyed to the ground of the German Osram Lamp Works Club to play them. This was the most important match of the tour; and as the fine silver cup kindly presented by Director Remané was at stake, the contest was a very keen one. The weather had much improved, and play started in brilliant sunshine. The English club soon scored from a free kick given for a foul, this point causing some discussion, as the Germans were under the impression that a goal could not be scored direct from a free kick. Shortly after this the Englishmen again scored, and held this lead until half time. After changing over they had most of the play, but thanks to the fine play of the German goal-keeper, who was really smart, they could only score once. The German team took their defeat in a fine sporting spirit, and heartily congratulated their visitors on winning the Cup. On Monday morning the party left for Hanover, arriving there about mid-day. They were met by the officials of the Hanover Club, whom they were due to play against in the afternoon. This proved to be the best match of the tour, although the result was a win for the Hanover Club by 4—2. The home team quickly scored twice, and this seemed to encourage the English players to do their very best. Playing a fine combination game the scores were very soon level, but before half-time the Englishmen's left back had the misfortune to put the ball through his own goal. The second half was evenly contested until one of the British backs received a nasty kick on the ankle and had to be carried off. Shortly after this Hanover scored again, their opponent's goal-keeper having no chance with a fine shot. This proved to be the end of the scoring, and Hanover won, as stated. In the evening the O. and R. Club were entertained by the club, who had arranged a concert in their honour. This was thoroughly enjoyed, some of the visiting party singing English songs, much to the amusement of their German friends. After the concert came dancing. Tuesday was spent in sight-seeing in Hanover. On Wednesday an enjoyable morning was spent with some of the Hanover players at the swimming baths. In the afternoon the party entrained for London, the Hanover players turning up in force to give them an enthusiastic send-off. Splendid hospitality was extended to the party everywhere they went, especially by the members of the German Osram Lamp Works Club, who did everything in their power to make the stay in Berlin a thoroughly enjoyable one. The thanks of the Osram and Robertson F.C. are due to Mr. Wilson and director Remané for the generous support they have given the club, and without which the tour could never have been carried through. The club is also indebted to Messrs. Stemmler and Philpot for organising the tour. Result of Matches:—v. Bremen F.C., lost 1-3; v. Maggi F.C., won 6-0; v. German Osram Lamp Works F.C., won 3-0; v. Hannover F.C., lost 2-4.

**Emergency Plant on Steamships.**—Referring to the recent disaster to the s.s. *Titanic*, which exemplified the enormous importance of adequate lighting when passengers have to be transferred to the boats, Messrs. Mirrlees, Bickerton & Day, Ltd., write to say that they recently carried out an installation on the new White Star liner *Megantic* on behalf of the White Star Co. and Messrs. Harland & Wolff, having for its object the continuance of the Marconi apparatus, and of a considerable portion of the lights, even after the whole of the steam machinery below has been stopped by an accident. In this scheme a 45-B.H.P. Mirrlees-Diesel oil engine, directly connected to a dynamo, is installed on an upper deck, and from the dynamo a separate circuit is taken round the ship and connected with lights fixed in the main passages, companion ways, saloons, &c. The circuit is also arranged to provide lights in the neighborhood of the boats, in addition to being connected with the Marconi apparatus.

From the above description it will be seen that in the case of a serious disaster, such as that on the s.s. *Titanic*, a supply of electricity would be continued on board the ship and would give light for the free movement of people about the ship and for the launching of the boats, as well as giving current for the wireless telegraph right up to the moment when the upper deck sank below water.

The installation on the *Megantic* is set at work daily as darkness



approaches and continues running until daylight, quite irrespective of the fact that the steam-driven electrical dynamos are working. This is done so as to avoid any rush or hurry to start up the plant in case of anything happening in the night. An independent plant of this kind could be driven by other forms of engine than the Diesel, but with steam or gas engines the space occupied would be greater, and the handling of coal on an upper deck would cause considerable nuisance. Petrol or paraffin engines might be suitable for the work, but the oils they use would be quite unsafe on board a large ship, and, in fact, are prohibited by Board of Trade regulations. The oil used in the Mirreles-Diesel engine is cheap residual petroleum.

The arrangement described is of the greatest value, as, with ample light, boats can be much more quickly and safely launched than in darkness or semi-darkness. Also the extended time during which the wireless telegraph apparatus can be worked, in case of accident to the accumulators, gives a greater chance of help being obtained. The fact that the White Star Line has been the first to try this scheme proves its desire to do everything possible to secure the safety of its passengers.

**Appointments Vacant.**—Commercial assistant, for the Battersea B.C. electricity department (£2 and commission); station superintendent, for the Wakefield Corporation electricity department (£140); chief electrical engineer and manager, for the Hampstead B.C. (£700 and bonus); junior switchboard attendant, for the Corporation electricity works, Lancaster (25s.). See our advertisement pages in this issue.

**Institution and Lecture Notes.**—THE INSTITUTE OF METALS.—On Friday, May 10th, the Third May lecture of the Institute of Metals will be delivered by Sir J. Alfred Ewing, on "The Inner Structure of Simple Metals," at the Institution of Mechanical Engineers, Westminster, S.W. Cards of invitation admitting to the lecture can be obtained on application to the secretary of the Institute of Metals, Caxton House, Westminster, S.W.

THE CONCRETE INSTITUTE.—At a meeting on April 25th, a discussion took place on two reports presented by the Tests Standing Committee of the Concrete Institute, entitled:—(a) "The Testing of Concrete, Reinforced Concrete, and Materials Employed Therein;" (b) "The Testing of Reinforced Concrete Structures on Completion." The annual general meeting of the Institute will take place at Denison House, Westminster, S.W., on Thursday, May 9th, at 4.30 p.m.

ROYAL INSTITUTION.—The annual meeting was held on May 1st, when the Duke of Northumberland was elected president for the ensuing year, and Sir W. Crookes secretary.

INSTITUTION OF CIVIL ENGINEERS.—At the annual general meeting on April 30th, the result of the ballot for the election of officers was declared as follows:—President, Mr. Robert Elliott-Cooper; Vice-Presidents, Mr. A. G. Lyster, M.Eng.; Mr. B. H. Blyth, M.A.; Mr. J. Strain; Mr. G. R. Jebb. The Council has made the following awards for papers read during the session 1911-12: Telford Gold Medals to Messrs. Ernest and Walter Mansergh; a George Stephenson Gold Medal to Mr. Roger T. Smith; a Watt Gold Medal to Mr. A. H. Roberts; Telford Premiums to Messrs. John Goodman, A. B. McDonald, G. Midgley Taylor, D. C. Leitch, W. C. Easton, and D. H. Morton; and the Manby Premium to Mr. S. H. Ellis.

On April 17th Mr. Marconi gave a lecture on wireless telegraphy before the New York Electrical Society, in the Engineering Societies' Building, New York. There were over 1,000 people present, and half as many more were unable to gain admission. The rescue of the survivors from the *Titanic* being fresh in the people's minds, Mr. Marconi had a most enthusiastic reception.

**The I.E.E. Articles.**—The following letter has come to hand as we go to press. As the matter will probably be settled before our next issue appears, we insert it here:—

"The suggestion given in your issue of April 26th by Mr. Charles C. Garrard has, in my estimation, been timely, and is well worthy of careful consideration by the Institution Council.

"If a higher grade of membership is not at the present time necessary, it will not be long before some such class must be made, unless the existing full membership qualifications are made more stringent.

"One or the other will have to come about, and why not now, while the new Articles are being torn to pieces?"

WILLIAM T. TAYLOR.

(Santiago, Chile, South America.)

London, W.C., May 1st, 1912."

**A Damper for the Prevention of Telephone Disturbances.** A Swedish engineer, Mr. Saxenberg, has invented an apparatus to prevent, or, at all events, reduce, buzzing and all such noise which does not concern the conversation. The apparatus is very simple, consisting of a kind of adjustable leak resistance for extra currents on the line in the shape of two columns of water, which are connected with each other and the earth at one end, while the other ends are coupled to the telephone wires. One of these devices is to be inserted at each end of the line, near the telephone apparatus, so as to enable the user of the telephone to reach it, and, by adjusting the one or the other electrode up or down, to cause the buzzing to disappear. By means of its resistance, which is non-inductive, the damper conducts to earth all static charges or induced currents, which take this path in preference to the inductive circuit through the telephone. At the same time, it gives an excellent protection against discharges of

electricity from the atmosphere. As both the electrodes can be regulated and the resistances at the poles can thus be varied quite independently of each other, it also becomes possible to compensate for various leakages which may occur in the line. The leakage and the induction vary according to the weather and the atmospheric conditions, and a readjustment of the apparatus accordingly is often necessary so as to obtain the greatest possible "buzz-damping" effect. It is therefore recommended, as mentioned above, to place the apparatus in such a position as to render it easily accessible.

The apparatus has been tested on the line Vesteraas-Traangfors, which was previously nearly useless, and the improvement was astonishing. Previously attempts had been made to obtain the same effect by the installation of an inductance coil between the wires, the centre of which was connected with earth. But such an apparatus has the great disadvantage of offering an inductive resistance, and apart from this there is this drawback, that the two portions are not adjustable in respect of their mutual relation. It therefore does not stand any chance as compared with the adjustable "buzz-damping" apparatus, which is non-inductive, and which is applicable as a remedy against all kinds of ordinary disturbances that are likely to take place. The apparatus has been brought into the market by the Allmänna Svenska Elektriska A.B. —*Teknisk Tidsskrift*.

### An Auxiliary Oil-Burning Generating Station.—

The growth of electrical service in the Los Angeles district of Southern California has necessitated many enlargements of existing systems of production, transmission and distribution, and conspicuous among the new facilities of the district, the Long Beach oil-burning steam-turbine station of the Southern California Edison Co. stands as a model installation.

The new plant, which has lately been placed in operation as an auxiliary to the existing hydro-electric system of the company, is situated about 25 miles south-west of the city of Los Angeles. The site was selected on account of the availability of condensing water and opportunities for expansion afforded, the possibilities of securing high efficiency of operation far off-setting the moderate transmission required to the centre of distribution. Within a few miles of Long Beach connection is made with the high-tension system of the company by two three-phase 60,000-volt and two three-phase 30,000-volt lines carried on steel towers. The plant is thus available at all times for continuous or temporary service in parallel with the hydro-electric stations of the company, and in the handling of both sudden and sustained peak loads constitutes a valuable insurance against irregularities of service.

The initial service has been initiated with a 15,000-K.V.A. turbo-alternator supplying three-phase, 50-cycle, 11,000-volt current. Eight water-tube boilers supply steam to each turbine and its auxiliary machinery at a pressure of 225 lb. per sq. in. and 125° F. superheat.

The fuel-oil supply for the station is delivered to storage tanks outside the building by gravity from tank trucks, or a neighbouring commercial pipe-line. It is estimated that four truck-loads of oil per day will be consumed by the plant at present, and this fuel will be supplied by the California field.

The storage tanks are made of reinforced concrete and situated 700 ft. from the station, the tops of the tanks being at ground-level. From these main storage tanks the oil is delivered to two auxiliary tanks outside the boiler-room through a 6-in. pipe-line, two triplex pumps driven by 5-H.P. induction motors being required. Each of the auxiliary tanks is fitted with live steam coils for pre-heating, and from these reservoirs the fuel is fed into the furnaces through Hammel burners, two steam pumps being used in this connection. The oil is heated to 130° F. in a feed-water heater, and the combustion is controlled by an automatic regulating system. The heaters are situated in the boiler-room near the base of the chimney, and insure a centralised delivery to the various firing lines. Four burners are installed per boiler, all being at the back of the furnace. Special attention has been given to the problem of securing economical working. A large number of instruments and recorders have been installed which will supply information comparable to that obtained under test conditions, and which will enable any departure from economical operation to be detected with minimum loss of time.

The turbine is of the five-stage Curtis type, running at 750 R.P.M. Oil for the step bearings is furnished by two duplex pumps working at 1,300 lb. per sq. in. on the delivery side. Two 125-KW. 125-volt horizontal turbo-excitors are installed, each exciter being capable of handling two generators. The exciters are worked non-condensing, exhausting into the feed-water heater.

Other interesting features of the station, according to the *New York Electrical World*, include the handling of all electrical output in a separate transformer and switchgear house; the use of auxiliary feed-water heating apparatus with the turbine condensers; use of the base of one chimney as a store-room and lavatory; installation of coloured wiring in connection with the control of oil switches; use of copper tubing instead of bar conductors for bus-bars and connections, and a complete system of oil circulation from motor-driven pumps for transformer cooling.

All the electrical equipment was supplied by the General Electric Co.

**Resuscitation from Electric Shock.**—The Commission on this subject appointed by the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers, has adopted the Schaefer system as the best method of resuscitation, and is preparing a chart giving details of first aid and describing the method.—*Electrical Review and Western Electrician*.



**Remuneration of Auditors.**—The general method of remunerating auditors of companies consists of voting them a stated sum for their services. It is, therefore, unusual to observe that, at a recent general meeting of a company, a firm of accountants were re-elected auditors for the ensuing year at the remuneration of 150 guineas in the event of the dividend on the ordinary shares for the year 1912 being less than 5 per cent. with an addition to such sum of 50 guineas in the event of the dividend being 5 per cent. or over. There may be special circumstances in the case, of which we are not aware; but it strikes us as being incongruous to introduce something of a single direction sliding scale in such a matter by apparently endeavouring to harmonise the audit fees with the profits.

**Educational Notes.**—A special short series of lectures on Rubber, arranged by the Imperial College of Science and Technology, is being delivered at the Royal College of Science by Dr. Philip Schidrowitz, who recently said that a fair proportion of plantation rubber was, in his opinion, already superior to any other rubber produced, not excluding "fine hard" Para, and there was very little doubt that at no very distant date it would replace the latter as the standard of quality. A high-grade rubber had been produced by a chemical process from a very low-grade raw material, namely, Jelutong.

**Poor Inventors.**—Mr. Bottomley recently asked the President of the Board of Trade whether he would consider the desirability of establishing a department for the purpose of aiding poor inventors in the development and completion of such patents as might, in the opinion of the Board, be of public utility. Mr. Buxton said that under the present practice of the Patent Office all possible help and assistance were given by the staff to every inventor in preparing the specifications and other documents necessary for obtaining patent rights. Having regard to the position of the Crown in granting patents, he did not think it would be practicable or advisable to establish a Government Department with any larger duties in the direction suggested.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—The Wakefield Electricity Committee last week recommended the Council to appoint Mr. B. HAWKINS, of the Wakefield Corporation Electricity Department, as station superintendent, and Mr. H. SIMPSON, of Manchester, was appointed junior shift engineer.

Mr. G. P. COSWAY has resigned his position as chief assistant engineer to the Nuneaton Corporation Electric Department, in order to become manager of the Nuneaton Electrical Contracting Co., Ltd.

Mr. A. C. BOSTEL, superintendent at the showroom of the Croydon Corporation Electricity Department, has been granted an increase of salary from £169 to £190, rising to £230 per annum.

The Stoke-on-Trent T.C. has appointed Mr. FREDERICK WILLIAM LAWTON, of Newcastle-on-Tyne, as mechanical draughtsman in the Electrical Engineer's Department.

Mr. G. M. HENDERSON having resigned the position of meter room superintendent at Brighton electricity works, Mr. W. KING, his assistant, has been appointed to succeed him, at £156 per annum, rising to £180.

The Bridlington T.C. has appointed Mr. FREDERICK FRENCH, of Kidderminster, as mains assistant.

The Rochdale Tramways Committee has advanced, by £25 per annum, the salary of Mr. J. S. D. MOFFET, the tramways manager, who was responsible for planning the Whitworth, Bacup and Milnrow extensions. A further increase of £25 takes effect a year hence.

**Tramway Officials.**—The staff of the Isle of Thanet Electric Tramways and Lighting Co., Ltd., has presented a golf bag and clubs to Mr. J. A. FORDE, manager, as a token of esteem, together with an oak tray for Mrs. Forde.

Preston Corporation Tramway employes met on April 26th to bid farewell to Mr. WM. BARKER, an inspector, who is about to leave to take up a position in Western Canada. Mr. Barker was presented with a kit bag, dressing case and pocket-book, and Mrs. Barker was also made the recipient of a dressing case.

**General.**—Mr. V. ZINGLER, for seven years manager of the publicity department of Messrs. Siemens Bros. & Co., Ltd., has been appointed manager of Messrs. Ozonair, Ltd., 96, Victoria Street, Westminster, London, S.W., in succession to Mr. R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E., who is joining the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., in order to devote his attention to the promotion of the sale of electric heating and cooking apparatus.

Mr. C. J. CATER SCOTT has resigned the chairmanship of the London United Tramways, Ltd., and has retired from the board of directors. He has become chairman of the London General Omnibus

Co. Mr. W. M. ACWORTH, a director of the London Electric Railway, has been appointed a director of the London United Tramways, Ltd., and will take the office of chairman.

The *Review of the River Plate* says that Mr. W. C. LAIDLER, the new manager of the Province of Buenos Ayres Electric Light Co., has arrived to assume his duties.

Mr. C. C. POWELL, district electrical engineer of the Southern lines of the London United Tramways, who has been appointed assistant engineer to the Madras Electricity Supply Co., has been presented by his colleagues with a folding pocket camera.

*Indian Engineering* states that the HON. SIR CHARLES STEWART WILSON has taken over charge of the Indian Telegraph Department from Mr. Dempster, and will now exercise control over both the Post and Telegraph Departments in his new capacity as Director-General of Post and Telegraphs.

According to the *Railway Engineer*, Mr. F. E. MILLS, formerly of the Natal Government Railway, has been appointed chief electrical engineer to the Union of South Africa Railways.

Mr. M. I. WILLIAMS-ELLIS, consulting electrical engineer, who left Buxton about a year ago for an extended business tour in South Africa, will arrive in England again about the middle of May, when his London address will be the Arundel Hotel.

The marriage recently took place at St. Agnes' Church, Moseley, of Mr. HENRY WILLIAM POWELL, only son of Mr. W. H. Powell, of Ashfield Avenue, Moseley, Birmingham, and Miss E. Parfitt, eldest daughter of the late Mr. Louis E. Parfitt, of Ashfield Road, King's Heath.

The marriage took place at St. Andrew's Church, Bruntcliffe, on April 24th, of Mr. EDWARD WM. NORRIS, chief electrical engineer on the *Morning Post*, London, and Miss Ethel Maria Wilson, youngest daughter of the late Mr. John Wilson, of Morley.

The following interesting announcement appeared in yesterday's *Daily Telegraph*:—"Wordingham—West.—On April 30th, 1912, at St. John's, Redhill, Surrey, by the Rev. J. W. Crauford Murray, M.A., CHARLES HENRY WORDINGHAM, M.Inst.C.E., to Emily Anne, elder daughter of the late Charles John West, J.P., of Goodwood, Maryboro', Queensland." We tender our hearty congratulations to the Electrical Engineer-in-Chief to H.M. Navy.

**Obituary.**—Mr. C. DAY.—The death occurred on April 22nd, after a short illness, of Mr. Chas. Day, for many years superintendent of the overhead wires of the Bolton municipal tramway undertaking. Deceased, who was 42 years of age had had charge of the overhead equipment since the completion of the work.

We regret to announce the death of Mr. HINDELL PARSONS, vice-president of the General Electric Co., of New York. Mr. Parsons met his death in an accident to his automobile near Albany, N.Y., on the 29th ult.

The *Edinburgh Evening Dispatch* states that among the passengers who were lost in the *Titanic* was Mr. ROBERT DOUGLAS NORMAN, aged 27 years, who was born at Edinburgh, and who, as part of his education, spent three years at Berlin University. He had resigned his appointment as an electrical and civil engineer under the A.E.G. Co. (Glasgow) in order to pay a visit to a brother in Vancouver, and to make a trip round the world.

It is with a deep and personal regret that we record the death of Mr. JOHN GRAY, B.Sc., Examiner at the Patent Office, which occurred on April 28th at his address at Clapham, from pneumonia. We hope to allude to his work in our next issue.

## NEW COMPANIES REGISTERED.

**Dubilier Electrical Syndicate, Ltd. (121,358).**—This company was registered on April 11th, with a capital of £10,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with W. Dubilier. The subscribers (with one share each) are:—L. O. C. Hathaway, 8, Wychiffe Road, Battersea, S.W., clerk; F. C. Parmenter, 48, Upper Richmond Road, S.W., clerk. Private company. Table "A" mainly applies. Registered office, 96-8, Leadenhall Street.

**Aberdare Electrical Engineering Co., Ltd. (121,424).**—This company was registered on April 16th, with a capital of £1,000 in £1 shares, to take over the business of electrical engineers and contractors for and dealers in electrical apparatus and appliances carried on by A. E. Belsten and B. Lewis, at 27, Victoria Square, Aberdare, Glamorgan, as Ben Lewis & Co. The subscribers (with one share each) are:—A. E. Belsten, 27, Victoria Square, Aberdare, electrical engineer; B. Lewis, 50, Gadlys Road, Aberdare, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Belsten and B. Lewis; qualification, £25; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**W. J. Furse & Co., Ltd. (121,420).**—This company was registered on April 15th, with a capital of £20,000 in £1 shares, to carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of and dealers in electric, railway, tramway and other apparatus, &c., and to adopt an agreement with W. J. Furse. The subscribers (with one share each) are:—W. J. Furse, 11, Loughborough Road, West Bridgford, Notts., electrical engineer; W. F. Furse, Holmview, Victoria Embankment, Notts., electrical engineer. Private company. W. J. Furse is permanent governing director, subject to holding £1,000 shares or stock; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Caledonian Telephone (New System) Co., Ltd. (8,219).**—This company was registered in Edinburgh on April 17th, with a capital of £2,500 in £1 shares, to carry on the business of fitting up private telephones and telegraphs. The subscribers (with one share each) are:—L. Muller, 62, Robertson Street, Glasgow, merchant; F. J. Jackson, 143-5, Great Portland Street, W. Private company. The number of directors is not to be less than two or more than five; the first are L. Muller and F. J. Jackson; qualification, one share. Registered office, 62, Robertson Street, Glasgow.



**British Engineers' Association** (the word "Limited" is omitted from the title by licence of the Board of Trade) (121,640).—This company was registered on April 26th, with an unlimited number of members, each liable for £1 in the event of winding up, to protect and promote the general interests of British Manufacturing Engineers, &c. The subscribers are:—C. H. Whittington, Queen Anne's Chambers, Westminster (director, Mather and Platt, Ltd.); P. B. Crowe, Queen Anne's Chambers, Westminster (director, W. H. Allen, Son, & Co., Ltd., Bedford); J. Cunningham Ford, 174, Bedford Hill, Balham, S.W. (director, F. Cooke & Sons, Ltd.); W. Stokes, 82, Victoria Street, Westminster (chairman, Ransomes & Rapier, Ltd.); J. E. Thornycroft, Caxton House, Westminster (managing director, John E. Thornycroft and Co., Ltd.); C. S. Schultz, 63, Pall Mall, S.W. (assistant managing director, Dick, Kerr, & Co., Ltd.); W. McDermott, 3, London Wall Buildings, E.C. (managing director, Fraser & Chalmers, Ltd.); F. R. Davenport, Bennfield, Rugby (managing director, Willans & Robinson, Ltd.); R. S. Lloyd, 99, Queen Victoria Street, E.C. (director, Hayward, Tyler, & Co.); A. H. Smith, Broad Street House, E.C. (London manager, Holman Bros., Ltd.); A. Anderson, Ocean Ironworks, Salford (director, Edward Wood & Co., Ltd.); H. Marsh, 21, Mincing Lane, E.C. (director, George Fletcher & Co., Ltd.); W. Beswick, Parkfield Works, Stockton-on-Tees (general manager, Power Gas Corporation, Ltd.); T. O. Callender, Hamilton House, Victoria Embankment, E.C. (managing director, Callender's Cable and Construction Co., Ltd.); T. C. Stewart, 41, Oswald Street, Glasgow (director, Stewarts & Lloyds, Ltd.); E. Jackson, Midland Works, Birmingham (general manager, Midland Railway Carriage and Wagon Co., Ltd.). The management is vested in a Council, the first members of which are:—C. H. Whittington, P. B. Crowe, J. Cunningham Ford, W. Stokes, J. E. Thornycroft, C. S. Schultz, W. McDermott, F. R. Davenport, R. S. Lloyd, A. H. Smith, A. Anderson, H. Marsh, W. Beswick, T. O. Callender, T. C. Stewart, and E. Jackson. Registered by Cullen & Allingham, 15, Duke Street, St James's, S.W.

**Electric Hammers, Ltd.** (121,553).—This company was registered on April 22nd, with a capital of £5,000 in £1 shares, to acquire from J. Scott his rights under an agreement between himself and E. J. Faraday, in a patent hammer for chipping steel or other hard substances. The subscribers are:—F. W. Baker Young, 54, Merton Road, Bootle, surveyor, 400 shares; J. Crichton, Huskisson Engine Works, Derby Road, Liverpool, engineer, 300 shares; J. A. Morton, 30, Regent Road, Liverpool, ship cementer, 250 shares; H. E. Henderson, Huskisson Engine Works, Derby Road, Liverpool, engineer, 200 shares. Private company. The number of directors is not to be less than two or more than seven: the first are J. Scott, C. J. Faraday, F. W. B. Young, J. Crichton, H. E. Henderson, and J. A. Morton. Registered office, 62, Dale Street, Liverpool.

**Walter S. Vaughton, Ltd.** (121,545).—This company was registered on April 20th, with a capital of £2,000 in £1 shares, to take over the business of an electrical engineer carried on by W. S. Vaughton, at 38, Barwick Street, Birmingham. The subscribers are:—T. A. Vaughton, Gothic Works, Livery Street, Birmingham, goldsmith, five shares; W. S. Vaughton, 38, Barwick Street, Birmingham, electrical engineer, one share. Private company. The number of directors is not to be less than two or more than five; the first are T. A. Vaughton (chairman), W. S. Vaughton (managing director), and Mrs. E. S. Vaughton. Registered office, 38, Barwick Street, Birmingham.

**Hydro-Electric Power and General Trust, Ltd.** (121,598).—Registered April 24th, by Linklater, Addison & Brown, 8, Bond Court, Walbrook, E.C. Capital, £500,000 in £5 shares. Objects: To acquire and hold any stocks, bonds, debentures, shares, scrip or other securities of any company established for the purpose of any railway, tramway, gas, water, dock, telegraph, electric lighting or power undertaking. The signatures (with one share each) are:—G. E. A. Waller, 167, Brondesbury Park, Cricklewood, N.W., clerk; G. Dickson, 20, Lovelace Gardens, Southend-on-Sea, clerk; W. J. Simpson, 35, King's Road, Willesden Green, N.W., clerk; E. J. Alldis, 18, Macdonald Road, Forest Gate, E., clerk; J. Coneybeare, 32A, Quinton Street, Earlsfield, S.W., clerk; L. H. Butcher, 52, Gaskarth Road, Balham Hill, S.W., clerk; A. P. Hollinshead, 29, Forthbridge Road, Clapham Common, S.W., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than seven) are the Earl of Denbigh, Newnham Paddox, Lutterworth; F. T. Bulteel, Plymouth; the Hon. R. V. Grosvenor, 88, Gloucester Place, W.; Sir James Pender, Bart., Donhead House, Salisbury; and A. Elliott, 2, Fenchurch Avenue, E.C.; qualification, £1,000; remuneration, £200 each per annum (chairman, £300) and 5 per cent. of the profits available for distribution in excess of 10 per cent. dividend. Registered office, 3, Frederick's Place, Old Jewry, E.C.

**British Union Lamp Works, Ltd.** (121,641).—This company was registered on April 26th, with a capital of £20,000 in £10 shares, to carry on the business of manufacturers of and dealers in carbon, metal and other filaments and lamps for electric lighting, suppliers of electric light and power, electricians, &c., to acquire the business carried on by the British Tungsten Lamp Co., Ltd., and to adopt an agreement with T. Griffiths. The subscribers (with one share each) are:—N. R. Stirling, 37, Malling Road, Southport, builder; G. E. Jowett, Yew Tree House, Eccles, Lancs., general merchant. Private company. The number of directors is not to be less than three or more than four; the first are T. Griffiths (chairman) and N. R. Stirling (both permanent, subject to holding 100 shares) and others to be appointed by the subscribers. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Underground Electric Railways Co., of London, Ltd.** (73,376).—Trust deed dated April 1st, 1912, to secure £1,400,000 first cumulative income debenture stock, charged on £1,000,000 ordinary stock of the London General Omnibus Co., Ltd., and all further amounts of such stock acquired wholly or partly by this issue. Trustees: Union of London and Smith's Bank, Ltd. Trust deed dated April 1st, 1912 (supplemental to trust deed dated July 30th, 1908), to secure £1,300,000 income bonds, ranking *pari passu* with £5,200,000 like bonds at present authorised, charged on £1,000,000 ordinary stock in London General Omnibus Co., Ltd., and other assets specifically charged by trust deed of even date for securing £1,400,000 income debenture stock, subject to such charge, and, as additional security for the whole £6,500,000 income bonds to be issued under said deed of July 30th, 1908, and supplemental deed of April 1st, 1912. Trustees: London County and Westminster Bank, Ltd., Lothbury, E.C.

**Hill, Harding & Co., Ltd.**—A memorandum of satisfaction in full on March 29th, 1912, of debentures dated June 30th, 1910, securing £100, has been filed. Particulars of £600 debentures, created April 1st, 1912, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £150. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Reason Manufacturing Co., Ltd.** (64,701).—A memorandum of satisfaction in full on December 29th, of charge dated July 4th, 1911, securing £1,000, has been filed.

**"Z" Electric Lamp Manufacturing Co., Ltd.** (96,594).—Issue on April 19th, 1912, of £1,100 debentures, part of a series of which particulars have already been filed.

**Foreign and Colonial Lighting, Ltd.** (99,020).—Charge on company's undertaking, patents, rights and other property, dated April 11th, 1912, to secure £500. Holder: A. B. Reckitt, Kenmore, Highlands, St. Leonards-on-Sea.

**British L. M. Ericsson Manufacturing Co., Ltd.** (79,061).—A memorandum of satisfaction in full on March 21st, 1912, of debentures dated November 19th, 1908, and October 1st, 1911, securing £70,000, has been filed. Particulars of £100,000 debentures, created April 4th, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold hereditaments at Beeston. Trustees: Aktiebolaget Stockholms Handelsbank.

**Hendon Electric Supply Co., Ltd.** (93,911).—Particulars of debenture stock for an amount not exceeding the subscribed capital, created by resolutions of July 29th, 1907, and March 20th, 1912, and secured by trust deed dated July 30th, 1907, and acknowledgement of indebtedness dated April 2nd, 1912, supplemental thereto, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £8,000. Property charged: The company's undertaking and property, including uncalled capital. Trustees: Beaver Trust, Ltd.

**Electromobile Co., Ltd.** (75,139).—Issue on April 3rd, 1912, of £161 5s. debentures, part of a series of which particulars have already been filed.

**Tramways (M.E.T.) Omnibus Co., Ltd.** (119,684).—Trust deed dated March 14th, 1912, to secure £100,000 debenture stock, charged on 19s. per share uncalled on 100,000 £1 shares allotted to the Metropolitan Electric Tramways, Ltd., and company's undertaking and other assets, present and future. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

**British Columbia Electric Railway Co., Ltd.** (51,953).—Return dated December 14th, 1911, filed March 9th, 1912. Capital £4,000,000 in £1,000,000 5 per cent. cumulative perpetual preference stock, £1,000,000 preferred ordinary stock, £1,000,000 deferred ordinary stock and 1,000,000 shares of £1 each. All the 5 per cent. cumulative perpetual preference, preferred ordinary and deferred ordinary stock taken up. £2,800,000 paid. £200,000 deferred stock considered as fully paid. Mortgage and charges, £2,367,613.

**C. J. Thursfield & Co., Ltd.**—Particulars of £4,000 debentures, created April 1st, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and book debts. No trustees.

**Johnson & Phillips, Ltd.** (84,968).—Issue on March 28th, 1912, of 16,000 debentures, part of a series of which particulars have already been filed.

**Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.** (107,947).—Trust deed dated March 27th, 1912, to secure £20,000 prior lien debenture stock and having priority in point of undertaking and assets over existing debenture stock, charged on certain premises, and company's other assets, present and future, including uncalled capital. Trustees: Right Hon. Lord Waleran, P.C., 44, Hans Mansions, S.W.; and Right Hon. Lord Rotherham, 61, Queen's Gate, S.W.

**Lechlade Electric Light and Power Co., Ltd.**—Particulars of £350 debentures, created March 18th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

## CITY NOTES.

### British Thomson-Houston Co., Ltd.

THE directors' report covers a period of nine months, from April 1st to December 31st, 1911. This change in the fiscal year was mentioned in the last annual report, as it was considered desirable that the fiscal year should end on December 31st instead of March 31st.

**Works at Rugby.**—The buildings and machinery of the company have been maintained in first-class condition during the year. A number of extensions were mentioned in the last annual report, the most important being a four-floor building to be utilised as a winding department, and a three-floor extension to the iron foundry. The winding department has been completed; the extension of the iron foundry is approaching completion. The company has recently acquired a tract of land adjoining its Rugby premises, having an area of about 12 acres, and a strip of land 30 ft. wide, lying next to and the full length of the approach to the works, for further extensions as they become necessary, some of which are now being proceeded with.

**Works at Coventry.**—The company has acquired on lease the premises formerly occupied by Messrs. Humber, Ltd. The necessary alterations are now being made. These works will be used for the manufacture of meters, instruments, and similar apparatus, and it is expected that they will be ready for occupancy in the very near future.

**Works at Willesden.**—The company has also acquired a tract of land at Willesden on which it is erecting a factory to be used solely for the manufacture of Mazda lamps. The present lamp factory at Rugby will be maintained.

**Metallic Filament Lamps.**—The advertising campaign in connection with Mazda lamps has been continued, and has been justified by the rapid expansion of lamp sales. The manufacture of the old pressed tungsten filament has been entirely abandoned, and only pure drawn tungsten wire is now used in the manufacture of Mazda lamps, with the most satisfactory results. In last year's report it was stated that the company had acquired premises in Upper Thames Street (adjacent to Cannon Street and Queen Street), in London, which would be known as "Mazda House," and devoted to the sale of lamps and wiring supplies. Unfortunately very



shortly after these premises were opened for business, a disastrous fire occurred, and, although insured, a considerable amount of trouble and loss was caused. The restoration has been completed, and the lamp and wiring supplies department is once more reinstated in these premises.

**Curtis Steam Turbines.**—The turbine business of the company continues to show satisfactory results, and the largest number of turbines that the company has had on order are now in course of manufacture. The directors can repeat the statement in last year's report to the effect that the shops are full of work, and this has brought about a marked improvement in the company's progress, as will be seen from the balance-sheet. The satisfactory rate of increase in "orders received" has been fully maintained from December 31st last down to the date of this report.

Under the terms of the trust deed securing the issue of the company's debentures, the company had to pay to the trustees on February 28th last the sum of £3,339, to be applied by them in purchasing debentures in the market. Since the closing of the books, debentures of the par value of £3,545 have been purchased, making the total par value of debentures retired to date £17,305. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, depreciation of shares held by the company, and other contingencies. The balance-sheet, after paying interest on debentures and loans, shows a profit of £23,081 as the result of the nine months' working, and the directors recommend that this should be appropriated as shown in the profit and loss account, leaving a balance of £4,379. This together with the previous year's balance, makes a total amount to be carried forward of £7,382.

### Deutsch-Atlantische Telegraphen Gesellschaft.

THE report for 1911 of the German Atlantic Telegraph Co., of Cologne, states that a gratifying increase took place in the Atlantic business, and traffic on the Vigo cable also further developed. The North German Sea Cable Works Co., in which the company holds a large financial interest, had been employed, apart from other orders for cables, in the manufacture of the Monrovia-Pernambuco cable of a length of 2,108 miles, which was laid in a period of 10 days. By the introduction of a new system the speed on the Emden-Vigo cable had been increased by 50 per cent., and it was also intended to use it in connection with the Atlantic cables. Since January 1st, 1912, messages in ordinary language had been accepted at half rates for transmission after fully paid telegrams had been despatched. It was expected that this practice would develop a new kind of business on the part of those who would not otherwise use the cable service. The accounts indicate gross receipts of £267,000, as compared with £260,000 in 1910. After meeting general expenses and taxation charges, the sum of £7,500 has been set aside for cable repairs, £29,000 for the cable redemption fund, and £7,400 for depreciation, these contrasting with £5,400, £29,000, and £6,300 respectively in the previous year. Including the balance forward, the net profits amount to £166,000, as against £167,000 in 1910. It is intended to distribute 7½ per cent. on the ordinary capital of £1,200,000, being the same rate as in 1910.

### Brisbane Electric Tramways Investment Co., Ltd.

—The directors report that the revenue account for 1911, including £3,526 brought forward, shows an available balance of £110,799. After paying debenture stock interest and interim dividends paid on preference and ordinary shares, £67,902 remains. Out of this the directors recommend a balance dividend on the preference shares, £8,828; balance dividend of 4s. per share, free of income-tax, on the ordinary shares, making a cash dividend of 8 per cent. for the year, £15,000; bonus of 10s. per share, free of income-tax, on the ordinary shares, payable in fully-paid ordinary shares, the equivalent of which will be retained for capital purposes, £37,500; carrying forward £6,574. The directors recommend the payment of a further bonus of 10s. per share, free of income-tax, on the ordinary shares out of the reserve fund, to be satisfied by the issue of fully-paid ordinary shares, making, with the bonus of 10s. per share out of revenue, a total bonus of £1 per ordinary share. Thus holders of every five ordinary shares will receive one fully-paid £5 ordinary share, and in cases where holdings are not divisible by five, fractional shares will be sold by the board, and the net proceeds proportionately divided.

**Eastern Extension, Australasia and China Telegraph Co., Ltd.**—The directors announce a dividend for the quarter ended December, 1911, of 2s. 6d. per share, together with a bonus of 4s. per share (or 2 per cent.), tax free, making a total distribution of 7 per cent. for the year.

**British Westinghouse Electric and Manufacturing Co., Ltd.**—The report for 1911, issued just as we go to press, shows a trading profit of £126,144. After allowing for depreciation, interest on debentures and debenture stock, &c., there remains a net profit for the year of £20,708, plus £5,117 brought forward. The Lot's Road turbine litigation is now to be carried to the House of Lords by the company.

**Great Northern Telegraph Co. of Copenhagen.**—The directors have declared a dividend of 12s. per share.

### Calcutta Electric Supply Corporation, Ltd.

THE directors' report for the year 1911 shows that the progress of the company continues satisfactory. During the year 10,566,038 units were sold, compared with 8,940,005 units in 1910. The number of houses connected at December 31st last was 6,383, compared with 5,695 at the same date in 1910, an increase of 688, and the equivalent connections in 8 c.p. lamps show an increase of 87,783. The following figures show the comparative results for the past four years:—

Year.	Houses.	Equivalent connections in 8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1908	.. 3,496	378,835	6,765,792	£115,287	£58,188
1909	.. 5,078	452,272	7,856,383	£127,576	£67,024
1910	.. 5,695	528,938	8,940,005	£137,998	£85,597
1911	.. 6,383	616,721	10,566,038	£151,905	£95,597

The profits for 1911 amount to £95,597, which, with the balance brought forward and interest received on money at deposit, makes a total of £102,200. After deducting the interim dividend at the rate of 7 per cent. per annum paid on the ordinary shares in November, 1911, the dividends paid and accrued on the preference shares, and the other items set out in the net revenue account, there remains an available balance of £63,881. The directors recommend that £32,000 be placed to the credit of the depreciation and renewals account; that £3,000 be added to the reserve fund, and that a final dividend be paid on the ordinary shares for the second half-year, at the rate of 10 per cent. per annum, making 8½ per cent. for the year, which will leave £3,289 to be carried forward after providing for the directors' extra remuneration of £2,050. By the above additions the reserve fund will be increased to £84,101, and the reserve for depreciation and renewals to £85,135. The important work of erecting and equipping the high-tension generating station at Cossipore is rapidly approaching completion, and it is expected that the supply from this station will be commenced in July or August next. To provide the money necessary to meet the payments falling due to the several contractors for these extensive works, the board, in November last, offered to the shareholders for subscription the balance of 39,630 preference shares, the whole of which have been taken up, and the issued share capital is now £1,000,000. In order to fill the vacancy caused by the death of the late Mr. Edmund Bulnois, the board have elected Major-General Reginald Henry Mahon, C.B., C.S.I., a director.

Total generated kw.-hours	.. .. .	12,395,138
Kw.-hours sold—public lamps	.. .. .	5,656
To consumers by meter for lighting	.. .. .	3,336,857
To consumers by meter for power	.. .. .	7,223,525
Total sold	.. .. .	10,566,038
Used on works, kw.-hours	.. .. .	712,161
Not accounted for, kw.-hours	.. .. .	1,116,939
Accounted for, kw.-hours	.. .. .	11,278,199
Maximum supply demanded, kw.	.. .. .	4,160

**Craigpark Electric Cable Co., Ltd.**—The accounts for the year ended March 31st show a net profit of £6,543, which, with the balance of £480 brought forward from last account, makes the sum of £7,024. The directors now recommend the following appropriations, viz.: Depreciation off buildings and machinery, £500; reserve account, £500; dividend (already paid) on 47,500 6 per cent. preference shares, for half-year ending September 30th, 1911, £1,425; ditto for half-year ending March 31st, 1912, £1,425; dividend on 37,500 ordinary shares, at 6 per cent., for the 12 months ending March 31st, 1912, £2,250; cost of new issue of preference shares—one-half of balance, £183; balance carried forward (subject to payment of directors' fees for the past year), £741. The volume of the business in the cable department continues to expand, and although prices have not been quite up to those of last year, there have been corresponding reductions in the prices of the raw material, which have practically equalised matters. Other departments have also yielded average profits, and all are fully employed. Prospects for the current year are highly satisfactory. The stocks have been carefully gone over by the managing director, and are certified by him as being correct.

**Cuba Submarine Telegraph Co., Ltd.**—The directors' report for the half-year ended December, 1911, states that the total receipts were £18,691, while the expenses amounted to £6,499, leaving £12,191, plus £7,294 brought forward, giving a total of £19,486 to be dealt with. £2,000 has been placed to the reserve against loss on investments, and £2,030 added to the reserve fund, which now stands at £88,000. The dividend on the preference shares will absorb £3,000, and leave £12,456, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax; the balance, £7,656, being carried forward. The main cables have continued in good order throughout the half-year. The new cable between Cienfuegos and Cape Cruz was successfully laid, and is now working in perfect condition.

**Prospectus.**—*Empire District Electric Co.*—The list was to close last Tuesday in an offer of \$1,500,000 first mortgage 5 per cent. sinking fund gold bonds in this American company, at 92½. The company owns the assets of four U.S.A. electric light and power companies, and the capital stock of four other power and gas companies.

**City of Buenos Ayres Tramways Co. (1904), Ltd.**—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the quarter ended March 31st.



### Neuhausen Aluminium Industry Co.

THE report of the directors of the Aluminium Industrie, A.G., of Neuhausen, states that the unfortunate conditions in the market for aluminium continued during the whole of 1911, and gave occasion to the company to introduce such competitive prices as would assure its position in the world's market. As a consequence the company had secured full employment, although not remunerative, for its works for the whole of 1912. The hope is expressed that this will contribute towards bringing about in the near future of the understanding which is desired by all interested parties. Satisfactory results were realised in the carbide department under the influence of the carbide syndicate, and the experimental plant for the production of nitric acid also worked satisfactorily. The larger installation which had already been completed would be set in operation this spring. An expenditure of nearly £136,000 was incurred in making extensions of the works in the Vallais Canton, and a large outlay was also devoted to the Marseilles works and the goldsmithy. The accounts show the following figures for the two years:—

	1911.	1910.
Paid-up share capital.. ..	£520,000	£520,000
Working profits .. ..	182,000	160,000
Depreciation .. ..	45,000	44,000
Net profits and balance forward ..	131,000	138,000
Dividend, per cent. .. ..	14	14

During the year the company raised a  $4\frac{1}{2}$  per cent. loan of £240,000, thus increasing the loan capital to £439,000.

### German Electrical Companies.

The Felten & Guilleaume Carlswerk A.G., of Mulheim, reports net profits of £210,000 for 1911, as compared with £140,000 in the previous year. It is intended to pay a dividend of 6 per cent., as contrasted with 4 per cent. in 1910.

The Kabelwerk Wilhelminenhof A.G., of Berlin, has declared a dividend of 15 per cent. for 1911, being the same rate as in the preceding year. According to the report submitted at the recent meeting, the undertaking was actively employed in all departments. The net profits, after placing £4,300 to depreciation, as against £5,600, amounted to £12,700, as compared with £10,900 in 1910.

The Dr. Paul Meyer A.G., of Berlin, which manufactures electrical measuring instruments and apparatus, reports an increased turnover of 20 per cent. in 1911. After allocating the sum of £6,900 to depreciation, as against £5,500 in 1910, the accounts show net profits of £14,700, as compared with £14,100. A dividend at the rate of  $7\frac{1}{2}$  per cent. has been declared on the share capital of £125,000, as contrasted with a similar rate on £100,000 in 1910.

The Sachsenwerk, Licht und Kraft A.G., of Dresden, reports the delivery of 10,040 machines of 108,739 H.P. in 1911, as compared with 7,108 of 75,380 H.P. in the previous year. A number of overland stations were equipped or extended, and the turnover, particularly in Rhineland and Upper Silesia, was almost doubled. After allocating £6,500 to depreciation, as against £5,900 in 1910, the net profits are £21,000, as compared with £10,800, and a dividend of 6 per cent. is proposed on the capital of £212,000, being the same as in 1910.

The Land und Seekablewerke, A.G., of Cologne-Nippes, reports that the works were well employed throughout 1911, although sale prices were not satisfactory in some departments. After apportioning £16,000 to depreciation, as against £5,900 in 1910, the net profits and balance forward are recorded at £30,900, as compared with £17,800 in the previous year. A dividend has been declared at the rate of 9 per cent. on share capital of £262,500, as contrasted with 5 per cent. in 1910. A good stock of orders was brought over into 1912, although sale prices of some manufactures still left something to be desired.

The report of the Hedderheim Kupferwerke und Suddentsche Kabelwerke, A.G., of Frankfurt-on-Main, states that the trade contest, especially in the case of copper and brass manufactures, still continued in 1911. In the cable factory overtime frequently had to be worked, but sale prices, particularly for insulated conductors, might have been better. Nevertheless comparatively good results were obtained owing to favourable purchases of materials and an extension of the turnover. After setting aside £16,000 for depreciation, as against £14,000 in 1910, the net profits amount to £44,000, as compared with £39,000 in the previous year. It is proposed to distribute 7 per cent. on the share capital of £450,000, as contrasted with a similar rate on £400,000 in 1910.

The Accumulatoren-Fabrik, A.G., of Berlin and Hagen, which has an ordinary share capital of £400,000, had a turnover of £1,023,000 in 1911, as compared with £892,000 in the previous year, the values representing the combined business of the German and Austrian factories. According to the directors' report, the trade in transportable batteries experienced a further favourable development, and the orders in general in the first quarter of the new financial year showed an increase over the corresponding period in 1911. The accounts indicate gross receipts of £366,000, as against £287,000 in 1910. Depreciation absorbs £17,000, as compared with £12,000, and working and management expenses £196,000, as contrasted with £192,000, the net profit and balance forward being returned at £127,000, as against £82,000 in the preceding year. It is proposed to pay 25 per cent. on the ordinary shares, this comparing with 15 per cent. in 1910, and  $12\frac{1}{2}$  per cent. in each of the four previous years. The company's loan of £150,000 is also to be paid off, notice for this purpose having already been given.

The Deutsche Kabelwerke, A.G., of Berlin-Rummelsburg, reports

that a further considerable increase in the turnover took place in 1911, although prices left much to be desired. The new capital was not fully employed on productive work. As to the several subsidiary companies, it is mentioned that these were developing satisfactory, and the Union Cable Co., of London, would begin working in its new factory in the course of the present year. The gross profits amounted to £58,000, as compared with £54,000 in 1910. After meeting interest charges, and setting aside £5,800 for depreciation, as against £5,100 in the previous year, the net profits are returned at £21,000, as contrasted with £19,000 in 1910. It is proposed to pay 7 per cent. on the share capital of £262,500, as compared with 8 per cent. on £175,000 in the preceding year. An abundance of orders was brought over into the new financial year, and the sales hitherto have exceeded those in the corresponding period in 1911.

The C. Lorenz, Akt. Ges., which is a telephone and telegraph undertaking, has just declared a dividend of 20 per cent. for 1911, being the same rate as in the preceding year. According to the directors' report, the private orders received were more favourable than in 1910 and resulted in an increased turnover. The orders placed by public authorities were also more numerous, although they did not reach the former level. Sale prices, however, were frequently not very profitable, so that despite the larger volume of business the profits only slightly exceeded those obtained in the previous year. If the company suffered less than other firms in the same branches, the reason was to be found in the considerable turnover in relation to the share capital which amounts to £70,000. The department for wireless telegraphy satisfactorily developed, although the orders were not in proportion to the large expenditure on this branch. After writing off £11,000 for depreciation the accounts showed net profits of £17,000, as compared with £16,000 in 1910.

The report for 1911 of the Bergmann Elektricitäts Werke, A.G., of Berlin, states that the machinery departments were well employed throughout the year, but the various foundry strikes had an unfavourable influence on manufacturing. Nevertheless, a considerably larger number of motors, dynamos and apparatus was delivered than in the previous year. Large orders were received for the new driving plant for ship purposes, and the departments for switchboards, high-tension apparatus and transformer construction experienced a further satisfactory development. In the case of electric railway work good results were recorded, and the construction and performance of the high-speed locomotive delivered to the Prussian State Railways had met with full recognition. The turnover in the lamp department was about on the same level as in 1910, although the sales of carbon-filament lamps slightly declined in favour of wire lamps. The reduction in the prices of metallic-filament lamps in the second half of 1911 had the result of extinguishing the profits in this department. A considerable increase in business occurred in installation materials, and the meter department also yielded favourable results although the decline in prices was only equalised by a larger volume of trade. On the other hand, the turbine and large machinery works were not satisfactory owing to the continuance of underselling. Good results were achieved by the ship turbines made by the licensees, and the Imperial Navy Board was now having a battleship equipped with Bergmann turbines. The metal factory was well employed and the cable factory had a larger turnover, although prices were in part unsatisfactory. It was expected that the motor-car department would produce profits in the new financial year. The volume of business increased from £2,540,000 in 1910 to £3,323,000 last year. After writing down stocks by an extra sum of £60,000, as compared with nil in 1910, the accounts exhibit gross profits of £402,000, as against £610,000 in the previous year. General expenses, commission and interest charges, &c., and the allocation of £98,000 to depreciation, as contrasted with £76,000 in 1910, bring the net profits down to £83,000, as against £151,000. It is proposed to distribute 5 per cent. on the share capital of £1,450,000, as compared with 12 per cent. in 1910, and 18 per cent. in each of the four preceding years. The degree of employment in the new financial year has improved, and some departments are realising better sale prices. The company is about to become associated with the Siemens-Schuckert Works Co., which is taking up a large financial interest in the undertaking.

### Stock Exchange Notices.—The Committee has (1) appointed special settling days as under:—

Wednesday, May 8th.—British L. M. Ericsson Manufacturing Co., Ltd.—99,990 (cumulative 6 per cent.) preference shares of £1 each fully and partly (10s.) paid, Nos. 100,011 to 200,000.

Underground Electric Railways Co., of London, Ltd.—1,131,357 "A" ordinary shares of 1s. each fully paid, Nos. 1 to 1,131,357; £1,188,974 17s. 6 per cent. first cumulative income debenture stock.

Thursday, May 9th.—Underground Electric Railways Co., of London, Ltd.—£1,188,980 6 per cent. income bonds, Nos. 53,001 to 53,000 of £200, 53,001 to 59,000 of £100, 60,001 to 64,000 of £50, and 64,001 to 73,449 of £20 each.

And (2) ordered the undermentioned securities to be quoted in the Official List:

British L. M. Ericsson Manufacturing Co., Ltd.—99,990 (cumulative 6 per cent.) preference shares of £1 each partly paid, Nos. 100,011 to 200,000.

Mexican Northern Power Co., Ltd.—£4,500,000 5 per cent. first mortgage 30-year gold bonds, in lieu of the scrip.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £213,000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B 27,501 to 29,630.

### Colombo Electric Trams and Lighting Co., Ltd.—

The annual meeting of this company was held in London last week. The directors declared a dividend of 10 per cent., free of tax, for the year 1911, carrying forward £7,447. £11,000 has been transferred to general reserve and renewal fund.



### Calcutta Tramways Co., Ltd.

THE annual meeting was held on Wednesday, last week, at 1, Queen Victoria Street, E.C., Mr. E. C. Morgan presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW of April 19th, page 649), said that while the gross receipts in 1911 exceeded those of 1910 by £16,000, the expenses had been greater by £8,000, leaving a net increase in receipts of £8,000. The number of passengers carried had exceeded those carried in 1910 by nearly three millions, and the number of miles run by about 350,000. Notwithstanding this increased mileage, the receipts per car and train-mile exceeded those of 1910, and the actual net increase in receipts indicated the advantage of the larger service, which had become more apparent during the current year. A further amount of £10,439 had been expended on capital account, which consisted almost entirely of cost of new cars and equipment rendered necessary by their expanding business, and as no fresh capital had been raised, this account showed an overspent balance of £37,612, which had been provided by revenue, pending the time when the continued expansion of the business might render the readjustment of the capital account needful. That led him to refer to the alterations which were to take place in Calcutta, due to the creation by Government of a new trust whose business it was to make such changes as they might consider were required by the difficulties which now existed in the housing question in Calcutta. To carry out these improvements they were granted very full powers by Government to open new and convenient thoroughfares, and alter the existing main arteries in the city by realignment and widening where required. The scheme was very comprehensive, and would be costly, but the powers granted to the new trust empowering them to levy certain rates would enable them to get over these difficulties, and to carry out the proposals for vastly improving the condition of the city. They were as yet without any definite information as to when and where the contemplated improvements were to commence, but it was expected that no long time would elapse before a start was made. Speaking generally, he thought he might claim that their efforts had brought about a great improvement in the condition of the company; that its position to-day was better in every way than it ever had been, and that the organisation now established gave reasonable ground for looking forward with confidence to still further improvement. It was at first thought that the removal of the capital of India from Calcutta to Delhi would prejudicially affect their traffic, but it was now generally recognised that this was not likely to be the case, and he believed that the steady improvement in their business would in no way be affected by the change.

SIR HENRY KIMBER, Bart., M.P., in seconding the motion, said that recently he had occasion to be in Calcutta, and he took the opportunity of inspecting the whole of the company's system, including the power houses. He was very much pleased with the latter, and he noted with special pleasure the introduction of the Diesel oil-engine system in the Howrah station. The costs were now being got out of the new system as compared with the cost with the old steam boilers, and he believed it would be found that a very large economy was being effected. Speaking generally the results of the past year had been very satisfactory, and there were signs of improvement even at Howrah, where they had carried 200,000 more passengers than in the previous year.

The report was adopted.

### Oriental Telephone and Electric Co., Ltd.

THE annual meeting was held on Wednesday, last week, at the Great Eastern Hotel, E.C., under the presidency of Mr. B. St. John Ackers.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 650), the CHAIRMAN said the result of the year's working had again been satisfactory. The accounts showed a further progress in the revenue, and the amount available for appropriation a further improvement on that of the previous year. They did not recommend a higher dividend than the 8 per cent. distributed during the last five years, as the board wished to see the company becoming financially stronger year by year, bearing in mind the undiminished demand on their capital resources. All their branches had done well during the past year, including the affiliated companies, of which the Bombay and Bengal companies paid higher dividends. He might mention that the Bombay Co.'s shares, which were of the nominal value of 25 rupees, and which two years ago stood at 32, had since risen to their present price of 60 rupees, after having attained an even slightly higher figure. The Bengal Co.'s shares were very firm at par. The negotiations of the Bengal Co. with the Indian Government regarding the acquisition of the latter's telephone system in Calcutta, to which he had made reference on previous occasions, came abruptly to an end last autumn, owing to the Government's decision to transfer the chief seat of the Administration to Delhi, which would naturally entail a very serious reduction of their telephone service in Calcutta. This proposed change of the seat of Government would not, however, apparently interfere with the growth of the Bengal Co.'s general business, which continued to increase unaffected by the change referred to. There might be inducements later on to open a telephone exchange in the new Delhi. The board had already given this possibility their attention, and would not lose sight of it at the proper time. They would have seen the extraordinary resolutions of which notice had been given. The object of the first resolution was to ask their assent to an increase of the board's powers in order to enable them to undertake general business, by altering the memorandum of association to that effect. As stated in the resolution,

the enlarged powers were solely and exclusively asked for for the benefit of the Mauritius establishment. Mauritius was a small island with a very busy but small population. The telephone was introduced there many years ago at the time when all their other stations were established. For a long time they found it a very difficult task to make the telephone pay in so small an area, but by perseverance and the efforts of their present excellent manager there, they ultimately made not only both ends meet, but were able to show a small surplus. The concession they secured from the Mauritius Government last year would enable them to extend the telephone business somewhat; but it would, by itself, never yield the proportionate results which they had achieved in other places. nor would it ever support a really first-class manager. For some years past, therefore, they allowed their present manager, a most capable, energetic and cautious man, at his urgent request, tentatively and for small amounts, to sell a variety of English goods which they sent out to him, but which did not come under the definition of electrical appliances, to which their powers at present were restricted. The result of this experiment had been entirely gratifying; and as the telephone profits in Mauritius did not suffice to support a manager such as they would approve of. together with the necessary assistant, they had now to decide whether this new departure was to be continued or not. The object of the second resolution was to make seven the maximum number of directors and four the minimum, instead of the present maximum and minimum of 15 and 5 respectively.

MR. T. LLOYD seconded the motion, and the report was adopted.

The resolutions referred to by the chairman in his speech were then proposed and carried unanimously.

### Johnson & Phillips, Ltd.

THE annual meeting was held on Thursday, last week, at Winchester House, E.C., Mr. R. W. Blackwell presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 687), said the trading profit for the year was £18,400, plus £2,154 brought forward, making £20,554 to be dealt with. After providing for the appropriations shown in the profit and loss account, amounting to £19,521, there remained £1,032 to be carried forward. Under the conditions of the debenture deed, the company had now redeemed out of profits £36,162 of its first debentures out of a total issue of £175,000. The onerous conditions of that deed still bore heavily upon them, but he would not again enlarge on the question. During the past year £5,796 had been devoted to the redemption of the first debentures. Since the registration of the company, they had necessarily expended in additions to the manufacturing plant £77,246, and the expenditure last year was £10,501. It was imperatively necessary that they should get modern plant. They had done much in that direction, and more remained to be done. During 1911 they had also expended out of revenue on keeping up the plant and allowing for depreciation, upwards of £9,000. Inasmuch as the original working capital provided at the time of the company's registration was insufficient to meet the demands upon them if they were to properly meet their growing trade the board effected a loan of £24,660 in 1909, and a further loan of £10,000 in 1910. As security for those loans they issued and pledged £50,000 in 5 per cent. second debentures, which issue would have fallen due for repayment next June. He was, however, pleased to say that arrangements had been made so as to enable them to repay those loans and to cancel the issue of the second debentures. A new issue of £50,000 in 5 per cent. second debentures had been made, repayable in 10 years from last October. Of that new issue £30,000 had been issued up to the end of 1911, and since then the remaining £20,000 had been taken up. The net result to the company had been £47,993, which would seem satisfactory. Considerable Press publicity had been given to the new issue without stating that the previous issue had been redeemed, with the result that some shareholders thought the company had been increasing its debenture debt. As regarded the business during the year, the turnover was larger than it had been for several years past. That the profit was less than in the previous year was due to the fact that the trade had been almost entirely in standard goods, on which the margin of profit was comparatively small. The political disturbances in the East, and the unsettled labour conditions, had also adversely affected them. At the present time the orders they had in hand might be considered very satisfactory, especially when they considered the difficulties under which all business had been conducted of late. He was glad to say that the coal strike did not greatly affect them directly, inasmuch as they were prepared to carry on for at least ten weeks as far as fuel was concerned. Indirectly, however, it had suspended many orders which would have been booked, and which he trusted would come later on. They had been favoured by a large and increasing amount of Government orders, and they believed they had filled those orders to the satisfaction of the various departments. He did not expect the shareholders to be enthusiastic over the results. It was, however, his belief that the concern was every year improving its position financially and bringing its plant into more modern and effective condition, thereby preparing itself the better to profit by any substantial and permanent improvement in general business conditions.

MR. THOMAS DENCE seconded the motion, and the report was adopted.

**Tramways and General Works Co., Ltd.**—The directors have declared a dividend of 1s. per share for the year ended December 31st, carrying forward £151.



**Indo-European Telegraph Co., Ltd.**

THE meeting of this company was held on Friday last at the offices, 18, Old Broad Street, E.C., Mr. J. Herbert Tritton in the chair.

In moving the adoption of the report (see ELEC. REV., p. 684), the CHAIRMAN said they began 1912 with very flattering prospects as regarded the question of the extension of the company's agreements. For some time past the concession from the Persian Government had been extended to 1945. With regard to the agreement with the Postmaster-General, and the concessions from the German and Russian Governments, it was best that at the moment he should confine himself to saying that negotiations were in each case far advanced, and that they had strong hopes of ultimate success. He took that opportunity of expressing in public his appreciation of the manner in which their representatives had been received by the officials of the Governments with whom they had been in treaty for those extensions. The extension of all their concessions to 1945 would give them a lease of life which would enable them to look some way ahead. There was no doubt that at present they were suffering from a lack of reserve power in their carrying arrangements. If both of their cross-Channel cable wires, and their long connecting landlines to Persia, were in perfect working order, they could get through their daily traffic, much as it had increased during the last 10 years, with satisfaction to their customers and credit to themselves. But if either a cross-Channel cable or any other section of their long and variable landlines was interrupted for even a few hours, they were unable to do justice to the day's traffic. It was, therefore, imperatively necessary to provide an adequate margin of carrying capacity. The directors had hesitated to incur the large expenditure involved whilst the company's existence was liable to be terminated in 1925, but with all their concessions extended to 1945, which they confidently hoped would soon be the case, they proposed first to obtain from the Postmaster-General the lease of an additional, a third, cable wire between England and Germany, and, secondly, to provide an additional landwire from Emden on the German coast to Teheran, by negotiation with the German Government as far as the section through Germany was concerned, and as far as the Russian and Persian sections were concerned by the addition of a wire on the existing poles. The cost of the landline extension would be under £60,000. £35,000 had already been set aside during 1909 and 1910, so it would be a matter of no difficulty whatever from the financial point of view. Their traffics had reached a high level from various causes. The Indian traffic had been heavy, owing, amongst other reasons, to the visit of the King-Emperor and his Consort. South Russian traffic had been fairly well maintained, and the vicissitudes of Persia had brought grist to their mill in the shape of increased telegraphic traffic. Turkish traffic over their direct route to Constantinople was also a satisfactory feature. He would add one word of prudent warning lest shareholders might think that increase upon increase of receipts was in store for them. Telegraph rates showed a perfectly desirable, though to telegraph companies naturally a depressing, tendency to decrease, and owing to the outpayments which they had to make to their concessionary Governments, their margin of profits was not a large one. It was for this reason, and for this reason only, that they were obliged to scrutinise proposed reductions carefully instead of at once accepting them with the alacrity which their good financial position would apparently demand. With a largely diminished margin of profit per word, they would have to carry very heavy traffics to keep up their receipts to their present level; hence the necessity for an additional wire throughout the system. "Deferred," or half-rate, telegrams in plain language were introduced, principally between the British-speaking countries and possessions, in January last. This scheme had now been internationalised to a considerable extent, and was found to meet the needs of those who desired to send a short telegram of a non-urgent character in plain language. Turning to the accounts, the revenue from message receipts showed a gratifying increase of £16,878. The combined commercial and maintenance expenses showed an increase of £5,218, mainly under the maintenance heading, owing to a heavy purchase of telegraph poles and the installations in many stations of accumulators, by which they were replacing their primary batteries wherever possible. The directors had considered it advisable to bring the reserve fund up to £200,000. The amount of £35,000 transferred from profit and loss to this heading accomplishes that object. In respect of depreciation on the company's long list of investments, it had been found necessary to provide only the comparatively small sum of £3,453. The directors now proposed the usual final dividend, absorbing £14,875, and a bonus of 20s. per share, or £17,000, and again recommended a special distribution out of interest upon certain investments and advance accounts of 15s. per share, free of tax in each case, carrying forward £12,144.

MR. CHARLES HOLLAND seconded the motion, which was carried without discussion.

**Continental.**—GERMANY.—The Schlesische Electricitäts und Gas Gesellschaft, of Breslau, reports a net profit of £76,841 for the last financial year; a dividend of 10 per cent. is being declared, the same as for the preceding 12 months.

**BELGIUM.**—The Société des Ateliers de Constructions Electriques de Charleroi, which is now giving employment to over 2,300 persons, reports a profit of £35,270 for the past financial year.

**Kaministiquia Power Co.**—A dividend at the rate of 4 per cent. per annum for the quarter ended April 30th is announced.

**Cork Electric Tramways and Lighting Co., Ltd.**

THE annual meeting of this company was held at 53, Cannon Street, E.C., on Thursday last week, Mr. S. R. Monks presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 597), said the depreciation reserve had been increased by £6,500, and the amount due to sundry creditors was merely £230 in excess of the figure for 1910. Capital expenditure, after deducting amounts written off house services, wiring consumers' premises, &c., showed a net increase of £3,000. Approximately half of this was for a new 1,000-H.P. boiler, the balance covering house services and cables for the new consumers connected up during the year, and an additional storey to the office buildings. The stores account was rather heavy, as they had a large stock of cables and coal on hand. When the strike was declared they had sufficient coal in the yards to keep the station running at its normal load for fully three months. The item of sundry debtors, £14,749, was heavier than in 1910, but this was the natural result of increased lighting and power business, and they had made ample reserve for bad and doubtful debts. They had invested £8,930 in first-class securities, and, including cash at bankers, £4,475, they had £13,400, which compared with £10,300 at the end of 1910. Turning to the revenue, the traffic receipts showed an increase of £594, as compared with those for the previous year, the revenue per car-mile being 7.02d., as against 6.89d. The exceptionally fine weather no doubt largely accounted for this improvement. The lighting and power branch of the business continued to give satisfactory results, the receipts for the year being £1,086 in excess of those for the previous year, and there were increases also in the other revenue items, which gave them a gross increase in earnings of £1,980. As to expenses they had the large increase of £1,087 for traction expenses. Considerable repairs were carried out on the permanent way, and this item alone was £1,000 in excess of the expenditure for the previous year. They had fitted a number of renewable plates at the joints of the rails on certain sections of the line, and they believed that these plates would add considerably to the life of the rails. During the past two years they had been rebuilding their car bodies. Up to the end of last year they had entirely rebuilt eight bodies, and they would bring in the cars gradually until the whole of the bodies had been rebuilt. Station expenses were £640 less than for the previous year, whilst there were small increases of £302 and £316 respectively for lighting and general expenses. The result of the year's working was a gross profit of £23,853—an increase of £913. After paying debenture interest, preference share dividend, and writing £1,753 off wiring consumers' premises, repair shop equipment, &c., and transferring £6,500 to depreciation reserve—as compared with £5,000 for 1910—the balance allowed of the payment of a dividend of 4 per cent. on the ordinary shares, leaving £1,555 to carry forward. He hoped they would agree that the result was very satisfactory.

MR. H. C. LEVIS seconded the motion, which was adopted.

**Lima Light, Power, and Tramways Co.**—The directors' report of the Empresas Eléctricas Asociadas states (says the *Financier*) that the accounts show a net profit of £p102,562, which the board has divided as follows:—To reserve fund, £p24,554; shareholders,  $4\frac{1}{2}$  per cent., £p60,730; less unpaid, £p30—£p60,719; leaving a balance of £p17,288, out of which the board proposes to pay an additional dividend of 1 per cent. to shareholders in respect of the year 1911, £p13,500; to place to account of unpaid dividends £p30, and to carry forward £p3,757.

**STOCKS AND SHARES.**

Tuesday Evening.

QUIETER markets are the order of the day in the Stock Exchange. A lull has occurred in the burst of speculative buying, which, as we have hinted once or twice, tended to become unwieldy. It is just as well that a halt should be called in the pace, and although the various rumours upon which the setback is based are none of them particularly credible, they serve a useful purpose in stopping the over-enthusiasm of buyers who could see no end to the bullishness of the markets.

Home Rails, moving with a good deal of irregularity, are, on the whole, inclined to reaction for the time being. The feature since last we wrote has been a violent rise in Metropolitan Consolidated stock, which rushed up the price from 68 to 75 upon the statement that the company was to be included in the Speyer group of Underground undertakings—the stock to be taken over on the basis of 4 per cent. dividend. This was promptly denied by the Speyer group, with the result that Metropolitans went back to 70. But lurking hopes remain that something may be done even yet, and on balance the price shows a substantial rise. Possibly the Great Western may be the ultimate partner. Districts recovered part of the fall which they experienced, and the price has gone up to 47, though this does not represent anything like the highest touched. Many people talk Districts to 50, the calculation being based, of course, purely upon prospects. Underground Electric Railway shares from  $4\frac{1}{2}$  rose to  $4\frac{3}{4}$ , the movement of these being regulated by that in Districts. Underground Electric Income Bonds fell to 89, but recovered to 92; probably they are not over-valued at the present price, in view of the increasing prosperity of the group. City and



South London fell 3 to 39½, and Central Londons are rather easier after their big advances of last week. Rumour continues to play pleasant tunes upon the expectations of what is going to happen to the Central London Railway, the company's name being linked with one after another of the big trunk lines. Great Northern and City Preferred have again given way. The special settlement has been fixed for next week in Underground Electric "A" shares, commonly called "Bus "A," which touched 17s., reacted to 14s., and at the moment stand at about 15s. middle.

Much of the buoyancy exhibited by these Undergrounds is due to the wonderful traffics being secured by the London General Omnibus Company, the receipts of which go up by leaps and bounds each week. It must be pointed out, however, that the present takings can hardly be regarded as normal, for one of the effects of the coal strike was to drive passengers into the 'buses; and while this factor may remain during the summer time, it can hardly be counted upon to become permanent, in view of the climate enjoyed by London.

Keen excitement in East Londons has resulted in substantial rises in the company's stocks. The Consolidated is up to 11½, and has touched 12½, while the four Debenture stocks stand at 96, 59½, 36½ and 23½ in their respective order. Some speculators prefer the lower-priced Debentures to the Ordinary, as being intrinsically worth more, which of course is the case, but the Ordinary can boast a freedom of market which none of the others possesses.

British Electric Traction are a shade easier after their recent improvements, the Deferred stock receding to 8½. The 7 per cent. Preferred stock, however, is a point higher. London United Tramways Preference have shot up to 5½, while the Debenture stock shows a rise of 3, for the reasons upon which we dwelt in our last notes. There is little market in either class, and when the profit-takers come in, the shares, at all events, are likely to experience some reaction.

English Electricity shares are scarcely so firm. St. James's Ordinary and Metropolitan Ordinary gave way a little. The rises in City of London, however, have been continued, and sharp fluctuations are taking place in both Ordinary and Preference Shares. The most conflicting statements are current with regard to the prospects of the company. Some persist that 25 is the least to which the Ordinary shares will rise, and hope to see the Preference standing at 20. The falls to which we have just alluded reflect the other side of the case, and the market in the shares is affected a good deal by the prevailing tone in the Stock Exchange for the time being. Just now a certain amount of liquidation is going on through the markets, and this may have a lot to do with the reaction in the prices. He wants to be behind the scenes who elects to take a hand in the City of London market at the present time. Bournemouth and Poole Ordinary are 15s. higher; there is an important announcement to be made respecting them shortly.

Disturbances in Mexico have little effect upon the quotations for stocks and shares connected with that country. Several of them gave way last week, but the falls are being recovered, and rises are shown by Mexico Trams Common shares and Mexican Light and Power Preference. Montereys lost their small rise of last week. The Canadian group is irregular. While Canadian General Common shares have fallen 3 points, the Preferences are up 1. Shawinigan Debenture rose ½, and Toronto Power Debenture at 101 is also ½ higher. The features, however, are provided by Sao Paulo Trams with a jump of 6 points, and Rio Trams, which have gained 5½, the buying of the latter especially being persistent. Several bond issues show improvements. British Columbia Electric Deferred fell back to 141. Brisbanes continue to improve. The rest of the Indian group remains very steady. La Plata Trams are a trifle down, and Kalgoorlie Preference, now *ex* dividend, are practically unchanged, allowing for the deduction.

The Telegraph market is still wildly excited over the movements of the Marconi group and National Telephones. The Deferred stock of the latter company has been carried up 5 points this week, following upon its previous rise. Nothing definite is known, of course, as to the figure which will be paid to stockholders as the result of the arbitration in respect of the Government purchase, but the bulls look for something like 180, upon grounds which we have been unable to discover. The Third Preference shares improved to 5½. Reuters have fallen back after their sharp rise of last week, some of the holders realising in order to take up the new issue. Great Northern Telegraphs and the Eastern group, as a whole, are steady to good, while there has been some recovery amongst the Anglo-American division.

Marconis, in which there is a too-big bull position, after being 8½ shed two sovereigns, and the closing price this (Tuesday) night is 7. American Marconi at 2½ compare with 4, to which they were pushed up during the madness of the Friday morning on which they were introduced to the London Stock Exchange market. Canadians receded to 31s., though, in their case, quiet purchases are being made by people who profess to be well informed as to the prospects of the concern. Spanish and General, after being 2½, fell ½; and, taking the group as a whole, the depression may be explained by a shake-out of some of the weaker brethren who bought more than they should have done, and who have been forced to sell by the drop in prices.

Manufacturing shares show few changes, and what there are are divided fairly equally into rises and falls. Callenders have firmed up, and Telegraph Constructions are £1 higher. The drop of 4 in Edison & Swan First Preference brought in a few buyers, with the result that the price has recovered 2 points. The Babcock shares of each class are rather easier, and in the case of the Ordinary, the explanation is the stock one of profit-taking. Henley's maintain their improvement, and Arons are a firm market.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Aberdeen .. ..	April 24	2,701	— 83	47	68,512	+ 3,384	14.4
Ayr .. ..	" 27	481	— 75	50	14,454	+ 168	8
Bath .. ..	" 24	851	+ 95	17	12,256	+ 438	14.75
Birkenhead .. ..	" 28	2,099	— 118	4	4,208	+ 408	13.68
Birmingham Corp.	" 20	20,132	+ 5,817	3	30,638	+ 6,911	56.4
Blackburn .. ..	" 24	2,306	— 707	4½	4,985	— 270	14.62
Blackpool Corp.	" 25	1,180	+ 1,898	..	3,504	— 504	11.87
Blackpool-Fleetw'd	" 27	788	— 612	16	5,559	— 70	8
Bournemouth .. ..	" 24	8,622	— 654	3½	6,682	+ 340	21.95
Bradford .. ..	" 27	10,441	— 1,031	4	22,467	— 723	56
Brighton .. ..	" 28	1,871	— 150	4	3,955	— 77	9.5
Bristol .. ..	" 26	13,112	— 528	..	105,807	+ 10,257	30.5
Brit. Elec. Trac. Co.							
Airdrie .. ..	" 19	589	+ 164	16	4,459	+ 1,137	3.65
Barnsley .. ..	" 19	278	— 151	..	2,471	— 305	..
Barrow .. ..	" 19	734	+ 126	..	5,096	+ 1,315	5.37
Devonport .. ..	" 19	1,213	+ 158	..	8,119	+ 1,245	8.85
Gateshead .. ..	" 19	1,610	— 251	..	15,610	— 122	11.25
Gravesend .. ..	" 19	443	— 52	..	3,136	+ 221	6.5
Greenock .. ..	" 19	1,722	+ 267	..	11,555	+ 1,778	7.25
Hartlepool .. ..	" 19	517	— 37	..	3,733	+ 281	6.72
Kidderminster .. ..	" 19	249	— 33	..	1,491	+ 80	..
Leamington .. ..	" 19	400	+ 30	..	2,304	+ 144	..
Merthyr .. ..	" 19	333	— 187	..	2,812	— 227	2.9
Metropolitan .. ..	" 19	18,907	— 1,244	..	132,996	+ 8,670	22
Middleton .. ..	" 19	745	— 116	..	4,620	— 81	8.5
Mil. Joint Com'tee	" 19	7,322	+ 47	..	57,926	+ 1,731	..
Oldham—Ashton ..	" 19	1,356	— 81	..	9,028	+ 476	9.13
Peterborough .. ..	" 19	251	— 48	..	1,823	+ 165	5.31
Potteries .. ..	" 19	3,307	— 819	..	27,583	— 2,323	29
Rotherham .. ..	" 19	427	+ 21	..	1,141	+ 105	2.75
Southport .. ..	" 19	657	— 64	..	3,895	+ 56	8.17
S. Metropolitan ..	" 19	2,016	— 102	..	12,022	+ 669	..
Swansea .. ..	" 19	2,116	— 310	..	16,927	+ 281	12.5
Tynemouth .. ..	" 19	450	— 60	..	2,478	— 29	3.75
Weston-s-Mare ..	" 19	175	— 89	..	534	+ 7	8
Worcester .. ..	" 19	664	— 35	..	3,951	+ 107	5.75
Wrexham .. ..	" 19	260	— 13	..	1,573	+ 106	..
Yorks. Wool. Dist.	" 19	2,272	— 43	..	16,147	+ 412	17
Miscellaneous .. ..	" 19	435	— 61	..	3,239	+ 69	..
Burnley .. ..	" 27	2,922	+ 368	..	..	..	11.73
Burton-on-Trent ..	" 28	510	— 54	4	1,062	— 9	6.6
Bury .. ..	" 28	2,641	+ 258	4	5,654	+ 24	22.5
Cardiff .. ..	" 13	2,134	— 125	2	3,836	+ 972	17.35
Chatham and Dist.	" 25	1,662	— 317	17	13,253	+ 321	14.95
Cork .. ..	" 25	986	— 45	17	7,417	+ 33	9.89
Croydon .. ..	" 19	3,956	— 37	3	5,291	— 214	11.6
Darlington .. ..	" 27	391	— 37	4	809	— 12	4.87
Darwen .. ..	" 26	599	— 1	4	1,086	+ 9	4.50
Dover .. ..	" 20	455	— 71	3	698	+ 16	4.75
Dublin .. ..	" 26	11,890	— 272	..	91,410	+ 6,885	54.25
East Ham .. ..	" 27	2,093	— 96	4	4,195	+ 143	7.87
Exeter .. ..	" 26	603	— 121	4	1,178	+ 107	5.5
Glasgow .. ..	" 27	38,365	+ 1,282	..	893,661	+ 46,271	98
Hastings .. ..	" 25	1,482	— 581	..	..	— 93	19.3
Huddersfield .. ..	" 27	3,715	— 585	4	7,601	— 532	24.5
Hull .. ..	" 27	5,470	— 345	4	11,161	— 930	13
Ilkeston .. ..	" 25	160	— 124	4	161	— 364	..
Ipswich .. ..	" 27	774	— 123	4	1,190	+ 76	10.5
Kilmarnock .. ..	" 20	296	— 11	49	7,833	+ 469	4.25
Lancashire United	" 24	2,593	— 818	17	20,319	— 416	39
Leeds .. ..	" 27	14,777	— 276	4	29,214	+ 404	57.5
Leicester .. ..	" 27	4,726	— 549	..	..	..	20
Leith .. ..	" 27	1,367	+ 188	49½	32,333	+ 3,022	5.72
Liverpool .. ..	" 20	23,545	+ 306	15½	183,751	+ 9,812	116
L.C.O. .. ..	" 17	88,116	— 888	2½	105,722	— 125	140.5
London United ..	" 27	12,457	— 2,872	17	57,700	+ 1,785	..
Lowestoft .. ..	" 27	254	— 89	80	4,652	— 44	3.5
Manchester .. ..	" 27	33,172	+ 656	4	65,778	+ 3,685	105
Newcastle .. ..	" 27	7,856	— 793	..	16,207	— 1,410	31.3
Newport .. ..	" 20	1,270	— 250	3	1,863	— 479	7.25
Oldham .. ..	" 28	4,041	+ 83	5	10,264	— 65	23
Pontypridd .. ..	" 27	628	— 396	4	1,239	— 666	5.5
Portsmouth .. ..	" 20	4,357	— 342	3	6,422	— 57	15.75
Preston .. ..	" 24	1,525	— 68	4	3,692	+ 151	10
Rotherham .. ..	" 25	1,232	— 270	34	2,248	— 143	12
Salford .. ..	" 22	9,897	— 405	3½	15,913	+ 233	41
Sheffield .. ..	" 30	12,476	— 678	5	29,674	— 914	40
Southampton .. ..	" 24	2,329	— 94	3	4,166	+ 346	11
Southend-on-Sea ..	" 24	1,236	— 179	4	2,602	+ 419	7
South Shields .. ..	" 27	1,120	— 110	4	2,194	— 142	10.25
Swindon .. ..	" 24	912	— 375	17	7,895	+ 446	11
Tyneside .. ..	" 27	2,133	— 151	3½	4,285	— 151	8.72
Wallaasey .. ..	" 27	1,488	— 194	4	3,125	+ 135	8
Walthamstow .. ..	" 18	5,688	— 137	2½	7,105	— 25	15.25
West Ham .. ..	" 24	1,827	— 331	4	3,963	— 58	13.75
Wolverhampton ..							
Cen. London Rly. ..	" 27	6,527	— 1,159	17	80,685	— 8,973	6.32
City & S. Lon. Rly.	" 18	5,913	— 891	17	54,866	— 3,615	7.26
Dublin-Lucan Rly.	" 26	248	— 66	17	1,978	+ 53	7
G.N. and City Rly.	" 27	3,133	+ 154	17	28,330	+ 1,642	3.5
L'pool Overh'd Rly.	" 28	8,152	+ 138	..	25,809	+ 1,511	6.5
Llandudno-Col. Bay	" 26	409	— 237	21½	3,901	+ 182	6.6
Lon. Elec. Ry. Co.	" 27	26,555	— 1,770	17	243,845	+ 3,910	21.25
Mersey Railway ..	" 27	4,148	— 157	17	81,895	— 181	4.5
Metropolitan Rly. ..	" 28	32,685	— 1,962	17	279,006	— 8,911	25.75
Met. District Rly. ..	" 27	24,538	+ 739	17	212,453	+ 3,821	25
Anglo-Argentine ..	" 29	102,516	+ 8,988	..	876,406	+ 33,711	..
Auckland .. ..	" 5	17,472	+ 1,038	..	172,044	+ 18,495	23.3
Bombay (B.E.T.) ..	Mar. 29	6,106	+ 222	18	89,005	+ 2,546	..
Brisbane .. ..	Feb.	6,700	— 1,975	8	23,734	— 13,101	..
Brit. Columbia Rly.	..	..	..	..	..	..	..
Calcutta .. ..	April 27	7,798	+ 598	..	..	..	..
Cape Electric T.Ld.	Mar.	8,384	..	3	8,952	..	20.5
Kalgoorlie, W.A. ..	..	..	..	..	..	..	..
Lisbon .. ..	..	..	..	..	..	..	..
Madras .. ..	Mar. 31	1,898	+ 458	..	9,503	+ 647	13.5
Montevideo .. ..	Mar.	31,498	+ 3,071	5	157,327	+ 16,407	..
Perth (W.A.) .. ..	April 26	3,657	+ 148	..	32,133	+ 4,486	29

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 30th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 30th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9 — 10	+ ½	5 10 0	Kensington & Knightsbridge, Ord	5	9 9	7½ — 7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½ 4½	8½ — 9½	..	4 14 9	Do. 4 % Deb. ..	Stock	4 4	92 — 95	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½ — 11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80 — 84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100 — 102	..	4 8 3	London Electric, Ord. ..	8	2 2½	1½ — 2	..	3 14 11
Brompton & Kensington, Ord...	5	10 10½	8½ — 8½	..	5 14 3	Do. 6 % Pref. ..	5	6 6	4½ — 5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7 7	7½ — 8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	92 — 95	..	4 4 3
Central Electric Supply, 4 %	100	4 4	98 — 101	..	3 19 3	Metropolitan ..	5	5 4½	8½ — 4½	— ½	6 1 8
Guar. Deb. }						Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½ — 4½	..	4 17 4
Charing Cross, West End & City	5	5 5	4½ — 5	..	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	101 — 104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½ — 4½	..	4 14 9	Do. 8½ % Mort. Deb. ..	Stock	8½ 8½	84 — 87	..	4 0 6
Do. " City Undertaking "	5	4½ 4½	8½ — 4½	..	5 2 10	Midland Electric Corporation }	100	4½ 4½	96 — 98	..	4 11 10
Do. 4½ % Cum. Pref. }						4½ % First Mort. Deb. }					
Do. Do. 4 % Deb. ..	100	4 4	95 — 98	..	4 1 8	Newcastle-on-Tyne ..	5	4 4½	82 — 8½	..	5 3 3
Chelsea, Ord. ..	5	5 5	4½ — 5	..	5 0 0	Do. 5 % Pref., Non-Cum. ..	5	5 5	3½ — 4½	..	5 14 3
Do. 4½ % Deb. ..	Stock	4½ 4½	98 — 101	..	4 9 1	North Metropolitan Power Sup-	100	5 5	99 — 102	..	4 13 0
City of London, Ord. ..	10	7 8	20 — 22	+ ½	3 12 9	ply, 5 % Mortgages (Red.) }					
Do. 6 % Cum. Pref. ..	10	6 6	16½ — 18½	+ ½	3 4 10	Notting Hill, 6 % Non-Cum.	10	.. 6	10½ — 11½	..	5 6 8
Do. 5 % Deb. ..	Stock	5 5	119 — 123	..	4 1 4	Pref. }					
Do. 4½ % Second Deb. ..	100	4½ 4½	101 — 104	..	4 6 7	Oxford ..	5	7½ 7½	5½ — 6½	..	5 13 9
County of Durham, 5 % First	Stock	5 5	87 — 89	..	5 12 4	St. James' and Pall Mall, Ord.	5	10 10	8½ — 8½	— ½	5 14 3
Mort. Deb. }						Do. 7 % Pref. ..	5	7 7	6½ — 7½	..	4 16 7
County of London, Ord...	10	5 6	10½ — 11½	..	5 6 8	Do. 8½ % Deb. ..	100	3½ 3½	85 — 87	..	4 0 6
Do. 6 % Pref. ..	10	6 6	11½ — 11½	..	5 2 7	Smithfield Markets, Ord. ..	5	Nil 2	1½ — 1½	..	..
Do. 4½ % Deb. ..	Stock	4½ 4½	108 — 110	..	4 1 10	South London, Ord. ..	4	5 5	2½ — 3½	..	6 8 0
Do. 4½ % Second Deb. ..	Stock	4½ 4½	99 — 102 xd	..	4 8 3	Do. 5 % First Mort. Deb. ..	100	5 5	99 — 102	..	4 18 0
Edmundson's, Ord. ..	5	Nil Nil	3 — 3	..	Nil	South Metropolitan, 7 % Pref. ..	1	7 7	1½ — 1½	..	6 1 0
Do. 6 % Cum. Pref. ..	5	Nil Nil	3 — 3	..	Nil	Do. 4½ % First Deb. Stock ..	100	4½ 4½	96 — 99	..	4 11 0
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86 — 89	..	5 1 2	Urban, Ord. ..	5	5 ..	1 — 1	..	..
Folkestone ..	5	6 6	4½ — 4½	..	6 3 1	Do. 5 % Cum. Pref. ..	5	5 ..	2½ — 3½	..	..
Do. 5 % Cum. Pref. ..	5	5 5	4½ — 4½	..	5 5 3	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86 — 89	..	5 2 3
Do. 4½ % First Deb. ..	100	4½ 4½	93 — 96	..	4 13 9	Westminster, Ord. ..	5	10 10	8½ — 9½	..	5 8 1
Hove ..	5	9 9	6½ — 7	..	6 8 7	Do. 4½ % Cum. Pref. ..	5	4½ 4½	5½ — 6½	..	4 4

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½ — 5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	87½ — 89½	— ½	5 11 9
Calcutta, Ord. ..	5	8½ 7½	7 — 7½	+ ¼	5 13 4	Do. 5 % 1st Mort. Deb. }					
Do. 5 % Pref. ..	5	5 5	5 — 5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	207 — 212 xd	+ 5	3 15 6
Calgary Power, 1st Mort. Bds.	100	5 5	93½ — 95½	+ 1	5 4 9	Northern, Lt., Power and Coal, }	\$500	5 ..	39 — 41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7 7½	113 — 117	— 3	5 19 8	Do. 5 % 1st Mort. Bonds }					
Do. 7 % Pref. ..	\$100	7 7	118 — 122	+ 1	5 14 9	River Plate, Ord. ..	Stock	10 ..	252 — 262	..	3 16 4
Cordoba Lt., Power and T., Ord.	1	3 3½	1½ — 1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	6 6	110 — 115	..	5 4 4
Do. 5 % Deb. ..	100	5 ..	94 — 97	+ 1	5 3 1	Do. 5 % Deb. Stock ..	Do.	5 5	103 — 105	..	4 15 3
Eleo. Lt. and P. of Cochabamba, }	100	6 6	93 — 95	..	6 6 4	Roy. Eleo. Co., Montreal, 4½ % }	100	4½ 4½	99 — 101	..	4 9 1
6 % Bonds }						1st Mort. Deb. }					
Elec. Supply Victoria, 5 % 1st	100	5 5	83 — 86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4 5½	137 — 141	+ 1	3 10 11
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108½ — 110½	..	4 10 6
Elec. Dev. Ontario, 5 % 1st	\$500	5 5	91½ — 93½	..	5 6 11	Do. 4½ % Per. Deb. ..	Stock	4½ 4½	104 — 106	+ ½	4 4 11
Mort. Bonds }						Toronto Power, 4½ % Deb. ..	Do.	4½ 4½	100 — 102	+ ½	4 8 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	7 — 7½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5 5	92½ — 94½	..	5 5 10
Do. 6 % Pref. ..	1	6 6	103 — 105 xd	— 3½	8 6 0	1st Mort. Deb. }					
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	103 — 105	..	4 15 3	Victoria Falls Power, Pref. ..	1	Nil 11½d.	5 — 1	..	..
Madras, Ord. ..	5	.. ..	2½ — 2½	..	..	West Kootenay Power and Lt., }	100	6 6	104½ — 106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5 5	102½ — 105½	..	4 14 9	1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	84½ — 86½	— ½	5 15 7						
Mexican Lt. & Power, Common	\$100	4 4	84 — 86 xd	..	4 13 0						
Do. 7 % Cum. Pref. ..	\$100	7 7	104 — 106 xd	+ 2½	6 12 1						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	94½ — 96½	..	5 3 8						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½ 7½	..	..	Monte Video Telephone, Ord. ..	1	6 6	1 — 1½ xd	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5 5	97½ — 99½	..	5 0 6	Do. 5 % Pref. ..	1	5 5	8½ — 8½ xd	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8 8½	149 — 151	+ ½	5 6 0	National Telephone, Pref. ..	Stock	6 6½	99½ — 102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4 4	94 — 96	..	4 8 4	Do. Def. ..	Do.	6 6½	154 — 156	+ 5	3 17 0
Anglo-American Telegraph ..	Stock	3½ 3½	65 — 67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ..	5	5 5	6½ — 6	— ½	4 3 4
Do. 6 % Pref. ..	Do.	6 6	107½ — 108½	..	5 10 4	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	102½ — 103½	..	4 7 2
Do. Def. ..	Do.	30/- 30/-	25½ — 26½	+ ¼	5 14 3	Oriental Telep. and Eleo. ..	1	8 8	1½ — 1½ xd	..	4 11 5
Anglo-Portuguese Tel., 5 % }	100	5 5	101 — 102	+ ½	4 17 1	Do. 6 % Cum. Pref. ..	1	6 6	1½ — 1½ xd	..	4 16 0
Mort. Deb. }						Do. 4 % Red. Deb. ..	Stock	4 4	88½ — 90½	+ ½	4 8 5
Chill Telephone ..	5	7 7	7½ — 7½	+ 1½	4 10 4	Pacific and European Tel., 4 % }	Do.	4 4	99½ — 101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	83½ — 85½	— ½	4 13 7	Guar. Debs. }					
Cuba Telegraph ..	10	6 6½	9½ — 10½	..	5 11 7	Reuter's ..	8	5 5½	11 — 11½	— 1½	3 12 6
Do. 10 % Pref. ..	10	10 10	17 — 18	..	5 11 1	Submarine Cables Trust ..	Cert.	6 6	127 — 130 xd	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4 4½	3½ — 3½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½ 4½	90 — 101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10 10	7½ — 8½	..	6 1 3	Deb. Red. }					
Do. 4½ % Debs. ..	60	4½ 4½	99 — 101	..	4 9 1	United River Plate Telephone	5	8 8	7½ — 7½	..	5 1 7
Direct United States Cable	10	4½ 5	7½ — 8 xd	+ ½	6 5 0	Do. 5 % Cum. Pref. ..	5	5 5	5½ — 5½	..	4 8 11
Direct W. India Cable, 4½ % }	100	4½ 4½	99 — 101	..	4 9 1	West Coast of America ..	2½	2½ 2½	1½ — 1½	..	3 6 8
Reg. Deb. }						Do. 4 % Debs., 1 to 1,500	100	4 4	98 — 100	+ ½	4 0 0
Eastern Telegraph, Ord. Stock	Stock	7 5½	134 — 137	..	5 2 2	guar. by Braz. Sub. Tel. }					
Do. 8½ % Pref. Stock ..	Do.	3½ 3½	81 — 83	— ½	4 4 4	West India and Panama Teleg.	10	1½ 1½	4½ — 4½	— 1½	5 9 1
Do. 4 % Mort. Deb. ..	Do.	4 4	99½ — 101½ xd	..	3 18 10	Do. 6 % Cum. 1st Pref. ..	10	6 6	10½ — 11	..	5 17 1
Eastern Extension ..	10	7 5	12½ — 13½	..	5 5 8	Do. 6 % Cum. 2nd Pref. ..	10	6 6	9½ — 10½	..	4 15 2
Do. 4 % Deb. ..	Stock	4 4	99½ — 101½	..	3 18 10	Do. 5 % Debs. ..	100	6 5	102½ — 104½	..	5 3 8
East and S. Africa Tel. 4 % }	25	4 4	99 — 101	..	3 19 3	Western Telegraph, Ltd. ..	10	7 6½	13 — 13½	..	3 19 5
Mt. Db. Mauritius Sub. }						Do. 4 % Deb. ..	Stock	4 4	99 — 101	..	3 13 5
Globe Telegraph and Trust ..	10	5½ 6½	10½ — 11	..	5 9 1	Western Union Tel., 4 % Bnds. A	\$1000	4 4	106 — 109	..	4 7 5
Do. 6 % Pref. ..	10	6 6	13 — 13½	..	4 9 0	Do. 4½ % Fdg. Bonds ..	\$1000	4½ 4½	100 — 103	..	..
Great Northern Telegraph ..	10	18 18	30½ — 31½ xd	..	5 9 1						
Indo-European Telegraph ..	25	13 5½	58 — 60	+ ½	5 8 4						
Mackay Companies Common ..	\$100	5 5½	83 — 85	..	5 17 8						
Do. 4 % Cum. Pref. ..	\$100	4 4	70 — 73	..	5 9 7						
Marconi's Wireless Telegraph	1	5 ..	61½ — 7½	— 1	..						
Do. 7 % Cum. Partic. Pref.	1	16 ..	6½ — 6½	— 1½	..						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 30th	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations April 30th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord. . .	1	Nil	Nil	32½ — 33½	..	Nil	Metropolitan Railway Consol. . .	100	12½	12½	70¾ — 71½	+2¾	2 12 8
Do. 5 % Pref. . .	1	5	5	32½ — 33½	..	6 8 0	Do. Surplus Lands . .	100	23½	24½	68 — 70	..	4 8 4
Do. 4½ % Deb. . .	100	4½	4½	78 — 83	..	5 8 5	Do. 8½ % Deb. . .	100	8½	3½	84 — 91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. . .	100	..	..	12 — 14	..	..	Do. 8½ % Pref. . .	100	8½	3½	86 — 88	..	3 19 7
Do. Do. Deferred . .	100	..	..	7½ — 9½	—½	..	Do. 8½ % Con. Pref. . .	100	3½	3½	85 — 87	..	4 0 6
Do. Do. 6 % Cum. Pr'f. . .	100	..	6	89 — 91 xd	..	..	Metropolitan District Ord. . .	100	Nil	..	46¾ — 47½	+½	Nil
Do. Do. 7 % Non-Cum. Pr'f. . .	100	..	..	39 — 42	+1	..	Do. 6 % Deb. . .	100	6	6	144 — 146	..	4 2 2
Do. Do. 5 % Perp. Deb. . .	100	5	5	93½ — 96½	..	5 3 8	Do. 4 % Deb. . .	100	4	4	96 — 98	..	4 1 8
Do. Do. 4½ % 2nd Deb. . .	100	4½	4½	78 — 82 xd	..	5 9 9	Do. 4 % Prior Lien . .	100	4	4	98 — 100 xd	..	4 0 0
Central London Railway, Ord. . .	100	3	8	85 — 87	—1	3 9 0	Do. 4½ % First Pref. . .	100	8½	4½	90 — 92	..	4 17 10
Do. Pref. . .	100	4	4	87 — 89	..	4 10 0	Do. 3½ % Gtd. . .	100	8½	3½	76 — 78	..	4 9 9
Do. Def. . .	100	2	2	88 — 90	—1	2 4 5	Metropolitan Elec. Trams, Ord. . .	1	5½	6	13 — 1	..	5 0 0
Do. 4 % Deb. . .	100	4	4	101 — 103	..	3 17 8	Do. Def. . .	1	Nil	..	7 — 7	..	Nil
City & South London, Ord. . .	100	1½	1½	39 — 40	—3	4 1 3	Do. 5 % Pref. . .	1	5	5	99 — 101	..	5 10 6
Do. 5 % Pref., 1891 . .	100	5	5	108 — 110	..	4 11 0	Do. 4½ % Deb. . .	100	4½	4½	99 — 101	..	4 9 1
Do. Do. 1896 . .	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. . .	100	5	5	97 — 99	..	5 0 0
Do. Do. 1901 . .	100	5	5	104 — 106	..	4 14 4	Potteries, Ord. . .	1	2	..	..	..	..
Do. Do. 1903 . .	100	5	5	103 — 105	..	4 15 3	Do. 5 % Pref. . .	1	5	5	99 — 101	..	6 19 8
Do. 4 % Deb. . .	100	4	4	99 — 101 xd	..	3 19 3	Do. 4½ % Deb. . .	100	4½	4½	89 — 92	..	4 17 10
Dublin United Trams, 6 % Pref. . .	10	6	6	102½ — 112½	..	5 2 2	Do. 4 % Deb. . .	100	4	4	72 — 77	..	6 17 2
Great Northern & City, Pr'f. Ord	10	Nil	..	2 — 2½	—½	Nil	Underground Elec. Railways . .	10	..	..	41 — 4½	+½	..
Hastings Trams, 6 % Pref. . .	5	Nil	..	1 — 1½	..	8 0 0	Do. 4½ % Bonds . .	100	4½	4½	99 — 101	..	4 9 1
Do. 4½ % Deb. . .	100	4½	4½	71 — 76	..	5 18 5	Do. 6 % Income . .	100	1	1½	91 — 93	..	..
Isle of Thanet Trams, 5 % Pref. . .	5	2½	2½	23 — 27	..	4 6 11	Yorkshire (West Riding), Ord. . .	5	Nil	..	2½ — 3½	..	Nil
Do. 4 % Deb. . .	100	4	4	75 — 80	..	5 0 0	Do. 6 % Pref. . .	5	Nil	..	2½ — 3½	..	Nil
Lancashire United, 5 % Deb. . .	100	5	5	83 — 85	..	5 17 8	Do. 4½ % Deb. . .	100	4½	4½	80 — 84	..	5 7
London Elec. Railw'ys, 4 % Deb. . .	100	4	4	97 — 99	..	4 0 10							
London United Trams, 5 % Pref. . .	10	Nil	..	5 — 5½	+¾	..							
Do. 4 % Deb. . .	100	4	4	79 — 82	+3	4 17 7							

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . .	5	5	5½	1 — 5½		5 2 4	La Plata Elec. Trms, Ord. . .	1			1 — 3	—½	
Do. 2nd Pref. . .	5	5	5½	4½ — 5½		5 7 4	Do. Pref. . .	1	6	6	2½ — 1		6 0 0
Do. 4 % Deb. . .	100	4	4	94 — 95½		4 3 9	Lisbon Elec. Trams, Ord. . .	1	5½	6½	1 — 1½		4 8 0
Do. 4½ % Deb. . .	100	4½	4½	102 — 104		4 6 7	Do. 6 % Pref. . .	1	6	6	1 — 1½		4 16 0
Do. 5 % Deb. . .	100	5	5	103 — 105		4 15 3	Do. 5 % Deb. . .	100	5	5	95 — 99		5 1 0
Auckland Trams, 5 % Deb. . .	100	5	5	104 — 106		4 14 4	Madras Elec. Tr. (1904), Deb. . .	100	5	5	99 — 101	+1	4 19 0
Bombay Elec. S. & Trams, Pref. . .	10	6	6	11 — 11½		5 4 4	Manaos Trams & Lt., 1st Deb. . .	100	5	5	93 — 96		5 4 2
Do. 4½ % Deb. . .	100	4½	4½	98 — 100		4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	100½ — 102½		4 17 7
Do. 5 % 2nd Deb. . .	100	5	5	99 — 101		4 19 0	Mexico Trams Com. . .	\$100	7	7	120 — 122	+4	5 14 9
Brisbane Trams Invt., Ord. . .	5	8	8	9½ — 9¾	—½	4 2 1	Do. Gen. Con. 5 % Bonds . .		5	5	96 — 98		5 2 0
Do. 5 % Pref. . .	5	5	5	4½ — 5½		4 15 3	Do. 6 % Bonds . .	100	6	6	101 — 103		5 16 6
Do. 4½ % Deb. . .	100	4½	4½	100 — 103		4 7 5	Para Elec. Rlys. & Lt., Ord. . .	5	10	10	7½ — 7¾	+½	6 13 4
B. Columbia Elec. Rly., Def. . .	100	8	8½	139 — 143	—1½	5 12 0	Do. 6 % Pref. . .	5	6	6	5 — 5½		7 0 4
Do. Pref. Ord. . .	100	6	6	126 — 129	—1	4 13 0	Do. 5 % 1st Deb. . .	100	5	5	101 — 103	+2	4 17 1
Do. 5 % Pref. . .	100	5	5	111 — 114	—½	4 7 9	Perth (W.A.) Elec. Tr., Ord. . .	1	2½		1 — 1½	—½	2 0 0
Do. 4½ % 1st Mort. Deb. . .	40	4½	4½	98½ — 101½		4 8 8	Do. 5 % 1st Deb. . .	100	5	5	101 — 103		4 16 2
Do. 4½ % Vancouver Deb. . .	100	4½	4½	103 — 105		4 5 9	Rangoon El. Tr. & Sup., Pref. . .	5	6	6	5½ — 5¾		5 6 8
Do. 4½ % Con. Deb. . .	100	4½	4½	103 — 105		4 5 9	Do. 4½ % 1st Deb. . .	100	4½	4½	99 — 101		4 9 1
Calcutta Trams, Ord. . .	5	6	7	6 — 6½ xd		5 7 8	Rio de Janeiro Trams . .	\$100	4½	5½	127 — 129	+5½	3 17 6
Do. 5 % Pref. . .	5	5	5	4½ — 5½		4 16 5	Do. 1st Mort. 5 % Bonds . .		5	5	104 — 105	—½	4 15 3
Do. 4½ % Deb. . .	100	4½	4½	100 — 103		4 7 5	Do. 5 % Mort. Bonds . .	100	5	5	97 — 98	—½	5 2 0
Cape Electric Trams . .	1	Nil	2½	2 — 3			Sao Paulo Tram, Lt. and P. . .	\$100	10	10½	213 — 216	+6	4 12 7
City Buenos Aires Trams (1904)	5	5	5	5½ — 5¾		4 5 1	Do. 5 % 1st Deb. . .	\$500	5	5	104½ — 106½		4 13 11
Do. 4 % Deb. . .	100	5	5	101 — 103		4 17 8	Singapore Trams, 5 % Deb. . .	100	5	5	79 — 82		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	92 — 96 xd		5 4 2	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95		5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101 — 104		4 16 2	Un. Elec. Trams Monte Video . .	5	6	7	5½ — 6		6 1 11
Kalgoorlie Elec. Trams . .	1	Nil				Nil	Do. 6 % Pref. . .	5	6	6	5½ — 5¾		5 12 11
Do. 5 % A Deb. . .	100	5	5	91 — 94		5 6 5	Do. 5 % 1st Deb. . .	100	5	5	98½ — 101½ xd		4 18 6
Do. 6 % B Deb. . .	100	5	6½	56 — 60		10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103 — 105	—½	4 5 9

## MANUFACTURING COMPANIES.

Aron, Ord. . .	1	Nil	6	21 — 22½			Dick, Kerr . .	1	5		27 — 3½		5 8 1
Do. 6 % Pref. . .	1	9	6	4½ — 5½		7 2 2	Do. Pref. . .	1	6	6	1½ — 1¾		5 12 11
Babcock & Wilcox . .	1	26	28	6½ — 6¾	—5	5 0 0	Do. Deb. . .	100	4½	4½	97 — 100		4 10 0
Do. Pref. . .	1	6	6	1½ — 1¾	—10	3 16 10	Edison & Swan, A, £3 paid	5	Nil				Nil
B.I. & Helsby Cables . .	5	10	10	6½ — 7½		6 18 0	Do. fully paid . .	5	Nil		1½ — 2½		Nil
Do. Pref. . .	5	6	6	5½ — 6½		4 16 0	Do. 4 % Deb. . .	100	4	4	68 — 72	+2	5 11 1
Do. Deb. . .	100	4½	4½	101 — 103		4 7 5	Do. 5 % Second Deb. . .	100	5	5	75 — 78		6 8 2
British Thomson-Houston, Deb.	100	4½	4½	91½ — 94½		4 15 3	Electric Construction . .	2	Nil	2½			
British Westinghouse, Pref. . .	8	Nil				Nil	Do. Pref. . .	2	7	7	1½ — 1¾		7 9 4
Do. Deb. . .	100	4	4	68 — 66		6 1 3	Greenwood & Batley, Pref. . .	10	7	7	7½ — 8½		8 5 8
Do. 6 % Prior Lien . .	100	6	6	99 — 102		5 17 3	Do. Deb. . .	100	5	5	94 — 96		5 4 2
Browett, Lindley, Ord. . .	1	Nil		16 — 2½		Nil	General Electric, Pref. . .	10	5	5	9 — 9½		5 5 3
Do. Pref. . .	1	Nil		5½ — 6½		Nil	Do. Deb. . .	100	4	4	85 — 90		4 8 11
Brush, Ord. . .	2	Nil		0 — 1		Nil	Henley's, Ord. . .	5	15	10½	11½ — 12½		6 0 0
Do. 7 % Pref. . .	2	Nil		0 — 1		Nil	Do. Pref. . .	5	4½	4½	4½ — 5½		4 6 9
Do. 4½ % Deb. . .	100	4½	4½	54 — 59		7 10 6	Do. Deb. . .	100	4½	4½	104 — 106		4 4 11
Do. 4½ % Second Deb. . .	100	4½	4½	37 — 42		10 14 4	India-Rubber, G. & T. . .	10	10		8½ — 9½		
Callender's Cable . .	5	15	10½	11 — 11½	+½	6 7 8	Do. Pref. . .	10	5	5	9½ — 10½		4 17 7
Do. Pref. . .	5	5	5	5 — 5½		4 15 3	Telegraph Construction . .	12	20	10½	34 — 36	+1	6 13 4
Do. Deb. . .	100	4½	4½	99 — 101	+½	4 9 1	Do. Deb. . .	100	4	4	99½ — 101½		4 9 0
Castner-Kellner . .	1	17½	20	8½ — 9½		5 6 8	Willans & Robinson . .	1	Nil				Nil
Do. Deb. . .	100	4½	4½	105 — 109		4 10 7	Do. Pref. . .	5	Nil		1½ — 1¾		Nil
Crompton & Co. . .	8	Nil	Nil	1 — 1½		Nil	Do. Deb. . .	100	4	4	59 — 61		6 11 2
Do. Deb. . .	100	5	5	58 — 68		7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3½ per cent., February 8th, 1912.



## RE DAVIS ELECTRICAL CO., LTD.

THE creditors and shareholders under the failure of the Davis Electrical Co., Ltd., of 17, Moor Street, Cambridge Circus, W.C., particulars of which recently appeared in these columns, met on Tuesday at the Board of Trade Offices, Carey Street, W.C.

Mr. W. J. Warley, Official Receiver, reported that there had been lodged 57 claims amounting to £2,332. With regard to the affairs of the company, the observations which had been issued to the creditors and shareholders showed what course had been taken. The matter of chief moment at the present time was the manner in which the securities held by the debenture-holders had been increased in value. He had not anything more to add upon that point to that had already appeared in his observations, except that it might be taken that the ordinary quantity of goods which would have been needed by the company during the period September 1st to October 6th, 1911, would not have been more than one-third of that which had been ordered in this particular period. That being so, it would be a matter for the consideration of the liquidator as to what steps might be taken with a view to the recovery of some part, at all events, of the securities for the benefit of the unsecured creditors. That was a matter which absolutely demanded some further investigation, and it would rest with the creditors to decide upon what steps should be taken. The immediate business of the meeting was to consider whether a liquidator should be appointed in the place of the Official Receiver and to elect a committee of inspection.

Mr. Kennard (Stanley Evans & Co.) said he appeared on behalf of the company.

The Chairman: You mean for Mr. Davis when you say company? —Yes.

Mr. Kennard (continuing) said that when the company was formed the liquid assets were worth in value a good deal more than the amount of the debentures which were then issued. When further debentures were issued, he thought he was correct in stating, the amount received in respect of these debentures went to the trade creditors in payment of the debts. That was the result of the Official Receiver's investigation.

The Chairman: That may be so, but when you say payment of debts that includes expenses of business and large sums paid away for salaries. The whole amount paid was not exclusively for goods supplied to the company.

Mr. Kennard said that his point was that the money paid by the debenture-holders was expended by the company for the purpose of the company's business and included payments made to trade creditors. He was instructed to take exception to the report of the Official Receiver, which said that from September 1st to October 6th, 1911, goods were delivered to the company much in excess, as regarded value, of any delivered during a similar period of trading at any time during the company's existence, viz., £1,613 16s. 6d., of which £1,034 related to the time between September 25th and October 6th. These figures were not quite accurate because it would appear that the amount £1,034 should be something like £865. It was not a very great difference, but when the Official Receiver issued observations relating to the purchase of goods and was not accurate in his figures, he claimed that he was entitled to call attention to the discrepancy.

The Chairman: I have the invoices here, but I am glad to have any explanation you wish to make.

Mr. Kennard pointed out that one of the invoices was re-dated, and, consequently, these goods had not come within the period in question.

The Chairman said it was only a question of a few days, and did not materially affect the bearing of his report.

Mr. Kennard said his point was that the figures £1,034 should have been £862.

The Chairman remarked that the difference of a week or a fortnight would not effect any material alteration.

Mr. Kennard said the matter had been considered by Mr. Davis, and he was bound to admit that the goods ordered within the period in question, although ordered in the ordinary course of the business, went to the benefit of the debenture-holders. He had very carefully considered the matter, and had put it to the debenture-holders that, under the circumstances, although they were legally entitled to rely upon their security, it might be a matter for them to consider whether, under the circumstances, they might not see their way to give up some of the security for the benefit of the trade creditors. If anything of that kind were to be arranged, it must be understood that the object of so doing was not to evade any threats, nor because anything in connection with the company had not been carried on in a proper and perfectly *bonâ fide* manner. If the creditors wanted a further investigation they were perfectly willing, and the parties attacked would give them all the assistance in their power. If, however, his offer was to be accepted, it must be taken as a settlement of the whole thing, and must be accepted in full satisfaction of any claims which the creditors might deem they had against the company or any officer of the company. He had consulted one of the principal creditors, and a sum of £500 had been mentioned as an amount which the debenture-holders might be prepared to pay over to the liquidator upon the terms he had mentioned. That sum would be added to the assets of the company, free from any claims of the debenture-holders, but, he repeated, that could only be done on the understanding that any claim by the liquidator and committee of inspection would be entirely withdrawn.

Mr. Rook (Sloan Electrical Co.), speaking on behalf of the

principal creditors, said that they had very carefully considered this matter, and for two reasons were not inclined to accept the offer which had just been placed before the meeting. In the first place, there were conditions attaching to the offer which might sweat the £500 down, with the result that the creditors would only get a very small dividend indeed. The general body of creditors would have been quite prepared to accept the £500 and take the small dividend, but, speaking on behalf of the largest creditors, he must say they were inclined to insist upon a further investigation. It mattered very little whether the value of the goods received by the company just before the collapse was £1,034, as stated by the Official Receiver, or only £860, as represented by Mr. Kennard. The question at issue was that they, as creditors, having confidence in the company, had delivered goods between those dates to the amount of about £1,000, and they claimed that those goods had gone to enhance the value of the debentures. As a matter of principle, apart from the question of money, he thought the commercial world would be better served if the question were fought out as to whether a company, consisting practically of one man, could, from the date of consulting its solicitor to the date of the winding-up order, purchase goods and throw them into "hotch-potch." The view of the creditors was that a further investigation into the matter would perform good service to the commercial world, and he was instructed to refuse the offer, and press the liquidator to conduct a further investigation into the whole matter of the debenture issue.

Mr. Pangbourne (Siemens Bros.) formally moved that the liquidation be continued by the Official Receiver and a committee of inspection.

The resolution was unanimously agreed to, and the following Committee of Inspection was elected, viz.:—Mr. Rook (Sloan Electrical Co.); Mr. Pangbourne (Siemens Bros.); Mr. Loewy (Electrical Co.); Mr. Lowe (Messrs. McDougall); Mr. Francis Nalder (Nalder Bros. & Co.).

Mr. Kennard, again addressing the meeting, said that, of course, the suggestion he had made was not put forward under threat of any pressure, but was an *ex gratia* offer. The creditors might take it or leave it, but if they decided upon a full examination they could not expect that the debenture-holders would renew the offer, but they would do their best to retain the security to which they were undoubtedly entitled. There was another matter to which he wished to call attention. The Official Receiver had reported that no creditor in respect of goods was paid after September 15th, but in the fortnight prior thereto accounts for goods amounting to about £310 were paid. He was instructed that that amount should be increased by more than £50. The total payments during the period came to £633.

The Chairman: Are they trade accounts?

Mr. Kennard agreed that they were not, but added that in making those payments the company were discharging liabilities which would have taken preference over the unsecured claims.

The Chairman: In any case these payments increased the security of the debenture-holders.

Mr. Rook pointed out that Mr. Kennard had made reference to the amount of goods ordered, but he was informed that some of the orders were never executed, and that the amount of £1,034 given by the Official Receiver would have been considerably more had all the orders been executed. The proceedings then terminated.

In the absence of a quorum the meeting of shareholders was formally adjourned for a week, but it was understood that the desire of the creditors for the liquidation to be left in the hands of the Official Receiver would be confirmed. The following are the principal unsecured creditors:—

Associated Battery Co. .. ..	220	Kingolite Co. .. ..	£40
Adnil Electric Co. .. ..	29	London Commercial Elec. Stores	45
Busch, F. W. ... ..	30	Marsh, Son & Co. .. ..	31
B. T.-H. Co. .. ..	17	McDougall, James .. ..	335
Conradty & Co. .. ..	313	Nalder Bros. & Thompson ..	18
Credenda Conduit Co. .. ..	38	Reckmng .. ..	32
Cable Accessories Mfg. Co. ..	12	Radium Electric Co. .. ..	13
Electric Co. .. ..	294	Siemens Bros. & Co. .. ..	116
Electric and Ordnance Co. ..	21	Sloan Electrical Co. ... ..	32
Fisher & Ludlow, Ltd. .. ..	103	Simplex Steel Tube Co. .. ..	26
Feld Bros. & Co. .. ..	83	Soutter, W., & Sons .. ..	32
General Electric Co. .. ..	20	Sluyters & Co. .. ..	12
General Accessories Co. .. ..	21	Société Bége Cable Co. .. ..	12
Gent & Co. .. ..	15	Schoen Bros. .. ..	32
Goossens, Pope & Co. .. ..	23	Thonwarth-Agent Carl Walterzahn	69
Galsworthy, Ltd. .. ..	19	Turner, Bergen & Co. .. ..	42
Hartwell, I. (Executors of) ..	52	Tucker, J. H., & Co. .. ..	17
Hunter Electrical Co. .. ..	29	Thomas, F., & Co. .. ..	14
Heatloy Gresham Eng. Co. ..	17	Union Electric Co. ... ..	27
Hayward & Co. .. ..	13	Wolfram Lamp Co. .. ..	132
Holophane Glass Co. .. ..	12	Wittusen, H., & Co. .. ..	16
India-Rubber Elecl. Supply Co.	113	Wardle Eng. Co. .. ..	13
Johnson & Phillips, Ltd. ..	150	Best & Lloyd, Ltd. .. ..	13
Kremenzky, John .. ..	116	Stanley, Evans & Co. .. ..	17
Kruegers Friedeburg .. ..	58	London and County Banking Co.	25
Kempton & Co. .. ..	11		

**Trade Announcements.**—MESSRS. MORRISON & Co., of Chile, who for many years have been in the market for the purchase of goods for their engineering, hardware and merchant business, have now opened their own buying agency in London, at 11, Queen Victoria Street, E.C. Hitherto their purchases have been in the hands of Mr. G. T. Harrap, who, in ceasing to act for Messrs. Morrison, will carry on his old-established business of consulting engineer, at 5, Budge Row, Cannon Street, London, E.C.

MR. JOHN F. MONNOT, of 41, Great Portland Street, London, W., has secured the sole concession for the Edison storage battery from the Edison Electric Manufacturing Co.



## COPPER: ITS PRESENT POSITION AS REGARDS PRODUCTION AND PRICE.

By JOHN B. C. KERSHAW.

THE long expected rise in the price of copper has at last occurred, and the metal has once again touched the £70 level, with every prospect at the moment of going still higher. It is now over four years since the last boom in copper prices came to a sudden end, and the price of the metal fell from £104 per ton on April 30th, 1907, to £57 12s. 6d. within the 12 months.

The questions which all large consumers of copper desire to have answered are: How long will the present upward tendency in the price of the red metal last, and how far is it likely to go?

Is it likely that the experience of 1906 and 1907 will be repeated, and that copper once again will soar to over £100 per ton, and remain at that high level of value for over six months? The following figures are designed to throw some light upon the answers to these questions.

*Production and Stocks.*—The total output of copper in 1911, according to Messrs. H. R. Merton & Co.'s Annual Statistical Statement, amounted to 873,460 tons, as compared with 855,685 tons in 1910. The totals for the last ten years have been as follows:—

Year.	Total output tons.	Increase : tons.	Year.	Total output tons.	Increase : tons.
1902 ...	541,295	24,000	1907 ...	713,965	(— 135)
1903 ...	574,775	33,000	1908 ...	754,180	40,000
1904 ...	644,000	70,000	1909 ...	839,425	85,000
1905 ...	682,125	38,000	1910 ...	855,685	16,000
1906 ...	714,100	32,000	1911 ...	873,460	17,800

The increase in output in 1911 has thus been 17,800 tons, as compared with 16,000 tons in 1910; and the check to production which has brought about the present rise in prices, is seen to have been negative rather than positive in character. When we examine the average rate of increase in output during the period covered by the above table, we find, however, that during the 10 years the production increased by 332,000 tons, equal to an average rate of increase of 33,200 tons per annum. The reduction of this rate by 50 per cent. for two years, has therefore enabled consumption to overtake production, and to deplete the large stocks of the metal accumulated in the years 1909 and 1910.

The remarkable reduction in stocks that has taken place during 1910-1912 is well brought out, by the following figures (taken from Messrs. H. R. Merton & Co.'s monthly circulars) for the combined visible supplies of copper, excluding Holland and Germany.

	Tons.		Tons.
June 30th, 1910 ...	179,129	June 30th, 1911 ...	140,455
Sept. 30th, 1910 ...	160,386	Sept. 30th, 1911 ...	130,239
Dec. 31st, 1910 ...	138,275	Dec. 31st, 1911 ...	97,218
Mar. 31st, 1911 ...	154,592	Mar. 31st, 1912 ...	78,018

The reduction by 50 per cent. of the stocks of copper in England, France and America, has had the desired effect, and has caused that rise in price which had been expected, so soon as the combined stocks in America and Europe fell below the 100,000 ton level. It may be pointed out here, however, that the stock in England and France and afloat thereto is still considerably higher than it was during the six months of 1906 and 1907, when copper was over £100 per ton; on April 15th, 1912, being 49,434 tons, as against 13,483 tons on February 28th, 1907.

Making use of the figures already given for calculation of the consumption of copper, in the years 1909-1910-1911, we obtain the following:—

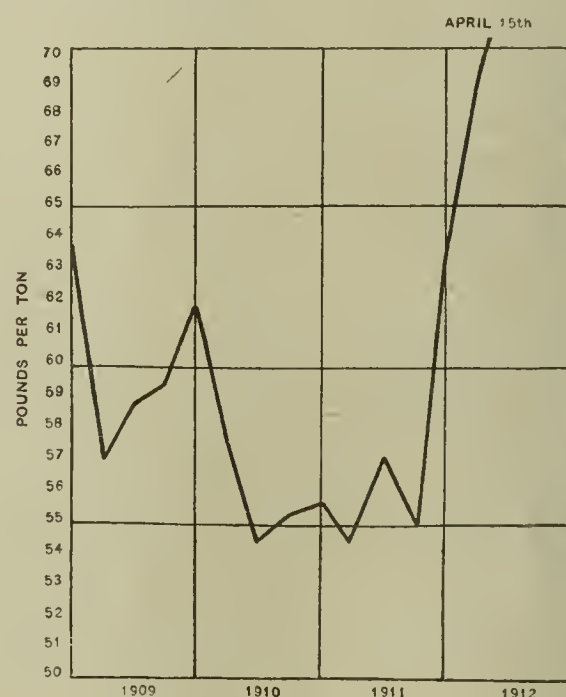
Year.	Stocks.	Production.	Consumption.
1909	+ 61,700 tons	839,425 tons	777,725 tons.
1910	— 34,100 "	855,685 "	889,785 "
1911	— 41,000 "	873,460 "	914,460 "

In 1909 the production exceeded the consumption by 61,700 tons, and stocks increased by this amount, whereas in the years 1910 and 1911 the position was reversed, and consumption exceeded the output by 34,100 and 41,000 tons respectively. The copper consumed in the twelve months ending December 31st, 1911, in fact, totalled 914,460 tons, an increase of 25,000 tons upon the aggregate consumption of 1910. At this rate of progress the world's demand for copper will reach 1,000,000 tons per annum by 1915.

The relation between Stocks and Price is shown by the following table, giving the figures as recorded in Messrs. Merton's monthly circular, at the end of each quarter since December 31st, 1908:—

	Stocks.	Price.
Dec. 31st, 1908 ...	110,667 tons	£63 15 0
March 31st, 1909 ...	132,729 "	57 0 0
June 30th, " ...	136,512 "	58 17 6
Sept. 30th, " ...	161,473 "	59 7 6
Dec. 31st, " ...	172,310 "	61 15 0
March 31st, 1910 ...	166,711 "	57 17 6
June 30th, " ...	179,129 "	54 10 0
Sept. 30th, " ...	160,386 "	55 2 6
Dec. 31st, " ...	138,275 "	55 17 6
March 31st, 1911 ...	154,592 "	54 10 0
June 30th, " ...	140,455 "	57 0 0
Sept. 30th, " ...	130,239 "	55 0 0
Dec. 31st, " ...	97,218 "	62 15 0
March 31st, 1912 ...	78,018 "	68 10 0
April 15th, " ...	—	70 7 6

From these figures we see that the stocks of copper reached their maximum in May and June, 1910, when they totalled 179,129 tons, and touched a level equal to one-fifth of a year's consumption, and that the price of the metal reached its minimum (£54 10s. per ton) about the same time. Since that date there has been a rapid depletion of stocks, accompanied by a slow, but steady, increase in value, culminating in the notable spurt of the last few weeks. If these price variations be plotted in the form of a curve, we obtain the following striking diagram:—



*Conclusions.*—The conclusions resulting from this study of the relationship between the figures for the production, consumption and price of copper during the past few years are that the metal is governed by the customary economic laws of supply and demand, and that given a continuance of the present trade activity, the price of the metal may rise considerably higher than the level yet touched.

As shown above, the consumption of copper in 1911 exceeded the output of the metal by 41,000 tons, and the figures for 1912, when complete, may quite possibly show a still larger consumption of the red metal, and a further depletion of stocks in order to meet the demand. Any further rise in price is, however, likely to cause a spurt in the production of the metal, and though copper may quite possibly touch £80 per ton before the current year is ended, the writer considers it unlikely that the extraordinary high level of prices attained in the winter of 1906-1907, will again be reached.

The swing of the pendulum and the end of the trade boom on this side of the Atlantic may, on the other hand, cause a falling-off in the European demand for the metal. Although this may to some extent be counteracted by the business activity which is certain to follow the end of the Presidential campaign and election in America, one cannot prophecy with great certainty as to the price of copper at the end of 1912. The writer's advice, therefore, to large consumers of the metal is, to buy cautiously and not to commit themselves too far ahead, the present position of the copper market being one which demands on the side of the buyers a policy of merely covering the immediate requirements of the moment.



## AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—II.

ON March 4th last the Federal Arbitration Court commenced the trial of the action brought by the Australian Tramway Employes' Association against the various Melbourne, Adelaide, Brisbane, Hobart, Ballarat, Perth, Fremantle, and Coburg tramways undertakings, dated October, 1911, and claiming higher wages and new conditions of service. These claims are numerous and controversial, and as it is understood that the Union intend to call over a hundred witnesses, the case is expected to last for a considerable time. As the companies have to be represented by their permanent officials, the tax on the staff of the affected concerns can be imagined.

As this claim directly concerns tramways, and may be taken as an authoritative statement of the demands of labour in such undertakings, an examination of its proposals may prove of interest.

The grounds of dispute are first given, and these include all apparent points on which disagreement was possible.

The minimum rates of pay per day demanded for each class of worker are then given. There are 72 rates in all, a few being:—Motormen and conductors, 11s.; ticket examiners, 12s.; leading car cleaners, 10s.; car and motor cleaners, 9s.; overhead wiremen, 12s.; motor tower wagon drivers, 10s.; power house engine drivers, 14s.; firemen of four fires, 13s.; general labourers, 9s. These rates to be operative in the States of Victoria, New South Wales, South Australia, and Tasmania; to be subject to 10 per cent. increase for the State of Queensland, and 15 per cent. increase for the State of Western Australia.

The working hours per day to be eight, and a week's work to consist of 48 working hours. Only 10 per cent. of the motormen and conductors to be allowed to work in broken shifts, and these are to complete a day's work within 10 hours of the time of signing on. All other employes to complete the day's work within 8½ hours of the time of signing on.

A monthly list of duties for each man to be posted, showing one day's holiday per week, and if any employé is asked to work on any listed holiday, he shall be paid time and a half rates. Sunday work to be paid double time and to be taken by motormen and conductors in rotation.

An employé attending on request at the dépôt and signing on, and then not required, to be paid four hours' time. An employé signing on and starting duty to be paid a full day's pay.

All work done on eight public holidays to be paid double rates.

All employes of more than 12 months' standing to have 21 days' holiday per year on full pay.

Full pay to be given for sickness, no matter, apparently, how long this may continue, and on recovery each employé is to be restored to his position.

Full pay to be given for time lost through accidents other than those caused by wilful neglect. Half-pay to be given when the employé is partly responsible.

Free passes over the system on which they are employed to be given to all employes. The claim then stipulates for one summer and one winter suit, one cap and one helmet each year, and one great coat and one oilskin every two years. Watches to be provided and kept in repair by the companies. Interest at the rate of 5 per cent. per annum to be paid by employers on all fidelity money found by employes.

Three minutes' standing time at least to be allowed at each terminus. Meal relief to be provided within 50 yards of the meal room.

The next proposal demands "that preference shall be given to members of this organisation in each tramway system, other things being equal." The right to wear a badge of membership and the grant of reasonable facilities for doing the work of the Association are then insisted on.

Then follow eleven regulations called working arrangements. These demand fixed stopping places, specify how the cars and motormen's cabs shall be constructed, class of brakes to be provided, number of men per car and per trailer, and generally deal with matters concerning the working of the line which the management should in all cases decide on.

Not content with stating how the line should be worked, the next clause deals with the way appointments are to be made. This is to be by examination and six months' probation. Eyesight tests are to be limited to practical tests under working conditions.

The manner in which complaints against employes are to be dealt with next receives attention. If summoned to the head office and kept waiting they are to be paid double time, and every facility is to be granted employes in obtaining evidence to rebut any charge made either by the employer or the general public.

An Appeals Board is to be formed on each system, consisting of a permanent official of the employer and a representative of the men's Association (not necessarily an employé of the undertaking), with an independent chairman. Any employé undergoing discipline for any offence may take his case to this Board, and may have his case argued by a Union official. If an employé feels aggrieved at the action of any superior official, he may first complain to the employer, and then appeal to the Board, whose decision shall be final.

The two last clauses prohibit any regulation of a tramway company in any way limiting the employes' rights as a citizen, and declare null and void any agreement or regulation which in any

way interferes with the right of an employé to become a member of the Association.

Such, in brief, are the claims which are the subject of the present action.

In his opening speech, Mr. Prendergast, the president of the Association, stated that they placed their claim for preference to be given to their members in a very prominent place, and looked on it as a matter of life and death to the Association. They alleged that non-union men were promoted over their heads, and that every small dereliction of duty on the part of their members was severely punished.

The Judge dissented from many of Mr. Prendergast's statements, and pointed out that he was not there to tell the employers how to manage their business, but only to try and settle disputes.

Several of the companies then claimed discharge from the case; one, the Brisbane Co., as they had no members of the Association in their employ, some as they had minimum rates of pay specified in their articles of association, and others because they were bound by their arrangements with the Carters' and Drivers' Union.

One small undertaking, the Coburg, said to have the reputation of having the slowest tramway service in the universe, made this excuse, calling forth the inquiry from the Judge: What do you call the driver of the horse which draws this perambulator of yours—(laughter)—a carter or a driver?

The next day was occupied by the evidence of the Secretary and President of the Association, who tried to prove that the policy of the Association was very moderate. They pointed out that while the policy of the Australian Labour Federation was to endeavour to gain their object through a general strike, they were in favour of proceeding rather by negotiation and arbitration, and that it was largely by their advice that a strike at Adelaide was postponed.

The President, in his evidence, stated that in August, 1910, he was in the service of the Prahran-Malvern Tramway Co. as conductor, and found there was a great deal of dissatisfaction with their conditions. He said that their efforts to form a Union had met with much opposition from the companies. One of them, the Melbourne Tramway Co., had dismissed five men at Brunswick ostensibly on the ground that they were dissatisfied with them. The matter had been brought before Parliament, with the result that the men were reinstated.

The hearing was then adjourned.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### New G.E.C. Griller.

The accompanying illustration shows the new restaurant type of griller or toaster made by THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C. It is built up in strong sheet-iron, mounted on a rigid angle-iron frame, the outside overall dimensions being 24 in. long × 12 in. deep × 18 in. high. The actual grilling or toasting area is 22 in. × 12 in. deep.

The heating element is placed in the centre of the griller and consists of open coil wires mounted on fire-clay insulators placed about 1½ in. apart, so as to do away with any danger of sagging. These insulators or carriers are mounted on a steel plate which is



FIG. 1.—G.E.C. GRILLER.

riveted to the angle-iron frame. The wires are worked at bright red heat, and being made of the new "Archer" type resistance wire, they can work exposed to the atmosphere without any oxidising.

The heater is split in two with a pair of terminals fitted to each end of the griller, and each section consumes 1 kW.—i.e., a total consumption of two units per hour. A grid and drip tin are provided, which slide on either of the three sets of runners conveniently spaced under the heater.

Above the steel plate holding the insulators is a space measuring 22 in. long × 12 in. × 6 in. high with a removable shelf or damper,



and this can be used as a food or plate-warming chamber, or even if required, the steel plate itself can be used for frying on.

The griller is intended for use in all classes of restaurants, clubs and eating houses of every description and appears to meet a real want. At a recent test it was demonstrated that, starting from cold, ten full slices of bread could be toasted both sides in  $3\frac{1}{2}$  minutes.

### "Barrow" Street Lighting Fittings.

These fittings have been designed primarily for the lighting of tramway routes where span-wire construction is in use.

After numerous experiments they have been adopted by the Barrow Corporation for lighting the main road into Barrow from the south: being a residential district, the road is entirely dependent upon the street lamps for illumination. The system was developed by Mr. H. B. Burnett, the borough electrical engineer, and was described as follows, in a paper by Mr. J. D. Mackenzie, before the I.E.E., Glasgow.

The road has a total width of 80 ft., and trees are planted along each footway. A  $7/16$  galvanized steel suspension wire is fixed across the road between each pair of tram poles, and from this are suspended two fittings, each being fixed 13 ft. 6 in. from the centre of the roadway. The fittings are 6 ft. 3 in. in length over all, and bring the lamp to a height of 17 ft. 6 in. from the road level.

The stems of the fittings are passed through reel insulators, which are attached to the tramway span-wire, thus preventing the fittings from swinging, while leaving them free to move vertically.

The work upon which the above results were obtained was carried out under the most unfavourable climatic conditions, and it is anticipated that the costs will be reduced on the remainder of the work, which is now in hand.

Cab-tire sheathed cable, though somewhat expensive, has also been employed for wiring from the fittings to the cut-outs, with a view to securing immunity from faults on this portion of the work.

In the case under consideration a spare conduit had been laid a few years ago, when other extensions were in progress, and therefore this has been utilised, and a public lighting main drawn in, thus making it possible to control each circuit by means of a clock switch, which switches off one-half of the lamps at 11.30 p.m.

Although the initial cost of this arrangement is considerably greater than that of connecting each pair of lamps direct to the distributing mains, it undoubtedly makes a more satisfactory arrangement, and it will generally be found that the increased capital charges are at least counterbalanced by the saving effected in the attendance charges, especially in cases where the lamps are situated at a considerable distance from the generating station.

The results obtained with this method of lighting have given the greatest satisfaction.

The illumination obtained from two 60-watt metallic-filament lamps on each span, as described, is decidedly superior to that obtained from 10-ampere open-type arc lamps fixed on alternate tram poles, although the consumption of electricity in the case of



FIG. 2.—THE BARROW STREET LIGHTING SYSTEM.

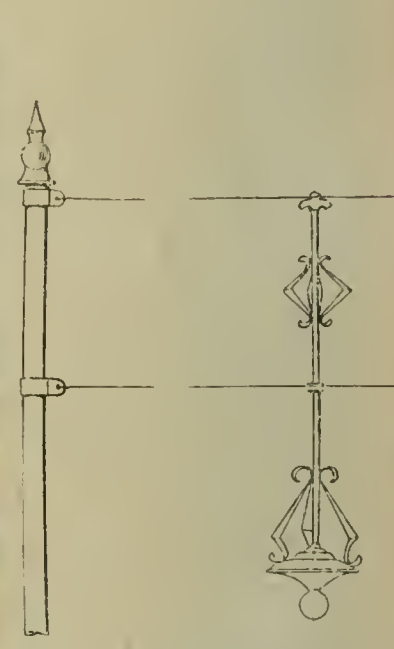


FIG. 3—"BEATAK" FITTING AND SPAN WIRES.

The fittings are fixed to the suspension wire by means of "U" binders; these are also used for fixing the insulators to the span-wires, so that the erection of a fitting only occupies a few minutes.

The lanterns employed are 18 in. "Beatak" fittings, in each of which one 60-watt metal-filament lamp is at present fixed, but allowance has been made in wiring for these being replaced by 100-watt lamps, should it be considered advisable to increase the illumination. The total weight of each fitting complete with lantern is approximately 17 lb.

A small three-way fuseboard in a cast-iron case is fixed to each tram pole along one side of the road, about 5 ft. from the ground, and from the outlet of this is taken a two-core  $3/22$  cab-tire sheathed cable, which runs up the inside of the tram pole and out through the finial, thence along the suspension wire to the first fitting, from which two-core  $3/22$  cab-tire sheathed cable is taken to the fitting on the other side of the road. These cables are fixed to the suspension wire by means of two part-porcelain insulators spaced about 3 ft. apart.

The connection from the main to each pair of lamps is made by means of three-core  $3/22$  paper-insulated and lead-covered cable drawn into 1-in. galvanized tubing, which passes through the base of the pole into the bottom of the fuseboard.

The capital cost of erecting and connecting complete three circuits, consisting of 112 lamps (56 spans), in the manner described, has been as follows:—

	Capital cost.	
	Total.	Per lamp.
112 suspension fittings, erected complete ...	£177	
Wiring ... ..	108	
Total cost of lamps erected and wired to cut-outs ... ..	£285	£2 10
Additional cost of laying service and main cables and controlling by clock switches:		
Services from main to three-way fuse-box, including fuse-box, &c. ... ..	£122	
Three control pillars, clock switches, &c. ...	41	
Main cable, exclusive of conduit ... ..	141	
Conduit, at 2s. per yard ... ..	235	
Total cost of lamps, complete with underground main and clock-switch control ...	£824	£7 7

From these figures it will be seen that the total cost of erecting lamps complete on this system, and connecting them to the cut-outs at which the service cable terminates, amounts to only £2 10s. per lamp. (These figures could be very materially reduced if the mains were carried overhead on the tram poles.)

the metal-filament lamps is only 5.04 KW. per mile of street, as compared with 11.5 KW. per mile of street in the case of arc lighting. The annual cost of the lighting on this system will also be found to be less than one-half of that with 10-ampere open-type arcs, the charge for electricity and allowance for interest and depreciation being the same in each case.

The price at which this lighting is being undertaken by the Electricity Committee at Barrow is £2 per annum per 60-watt lamp, one-half of the lamps being extinguished at 11.30 p.m. This price is equivalent to £168 per mile of street per annum, as compared with £367 per mile per annum for arc lighting.

The method of suspension employed entirely overcomes any trouble which might otherwise be experienced with metallic-filament lamps due to the vibration of the tram poles caused by the passing of cars. The average life of 60-watt lamps in four experimental fittings, which have been in use for some time past, already exceeds 1,200 hours, although three lamps have been broken, either in storms or due to defects in the fittings, and four are still burning.

In the case of six experimental fittings in which 100-watt lamps have been used, the results which have been obtained are even more satisfactory, the average life of the first six lamps in these fittings being no less than 2,071 hours.

### Ball-Bearing Line-Shafting Hangers.

THE HOFFMANN MANUFACTURING CO., LTD., Chelmsford, have introduced the "Hoffmann" ball-bearing hanger, which is shown in fig. 4. The main housing is fixed to the hanger casting by means of three eyebolts, allowing an easy means of vertical adjustment during erection, and as the holes in this casting are slotted out, horizontal adjustment can also be made. The main hanger castings can be erected quite independently of the bearing, this being done by withdrawing the pin which runs through the eyebolts. It is claimed for the "Hoffmann" hangers that they have most effective compensating devices, obtained, first, by allowing the whole housing to swing on its hanger (to prevent the whole shaft swinging endways, one hanger in each line shaft is fixed by means of the locking device shown in fig. 4); secondly, by constructing the bearing with a spherical seat.

The inner ball-race is firmly clamped to the shaft by means of a split taper sleeve, while the outer one is fitted in the spherical seat of the housing. The position of the bearing can readily be changed, as no wear comes on the shaft. There are two side plates which are a sliding fit in the spherical seating of the housing on their circumference, and a running fit on the split taper sleeve, a pin being provided to stop any tendency to revolve. These plates, being



able to move with the bearing in the spherical seat, are thus enabled to keep a tight fit, even if the shaft should be untrue. Grease-retaining grooves are turned in their bore, which retain the grease

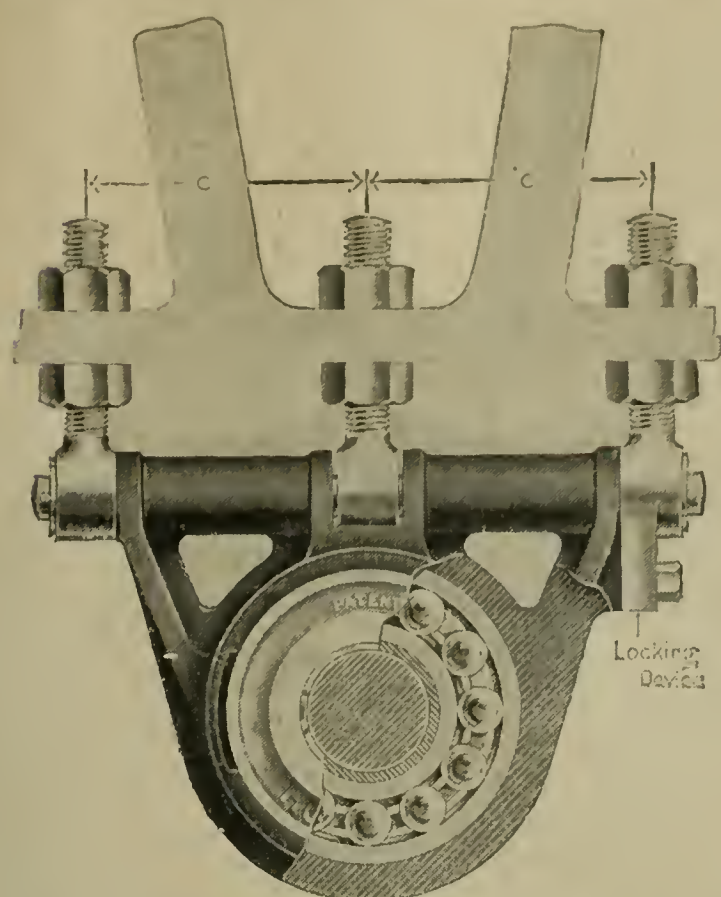


FIG. 4.—HOFFMANN PATENT BALL-BEARING HANGER.

in a very effective manner. Greases containing graphite or chalk should not be used, as they tend to lap down the races and balls. These bearings are made in both hanger and pedestal patterns and in the usual range of sizes.

#### Simplex Egg Boiler.

The egg boiler shown in fig. 5 is being manufactured by MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham, and is made in two sizes, respectively suitable for cooking three and six eggs at one time. The design is conventional, and in keeping with the object for which the appliance is intended; at the same time



FIG. 5.—SIMPLEX ELECTRICAL EGG BOILER.

it is well finished and made in copper, so as to constitute an ornamental addition to the breakfast table. The loading of the three-egg size is 300 watts, and as only a very small quantity of water is required for the operation of the apparatus, this loading is amply sufficient to raise the water to the necessary temperature for the cooking of the eggs within a few minutes of its being put on circuit. The six-egg size is relatively highly loaded.

#### New Insulator.

The accompanying figures show a new type of insulator which has been devised by MR. GEORGE BULL, of 50, North Lonsdale Street, Gorse Hill, Stretford, Manchester. The body of the insulator can be made to suit telephone and telegraph wires, as illustrated, or high-pressure lines by providing additional sheds; the special feature is the method by which the wires are attached to it, with the aid of a brass clamp and wing-nut. Obviously the attachment of wires is a very simple matter, as it is only necessary to

slacken the nut, lay the wire in the groove between the clamp and the insulator, and screw up the nut. No tools are required, and a firm grip is obtained in a few seconds. The merits of this device

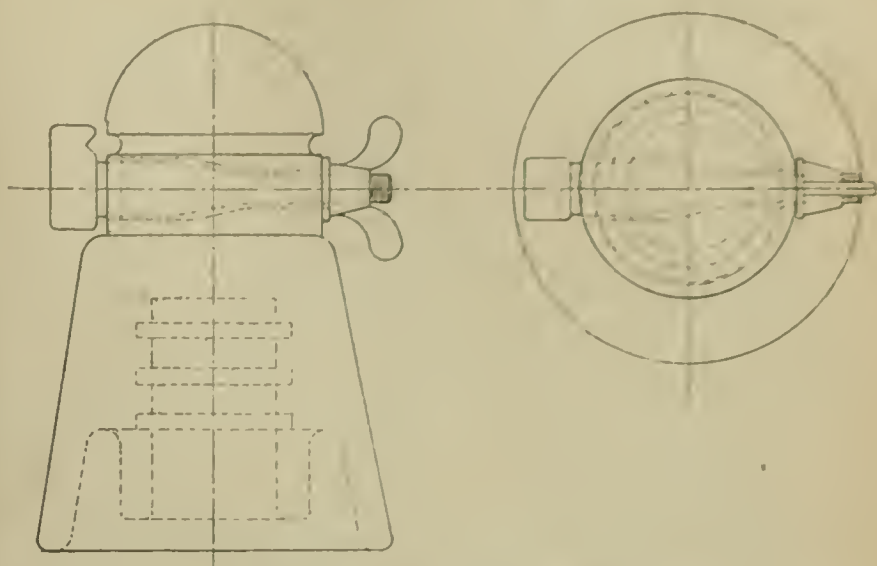


FIG. 6.—NEW INSULATOR AND CLAMP.

will be most fully appreciated by linemen in the winter season, as they need not spend much time at the top of a pole in fixing wires. The inventor has applied for letters patent for the device.

#### White Electrical Instruments.

In the new catalogue just issued by the WHITE ELECTRICAL INSTRUMENT CO., of 2 and 4, Gloucester Street, Clerkenwell, London, E.C. (formerly the electrical department of Messrs. James Pitkin & Co.), the firm have devoted special attention to their iron cased switchboard instrument in which improvements are embodied for ensuring accuracy and durability. The makers claim that every detail in size and shape of cover and scale has been carefully studied to facilitate readings being taken easily and correctly, whether the instruments happen to be fixed at eye-level or otherwise. Various types of portable instruments are also described and illustrated, and likewise a number of testing sets for the measurement of insulation and resistance. Several novel forms of conductivity testing sets are included. The accompanying illustration (fig. 7) shows one of their type "T" portable wattmeters which has a moving-coil dynamo-

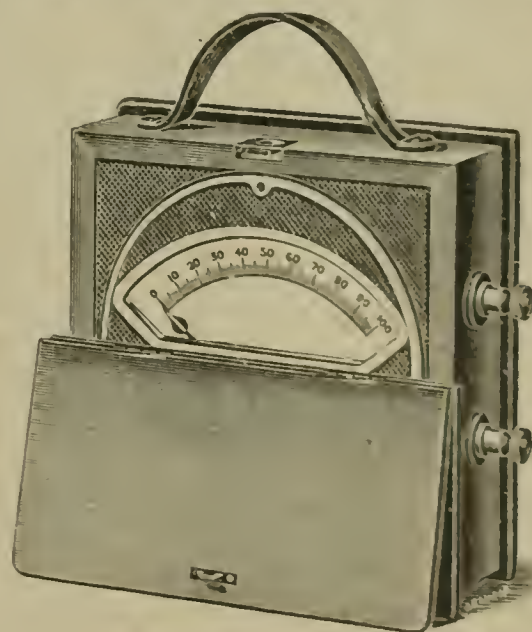


FIG. 7.—TYPE "T" WHITE PORTABLE WATTMETER.

meter movement and is supplied in a polished teak case with leather handle, also with rubber buffers to prevent injury in transit. It has a 6-in. silvered and engraved dial. The instrument can also be supplied in a leather case lined with green baize, and having a sling strap. The list should be useful to switchboard makers and electrical contractors.

#### Moulded Steatite.

Steatite, as an electrical insulator, has been known and used to a limited extent for many years in this country, but only in the native form; and the necessity of cutting it out of the solid—an expensive process—has precluded its employment, except for special purposes, though its ability to resist high temperatures is a very valuable characteristic. A process has, however, been developed for moulding steatite into any desired form and afterwards baking it at a high temperature, the resulting product being extremely hard and tough, besides possessing excellent insulating qualities. We recently inspected a variety of parts of moulded steatite, such as tumbler switch bases, bayonet lampholder interiors, &c., at the offices of MESSRS. KRAUSSE & AUERBACH, of 45, Basinghall Street, E.C., and were impressed with the perfectly sharp edges and the strength of the material, in both of which qualities it is superior to porcelain. While only a few British manufacturers have as yet "discovered" this useful material, we understand that it has been



widely employed on the Continent by some of the largest firms for several years, single orders for a million pieces at a time being not uncommon. Even such parts as links and dollies in tumbler switches—which, if made of metal, are difficult to insulate satisfactorily—can be made of moulded steatite, which has ample strength for the purpose, and it can be had in the form of slabs, &c., of practically the same dimensions as can be attained with porcelain. It is worthy of the careful attention of makers of switches, fuses and similar apparatus.

Split-Seconds Chronograph.

MESSRS. WALES & McCULLOCH, of 20, Ludgate Hill, E.C., recently submitted for our inspection a handsome specimen of their 18-ct. gold split-seconds chronograph, which received exceptionally high commendation at the hands of the Kew testing office. It occasionally happens that it is necessary to record separately the durations of two events which start simultaneously, but do not stop at the same time, and for such a case the split-seconds device, reading to  $\frac{1}{5}$  seconds, is admirably adapted.

PROCEEDINGS OF INSTITUTIONS.

On the Power Factor and Conductivity of Dielectrics.

By J. A. FLEMING, F.R.S., M.I.E.E., and G. B. DYKE, B.Sc., A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, March 28th, 1912.)

IN the present paper we concern ourselves only with the power factor and conductance of dielectrics under alternating electromotive force of low voltage, pure sine wave-form, and of frequencies between 900 and 5,000 P.P.S., as this has a close connection with practical telephony.

It has long been known that the conductivity of certain dielectrics for alternating currents of telephonic frequency is much greater than for direct or unidirectional currents.

Telephonists are well aware of the great effect which the ratio of the leakance of a line to its capacity per mile exercises upon the attenuation constant, and therefore on the speech-transmitting qualities, especially in the case of highly inductive or loaded lines. In these cases if  $s$  denotes the alternating-current dielectric conductance or leakance per mile and  $c$  the capacity per mile, the ratio  $s/c$  (denoted by  $\rho$ ) is an important quantity.

This same ratio  $\rho$  concerns us in the case of condensers having dielectric conductivity or leakance, which are operated with simple harmonic alternating electromotive force of maximum value  $v$  and frequency  $n = p/2\pi$ . If a condenser or cable of capacity  $c$  has such a voltage applied to it, it creates a dielectric current  $c p v$  nearly in quadrature with the impressed voltage, and also there is, or may be, a power absorption proportional, as shown by all experiments, to the square of the impressed voltage. This indicates that there is a current  $s v$  in step with the voltage. Hence, the power factor of the condenser is given by the expression  $s/\sqrt{p^2 + s^2}$ , but for small power factors is sufficiently nearly expressed by  $s/p$  or by  $s/c p$ .

It is curious that cable manufacturers continue to pay such great attention to the so-called insulation resistance (I.R.) measured by applying a steady or direct-current voltage to the cable and then stating the I.R. as so many megohms per mile after 1 minute's electrification. Except as a rough test of dielectric strength and means of revealing defects of manufacture, the above measurement

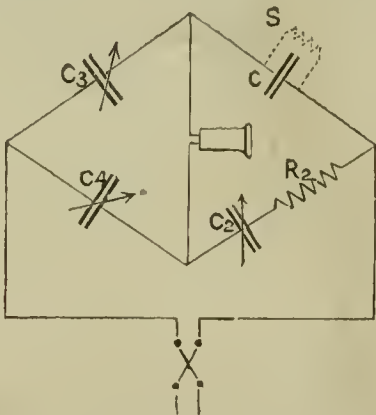


FIG. 1.

has very little, if any, scientific value. The quantities which have real significance are the alternating-current conductivity  $s$  for a stated temperature and frequency, the ratio  $s/o = \rho$ , and the ratio  $s/c p = s/p$  (which when small is nearly the power factor), and the quantity usually called the admittance  $\sqrt{s^2 + c^2 p^2}$ .

In all these expressions when they occur in formulæ concerned with telephonic transmission and high-frequency currents, the symbol  $s$  is not to be taken as equivalent to the reciprocal of the insulation resistance measured with direct currents, nor is the  $c$  the steady or direct-current capacity, but they are quantities only to be obtained by special measurements.

We possess in the Pender Electrical Laboratory, at University College, London, an alternator built by Messrs. Crompton & Co., of Chelmsford, the normal frequency of which is about 900 P.P.S. The wave form of the E.M.F. is very far from being a simple sine curve; but this proves to be a great advantage, as it enables us to filter out three harmonics having frequencies in the ratio of 1 : 3 : 5, each of very pure sine-form.

For determining energy loss in dielectrics we gave preference to bridge methods, which would enable us to determine the conductivity and capacity separately, even when using very small condensers or short lengths of cable having a capacity of about a thousandth of a microfarad.

The arrangement is as shown in fig. 1, in which  $C_2$ ,  $C_3$  and  $C_4$  are three air condensers of variable capacity; the resistance  $R_2$  is a practically inductionless resistance, and  $c$  is the capacity of the condenser or cable operated upon, having a dielectric conductance represented by  $s$ .

The bridge is supplied with a perfectly pure sine-form E.M.F., having a value of 4 or 5 volts. The opposite corners of the bridge are connected to a sensitive high-resistance head telephone. The condenser or length of cable to be measured is then connected in as the fourth arm of the bridge. The experimental adjustment consists in varying the capacity of the condensers,  $C_3$  and  $C_4$ , and the resistance  $R_2$  for some selected value of the capacity  $C_2$  until perfect silence is obtained on listening to the telephone.

Obtaining the equation  $s/c p = \rho$ ,  $C_2 R_2 = \rho$ , it is easy to calculate the separate values of  $s$  and  $c$  from the equation  $c = \frac{C_2 C_3}{C_4} \times \frac{1}{1 + \rho^2}$  and  $s = \rho c p$ . These equations give us  $s$  and  $c$  in terms of  $C_2$ ,  $C_3$ ,  $C_4$  and  $R_2$ , and also  $s/c p$ .

We prepared a number of small condensers having dielectrics respectively of dry Manilla paper, paraffined Manilla paper, celluloid (cinematograph film), gutta-percha, pure india-rubber, vulcanised india-rubber, ebonite, glass, mica, sulphur, thin slate, and other materials. The dielectrics were sheets about 3.5 cm. by 12 cm. in size and 1 or 2 mm. or less in thickness, except the sulphur. The metal condenser plates were usually tin-foil, with a lug and with rounded corners, and a sufficient number of sheets taken to give a capacity of the order of 0.001 of a microfarad or rather less.

They were tested at three frequencies: viz., 920, 2,760 and 4,600 P.P.S., and at temperatures varying from  $-15^\circ\text{C.}$  to  $80^\circ\text{C.}$  We also measured a dry-core paper-insulated telephone cable and two samples of gutta-percha-insulated cable, and certain pure dielectric such as paraffin wax and sulphur in the form of thicker flat plates.

Some of the results are given in the following table:—

Dielectric.	Frequency $n$ .	Approximate dielectric constant $k$ for frequency $n$ .	Approximate percentage variation of $k$ per $^\circ\text{C.}$	Approximate A.C. resistivity in megohms per cm. <sup>3</sup> for frequency $n$ .	Power factor for frequency $n$ .	Ratio $s/c = \rho$ .
Glass at $17^\circ\text{C.}$ ...	920	6.60	+ 0.260	16,900	0.018	104.0
	2,760	6.50	+ 0.190	6,400	0.016	277.0
	4,600	6.50	+ 0.160	4,000	0.015	433.0
Dry Manilla paper at $19^\circ\text{C.}$	920	1.95	+ 0.108	140,000	0.007	41.6
	2,760	1.95	+ 0.106	46,000	0.007	125.0
	4,600	1.95	+ 0.112	26,000	0.008	225.0
Paraffin wax at $17^\circ\text{C.}$	920	2.36	Nearly zero	2,460,000	0.0003	2.0
	2,760	2.36		493,000	0.0005	10.0
	4,600	2.36		296,000	0.0005	17.0
Mica at $16^\circ\text{C.}$ ...	920	4.00	+ 0.060	423,500	0.001	7.0
	2,760	4.00	+ 0.060	141,200	0.001	21.0
	4,600	4.00	+ 0.060	50,000	0.002	58.0
Ebonite at $19^\circ\text{C.}$ ...	920	3.17	+ 0.360	148,500	0.005	24.0
	2,760	3.15	+ 0.310	38,500	0.005	93.0
	4,600	3.14	+ 0.290	23,100	0.005	155.0
Vulcanised india-rubber at $17^\circ\text{C.}$	920	2.73	— 0.150	343,300	0.002	12.0
	2,760	2.71	— 0.130	103,000	0.002	40.0
	4,600	2.71	— 0.140	38,100	0.004	108.0
Gutta-percha at $15^\circ\text{C.}$	920	2.86	+ 0.105	33,700	0.020	117.0
	2,760	2.86	+ 0.124	10,200	0.023	389.0
	4,600	2.86	+ 0.133	5,600	0.025	708.0

These measurements show that the value obtained for the so-called dielectric resistance of insulators, by measuring the current which flows through them after applying for one minute a steady voltage, has very little relation to the true alternating-current resistivity, with which alone we are concerned in telephony. This latter number, as obtained and measured by us, is the real index of the energy dissipation in the dielectric.

The following are the conclusions arrived at as a result of the measurements:—

All the dielectrics so far tested prove to possess a true dielectric conductivity for alternating-currents considerably greater than for steady unidirectional currents.

This increased conductivity implies greater power dissipation for the same terminal potential difference or voltage.

The alternating-current conductivity increases with the temperature except in the case of vulcanised india-rubber rather below  $20^\circ\text{C.}$ , and gutta-percha rather above  $15^\circ\text{C.}$ , in both of which cases it decreases with rise of temperature. In the case of mica and very dry paper it is not affected to any sensible extent by rise of temperature over a range between  $0^\circ\text{C.}$  and  $60^\circ\text{C.}$



The alternating-current conductivity is in most cases a linear function of the frequency, and may be expressed in the form  $\sigma = a + b n$ , where  $a$  and  $b$  are coefficients, which are functions of the temperature, and  $n$  is the frequency.

The alternating-current conductivity, especially that part of it denoted by  $a$ , is greatly increased by the presence of moisture in the dielectric. This part is probably identical with the true direct-current conductivity.

The part of the conductivity denoted by the coefficient  $a$  is possibly electrolytic in nature, whilst the part proportional to the frequency is a consequence of an energy loss which is possibly analogous to the hysteresis loss in iron.

The dielectric constant for alternating electric force is in most dielectrics rather smaller than that for steady or unidirectional electric force. In no case is it larger.

The ratio  $s/C_p$ , nearly identical with the power factor, is, for some dielectrics such as mica and dry paper, a constant independent of frequency and temperature. For most dielectrics it increases with rise of temperature, but decreases with rise of frequency. The power-factor variation with temperature of vulcanised india-rubber and gutta-percha is quite abnormal.

Those dielectrics such as celluloid and gutta-percha, which have large alternating-current conductivity, although free as far as possible from moisture, also exhibit in a marked manner the phenomena of dielectric absorption and residual charge.

For certain dielectrics there is a temperature at which the power-factor and alternating conductivity have maximum values.

#### DISCUSSION.

DR. ALEXANDER RUSSELL said the paper opened a new chapter in the theory of conductance of electricity through dielectrics; the authors had found out a law according to which current flow through a dielectric could be measured. He was afraid the theory of telephony would have to go through the melting pot, and he was not sorry for it. The authors criticised the ordinary test for insulation resistance, but it was efficient for weeding out faulty cable. The method described of filtering out harmonics was ingenious and simple. The critical part of the paper was the assumption (on page 21) that every condenser could be represented by a perfect capacity shunted by a conductance which varied with the frequency; this would have to be very carefully considered. The capacity bridge was well worth the reading of the paper. It appeared that the capacities of small condensers decreased with high frequency, and he could not understand a condenser's capacity varying, as it should, theoretically, be constant. Perhaps the authors' was not a true model of an absorptive condenser.

MR. B. S. COHEN said it was surprising that even now the importance of alternating-current constants for telephonic and telegraphic work was not fully realised, and yet it was easier to get apparatus for such measurements than for direct-current measurements. Many condensers for telephonic work were found to have far less capacity than they were supposed to have; the effective insulation was also often low. The authors' scheme for wave filtering was very interesting; he suggested that the Campbell filter method inverted would eliminate all frequencies below a certain value, and this would have the advantage of more power than with the method used. Measurements by the authors and others gave the effective insulation with telephone currents of dry-core cable as a megohm per mile loop, but some measurements by himself and others using vector methods showed a result about a quarter of this.

MAJOR A. J. O'MEARA said it was known that damp seriously affected the properties of paper insulation, but the importance of this was not fully realised. He thought there was no other country where provision for the desiccation of underground telephone and telegraph cables was made, but the tables in the paper showed the necessity for this. The importance of the twin-wire system for submarine cables was appreciated at the time he (the speaker) read his last paper before this Institution.

MR. A. CAMPBELL disagreed with the statement in the paper that no current interrupter of any kind could be substituted for the sine wave alternator and wave filter, as he had been employing buzzers, interrupters and microphones on the same class of work for years, and he considered them equally good for such tests as the authors' arrangement. He described an arrangement of microphone hummer and Wien bridge, with which one could get 100 volts if desired, and pure wave form for frequencies from 300 to 3,000 per sec. He could use one of his wave sifters between the microphone hummer and tuning circuit and obtain frequencies corresponding to various harmonics; with an ordinary 5s. electric trumpet frequencies up to 4,000 were obtainable.

MR. H. R. KEMPE said the steady current insulation test was one of the very best for cable testing; A.C. high-frequency tests would not show defects in the same way as D.C. tests would, and the former was practically useless from the manufacturers' point of view. It was well known that gutta-percha improved with age, and experimenters should state that in giving results; some cores when first made had an insulation resistance of 200 megohms, but this might rise subsequently to as much as 10,000 megohms, which showed that a definite value for the specific resistance of gutta-percha could not be fixed. In order to get over the difficulty of determining when absolute silence had been obtained with the bridge-telephone method of testing, an assistant of his had introduced a short-circuiting key on the telephone which much facilitated accurate determination.

MR. G. L. ADDENBROOKE also spoke, referring to experimental results obtained by himself, and mentioned that in some cases his results might be taken as confirming those in the paper. The authors decided to communicate their reply to the *Journal*.

#### THE KELVIN LECTURE.

ON Thursday, April 25th, the third Kelvin Lecture was delivered at the Institution of Electrical Engineers, by Prof. H. du Bois, of the Bosscha Laboratory, Physico-Technical Institute, Berlin. He dealt with the work of Lord Kelvin in electricity and magnetism, extending over some two-thirds of a century, and described some of the later developments of his teachings by his pupils and followers. The lecturer pointed out that electrostatics was Lord Kelvin's first love, and summarised the large amount of scientific investigation which he carried out, leading ultimately to the introduction of such practical instruments as electrometers, electrostatic volt-balances, the electrostatic voltmeter, &c. One of Kelvin's aims was to make galvanic batteries amenable to electrostatic determination, and the lecturer outlined the experimental research carried out in connection therewith. Further, Kelvin in 1857 drew attention to the enormous variation of specific conductivity of copper for different samples and to the commercial importance of this fact. Eventually his long series of experiments led him to improve Wheatstone's device and construct the low-resistance bridge. Kelvin was the most prominent delegate at the first International Congress in Paris in 1881, to which we owed the sanction and legalisation of the volt, ohm, ampere, coulomb and farad. In the subject of magnetism Kelvin showed that a complete mathematical theory could be founded on known facts, the results agreeing with those previously deduced in other ways. His great work in this connection was detailed by the lecturer, as well as the practical applications of many of his discoveries. In conclusion, Prof. du Bois referred to the influence of Lord Kelvin on those students with whom he had had daily intercommunication; besides the British and American physicists educated in the Glasgow laboratory, he said that probably the Japanese and Polish schools had been most influenced. He was also appreciated in Holland, through the shipbuilding connection between that country and the Clyde, but his work had never been quite so well appreciated in Germany as, from the beginning, it was in Italy and France.

#### PARLIAMENTARY.

##### Keighley Corporation Bill.

A SELECT COMMITTEE of the House of Commons, presided over by Sir Charles Nicholson, commenced the consideration of the Keighley Corporation Bill before Easter. The main provisions of the Bill related to water, and these were considered first at great length. Part 5 of the Bill asked for powers to install a system of railless traction, for which the estimates amounted to £47,970.

MR. WHITEHEAD, K.C., in opening this part of the Bill, said there was considerable opposition to the proposals. Several of the adjoining local authorities, the County Council of the West Riding and the Great Northern and Midland Railway Companies had petitioned against the Bill. The opposition of the County Council was in respect of main roads, and that of the District Councils in regard to the district roads. They were asking for contributions towards the maintenance of the roads, for control over the standards and posts and equipment, and for certain guarantees regarding the service, &c. The object of the Corporation was to inaugurate a system of overhead trolley vehicles in order to link up the existing tramways with the outside district. Four routes were proposed, viz., from Uttley, in the direction of Skipton—four miles; from Stockbridge to Nab Lane—five miles; and also from the town to Oakworth and to Lane Fields. With regard to the powers for running motor-buses, the object was to test other districts before embarking on the construction of further routes of trackless tramways, and also to have another system as a stand-by in case of the trolley system breaking down.

MR. J. B. HAMILTON, the general manager of the Leeds Corporation Tramways, was called and gave evidence as to the installation of the railless system in that town, which, he said, had been very successful.

After an adjournment, MR. F. FITZGERALD, K.C., who represented the Bingley U.D.C., stated that the Board of Trade had intimated that they would shortly be prepared to make a provisional order sanctioning a tramway from Bingley to the Keighley rural area.

The representative of the Board of Trade replying to the chairman, said the order had really been made, but had not yet been introduced into the House. The Board were aware of the proposal for the trolley system, but they simply dealt with the tramway order on its merits.

MR. FITZGERALD said that Bingley was prepared to widen the road where the Board of Trade thought it should be widened. An agreement had been come to with the Bradford Corporation whereby when the Bingley tramways were constructed they would be leased to the Bradford Corporation, which would give a route right into Bradford.

Having considered the question in private, the CHAIRMAN pointed out that it would be difficult for the promoters to persuade the Committee to give powers to run trackless trolleys over the same route as that on which a tramway was sanctioned.

MR. WHITEHEAD having consulted with his client, said that if Bingley was hostile to the proposal he agreed it would not be wise to press it on the Committee, but they did not believe Bingley was hostile.

The CHAIRMAN having intimated that the promoters might proceed with their case in the ordinary way, witnesses from



Keighley were called to prove that there was a large demand for communication between the Keighley district and Bingley.

MR. HAMILTON was recalled, and expressed the opinion that the routes proposed by the Bill would well serve the district, and that the working would result in a profit. There were no dangerous places in the routes proposed, and as Keighley did not contribute to upkeep of the roads over which motor-buses were now run, he did not think they ought to contribute in respect of trolley vehicles. The installation of railless traction was under the direct control of the Board of Trade, and consequently there was no necessity for the local authorities having supervising powers. If either motor-buses or trackless trolleys were only run from the terminus of the Keighley tramways to the boundaries of Keighley and Bingley, it would stop through communication between Keighley and Bradford, and it would not pay.

In cross-examination, WITNESS said he was unable to give any instance of a public authority which had been authorised to run trackless trolleys outside its district, and had not to contribute to the upkeep of the roads over which the system ran.

MR. J. MOFFET MCELROY, general manager of the Manchester Corporation Tramways, endorsed the views of Mr. Hamilton.

MR. D. GRAY, manager of the Keighley Corporation Tramways, gave evidence to the effect that whilst he did not think an ordinary tramway service would pay between Stockcross and Nab Lane, he thought a railless trolley system would pay.

The CHAIRMAN said the Committee had decided to strike the route from Stockbridge to Nab Lane out of the Bill.

MR. FITZGERALD asked the Committee to allow the Bingley Urban District Council their costs in regard to their opposition to this route, on the ground that the proposal had been unreasonable and vexatious.

The CHAIRMAN said the Committee would not agree to this.

The other part of the scheme was passed.

Considerable discussion took place with regard to road widenings and the question of the Corporation contributing to the maintenance of roads. Ultimately the Committee decided that where the cars ran county roads must be widened to 20 ft., and rural and urban district roads to not less than 17 ft., except where such widening would mean the widening of bridges. The Committee did not think the Corporation should be called upon to contribute towards the maintenance of roads.

### Midland and London and Tilbury Railways Bill.

ON Thursday, April 25th, a Select Committee of the House of Lords, presided over by the Earl of Camperdown, passed the preamble of the Bill promoted by the Midland Railway Co. for the vesting of the London, Tilbury and Southend Railway undertaking in the Midland Co. The only opposition to the Bill came from the Great Northern and the Great Eastern Companies.

MR. TALBOT, in opening the case for the promoters, said the proposal was in no sense a move in a campaign against the Midland Co.'s rivals, but it was believed the amalgamation would result in a great development of the traffic on the Tilbury Railway.

SIR GUY GRANET, general manager of the Midland Co., said his company was at present connected with the Tilbury Co., and its acquisition would give them an outlet to the Thames. The first thing they would probably do was to electrify a considerable portion of the line, and he considered that the Midland Co., with its large financial resources, could do this more quickly and advantageously than could the Tilbury Co. He considered they would first wish to electrify the direct route to Southend, while the electrification of the lines from Barking to Tilbury and to Pitsea would be the next development. The electrification of the 2½ miles of the London and Blackwall Railway, over which the Tilbury Co. ran to get to Fenchurch Street, could only be carried out by agreement with the Great Eastern Co., and he was prepared to give that company protective clauses.

In cross-examination by MR. BALFOUR BROWNE, K.C., for the Great Northern Railway Co., WITNESS said there was nothing in the Bill which compelled the Midland Co. to electrify the line, but it was only by doing this that they could hope to get a profit out of the transaction.

MR. A. L. STRIDE (chairman and managing director of the London and Tilbury Co.) said that the reasons which induced his board to agree to the vesting was that they were faced with a large capital expenditure in regard to increased station accommodation at Fenchurch Street, the electrification of the line, and for new rolling stock.

Before further evidence was called, MR. TALBOT stated that an agreement had been come to with the Great Eastern Co., with regard to Fenchurch Street, by which, amongst other things, the Great Eastern Co. agreed to do their utmost to facilitate electrical working over the Blackwall line.

MR. BALFOUR BROWNE, K.C., addressed the Committee, and urged that the Great Northern Co. should be allowed absolute running powers over the line, but this the Committee refused to concede.

**Metropolitan Railway Bill.**—After a protracted hearing, Mr. Soames' Select Committee of the House of Commons which commenced the consideration of the Metropolitan Railway Bill before Easter, has rejected the principal proposal. The Bill sought authority to enable the company to make a new railway at Hammer-smith to join up with the authorised line of the Great Western Railway Co. to West Ealing, and thus to give yet another route from Ealing to the City; and it also sought power to enable the company and the Metropolitan and Great Central Joint Committee

to construct a railway from Rickmansworth to Watford, and to give the Metropolitan Co. running powers over the new Great Western line to Ealing Broadway. After hearing a great deal of evidence, including that of Mr. A. H. Stanley, general manager of the Metropolitan District Railway Co., in opposition to the Bill, Mr. S. Sellon, and Dr. H. F. Parshall, chairman of the Central London Railway, the Committee decided that the part of the preamble of the Bill relative to the running to Ealing was not proved.

Later, the Committee proceeded to consider the remainder of the Bill which sought to empower the company to make an extension from Rickmansworth to Watford, at a cost of £108,436. This portion of the Bill was opposed by the London and North-Western Railway Co. who are contemplating, by their Bill before Parliament this year, a great extension of the service to Watford, following on the electrification of parts of the system. The Committee found the preamble of this part of the Bill proved.

**Electric Lighting Provisional Order (No. 1) Bill.**—This Bill, which has been committed for second reading, contains confirmation of Board of Trade Orders relating to the following places:—Ardsley.—Order granted to the Electrical Distribution of Yorkshire, Ltd. Bingley.—Order granted to the U.D.C. Birstall.—Order granted to the U.D.C., with power to transfer within one year to the Electrical Distribution of Yorkshire, Ltd. Bognor.—Order granted to W. Tate, of Tower House, Felpham, but such powers are not to be authorised unless transferred to a company. Burnham.—Order to the U.D.C., but powers not to be authorised unless transferred to a company to be called the Burnham and District Electric Supply Co. Great Harwood.—Order to the U.D.C. Greetland.—Order to the U.D.C. Hoyland Nether.—Order to the U.D.C., with power to transfer to the Electrical Distribution of Yorkshire, Ltd. Launceston.—Order to the Launceston and District Electric Supply Co. Wimborne and District.—Order to the Bournemouth and Poole Electricity Co., Ltd.

**Tarbert Harbour.**—The Pier and Harbour Provisional Order Bill which passed the Examiners on Monday contains clauses to enable the trustees to, amongst other things, lay down electric mains, to provide tramways, and to provide motive power for tramways.

**Electric Lighting Provisional Order (No. 2) Bill.**—On Monday the above Bill passed the Examiner. It confirms Board of Trade Orders in regard to the following: Abercarn.—Order granted to the U.D.C., but not to be exercised unless transferred to the South Wales Electrical Power Co. Aylesbury.—Order to the U.D.C. Biddulph.—Order to the U.D.C. Burnley.—Order to the Corporation for extension to adjoining parishes. Darton and District.—Order to Electrical Distribution of Yorkshire. Doncaster.—Order to the Corporation to extend area to include Wheatley. Dorchester.—Order granted to J. & W. Purves to be transferred to a company to be called the County of Dorset Electric Supply Co., Ltd. Ilkley.—Order to the U.D.C. Pontefract.—Order to the Corporation to be transferred to the Yorkshire (West Riding) Electrical Tramways Co., Ltd. Sherborne.—Order granted to J. & W. Purves to be transferred to the County of Dorset Electrical Supply Co., Ltd.

**Second Readings.**—In the House of Lords, on April 25th, the Metropolitan Railway Bill, Edgware and Hampstead Railway Bill, London Electric Railway Bill, and the Ramsbottom Urban District Railless Traction Bill, were read a second time.

**Electricity in Westphalian Collieries.**—It is known that the use of electricity in German collieries has increasingly progressed during the past 10 years, but no statistics on the subject were available until recently. These have been published by Dr. Jungst, in reference to the coal mines in the Ruhr. It appears that the production at the mines amounted to 461,600,000 kw.-hours in 1910, the source of power being coke-oven gases used in the working of large gas engines, or in the firing of steam boilers. In 1906 the output of electric power at the coal mines in the Ruhr was only 58,000,000 kw.-hours; in 1907 it advanced to 107 millions; in 1908 to 171 millions; in 1909 to 256 millions; and in 1910, as already mentioned, to 461.6 millions of kw.-hours. The largest producers bear such well-known names as the Gelsenkirchen Mining Co., with 58.7 millions in 1910; the Hibernia Mining Co. with 43.9 millions, the Harpen Co. with 41 millions, and the Gutehoffnungshutte with 22 millions of kw.-hours. Out of the total production in 1910 the largest proportion (402 kw.-hours) was utilised for the private purposes of the collieries concerned, and 38 millions were used in connection with other plants owned by the producing companies, whilst the balance of nearly 22 millions was disposed of to third parties in 1910, as compared with only 83,000 kw.-hours in 1906. In addition to the collieries, the iron and steel works in Rhenish-Westphalia are also large producers and consumers of electric power, which is principally obtained by the use of blast furnace gases, although they have not made such progress in this direction as the purely coal mining undertakings themselves. In 1906 the iron and steel works had an output of 45.7 millions, but the quantity had only risen to 106 millions of kw.-hours in 1910, although the latter does not include the production of the works of the Deutscher Kaiser Corporation, concerning which no particulars are obtainable. About two-thirds (69 millions) of the output of the iron and steel works were consumed by the works themselves, 32 millions were employed in their own collieries, and the balance of five millions was sold to other undertakings.



## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**ROUMANIA.**—With reference to the recent note regarding a Bill for the modification of the Roumanian Tariff, the Board of Trade are informed that the Bill has now been passed, and in addition to the alterations already notified the following reductions have been made:—

	Former rate. Lei per 100 kg.	New rate. Lei per 100 kg.
Iron or steel wire—		
1.5 mm. in diameter or more ...	8	6
From 1.5 mm. to .5 mm. in diam.	15	9
Less than .5 mm. in diam. ...	18	13

25 Lei = £1. Kilog. = 2.204 lb.

**BRAZIL.**—With reference to the notice which appeared in a recent issue of the ELECTRICAL REVIEW regarding the proposed modification of the Consular invoice regulations for goods shipped to Brazil, the Board of Trade have received a telegram from H.M. Minister at Rio de Janeiro, reporting that he has been officially informed that the regulations in question will not be enforced pending the decision of Congress with regard thereto.

**CHILE.**—The Chilean Government effected certain alterations in the tariff which were to come into force on April 15th of this year. The information as to duties leviable on electrical goods in Chile previously published in the ELECTRICAL REVIEW will therefore require to be modified in accordance with the following amendments:—

An additional duty of 5 per cent. *ad valorem* is to be levied on articles which now pay 5, 15, 25, 35 or 60 per cent. *ad valorem*; and a surcharge of 10 per cent. is to be imposed on the specific duties levied under Article 6 of the Tariff Law of December 23rd, 1897, except on sugar and on wheat flour; this additional duty and surtax are to remain in force for three years. A duty of 5 per cent. *ad valorem* is to be levied *permanently* on goods which are now duty free under Article 7 of the Tariff Law, with certain exceptions.

**PORTUGAL.**—A Bill has recently been introduced into the Portuguese Legislature by the Minister of Finance providing that the duties prescribed by the Portuguese Customs Tariff shall be levied in gold in one of the following forms:

- Portuguese gold coins at their face value;
- Sovereigns, and gold coins of the Latin Union, at their par value;
- Duly guaranteed cheques on London, Paris, Brussels, Berlin, and Amsterdam, in pounds sterling, francs, marks, and florins, respectively, at their par value;
- "Gold warrants," *i.e.*, special bonds intended exclusively for the payment of Custom duty issued by the Bank of Portugal or by other banks and bankers authorised by the Government. These "warrants," made out for the amount of duty for which each consignment of imported merchandise is liable, will be sold at such a premium as circumstances and competition may dictate.

For consignments cleared through Customs offices of the Continent or adjacent Islands, or through urban sub-offices, on which the amount of duty does not exceed 4,500 reis (about £1), and for consignments cleared through other Customs sub-offices on which the amount of duty does not exceed 18,500 reis (about £4), payment may be made in national currency, the duty in these cases being increased by an amount corresponding to the average premium on gold, as determined by the Government each week.

## EXPIRING PATENTS.

(Continued from page 700.)

9,802. April 28th, 1898. "Driving printing, &c., machines by electromotors." W. A. CLATWORTHY, W. H. HOLMES, A. HOLMES, J. H. HOLMES, L. W. HOLMES and E. HOLMES, trading as J. H. Holmes & Co. Relates to a method of, and means for, driving printing and other machines at variable speeds by electric motors. The machine is driven direct by a large motor at high speed when printing, and is driven slowly, as when making ready, &c., by a small motor geared to the driving shaft by worm and screw gears and a clutch. When the switch is operated the circuit through the small series-wound motor and the solenoid is closed. The latter operates to engage the clutch through which the small motor drives the machine. Further movement of the bridge pieces closes the main switch; later it closes the circuit through the armature of the large shunt-wound motor. When the speed of the large motor becomes greater than that of the small motor, the clutch over-runs and the cone of the solenoid is operated by it to connect the two contacts, closing a circuit which short-circuits the magnet. This releases the switch and throws out the small motor.

10,291. May 5th, 1898. "Relates to Rheostats." C. WIRT. A continuous metal ribbon is wound or folded into a number of connected sections. These may be made by winding them on a circular or elliptical mandrel, and afterwards pressing them flat. The layers in each section are separated by applying an insulating cement to the ribbon as it is wound, or by oxidising the surface of the ribbon, or otherwise. The connected sections are arranged circularly on mica or asbestos insulation in a ribbed case. Each section is covered by a metal sector, and the sectors are held down by insulating material below a covering ring.

11,158. May 16th, 1898. "Electric railways, &c." H. H. LEIGH. (F. J. Sprague.) Relates to methods of controlling electrically-driven trains from any desired point on the train, which may be built up of vehicles, arranged in any order and any or all of them carrying one or more driving motors or none at all. In the simplest form, two wires run the length of the train and

have connected to them in parallel all the driver's controller, so that current can be sent from the main supply to either of two solenoids, whereby the circuits to the motors are made for forward or backward running. Instead of the simple make-and-break switches actuated by these solenoids, resistance switches may be used.

11,158A. May 16th, 1898. "Electric couplings." H. H. LEIGH. (F. J. Sprague.) Relates to couplings for electrically-propelled vehicles which are equipped to form trains as described in Specification No. 11,158, A.D. 1898. The couplings are so arranged that the speed-controlling wires and direction-controlling wires may be properly connected even though the cars are reversed. Couplings of like constructions are secured at the end of each car, and connection is made by a detachable connecting piece. The speed-controlling wires are arranged vertically and the direction-controlling wires horizontally. The fixed part of the coupling is completely shrouded and carries the contact plugs on an insulating block. The flexible connecting piece is fitted with a socket piece at each end and with a key to fit in the keyway.

11,158B. May 16th, 1898. "Controlling electric motors." H. H. LEIGH (F. J. Sprague.) Relates to apparatus for controlling motors used for traction purposes, such as are described in Specification No. 11,158, A.D. 1898. A number of vehicles are adapted to be coupled up as a train, and each vehicle has a controller operated by a pilot motor controlled by a master controller. The main switch is driven by the pilot motor through worm gearing and a flexible coupling, notched wheels serving to hold the switch in the proper position. The reversing switch is operated when one of a pair of cores is drawn within the corresponding coil. The cores fit closely to the tube of the coil, so as to form a dash-pot arrangement, and blow-out magnets are fitted around the contacts to minimise arcing. In modified arrangements the reversing, the resistance and the series multiple switches are separately controlled, and additional switches are provided for cutting out the pilot motor when the main switch is in its limiting positions.

12,325. June 1st, 1898. "Wireless telegraphy." G. MARCONI and WIRELESS TELEGRAPH AND SIGNAL CO. Relates to the class of apparatus described in specification No. 12,039, A.D. 1896. The receiving apparatus including the coherer with its trembler and choking coils, relay batteries and resistances, is enclosed in a metal case. The coherer and relay circuits are connected on one side to the metal case, which is put to earth by a wire. The other terminal of the coherer circuit is formed as a clip for engagement with a plug on the end of the flexible connection of the aerial conductor; this plug can be connected as desired to the transmitter circuit. The relay is connected to the recording receiver by the case connection and by a wire which passes insulatingly through the case to a chamber containing a coil of insulated wire sheathed with tinfoil.

11,326. May 18th, 1898. "Cord winches." W. H. STURGE. An automatic cord reel applicable to taking up leads for electric lamps, consists of a loose bobbin through which the cord is passed, and which is connected to a supporting tube by a coiled spring. The tube is screwed into a projection in one half of a spherical case, and locked by a nut. Before the cord is applied the bobbin is turned on the tube to wind the spring sufficiently to support the weight that is to be supported, and the bobbin is then held temporarily by a screw engaging an arm of the tube until the cord has been passed through a hole in the bobbin.

11,627. May 23rd, 1898. "Electric conductors." W. S. SMITH. Electric conductors are formed of a central metallic core covered with one or more spirals of metallic tape. The tape employed is of the same metal as the core, a suitable adhesive being employed when necessary.

12,326. June 1st, 1898. "Wireless telegraphy." G. MARCONI and WIRELESS AND TELEGRAPH SIGNAL CO. Relates to improvements in that class of apparatus described in Specification No. 12,039, A.D. 1896. The coherer is connected to the secondary coil of a fine wire induction coil, the primary of which is connected between the aerial conductor and the earth or a capacity. A condenser is in series with the secondary and the coherer. The circuit of the local receiver is provided with choking coils, and forms a parallel circuit. Several forms of induction coil are described in which the primary is wound in parallel or series parallel sections, and the secondary is formed of one or more sections having decreasing numbers of turns in the several layers.

12,431. June 2nd, 1898. "Driving dynamos." E. J. PRESTON. The dynamo used for electric lighting railway vehicles is suspended at each end by a pair of links from the underframe of the carriage. The driving belt is maintained taut by the weight of the dynamo and the tension of the belt is regulated by means of an adjustable counterweight or an adjustable spring.

12,731. June 7th, 1898. "Electric telegraphs." A. MUIRHEAD. Cable circuits for submarine working are provided with inductance coils and condensers in series with the cable and artificial cable. The receiver may be of any type, and is shown with an adjustable inductance shunt. The transmitter is shunted by an inductance, both being connected to the arm of a balancing rheostat.

13,680. June 20th, 1898. "Secondary batteries." S. W. HART and E. J. CLARK. The plates are held together by insulating bolts which pass through retaining bars through holes in the plates and through holes in insulating washers placed between the plates and acting as separators. The lugs of the plates of one polarity are connected together by casting on them a bridge with a main central contact piece in which is a tapered hole and which is connected with a similar piece of another cell.

14,127. June 25th, 1898. "Heating: medical appliances." H. J. DOWSING. Relates to apparatus for utilising radiant heat or light for medical and other purposes. The incandescent electric lamps are supported partly by their connection to the ends of the chambers and partly by metal clips secured to angular reflectors. The chambers are of metal or other suitable material. Screens are provided between the radiating source and the space or part under treatment.

15,041. July 8th, 1898. "Electric cut-outs." BRITISH THOMSON-HOUSTON CO., LTD. (E. M. Hewlett). Relates to the moving arm of the cut-out which is connected to the resetting handle by a toggle arrangement controlled by an electromagnet and tripping mechanism. The handle is moved downwards to reset the apparatus. The fixed terminals are fitted with brushes and carbons. The armature is held up by a spring acting through a pivoted bar and handle. When it is pulled down, as by an excessive current, its end strikes the latch and liberates the pawl to release the cut-out.

(To be continued.)

**Book Notices.**—*Yellowsands.* By A. Gowans Whyte. London: William Blackwood & Sons. 1912. Price 6s.—The subtitle of this book is "A Holiday Tale"; it is, in a sense, a tale of a holiday, and is certainly a suitable tale for a holiday, but the limitation was hardly necessary, for it is well worth reading at any time. The characters are portrayed with originality and vraisemblance, and the dialogues are never wearisome: the plot holds the reader's attention to the end, and though the story ends rather in the air, one feels that there is nothing more to be said, and the author wisely says it. The tale has no connection with the electrical industries except the author: the hero, in fact, is a vinegar manufacturer who, after years of absorption in his business, discovers a world of thought and emotion of whose existence he had been but dimly aware. He is sucked into a whirlpool of romance, and after a series of bewildering gyrations, is gently restored to his normal surroundings with a new outlook on life. We have read the story with pleasure and edification.



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co.,  
Electrical Patent Agents, 285, High Holborn, London, W.C., and at  
Liverpool and Bradford, to whom all inquiries should be addressed.

- 8,843. "Electric bell alarm." R. H. MARSH. April 15th, 1912.  
8,846. "Telephone systems and the registration of calls and messages therein." H. HAWTHORN and H. THOMAS. April 15th, 1912.  
8,864. "Ceiling roses and like electrical fittings." T. KEARNS. April 15th, 1912.  
8,894. "Electric measuring instruments." E. A. FAGERLUND. April 15th, 1912. (Complete.)  
8,907. "Electric arc lights." GENERAL COMPOSING Co., G.m.b.H. (Divided application on 15,474/11, July 3rd. Convention date, July 4th, 1910, Germany.) April 15th. (Complete.)  
8,908. "Process for the better utilisation in therapeutics of the products of decomposition of radio-active elements." S. SAUBERMANN. (Convention date, April 18th, 1911, Germany.) April 15th. (Complete.)  
8,917. "Automatic photometric electrical variable resistance." J. W. HAGGARD. April 16th.  
8,951. "Non-polar, unipolar, or homopolar dynamo." P. HYNES. April 16th.  
8,986. "Apparatus for starting multiple cylinder internal-combustion motors by means of magnetos." WECKERLEIN and STOCKER. (Convention date, October 11th, 1911, Germany.) April 16th. (Complete.)  
8,989. "Apparatus for producing contacts at adjustable periodic intervals." Soc. A. GRANOUX & Co. (Convention date, October 10th, 1911, France.) April 16th. (Complete.)  
8,997. "Telephone exchange system." M. L. JOHNSON. April 16th. (Complete.)  
9,010. "Telephone metering systems and apparatus therefor." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) April 16th.  
9,046. "Contacts for electric controllers or switches." G. P. FAIRLESS and S. N. WARREN. April 17th.  
9,075. "Electro-deposition of metals." A. LEUCHTER. April 17th. (Complete.)  
9,076. "Suspension devices for cables, trolley wires, and the like." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Elektrizitäts Ges. Germany.) April 17th.  
9,134. "Speed regulation of alternating current induction motors." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H. Germany.) April 18th. (Complete.)  
9,147. "Rotary annular multipolar magnetic separator." MASCHINENBAU ANSTALT HUMBOLDT. (Convention date, April 19th, 1911, Germany.) April 18th. (Complete.)  
9,148. "Anode supports for use in electro-plating." SPIRELLA Co. OF GREAT BRITAIN, LTD. (Spirella Co., United States.) April 18th. (Complete.)  
9,149. "Anode supports for use in electro-plating." SPIRELLA Co. OF GREAT BRITAIN, LTD. (Spirella Co., United States.) April 18th. (Complete.)  
9,154. "Electrical winding gear for clocks and the like." L. J. ARON and C. WIENER. April 18th.  
9,168. "Lamp arrangements for electric lighting." H. T. HARRISON. April 18th.  
9,178. "Submarine sound direction finders." L. I. BLAKE. April 18th. (Complete.)  
9,179. "Telephony." S. G. BROWN. April 18th.  
9,181. "Method of setting or adjusting from a distance through the medium of periodic oscillations of different frequency." E. F. HUTCH G.M.B.H. (Convention date, April 18th, 1911, Germany.) March 18th. (Complete.)  
9,203. "Electric resistance furnace." L. UBBELOHDE. April 18th. (Complete.)  
9,210. "Alternating current motors." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) April 18th.  
9,211. "Governing mechanism for centrifugal compressors." WARWICK MACHINERY Co. (1908), LTD. (General Electric Co., United States.) April 18th.  
9,263. "Electric traps." S. TAKACS. April 19th. (Complete.)  
9,278. "Terminals for electric batteries." H. LUOAS and G. H. JACKSON. April 19th.  
9,302. "Device for securing shades and the like on electric lampholders." W. J. INSTAN and A. HOLT. April 19th.  
9,309. "Electric cables." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States.) April 19th. (Complete.)  
9,328. "Electric motors." A. LEHMANN. April 19th.  
9,338. "Device for disinfecting telephone mouthpieces and other similar instruments." S. B. DEWHIRST. April 20th.  
9,369. "Method of indicating to ships the presence of icebergs or other obstacles." W. GRIMSHAW. April 20th.  
9,374. "Junction and test boxes bonding sleeves for electrical purposes." B. A. PILKINGTON. April 20th.  
9,379. "Regenerative process for use in electro-zincing." F. E. HAMPTON. April 20th.  
9,380. "Apparatus for electro-galvanising small articles." F. E. HAMPTON. April 20th.  
9,382. "Automatic electric switch devices." FRIED. KRUPP Akt.-Ges. (Convention date, June 7th, 1911, Germany.) April 20th. (Complete.)  
9,411. "Electric measuring instruments." C. HUBERT. April 20th. (Complete.)  
9,416. "System of electric generation and transmission for motor-driven vehicles, locomotives or trains." H. LEITNER. April 20th.  
9,422. "Telegraphy and telegraphic apparatus." J. S. ENRIGHT and GRESHAM FINANCE CORPORATION, LTD. April 20th.  
9,426. "Electrical distribution systems." J. BJUR. April 20th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

- ELECTROMAGNETIC ORE-SEPARATORS. R. Steinert and N. Stein. 1,619. January 21st.  
SELF-REGULATING DYNAMO-ELECTRIC MACHINES. A. H. Midgley and C. A. Vandervell. 2,158. January 27th.  
SUSPENSION OF ELECTRIC CONDUCTORS. Allgemeine Elektrizitäts Ges. 4,623. February 20th. (February 24th, 1910.)  
ELECTRIC MOTOR CONTROLLERS. R. Edwards and E. S. Stait. 6,996. March 21st.

- DEVICES FOR SUSPENDING, LOWERING AND HOISTING ELECTRIC AND OTHER LAMPS. Johnson & Phillips, Ltd. 7,092. March 21st.  
ELECTRIC METERS AND THE LIKE. R. B. Hill. 7,522. March 25th.  
TELEPHONE EXCHANGE SYSTEMS. E. E. Clement. 7,611. March 27th.  
DYNAMO-ELECTRIC MACHINES FOR GENERATING HIGH-FREQUENCY ELECTRIC CURRENTS. J. G. Balsillie. 7,749. March 28th.  
CONTROLLING ELECTRIC MOTORS. A. L. Holmes and D. C. Holmes. 7,785. March 29th.  
CONTINUOUS ELECTRIC SWITCH. R. Johnson. 7,872. March 30th.  
TYPE-PRINTING ELECTRIC TELEGRAPHS. E. Belin. 9,556. April 19th.  
ELECTRIC LIFTS. H. Marryat. 10,848. May 4th.  
MINE EXPLODERS. Sterling Telephone and Electric Co. (Schaffler & Co., Austria) 12,145. May 19th.  
ELECTRIC SIGNAL SYSTEMS FOR RAILWAYS AND THE LIKE. British Thomson-Houston Co. (General Electric Co.) 12,579. May 24th.  
POLE-SHOES OF MAGNETO-ELECTRIC MACHINES FOR IGNITION PURPOSES IN CONNECTION WITH INTERNAL-COMBUSTION ENGINES. Electric and Ordnance Accessories Co., J. R. Garner and N. Collins. 13,246. June 2nd.  
INTERCOMMUNICATION TELEPHONE SYSTEMS WITH SECRECY. H. E. R. Roose and W. Finlay. 13,601. June 7th.  
ELECTRIC HORNS AND LIKE SIGNALLING DEVICES. S. Manson. 15,138. June 28th. (October 3rd, 1910.)  
GALVANIC SOCKS OR LOOSE SOLES FOR BOOTS AND OTHER FOOTWEAR. N. Pultinger. 15,279. June 30th.  
TELEPHONE EXCHANGE SYSTEMS. W. Aitken and British Insulated and Helsby Cables, Ltd. 15,503. July 4th.  
TELEPHONES. B. Gwozdz. 18,235. August 11th. (June 2nd, 1911.) (Addition to No. 11,234 of 1911.)  
TELEPHONE STATION. C. B. Redfern. (Telephon Automaten Ges.) 19,252. August 28th.  
COMMON-BATTERY TELEPHONE SYSTEMS. Aktiebolaget L. M. Ericson & Co. 21,924. October 4th. (October 7th, 1910.)  
APPLIANCE FOR OBTAINING STATIC ELECTRICITY FROM EITHER POSITIVE OR NEGATIVE POLE OF THE SECONDARY OF AN INDUCTION COIL. G. C. Blake. 22,663. October 14th.  
ELECTRIC HEATING AND STERILISING APPARATUS. Soc. Electro-Industrielle et Anciens Etablissements Mathieu Reunis. 23,828. October 27th. (October 27th, 1910.)  
PRIMARY CELLS WITH DEPOLARISER. Z. Szpor. 26,842. November 30th.  
INTERRUPTING DEVICES FOR INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 26,929. December 1st. (November 7th, 1911.)  
ELECTRICALLY-HEATED THERMAL ACCUMULATOR. A. Rittershausen. 27,843. December 11th.  
ELECTRICAL HEATING OF SERVICE OR DINNER LIFTS. Hodgson. 27,883. December 12th.  
DYNAMO-ELECTRIC MACHINES. A. H. Midgley and C. A. Vandervell. 15,038. June 27th.  
CONSTRUCTION OF ELECTRIC PLUG CONNECTION. A. A. Price. 16,081. July 11th.  
AUTOMATIC TELEPHONE EXCHANGE SELECTOR. F. R. McBerty. 16,867. July 22nd. (July 23rd, 1910.)  
PURIFICATION OF ASBESTOS. British Thomson-Houston Co. (General Electric Co.) 16,960. July 23rd.  
ALTERNATING-CURRENT COMMUTATOR GENERATORS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 17,040. July 23rd.  
HOLDERS OR CARRIERS FOR SUPPORTING INCANDESCENT ELECTRIC LAMP-SHADES AND THE LIKE. R. Stafford and C. F. Barnes. 18,036. August 9th.  
STARTING SWITCHES FOR ELECTRIC MOTORS. Siemens Bros. Dynamo Works, Ltd., and E. Schupp. 18,575. August 17th.  
TROLLEYS OR COLLECTORS FOR ELECTRICITY. J. Coan and S. Cook. 19,695. September 4th.  
PROCESS FOR THE MANUFACTURE OF ELECTRIC METAL-FILAMENT LAMPS. K. Schwab. 20,224. September 12th. (May 4th, 1911.)  
SAFETY DEVICE FOR ELECTRIC CABLES. Siemens-Schuckertwerke Ges. 20,935. September 14th. (May 2nd, 1911.)  
ANNUNCIATORS FOR HOTELS AND THE LIKE. W. P. Thompson. (Akt.-Ges. Mix und Genest Telephon und Telegraphen Werke.) 22,948. October 3rd.  
ELECTRIC CONTACT-MAKING AND CUT-OUT DEVICES FOR ELECTRICALLY LIGHTING MOTOR-CARS AND OTHER VEHICLES AND ROLLING STOCK. J. Polkey. 24,431. November 3rd.  
ELECTRIC READING LAMPS. R. E. Burnham. 25,211. November 13th.  
ELECTRODES FOR ARC LAMPS. H. Beck. 25,916. November 20th.  
METHOD AND APPARATUS FOR THE ELECTRIC TRANSMISSION OF PICTURES. L. Tschörner. 27,474. December 7th. (February 11th, 1911.)  
APPARATUS FOR LIFTING THE BRUSHES AND SHORT-CIRCUITING THE ROTOR WINDINGS OF ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. Bruce Peebles & Co. (incorporated 1908) and F. G. Brookhouse. 28,682. December 20th.  
CONTROL SYSTEMS FOR ELECTRIC MOTORS FOR DRIVING REVERSING MECHANISMS AS APPLIED TO MACHINE TOOLS. Vickers, Ltd., and B. E. Ellison. 7,882. March 29th.  
ELECTROMAGNETIC STEP-BY-STEP MECHANISM FOR ELECTRIC CLOCKS AND OTHER PURPOSES. G. B. Howell & Howell. 8,039. March 30th.  
ELECTRIC MOTOR-CONTROLLED REGULATING DEVICES FOR FURNACE-DAMPERS, VALVES AND THE LIKE. O. Rennert. 8,151. March 31st. (April 1st, 1910.)  
WIRELESS TELEGRAPHY. R. Bull, O. Arnesen and B. Sixer. 8,236. April 1st.  
MAGNETO-ELECTRIC MACHINE. L. Lindos. 8,340. April 3rd.  
MEANS FOR MAGNIFYING SMALL MECHANICAL OR ELECTRICAL EFFECTS. E. S. Heurtley. 8,397. April 4th.  
REMOTE CONTROL SYSTEMS FOR ELECTRICALLY-DRIVEN VEHICLES. Elektromotoren-Werke Hermann. 10,551. May 1st. (September 22nd, 1910. Addition to No. 10,550 of 1911.)  
ELECTRIC FURNACES. Plauson, N. Zsvetaeff and T. Tistchenko. 10,858. May 4th.  
MEANS FOR ATTACHING ARMS TO TELEGRAPH AND OTHER SUCH POLES, AND IN THE MANUFACTURE THEREOF. H. Lench. 10,917. May 5th. (Cognate application, No. 12,528 of 1911.)  
MEANS FOR ATTACHING LAMP-SHADES OR THE LIKE TO ELECTRIC LAMP-HOLDERS. J. G. Berry. 12,784. May 29th.  
ELECTRICAL CURRENT-CONTROLLING DEVICE. A. E. Borden. 15,149. June 28th. (July 5th, 1910.)  
ELECTRIC FURNACES. British Thomson-Houston Co. (General Electric Co.) 17,060. July 25th.  
MAGNETO-ELECTRIC MACHINES. N. Flint. 18,702. August 13th.  
ELECTRICAL CONTROLLERS. Bray, Markham & Reiss, Ltd., F. N. Bray, F. R. Markham and F. E. Reiss. 19,365. August 30th.  
ELECTRICAL ALARM APPARATUS FOR CASH-BOXES, JEWEL-BOXES AND LIKE RECEPTACLES. G. Downing and P. S. Moulton. 25,446. November 15th.  
ELECTRIC ARC LAMPS. W. Rogers and G. Rowe. 26,511. November 27th.  
APPARATUS ADAPTED FOR USE WITH AN ALTERNATING CURRENT FOR SIGNALLING TO A DISTANCE. Hartmann & Braun Akt.-Ges. 26,548. November 27th. (December 21st, 1910.)

## 1912.

- SWITCHING APPARATUS FOR TELEPHONE EXCHANGE SYSTEMS. E. E. Clement. 3,947. February 10th. (Divided application on No. 7,611 of 1911. March 27th.)



# THE ELECTRICAL REVIEW.

VOL. LXX.

MAY 10, 1912.

No. 1,798.

## ELECTRICAL REVIEW.

## THE ETHICS AND ECONOMICS OF THE LOWEST TENDER.

Vol. LXX.]

CONTENTS: May 10, 1912.

[No. 1,798.

	Page
The Ethics and Economics of the Lowest Tender ...	741
International Regulation of Wireless Telegraphy ...	743
Arc Lamp Tenders ...	743
Some Considerations of Detail in the Design of Electricity Meters ...	743
Correspondence:—	
The Want of Co-operation in Pushing Electricity ...	745
On Advertising Electricity ...	745
The Domestic Load ...	745
The Education of the Engineer ...	746
The I.E.E. Students and the New Articles ...	746
Warning to Inventors and Patentees ...	746
Midland Electrical Exhibition ...	746
Central Station Status ...	747
Notes from Canada ...	747
Australian Tramway Companies and their Employés.—III ...	747
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	748
Parliamentary ...	749
Legal ...	752
Electrical Cooking at Earl's Court ...	754
Business Notes ...	755
Notes ...	762
City Notes ...	764
Stocks and Shares ...	768
Market Quotations ...	768
Share List of Electrical Companies ...	769
Metal Market.—Fluctuations in March ...	771
The Characteristics of Copper and Aluminium Overhead Line Conductors ( <i>illus.</i> ) ...	771
Exhibitions and Lectures ...	773
Proceedings of Institutions:—	
High-Tension Porcelain Line Insulators ( <i>illus.</i> ) ...	775
Domestic Electricity ...	779
Expiring Patents ( <i>continued</i> ) ...	779
New Patents Applied For, 1912 ...	780
Abstracts of Published Specifications ...	780
Contractors' Column ...	Advertisement pages xxiv and xxvi

ONE of the questions which no conference, no matter how convened or by what chairman it may be guided, can be reasonably expected to settle, is that of competitive tendering on certain branches of manufacturing. We have not forgotten, in making this remark, that in one branch of electrical manufacturing an Association of manufacturers does, in effect, if not in avowed intention, keep up *quality of output* and prices within the home market. But in that case standardisation has been simple, the price of raw material is a substantial item, and the formulation of the detailed principles of a common policy relatively easy. We have had futile attempts at emulation in some other branches of electrical manufacturing, but the complexity of the interests involved has prevented these projects from coming to fruition. We believe, however, that co-operation is not a wild impossibility. The situation is full of difficulties, and a recognition and discussion of these is of interest.

Let us first consider the mental attitude of the recipient of a number of tenders. A firm of merchants may receive a number of tenders based merely on a schedule of quantities, varying as such tenders always do. The sum total at the foot of the tender has in general far more to do with the placing of the order than the technical details of the pious generalities and details of guaranteed performances bound in a decorative cover which accompany the tender. Of course the personality of the manufacturer's representative has some persuasive value with the buyers, whose ears are filled with the asseverations of Mr. Codlin or Mr. Short. Or again, a large commercial undertaking may decide to purchase some electrical plant. It may not always know exactly what it wants or what is best suited for its requirements, but its first interest in the matter is that of getting some index of the cost. As a start it obtains a price and scheme from some firm, very generally the one whose representative may have first succeeded in persuading it to consider the matter. Then, if not frightened at the outlay, it may ask for other schemes and tenders, and quite conceivably place an order with the firm quoting the lowest price, without regard to technical detail. In some cases, of course, a board of directors may call in a consultant to report on the schemes and recommend one for their acceptance. As no two men see anything from the same perspective, the consultant is probably driven to take up the attitude that none of the proposals coincides exactly with his own view of the needs of the case. One may be unnecessarily elaborate, another may lack important essentials. The prospective purchaser then becomes aware of the importance of requiring tenders all approximately to the same common scheme; the consultant prepares such, and further tenders are invited. Given the capable impartial consultant who does not embroider a scheme with pretty and costly frillings, tenders become

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: W.M. DAWSON & SONS, LTD., Manning Chambers. Paris: BOUYEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.



more strictly comparable, and a true, if not always superficially apparent, saving of capital outlay results. This, however, must not be held to imply that the position of the impartial consultant is an easy one. Pressure is often exerted to induce him to invite or to receive tenders from firms in whom he may not have full confidence, and he will at times find it hard to justify to a board of directors the acceptance of any but the lowest tender.

At this stage in the negotiations, serious developments have been known to arise. The magnitude of these in the case of a large and complex project will depend upon whether or not an "omnibus" specification has been issued to, say, four firms, leaving them to obtain sub-tenders for divers items such as boilers, cables, turbines, or tramway poles. The alternative is to sectionalise any big scheme into its distinctive divisions, and obtain tenders on each of these. The evil which may happen will in the latter case be localised, but it is none the less a serious evil. It is axiomatic that, when once the tender is in, no deviation should be permitted. Yet one has heard of Dutch auctions, and one does know that honest consultants have thrown clients up in disgust because of their introduction in such cases. Equally it is alleged, and we fear with some justice, that certain persons engaged in an advisory capacity have in their arm-chairs played the part of the auctioneer. The contractor is squeezed in his price. He is told in effect that "so-and-so is offering to do it 10 per cent. cheaper than your price, if you can meet us then, of course, &c." In such cases the lowest tender, if not accepted, becomes the lever in depressing the prices of firms of better repute. With the "omnibus" type of tender, matters may be much worse, and the huckstering of the Dutch auction may be repeated between the main and each sub-contractor. It is argued, therefore, that it is desirable that this type of specification should disappear, for absolute impartiality on the part of the consultant cannot prevent the "squeezing" policy being carried out in the provinces in an accentuated form. The factor which has produced the omnibus tender, particularly in lighting, traction, or power schemes for places abroad (where one firm has undertaken the contract not only for supplying plant, but also for erecting and handing over a completed installation), has been the centralisation of responsibility between the purchaser and contractor. It is not impossible to indicate a *via media* between the risk of squeezing contractors for machinery by the main contractor and the centralisation of financial responsibility in these cases. Too much may, however, be paid for centralised responsibility. From the point of view of economy in capital and economy in departmental administration of the factory, the omnibus specification is not efficient. If six firms are asked to tender for a contract with, say, a dozen distinctive sections, of which two-thirds come from outside their own works, it falls upon each of the six main firms to get out comprehensive prices, and a multiplicity of drawings, and to co-ordinate purely for tender purposes the component items of their scheme. It is quite obvious that this extra work has to be paid for, and it is more efficient to pay one man for doing it than to have the whole industry saddled with the cost of unnecessary duplication.

The evil of the omnibus tender is not unknown, but it exists in a less degree, even in such a simple subject as a direct-coupled generating set. In this case, we believe that certain of the firms concerned are, by united action, endeavouring to stop the abuse in question. Hitherto, however, the efficiency of their intelligence departments in ascertaining the exact figure at which some other firm is tendering, or has tendered, might well put to shame the intelligence departments of the offensive and defensive forces of any civilised power.

The lowest tender requires to be considered in another aspect, as it can be said to be due both to artificial and to natural causes. We have discussed the artificial causes which lead to the lowering of tenders. Well known though the causes are which underlie what we may term the naturally produced lowest tender, their recital and discussion at this juncture will, at least, serve to indicate the complexity of the problems confronting those who would engineer any understanding between rival firms whereby the average price of any line of manufactured articles might be raised. It is quite obvious that the price at which any article can be manufactured for sale in any given market must depend upon (a) the price of the component raw material; (b) the actual cost of the labour requisite for its construction; (c) the standing charges of rent, salaries of the staff, wear and tear or renewals of machine tools or other plant, correct ratio of allowance for repayment of capital expended on patents; and (d) the desired margin of profit on the transaction. Of these, the first is outside the direct control of the works, although judicious provision on the part of the purchasing department will count for much; the second is, to a certain extent, capable of modification if a number of machines of the same size are going through the works simultaneously. But in regard to the third and fourth, anxious problems arise. Standing charges are for any given factory a lump sum of an irreducible character, but vary in the percentage on any job as the works output varies. In times of slack trade, with one or more departments working short time, any board of directors is tempted to forgo an actual profit margin on an order which meets its ratio of standing charges, as, thereby, actual financial loss on the year is minimised. Carried too far, this spells absence of dividends, while lowering prices all through the industry, and it has been known to be the root cause of severe losses of invested capital. It is difficult, however, to imagine that competition between independent firms can under any modern conditions be so inspired as to prevent firms tendering at low prices for this cause.

Another cause which accounts for an unduly low tender often being put in at a time of trade activity, is under-quoting by a firm desirous of entering upon a certain market or of supplying the first of a new type of machine from their works.

Frankly, the lowest tender, if naturally produced by the deliberate lowering of prices to a margin permitting little or no profit, or if artificially inspired by the contemptible artifices of the Dutch auction, is a curse to the industry. Nothing can be urged against a lowest tender when that tender does permit of the work being done, contingencies of defective raw material allowed for, standing charges met, and a proper profit margin secured to the manufacturer. But every tender which does not cover these is contributing to the ruin of the industry concerned. While the type of lowest tender we have criticised does very little good, and may even do much actual harm to the purchaser who is not well advised, it means a squandering of the money invested in the industry, and is an absolute bar to the securing of more capital. It must not be forgotten that manufacturers have to buy their capital just as they buy, say, their pig iron. Capital is only the means whereby the factory buys material and labour, and has to be paid for even as a steel forging has to be paid for.

One grants, of course, that the progress of invention has continuously cheapened manufacture, and that the incentive of competition has produced such devices as automatic or semi-automatic machine tools. It is, moreover, well-known how each year the increase in knowledge of the properties of materials or the invention of new processes tends to cheaper manufacture. All these are not only legitimate aids to cheaper tendering, but are a necessity of continued national industrial existence. Against these forces one has to reckon illegitimate methods of tendering by which the lowest tender, as has been shown, may be produced by unworthy artifices or by a reckless competition. A course of such tendering only acts as a deterrent to investment when further capital becomes necessary at times of great activity. Any industry so weakening itself is indulging in a slow form of suicide. The condition unfortunately is more easy of diagnosis than of cure by any other than the brutal but inevitable remedy of the weaker going to the wall.



**International  
Regulation  
of Wireless  
Telegraphy.**

A COMMUNICATION from Berlin recalls the circumstance that the United States and Italy have not yet given their adhesion to the International Convention with regard to wireless telegraphy, whilst Great Britain has only become partly associated with it. Hitherto the British Government has declined to make wireless communication compulsory as between ships, and has only joined the Convention so far as it concerns traffic between ship and land stations. The Berlin intimation submits that it may now be reckoned on that the United States will adopt the Convention and ratify it. On the other hand, the Italian Government has entered into negotiations with the Marconi Co. in order to obtain a free hand in respect of association with the agreements between the other countries. If the negotiations should lead to no result up to the time of the International Conference, to be opened in London on June 4th, it is said that the Italian Government will not send any representatives to the Conference. The British Government is not contractually bound to the Marconi Co. by definite agreements which would prevent the former from becoming fully connected with the International Convention. It is now reported that the British Government will express its agreement with the remaining regulations of the Convention, and this assumption is said to be all the more justified as the invitations to the conference have been issued from London, and the management of the Convention rests in British hands.

**Arc Lamp  
Tenders.**

BETWEEN two and three years ago a number of firms protested, in our "Correspondence" columns, against the demand of a certain Municipal Corporation that a considerable number of arc lamps should be forwarded as samples with tenders. We supported the protest, feeling with some of the tenderers that the burden thus put upon the arc lamp industry was unreasonable, and out of all proportion to the value of the business to be done. The protests drew from the engineer an explanation of the reasons that had influenced him in making the stipulation, but we should have hoped that borough electrical engineers generally, profiting by reading the whole of the letters, would have sympathetically studied the matter from the standpoint of the manufacturer, and adopted a more considerate course thereafter. In the rush and hurry of the life of city officials, however, some things are apt to be forgotten, and so it came to pass recently that the Dublin Corporation, in inviting tenders for flame arc lamps and suspension gear, issued a specification and conditions which contained clauses that the Arc Lighting Committee of the B.E. and A.M.A. could not accept, and, in the terms of an official notice issued by the Association, "its members deemed it advisable not to tender for the contract unless certain unreasonable clauses of the general conditions and the specifications were altered." Each tenderer was to be prepared to leave on deposit for trial for an unstated period as many as 22 arc lamps, and the terms of settlement were far from being satisfactory. On these and other grounds most of the principal firms in the arc lamp industry preferred to have nothing to do with the matter unless the Corporation amended its demands. We believe that the upshot of the protest is that new specifications are to be issued, and we hope that these will be found to show that regard for the proper interests of the electrical industry which every borough electrical engineer should consider it his privilege to exercise.

We believe that there is reason to be satisfied with the improvement that has taken place in municipal specifications since we made a weekly practice of drawing attention to the hardness and ambiguity of clauses and stipulations that occurred in many of them, and we hope that the recent strong action on the part of arc lamp makers in the case of Dublin will bear good fruit in all departments of the industry, by making it clear to the municipal mind that tenderers have rights as well as privileges, and one of these rights is reasonable consideration.

**SOME CONSIDERATIONS  
OF DETAIL IN THE DESIGN OF  
ELECTRICITY METERS.**

By "X. Y. Z."

AN electricity meter is an article which has to be designed to satisfy a variety of requirements. The two most important are, perhaps, those of accuracy and cheapness, for these are the two factors which will mainly determine the sale of a particular type of meter. It has, however, to be borne in mind that a meter is not only bought and checked in the test room, but is also fixed and refixed—often many times during its useful life—on various premises. Moreover, it has frequently to be adjusted, and sometimes to be taken apart, cleaned and recalibrated. Whether or no these operations can be carried out easily and expeditiously depends largely upon the attention given to detail in the design of the meter. A meter having three dials, equilateral triangle fashion, the tens dial being above the hundreds and units is liable to be read wrongly if it be fixed in an awkward position in a dark cellar, although such a mistake would never occur in the test room. Or again, if the clamping device of a meter is not plainly marked, it is liable to be brought in unclamped by a careless meter fixer, and, as such a man will naturally be the least careful in carrying the meter, to suffer considerable damage.

It is the purpose of the writer in the article to deal with those points of detail which do not affect the fundamental design of the meter, or the cost of its manufacture, but which apply to nearly all types, inattention to which causes the meter to be a source of vexation to the repairer and tester, and to become unpopular with those people who have to look after it.

It is a source of great annoyance to have the top bearing of the armature spindle attached to the counter. In investigating the cause of failure of a sluggish meter, it is exceedingly inconvenient not to be able to run the meter without the counter, and if for any reason the counter has to be removed during the examination of such a meter *in situ*, its replacement is somewhat difficult. The method of fixing the counter is of considerable importance. Means should be taken to ensure that the counter, after being removed, can be replaced exactly in its original position. This can be accomplished by the provision of steady pins and an ample bearing surface. In this matter the Chamberlain & Hookham meter is, in the opinion of the writer, unequalled. With this meter, it is necessary merely to slacken the fixing screws in order to remove the counter, and it can be quickly replaced without any need of subsequent adjustment. It is very desirable that the dials be large and clear and plainly marked, and this is especially the case with large meters with no units dial. The provision for short-time tests varies very much among the meters now on the market. There would seem to be very little difficulty in designing a counter that would enable readings to be taken to one-thousandth part of a unit, but this provision is not often found. The superiority of the time over the revolution test is so generally recognised that it is a little surprising that greater facilities for taking short-time tests are not given. Many cyclometer counters now in use are far from satisfactory. They are frequently made so that it is necessary for the eye to be level, or nearly level with the figures for a reading to be taken, and the figures, moreover, are often so small as to be almost unreadable excepting in a good light. The only object of a cyclometer dial is to enable quick and accurate reading to be done, and it is of no advantage to the meter reader to have his reading in actual figures if he has to get a ladder to see the meter, where, with a good clock counter he could have read it standing on the ground. It should not be necessary to remark that the figures on cyclometer counters referring to decimal parts of a unit should be clearly distinguishable from the rest. This is not the case, however, with at least one modern electricity meter. In this connection it may be said that, in addition to the difference in colour of the decimal figures, it is a great advantage to have a prominent comma marked on the counter to show the position of the decimal point used in



this country. Cyclometer counters with a jumping attachment are very convenient if they work well. The writer saw the other day, a meter with one of these counters, in which half figures were showing on two dials, while the units opening was completely closed by a shutter. In such a case as this it is at least as easy to read an ordinary clock dial. An arrangement for setting cyclometer counters to zero without removing them from the meter is useful. Before leaving the consideration of this part of the meter it may be advisable to mention the advisability of making the pinion on the armature spindle of phosphor bronze in the case of those meters having spur gearing from armature to counter. The risk of rusting is frequently considerable with a steel pinion if the meter be fixed in a damp place, and the effect of rusting is, of course, most felt on the armature spindle, where the torque is lowest.

The methods of adjusting the meter when it is inaccurate are divisible into two classes, that in which the speed of the meter is altered, and that in which the gearing in the counting train is arranged to suit the new speed. It is a pity that greater facilities for this latter operation are not provided by meter manufacturers. When a meter shows an inaccuracy which is constant at all loads it is by far the most convenient method of standardising to make an alteration in the wheel train, provided the counter is suitably designed for this purpose. Change wheels should have the number of teeth clearly marked, and these teeth should not be too small, otherwise it will not be easy to get the new wheel to gear properly. The speed of an inaccurate meter may be altered either by varying the brake field or by adjusting the shunt of the meter. When it is intended that the former operation is to be the normal one, means should be provided for carrying out this adjustment conveniently, and with some degree of fineness. The magnetic shunt fitted to the modern Ferranti continuous-current meter is as good a device of this kind as could be desired, and with it small adjustments can be made with great nicety. In those cases, however, where no provision is made for giving a small movement to the controlling magnets, and this has to be done more or less by guesswork, the adjustment of the meter may be very difficult. The method of altering the speed of a meter by varying the resistance in the shunt is troublesome if a connection has to be unsoldered; if, however, a number of shunts of different resistance are provided, and these can be easily changed, the method is quite convenient. As with the change wheels, these shunts should be clearly marked, in order that their relative resistances may be known. The method of adjusting a meter by varying the resistance of its shunt is open to the objection that since the normal tendency of a meter is to get fast, each calibration decreases its full-load torque.

In many meters accurate revolution tests are very difficult to take quickly, through a difficulty in seeing the moving element. In the 1910 type British Thomson-Houston mercury meter it was almost impossible even to see if the meter were moving if fixed in a bad light. It would be a great convenience to have a somewhat more definite mark than the dab of paint that is customarily seen, and also to have a corresponding fixed reference mark on the stationary part of the meter. With the slow speed now found with mercury motor meters, the time taken for one revolution of the moving element on the lowest load tested is sometimes as much as one minute. In most meters the part of this element used for purposes of observation is small in diameter, and an error of  $5^\circ$  in estimating one revolution is not improbable, in spite of great care, with the resources provided. Consequently the time required for revolution tests at low loads is inconveniently great. With two fine marks provided, the one fixed and the other attached to the revolving part, this probable error would be much diminished. It may be mentioned that even with two marks there is still a liability of error through parallax. If a third mark, arranged to be in line with the first two when the armature was in the position for commencing a test, were provided, the possibility of error through parallax would be eliminated. The fixed mark referred to above is provided in the British Thomson-Houston Co.'s mercury motor meter, but its utility is considerably impaired by the difficulty experienced in seeing the moving element.

The provision of a hinged front cover to a meter is not

always practicable, but, where possible, it is a great convenience when adjusting the meter for inaccuracy. If the meter happens to be a tiresome one to calibrate, the amount of time wasted in taking off the cover for adjustment, and in putting it on for the tests, is quite considerable. The testing constant of a meter might always be marked in a position where it can be seen without removing the cover. This is, perhaps, not of much importance when meters are tested in the test room, but it is a great convenience in the case of a test *in situ*. In some meters it is a matter of difficulty to put a new glass in the window. The breaking of meter glasses is by no means an uncommon occurrence in shops, and it should be possible to replace these easily and quickly. Meter glasses should not be held in position by means of tiny clamps and screws, as the replacement of a glass is awkward in such a place as a dark cellar. If slips of metal soldered on to the case are used, the meter has to be brought in—an otherwise unnecessary proceeding. Windows in meter cases requiring round glasses should be avoided, as in some parts it is difficult to get the glass satisfactorily cut to this shape. Provision for sealing is, of course, found in all meters, but this is a point to which further consideration might, in many cases, be given. Every screw used in fixing the cover of the meter should be sealed, and if the meter cover is secured by four screws, either four seals have to be used, or the method of passing a wire right round the meter has to be resorted to. This last is a very unsatisfactory way, as it takes a long time, and if the case screws are unfavourably placed, is very difficult to accomplish should the case of the meter have to be sealed *in situ*. Two screws should be sufficient to fix the front cover of a meter, and unless these are well to the front, a drilled lug should be provided near each. Frequently meters have to be fixed in damp situations, and it then becomes important that a good air-tight joint be made between the cover and the case of the meter. When, as with some meters, small brass screws are used to secure the cover, this cannot well be done. These screws should consequently be of ample size, so that the cover can safely be screwed up very tight when this is desirable.

The various and minor defects set out above do not affect the theoretical goodness, or the ideal performance of a meter, but they may be productive of troubles more or less serious. If a meter with a small and badly-arranged dial is read wrongly, it is, of course, primarily the fault of the meter reader, but it is none the less a fact that had the dial been properly designed, as it is in some meters, such a mistake would not have occurred. Difficulties in testing meters can be greatly multiplied by minor and apparently insignificant defects in design. In some cases these defects would appear to be the result of pure oversight. In the case, for instance, of a watt-hour meter of otherwise great excellence, and which now enjoys considerable popularity, the hole through which mercury is introduced into the bath is under, and quite close to, the brake disk, and the use of a funnel of special design is thereby necessitated. In this same meter, moreover, it is necessary to remove the counter in order to adjust the brake magnets. Such minor defects as these, so far from being rare, are far commoner than they ought to be. The problem of the construction of a meter that will register accurately over long periods, and that is cheap, has been successfully solved by a number of meter manufacturers, and it would now seem desirable that more attention be given to the correction of defects in detail.

---

**Rand Industries.**—A fact worth pondering by those who manufacture mining machinery and electrical and other appliances in this country is that, in six months alone in 1911, the famous Witwatersrand Gold Fields, in South Africa, imported machinery and stores to the tune of £14,070,291. Special reference to this matter and much other information affecting the Rand gold industry will appear in the twenty-first birthday number of the *South African Mining Journal*, which will be published in Johannesburg early in June. The chemical, mining and metallurgical progress and problems of the great South African gold fields will be reviewed by experts; whilst local engineering in all its phases—electricity, steam and air power—will receive special treatment. The question of transportation as it affects the inland industrial centres will be exhaustively dealt with.



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## The Want of Co-operation in Pushing Electricity.

The question as to whether or not it is worth while pushing the sale of electric heaters is one which has for long exercised the mind of every up-to-date and enterprising electrical contractor. It is recognised by those who are in touch with the latest developments in the design and manufacture of electric cookers, &c., that there is no justification for the old complaint that electric heating and cooking apparatus is inefficient and unreliable, and it is further agreed that the demand for the latest cookers, toasters, grills, &c., has increased marvellously during the last few years. That the opportunity for handling this remunerative business has not been seized to a greater extent by the electrical contracting fraternity is a matter for universal regret. On all sides we hear of the rejuvenated and invigorated gas apparatus manufacturer who realises that times are changing, and that if he is to retain his business, and meet the competition of the electric cooker, he must be up and doing, hence we find him flooding the daily Press with his well-written advertisements, urging upon the unsuspecting public the necessity of installing gas geysers, gas cookers, &c.

It seems to me that now is the time for the electrical contractors, electrical manufacturers and electric supply authorities to come together with a view to uniting their efforts in fighting the gas bogey, in educating the public to the many advantages possessed by the electric cooker, and in giving a fillip to the domestic electric load, which seems to be so badly needed, and for which the supply companies are so well prepared at the present time. The lack of co-operation among the various sections of the electrical industry has been deplored again and again, and yet no definite steps seem to have been taken to put matters on a better footing. Surely it is time we realised our responsibilities. It seems to me that we are simply playing at it, and that if we are not to be hopelessly out of it so far as good cooking and heating business is concerned, we must really mend our ways. Now, it is certainly the case that with one or two exceptions, electrical contractors do not trouble themselves about electric cookers and the like, and, perhaps, they have a good reason for their apathy. They may be dissatisfied with the manufacturers or the supply authorities, or, indeed, with both. I have been told that the supply authorities are in some cases inclined to pooh-pooh the efforts of the contractors, and are out of sympathy with them. If this is the case, I can quite understand that the contractor does not bother himself.

Now, my proposition is this: Why should not the Electrical Contractors' Association, the Municipal Electrical Association, and the British Electrical Manufacturers' Association, call a joint meeting of their members in order to discuss this question? Or better, perhaps, let each body appoint a small Committee to represent its views on the larger Committee. Let the representatives meet and consider this matter fully, and from every point of view. Let all difficulties and complaints be voiced, and I am sure that the results can only be for the mutual good of the interested parties.

Do you think that Mr. Walker, of the Electric Supply Publicity Committee, would be prepared to take the initiative in this matter?

Warwickshire.

## On Advertising Electricity.

I have been interested in the remarks of Mr. C. P. Sparks, at the last meeting of the Institution of Electrical Engineers, in the discussion of the means of increasing the use of electricity for domestic purposes. Mr. Sparks, among others, states that he does not believe in newspaper advertising, holding the view that the only proper method of publicity is demonstration in showrooms and by personal canvassing.

Why does Mr. Sparks narrow his business development work to the showroom? Showrooms are only one form of

advertising, and it goes without saying that they are necessary, just as a shop is necessary to a merchant.

Central station companies need to employ not one, but all the established and effective advertising and business developing methods, the use of not only showrooms and canvassing, but demonstrations, exhibitions, circularising and the free use of newspaper space.

To state one's disbelief in the efficacy of newspaper advertising is to shut one's eyes to evident facts. If anything has been established clearly it is that daily newspaper space is one of the most effective means of creating a demand from the general public. Central stations should use every recognised means of advertising their wares, and not confine themselves to one or another form of advertising. Most of the criticism which has been levelled at the Electric Supply Publicity Committee has been on the score that their advertising work has been confined too much to one form, viz., the use of circulars, and too little attention has been given to the use of newspaper space and other advertising methods.

It would perhaps clear the situation if those who think like Mr. Sparks were to arrive at a proper understanding of what advertising really means. Advertising has been aptly defined by someone as "changing the mental attitude." Now, that is what is needed in the case of electricity supply—the "mental attitude" of the public towards electricity must be changed—the ignorance that exists must be corrected, and people must be taught to understand and appreciate the safety, convenience, and numerous other advantages of electric service and appliances; also that electricity is not a luxury, and, all things considered, is as cheap or cheaper than other forms of light and power.

Now, the advertising must be made effective, and to this end advertisements must be ably prepared, tellingly conceived, illustrated and worded. The services, therefore, of an advertising expert are needed, and electric supply companies should take a leaf from the practice of the most aggressive and successful of the national business firms, all of whom have an advertising department in charge of an able advertising man.

Material progress will be made when the English companies and supply authorities cease to treat central station work as simply an engineering profession and recognise it for what it really is—a commercial business proposition. A lot of the false pride and mistaken objections that exist to-day in regard to advertising and the use of commercial methods would then disappear, and give way to honest acceptance of good business-getting methods.

F. W. Willecox.

London, E.C., May 1st, 1912.

## The Domestic Load.

On page 669 of your current issue I find Mr. Howard Foulds deploring the attitude of the British Electrical and Allied Manufacturers' Association in recommending its members not to countenance the proposed Exhibition in Birmingham. On page 673 in your notice of the "Ideal Home" Exhibition you rightly comment on the inadequate representation of the electrical industry at Olympia. On page 693 Mr. R. Borlase Matthews slates the electric supply station and the contractor for their inefficiency in salesmanship, and gives it out that the Supply Undertakings Committee is only playing at the business of publicity, and again on page 693 in the discussion on the recent paper on "Domestic Electricity." I find Mr. Seabrook lamenting the ignorance displayed by electrical men in pushing the electric supply business and referring to the rubbish which is spoken and written on the subject.

Now, sir, what does all this mean? It seems to me, an onlooker, that the above views are amply justified. There is an immense field for the sale of electric heating and cooking apparatus, and yet the business done is practically nil. We seem to be all at sixes and sevens on the question of sales organisation. Every section of the industry is more or less following its own bent, and the result is chaos and negligible returns. Is there no remedy for this state of affairs? Why should the manufacturers not assist Mr. Foulds with his Exhibition? Are they so blind to their



own interests that they do not think it worth while exhibiting, or is it a question of expense? Perhaps the fault is on the other side, and it may be that supply authorities in general are not taking their fair share of the work and expense of publicity. It would seem so, judging from the above extracts.

It is quite clear that co-operation is badly needed. We must all pull in the same direction. Let us study the gas people and their ways. If we do not take some steps soon to meet the competition of our prosperous friends, we shall be lost altogether.

The opportunity is with us now. If we allow it to pass, we may as well give up the idea of ever successfully handling the domestic cooking and heating load.

Onlooker.

May 1st, 1912.

#### Midland Electrical Exhibition.

I am sorry to see, from your correspondence columns, that my old friend Foulds is labouring under a sense of injury in connection with the action of the B.E.A.M.A. and the Midland Exhibition. Mr. Foulds says that "a serious error of judgment has been committed," with which I agree, and since he has put his case before your readers, I am compelled to put that of the Manufacturers' Association, in order that those readers may have an opportunity of judging where the error lies; on the part of Mr. Foulds, or on the 15 leading manufacturers who form the Council of the Association.

First, let me dispel what seems to be a wrong impression in the mind of Mr. Foulds. He writes of the Association having "declined to allow the manufacturers to exhibit." The Association is not a separate entity with authority over the manufacturers. The Association is the manufacturers, and any expression of the Association is the wish of the manufacturers. It cannot be otherwise. I will not venture to burden your columns with all the contradictions which Mr. Foulds' letter seems to call for, line by line. Suffice it that the only offer the Association made was to co-operate in exhibiting such apparatus as would appeal to the general public. The Council, at an interview, were informed by Mr. Foulds that that was insufficient, as what was contemplated was an exhibition "substantially on the lines of the Olympia Exhibition." Anyone pausing to consider what the Olympia Exhibition cost the manufacturers, both in money and interruption of ordinary work at a very busy time, will, I am sure, understand that they cannot undertake such labour and expense oftener than is necessitated by the usual triennial exhibition. That such an exhibition was not only contemplated in Birmingham, but actually planned and arranged for, without any reference whatever to the Manufacturers' Association, and now has to be abandoned owing to the inability of the manufacturers to do that which was taken for granted, is, I think, sufficient evidence of where the error of judgment lies. The only promises made by one or two individual manufacturers to exhibit were contingent upon other manufacturers doing likewise, and the fact that the great majority had no wish to exhibit is only another proof of the utility of the Association.

It has been a matter of very great regret to the Council of the Association that anything having the appearance of a disagreement should have arisen with the authorities of such a centre as Birmingham, and I can only express the personal hope that, in due course, such an Exhibition may be held in that city as will be a credit both to the local authorities and the manufacturers and a benefit to the electrical industry.

A. Bruce Anderson,

Chairman of Council, B.E.A.M.A.

Hollinwood, April 29th, 1912.

#### The Education of the Engineer.

Having had occasion to peruse Mr. J. F. C. Snell's valuable treatise on "Power House Design," I beg to draw attention to one or two points in connection with the publication of the work, which, perhaps, will to some extent tend to militate against its value as a reliable source of information for those engineers connected with station work, who may refer to it for guidance.

Errors of any description in an up-to-date technical book are, of course, regrettable; but when such errors are largely typographical, and have, no doubt, crept in during the publication of the work, it is all the more regrettable, and especially so in the case of a rather expensive volume on such an important engineering subject.

Probably a large number of the errors will be observed at first sight—as for example, "252 periods," where, no doubt, 25 periods is intended by the author; but in the chapter dealing with small power houses and sub-stations, I notice that the annual efficiency of the L.C.C. tramways sub-stations is given as 73.5 per cent. for the synchronous sets and 82.1 per cent. for the asynchronous motor-generator sub-stations.

Possibly these figures have been misplaced in the present edition, as, from experience in one of the largest Corporation undertakings, my opinions have been confirmed with regard to the higher all-round efficiency (usually from 7 to 10 per cent.) of synchronous sub-station machinery as compared with asynchronous, and the difference in this case of 8.6 per cent. is probably in favour of the former type of converting plant.

Those engineers who are conversant with Mr. C. H. Wordingham's excellent treatise on "Central Electrical Stations," cannot fail to appreciate the value of careful supervision during the publication of an important technical book, and it is to be hoped that the publishers of "Power House Design" will take an early opportunity of issuing an errata sheet for the present edition, or else take other steps to render Mr. Snell's important work of the highest possible value to those for whom it is specially intended.

L. Marshall Jockel.

Middlesbrough, April 30th, 1912.

#### The I.E.E. Students and the New Articles.

It is a matter for regret that the only note of protest against the revised alterations of the Articles of Association of the I.E.E. should emanate from one of the Student Section. Mr. H. Douglas Steers's ill-timed protest is written without cognisance of the facts, and apparently his interest in Institution affairs has not been large enough to create the desire to ascertain them.

As long ago as last November, when the Local Sections and independent members made their protests, Students also respectfully protested, as Mr. Steers will note if he refers to the electrical Press of that period.

The Council have shown the utmost consideration and sympathy in dealing with the Student Section, and it may interest Mr. Steers to know that, when Members of the Council visited and conferred with the Local Sections, Messrs. Hammond and Rowell received a deputation of five Manchester Students, with whom they discussed at considerable length the views of the Manchester Student Section. Further, Professor S. P. Thompson and Mr. J. F. C. Snell have in particular watched the interests of the Students.

If Mr. Steers will compare Articles 13, 16, 17, 26 and 27 as proposed in November and as now finally revised, he must admit that the Student point of view has been considered to no small extent; and if he will carefully read these Articles he will also admit that Students have no ground for complaint as far as the Articles go.

I can assure Mr. Steers that many other ideals of the Student Section, including the printing of their papers, are receiving the sympathetic consideration of the Council.

Adolf R. Stelling, *Stud. I.E.E.*

Manchester, May 5th, 1912.

We are hearing a lot just now about the status of the Institution of Electrical Engineers and the new rules that are being introduced to improve the same. What about the status of the members of the I.E.E.? To instance the case as applied to central stations. Would not the I.E.E. be a real staff for central station engineers to lean upon, if the code of honour of its members forbade central station managers from employing side by side with men of training and years of experience, totally inexperienced men as switch-



board attendants, charge engineers, &c., or forbade the paying of such miserable pittance as 10s. to 25s. for 56 hours per every week in the year, of day and night, Sunday, Saturday, Bank Holiday and every day of strain and endurance, under the guise of gaining experience?

Also some regulations are required with regard to the pupil evil.

It appears to me that it is not new rules that are so badly wanted as a code of honour, or unwritten or written law amongst the members.

One has only to glance down the "Situations Vacant" column of this journal to satisfy himself of the veracity of these facts and failings.

Might not at this time some thought be given to the "Students," who are to supply the future members, not as in the present new rules discussion, total and absolute disregard of their very existence?

Struggling Stud. Inst.E.E.

May 6th, 1912.

#### Warning to Inventors and Patentees.

I have had considerable trouble with electrical firms who receive models of Patent apparatus on trial ostensibly with a view to taking up the manufacture, but really with the idea that as long as the patentee thinks they are considering it he will place any orders that he may have control of with them to "oil the wheels." Then after wasting about six months, and a lot of letter paper, they say that their works have so much in hand that they reluctantly feel that they must drop all idea of proceeding in the matter or they make some equally useful excuse, and the model is generally returned badly packed and in a derelict condition, showing that it has simply been laid aside.

What I intend to do in future is to avoid, as far as possible, the placing of orders with firms who have a patent of mine under consideration, and I hope brother inventors will do ditto.

Arch. J. Howard,

Borough Electrical Engineer, Taunton.

May 6th, 1912.

#### NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

INTEREST has recently been manifested in oil-shale deposits in Canada and it is not at all improbable that such deposits may be made use of for power purposes in time.

Peat has already been mentioned in these notes and, owing to the publicity given to the subject by the Department of Mines and the Commission of Conservation and the efforts of the recently formed Canadian Peat Society, it is attracting attention. This country has already had one experience of a coal strike in the States seriously affecting its supply, and the recent trouble in England combined with the threatened serious strike in America, are likely to make Canadians take the question of the utilisation of peat as fuel into careful consideration. The coal used in the Dominion last year consisted of 9.8 million tons mined here and 14.6 million tons imported from the States, so it is quite evident that the effect of a strike in the latter country might be to create a very awkward position in the former.

The Commission of Conservation has issued a pamphlet dealing with the subject of an application by the city of Chicago for permission to increase the flow of water from Lake Michigan to the Mississippi River. As the ostensible object for which the water is required is that of dealing with the sewage effluent, the subject does not at first appear to have much interest for electrical engineers, but the pamphlet referred to points out that, besides seriously affecting navigation and the great lakes by appreciably lowering their levels, a good deal of water-power will be diverted to, and probably made use of by, Chicago; and what is more, the same wafer if allowed to flow over Niagara Falls as it does at present, instead of being utilised at Lockport, Illinois, could

generate five to seven times more power than at the latter place.

The Commission expresses its "unqualified disapproval" of the scheme.

The Canadian Northern Railway is reported to be trying a new gas-electric car, the cost of operation of which works out to something like 18 or 20 cents per car mile, which compares very favourably with that of ordinary electric trains, so that similar cars could be used instead of trains for outlying districts, &c.

An order for 20 cars built entirely of steel, except the door and window frames, has recently been placed by the Ottawa Electric Street Railway Co.

#### AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYEES.—III.

THE hearing of the arbitration case, brought by the Australian Tramway Employes' Association against eleven of the principal Tramway Authorities in Australia, was continued before the Federal Arbitration Court at Melbourne on Thursday, March 7th. The claims made by the Association were summarised in our last issue.

The evidence of Mr. G. L. Prendergast, the president of the Association, was continued. He said that the policy of the Association was to gain their object without striking, and that both at Brisbane and Adelaide they had used their influence towards peace. He had been a builder's clerk, and commenced to agitate for better conditions of employment soon after he joined the Prahran-Malvern Tramway Co. as a conductor. As tramway workers they objected to long hours and the manner in which occasional labour was engaged. A number of other minor grievances were detailed.

The next day was largely devoted to questions as to the manner in which the statement of claim was prepared, and whether it had in reality been carefully considered by the various branches of the Association. At Malvern, it was stated, the conductors' wages at present were 48s. per week, and motormen's 48s. to 50s., with a bonus on current-saving; it was also stated that although some of the motormen made 6s. to 7s. 6d. per week bonus, yet the Association objected to it. Asked why, it was stated that the bonus system encouraged men to break the company's regulations and run by passengers in order to save the current consumed on re-starting.

Mr. Prendergast stated that the men had decided to withdraw their claim for an extra 10 per cent. from the Brisbane Co. The only district in which they now asked extra was Western Australia, where they wanted 15 per cent. over the other normal rates. He intended to call witnesses from each State to show that dissatisfaction did exist, although in some cases it had not been brought to the notice of the management.

Mr. Champ, the secretary of the Queensland branch of the Association, dealt with the position of affairs at Brisbane. Many of these have already been stated. The Company was decidedly averse to the formation of any union outside its own employes, and started one of its own. This had about 80 members, as against 450 in the other. A bad feeling was created, and every act of the company was criticised. Instances were given, and reserved for further evidence, where it seemed as if men had been penalised, by dismissal for minor offences, for being members of the larger union.

Mr. G. Bryant, the secretary of the Hobart branch, resumed his evidence. Out of 105 employes, about 70 were unionists. Complaints were made of hours and wages, and that conductors were responsible for lost tickets or for tickets advanced to passengers on credit. It was also stated that time was reckoned as starting from when the car reached the Post Office, 400 yards away from the depot, so that the motormen had to give about a quarter of an hour on going on duty, and the same at night. Again, there was a break of three hours, 2 a.m. to 5 a.m., in the night shift, which free time was perfectly useless to the men.

It was pointed out by the Judge that many of these matters seemed capable of adjustment by a conference between the parties, and a suggestion was made that the manager should meet the men. Mr. Parker, the manager, asked for time to consider this proposal.

Mr. Hill, secretary of the South Australian branch, gave evidence of the condition of affairs at Adelaide. This branch had drawn up a demand for 12s. per day for motormen and 11s. per day for conductors, but they had subsequently adopted the Association's proposal for 11s. per day for both motormen and conductors. At the end of November the minimum rate paid by the company was raised to 8s. per day. The men were dissatisfied with wages, hours, overtime rates, and other matters. Conductors had to make up shortages, but were not given the benefit of moneys overpaid. As justification for their demand for higher wages, they stated that in South Australia builders' labourers received 12s. per day, boiler-makers' labourers and blacksmiths' strikers 9s. a day, and pick-and-shovel men on tramway construction works 9s. a day; members of the Amalgamated Society of Engineers received as a minimum 12s. a day. Further evidence of the cost of living was given. It was stated that out of 700 employes at Adelaide, 257 had left during 2½ years. About 500 members belonged to the Association, but the tramway company refused to recognise them.



Mr. O'Connor, the president of the Victorian branch of the Association, detailed his experiences as an employé for 12 years, during which time he had been twice dismissed and reinstated—once after the matter had been mentioned in the Legislative Assembly. Amongst other points, he demanded the Appeal Board, to which all disputes between employer and employé as to discipline could be referred.

The Judge pointed out that he was open to conviction, but at present he thought the claim an extravagant one.

The Association, through Mr. Prendergast, then asked for the production of the company's books relating to all cases of discipline, to show that favouritism existed; and, after discussion, it was decided that books, other than financial books, relevant to the case for the past two years should be produced.

Mr. O'Connor complained of having to collect 80 fares in three minutes and being held responsible for ticket shortages, having to have tea on the car, and having at times to work with inexperienced gripmen. He also claimed that tramway work was very unhealthy, and that this should be taken into account in fixing wages.

Mr. Ovenden, an Adelaide motorman, complained that a motorman was once fined £2 2s. for damage done to a car in collision, and a conductor had been fined for declining to work more than nine hours a day. A conductor had to know every street on his route, and till he knew them the motorman had more work to do. Motormen had also a number of forms to make out, and, in fact, he had to be a person having more knowledge than he was generally credited with. The men wanted higher pay and shorter hours, and asked for promotion by seniority.

The Judge pointed out that this method prevented merit from receiving its due reward.

Another claim was that the men should be paid for the time spent in attending ambulance lectures.

After several other similar complaints had been ventilated, the Court adjourned for a period of 11 days.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### A New Design of Travelling Crane.

An electric travelling crane of improved design is shown in the accompanying illustrations. This crane was designed by MESSRS. SMITH, MAJOR & STEVENS, LTD., of Abbey Works, Northampton, as the result of their failure to obtain exactly what they wanted in

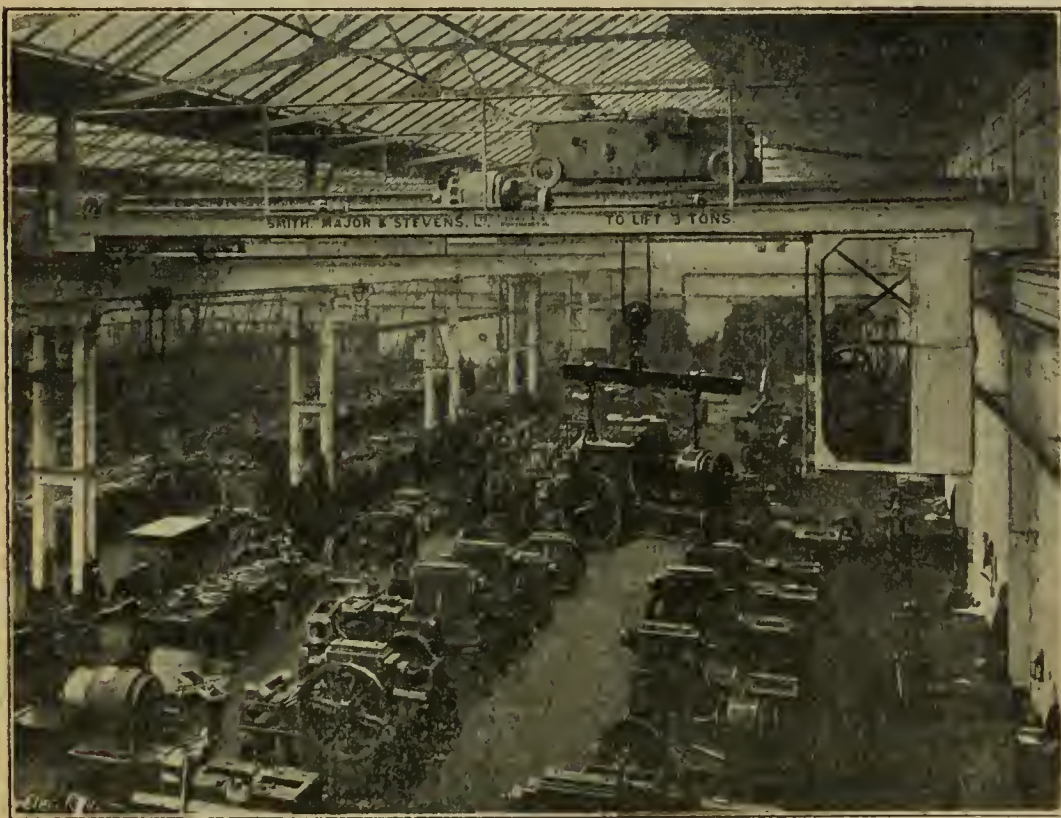


FIG. 1.—NEW ELECTRIC CRANE.

the open market when they were equipping their new factory at Northampton, and they evolved this design, two examples of which are now working in their shop with success. The points aimed at in the design were simplicity consistent with high efficiency and convenient control, together with more ample proportions of the smaller parts than are usually to be found in the standard types of cranes of this size that are at the present day on the market. The first figure shows the general appearance of the crane, which is designed to lift three tons and has a full-load lifting speed of 27 ft. per minute, while the longitudinal traverse has a speed of 233 ft. per minute, and the cross traverse can run up to 80 ft. per minute. The motors are all series-wound, the lifting motor having a capacity of 9 B.H.P. at 400 R.P.M. The longitudinal traverse motor is a 5-B.H.P. one, running at 500 R.P.M., and the cross traverse is

operated by a 1½-B.H.P. motor running at 440 R.P.M. These motors are controlled by means of liquid starters arranged in the cab and conveniently placed for the use of the operator, while the lifting motor is controlled by an electric brake of the type which Messrs. Smith, Major & Stevens have used with success on their standard lifting gear. The drum and bands are of the multi-grooved type, the drum being constructed of cast-iron and the bands of gun-

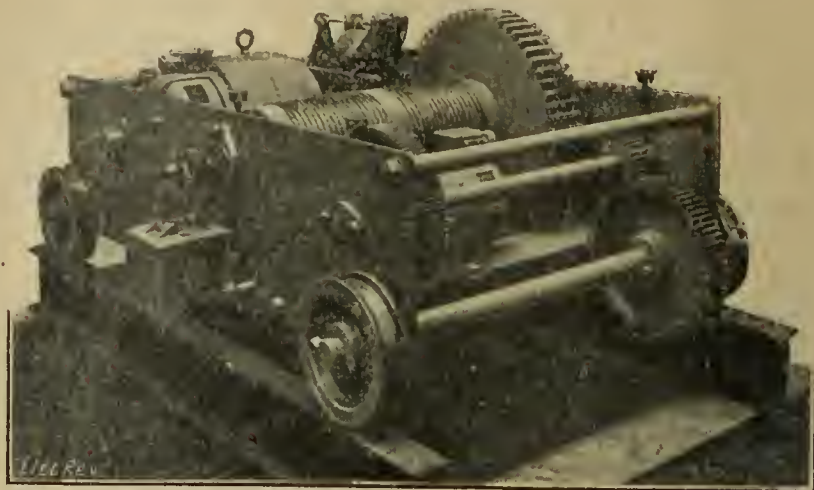


FIG. 2.—CRAB OF ELECTRIC CRANE.

metal. The longitudinal traverse is controlled by an ordinary band brake foot-operated from the cab. The span of the gantry is 28 ft., the cross travel of the hook 22 ft., and the effective lifting travel of the hook 17 ft. Fig. 2 shows clearly, fixed to the side of the traveller, the special knock-off switch which is provided in order to guard against the possibility of overwinding, this switch operating automatically when the safe limits of lift are exceeded. It will be seen that a very light and yet strong type of electric crane has been evolved by this firm, which appears to possess merits which make it of considerable practical interest. The first illustration also shows the general lay-out of one of the important departments in the new shops at Northampton.

### "Efesca" Electric Grill.

In the new catalogue issued by MESSRS. FALK, STADELMANN AND CO., LTD., 83 and 87, Farringdon Road, London, E.C., there are several serviceable lines of electric heating and cooking apparatus. A hot-plate cooking range with polished mouldings, made in cast-iron, contains two 7-in. boiling plates, and measures over all 24 in. × 12 in. It gives ample space for a number of saucepans, three of which can be kept boiling over each plate. Each hot plate is controlled by a switch fixed on the front, and a suitable oven can be placed over either for cooking

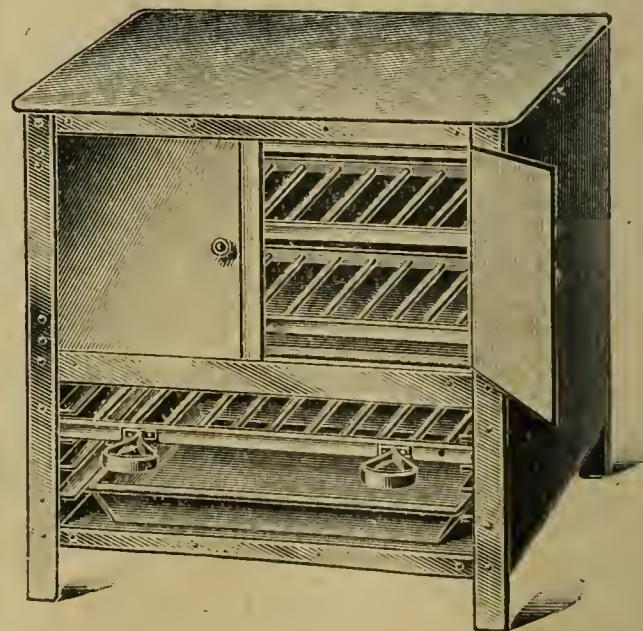


FIG. 3.—"EFESCA" ELECTRIC GRILL.

small joints. Another feature is a breakfast cooker in black enamel finish, with polished-steel top plate and facings. It comprises one 6-in. boiling plate with two heat regulations, and a grill 9 in. × 9 in., the top of which can also be used for boiling. Another line is that illustrated in fig. 3, which shows a nickel-plated grill and hot cupboard made in sheet metal 19 in. wide × 13 in. deep × 19 in. high.

### Automatic Solenoid Starter.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W., have brought out a new automatic solenoid starter, which has the novel feature that one solenoid operates two separate plungers, one at each end. The one at the top controls the main switch. This has a double break, and is fitted with laminated contact brushes and carbon arcing tips.



The operation is as follows:—On the solenoid being energised, by means of a push button or otherwise, the top plunger immediately acts, closing the main switch, and starting the motor with all the resistance in circuit. The bottom plunger then comes up at a rate regulated by the dashpot, causing the lower switch gradually to cut out the resistance till full speed is attained.

On the solenoid being de-energised, the top plunger at once rises, opening the main switch. At the same time the bottom plunger



FIG. 4.—E.A.C. AUTOMATIC SOLENOID STARTER.

falls to its lowest position, ready for another start. The switch that controls the resistance has no "off" position, so that the circuits cannot be broken on the sliding contacts.

This starter has been specially designed for inching, such as is required in printing press control. There is no shock or noise when the plungers operate, and a double break is provided on the main switch. The use of a single solenoid for the two switches makes the starter more reliable, more compact, and less expensive than old types.

#### The "Mumps" Lampholder.

We have received from MESSRS. G. ST. JOHN DAY & CO., of Mumps Electrical Works, Oldham, a sample of their "Mumps" lampholder, a patent for which is, we understand, pending. This holder possesses features of its own, and is well worth inspection.

The interior consists of two cylindrical porcelain blocks, the upper one fitting into a recess in the lower one, and held in position by the screwing-up of the plunger contacts. The upper block is

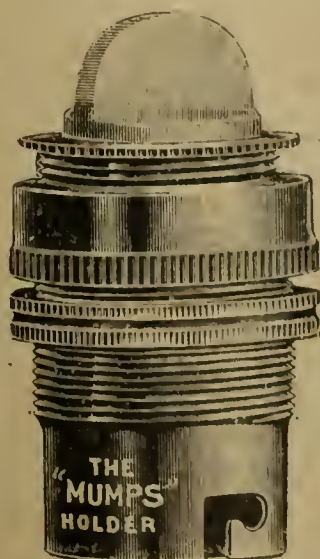


FIG. 5.—THE "MUMPS" LAMPHOLDER

made with a porcelain bridge, which effectively separates the wires at the point of entry: the wires pass down through holes and are secured to small brass terminals on the under side. The terminal

screws are double-ended, and the long projecting ends are inserted into the lower porcelain block, the plunger contacts fitting into recesses in the opposite or lower side, and being screwed on to the ends. It may be noted that in fastening the two blocks together the flexible is securely gripped between the two; moreover, the unscrewing of the plunger contacts releases the wiring parts. The two porcelains fit into a thick-gauge brass barrel, the lower end having the bayonet sockets formed in it, while an adjusting nipple screws over the upper end, and a locking ring is screwed down inside on to the porcelains, fixing them in position and, if screwed down far enough, locking the lamp in position.

The device is solidly constructed to the Home Office specification, and its simplicity and other good features should appeal to electrical men generally.

#### New Inspection Tee.

Special forms of inspection tee are now being introduced by MESSRS. SIMPLEX CONDUITS, LTD., for installations where the tubing is run under the floor boards and laid across the joists, with a short drop to the ceiling rose or light point in the room below. These tees are made somewhat smaller than the standard circular boxes, thereby effecting some saving in cost, and at the same time providing for a convenient inspection opening, from which the



FIG. 6.—SIMPLEX INSPECTION TEE

wires may be threaded or pulled into the tubes. They are sufficiently large to allow of a joint being made between small wires also. The tee piece is provided with a spring-in lid.

The illustration shows the method of application in practice, looking from the floor above the room in which the light point is fixed, the tubing being let into the joists and fixed with an ordinary crampet. It may be pointed out that care should be exercised in cutting "ways" in joists for the conduit to lie in; only a small factor of safety in the strength of joist is allowed for, and this is seriously reduced if too much cutting-away is done in erecting the conduit.

## PARLIAMENTARY.

### Light Railways Bill.

SIR A. BOSCAWEN presided on April 30th over Standing Committee B, which commenced the consideration of the Light Railways Bill promoted by the Board of Trade, which is a Bill "to continue and amend the Light Railways Act, 1896."

Clause 1 was as follows:—"(1) If any order under the Light Railway Act, 1896 (in this Act referred to as the principal Act), is not confirmed by the Board of Trade on the ground that the proposals of the promoters ought to be submitted to Parliament in pursuance of Sub-Sec. (3) of Sec. 9 of the principal Act, the Board may, if they think fit, submit the proposals to Parliament by bringing in a Bill for the confirmation of the Order. (2) If while a Bill confirming any such Order is pending in either House of Parliament, a petition is presented against the Order, the Bill so far as it relates to the Order may be referred to a Select Committee, or, if the two Houses of Parliament think fit so to order, to a Joint Committee of both Houses, and the petitioner shall be allowed to appear and oppose as in the case of Private Bills. (3) In bringing in a Bill under this section for the confirmation of an Order, the Board of Trade shall make a special report to Parliament with respect to the Order."

MR. HICKS-BEACH asked that the Minister in charge of the Bill should give them some explanation of its objects; so far as he could gather from Clause 1 it would seem that there were difficulties under the present procedure.

MR. WARDLE asked if the Government was to pay the whole of the expenses of the Bill. If it was of benefit to a private promoter, why should he not pay?

MR. J. M. ROBERTSON (Parliamentary Secretary to the Board of Trade), in reply, said some difficulty had actually been found in regard to the form of procedure. The Light Railways Act had not done all that was expected of it, but it had done enough to make it highly desirable that the facilities for light railways should be further extended if they could do so by means of an amendment of the law. There had been two or three cases in which schemes had been brought forward which the Board of Trade entirely approved of, and which would have been beneficial to the districts concerned; but when the promoters found that they were called on to begin again, and bring forward a Bill in Parliament, they dropped the schemes, and they had never been revived. They were discouraged by the trouble and expense which the method of procedure put



upon them. The effect of this clause was to provide that in any future cases of that kind when a scheme was brought forward which the Board of Trade approved of, but which was important enough to require the consent of Parliament, then, instead of the promoters having to incur the expense and trouble, the Board of Trade would practically do the work for them, and schedule the Bills in one Order. The defence of such a Bill before the House would lie with the promoters, but by this new procedure they would be saved so much trouble and expense that the Board of Trade felt that such schemes as had fallen through under the old procedure would be enabled to go on, and thus the construction of light railways in general would receive useful encouragement without any such abuse as Mr. Wardle expected might arise.

MR. WARDLE asked if it would be the same as an ordinary Bill going before a Committee.

MR. ROBERTSON said the defence could lie with the promoters. It was not a case in which the Board of Trade would incur the cost.

MR. J. SAMUEL pointed out that local authorities ought to be safeguarded. The promoters of a scheme might satisfy the Board of Trade, but the local authority might object. If the Board of Trade took up the case the local authority would be greatly handicapped.

The Hon. H. LAWSON thought the House had hardly any idea of the extent to which the Bill attempted to extend the powers of the Board of Trade. In fact, if the Bill was adopted without amendment it would deprive Parliament and the local authorities of a great deal of the controlling powers they now had. A Bill brought forward under Clause 1 would not follow the ordinary procedure of Private Bill Legislation. No notices, he took it, would be given, and therefore persons and authorities interested would only get such notice as would be convenient to the Board of Trade of what was proposed to be done. He considered this a very serious innovation.

MR. ROBERTSON said that in cases where there was no opposition by the local authority the Board of Trade could call on the promoters to proceed by Bill. Members must not think the Bill was promoted merely to deal with cases where there were disputes between promoters and the local authorities. The cases of good schemes which had been discouraged included the Eardley and Coatbridge scheme, the Dundee and Broughty Ferry scheme and the Staines and Egham scheme. The local authority could first put their case before the Light Railway Commissioners, and then before the Board of Trade, and in the past the Light Railway Commissioners had been accused by promoters of unduly favouring the local authorities. If the Board of Trade did not think a scheme sufficiently important to come before Parliament as a Bill, then, under the existing law, the local authorities could make their views heard before the Light Railway Commissioners. When the Board of Trade called on the promoters to come before Parliament, they relieved them of the expense, but the Board of Trade had no power to turn the local authorities out of Court. The action of the Board of Trade would always be subject to due supervision by Parliament.

MR. LAWSON asked if notices would have to be given before a Bill was introduced.

MR. ROBERTSON said they would. A Bill could not be introduced by any secret procedure.

MR. HICKS-BEACH said it seemed to him that this Bill would be a direct incentive to the promoters of light railways to promote a big scheme, and so force the Board of Trade to submit it to Parliament and pay some of the cost of the promotion.

MR. ROBERTSON said that under the procedure there would be no expense on the Board of Trade at all. The expenses of the Board of Trade would be charged to the promoters, but such expenses would be trifling as compared with the expenses now incurred by the promotion of a private Bill.

Clause 1 was then agreed to.

Clause 2 provides that (1) "A trackless trolley system along any road or street may be authorised by order under the principal Act in the same manner and subject to the same conditions as a light railway, and that Act, and any Act amending the same, shall accordingly be construed as if the expression 'light railway' included a trackless trolley system."

MR. LAWSON moved an amendment to the effect that the clause should read "A trackless trolley system along any road or street may, with the consent of the road authority of the district in which such road or street is situate, be authorised, &c." He said that this clause would enable the whole of the country to be covered by a network of trackless trolleys. The whole of the system by which the tramways had been extended in different parts of the country was reversed by the provisions of this measure. The Board of Trade was enabled practically to take the place of the local authorities and to ignore the policy of Parliament. The trackless trolley system was wholly an experiment, and without going into the merits of it he could say it would be wholly unsightly. It would do enormous damage to the roadways, both in the town and in the country, and at any rate it required, as such, more deliberate consideration than it had yet had before these wide powers were given to a department of the Government. He thought the Board of Trade was much too greedy in this Bill. At present the Borough Councils in London had the right of veto in regard to tramways, but the whole of that right was done away with under the Bill. He could not imagine such a system being applicable to towns at all, for there would be two overhead wires, whilst the roads would be cut up to an extent to which the damage done by omnibuses would be a trifle. At the same time no compensation for damage was to be made by the promoters of the schemes. He did not think it would be difficult to imagine enormous ruts being made in the roads.

MR. HICKS-BEACH said he would support the amendment on behalf of the company. He was not an electrician, and did not really know what a trackless trolley system was. He rather gathered that

the vehicles would be something like the enormous pantechnicons which came from London to the country now, and did enormous damage to the roads. He did not conceive that the system would be any good to traders and agriculturists unless they were of fair size, and in that case they must damage the roads, and they certainly ought to pay something towards the maintenance of the roads.

MR. ROBERTSON said the question of the effect of the system on the roads would be discussed later. He would point out that the amendment went much further than anything sanctioned under the Tramways Act of 1872. Under the Tramways Act, two-thirds of the local authorities had to give consent, but the amendment would mean that one authority alone could upset a scheme. Such a veto as this would be a most reactionary thing, and the real rights of the local authorities were abundantly safeguarded. As regarded the effects on roads of trackless trolleys, they had enormously exaggerated the effect. If they were going to run in ruts they had better have a tramway. The vehicle would be lighter than a motor-bus, as it got its electric power through the trolley and the overhead wire, and did not have to carry machinery as was the case with the omnibus. The weight limit put to the vehicles so far was 5 tons, which was much less than that of the vehicles referred to by Mr. Hicks-Beach. Hon. members were condemning a system which really was carrying out what they wanted.

MR. BIGWOOD said that from inquiries he had made, the damage to the roads of the trackless system was exceedingly light, as compared with motor-buses. He had received a communication from the Municipal Tramways Association approving of the Bill, as its objects were highly desirable. He also felt that with regard to housing, large municipalities would, by the adoption of this system, be enabled to carry working men to the outskirts. He understood that the Board of Trade had given an undertaking that where a municipality had a well-equipped tramway system no private promoter would be allowed to run over such routes.

MR. ROBERTSON said that no pledge had been given, but obviously there would be no disposition to grant such powers.

MR. BIGWOOD said it seemed to him that local authorities would get something in the shape of increased rateable value from districts developed by the system.

MR. HASLAN pointed out that a tramway had to keep in repair so much of the road, and if these trolley vehicles were going to do damage to the roads, they ought to pay something. At present petrol vehicles did pay something by way of the tax on petrol.

MR. WHEELER argued that if the local authority was to have no veto, what was the good of a local authority being elected by the people? He had in his mind the case where only a single local authority was concerned.

MR. ROBERTSON said that in the case where one local authority only was concerned, the Light Railway Commissioners would give no order.

MR. WHEELER urged that in narrow streets ruts in the road would be bound to be made.

MR. F. GOLDSMITH said that, as a member of the Local Legislation Committee, which had given consideration to several trackless trolley systems, he agreed that they did less damage to the roads than the ordinary motor-bus, but, at the same time, he would like an assurance that something would be done to satisfy any possible objection of the local authorities. At present in London the Borough Councils had a veto on the overhead system of tramways, but this Bill would do away with that veto. There should be some safeguard put in the Bill. In the country the trolley vehicles would cut up the main roads, and he would like to know whether the cost of improvements could not be thrown on the authority owning the system. These trackless trolleys had only been running in this country about seven months, and 5 tons as the limit of weight was put on by the Board of Trade because it was an experimental system, but there was nothing in the Bill limiting the weight to 5 tons.

MR. LAWSON intimated that he would add the following words to his amendment: "Such consent not to be unreasonably withheld."

MR. ROBERTSON said he could understand the apprehension with regard to the possibility of the amenities of a town being injured by a trackless trolley system, but the common-sense of the Light Railway Commissioners would never admit such a system against the wishes of the inhabitants. He contended that the rights of local authorities were absolutely safeguarded. The limitations of weight to 5 tons per vehicle, and the limitation of speed to 12 miles an hour came from the Board of Trade, which, of its own motion, was imposing these safeguards.

On a division, the amendment was carried by 16 votes to 8.

MR. EDMUND HARVEY then moved that the following words should be inserted at the end of Sub-Sec. 1 of Clause 2: "Provided that any such order shall contain provisions requiring the company, body, or person upon whom the powers thereof are conferred to pay the cost of any alterations or improvements in the road or street made for the purposes of, or rendered necessary by, the trackless trolley system, and to make a contribution towards the cost of maintaining the road or street, regard being had in determining the amount of such contribution to (amongst other things) the additional expense incurred by the authority by whom the road or street is maintained."

MR. LAWSON seconded the amendment.

MR. ROBERTSON said that whilst members would like to safeguard local authorities, yet the amendment would give the local authority the power to squeeze a particular undertaking. The local authority would be unable to get anything out of the heavy road engines and traction engines, but the promoters of the trackless trolley systems would be mulcted. In view of the decisions of the



Local Legislation Committee, he hoped the amendment would not be carried.

MR. GOLDSMITH said the Local Legislation Committee considered each case on its merits. It was true that the Committee had decided that the Keighley Corporation should not contribute to the maintenance of the roads, but he understood the question would be raised before the House of Lords Committee, and also in the House of Commons. He thought it ought to be made quite clear that a company or a local authority putting down a trackless trolley system for profit ought to pay for the roads, and not the county authority.

MR. HICKS-BEACH urged that it was no argument to say that because certain classes of vehicles did not pay for the upkeep of the roads now, therefore a new system should be allowed which should also be exempt from contributing to the cost.

MR. ROBERTSON said, to meet the wishes of the Committee, he was prepared to accept the following amendment:—

"That an order under this section may provide for a contribution from the applicants of the order towards the cost of maintaining any road or street along which the trackless trolley system is authorised, and in determining the amounts of any such contribution, regard shall be made, amongst other things, to the additional expense which may be caused to the road authority by reason of the order."

MR. LAWSON said this would not apply to the cost of widening of the road except as a point in the maintenance of the road.

MR. BIGWOOD urged that there should be a definite figure placed in the Bill as to the percentage of cost which promoters should pay. He was prepared to move for the insertion of a contribution of 5 per cent. of the total gross receipts.

MR. HARVEY said that, in view of the position they had arrived at, he suggested that they might adjourn so as to have the amendments printed.

On Tuesday, May 7th, VISCOUNT HELMSLEY supported the amendment, as he was of opinion that unless it was carried local authorities would be unfairly mulcted. The local authorities would be called upon to pay very heavy charges for the upkeep of the roads, unless some provision was made for a contribution from the persons who started a trackless trolley system. He denied that supporters of the amendment had any desire to injure this new system, but the ratepayers had to be considered.

MR. J. M. ROBERTSON (who was in charge of the Bill) said he understood that the amendment was moved on behalf of the Association of Municipal Corporations, and he now gathered that it did not altogether meet the wishes of all the members of the Association, as the interests of large and small areas differed. He understood that those who acted for the Association of Municipal Corporations were willing to withdraw the amendment if the Government would accept the amendment which was proposed at the last sitting by Mr. Lawson and carried by the Committee, which was to the effect that the consent of a local authority should be required for any scheme, although the consent was not to be unreasonably withheld. The Government would accept that amendment, but the form of the former would have to be altered on report. Further, he would give the Committee the assurance that the Board of Trade had undoubted powers to insert in any order a provision that the promoters of a trackless trolley system should not only meet the cost of any widening of the roads or anything of that kind which might be necessary, but they also undoubtedly had the power to impose on the new system a contribution towards the upkeep of the roads, and had always exercised their powers with an eye to the interests of the local authorities. In some cases already voluntary arrangements had been made between local authorities and the promoters of the system. He contended that it would be much better to leave the matter to the Light Railway Commission and the Board of Trade, who had full power to protect the local authorities, than to try and lay down any hard-and-fast rule.

MR. GOLDSMITH urged that the amendment should not be withdrawn. He pointed out that trackless trolleys were really in the same position as tramways. The systems would be mostly promoted by Corporations as feeders to their tramways, and it would be very hard that country ratepayers should be called on to contribute to the cost of such systems.

MR. HODGE objected to any tax on means of transit, and considered that the community, as a whole, would benefit by the introduction of the system.

MR. MALCOLM said he strongly objected to any private venture of that kind being made a lucrative concern at the public expense.

MR. HARVEY said the position had been entirely altered by the statement of the Parliamentary Secretary to the Board of Trade, and he asked leave of the Committee to withdraw the amendment.

The HON. HARRY LAWSON protested against any outside body being brought into the matter. They had to adhere to sound lines of legislation, and the real precedent they had to adhere to was the Tramways Act of 1872. Under this Bill they were giving a new franchise of considerable value to a new system of traction.

MR. ROWLAND HUNT moved as an amendment to Mr. Harvey's amendment, the insertion of the following words after "to make a contribution," viz., "of 5 per cent. of the gross receipts towards the cost of maintaining the road or street, to be divided *pro rata* between the local authorities concerned according to mileage."

After some discussion, this was withdrawn. The amendment of Mr. Harvey was subsequently put to the vote, and carried by 19 votes to 16.

VISCOUNT HELMSLEY then moved to add the following words to Paragraph 1 of Clause 2:—"Provided that any such order shall also contain provisions giving the road authority power to control the weight of the cars and to prohibit cars of excessive weight, and

that the traffic of such trackless trolley system shall be subject to general regulations made by the road authority."

MR. ROBERTSON expressed himself in full sympathy with the views of the mover and said that later he proposed to move an amendment which would carry out the wishes of the hon. member.

VISCOUNT HELMSLEY thereupon withdrew his amendment.

Paragraph 2 of Clause 2 was next discussed, viz. "The expression 'trackless trolley system' means a system of running on roads or streets without any defined track or line of rails mechanically propelled vehicles moved by electrical power transmitted thereto from some external source, and includes all apparatus necessary for working the system."

MR. HICKS-BEACH moved an amendment to the effect that the clause should read "electrical power transmitted thereto by overhead wires."

MR. ROBERTSON opposed the attempt to alter the definition, although he was prepared to consider any alternative definition before Report stage.

The HON. H. LAWSON ridiculed the draftsmanship of the Board of Trade, inasmuch as "some external source" really meant nothing.

MR. GLYN JONES thought that by the present definition any vehicle which did not manufacture its own electricity would come under the Bill.

MR. ROBERTSON agreed to reconsider carefully the matter of the definition. He did not think an electric brougham which did not generate its own electricity would come under the Bill.

On the understanding that the matter would be reconsidered, the mover withdrew the amendment.

Considerable discussion also took place on Paragraph 3 of Clause 2, and a number of amendments were moved with the object of incorporating several sections of the Motor Car Acts. Two amendments were moved by MR. ROBERTSON, and carried, and when the Committee adjourned the paragraph stood as follows:—"Mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section shall not be deemed to be light locomotives within the meaning of the Locomotives on Highways Act, 1896, or the by-laws and regulations made thereunder, nor shall they be deemed to be motor-cars within the meaning of any provisions of the Motor-car Act, 1903, except Sub-Sec. (1) of Sec. 1 of that Act, and the provisions necessary for enforcing that sub-section and subject to that exception, neither that Act nor the regulations made under that Act, nor the enactments mentioned in the Schedule to the Locomotives on Highways Act, 1896, nor the Locomotives Act, 1898, shall apply to any such mechanically-propelled vehicles, except in so far as they are incorporated or applied by the order authorising the system."

VISCOUNT HELMSLEY protested against the hideous complexities of this kind of legislation by reference.

The Committee adjourned till yesterday.

**London and North-Western Railway Bill.**—This Bill was due to come before Lord Bristol's Committee of the House of Lords on April 30th, but there being no appearance in opposition, the Bill was referred to the Unopposed Bill Committee. The Bill provides, in conjunction with the London Electric Railway Co., for new electric railways from Watford to Euston, and is in connection with the scheme for the electrification of the North London Railway. The promoters have struck out Clause 37 of the Bill, enabling them to supply electrical energy to manufacturers near their railways, and also Clause 36, giving them power to enter into agreements with other railway companies for the generation and transmission of electrical energy for the purposes of those railways.

**Canvey Dock and Railway.**—Lord Bath's Committee has rejected the Bill for the construction of a deep dock at Canvey Island and of a short railway to Benfleet. The Bill gave power to erect generating stations and to work the railway by electricity.

**German Works in Russia.**—The Russian A.E.G. Co. of St. Petersburg reports that the volume of business transacted in 1911 was much greater than in the previous year, and notwithstanding the low prices which prevailed owing to competition, the financial results were more favourable than in 1910. After making what is characterised as ample provision for depreciation and reserve funds, the balance of net profits permits of the payment of a dividend of 8 per cent. on capital of £700,000 for 1911, as compared with 7 per cent. in 1910. Large orders are on hand for the new financial year, and important contracts are also expected from the Russian Admiralty. The United Cable Works Co. of St. Petersburg, which is the amalgamated undertaking of the Russian cable departments of the Berlin A.E.G., the Siemens & Halske Co. and the Felten & Guilleaume Co., also experienced an increase in the turnover in 1911, but in consequence of keen competition prices were much depressed, and the financial results were not in proportion to the sales. Including the balance forward, the accounts show net profits of £80,000 for 1911, as against £76,000 in the previous year. The allocation made to the capital redemption fund absorbs £21,000, and the balance allows of the distribution of 8 per cent. on the share capital of £480,000, the same rate as in 1910. The share capital has now been raised to £600,000, by the issue of £120,000, for the purpose of extending the manufacturing plant.



## LEGAL.

OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(Continued from page 711.)

THE cross-examination of DR. PASSMORE was continued by MR. TERRELL.

In the patent of 1906 his invention is to take place in the process which is going to operate directly after the baking process, or the carbonising process, and he is going now to retain the reducing gases, that is, to retain them from the specification of 1905, and that is the hydrogen?—Yes.

He says he is going to change the steam into nitrogen. Is that the effect of it?—He is going to have hydrogen and nitrogen instead of steam.

And you say you have proved that it forms cyanogen?—I have proved that it is hydrocyanic acid that is formed there.

Suppose I have a tungsten filament, are nitrogen and hydrogen neutral gases?—Hydrogen will protect the tungsten from the action of oxygen; nitrogen has no action on tungsten.

They are not an indifferent atmosphere to carbon?—Or to tungsten filaments containing carbon.

Supposing you do not care whether you remove the carbon or not, would you treat hydrogen and nitrogen as indifferent gases because you want to sinter; this man is telling you for the first time to sinter?—If I merely want to sinter, and not to affect the composition, I should not use those gases; I would use either one alone, but not both together, because they affect the composition.

The patentee is aiming at getting rid of all the impurities and getting the pure tungsten filament?—It depends on what he calls impurities.

For the purpose of making a filament into a finished filament, is carbon an impurity?—A certain amount of carbon in a filament is not material, the filaments always contain traces of carbon.

If carbon were present in quantities, that would be an impurity?—I do not know.

HIS LORDSHIP: Are you using this as an anticipation of the second invention.

MR. TERRELL: I am using it as an anticipation of the second invention, if that they say the invention is for the use of nitrogen and hydrogen, and that nitrogen and hydrogen remove carbon by forming cyanide. If they say it is limited to the use of ammonia, then we understand where we are, and we can argue it. We say that nitrogen and hydrogen are both indifferent to carbon and to tungsten, and that cyanogen is not formed.

HIS LORDSHIP: That goes to non-utility.

MR. TERRELL: Yes, cyanogen is not formed, and if cyanogen is not formed, then to both carbon and tungsten nitrogen and hydrogen are an indifferent atmosphere, and this is an anticipation, and carbon goes out by volatilisation.

HIS LORDSHIP: At present the witness does not admit that it is an indifferent atmosphere to carbon.

WITNESS: Nitrogen alone is indifferent, but nitrogen and hydrogen act upon carbon.

MR. TERRELL (to Witness): I am going to put to you an experiment that has been tried. A batch of 35,000 filaments of the kind in dispute were squirted, baked, and sintered in the manner adopted at the time of the alleged infringement. The die used was of .034 mm. diameter—that gives you the size of the filaments. The samples of both baked and sintered filaments were analysed. About 1,080 lamps were made with phospham and about 850 lamps without phospham, the filaments from the lamps also being analysed. The result was as follows:—Carbon in baked filaments, .804 per cent.; sintered filaments, .164 per cent.; filaments from the phospham lamp, .019 per cent.; filaments from non-phospham lamp, .017 per cent., that being only  $\frac{1}{1000}$  of 1 per cent. lower, and, therefore, within the region of error.

Did you make up any lamps without phospham with our filaments?—Yes. We made up lamps with your filaments without phospham and with phospham. We pumped them—exhausted them—by the usual method at the Osram works, not by the method carried out by the "Z" works, and then they were put on the light rack—that is, they were run for so many hours to see whether they blackened at all. I do not know what the last record was, but after they had been running four weeks one was as good as the other, with phospham or without.

Did you estimate the carbon in them?—No, I did not.

Now, I wish to deal with the third patent. This weight referred to is a very tiny little weight, indeed?—It depends on the size of the filament.

In the plaintiffs' factory you have seen the weights put on?—In the laboratory with your apparatus, yes.

What were the sort of hooks you put on?—For these fine filaments a small hook of tungsten metal. I think it weighed about 3 milligrammes.

The weight is put on to the filament before the electric current is put on. Then the current is passed through, and the filament goes through some contortions?—Not with the weight on.

You prevent them happening, and then the filament comes down to a hairpin, and that is done during the process of sintering?—Yes.

You can just as well sinter the filament itself, and then repeat the process, and do it when they are soft a second time, as at first?—No; you do not get the same shape.

I suggest that it does not matter, and it is immaterial in practice

whether you put the weight on during the first process of sintering or whether you put it on in the second process, when you also get the benefit, and the full benefit, of the weight on?—I can see considerable difficulty first of all if the weight is not on during the sintering process. At any rate, in the circumstances of a fine filament, it would be nearly all destroyed; and in the second place, having the filaments you cannot get the same shape, and you cannot get such an acute angle.

Re-examined by MR. ASTBURY: Where you get these fine filaments and decarbonise and sinter them in this gas atmosphere which we have been told about, what happens when you start the current on to these fine filaments if they are unweighted and if they are very fine?—They begin to twist and curl. Apparently the decarbonisation is not equal all over, and on one side the strain is more than on the other, and it makes them curl and twist. Very often they touch against the glass or else short-circuit themselves by curling, or touch against the metal support, in either event being destroyed certainly with the apparatus that is used at the Osram works. I should say it would be impossible to make very fine filaments with the apparatus commonly used.

Do you know whether there are specifications prior to 1904 where the making of a homogeneous paste from a metal is described clearly and plainly?—Yes, in many cases amongst those specifications which have been cited as anticipations.

Is our specification of 1904 deficient in telling you how to get at the stage of forcing the thing through the die and getting that which you are going to carbonise and decarbonise?—No, not at all.

Was carbonisation of such filaments as were known a perfectly well-known process in 1904, and was the reason for it appreciated and understood?—Perfectly well known and understood.

Do you know of any difference between the mode in which you carbonise and the mode in which you carbonise and build up osmium filaments, and the result which you get qua carbonisation?—No.

At this stage MR. TERRELL said he thought from his side of the case that it was important his Lordship should see the process at some time or other. If his Lordship went to the defendants' works he could see defendants' process, and also that of the plaintiffs.

The Court was adjourned for half a day to enable his Lordship to visit the works, as arranged.

MR. ASTBURY: After what his Lordship has seen at the works, no doubt we can get along faster. With regard to the decarbonising and sintering before the filaments are put into the globes. During that process, is there any precaution taken at all, such as you see in the carbonising earlier process, to get rid of the hydrogen moisture, or the atmospheric moisture, or the moisture which you say is necessarily in the jar?—The only precaution taken is to insert a small calcium chloride tube in the hydrogen current which would be totally ineffective to dry the large quantity of hydrogen which is being passed rapidly through the tube—calcium chloride being a comparatively weak drying agent.

Could that little bottle or tube of calcium chloride in the sintering process take out any oxygen as distinct from moisture?—No.

How many seconds are the filaments under current during that decarbonising and sintering process in the jars?—It varies with various operators, some are only 20 seconds, others 50.

Having regard to the quantity or percentage of carbon in the filament, was or was not the filament as you observed it during its red state kept sufficiently long in that state for the moisture to decarbonise chemically the carbon in the filament?—Yes.

My friend suggested to you that during the whole of this jar process no carbon monoxide was formed at all?—On the "Z" filaments—no.

Taking the filaments made by the Osram people, have you treated them to an exactly similar process and determined the formation of carbon monoxide?—Yes.

And the effect of the moisture in the jar upon the carbon in the filaments, would the fact that you did it with some thicker filaments make any difference except that you got more to determine?—From a chemical point of view, no. As far as the reaction between steam and carbon is concerned there would be no difference whether it was done with a thin or thick filament.

Have you experimented to ascertain the gas that comes off from the filament during the time when it is dull red—that is, distinct from the subsequent time when it is at incandescence?—Certainly not with the "Z" filaments, but with the thicker filaments carbon monoxide was always obtained in the gases coming away.

Should we be quite safe in saying that carbon monoxide must form with moisture at a temperature of 700°?—Certainly.

What is the lowest temperature under which carbon will volatilise with heat in an atmosphere in which it is protected from any chemical influence, such as oxygen or anything of that kind—either a vacuum or a neutral atmosphere?—I do not know what the lowest temperature is at which it will volatilise—from experiment—but it is certainly a temperature of the order of 1,500° or 2,000° C.

Having regard to those facts, have you yourself any difficulty in forming an opinion as to what it is that takes out the carbon during that process when the defendants turn on the current in the jars?—No. In my opinion the carbon is oxidised out in the form of carbon monoxide.

HIS LORDSHIP: The point of all these experiments was that the gas which was used had no chemical reaction with carbon?—Yes, but there is nothing to show how it was dried or what was the parity of it, or anything of the kind.

MR. ASTBURY: Is it a matter of extreme difficulty to get all traces of moisture out of a glass bulb?—Yes, it is. And oxygen?



—Yes. If that is done while the thing is hot it takes some time, and if cold it is impossible.

Taking it as you saw it done at the defendants' place and as you had it repeated to you before, and as you tried yourself on other filaments, have you any doubt at all as a chemist that the filament goes through the stage of temperature, at which it is impossible chemically to prevent oxidation?—Yes, there must be oxidation and formation of carbon monoxide.

Now take the patent of 1904. Plaintiffs have two alternatives—one for doing it with steam and hydrogen, and one for doing it with hydrogen and nitrogen or ammonia. When they do it with steam and hydrogen, do they obtain complete oxidation of the carbon to the practical point at which the filament can then be put in and sealed up in the lamp?—Yes.

COUNSEL then read certain passages from Welsbach No. 1,535 of 1908, and asked: Is tungsten a metal which would make it impossible to apply that process to it?—Yes, it is. Because it is too easily oxidised. I should say the reason why the process would not work, is because the tungsten oxide is not volatile. I did not mean that tungsten is more readily oxidised.

Do you know of a single specification prior to the one we are suing on in this action, which suggests that you can build up tungsten filaments by the osmium process?—No.

Could anyone, in your opinion, as a chemist have foretold without experiment and research, that that could be done?—Most decidedly not.

Is there anything in either of those two Lodyguines which, in your view, taught the world anything at all about making a squirted tungsten filament?—No.

Referring to the Just and Hanaman (German) patent 154,262 (which plaintiffs disclaimed in their patent), counsel asked: Is the process there by which you are directed to get a filament at all comparable to the process in plaintiffs' 1904 patent?—No.

Have you ever heard of a practical filament made by this process?—No, I have been assured it is impossible to make them.

A number of suggestions have been made that in the defendants' process what they do is to form a carbide during the carbonising process, and then when the filaments get into the bell jar, the carbon is not there in the form of a carbon, but in the form of carbide of the metal, and that, therefore, the steam and hydrogen do not act according to the first patent in oxidising the carbon?—Yes.

MR. TERRELL: I suggested that carbide of tungsten has a very much lower melting point than tungsten; that if the current is passed through during the sintering operation, then the carbide of tungsten begins to melt. Then, physically, by the operation of the electric current, the carbon is volatilised off, which leaves pure tungsten, and that is infusible at that temperature, and that is the process of sintering.

MR. TERRELL: This answer of Dr. Passmore is admitting that there is carbide of tungsten.

MR. ASTBURY: Yes—some.

MR. TERRELL: That is all that is necessary for me for the purpose of sintering.

MR. ASTBURY: Supposing there is some trace of carbide of tungsten formed during the carbonising—has any experiment been made to ascertain whether that is so, and if so, what its percentage is?—No.

DR. ADOLPH LIEBERMANN, an expert chemical witness, was examined by MR. WALTER. Witness had read specification No. 23,899 of 1904, and satisfied himself that it worked; he also attended the inspection of the process with Sir James Dewar and Dr. Oberlander, and saw the weights used. He had made experiments with the hydrogen used by the defendants. He used a furnace heated by gas, and in this was inserted a large silica tube, into which he put a little vessel containing carbonised filaments. Then a current of the defendants' hydrogen was first dried through a calcium tube so as to imitate the conditions as closely as he could, and that was allowed to go through the tube at ordinary temperature for a considerable time to wash the whole tube out with the defendants' hydrogen. Then the apparatus was slowly heated up, and was kept at a very high temperature for about five minutes at about 1,100° or 1,200° C.

In the apparatus as used by the defendants, in your view as the result of experiments, what operation is taking place?—In my view it is a decarbonisation by means of steam and hydrogen. In his view, whether carbide or whether a mixture of tungsten and carbide was used, the action of water was to oxidise the carbon out and leave pure tungsten.

Do you find in any of the earlier literature that has been referred to in this case any disclosure of the invention set out in the plaintiffs' specification 23,899 of 1904?—I find nothing at all. In the hydrogen which was sent to him by the defendants he found '05 per cent. of water. In 20 operations when the water was collected without any heating—viz., without the process of sintering taking place—it was '4 of a gramme. The filaments were glowing, and the process was carried out exactly like that of the defendants. He had tried the process with different metals to see whether or not it would work as it did with tungsten; it did not work with tantalum, titanium, zirconium, thorium, or uranium.

It has been suggested that if you take nitrogen and hydrogen containing no oxygen, and pass them over a tungsten filament, no action will take place?—I have heard that, and it is utterly incomprehensible to me. It is the easiest action.

With regard to the second patent, do you find anything in the literature, which has been referred to in the cross-examination of Dr. Passmore, that would lead you, as a chemist, to use hydrogen and nitrogen free from oxygen or ammonia for the removal of carbon from a tungsten carbon filament?—No.

With regard to the third patent, what is your view with respect to that specification?—It was an inspiration.

From anything that you know of, or any literature that has been referred to in this case, is there anything that would lead you to believe that benefits would result from putting a weight, or that there was the possibility of putting a weight, upon a filament at that stage of its manufacture?—Nothing. It seems a little ridiculous to put a weight on at a period when you would expect the filament to be very much weakened.

As regards the manufacture of fine filaments by plant known at the date of this specification, do you know of any plant at that date by which fine filaments could be made at all without the use of this invention?—I cannot conceive it.

Referring to Just and Hanaman's specification, the German one, 154,262, COUNSEL asked, do you know any way not specified of removing or carrying out the suggested removal of the carbon in the oxychloride process?—I agree with the later publication of Just and Hanaman. You simply have to use steam and hydrogen.

You cannot do it on the instructions in this specification?—No.

Cross-examined by MR. TERRELL, on the specification of Welsbach, No. 1,535, WITNESS agreed that the process there described in the second method was exactly the process described by the plaintiffs in the plaintiffs' specification, except that the metal tungsten was substituted for the metal osmium.

I am talking of making a pure metal filament out of a metal which has the property of not being capable of being drawn, and Welsbach is telling you for the first time how that may be done?—Yes, how to arrive at a filament of metal of the platinum group without drawing it, but by building it up and decarbonising.

Was it known that tungsten was a metal which, in the presence of hydrogen, was not oxidised by steam at considerable temperature?—No.

Was it known that metallic tungsten could be put in an atmosphere of steam and hydrogen at a temperature of 600° to 1,000° and not oxidise?—I say that was not known.

Do you know of any useful filament of any metal which will stand treatment with steam and hydrogen?—I know of only one: that is osmium. The other one, I am told, is absolutely useless, viz., molybdenum. The latter is no good at all, the temperature at melting point is not high enough.

DR. LIEBERMANN further cross-examined by MR. TERRELL: The qualities of tungsten as a metal were well known?—Yes.

It was also known that tungsten carbides were fusible at a lower point than tungsten?—No. I do not know it, and from experiments which I have made, I cannot form any opinion whether it is so.

At the time of Just and Hanaman's German Specification 15,426, it was known that tungsten and molybdenum were particularly suitable as metals for incandescent bodies?—It was not known when it was written, because all the previous attempts had failed.

HIS LORDSHIP: This is an assertion on their part?—Yes, it had not been proved by experiments.

Your contention is that the defendants infringe this patent because they have water vapour in their sintering jar and in the rubber, and in the hydrogen, and it is that water vapour which removes the carbon?—Yes.

MR. TERRELL, dealing with the test of some lamps, said: About 1,080 lamps were made up with phospham and 850 without. The filaments from these lamps were analysed, and the result was as follows: In the baked filaments the carbon contents were '804. In the sintered filaments it had gone down to '164. The sintered filaments were then placed in the lamps, and were run for about an hour in the lamps.

The filaments were then taken out and tested again. In lamps that had had no phospham, the filaments gave an average of '017, and the filaments with phospham gave '019. That is substantially the same thing?—Yes.

That showed the phospham being present did not remove any more carbon than if it were not present, and so far as the carbon is concerned the phospham played no part?—Do you mean to say that this '16 which was in the filaments was without any further treatment reduced in the lamps to '017.

HIS LORDSHIP: Your point is the double process of evacuating lamps and renewing them has resulted in practically the same amount of carbon being removed from each?

MR. TERRELL: That is my point. Therefore in the lamp that contains phospham there is much more likelihood of there being a reaction removing carbon by moisture than in the lamp that does not?—I agree with you, unless the quantity of oxygen is large.

Therefore, if the lamp that contains phospham has a greater tendency to lose carbon by moisture than the lamp that does not contain phospham—if you expect a fair quantity of carbon to be removed by the action of hydrogen and nitrogen, how do you account for the fact that the lamps that do not contain phospham as a matter of fact contain practically the same quantity of carbon at the end as the lamps that do?—If I understand you rightly, you are omitting a fundamental consideration. The lamps that had no phospham added were sealed up, and had been done with. There was no more evacuation or anything else, they were simply then run for an hour. Now, the other one had the phospham application during 30 minutes.

You have said that the gases given off by the phospham would, at the beginning, contain moisture?—There is always moisture in the beginning.

And as the operation proceeded, the percentage of moisture would get less?—After a short time the moisture would have disappeared, because you heat not only from the inside, but also from outside.

Have you taken any steps to ascertain whether, when you get



evolution of cyanogen, the moisture has completely ceased?—Yes I have made experiments which make it absolutely certain that no moisture can be present when cyanogen compounds are formed.

And you say that by using phospham the defendants infringe?—Yes.

I am talking of traces of moisture on the sides of the bell jar of the character of '2 per cent. in the hydrogen and moisture and of the india-rubber. Would that moisture spoil the formation of hydrocyanic acid?—If sufficient to oxidise the carbon it would.

That quantity of moisture is very small?—It depends on the filament. I used a filament containing 10 per cent. of carbon.

Why did you use a filament containing 10 per cent., that is not a commercial filament?—Why not.

I thought that commercial filaments that were made by defendants, and which were the subject of the action, contained '6 to '7 per cent. of carbon, or 8 per cent. when carbonised and '14 when sintered.

MR. ASTBURY: These are only the thin ones which you have obliged us by showing to us up to the present.—WITNESS: You can have any percentage of carbon.

MR. TERRELL: Have you heard of people making filaments nowadays with 10 per cent. of carbon?—I do not know. I have seen them frequently with 5 per cent., and I think that is the ordinary manufacture.

MR. TERRELL, referring to the old process in Specification 19,379 of 1905, read: "It has been proposed to remove this carbon by heating the filament to incandescence by means of the electric current in an atmosphere of steam in the presence of free hydrogen, but this operation fails to remove the carbon in an entirely satisfactory manner. If, moreover, the incandescence filaments be heated in a vacuum or an inert atmosphere to a white heat carbides are produced, which either form the entire material of the filament or render it so impure that its value for lighting purposes is diminished."—I do not agree to that statement at all. All experiments have proved to the contrary.

Proved what?—That you get good filaments and the carbide formation does not interfere with it. I think it is a basis of making a patent. It is put in to establish a basis, so that there would be subject matter in the part following.

So that there may be no doubt about what we are talking about, will you look at Specification 15,510 of 1907, which is alleged as a prior grant, and also bear in mind Specification 19,379 of 1905. We say that this is a prior grant of your specification of the second patent which we are now discussing. It begins "In British Specification No. 23,899, of 1904," that is the first one on which you are suing us—"is described a method of making tungsten and molybdenum filaments for incandescent lamps, which so far as this specification is concerned may be briefly summarised as consisting in first forming a combination of such substances with carbon as a binding medium and then removing the carbon by subjecting the filaments to the passage of an electric current in an atmosphere of steam and hydrogen, so as to oxidise the carbon and leave a metallic filament, and in our prior specification 19,379, of 1905, we have described a limitation as to the proportion of water vapour to hydrogen, which our experiments led us to believe need only be from 1 to 2 per cent. of water vapour," so that there they are distinguishing the first patent from their own first patent by pointing out in our specification 19,379, of 1905, we were only going to use a small quantity of water vapour?—But in the very description they give they do not say it is a limitation, it is steam and hydrogen.

Then he gives a process by which he says, remove all possible traces of moisture and you will still, because your plant must of necessity be inadequate, have traces left, and these traces are enough?—Experiments prove that it is untrue. You can remove all the oxidising substances easily, and you can remove your carbon by means of the formation of hydrocyanic acid.

His LORDSHIP: What you mean is, that you could not form hydrocyanic acid if you had any of the oxidising gases in?—Yes.

(To be continued.)

#### COMPENSATION CLAIM.

A part-heard case in which Wm. Henry Stephens, of Fleetwood, claimed damages under the Compensation Act, from the Blackpool and Fleetwood Tramroad Co., was re-opened before Judge Hamilton, on May 2nd. Applicant, it was stated, was formerly a colour-sergeant and had suffered sunstroke, which brought on epileptic fits. He obtained employment on the Blackpool and Fleetwood Tramroad. Suffering two fits whilst on the cars, he was appointed storekeeper and timekeeper at 28s. per week. On January 11th, 1911, he had a fit and fell into the fire, burning his clothes. Again, on February 8th, he had a fit and fell into the fire, in which the back of his head was burned. A son of Mr. Cameron, the general manager, saw the man in this dangerous position and rescued him. He was between life and death for a considerable period.

For the man, MR. CALLIS commented that they had occupied nearly two whole days hearing discussion as to whether respondents should recompense this man for an accident. A company with capital amounting to hundreds of thousands wasted more money in defending the case than it would have cost to compensate the applicant.

His HONOUR reserved judgment, and said he would probably view the scene of the accident.

#### ELECTRICAL COOKING AT EARL'S COURT.

THROUGH the courtesy of Mr. R. S. Downe, the hon. manager of the Electric Restaurant, which will, we believe, form one of the conspicuous features of the Shakespearian Exhibition which was to be opened at Earl's Court yesterday, we were recently enabled to inspect the very complete installation of cooking apparatus which is to be used there.

The Electric Restaurant—otherwise known as the Queen's Head—is intended for actual catering purposes; in fact, the adjoining Boar's Head Restaurant is also to be supplied from the same cooking installation: and while in Mr. Downe's experience the reliability of the electrical cooking apparatus is not in question at the present time, the practical experience which is gained by all concerned of the behaviour of this plant over the several months' run of the Exhibition will prove a most valuable asset to the electrical fraternity.

Commercial electrical cooking on a considerable scale has, of course, been adopted in several instances in this country with perfectly satisfactory results, but the Queen's Head Restaurant can claim the most extensive array of apparatus for this purpose, being designed to supply 1,000 meals at one sitting.

A complete list of all the large apparatus is as follows:—

##### ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD.

One boarding house cooker	...	...	13	KW.
Two domestic cookers: each	...	...	5½	"
One carving table and hot cupboard	...	...	4	"
One grill	...	...	5	"
One toaster	...	...	6	"
One 6-gal. circular boiler urn	...	...	3	"
One 10-gal. hot water urn	...	...	4	"

##### GENERAL ELECTRIC CO., LTD.

Two domestic cookers: each	...	...	6	"
One grill	...	...	4	"
One brisket boiler	...	...	3½	"
One 3-gal. hot water urn	...	...	2	"

##### MESSRS. T. & J. JACKSON, LTD.

One grill	...	...	6	"
One double cooker, with six boiling rings	...	...	13	"
One special boiler	...	...	4	"
One small domestic cooker	...	...	4½	"

##### MESSRS. PURCELL & NOBBS.

One domestic cooker	...	...	6½	"
One fish and potato frier	...	...	7½	"
One carving table and hot cupboard	...	...	5	"
One egg poacher...	...	...	2½	"

##### MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD.

One domestic cooker	...	...	7	"
One double urn	...	...	26	"
One cafe au lait	...	...	86	"
One coffee and milk urn...	...	...	26	"
One 10-gal. boiler with steamer	...	...	7	"

##### BERTRAM THOMAS.

One No. 1 electric cooker complete	...	...	4	"
------------------------------------	-----	-----	---	---

##### FERRANTI, LTD.

One small oven	...	...	8	"
One duplex boiling plate	...	...	16	"
One single boiling plate	...	...	8	"

The cookers are arranged along one side of the hall with suitable counters, and the two big carving tables, with hot plates, in front; the counters are designed to carry all the still-room apparatus such as grills, hot-water urns, &c.

For drawing off fumes from this part of the building a 12 in. duct is provided, running along the top of the partition behind the range of cookers, in connection with a 3½-H.P. Sturtevant exhaust fan outside the building: the fish and potato frier is provided with a special 15-in. fan for dealing with the usually obnoxious fumes arising from this process.

It may be mentioned that the restaurant has been arranged jointly by the various manufacturers of cooking apparatus mentioned and the Publicity Committee, and that the Brompton and Kensington Electricity Supply Co. is providing the electricity supply.

The Brompton Co. has for 18 years supplied a portion of the Exhibition grounds, and had a 300-kw. sub-station in use, but, for the special purposes of the electrically equipped restaurant, the company has equipped another sub-station, with three 50-kw. Berry transformers, giving a supply of single-phase 83-cycle current at 200 volts pressure.

On the L.T. side, the transformers feed through a L.T. board and two '3 twin cables leading to two 400-ampere D.P. main switches and two 12-way D.P. distribution boards for supplying the various apparatus.

The L.T. sub-station board and distribution boards are fitted with switch fuses, and were supplied by Messrs. Prestwich & Burt, of Kingston-on-Thames.

Each distribution circuit consists of a Martyn twin-wire armoured cable, connected direct to the stove terminals—the stoves being wired complete, and their casings earthed on to the wire armoured of the cable; suitable metering arrangements are provided on the distribution boards. For the apparatus on the counters, Lundberg three-pin switch plugs (one plug being for earthing) are provided.



A semi-circular demonstration table has also been provided on one side of the hall for showing small accessories, such as toasters; switch plugs for connecting the apparatus are provided under the counters and at floor level on either side.

For the lighting of this restaurant, which has been newly decorated, eight 16 in. dished Holophane fittings, each with one 100-C.P. 100-volt lamp, are suspended from the ceiling, while four 100-C.P. 200-volt lamps are provided on the centre fanlight. Over the latter 22-300-C.P. 200-volt lamps in Benjamin reflectors serve for concealed lighting, the glass being partially obscured by coloured gauze.

A certain amount of concealed lighting with Benjamin two-light reflectors has been provided over the cookers as also 100-C.P. lamps in the verandah outside. Messrs. Siemens Bros. Dynamo Works were responsible for the whole of the lighting, their distribution boards being also fitted.

Great credit is due to those concerned in this enterprise, which, whatever its result financially, will undoubtedly prove an object lesson in electrical cookery, and an invaluable means of demonstrating indirectly the many attractive features of the electrical cooking apparatus.

## BUSINESS NOTES.

**Book Notices.**—“*Manual of Electrical Undertakings and Directory of Officials.*” E. Garcke, 1912-1913. Vol. XVI. London: Electrical Press, Ltd. 21s. net.—It is always difficult to find something new to say regarding a fresh edition of a work of this kind. By this time so many of our readers have either purchased or seen the *Manual* that the character of its contents and its general usefulness are well known. The information relating to electrical undertakings and businesses—whether under municipal or company ownership—including financial, commercial and engineering particulars, is very completely given in separate sections, according to their class and to their geographical location—at home or abroad. Many matters of interest are as usual covered under “Progress of the Year,” including the rating of tramways, applications to Parliament for powers, wireless telegraphy, electricity in mines, the I.E.E. new articles, and so forth. There are comparative summaries of the financial results of electric lighting and traction undertakings; electric supply and railway maps have been brought up to date; there is a map of the underground telegraph lines, and a large new map showing the situation of all lighting power and traction undertakings in the United Kingdom. A list of members of the electric lighting and tramway committees, and a directory of 12,000 addresses of officials and others, are among the numerous features of a book which, at this date, requires no recommendation.

“*Journal of the Institution of Electrical Engineers.*” Vol. XLVIII, No. 212. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for March contains the following papers:—Automatic Reversible Battery Boosters, by R. Rankin; Residence Tariffs, by A. H. Seabrook; The Production of Electric Oscillations, by A. S. M. Sørensen; An Automatic Starting Device for Asynchronous Motors, by N. Pensabene-Perez; The Circle Diagram for the Three-phase Induction Machine, by T. F. Wall; Dynamometer Amperemeters and Voltmeters, by J. L. D. Ridsdale; Hysteresis Loss in Iron taken through Unsymmetrical Cycles of Constant Amplitude, by M. Rosenbaum; Losses in Induction Motors arising from Eccentricity of the Rotor, by C. F. Smith and E. M. Johnson; An Indicating Coil for applying the Oscillograph to the Study of of Commutation, by Prof. D. Robertson.

“*Proceedings of the Physical Society of London.*” Vol. XXIV, part 3. April 15th, 1912. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

“*Tables Annuelles de Constantes et Données Numériques de Chimie, de Physique et de Technologie.*” Vol. I, 1910. London: J. & A. Churchill. Price 24s. net.

“*Transactions of the North-East Coast Institution of Engineers and Shipbuilders.*” Vol. XXVIII, part 5. April, 1912. Newcastle-on-Tyne: Andrew Reid & Co., Ltd.

“*The Physical Review.*” Vol. XXXIV, No. 3. March, 1912. Lancaster, Pa.: The Review Office.

“*Bulletin Scientifique de l'Association des Elèves des Ecoles Spéciales.*” January and February, 1912. Liège: Lahaye & Co. Price 75 cents.

“*Transactions of the Illuminating Engineering Society.*” Vol. VII, No. 3. March, 1912. New York: The Society. Price 75 cents.

“*The Development of the Incandescent Electric Lamp.*” By G. Basil Barham, 1912. London: Scott, Greenwood & Son. Price 5s. net.

“*Prüfungen in Elektrischen Zentralen.*” By Dr. E. W. Lehmann-Richter. 1912. Brunswick: Vieweg & Lohr. Price M. 20.

“*Applied Science.*” April, 1912. Toronto: University Engineering Society.

“*Proceedings of the American Society of Civil Engineers.*” Vol. XXXVIII, No. 4. April, 1912. New York: The Society.

“*Science Abstracts.*” Sections A and B. Vol. 15, Part 4. April, 1912. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

“*Irrwege der Naturlehre.*” By Johannes Zacharias. 1912. Hamburg: Hephæstos-Verlag. Price M. 1.

“*Collected Researches of the National Physical Laboratory.*” Vol. VIII. 1912. Teddington: From the Laboratory.

The first number of the “*Donuts*” magazine appeared last month: it is announced as an “aperiodical,” the next issue being due when published. It is an amusing production, emanating from the Donut Society of the B.T.H. Co., Rugby.

We have received from the Central Translations Institute, 16, Eastcheap, E.C., a specimen of their “standard metric equivalent tables comprising weights, measures and prices in francs and marks,” neatly printed on a large card suitable for hanging up. Provision is made for ascertaining practically every equivalent between British and metric weights and measures, and also between sterling prices and the equivalent prices in francs and marks per unit. The prices are worked at the par exchanges of fr. 25·23 to the £, and marks 20·40 to the £ respectively. The price is 1s. 2d. post free.

**Bankruptcy Proceedings.**—C. A. SMITH (trading as C. J. Smith, electrician, 23, King Street, Regent Street, London). The last day for the receipt of proofs for intended dividend is May 22nd. Trustee, E. S. Grey, Official Receiver, Carey Street, W.C.

DAVID ROBERTS, electrical and motor engineer, Derby.—Order made April 2nd, suspending discharge for two years.

**Dissolutions and Liquidations.**—THE BERRY CONSTRUCTION CO., LTD.—With a view to effecting an amalgamation of this company with the British Electric Transformer Co., Ltd., a resolution has been passed for voluntary liquidation. The meeting of creditors of the company provided for by sub-Section of Sec. 188 of the Companies’ (Consolidation) Act, 1908, will be held at the offices of Messrs. Biddle, Thorne, Welsford, & Sidgwick, 22, Aldermanbury, London, E.C., at 11 o’clock on 15th inst. Liquidator, Mr. J. C. Wrist.

PHILLIPS & TURNER, electrical suppliers and hardware merchants, 71, Broad Street, Birmingham.—Messrs. C. F. Phillips & R. S. Turner have dissolved partnership. Debts will be attended to by Mr. R. S. Turner, who will continue to trade in the firm’s name at the same address.

S. THOMAS PEMBERTON & CO., electrical manufacturers’ agents and specialists, 8, Church Street, Colmore Row, Birmingham.—Messrs. S. T. Pemberton & H. W. Clarke have dissolved partnership. Mr. Pemberton will attend to debts, &c., and continue the business under the same style.

POWER PUBLISHING CO., LTD.—This company is winding up voluntarily, with Mr. E. W. Sanger, 6, Bouverie Street, E.C., as liquidator.

TELEPHONE DEVELOPMENT CO., LTD.—A meeting will be held at Telephone House, Victoria Embankment, E.C., on June 6th, to hear an account of the winding up from the liquidator, Mr. M. W. Jenkinson.

**Japan.**—The Belgium Consul at Yokohama gives the names of the following firms in Japan as importers of electric lamps:—Takata & Co., Tokio; Oki & Co., 4 Tamachi 4 chome, Shiba-ku, Tokio; Ypnei Shoten, 12 Ginza Nichome, Kyobashi-ku, Tokio; Dewette & Co., Tokio; Nippon Electric Co., 2 Mita Shikoku-machi, Shiba-ku, Tokio; Andrews & George, 242, Yokohama; Iwai Shoten, 12 Himono-cho, Nihombashi-ku, Tokio; Kitahama, 4 chome Higashi-ku, Osaka.

**Patent Application.**—Application has been made for the restoration of Patent No. 24,411, of 1905, for “Improvements in and relating to the regulation of the supply of liquid fuel to internal combustion motors,” granted to G. Brandstetter.

**Catalogues Wanted.**—MR. J. HODGSON, electrical contractor, P.O. Box 2,614, Johannesburg, wants catalogues of electric cooking, heating, hot water and lighting apparatus, for private residences, together with prices, power consumption, &c.

**Old Dutch Fittings.**—MESSRS. W. J. STOKVIS, of Arnhem, Holland, the well-known manufacturers of the artistic old Dutch style lighting fittings, replicas of the seventeenth century, were last week honoured by an official visit of Her Majesty the Queen of Holland and H.R.H. Prince Henry of the Netherlands at their works. Her Majesty has graciously sanctioned the firm styling themselves “The Royal Metal Works.”

**A New Swiss Aluminium Enterprise.**—The United Aluminium Works Co., of Schaffhausen, is the title of a new company which has been formed, with a share capital of £80,000, for the amalgamation of the firms of Dr. Lauber, Neher & Co., of Schaffhausen, Dr. Lauber, Neher & Co., of Singen, and the Aluminium Co., of Tenningen. All three firms are engaged in the production of aluminium sheets and foil.

**Canada.**—H.M. Trade Commissioner for Canada reports that an engineer of a town in Western Canada desires to obtain catalogues of manufacturers of hand cars, hoists, ice and refrigerating machinery, jacks, lamp-posts, levels, locomotives, manhole covers, water, oil and gas meters, electric motors, paints and metal coverings, penstocks, and perforated metals. The name and address can be obtained at the Board of Trade Commercial Intelligence Department in London.



**The Insurance Bill.**—A proposal is on foot to organise an approved society under the Insurance Act in the British Westinghouse Works, Manchester, in order to administer the benefits of Part I of the Act, and on Friday a meeting of all the employes was held to consider the scheme during the dinner hour. Mr. P. A. Lange, managing director, presided, and said that the company offered every facility for carrying on the society. A resolution was submitted to the meeting to the effect that a works society be formed, and was strongly supported by those present.

A correspondent says the heads of various municipal electricity departments in Manchester, Salford, Bury, Eccles and other parts of south-east Lancashire have recently held conferences with respect to the working of the Insurance Act.

**For Sale.**—The Corporation of Taunton has for disposal sixty 7—10-ampere D.C. Brockie-Pell arc lamps, a number of A.C. flame arc lamps, and a quantity of globes and solid carbons. The Stockton-on-Tees Corporation has for disposal a number of Crompton arc lamps, resistances, cut-outs and accessories. See our advertisement pages to-day.

**Business Tour Through Canada.**—The *Times* states that a party is being organised, to consist of representatives of about 100 leading commercial or manufacturing firms in this country, for an excursion through Canada. The enterprise is a private one, but will be facilitated by the Canadian Government.

**Catalogues and Lists.**—MESSRS. BRUCE PEEBLES AND Co., LTD., Edinburgh.—Pamphlet No. 13B (28 pages) containing particulars of their A.C. generators, in sizes AD 10 to AD 70 inclusive. Full specification information and half-tone illustrations are given, also a number of pages of tabulated details of ratings of standard 50 and 25-cycle machines for a range of speeds of from 1,000 to 125 R.P.M. at pressures of from 200 to 2,200 volts. Rules are published for selecting the correct machine for other periodicities that are not listed, and full lists of approximate weights and dimensions are included, followed by a list of home and foreign users.

MR. C. A. MATTHEWS, 47, Grange Road, Chorlton-cum-Hardy, Manchester.—A number of illustrated descriptive pamphlets, has been received, dealing with the following:—"Ohnesorge" power equalising clutches, "Bomag" belt shifters for cone pulleys, and "Dohmen-Leblanc" friction clutches.

THE LENNOX FOUNDRY Co., LTD., Tantiron Foundry, Glenville Grove, New Cross, London, S.E.—48 pp. catalogue, giving particulars relating to "Tantiron," an acid-resisting alloy, and manufactures made thereof, including nitric acid stills and condensers, pans and vessels for foundry and other service, pumps, pipes, valves, &c., and the Lennox electric blower. The pamphlet is fully illustrated.

MESSRS. WAILES, DOVE, & Co., LTD., Newcastle-on-Tyne.—Twenty-page pamphlet containing a great deal of information respecting their patent "Bitumastic" solution for protecting iron-work, pipe lines, blast furnace plant, steel chimney stacks, tanks, bridges, and so forth.

THE ARMORDUCT MANUFACTURING Co., LTD., Farringdon Avenue, London, E.C.—Leaflet No. C/1149, containing illustration, particulars, and prices of the Premier electric vacuum cleaner, a box-type machine for hotels, public buildings, mansions, &c. The word "Premier" is on every cleaner. The machine case is of polished oak with inlaid rosewood top. Six bellows, actuated by a malleable steel crank running in ball bearings, ensure continuous suction. The dust is drawn into an air-tight steel dust-box, which can be removed when necessary. A metal spiral flexible suction tube, with one carpet mouthpiece and one small mouthpiece for concentrated suction, are supplied with the machine.

MESSRS. FALK, STADELMANN & Co., LTD., 83-87, Farringdon Road, London, E.C.—1912 season list of prices (with illustrations, &c.) of "Antarctic" electric motor fans for C.C. and A.C., for table, wall, and ceiling service.

THE BRITISH ALUMINIUM Co., LTD., 109, Queen Victoria Street, London, E.C.—Four-page leaflet entitled "Aluminium in the Foundry" showing castings for an eight cylinder crank case and radiator parts cast in aluminium. Tabulated information is given relating to B.A. standard casting alloys, and comparing the properties of aluminium, brass, bronze and iron for foundry work.

MESSRS. RUSTON, PROCTOR & Co., LTD., Lincoln.—Four-page leaflet describing the Ruston patent crude oil engine and giving sizes, dimensions, &c., of single and double cylinder engines. One of the illustrations shows three 50-B.H.P. engines direct coupled to dynamos at the Lucknow Medical College, India. A large loose print illustrates a 130-B.H.P. "Ruston" throttle valve suction gas plant.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS Co., LTD., Blomfield Street, London Wall, London, E.C.—12-page "aerial list" containing tabulated prices of aerial cables for use overhead on insulators (bare, single-braided, taped and single-braided, double-braided, and triple-braided). The firm's patent cable suspender is also described and priced, and a table gives particulars of steel suspension wires.

MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, London, W.C.—28-page pamphlet containing illustrated particulars and prices of "Aston" switchgear conforming to Home Office Regulations. The manufactures covered include H.O. knife switches, heavy service switches, double-throw or change-over switches, H.O. handle fuses, "Vim" ironclad switches, fuses, distribution boards, and V.P. circuit breakers. Dimension drawings and particulars of weights are included.

THE BRITISH THOMSON-HOUSTON Co., LTD., 77, Upper Thames Street, London, E.C.—This company has just issued a folder relating

to its "eye-rest" system of indirect lighting. Information is given regarding the different styles, finishes and prices of these fittings, and some photographs are reproduced of existing installations of indirect lighting. "Eye-rest" fittings are supplied with either "carton pierre" or metal bowls, and in a number of different finishes. Inside the bowl are fixed one or more reflectors—according to size of bowl and number of lamps used—and the light is first thrown on to the ceiling and from thence reflected evenly over the room. The reflector used, known as the "X-ray," is made of corrugated silvered mirror.

**Trade Announcements.**—THE BRITISH ELECTRIC TRANSFORMER Co., LTD., 29A, Charing Cross Road, W.C., which has hitherto carried on the manufacture of the "Tricity" cookers for the Berry Construction Co., Ltd., announces that having now purchased the entire business of the latter, including patents, trade marks, &c., it will henceforth carry on the business in its own name.

MESSRS. SCHOLEY & Co., LTD., of 151, Queen Victoria Street, London, E.C., have been appointed sole agents for this country for the Electric Speedometer Co., of Boston, U.S.A.

MR. OLIVER SNOWDEN has commenced business as an electrical engineer, &c., at Regent Street South, off Eldon Street, Barnsley.

THE THOMSON Co., late of 53, Back George Street, Manchester, have removed to very commodious works (Marlborough Works, Marlborough Place, Clifford Street, Oxford Road, Manchester), where they are now turning out large quantities of their speciality, portable electric lamps. A new catalogue can be obtained on application.

THE METALLIC SEAMLESS TUBE Co., LTD., Wiggin Street, Birmingham, have appointed Mr. A. J. Holman as their Newcastle and district manager, and increased stocks of conduits, cables, accessories, &c., will be held at his address at 17, Eldon Square, Newcastle-on-Tyne.

THE SYNCHRONOME ELECTRICAL Co., of New South Wales, LTD., has been registered, with a capital of £5,000, in shares of £1 each. The first directors are Messrs. A. Ward and A. H. Pace. The operations of the company were started about three months ago.—*Australian Mining Standard*.

## LIGHTING and POWER NOTES.

**Accrington.**—The Electricity Committee has given consideration to a scheme for substituting for the present system of lighting the main roads, one using overhead equipment over the roads, with incandescent electric lamps. Automatic switches are to be fixed to the service in each road in order that the entire lighting of the main roads can be controlled from the Superintendent's office. The total cost of the undertaking will be £419 and the total cost of lighting per year £269. The candle-power of the lamps will be increased from 9,780 to 12,100.

An application from Messrs. Highams, Ltd., for a supply of 400,000 to 500,000 units per annum, has been granted on the following terms. The price to be 5d. per unit with a limit of 5 per cent. for lighting purposes, with the usual condition as to fluctuation in the price of coal. Period of supply, 7-10 years.

An application from the Albion Mill Company, for a supply for driving 266 looms (estimated consumption 220,000 units per annum) was granted on similar terms.

**Ashton-under-Lyne.**—The B. of G. has referred back for further consideration the proceedings of a special committee appointed to deal with the question of the electric lighting of the workhouse, etc. The committee recommended the Board to accept the tender of Messrs. Swainson & Co., Booth Street, Manchester, amounting to £653 for carrying out the work.

**Atherton (Lancs.).**—The U.D.C. has decided to reduce the charge for electricity to be used for cinematograph purposes.

**Bath.**—The T.C. is recommended to apply to the L.G.B. for a loan of £3,000 for mains extensions principally in the Westor, Combe Park, and Newbridge Hill districts.

**Bentham (Yorks.)**—A meeting has been held at High Bentham to consider a scheme, estimated to cost £3,000, for supplying electric light and power to High and Low Bentham and Burton-in-Lonsdale. Full particulars of the proposals were laid before those present, and a Committee was appointed to go further into the matter.

**Blackburn.**—The T.C. has sanctioned the carrying out of a scheme prepared by the borough electrical engineer for the extension and improvement of the electric street lighting in the centre of the town and along the tramway routes.

**Burton-on-Trent.**—With reference to the proposed municipal showroom mentioned in the last issue of the ELECTRICAL REVIEW, the Chamber of Trade has passed a resolution opposing the scheme. At the meeting of the Chamber two members of the Gas and Electricity Committee of the T.C. mentioned that it was the intention of the Committee to consult with the traders more immediately concerned before deciding upon any definite line of action.



**Canterbury.**—The T.C. on May 1st received from the Lighting Committee a recommendation not to entertain the offer of the National Electric Construction Co., Ltd., to sell its rights in the free wiring installations in the city for £150, the town clerk having advised that any payment should come from the consumers using the wires, and not from the ratepayers. It was stated that at Canterbury there were now only two consumers using the company's wires, the original number being 22, while the installations cost £323.

**Cheltenham.**—The B. of T. has granted the T.C. a prov. order enabling it to supply current in the parishes of Leckhampton and Prestbury, in the area of the R.D.C., the charges for current to be the same as in the borough. At the L.G.B. inquiry the proposed extension was stoutly opposed by the R.D.C.

**Continental Notes.**—GREECE.—A new company at Athens is the Ionische Elektrizitäts-Gesellschaft K.A. Raftopoulos und Co., with a capital of 112,000 drachm. The company has been formed to supply electrical power.

RUSSIA.—From the report of the Société d'Eclairage Electrique de Saint-Petersbourg, we learn that the mains for private and public electric lighting were extended from 418 to 425 km. during the past financial year. A new steam turbine and alternator of 6,700 H.P. were put down at the generating station, the capacity of which is now 21,500 H.P.

The question of the electric lighting of the town is at present being considered by the municipal authorities of Rjasan.

SPAIN.—La Sociedad Electra de Velin has acquired the concession to utilise the water power of the river Bupal at Bibale in the generation of electrical energy for lighting and power purposes.

FRANCE.—A concession has lately been secured by La Compagnie Départementale d'Energie Electrique for the electric lighting of the town of Coulonges-sur-l'Autroc (Deux-Sevres).

**Creswell (Derbyshire).**—Arrangements are being made by the directors of the Bolsover Colliery Co. to install fresh plant at the Creswell Colliery to supply every house in the village with electric light at 3½d. per unit. The scheme has been approved by a Committee of the Parish Council, and the parishioners are to be called together to give their assent.

**Croydon.**—In reference to the agreement entered into with the County of London Electric Supply Co., Ltd., for the supply of energy in bulk, the Lighting Committee has recommended that the terms of payment by the company to the Corporation shall be as follows: A sum of £1 5s. per quarter per kw. of maximum supply demanded. The actual maximum demand supplied under the agreement shall be ascertained by the average readings of two "Merz" or other agreed demand indicators, which shall be provided and fixed by the Corporation. These instruments shall be calibrated to record maximum demands extending over a period of 15 minutes each. If the readings of the two instruments vary more than 3 per cent., the instruments shall be tested and re-calibrated by the inspector, as provided for by the agreement. An additional charge of ¾d. per unit is to be made for all units supplied as measured by meters under the conditions set out in the agreement, and the Corporation will allow the company discounts upon the prices at the following rates: For electrical energy supplied when the amount of the account lies between £100 and £250, 5 per cent.; £250 and £500, 7½ per cent.; £500 and £750, 10 per cent.; £750 and £1,000, 15 per cent.; £1,000 and £1,500, 20 per cent.; £1,500 and upwards, 25 per cent. The average price actually charged under the agreement is not to exceed 2½d. per unit.

**Dartford.**—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £10,000 for new plant at the electricity works. As it was not intended to provide a new boiler for some time, the amount of the loan was reduced by the Inspector to £8,685. There was no opposition.

**Eastbourne.**—The Electricity Committee has decided to install coal conveyors, elevators, &c., at the electricity works, at an estimated cost of £1,181.

**Glasgow.**—The T.C. purposes promoting a second Smoke Abatement Exhibition in the city from September 20th to October 12th next. Nearly all the available space in the large building engaged has already been taken up. A special feature of the show will be the combined exhibit of the T.C.'s Electricity Department and the Electrical Allied and Trades Manufacturers' Associations, which will take the form of an electrical luncheon and tea room, including a kitchen. A joint meeting will take place in London in a few days to decide the design of the exhibit and other details. All the latest electrical appliances are to be shown, and the object will be to show the uses which can be made of electrical energy for domestic and other purposes. The expectation is that, on the invitation of the T.C., representatives of many public bodies throughout Great Britain will visit the Exhibition.

**Hastings.**—At a meeting of the B. of G. the first quarterly accounts for the electric light (recently installed in the whole of the workhouse buildings) were passed. For the period covered—January 4th to April 13th—the saving (comparing the accounts with those for gas in the corresponding period) amounted to £33. Naturally, general satisfaction was expressed.

**Holmfirth.**—The B. of T. has sanctioned the application of the U.D.C. for a prov. order for the electric lighting of the district.

**London.**—At the fortnightly sitting of the Metropolitan Asylums Board, it was reported that the Charing Cross Electricity

Supply Co. had given formal notice of its intention to determine at the end of June its existing contract for the supply to the head office of electricity for power and lighting. The company was, however, prepared to enter into a fresh agreement with the managers for the supply of electricity at 3½d. per B.T.U. for lighting and 1½d. per B.T.U. for power and heating, as against 3d. and 1d. under the agreement with the Board dated September 29th, 1904. The engineer-in-chief reported that the reasons assigned by the representative of the Charing Cross Co. for the increase in the rates are the increased cost of coal and other materials, and the obligations of the company under the Insurance Act; and advised that the revised terms be accepted, and that two separate meters be fixed for existing radiators. This was agreed to.

MARYLEBONE.—At a meeting of the B.C. on May 2nd, the report of the Electric Supply Committee which, as noted in our issue of April 26th, was not reached at the previous Council meeting, was discussed. The report recommended that the Council should continue the sales department on existing lines, subject to certain modifications set forth. The modification related to the method of sub-contracting, the Council agreeing to a tentative proposal that, instead of all the work being placed with one contractor, the borough be divided into districts which were to be allotted between eight contractors, or if there were more than eight contractors, the larger districts to be further divided. Col. Hopkins, chairman of the Committee, in moving the adoption of the report, amplified the information set out. He made a special point of the fact that, while various complaints as to the conduct of the department were said to exist, only one such complaint had been brought before the committee by the Electrical Contractors' Association, despite repeated invitations to bring proofs, and that one specific case had been proved to be fallacious. He further spoke of the proposal by the contractors that all wiring work be thrown open to be competed for by all the contractors in the borough. One could easily understand, remarked the Colonel, that if there were a small job of wiring, say, £3 or £4, that it would be futile offering that to all the contractors. On the face of it, it was impossible. The contractors, he said in conclusion, practically asked the Council to close the sales department down, but that it declined to do. Mr. Oswald Lewis moved, as an amendment, that they determine "to continue the department for the present," &c. There were two questions before the Council, he said, one whether they should have a department or not; the other whether, if they had a sales department, they should conduct it on existing lines or not. He wished to keep to the former question, and he would like them to divide on the point, so that the electors would be able to see who voted for the continuance or the cessation of a sales department. In answer to the chairman of the Committee, he urged that if only one complaint was brought forward, that was because the Contractors' Association had been told that specific complaints were not to be dealt with, the only question being one of general policy. Personally he had brought before the Council complaints which had never been satisfactorily answered. Mr. Duncan Watson seconded the amendment. Mr. Garrold, in taking the part of the Committee, said they must all come to the conclusion that the Electrical Contractors' Association had been unreasonable throughout. The suggestion that the department had cut prices was untrue, as was shown by the fact that it was able to make a gross profit of 40 per cent. Mr. O'Brien appealed for the continuance of the sales department. What business man, he asked, having found one department was essential to make the whole of his business successful, would at once proceed to shut down that department? Mr. H. J. Halsdon urged that the continuance of the sales department was detrimental not only to the contractors but also to the ratepayers. Mr. W. Dennis suggested for the consideration of the department the cessation of the practice of selling lamps. It could not be said that the sale of these lamps assisted or increased the sales of current by a single unit. Col. Hopkins, in his reply, despaired of ever satisfying Mr. Lewis if the explanations he (the speaker) had given from time to time had not met with his approval. He denied that the Contractors' Association was told that complaints would not be dealt with at the interview between the Committee and the Associations' representatives. As for the sale of lamps, he could assure Mr. Dennis that, while they were not anxious to carry on that business, and did not encourage it, there were good reasons why the practice should be continued. Indirectly, it encouraged the use of the current, for people once obtaining the metallic-filament lamps from the department were so satisfied that they were encouraged to use the current. The amendment being put, was lost. A further amendment by Col. Maud asked for a statement by outside accountants showing the position of the undertaking in 1909, the cost of the establishment and annual cost of the sales department, and how much profit might be credited to the sales department? This information, he said, would give them all a clearer view of the case for and against. Mr. M. Morris seconded. Mr. Russell ridiculed the idea, and went on to urge that it was too late in the day to "dilly-dally with the matter." The amendment being lost, another was put by Mr. Ince referring the matter back, but the Council being anxious to deal with the report that night, no seconder was forthcoming. The motion of the Committee, as set forth in its report, was then put and carried. At the time of the voting there was not half the members present, the attendance at the commencement being further depleted by various defections as the proceedings dragged to a close.

The Electric Supply Committee has reduced its tariff for outside illumination of shops from £8 per kw. and 1d. per unit, to £5 per kw. and 1d. per unit. The Committee has also decided to make a grant of £50 towards the expenses of the Smoke Abatement Exhibition. It has been informed that this exhibition has been of exceptional value to the department, many orders having been obtained.



**Lytham.**—The B. of T. has informed the U.D.C. of its decision to revoke forthwith the Lytham Electric Lighting Order, 1907, and, in reply, the Clerk to the Council has informed the B. of T. that that authority has under consideration the advisability of itself applying for an electric lighting order in December next.

A section of the Lytham residents has petitioned the St. Anne's U.D.C. to supply electric light, owing to the failure to secure a supply in the Lytham area, and in reply to an inquiry from the St. Anne's Council as to the Lytham Council's intentions, the Clerk has written informing it what is proposed to be done.

**Newcastle-on-Tyne.**—The Newcastle Electric Supply Co. has applied to the B. of T. for consent to the use of E.H.T. overhead transmissions for supplying current at a pressure of 20,000 volts. Three lines are proposed, one from Hartford to Dudley Colliery; another from Weetslade Colliery to Hazlerigg Colliery and Burn Pit; and a third from Dinnington Colliery to Dudley Village.

**Newport.**—The T.C. proposes erecting a new power station in Corporation Road, the plans of which have just been adopted by Electricity and Tramways Committee. The work will be taken in hand without delay.

**Nottingham.**—Much interest has been excited in the East Midlands by a proposal to harness the Trent for the production of electricity, which was discussed by the City Council on Monday. The project came before the Council in the form of a resolution moved by Councillor Albert Ball: "That the Electricity Committee be instructed to consider and report to the Council the possibilities and prospects of obtaining powers to harness Colwick and Beeston Weirs with a view to generating electric current to supply the city and district, and to ascertain from experts the power which could be relied upon at low water." The Trent skirts the southern limits of Nottingham, and Beeston Weir is situated about three miles west and Colwick Weir two miles east of the city.

The resolution met with a somewhat cool reception, although after discussion, in which members of the Council appeared to be reluctant to commit themselves to a definite expression of opinion one way or the other, the resolution was adopted, Mr. Ball accepting the suggestion that the Committee should take the advice of the Council's own officials. Alderman Sir John Turney, chairman of the Electricity Committee, in seconding the resolution, said he thought it was a tall order, and he stipulated that they should have Mr. Ball on the Committee to help them, so that it would not be a one-sided inquiry. Councillor Hobson pointed out that the Beeston U.D.C. had inquired into the possibilities of harnessing Beeston Weir for electricity purposes, and he had no doubt they would be pleased to hand over all the expert advice they obtained. He thought Mr. Ball would be astonished when he got to the bottom of the question.

Commenting on Mr. Ball's scheme, the *Nottingham Guardian* says: "There is no doubt what expert advice will be about the production of electricity from the Trent. This was shown some years ago by correspondence in our columns. Expert advice then was that the proposal was impossible, and it will be so again . . ."

**Nuneaton.**—The T.C. has received from the L.G.B. sanction to a loan of £7,500, for extensions at the electricity works.

**Shipley.**—The U.D.C. has instructed the engineer to prepare a scheme for improved street lighting by electricity.

**Skelton and Brotton.**—At a meeting of the U.D.C. on Friday, a motion was made to rescind the resolution recently passed accepting the tender of Graham Bros., of Middlesbrough, for the lighting of the whole of the district by electricity. The mover contended that it would be illegal to distribute electricity without an Act of Parliament or a B. of T. Order. The voting was even, and the chairman declined to give a casting vote. Notice was then given to again move the rescission of the resolution at the next meeting of the Council.

**Southend-on-Sea.**—The assessment of the electricity undertaking of the T.C. has been increased from £2,364 to £6,250.

**Stoke-on-Trent.**—The T.C. has decided to supply current for domestic cooking and heating, where premises are lit throughout by electricity, at 1d. per unit.

**Tadcaster.**—On the recommendation of the Housing Committee, the R.D.C. has decided to have the workhouse lighted by electricity.

**Tripoli.**—A company has been formed for the electric lighting of Tripoli. It is the Compagnie pour l'Eclairage de Tripolis, Soc. Anonyme. Head office, Athens; capital 1,000,000 drachm.

**Tunbridge Wells.**—The T.C. has decided to reduce the price of current for heating, cooking, and motive power from 2½d. per unit to 1½d.

**Wakefield.**—The Tradesmen's Association, after considering a proposal to establish in the city a municipal showroom for electrical fittings, &c., has passed a resolution protesting against this extension of municipal retail trading, on the grounds that "the selling of electric lamps, fittings, accessories, &c., being of essentially a speculative character, is more economically and efficiently carried out by private firms than by Municipal Corporations, and that the granting of such a monopoly would result in the extinction of competition, to the detriment of the consumers and ratepayers generally."

**Workshop.**—The U.D.C. has applied to the B. of T. for consent to utilise overhead lines in various parts of the town for the transmission of current at a pressure of 220 volts.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—The Corporation on the 2nd inst. decided to start a system of profit sharing in connection with the tramways. It was stated that all employes would participate, and that the distribution this year would be equal to about £4 per head.

**Birkenhead.**—A long debate took place at the T.C. meeting, on May 1st, upon the Tramway Committee's recommendation that application be made to the B. of T. for sanction to borrow £4,404 for the purchase of six double-bogie cars, with a seating capacity of 80 passengers, from Messrs. Siemens Bros. Dynamo Works, Ltd. An amendment was submitted that the recommendation be referred back, it being contended that the New Ferry route, catering for the Port Sunlight district, required lighter cars than those for which the tender had originally been accepted.

It was also urged that the Committee had done nothing to comply with the Council's request that it should try and reduce the weight of the cars. The amendment, which was in the nature of an instruction to the Committee to adopt the smaller and lighter type of car, was carried by 19 votes to 9.

**Brazil.**—The Office of Public Works in Pernambuco, Brazil, is leasing a concession for the construction and exploitation of an electric tramway system for the town of Recife and its suburbs.

**Canada.**—The Canadian Northern Railway is experimenting with a gasoline-electric car of United States manufacture, propelled by power generated by a 200-H.P. gas engine carried above the front truck, with a view to the adoption of this type of car on its local lines. The engine is started by compressed air, and drives a generator which provides electric power for two motors working on the front truck. The gasoline tanks have a capacity of 100 gallons, which is sufficient for a run of about 200 miles. The car is equipped with electric light and a plant for compressing air for the starting and the brakes. The car is about 60 ft. long and about the same weight as an ordinary railway coach; it seats about 75 passengers.—*Board of Trade Journal*.

At a recent meeting of the Brandon Municipal Council, a draft contract was signed for the construction of an electric tramway in that town. Should the approval of the ratepayers be obtained, it is expected that at least 5 miles of tramway will be in service by the end of the year.

**Carshalton.**—On May 1st the South Metropolitan Co. abolished the "fair fare" system on its Sutton and Tooting tramway routes, by which farthings were charged for some of the stages, and gave notice of the fact to the local authorities. The Carshalton U.D.C., at its last meeting, expressed disapproval of the new system of fares, which has resulted, in some cases, in an increase, and has notified the B. of T. of its action. A suggestion was made that the cars should be boycotted, and attention was called to the company's agreement with the Council in 1906, which provided for the approval of any alterations by the Council, and, failing such approval, that the alterations be submitted to the B. of T.

**Continental Notes.**—**TURKEY.**—According to the Belgian Legation at Constantinople, the Ottoman Government has called for tenders for the construction and working of a system of city and suburban electric tramways in the Asiatic part of Constantinople. Tenders must be submitted before June 15th.

**ROUMANIA.**—The Galatz Chamber of Commerce has petitioned the Ministry of Trade and Industry at Bukarest to construct an electric tramway to link up the towns of Galatz and Braila. This project would involve the drainage of a considerable area of the marshes alongside the Danube and the construction of a dam. However, although the expense of such an undertaking would be large, there would be, in addition to the convenience of the tramway connection, a considerable surface of reclaimed land which could be used for agricultural purposes.

**BELGIUM.**—Of the total of 2,450 miles of local railways now being worked by the Société Nationale des Chemins de Fer Vicinaux, 225 miles are operated electrically. Plans are in hand for the conversion of another section to electric traction.

**RUSSIA.**—La Société des Tramways et Entreprises Electriques de la Banlieue de Saint Petersburg is the name of a company which has lately been formed in Antwerp with a capital of £400,000.

**FRANCE.**—Plans are being prepared for the electrification of the Luchon-Montrejean section of the Midi Railway of France.

A scheme for the construction of an electric tramway in the town of Valence St. Peray (Drome) is at present under consideration.

**Darwen.**—At the T.C. on Tuesday last, Ald. Tomlinson stated that for the first time a net profit had been made on the tramways. On the main section there was a profit of £691, and on the Hoddesden section a loss of £19, leaving a net profit of £271.



**Eccles.**—The Salford Corporation having applied for a revision of the rates and charges for the supply of electrical energy for the tramways, the borough electrical engineer has been instructed to prepare a statement of the cost of supply for traction purposes.

**Glasgow.**—The T.C.'s Tramways Committee, which at an earlier meeting decided, after considering a report by Mr. Dalrymple, the general manager, not to entertain the proposal to run a service of all-night cars, or a service from midnight till 3 a.m., has, on a remit back, reaffirmed its former decision.

The Tramways Committee of the T.C. has had under consideration a recommendation of the Cowlaids Ward Committee to the effect that the time has arrived when all members of the T.C. should have the privilege of free passes on the tramway system. On a division between a proposal that the letter lie on the table and an amendment that the sub-Committee on Finance should report on the communication, the latter was carried by 9 votes to 4.

**New Zealand.**—The electrical engineer to the Government has submitted his plan for the replacing of steam by electric traction on the railway between Christchurch and Lyttleton. He estimates the cost of the electrical equipment—including locomotives, sub-station equipment, line equipment, and motor-car and trucks—at £100,000. The present carriages would remain in use. The line and sidings would be equipped with overhead wires, the track rails being utilised for the return portion of the circuit.

**Quarry Bank.**—The Quarry Bank, Brierley Hill and Rowley Regis U.D.C.'s have been granted an order by the Light Railway Commissioners transferring their powers under the Order for 1903 to a company.

**Sheffield.**—It has been decided to renew the tramway track in portions of Church Street, Western Bank, London Road, and Spital Hill. The present single line in a portion of Fulwood Road is to be doubled. The town clerk has been instructed to endeavour to obtain consents for the doubling of the tramway track on the Nether Green section.

**Southend-on-Sea.**—The Assessment Committee of the Rochford Union has increased the assessment for the Southend tramways from £1,619 to £3,170.

**Stockport.**—Owing to opposition on the part of the Hazel Grove U.D.C., the T.C. has decided not to extend the proposed railless car service outside the borough. The original proposal was to run as far as Marple.

## TELEGRAPH and TELEPHONE NOTES.

**Cables and the Spanish-American War.**—Answering a question in Parliament, Mr. Acland said that only two claims arising out of the telegraph cables cut in the West Indies were preferred against the United States Government as the result of the Spanish-American War. One was by the Cuba Submarine Telegraph Company and the other by the French Cable Company. That of the Cuba Submarine Telegraph Company was presented in November, 1899, but no compensation had yet been paid. It would shortly be referred to arbitration under the Pecuniary Claims agreement with the United States.

**New Zealand.**—The *Australian Mining Standard* reports that the Postmaster-General has prohibited the erection of private wireless stations in the Dominion, with the exception of four owned by officers of the department, for which permits have been granted, and no further permits will be issued.

**Peru.**—The Government is about to establish a wireless telegraph station on the San Cristobal Hill above Lima, in order that that city may be put in communication with Iquitos. The distance between the two places is very considerable, but it is hoped to overcome all difficulties in this direction without having a relay station.

**Radio-Telegraphic Convention.**—The Greek and Egyptian Governments have intimated their adhesion to the Convention.

**Trans-Atlantic Wireless Telegraph Service.**—The Postmaster-General, on application from the Marconi Co., made arrangements to accept from the public, on and from May 1st, at all telegraph offices in the United Kingdom, telegrams addressed to places in Canada and the United States, for transmission by the company's wireless trans-Atlantic service. The full rate for telegrams to New York or Montreal is 8d. a word, the rate for cablegrams being 1s. a word, and there is a similar reduction in the full rates for telegrams for other parts of America. For deferred telegrams in plain language the rate to New York is 4d. a word, the cablegram rate being 6d., and there are corresponding reductions for other places.

**The Telephone Service.**—The Postmaster-General last week stated that provision was being made for the expenditure of about £2,600,000 in the extension of the trunk and local systems during the present financial year, and that new telephones were being provided in London alone at the rate of between 500 and 600 a week.

**Turkey.**—The Government has decided to prohibit the use of wireless telegraphy by ships in the port of Constantinople.

**Wireless Telegraphy at Sea.**—In reply to a question in the House of Commons, Mr. H. Samuel stated that all wireless telegraph installations on board British ships were capable of being used for inter-communication with other systems, and they were worked in accordance with licences issued by the Post Office. The Radio-Telegraph Convention did not provide for the compulsory interchange of messages between ships for other than distress purposes; and the Marconi Co. declined to inter-communicate, except in cases of distress, with ships fitted with other systems unless the matter had been arranged by agreement. He was not aware that other systems were similarly hampered.

The Allan Royal Mail Line has arranged with the Marconi Co. to carry two wireless operators in every ship of the Allan fleet.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Ashton-in-Makerfield.**—May 14th. U.D.C. Centrifugal pumps and motors, cables, switchboards, wiring and accessories. See this column in our last issue.

**Australia.**—VICTORIA.—June 4th. 1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" April 26th.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9½ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—Apply to High Commissioner in London for Australian Commonwealth.

June 18th.—50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

NEW SOUTH WALES.—July 31st. For Newtown, Sydney, an automatic or semi-automatic switchboard and equipment (Schedule No. 154); also 20 sections of a common-battery switchboard and equipment (Schedule No. 131). For Balmain, Sydney, 14 sections of a common-battery switchboard and equipment (Schedule No. 122); an automatic or semi-automatic switchboard and equipment (Schedule No. 151). For Glebe, Sydney, automatic or semi-automatic switchboard with associated apparatus (Schedule No. 153).—*Australian Mining Standard*.

WESTERN AUSTRALIA.—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" to-day.

**Belgium.**—May 25th. The municipal authorities of Ghent are inviting tenders for four steam boilers, with economisers, at the central electric lighting station.

**Birkenhead.**—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" April 26th.

**Bohemia.**—SMICHOW.—May 22nd. Tenders are invited for the supply of a steam turbine and two dynamos. Particulars of the Canzlei. No. 10A des Stadtischen Rathhaus, Smichow.

**Constantinople.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Edinburgh.**—May 11th. Coal for the Electricity Supply Department for three or twelve months. Engineer's office, Dewar Place. Deposit 10s.

**France.**—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

**Germany.**—May 15th. The Prussian State Railway authorities at Halle-am-Saale are inviting tenders for a 25-ton electrically-operated travelling crane.

**Glasgow.**—May 10th. Sub-station switchgear, for the Corporation Electricity Department. See "Official Notices" April 26th.



**May 20th.**—The Tramways Committee invites tenders for the following works required in connection with a 5,000-kw. turbo-alternator to be installed at Pinkston power station:—Iron and steel works for turbine foundation, engine-room floor, &c., and steam and water piping and valves. Mr. J. Dalrymple, general manager, 45, Bath Street.

**Gloucester.**—Forty-five street-lighting lanterns for high candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

**Grimsby.**—May 16th. Continuous-current motor-generator with switchboard panel, and an automatic reversible booster with switchgear, for the Corporation. See "Official Notices" April 26th.

**Halifax.**—May 13th. One 360-tube fuel economiser, for the Corporation Tramways and Electricity Committee. See "Official Notices" May 3rd.

**Huddersfield.**—May 20th. 1,000 single-phase meters, for the Corporation. See "Official Notices" May 3rd.

**Italy.**—ROME.—Tenders are invited for the supply and erection, at the new offices of the Ministry of Agriculture, of one elegant passenger-lift to carry four persons, fitted with two doors; two lifts to carry six persons each; a goods lift to carry 1,000 kg.; two goods lifts to carry 50 kg. each; and one lift to carry 50 kg., with electric working equipment.

**Kimberworth.**—May 16th. Electrical wiring at the Smallpox hospital, for Rotherham T.C. Borough Engineer.

**Leicester.**—May 17th. One 750-kw. single-phase motor-alternator, for the Corporation Tramways and Electricity Department. See "Official Notices" May 3rd.

**Leigh.**—May 13th. Telephone installation at the Union Workhouse, for the B. of G. See "Official Notices" May 3rd.

**London.**—May 14th. Steam coal for the Central London Railway Co.'s power house at Shepherd's Bush for six, nine or twelve months. Secretary, Oxford Circus Station, W.

June 3rd.—Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" to-day.

**BATTERSEA.**—May 15th. Two 30-in. electrically-driven reversible ventilating fans, with controlling and reversing switches, for the B.C. See "Official Notices" to-day.

**HAMMERSMITH.**—May 15th. Steam traps and recording voltmeters, for the B.C. See "Official Notices" to-day.

**Manchester.**—May 14th. Corporation Tramways Department:—Rail bonds, trolley wire, poles, &c. Mr. J. M. McElroy, general manager.

May 15th.—High-pressure steam pipes and supports for Stuart Street generating station, for the City Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street.

**Newcastle-on-Tyne.**—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" April 26th.

**New Zealand.**—July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Nuneaton.**—May 14th. Main switchboard, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Rochdale.**—May 22nd. Contract A 57.—Overhead line for the supply of electricity to Roch Mills sewage disposal works. Contract B 58.—Paper-insulated lead-covered, and also lead-covered and armoured cable. Specifications, &c., from Mr. C. C. Atchison, borough electrical engineer.

**Rotherham.**—May 18th. Two automatically-controlled electrically-driven motor and pump sets. Borough Engineer.

**Salford.**—May 11th. The Corporation Electricity Department is inviting tenders for a 10-ton travelling crane. Specifications, &c., from the Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

**Spain.**—May 17th. The municipal authorities of Puebla de Alcocer (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

**Uruguay.**—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

**West Ham.**—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

## CLOSED.

**Australia.**—The *Australian Mining Standard* announces the placing of the following contracts:—

Frankton Junction (N.Z.) Town Board:—

Suction gas plant, d.c. dynamos, balancer, booster sets, &c., at rates.—Brush Electrical Engineering Co.

Napier (N.Z.) Borough Council:—

Rolling stock.—Brush Electrical Engineering Co.

P.M.G.'s Department, Melbourne:—

3 miles lead-covered, paper-insulated telegraph cable, 12 conductors, 50 lb. per mile, at £207 per mile, £621.—W. T. Henley's Telegraph Works Co., Ltd.

117 tons galvanised iron wire, 200 lb. per mile, at £11 18s. 9d. per ton, 81 tons galvanised iron wire, 400 lb. per mile, at £11 8s. 9d. per ton, £2,323.—R. Johnson, Clapham & Morris, Ltd.

Two combined Gardner oil engine and generator sets, at £283 10s. each, £567.—Noyes Bros. (Melbourne) Pty., Ltd.

Large quantities of steel spindles have been ordered from Messrs. Williams and Co., Brunswick.

**Bexhill-on-Sea.**—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for an electric commutator grinder, at £35.

**Bootle.**—In connection with the new generating station, Messrs. Joshua Henshaw & Sons, of Liverpool, have received a contract for the construction of the boiler house, engine house, weigh office and elevated roadway, at £8,399; and the tender of Messrs. Dryland & Preston, Ltd., of Littleborough, at £1,500, for the erection of the chimney shaft, has been accepted.

Amended tenders from the B.T.-H. Co., Ltd., and Messrs. A. Reyrolle & Co., Ltd., for switchgear at the new works, have been considered, and the Corporation has accepted that of Messrs. Reyrolle for high and low-tension switchgear, at £1,867. The Council has rescinded its former provisional resolution, of April 3rd, accepting the tender of the B.T.-H. Co. for low-tension switchgear, and of Messrs. Reyrolle for high-tension switchgear.

**Bristol.**—In connection with the proposed conversion of Southmead Workhouse into an infirmary the following contracts have been recommended:—

Electric generating plant.—The Electric Construction Co., Ltd., £1,432.

Electric fittings and wiring.—Messrs. Hancock & Rixon, £897.

**Burnley.**—The Corporation has accepted the tender of the British Insulated and Helsby Cables, Ltd., to supply the overhead wire required in renewing two overhead sections of the tramways, for £536. The Electricity Department has renewed the contract for 10 years with the Tudor Accumulator Co., Ltd., for the maintenance of the traction battery; the company are also to supply 28 cells for £189. Other tenders accepted are those of the British Thomson-Houston Co., Ltd., to supply electric motors and spare parts, and of Messrs. Ferranti, Ltd., to supply starters required during the next 12 months.

**Burton-on-Trent.**—The T.C. has accepted the tender of Messrs. Marriott & Co. for coal slack for the electricity works for a year.

The T.C. has accepted the tender of Messrs. R. Kershaw & Sons, at £1,345, for the erection of offices in connection with the electricity works extension.

**Cannock.**—The U.D.C. has accepted the tender of Messrs. Bumsted & Chandler, of Hednesford, for an engine and electric fittings for the new Technical Institute, at £235.

**Dundee.**—The following tenders have been recommended for acceptance by the T.C. Electricity Committee in connection with the new electric substation:—

Demolition and foundations.—The Yorkshire Hennebique Co.

Steel work.—Thos. Russell, Dundee.

Crane.—John Smith, Ltd., Keighley.

Converting machinery.—British Westinghouse Co., Ltd.

Switchgear.—The British Westinghouse Co. and the British Thomson-Houston Co., Ltd.

The erection and equipment and the general extension of the electrical system will cost over £6,500.

**Glasgow.**—The T.C.'s Tramways Committee recommend acceptance of the offer of Hadfield's Steel Foundry Co., Ltd., for spare points.

For the Whitevale depot extension the following are included in the tenders accepted:—

Cable.—British Insulated and Helsby Cables, Ltd.

Special work.—Lorain Steel Co.

**Hull.**—With reference to the paragraph in our last issue, the contract for an overhead crane for the Sculcoates works has been placed with Messrs. S. H. Heywood & Co., Ltd., of Reddish, not Messrs. S. Heywood & Co.

**Leyton.**—The U.D.C. has received the following tenders for the supply of two miles of 2 sq. in. distributor cable:—

R. R. Todd	..	..	..	..	(accepted)	£590
Standard Cable Co., Ltd.	..	..	..	..	..	604
Henley's Telegraph Works	..	..	..	..	..	667
Aubert Grenier & Co.	..	..	..	..	..	670
Johnson & Phillips	..	..	..	..	..	670
Brit. Insulated & Helsby Cables, Ltd. (not to specification)	..	..	..	..	..	670
St. Helens Cable Co., Ltd.	..	..	..	..	..	670
Union Cable Co., Ltd.	..	..	..	..	..	685
Electrical Engineering and Equipment Co., Ltd.	..	..	..	..	..	690
Siemens Bros. & Co., Ltd.	..	..	..	..	(not to specification)	701
General Electric Co.	..	..	..	..	..	770



**Liverpool.**—The Corporation has accepted the tender of the United Electric Car Co., Ltd., of Preston, for one double-deck single-truck car, with two staircases, segmental in form, set "reversed" at each end of the car, and one centre entrance double-deck bogie-car. These are cars of new design, the outcome of the attention given by Mr. C. W. Mallins (general manager) to the problem of simplifying the access facilities of tramcars. Both types have a special provision to prevent the inconvenience arising from persons attempting to board cars before the outgoing passengers have left. They will be equipped with the Liverpool standard braking arrangement, and also the apparatus, consisting of a balanced or spring-controlled signal arm, operated by two electromagnets energised by coils and controlled for three different positions, which gives, independent of the conductor, a definite signal to passengers on the boarding platform that the car is about to start. The Corporation has also, on the recommendation of the Tramways Committee, accepted the tender of Messrs. W. A. Stevens, Ltd., of Westminster, for two 10-H.P. "Tilling-Stevens" petrol-electric motor omnibuses, complete with tires and double-deck bodies, to seat 34 passengers each. These are to be used on one of the suburban services.

**London.**—**SHOREDITCH.**—The B.C. Lighting Committee has accepted the offer of the Electric Construction Co., Ltd., at £690, for re-winding two 100-K.W. transformers, to make them capable of being used as reducers on the new three-wire supply, and providing new commutators and brushgear. The borough electrical engineer will carry out the alteration to the field coils.

**BATTERSEA.**—The offer of Messrs. Babcock & Wilcox, Ltd., at £645, has been accepted by the B.C. for five superheaters for boilers at the generating station.

**MARYLEBONE.**—The B.C. has accepted the tenders of Mr. R. R. Todd and the Standard Cable Co. for annual supplies of underground cables.

The Titan Lift Co., Ltd., has successfully tendered to the Metropolitan Asylums Board for the installation of two electrically-controlled lifts at the Tooting Bec Asylum, for £420. Twelve tenders were received, the prices ranging from that accepted to £840.

**BERMONDSEY.**—At a Council meeting on Tuesday, the Electricity and Street Lighting Committee recommended that the tender of Pirelli, Ltd., be accepted for lead-covered cable, at between £200 and £300. Mr. F. Franken proposed the acceptance of the tender of the Western Electric Co., Ltd., of Woolwich, subject to an undertaking that the cable was manufactured in this country. He said that the cable of Messrs. Pirelli was made in Milan, and the reason for their low tender, which was £70 below that of the Western Electric Co., Ltd., was that the wages paid by the Italian firm were only £1 a week as against 35s. paid in this country. Mr. A. Clarke seconded. Mr. W. Pridmore held that to throw away £69 on a tender of this kind was what no business man would tolerate for a single moment. All the tenders of the English firms were over 30 per cent. higher than those of Messrs. Pirelli, and he was informed that the reason for this was that English companies were members of an association to keep up prices. No other reason had been assigned for their high prices, and it was the duty of the Council to break up these associations of manufacturers. The Council decided to accept the tender of the Western Electric Co., Ltd., at the enhanced price.

Messrs. Stothert & Pitt, Bath, have received the contract to provide 13 electric capstans at the South Lambeth goods depot of the G.W.R.

**Newcastle-on-Tyne.**—The City Council has allocated contracts for tramway junctions, cross-overs, &c., to Messrs. Edgar Allen & Co., £1,220; the Titan Trackwork Co., £853; and Hadfield's Foundry Co., £2,250.

**Newcastle-under-Lyme.**—The Electricity Committee of the T.C. recommended the acceptance of the tender of the Diesel Engine Co., Ltd., for one 180-K.W. Diesel engine (300 R.P.M.), at £2,091; a Bruce Peebles generator, at £318; a 135-K.W. Diesel engine (300 R.P.M.), at £1,670; a Bruce Peebles generator, at £279; and one Little's cooler, at £231. The recommendation has been referred back to the Committee.

**Sheffield.**—The T.C. has accepted the tenders of Messrs. Reyrolle & Co., Ltd., at £1,682 and £397, for extra high-tension three-phase sub-station switchgear and 36 high-tension switches, respectively.

**Stockport.**—The Tramways Committee of the T.C. has accepted the tender of the British Westinghouse Co., Ltd., for gear wheels.

**Stoke-on-Trent.**—The Council has ordered for the electricity station, Hanley, mechanical stokers and self-cleaning furnaces from Messrs. Ed. Bennis & Co., Ltd. This is the second repeat order given to this firm.

**Tonbridge.**—The U.D.C. has accepted the following tenders for a year:—

Electrical Apparatus Co.—Motor-type meters.  
Bastian Meter Co.—5-ampere electrolytic meters.  
White & Co.—General Stores.  
Sloan Electrical Co.—Carbons.  
Western Electric Co.—Cables.  
Vacuum Oil Co.—Oil.

**Worthing.**—The T.C. has accepted the tender of Messrs. Hughes & Stirling for additional cells at the refuse destructor, at £595.

**York.**—The Electricity Committee has accepted the tender of Messrs. Babcock & Willcox, Ltd., at £5,200, for extensions to boiler-house plant at the generating station.

**Wimbledon.**—The following tenders have been accepted by the T.C.:—

Compounds.—Dussek Bitumen Co.  
Tapes, &c.—British Insulated and Helsby Cables, Ltd.  
House-service boxes.—W. Lucy & Co., Ltd.  
Main joint-boxes and lead sleeves, and joint-box fittings.—W. Lucy and Co., Ltd.  
House fuse boxes.—Sykes & Sugden, Ltd.  
Frames and covers.—Callender's Cable and Construction Co., Ltd.  
Transformers.—British Electric Transformer Co., Ltd.  
Lamps, and V.I.R. cables and accessories.—General Electric Co., Ltd.  
Arc lamp globes.—E. J. Shaw & Co.  
Flame arc lamp carbons.—Giepel & Co.

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, May 10th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Method of Measuring Small Inductances," by Mr. S. Butterworth; "The Conversion of Starch into Dextrin by X-rays," by Messrs. H. A. Colwell and S. Russ; "Calibration of Wave-Meters for Radio-Telegraphy," by Prof. G. W. O. Howe; and demonstration of "Apparatus for Showing the Generation of Electricity by Carbon at High Temperatures," by Messrs. J. A. Harker and G. W. C. Kaye.

**Junior Institution of Engineers.**—Friday, May 10th. At 8 p.m. At the I.E.E. Paper on "Notes on Telephone Exchange Equipment," by Mr. A. J. Hayes. Friday, May 17th.—At 8 p.m. At 89, Victoria Street, S.W. Paper on "Storage Battery Engineering," by Mr. G. C. Allingham.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, May 13th. At 8 p.m. Discussion on "Steam and Electricity for Railway Traction."

**Royal Society of Arts.**—Monday, May 13th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture III.) Wednesday, May 15th.—At 8 p.m. Paper on "The Manufacture of Nitrates from the Atmosphere," by Mr. E. Kilburn Scott.

**Institution of Electrical Engineers (Scottish Local Section).**—Tuesday, May 14th. At 8 p.m. At 207, Bath Street, Glasgow. Annual general meeting. Paper on "Power Generation and Distribution in the Clyde Valley Electrical Power Co.'s Area," by Mr. D. A. Starr.

**Institution of Electrical Engineers (Yorkshire Local Section).**—Wednesday, May 15th. At 7.30 p.m. At the University, Leeds. Annual general meeting.

**Institution of Electrical Engineers (London).**—Thursday, May 16th. At 7.45 p.m. Annual general meeting. At 8.30 p.m. Ordinary meeting. Paper on "Condensers in Series with Metal-Filament Lamps," by Mr. A. W. Ashton. Presentation to the Institution of a bust of the late Lord Kelvin.

**Royal Institution.**—Friday, May 17th. At 9 p.m. Discourse on "High-Frequency Currents," by Mr. W. Duddell.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, May 13th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, May 14th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Wednesday, May 15th.—All Companies. Annual course of musketry at Purfleet. All instructions and railway tickets will be sent to members notifying the O.C. if they can attend on this date.

Thursday, May 16th.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, May 17th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Recruits' instruction will be continued on Tuesdays and Fridays for all those not passed out by the Adjutant.

Saturday, May 18th.—Annual course of musketry at Purfleet. Instructions for, see detail for Wednesday, May 15th. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

**Fatality.**—At Chopwell Colliery, County Durham, a hewer, named John Hudson, aged 25, was killed on the 3rd inst. At the inquest, George Wallace, another hewer, said that on Friday morning Hudson went from the "coal face" to the switch-box, which had gone wrong. Deceased, who knew there was a "finger" broken, and said he thought he could put it right, lifted the cover up and put it down again, and then shouted to the boy near the main switch to switch the current on. The deceased then became fast to the lever of the switch-box. Witness shouted to the boy to shut the current off, and as soon as this was done Hudson fell. Artificial respiration was unavailing. In reply to Mr. Atkinson, Inspector of Mines, witness said the workmen had not been told not to attend the motors. The deceased had often done that work. James Wills, a deputy-overman, said if there was anything wrong with the motor switch-box, the electrician ought to have been sent for. It was not part of deceased's duties. John Morland, electrician, said the switch-box was not earthed. The cables were put down the pit before the rules, read by Mr. Atkinson, came into force, therefore they were exempt. If the switch-box had been earthed, the deceased would not have been killed. The Miners' Inspectors suggested that all switch handles should be covered with insulating material. The jury found that the deceased had been accidentally killed by electric shock.



## NOTES.

**Conversazione of the Arc Works Engineering Society.**—This Society held its fifth annual conversazione on Friday, May 3rd, 1912. The entertainment took place in the Arc Works Club House, Writtle Road, and there was a large attendance of members and their friends. Col. Crompton wrote expressing his regret at being unable to be present, and in his absence the chair was taken by Mr. A. J. Hodgson, works manager, who, during the evening, presented premiums to Messrs. Edward Hughes and F. H. Foxlee, who, as apprentices at Messrs. Crompton & Co., had contributed the best papers to the Society during the last session. A new departure was made on this occasion, the Society's invitation being extended to ladies, and the success of the entertainment showed that the innovation was much appreciated. An opportunity given for the examination of the various experiments and scientific exhibits, which were provided in the building. The musical programme was of great interest, and it was here that the admission of ladies proved the greatest gain, the audience very much appreciating the contributions of Miss Ethel Waumsley, Miss E. Matthewson and Miss Eva Hodgson. Violin solos were played by Mr. Gatehouse, who was admirably accompanied on the piano-forte by Miss Evelyn Thornton. The programme was varied with recitations by Mr. W. E. Warrilow, and the very clever conjuring of Mr. J. B. Knight, and the audience was kept perfectly happy by the very humorous singing of Mr. Percy Phillips. A novel item in the programme was provided by Mr. Edward Hughes, who sang a Welsh song, entitled "Brenddwyd-y-Freuhines" (The Queen's Dream). Miss Eva Hodgson, Miss Ethel Waumsley and Mr. G. L. Williamson provided a trio for piano, violin and cello, Mr. A. G. Collis contributed two songs, and Mr. C. W. Shepherd was the Society's accompanist. The evening closed with a vote of thanks to all those who had contributed to the success of the entertainment. Mr. C. Lucy and the hon. secretaries are to be congratulated on the result of their efforts.

**Electricity Supply Rifle League.**—The following are the results of the matches shot during April in connection with this League:—Westminster, 568. v. Central, 545; Westminster, 565. v. Stepney, 545; Central, 555. v. Hackney, 540; Central, 568. v. Shoreditch, 554. The following is the position of clubs to date:—

Club.	Matches.			Points.	Scores.	
	Shot.	Won.	Lost.		For.	Against.
Central ...	3	2	1	4	1,668	1,662
Westminster ...	2	2	0	4	1,133	1,090
Shoreditch ...	1	0	1	0	554	568
Stepney ...	1	0	1	0	545	565
Hackney ...	1	0	1	0	540	555
Ilford ...	0	0	0	0	0	0

**Melbourne Railways Electrification.**—A correspondent writes:—

"I have seen with great interest the advertisement in your columns, of the tenders which are being called for by the Government of Victoria in connection with the electrification of the Melbourne Railways.

"It is much to be regretted that as comparative tenders are being asked in connection with continuous and single-phase systems, that items have been left out which will vitiate the comparison between the two systems.

"No specifications have been issued either for transmission or distributing lines, or for the contact line.

"It is well known that the American and German upholders of the single-phase system state, that in these three items the single-phase system is superior to the continuous current.—A LOOKER-ON."

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).—The Committee has prepared the following list of officers to act during the Session 1912-13:—

*Past Chairmen*—Gisbert Kapp, R. K. Morcom, M. Railing.

*Chairman*—A. M. Taylor.

*Vice-Chairmen*—C. E. C. Shawfield; W. E. Sumpner, D.Sc.

*Present ordinary Members of Committee (remaining in office)*—W. C. Goodchild; M. L. Kahn; W. J. Larke; F. M. Lea; D. K. Morris, Ph.D.; M. Solomon; R. Threlfall, F.R.S.

*Ordinary Members of Committee (new nominations)*—G. Barnard; J. F. Lister; A. Railing; F. W. Schiller; T. F. Wall.

*Hon. Secretary*—H. B. Matthews.

New nominations have to reach the Hon. Local Sec. (H. B. Matthews, Winchester House, Victoria Square, Birmingham) by May 15th. The annual general meeting will be held at the Grand Hotel on Wednesday, May 22nd, at 7 p.m.

**ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.**—The annual conference of the Association will be held at Whitsuntide in London, at the Polytechnic, Regent Street. A paper will be read by Sir Alfred Keogh, K.C.B., on "The relations between the Imperial College of Science and Technology and Technical Institutions," and there will be a discussion on the important question of the co-operation of Employers in Technical Education. A paper on this subject will be read by Mr. E. A. Atkins.

**VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.**—The annual meeting of the Institute was held last month, when Mr. J. H. D. Brearley was elected president, and Prof. Payne and Mr. W. J. Newbiggin, vice-presidents. It was reported that the membership amounted to 150.

**INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION).**—To-morrow the members of this Section, together with members of the North of England Branch of the Association of Mining Electrical Engineers, go for their second excursion of the session. The first took place in February, to Darlington. To-morrow's visit will be to some of the largest and most important steel and iron works and waste-heat power stations in the Middlesbrough district. Lunch is to be served at the Corporation Hotel at 1.30 p.m., and in the afternoon the President of the Local Section will deliver an address, and a discussion will follow on the possibility of forming a Sub-Section of the I.E.E. in Middlesbrough, or of adopting other means of increasing the utility of the technical societies to residents in Middlesbrough, Cleveland and Darlington districts. Thus, it will be observed, the Section is not satisfied with looking after the interests of its own members, but is in a very excellent way trying to popularise the Institution. The evening will be spent socially with the Cleveland and Durham power station staff, who have invited the party to tea. On Saturday last the students of the Newcastle Section paid a visit to the Harton Colliery.

**ROYAL INSTITUTION.**—The Friday evening discourse, on May 17th, will be delivered by Mr. W. Duddell, on "High-Frequency Currents."

**INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE STUDENTS' SECTION).**—The first annual report states that at a special meeting of Students and their friends on December 15th, 1911, it was unanimously agreed to form a Students' Section in Newcastle. Eight general meetings were held in the Armstrong College, at which papers were read and discussed. The total number of Students of the Newcastle Section is 151, and the average attendance at general meetings has been 54. Mr. B. A. Robinson has been elected chairman of Committee for the session 1912-13, and Mr. T. C. Christianson, vice-chairman. The hon. secretary is Mr. T. E. Bridge, 31, Simpson Street, Newcastle-on-Tyne.

**INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).**—The annual meeting of the Section was held on the 30th April, when the annual report was read and approved. Mr. J. S. Peck proposed a vote of thanks to Mr. Cramp, who as chairman had experienced a strenuous year of office. Mr. W. Cramp in responding said the session had been an arduous one, not for him alone, but for the whole Committee. A large amount of additional work had had to be done in connection with the new Articles of Association. He suggested that they might have one meeting next session where an exhibition of the domestic uses of electric cooking apparatus could be held and ladies might be present. A vote of thanks was accorded to Mr. J. Frith for his services as Hon. Sec. Mr. A. A. Day was elected chairman: Professor E. W. Marchant and Dr. E. Rosenberg, vice-chairmen, and Mr. Julius Frith, hon. secretary and treasurer. Other members of Committee are: Prof. Miles Walker, Messrs. K. Faye-Hansen, Ll. Foster, H. J. Hawkins, E. L. B. Hill, G. Layton, E. M. Hollingsworth, A. E. McKenzie, T. L. Miller, B. Welbourn, P. P. Wheelwright and F. H. Whysall.

**INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS).**—A Students' meeting was held in Birmingham, on May 2nd, Mr. A. M. Taylor presiding. A discussion was held on "D.C. v. A.C. for Traction Purposes," which was opened by two papers, Mr. L. H. A. Carr outlining the chief advantages of the D.C. high-tension system, and Mr. C. H. Goulden upholding the A.C. single-phase system. An interesting discussion took place. It may be pointed out that this was the first meeting exclusively for students that has been held in Birmingham, and it is hoped that in future such meetings may be held regularly.

**INSTITUTION OF CIVIL ENGINEERS.**—It is announced that in order to avoid interference with the ordinary work of the Institution, the removal of the contents of the present building in Great George Street, S.W., and the internal fixtures and structural fittings will be proceeded with early in the recess. The library is to be stored in the lower ground floor pending the construction of the new building, and it is expected that some of the rooms will be ready for occupation by the end of this year, so that the library books may be then rendered available and the reading room reopened. It is hoped that the new premises may be brought into partial use in the early part of 1913 and completed for occupation some months later. Correspondence should be directed to 12, Dartmouth Street, S.W., where temporary offices have been taken for the accommodation of the staff and meetings of the Council and its committees.

**INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH AFRICA).**—At a meeting of the Local Section of the Institution on April 11th, at the South African College, Cape Town, the Chairman for the ensuing year (Mr. Walter F. Long) delivered an address, which took the form of a description of electric lighting developments in Cape Town and suburbs from the first installation in 1882 by the Brush Co., to the present time. Practically all the earlier installations have been discarded in favour of a supply by the Corporation from its Dock Road power station.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—At a meeting of the West of Scotland Branch of the Association at Glasgow, Mr. Matthew Brown, general manager of the Banknock Coal Co., was elected president, and Mr. A. B. Muirhead (Lenzie) vice-president. The total membership of the branch, it was announced, stood at 180. A paper contributed by Mr. James Gillespie, of the East of Scotland Branch, on "The Operation of Electrical Apparatus in Mines by Remote Control," was read and discussed. Mr. Robert W. Peters (Lochgelly) recently read a paper on "Earthed and Insulated Neutrals in Colliery Installations." The author stated that he favoured the earthing of the neutral, after 16 years' experience in mining electrical work, both on high and low-tension three-phase plants, and on large direct-current insulated systems. He strongly advocated the earthing of the neutral at one



point and through a suitable resistance in all cases of three-phase supply. He believed in having armoured cables throughout, and the motor frames, switch boxes, joint boxes, gate ends, and the like thoroughly bonded and earthed to the same.

At a meeting of the NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION, on May 4th, in Newcastle-on-Tyne, Mr. Jacques Abady delivered a lecture on "Light and Competition." He said that with gas as it was made now, and burners as at present designed, he did not think there was very much possibility of greatly improving the service that could be obtained from a cubic foot of gas. Electricity, on the other hand, was hot-foot in pursuit of an idea, that was using vapour as a conductor, which he thought would, in, perhaps, the near future, be productive of great results. He claimed that the gas man had little to fear from the electrician in the matter of cost. He had recently attended an experiment with a new form of gas lighting, the introduction of which, he thought, would do as much for gas as the metal-filament lamp had done for electricity.

**Appointments Vacant.**—Improver operators (Irishmen only) for the Provincial Cinematograph Theatres, Ltd. (30s.); cost clerk, buyer for raw material, and a test-room assistant, for the Phoenix Telephone and Electricity Works, Ltd. See our advertisement pages to-day.

**Catalogues Wanted.**—A trader in Ontario, Canada, wants catalogues and prices of British-made telephone apparatus. Apply for name to Board of Trade Commercial Intelligence Branch, London.

**Inquiries.**—A correspondent asks for particulars of the "Star" system of regeneration, as applied to rolling mills, &c. Makers of the Permutit electric water-softening plant, and the "Whisperphone," are asked for.

**Educational Notes.**—IMPERIAL COLLEGE OF SCIENCE.—In the course of a series of lectures on rubber, by Mr. Herbert Wright, at the Imperial College of Science, South Kensington, the lecturer stated that the rubber plantations in Ceylon had grown from 300 acres in 1890 to 220,000 acres to-day, and in Malaya from 350 acres in 1897 to 400,000. Including financial corporations, over £90,000,000 had, in Great Britain alone, been ear-marked for rubber plantation from 1906 to the end of 1911. Ceylon, India and Malaya headed the list with £45,000,000, and this money had, so far, given us about 100,000,000 rubber plants under cultivation.

He stated that the highest yield of latex from a single tree was 480 lb. in two years; this giving 160 lb. of dry rubber. The range in thickness of the bark shavings cut away at each tapping operation was too great; where the bark had been cut away too rapidly, the percentage of caoutchouc in the latex seriously diminished.

In the sixth of the special series of lectures on rubber, Dr. Philip Schidrowitz dealt with the chemical and physical properties of crude rubber. He said it had not yet been definitely ascertained whether the nitrogenous "insoluble" matter, which was present in considerable quantities in some rubbers, did not play some important part in regard to quality. There appeared to be an important connection between the viscosity of a rubber solution and the strength of the material.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—MR. NORMAN BROOKSBANK, engineer-in-charge at the Leicester Corporation tramways power station, was, on the occasion of his marriage, which took place on April 20th, presented with a cake basket and tea-tray from the staff and employés. The presentation was made by Mr. T. R. Smith, the chief engineer.

The Bury (Lancs.) T.C. has increased the salary of Mr. J. G. POTTS, works superintendent at Chamber Hall power station, from £2 10s. to £3 per week.

MR. A. H. SMITH, charge engineer at the Whitehaven Corporation electricity works, has been appointed to a similar position at the Crewe electricity works.

On Tuesday last MR. B. DRANE, who recently occupied the position of mains superintendent to the electricity supply department of the South Metropolitan Electric Tramways and Lighting Co., Ltd., was the recipient of a silver demi-hunter watch, presented to him by his late colleagues to mark the occasion of his leaving to take up an appointment with the Marylebone Corporation. The presentation was made by the general manager, Mr. A. V. Mason.

The marriage took place at Blackpool last week of MR. CHAS. J. MELBOURNE, chief assistant electrical engineer to the Burton-on-Trent Corporation, and Miss Florence White, of Blackpool. The presents included silver servers for the bride from the employés of Blackpool electricity works, and an oak clock from the employés of the Burton works.

A Cape Town correspondent says that the city electrical engineer of Cape Town (Mr. W. F. LONG) left for England by the Mail boat on April 17th, in connection with the purchase of additional plant required by the Corporation for the extensions of electrical energy to the municipalities in the southern suburbs of Cape Town.

The Walthamstow Council has increased the salary of Mr. W. H. TAYLOR, assistant electrical and tramways engineer, from £210 to £260 per annum.

The appointments of MESSRS. B. HAWKINS and H. SIMPSON referred to in our last week's issue, are under the *St. Helena* Electricity Committee, not Wakefield. We regret the error.

MR. H. HODGES has resigned his appointment at Mansfield, to take up the duties of assistant engineer at Nuneaton.

**General.**—MR. F. L. N. TUCK, A.C.G.I., B.Sc. (Eng.), whose appointment as chief instructor in Physics and Electrical Engineering in the Seddon Memorial Technical College, Auckland, N.Z., has just been announced, sails for the Antipodes on May 11th. After obtaining the diploma of A.C.G.I. at the Central Technical College in 1905, Mr. Tuck served an apprenticeship with the British Westinghouse Co., Manchester, and had subsequent experience with Messrs. Reyrolle & Co., of Hebburn-on-Tyne. For the past year he has been engaged in the foreign department of the A.E.G. in Berlin.

MR. A. PODMORE, assistant engineer to the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople) left London on Tuesday, April 30th, to take up his duties in Constantinople.

The *Review of the River Plate* states that MR. D'ABBADIE D'ARRAST has resigned the post of general manager of the Cordoba Electric Light and Power Co., to take a seat on the London board of directors. Mr. D'Abbadie has been manager of the company since 1899. MR. G. LEWIS, of the firm of Messrs. J. G. White and Co., has been appointed manager. Mr. Lewis has had charge of the additions recently made to the power house, and also of the electrification of the tramways which belong to the company.

MR. HARRY J. BOOKER is taking up the appointment of manager of the sales department for Messrs. Scholey & Co., Ltd., and is leaving Messrs. J. & H. Grevener, with whom he has been associated for a number of years.

MR. J. KING, electrical engineer, who is leaving the service of Messrs. Eagleston & Son, electric wiring contractors, of Oxford, with whom he has been for 10 years, was last week presented with a smoker's cabinet at a smoking concert arranged by the employés.

Last Saturday evening at the Restaurant Frascati, the departmental managers and representatives of the Electrical Co., Ltd., entertained MR. O. SCHACHERT, their general manager, to dinner, on the occasion of his departure for South America to take charge of the A.E.G. interests there. Mr. Loewi, the company's secretary, occupied the chair, and voiced the feelings of all present in a speech well worthy of the occasion, and made the presentation, which took the form of a dressing case. He was ably seconded by Mr. Schachert's successor, Dr. Koch. Mr. Schachert, in saying farewell, called upon the staff to render to his successor the same loyal support that they had given him in the past. After the speeches, many songs and musical items were rendered, and the evening concluded with the singing of "Auld Lang Syne."

**Obituary.**—MR. JOHN GRAY, B.Sc.—The death of Mr. John Gray, which we mentioned briefly in our last issue, removes from our midst, at the age of 58 years, a gentleman who was highly esteemed by many with whom he had become associated in the scientific world, by reason of his quiet and unflinching good humour and the originality and excellence of his work in certain departments of research. Some 38 years ago in Aberdeen, Mr. Gray was one of a brilliant band of Whitworth scholars, and while employed in the same engineering works as Mr. W. B. Esson he was, at night, engaged as a lecturer on "Applied Mechanics and Steam" at the Aberdeen Mechanics Institution. Shortly afterwards (in 1874), Mr. Gray and Mr. Esson left Aberdeen together for London, the former as a Royal Exhibitioner to be three years at the Royal School of Mines, the latter as a teacher in training, to attend lectures at the Normal College of Science. After his course at the School of Mines was ended and he had obtained his A.R.S.M., Mr. Gray entered the Patent Office in London as an indexing and abridging clerk under a new régime then beginning. At the time of his death he was still in the Patent Office service, having risen to a very responsible position as Examiner, where he specialised largely in patents connected with electrical matters. For very many years past, we believe getting on for 20, he had been a regular and valued contributor to the pages of the ELECTRICAL REVIEW. Physics, Röntgen rays, wireless telegraphy, atmospheric electricity, atomic and electronic theories—these were a few of the subjects in which he took an interest, while his name is known to many by reason of his excellent little book published years ago on "Influence Machines." For some time past the deceased gentleman had devoted a tremendous amount of time to anthropological pursuits. Into these he threw himself with an immense enthusiasm and a zeal that spoke of a deep conviction. One effect of his development along this line of study was that Section A (Mathematical and Physical Science) of the British Association, which once knew him so well, no longer "held" him, the new love of the Anthropological Section, in which he was a very active member and read many reports and papers, winning him away. Mr. Gray was treasurer of the Anthropological Institute. During the early months of this year he was unwell and went abroad for a change. He was in these offices only a few weeks before his death, and though he had not fully recovered his former health, the news of his death from pneumonia—doubtless contributed to by the keen and biting winds of last month—came to us, as it must have done to his many friends, as a shock. The funeral took place at the Necropolis, Woking, on May 2nd. We desire to tender to his widow our deep and sincere sympathy in her bereavement.



## NEW COMPANIES REGISTERED.

**Callender's Share and Investment Trust, Ltd. (121,778).**—Registered May 3rd, by Drake, Son & Parton, 24, Rood Lane, E.C. Capital £200,000 in £1 shares. Objects: To acquire, hold and deal with stocks, shares, debentures, debenture stocks, bonds, obligations and securities of any company, Government or other body, and to adopt an agreement with Callender's Cable and Construction Co., Ltd. (vendors). The signatories are:—T. O. Callender, Hamilton House, Victoria Embankment, E.C., engineer, 100 shares; E. W. Fradley, 10, Throgmorton Avenue, E.C., stockbroker, 100 shares; C. H. McEuen, 97, Cannon Street, E.C., merchant, 100 shares; J. Varley, 11, Stanley Gardens, Kensington Park, W., gentleman, 100 shares; W. Allnutt, 5, Lime Street, E.C., accountant, one share; C. W. Clark, Ellesmere, Nightingale Square, Balham, S.W., clerk, one share; N. H. Busson, 83, Cheshunt Grove, New Malden, clerk, one share. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are T. O. Callender, E. W. Fradley, C. H. McEuen, and J. Varley; qualification, £100; remuneration, £100 each per annum. Registered office, Hamilton House, Victoria Embankment, E.C.

**Orford Electric Light and Power Co., Ltd. (121,711).**—This company was registered on April 30th, with a capital of £1,000 in £1 shares, to carry on the business of an electric power, light and supply company. The subscribers (with one share each) are:—H. T. Harrison, 11, Victoria Street, S.W., electrical engineer; S. T. Bacon, 60, Cumberland Road, Acton, W., clerk; T. D. Dymond, 23, Davies Street, W., engineer; W. Riggs, 23, Davies Street, W., engineer; H. M. Andrews, 54, New Broad Street, E.C., C.A.; H. I'Anson Jones, 51, Curzon Road, Muswell Hill, N., solicitor; W. G. C. Masham, 54, New Broad Street, E.C., secretary. Minimum cash subscription 200 shares. The number of directors is not to be less than two or more than five; the first are H. T. Harrison and W. Riggs. Registered by Jones, Son & Andrews, 54, New Broad Street, E.C.

**Galsworthy Otovacuum, Ltd. (121,705).**—This company was registered on April 30th, with a capital of £50 in £1 shares, to carry on the business of art metal workers, manufacturers of and dealers in electrical fittings and accessories, electricians, engineers, &c., and to take an assignment of an agreement between the Vacuum Engineering Co., Ltd., and Galsworthy, Ltd. The subscribers (with 10 shares each) are:—S. S. Galsworthy, 6, Brunswick Gardens, Kensington, W., electrical engineer; M. H. Galsworthy, 12, Ornan Road, Belsize Park, N.W., electrical engineer. Private company. Table "A" mainly applies. Registered office, 15-16, Newman Street, W.

**T. H. Cubey, Ltd. (121,692).**—This company was registered on April 29th, with a capital of £1,000 in £1 shares, to take over the business of electrical engineers carried on by T. H. Cubey and A. Cubey as T. H. Cubey and Co. The subscribers (with one share each) are:—T. H. Cubey, 22, Pollard Street, South Shields, electrician; A. H. Cubey, 25, Osborne Avenue, South Shields, insurance broker. Private company. The numbers of directors is not to be less than two or more than five; the first are T. H. Cubey and A. C. Cubey; qualification, £25; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

## CITY NOTES.

**Dudley, Stourbridge and District Electric Traction Co., Ltd.**

THE annual meeting of this company was held at the Electrical Federation Offices, Kingsway, W.C., on May 2nd, under the chairmanship of Mr. S. R. Blundstone.

The CHAIRMAN, in moving the adoption of the report, said there was nothing in the accounts which called for any special explanation. The receipts showed an increase over the previous year of £2,900 and the expenses had increased by £350. Administration and general expenses showed a reduction of £200, and repairs and maintenance charges were less by £1,200, due to the heavy amounts expended on repairs and rolling stock in 1910. The power and running expenses had increased by £1,750, due to the increased car-mileage run, and also to the 1910 accounts having received the benefit of 18 months' reduction in the price paid to the Dudley Corporation for electrical energy under the recent arbitration. £1,000 had been credited to the renewals account out of profits, as against £600 in the previous year. A total amount of £470 was charged against that account during the year, and it now showed a credit balance of £4,128. The net result of the year's working was, that after paying the dividend on the preference shares and placing £1,000 to renewals, and adding the balance brought forward from last year, there was a distributable balance of £3,353 6s. 10d. Subject to the approval of the shareholders, the directors proposed to devote £1,800 to the writing out of the balance of cost of the Arbitration proceedings with the Dudley Corporation; to place £1,000 to depreciation and reserve account; to put £450 to the sinking fund; and to carry the balance of £103 forward. They paid £1,800 a year for rates, and it was expected that, as the result of a recent legal decision, that amount would be substantially reduced. The coal strike did not affect the company, for the service was unrestricted, and the receipts were maintained. The management by the Birmingham and Midland Joint Committee would be continued for another year, as the joint working of the companies operating in the Black Country enabled greater economies to be obtained. The better results of the year's working were generally due to the improved state of trade in the Black Country, and with a continuance of the trade revival, he hoped the results for the present year would show still further improvement.

MR. ALLEN seconded the motion, which was carried without discussion.

**Great Northern Telegraph Co., Ltd., of Denmark.**

The paragraph published in our last issue regarding the dividend declaration of this company was incorrect. As announced on page 595 of our issue of April 12th, the total distribution was 18 per cent. for the year 1911.

**Held Over.**—Heavy pressure upon our space compels us to hold over a number of "City" matters until next week.

**The Austrian Bergmann Works.**—It is stated that previous to the arrangements made between the Bergmann Electricity Works Co., of Berlin, and the Siemens-Schuckert Works, for the financial participation, as was recently announced, of the latter in the former, negotiations had taken place with the Anglo-Austrian Bank in regard to the financing of the Austrian Bergmann Works, of Bodenbach. These have now led to the conclusion of an agreement in respect of all points of detail, whereby the bank is authorised on the basis of the next balance-sheet to form a limited company to take over the Bodenbach Works, the share capital to be from £250,000 to £291,000. A draft scheme of the relations to exist between the new company and the parent company in Berlin has also been arranged. The final adoption of the agreements depends upon the sanction of the new board of directors to be elected at the forthcoming meeting of the German Bergmann Co.

**Eastern Telegraph Co., Ltd.**—The directors report that for the six months ended December, 1911, the revenue amounted to £729,470, from which are deducted £245,387 for the ordinary expenses, and £37,461 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £446,621, plus £49,048 brought from the preceding account, making a total available balance of £495,670. After providing for income-tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £81,787, there remains a balance of £413,882, out of which the directors have placed £210,000 to the general reserve fund, and have paid an interim dividend of 1½ per cent. on the ordinary stock, amounting to £50,000. The directors now recommend a final dividend on the ordinary stock of 1½ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on May 15th, free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year ended December 31st, 1911. It is proposed to carry forward the balance of £23,882. The directors allude to the death of the Marquess of Tweeddale, K.T., who had been a director of the company since its formation. The Right Hon. Frederick Huth Jackson has been appointed to the board.

**Western Telegraph Co., Ltd.**—The directors' report for the half-year ended December 31st, 1911, states that the revenue for this period amounted to £430,572, and the working expenses to £158,022. After providing £16,373 for debenture stock interest, and £7,874 for income-tax, there remains £248,302, plus £4,390 brought forward from June last, making a total of £252,691. First and second interim dividends, amounting to £62,379, have been paid, and after transferring £150,000 to the general reserve fund, and £10,000 to the land and buildings depreciation fund, there remains £30,312, which is carried forward.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Company of Baltimore.—Further issue of \$1,000,000 general mortgage 4½ per cent. 30-year gold bonds of \$1,000 each (Nos. 9,933 to 10,082, 10,233 to 10,582 and 11,017 to 11,516).

Puebla Tramway, Light and Power Co.—Fully-paid scrip for \$3,000,000 prior lien 5 per cent. 50-year gold bonds.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Further issue of 160,000 shares of £1 each, fully paid (Nos. 160,001 to 320,000).

**Prospectus.**—*Victoria Falls and Transvaal Power Co., Ltd.*—There are being offered for sale by Messrs. Emile Erlanger and Co. (the list closes to-day) £1,000,000 5½% second mortgage debentures (series A) at 96 per cent. There are already issued £3,000,000 five per cent. first mortgage debentures. The proceeds are to provide additional facilities for supplying power contracts that have been already booked. It is estimated that within twelve or eighteen months when these orders are supplied, there will be an annual profit of £660,000 per annum. In a page "write up" with illustrations appearing in the *Times Financial Supplement* the day before the publication of the prospectus, the central picture is a view of the Victoria Falls. The letterpress, however, states that this great asset (a preferential right to develop 250,000 electrical H.P. at the Falls for 75 years from December, 1906) remains for future exploitation.

**West London and Provincial Electric Supply Co., Ltd.**—The directors' report for 1911 states that the revenue of the company is derived from the dividends on the shares of the Chiswick Electricity Supply Corporation, Ltd., which the company owns, from the fees charged for managing the business of the Corporation, and from commission for acting as engineers in respect of additions to the Corporation's plant and machinery. The accounts of the Chiswick Corporation show, says the *Financial Times*, after paying interest on the first mortgage debenture stock, a profit of £3,763. Out of this the directors propose to carry £620 to depreciation reserve fund, and to pay a dividend at the rate of 5 per cent. per annum on its shares. This will be received in due course by the company, whose accounts show a balance at the credit of profit and loss account of £2,947. The directors propose to apply the above balance of £2,947 to the payment of a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for the year.

**West India and Panama Telegraph Co., Ltd.**—The directors last week announced a dividend of 1s. per share on the ordinary shares, free of tax. This compares with 1s. 6d. per share a year ago.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended March 29th, 1912, were 854,021, compared with 658,729 units in the corresponding four weeks of 1911.



### British Westinghouse Electric and Manufacturing Co., Ltd.

THE twelfth annual report for the year ended December 31st, 1911, reads as follows:—The increase in the volume of business referred to in the report for 1910 has been more than maintained, and the results of the year's trading, notwithstanding the continuance of severe competition, again show an appreciable advance. The trading, &c., profits amount to £126,144, from which fall to be deducted:—Depreciation on machinery, plant, tools, &c., £30,868 (in addition to £6,100 included in reserve for general depreciation); expenses on surplus land and buildings, £4,254; interest on 6 per cent. prior lien debentures, £14,016; interest on 4 per cent. mortgage debenture stock, £49,654, leaving a balance of £27,352. From this balance has to be deducted the amount required for the prior lien redemption fund, £5,984; proportion of expenses of issue of prior lien debentures, £660, leaving a net profit for the year of £20,708, plus £5,117 balance brought forward, making £25,825 to the credit of profit and loss account, which it is proposed should be carried forward.

"The directors alluded in their last report to the pending proceedings between the company and the Underground Electric Railways Co. of London. They regret to say that the appeal to the Lords Justices was unsuccessful. Counsel have advised appeal from their judgment, and, having regard to the sum involved, it has been decided to carry the case to the House of Lords. No provision has been made in the accounts now presented for the loss which may ultimately result. There is bound to be some loss, which will be dealt with when the amount is definitely ascertained. Last year the chairman, in his address to the shareholders, referred to the closing down of the steel foundry. As a consequence of this, the plant has since been sold at a loss of £36,720. This amount, however, is more than covered by the reserves for depreciation appearing in the balance-sheet, and amounting £51,912. The steel foundry premises are now being utilised for other manufacturing purposes. Revenue has again been charged during the year with a substantial amount for the maintenance of buildings, machinery and plant, in addition to which a sum of £30,868 has been applied to the depreciation of the same items. Orders received during the year are slightly in excess of 1910, both the home and the export markets showing improvement. This improvement is being fully maintained during the current year. But for the railway strike in August last, your directors believe that a still larger increase in orders might have been obtained, and there is no doubt that the actual output from the works was adversely affected by the strike. Your board deeply regret to have to record the death of Mr. Robert Mather, the chairman of the American company, whose relations with your board were always most cordial."

The annual meeting was called for yesterday (Thursday).

### Kidderminster and District Electric Lighting and Traction Co., Ltd.

—The directors' report states that the gross receipts for 1911, including the dividend on the shares held by this company in the Kidderminster and Stourport Electric Tramway Co., amounted to £10,330, plus £122 brought forward, making £10,453, compared with £9,686 for 1910. After deducting all expenses (including debenture stock and other interest), amounting to £5,590, there remains an available balance of £4,862. The directors propose to deal with this as follows, viz.: Depreciation and renewals fund, £1,250; debenture and loan redemption reserve, £250; dividend on cumulative preference shares for the year, £1,500; dividend at the rate of 3 per cent. per annum on the ordinary shares, £1,410; carry forward £452. The gross receipts of the Kidderminster and Stourport Electric Tramway Co. amounted to £6,412, an increase of £369, and the expenses, before providing for renewals, to £3,449, an increase of £160. The profit on the year's working, after providing for renewals, is £2,090, plus £166 brought forward. This amount has been applied thus: Reserve fund, £250; a dividend at the rate of 3½ per cent. on 5,720 shares, £2,002; carried forward, £5. The Board of Trade have rescinded the Kidderminster and Stourport Electric Lighting Order, 1906, in so far as it relates to the town of Stourport, as the company do not see their way, owing to the very small demand in Stourport for electric light and power, to give a supply from the power station at Kidderminster into Stourport. The portion of the order in respect of the Kidderminster foreign area is being developed by the company, and a small revenue is at present derived therefrom.

**West African Telegraph Co., Ltd.**—In their report for the year ended December, 1911, the directors announce the death of the late Marquess of Tweeddale. John Cuthbert Denison-Pender, Esq., L.C.C., has been elected to the board. The revenue for the period under review amounted to £54,923, from which is deducted £17,083 for the ordinary expenses, and £8,969 for expenditure relating to maintenance of cables and income-tax abroad, leaving £28,872, plus £233 brought forward, making a total available balance of £29,105. £1,377 has been provided for income-tax, £497 has been paid as a bonus to the staff, £17,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income-tax), absorbing £4,622, was paid on December 1st last. The directors recommend a final dividend of 2 per cent. (free of income-tax) on and after May 15th, making, with the interim distribution, 4 per cent. for the year, the balance of £987 being carried forward. All payments in respect of the guarantee of the Portuguese Government under its concession, from which this company benefited for 25 years, ceased in September last.

### Brisbane Electric Tramways Investment Co., Ltd.

MR. H. R. BEETON, chairman, presided on Monday at Winchester House, E.C., over an extraordinary general meeting of the above company for the purpose of considering, and, if thought fit, approving of a resolution altering the articles of association.

The CHAIRMAN said there was not much to say in elucidation of the resolution, the necessity for which arose in virtue of the policy which had been announced in the report. It was necessary that they should take powers under the articles, which they had not at present, in order to give effect to the dividend policy of issuing a bonus in shares. The books would be closed in Brisbane that day, and it became necessary under the Joint Stock Co.'s Acts to file the contract at Somerset House, in order to constitute the shares fully paid, and for that purpose they had to await the list of shareholders in Brisbane. Therefore, if they carried out their intentions, they would pay the cash dividend on May 21st, and the bonus in shares before the end of June.

MR. J. B. CONCANNON seconded the motion.

Answering a shareholder, the CHAIRMAN said that the money for the shares was required for extensions, some of which were in progress, and had been referred to at previous meetings. They were valuable extensions, from which they hoped to derive considerable benefits. In the event of purchase by the Government, the company would be in no way prejudiced by the issue of shares as a bonus to the shareholders, as by the purchase clause the Government would purchase the undertaking as a going concern at a price based upon the earnings.

The resolution was carried.

### Callender's Cable and Construction Co., Ltd.

SIR J. FORTESCUE FLANNERY, Bart., M.P., took the chair at Hamilton House, E.C., on May 2nd, at the sixteenth annual general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 684), the CHAIRMAN referred to the absence of Mr. H. Drake (the chairman of the company) through illness, and said that he was glad that on the first occasion of his taking the chair he had so satisfactory a report to put before the shareholders. They would be pleased to know that the accounts had been issued at an earlier date this year, although when accounts were ranged more or less all over the globe it was not easy to get a balance-sheet prepared immediately after the end of the financial year in December. The report was very full, because it was the policy of the directors to take the shareholders as fully into their confidence as they possibly could, especially having regard to the strenuous competition under which the company carried on its operations. They had some difficulties during the year in regard to transport, but they were not affected so much as some manufacturers, because at their Erith works they had a frontage to the River Thames, and they had their own wharf and apparatus, and also control over some tonnage, all of which enabled them to reduce their difficulties to a minimum. Their Colonial trade had been very satisfactory, and they realised the warm feeling that existed amongst their Colonial customers to the manufacturers of the Mother Country. They were doing their very best to foster that feeling, and to combine it with trade advantages such as they knew they could offer to Colonial customers, and of which they seemed willing to take the very fullest advantage. As regarded the United Kingdom, all their old customers—many of them of two generations standing—stuck to them. He was glad to say they had standing connections with many public authorities and large consumers upon which they relied from year to year, and there was no sign of other than a continuance of this good feeling. They were going as far over the world as they could, and it would be observed that they had just taken a large contract in Japan for the city of Tokio. They believed that if, as they intended, that contract was carried out faithfully, it would be the forerunner of other and perhaps still larger business in Japan, because that country had not yet begun to be opened up in the way that it ultimately would be in the comparatively near future as regarded electrical enterprise. They had done a big business with the Post Office in connection with the taking over by the Post Office of the telephone system. They had made special arrangements to carry out this work, and machinery particularly suitable for telephone cables had been concentrated at Erith. Previously they made part of the telephone cables at Erith and part in the works at Lancashire, but now they hoped to be able to give the best possible delivery and to economise in the cost of production. The Anchor Cable Co., of which they were the proprietors, had done extremely well, and they had extended the buildings and added to the plant. Its business had increased, and was increasing, and the policy of the directors some years ago of adding these works to Callender's ordinary business had proved to be more and more satisfactory as time had gone on. Both at the Anchor Works and at Erith the buildings and plant had been kept at the highest possible state of efficiency out of current profits. It would be seen that a new trust company under the care and guidance of Callender's Co. was to be formed. Callender's Co. held certain investments in various power and lighting undertakings which yielded rates of interest quite satisfactory as an ordinary investment, but the holding of these investments did not allow of the money being used in the way they would like in the business, and, therefore, it was proposed to give not only the public, but the shareholders, the opportunity of taking a part in those investments if they desired to do so, and the money so raised would be transferred to the ordinary manufacturing business of that company. The chairman next referred to the appointment of Mr. Allnutt as the secretary of the company, and said that for some years he had been



the office manager of the company, and was thoroughly conversant with all the details of the business. Passing next to the balance-sheet, he pointed out that the board had been entitled to write off £20,000 off machinery renewal. The trade creditors had increased from £107,000 to £152,000, and the bills payable from £80,000 to £107,000, both increases being due to the extended business done. The loan from the bank on account of the St. Helens Co. had been reduced by £10,000, and the loan on account of the Uxbridge Co. had been written out altogether. The profit carried to profit and loss account was £84,781, against £66,320 last year. On the assets side, he pointed out that nothing whatever was put down for goodwill and patents. The gross profits for the year were £129,569, as compared with £98,204 last year, or an increase of £31,364. These good results were due primarily to the splendid business capacity of Mr. T. Callender, the managing director, and the excellent manner in which he had been backed up and supported by the assistant general managers, Mr. J. Callender and Mr. Petersen, and the staff. They had an extremely well-organised staff working in unison, and working almost all over the world, and he believed they could look forward in the future to good results. The opening months of 1911 were promising, and although it was too soon to speak of them with any certain sound, they were very hopeful about the future.

MR. T. CALLENDER (managing director), in seconding the motion, said he thought the results must be considered satisfactory, for most people had not found the past year a very agreeable one to deal with, for they had an immense amount of trouble in connection with the railway strike and with various items of labour and other unrest. Their company had not escaped free from the imposition of heavy charges, but in spite of this, and in spite of the lessening of the volume of trade during a certain period of the year, they had done very well. In order to arrive at this result they had had to extend their operations on every side. They had a foot in Germany, and from there and from this country they had extended their ramifications to many parts of the Continent. Just now the company had its own men working in Germany, Belgium and Italy, and in a few days they would be starting an important contract in Spain. Considering the difficulties which English firms had in obtaining orders in Continental countries which were hedged round with various troublesome formalities and heavy payments, it spoke well for them that they had been able to carry the flag as they had done into so many and widely scattered parts of Europe. In addition, their work in Australia, South Africa, South America, and last, but not least, India, kept up and extended. In India they had their own office, and practically a completely equipped branch, and they were doing an important business. The contract they had taken in Japan was a large one, but he did not say it was a very profitable one, for the Japanese had an unfortunate knack of leaving little to the manufacturer who supplied them. Still, it was quite satisfactory, under the circumstances, to the company, and they hoped to be able to carry a certain amount of profit from it to the balance-sheet in the current year. At the present moment they were devoting a great deal of attention to China, where they had certain relations. It was possible that the business to be done in China in the materials they supplied would not be important for some years to come, but they recognised that it was no good waiting till the goods of someone else had got a good name in the country, and there they were spending money which would have no immediate result, but which they felt would be very profitable in the end. In regard to the current year's business the first three months had not been unsatisfactory. The volume of trade had been quite good, and they had a considerable number of orders in hand. In fact, their factory was busier than it had been for a considerable number of years at this period of the year. To what extent that good position might continue depended on two important items. The first was the political outlook which seriously affected finance, for financial crises and troubles which arose were apt to cause considerable trouble and reduce the volume of trade. Subject to there being no complications at home or abroad, they hoped that the good outlook at present prevailing would continue. But this also depended on the absence of labour troubles. They happily escaped the worst effects of the coal strike, but coming in touch, as he did, with large employers of labour in the North, he was sorry to say that the unrest in the labour world had by no means disappeared, and there was quite a possibility of still further trouble in the future. So far as their own men were concerned, they had acted very loyally, and no serious questions had arisen between the company and the employees. Unfortunately, however, the views taken by men engaged in daily work were now not quite the same as they were a few years ago, and they were apt to run loose on matters which were of comparatively little importance to themselves, but which were sometimes of the utmost importance to the manufacturer. Their prosperity depended largely on the smooth running of the trade in the country, for if there was trouble in the woollen mills of Yorkshire or in the South Wales coalfields, it was reflected in their business at once. Mr. Callender also referred to the formation of the Trust Co., and concluded by paying a high tribute to the efficiency of the staff.

The report was adopted and the retiring directors were re-elected.

**Continental.**—AUSTRIA.—The A.E.G. Union Electricitäts Gesellschaft, of Vienna, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

HUNGARY.—Messrs. Ganz & Co., of Budapest, report a net profit of £26,586 for the last financial year, as compared with only £23,203 in the preceding 12 months. The dividend is being increased from 6 to 7 per cent.

## Electric Supply Corporation, Ltd.

THE directors' report for 1911 says that the gross earnings amounted to £29,392, an increase of £3,926 upon the corresponding figures of the previous year. The sum taken into net revenue account amounts to £13,167, as against £11,224 for 1910. After paying interest upon debenture stock and temporary loans, also the actual cost of the year's repairs and renewals, the company has, with the balance brought forward, a surplus of £6,962. Of this, it is proposed to place £800 to the renewals account; to distribute a dividend at the rate of 2 per cent. per annum for the year, less income-tax; and to carry forward £2,207. The following table shows the progress made by the company during the last four years:—

Year.	Equiv. in 32-watt lamps connected.	Units sold.	Gross earnings.	Profit including investments.
1908 .. ..	97,778	2,034,087	£21,240	£6,566
1909 .. ..	113,699	2,492,416	23,801	9,300
1910 .. ..	135,719	2,479,172	25,466	11,224
1911 .. ..	172,202	3,070,851	29,392	13,167

During 1911 the company received a dividend on their 6 per cent. preference shares in the Dumbarton Burgh and County Tramway Co., Ltd. These shares were disposed of during the year. The Hendon Electric Supply Co., Ltd., has distributed a dividend of 5 per cent. for 1911, and the amount received has been brought into these accounts.

### LAMPS CONNECTED (EQUIVALENT IN 32-WATT LAMPS).

	1910.	1911.	Inc.
Chelmsford .. ..	30,037	31,684	1,647
Jedburgh .. ..	3,445	3,618	173
Melrose .. ..	3,876	4,461	585
Dalkeith .. ..	6,816	7,169	353
Dollar .. ..	2,274	2,419	145
Totnes .. ..	4,294	4,695	401
Exmouth .. ..	12,279	14,034	1,755
St. Andrews .. ..	18,717	21,464	3,247
Hitchin .. ..	7,762	8,925	1,163
Dumbarton (A) .. ..	34,583	59,576	24,993
Falmouth .. ..	11,636	13,657	2,021
	135,719	172,202	36,483
Hendon (B) .. ..	40,108	55,967	15,859
Dawlish (C) .. ..			

(A) These figures take no account of the supply to the Dumbarton Burgh and County Tramways, which used 581,185 units in 1911. The company holds 29,490 £1 ordinary shares (out of 80,000 issued) in the Dumbarton Burgh and County Tramways Co., Ltd. The traffic receipts of the tramways were £18,877 in 1910, and £19,956 in 1911.

(B) The company holds 3,793 £5 ordinary shares (out of 6,630 issued) in the Hendon Electric Supply Co., Ltd.

(C) The company holds 356 £1 ordinary shares in the Dawlish Electric Light and Power Co., Ltd.

## Wolverhampton District Electric Tramways, Ltd.

MR. S. R. BLUNDSTONE presided on May 2nd over the annual meeting of this company held at the offices of the Electrical Federation, Kingsway, London.

In moving the adoption of the report, the CHAIRMAN said the receipts of the past year had increased by £1,070, chiefly due to the improvement in trade which had taken place in the district served by the company's tramways. In spite of the fact that 247,000 more passengers were carried than in the previous year, the power and running expenses had only increased by £26, and the administration and general expenses by £17. The repairs and maintenance costs showed a reduction of £276, and £160 had been written off the cost of the Dudley current arbitration out of the profits, as compared with £312 in the previous year; these two items together cleared off the whole cost of the arbitration, so far as that company was concerned. £1,000 was provided for renewals, as in the previous year. The net result of the working was that the company was £1,578 better off than in the previous year, and, including the amount brought forward, there was £2,133 to be dealt with. It was proposed to apply £760 to the sinking fund, £1,000 to depreciation and renewals, and to carry forward the balance to next year's account. The sinking fund would now be £3,856, and the depreciation and reserve fund, £4,587. The arrangement by which the company was managed by the Birmingham and Midland Joint Committee had been continued, as, by this arrangement, greater economy of management was obtained than if it were worked as a separate undertaking. The City of Birmingham Tramway Co. retired from the Joint Committee in March last. The chairman then referred to the rating decision given in the case of the Metropolitan Electric Tramways Co. and the Tottenham U.D.C., as the result of which, he said it was hoped their rates would be considerably reduced in the future.

MR. ALLEN seconded the motion, which was carried, and Mr. J. A. Lycett, the retiring director, was re-elected.

## Leatherhead and District Electricity Co., Ltd.

The accounts for the year 1911 show that the revenue from Leatherhead was £1,630 and from Ashted £2,342, total £3,972. After meeting generation, distribution, and management expenses, the Leatherhead balance of profit is £975, and that of Ashted £1,472, total £2,448. £314 is carried to Leatherhead depreciation account, and £773 to Ashted depreciation account. The net revenue appropriation account for the year shows thus:—By balance from last account £1,561, less dividend of 3½ per cent. £1,197 = £364, plus balance from net revenue accounts as follows:—Leatherhead £672, Ashted £711 = £1,383, making £1,748, which is carried to the general balance-sheet.

**Bank Rate.**—The Bank Rate was yesterday reduced from 3½ to 3 per cent.



**River Plate Electricity Co., Ltd.**

THE directors report continued steady progress during 1911. The net revenue, after providing for administration expenses, bad debts, and depreciations, was £47,200, plus £5,889 brought forward. Interest on the 5 per cent. debenture stock requires £10,000, leaving a surplus of £43,089. The preference dividend of 6 per cent for the year required £7,500; a dividend of 10 per cent. upon the ordinary stock, £12,000; addition to general reserve, £15,000; further remuneration to directors, £930; and £7,659 is to be carried forward. The total reserves stand at £136,422. In November a provisional agreement was concluded with the Government of the Province of Buenos Ayres for the continuance of the supply of public lighting by this company in the City of La Plata and the town of Ensenada until the year 1927, at least. This agreement has been confirmed, and has now become law. Under this contract the company agrees, as regards a definite area in the city, to place its cables and electrical connections underground, and also within five years to transfer its generating plant from La Plata to the new power station at Ensenada. On the other hand, the contract provides for large additions to the public lighting to be supplied by the company, and paid for by the province, and, in addition, the company's entire exemption from taxation is continued during the currency of the extended public lighting contract. The board regard this new contract as highly advantageous alike to the Government and to the company. Important industrial developments have arisen in the past year, and are now in active progress at Ensenada, which will add greatly to the working population in the immediate future. Increased demands for public and private lighting, and for power for industrial purposes, will follow on this growth of population. With a view to meeting the increased business anticipated, extensive additions to the new generating station at Ensenada are necessary. A contract for a 6,000-kw. turbo-generator, with all necessary boiler and other auxiliary plant, has been placed. It is expected that within two years the company will be in a position to conduct the whole work of generating light and power at Ensenada. Considerable economies in working will result when production is concentrated there, while the entire transfer of the works from La Plata will free for sale in the future a large and important building site of growing value near the centre of the city. The capital expenditure involved in the extensions and improvements will be spread over two years. A considerable part of this expenditure will, in accordance with the policy heretofore pursued, be provided out of current earnings, but as further provision the board have decided to offer for subscription the unissued balance of £30,000 ordinary share capital of the company. These shares, which are of the denomination of £1, will be issued at a premium of £1 per share. The whole premium of £1 per share will be added to the general reserve fund. The third payment on account of the amortisation of the 5 per cent. obligations of the German Transoceanic Electric Co. (Series 1) held by this company—viz., £1,800, was duly made on April 1st, 1911, reducing the amount outstanding to £144,800.

The annual meeting was held on April 30th, at Capel House, New Broad Street, E.C.

MR. M. W. MATTINSON, who presided, said that the net revenue of their three stations in the Argentine had amounted to £48,015, compared with £43,505 a year ago, an improvement of £4,600. In 1910 the company had an exceptional profit of £3,000, due to the great illuminations in La Plata to celebrate the centenary of the Argentine Republic, and the comparison, therefore, was the more favourable, as in the past year they had nothing of the kind. The increase in revenue was almost wholly at La Plata and Ensenada, and was due to no abnormal circumstances, but to the steady growth in the size and importance, and in the industrial activities of those towns. Their receipts from sources other than the profits of the three electrical stations, that was to say, interest upon their large investment in the 5 per cent. obligations of the German Transoceanic Co. and interest upon investments and exchange, came to £9,017, which was 90 per cent. of their annual debenture charge, showed a reduction of £1,274. Last year he told the shareholders of that reduction, and pointed out that in the item of interest for that year they had a whole year's dividend on the shares of the Rosario Electric Co., and that as they had sold those shares at a large profit, and the proceeds had gone in the extensions at Ensenada they could not hope to have the interest as well. The company would, however, get a very full equivalent in the near future for this loss of interest. The extensions at Ensenada would give them a good return upon the money involved, but during the year under review their revenue only benefited to a very moderate extent from that source. The station at Ensenada was now finished and running satisfactorily. On the other side of the revenue account the only material increase in the outgoings was for depreciation of fixed plant. The final outcome was that the net balance available for dividend and other purposes was £47,200, against £45,026, an increase of £2,173. They again paid a dividend of 10 per cent. upon the ordinary stock, added £15,000 to reserve, against £14,000, and carried forward £1,771 more than they brought in. There was no doubt those figures would have justified a higher dividend than 10 per cent., but they were deliberately following the policy of restricting the dividends on the ordinary stock and strengthening the capital resources of the company. He was in the Argentine last September and spent a great deal of time in La Plata and Ensenada, going most carefully into the company's interests. That was the third occasion upon which he had visited La Plata, and he observed with much gratification the evidences of progress which were apparent on every side. The two tramway systems to which their company supplied the current under long-term contracts, and in one of which they were considerable shareholders, were extending

their systems all over the town and down to Ensenada, and building operations were going on rapidly everywhere, and in particular in La Plata, a much better type of house and shop was being put up. A new Government railway which opened up new country and ended at La Plata and Ensenada, was nearing completion, and since his return he had heard that they had taken over the lighting of the railway station, and it was probable that within a year their company would be supplying light and power to the extensive workshops of the railways being erected in the suburbs. As regarded Ensenada, he told the shareholders a year ago that he thought that they might look for considerable industrial progress there. He confessed he did not think his anticipations would be so quickly realised. Heretofore the docks at Ensenada had been the principal, though not the only source of employment there, but they were overshadowed by the docks at Buenos Ayres, 30 miles distant, and they did nothing like the trade they ought to have done. Things, however, were rapidly changing. In the first place, the docks at Buenos Ayres were quite inadequate to the demands upon them, and there was an overflow to La Plata, and in addition La Plata was getting further railway outlets. At Tucuman they were threatened by further competition by a company called the "Hydro-Electric Co., of Tucuman." That company had in course of construction an installation to utilise water-power at the Lules River and transmit electricity to Tucuman, where it was proposed to supply in direct competition with the Electrica del Norte and their company. The city of Tucuman was already fully supplied with light, power and trams, by two powerful companies who were resolved to maintain their position.

MR. ROBERT MILLER seconded the motion, which was carried.

**Rangoon Electric Tramway and Supply Co., Ltd.**

THE annual meeting was held on April 30th, at 3 and 4, Great Winchester Street, E.C., Mr. Frank Tobin, who presided, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 687), said that the increase in the capital expenditure last year, which amounted to £45,778, was mainly due to the purchase and erection of the new 2,500 kw. turbine and the extension of mains to the suburbs of Rangoon. The power house, including land, buildings and plant had cost altogether £265,796. The receipts from their tramways showed a slight falling off, which was caused by the pauperism that had prevailed among the poorer classes in Rangoon. When that unhappy condition of things passed away they might confidently look for a considerable improvement in their receipts. In spite of the decrease in the tramways, there had been a considerable improvement in the profits from the light and power branch of the business; the decrease in the former being more than made up by the improvement in the latter. The house-wiring department had also been very satisfactory, the profit having increased from £769 in 1910 to £2,020 last year. He did not anticipate that they would have to spend anything on new machinery for some time to come, although they would doubtless have to continue expenditure on the upkeep of mains, as they were the things that brought in income. In conclusion, the CHAIRMAN paid a tribute to the staff in Rangoon for the excellent manner in which they discharged their duties.

SIR F. W. R. FRYER, K.C.S.I., seconded the motion, and the report was adopted.

**Lisbon Electric Tramways, Ltd.**—The directors' report for 1911 shows that a net profit of £103,374, plus £6,242 brought forward, making £109,616. From this £35,000 has been placed to depreciation reserve and £5,000 to the credit of exchange reserve account. There remains an available balance of £69,616, out of which the usual preference dividend, amounting to £25,533, has been paid. On November 1st the directors paid on the ordinary share capital an interim dividend of 3 per cent. net, amounting to £19,020, and they now recommend a final dividend at the same rate, making 6 per cent. net for the year; £6,041 has been carried forward. The board has deemed it advisable (says the *Financier*), having regard to the heavy and continued fall in values of investment securities, more especially those of the gilt-edged class, to write down the holdings of the company by £8,457, which has been charged against the depreciation reserve account. The traffic receipts show the satisfactory advance of Rs61,892,612 over the previous year's working, this being largely due to the exceptional advantage of record receipts during the festivities in connection with the anniversary of the Republic. On the other hand, the Lisbon working expenses have increased by the sum of Rs84,375,243, owing to the heavy burden of the higher wage charges imposed under the arbitration award referred to in last year's report. The net result is a somewhat smaller profit than shown for the year 1910. In March a general strike was declared in Lisbon, causing the service to be temporarily curtailed. The employés showed their loyalty, and the only loss suffered by the company was a slight falling-off in the revenue through the partial stoppage of the traffic.

**Eastern Telegraph Co., Ltd.**—The directors, after making a contribution to the general reserve fund, payment of interest on the 4 per cent. mortgage debenture stock, dividend on the 3½ per cent. preference stock, and three interim dividends of £1 5s. per cent. each on the ordinary stock to September 30th, recommend (says the *Financier*) a final dividend of £1 5s. per cent., and a bonus of £2 per cent., making a total distribution of 7 per cent. on the ordinary stock for the year.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 8th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. ..	22/-	..
a " Oxalic .. .. ..	23d.	..
a " Sulphuric .. .. ..	5/6	..
a Ammoniac Sal .. .. ..	42/-	..
a Ammonia, Murate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. ..	£5 10	..
a Bisulphide of Carbon .. .. ..	£18	..
a Borax .. .. ..	£16 10	..
a Copper Sulphate .. .. ..	£24 15	..
a Lead, Nitrate .. .. ..	£26 10	..
a " White Sugar .. .. ..	£26 10	..
a " Peroxide .. .. ..	£32	..
e Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	33d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. .. per lb.	33d.	..
a " Perchlorate .. .. ..	43d.	..
a Potassium, Cyanide (98/100 %) .. ..	73d.	..
(for mining purposes only)		
a Shellac .. .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ..	£6 10	..
a " Recovered .. .. ..	£5 10	..
a " Lump .. .. ..	£5 5	..
a Soda, Caustic (white 70/72 %) .. ..	£10 5	..
a " Chlorate .. .. .. per lb.	33d.	..
a " Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£67	..
b " Wire, in ton lots .. ..	£102	..
b " Sheet, in ton lots .. ..	£120	..
p Babbitt's metal ingots .. ..	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	83d.	..
c " Tube (brazed) .. .. ..	103d.	..
c " " (solid drawn) .. .. ..	9d.	..
c " Wire, basis .. .. ..	83d.	1d. inc.
c Copper Tubes (brazed) .. .. ..	113d.	1d. inc.
c " " (solid drawn) .. .. ..	103d.	1d. inc.
g " Bars (best selected) .. .. per ton	£86	..
g " Sheet .. .. ..	£86	..
g " Rod .. .. ..	£86	..
d " (Electrolytic) Bars .. .. ..	£74 10	..
d " " Sheets .. .. ..	£91 10	..
d " " Rods .. .. ..	£79 10	..
d " " H.C. Wire per lb.	93d.	..
f Ebonite Rod .. .. ..	5/8	..
f " Sheet .. .. ..	4/9	..
n German Silver Wire .. .. ..	1/11	..
h Gutta-percha, fine .. .. ..	..	..
h India-rubber, Para fine .. .. ..	4/7 3/4	1 1/4 d. dec.
i Iron Pig (Cleveland warrants) .. per ton	53/1 1/2	5 1/2 d. dec.
i " Wire, galv. No. 8, P.O. qual. ..	£14	..
g Lead, English Pig .. .. ..	£15 15s. to £16 17s. 6d.	10/- inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. .. per bot.	£8 5	7/6 dec.
e Mica (in original cases) small .. per lb.	6d. to 2s.	..
e " " " medium .. .. ..	2/6 to 4/-	..
e " " " large .. .. ..	4/6 to 8/6	..
p Phosphor Bronze, plain castings ..	11d.	..
p " " rolled bars & rods .. ..	1/0 1/2	..
p " " rolled strip & sheet .. ..	1/1	..
o Platinum .. .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. .. per lb.	10 3/4 d.	..
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. ..	£212 to £214	£5 inc.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/4 1/2	1/2 d. inc.
p White Anti-friction Metals .. .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) ..	£29 15	..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p ..
h Edward Till & Co.	r W. F. Dennis & Co.

## STOCKS AND SHARES.

Tuesday Evening.

SEVERAL of the Stock Exchange markets had rather a shake-out early this week, for which various reasons were advanced, the most likely-looking one being that speculators had bought more than they could carry conveniently, and that as markets sagged a number of the weaker bulls rushed simultaneously to get out. A whole crop of rumours accompany the movements, but none of them carry much weight, although in some quarters a quiet hint that labour trouble may be expected in this country towards the end of the month was associated with the names of prominent members of the Cabinet whose views command respect, even in the Stock Exchange.

In the general set-back amongst Home Railways the Under-grounds suffered with the rest. Central London continue to fall, and the Deferred stock is 4 points down, the Ordinary and Preferred showing similar declines. Districts recovered after having given way a little, and Metropolitan are unchanged. The market in Metropolitan, however, is certainly a strong one. We mentioned last week that it might be the Great Western which is angling for control of the company, and now there are suggestions that the Great Central would possibly like to have a hand in the business. City and South London Ordinary rallied 1/2 after its previous drop of 3 points, but lost the improvement. Great Northern and City Preferred are 5s. lower. East London went down as quickly as they rose, and the middle price is once more back to 10, while the Debenture stocks have also experienced a relapse. There is talk of labour trouble at the docks. Underground Electric Railway shares at 4 1/2 gave way with other speculative issues, but the 6 per cent. Income Bonds keep firm at 92.

London United Tramways 5 per cent. Preference shares spurted again on top of their big rise, and have reached 5 1/2 amid growing expectations that the shares may be within sight of an early resumption of dividends. Possibly the present buyers are, perhaps, discounting the future very liberally. British Electric Traction issues are good, the 6 per cent. Preferred being 3 points higher and the 7 per cent. Preferred gaining 3 1/2, these being to some extent in connection with the substantial improvement in London United Tramways. Bath Preference hardened to 15s. on consideration of the good yield obtainable upon the shares at this figure.

The Colonial and Foreign Tramways list is quiet, but there is a good deal of strength about the popular descriptions. Matters in Mexico move very erratically, but the general assumption is that the trouble there will quiet down in time, and meanwhile proprietors of Mexican Light and Traction investments are not selling. Rises have occurred in Mexican Light and Power common shares and First Mortgage Bonds in Mexican Tramways common, and in the company's 6 per cent. bonds; while Mexican Electric Light First Mortgage bonds are 1/2 higher. Rio Trams continue their remarkable rise, but a good many people elected to take their fine profits round about 130, with the result that the price reacted a trifle from the top. The company is now paying quarterly dividends at the rate of 5 per cent. per annum, and these it is hoped will be raised to at least 7 per cent. before long in consequence of the expansion shown in the receipts. Sao Paulo Trams at 218 1/2 are 4 1/2 better, making a rise of over 10 points within a fortnight; while Montreal Light and Power shares retain their exalted price of 210. British Columbia Electric Railway descriptions have been very steady, and the Indian list is good. Madras Ordinary gained 1/2. Calcutta Ordinary jumped up 12s. 6d., with substantial buying to support the shares. Calcutta Tramways are 1/2 higher at 6 3/4. On the other hand, River Plate Ordinary stock slipped back 7 points on the prospect of competition, but the Preference stock rose superior to this consideration, and has a rise of 2 to its credit on the week. Canadian General common shares have gone back 3, although Canadian things, as a whole, have been very much in favour in the markets this week.

The English Electricity list is remarkable only for its steadiness. Bournemouth and Poole Ordinary put on a further 5s. in anticipation of the "something good" to which we alluded last week. Edmundsons' Preference and Westminster Preference are both better. It is worth noticing that two or three issues have been taken out of the Stock Exchange Official List, and therefore removed from our price lists, on account of the fact that no business has been officially recorded in them for several months. The speculation in City of London has quieted down to some extent; but, considering the dulness of some of the other markets in which a large account exists, the firmness of Cities deserves attention.

The Telegraph market continues to be absorbed in the wild movements of Marconis, the prices of which have been jumping up and down like the mercury in a thermometer with which a little hot-handed child is playing. American Marconis dropped to 2 1/4, rallied to 2 5/8, and again receded. Canadians fell back, and Spanish kept them company, while the prices of the new shares and the Preference kept pace with those of the parent company. West India and Panama Telegraph shares dropped abruptly to 3 1/2 on the announcement of a very disappointing dividend.

National Telephone Deferred is 3 1/2 higher, and the third Preference rose 1/8, upon the statement of claim made by the National Telephone Company upon the Government in respect of the purchase of its undertaking. The claim, of course, is subject to the arbitration, and were it not so, National Telephone Deferred stock would be standing nearer 200 than 150. The Eastern group is rather duller. Great Northern Telegraphs fell 15s. Anglo-American descriptions are just steady, and there is very little going on in the shares of the manufacturing companies.

Of the Miscellaneous group, Aron Ordinary rose to 16s. 3d., confirming the reference made here last week to the firmness of the market in the shares. British Westinghouse Preference have gone back to 12s. 6d. The quotation of Brush Ordinary has been removed from the lists in consequence of the paucity of business done in the shares, but in substitution we have added the company's 5 per cent. prior lien Debenture stock, the quotation of which is 80 middle. Callender's Ordinary are good at 11 1/2, showing a 5s. advance.

**Auckland Electric Tramways Co., Ltd.** — The directors have declared an interim dividend of 7 1/2d. per share, free of income-tax, on the ordinary shares for the half-year ended December, 1911.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 7th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations May 7th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.			1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	94—10½	+ ¼	5 7 4	Kensington & Knightsbridge, Ord.	5	9	9	7½—7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½	4½	8½—9½	..	4 14 9	Do. 4 % Deb. ..	Stock	4	4	92—95	..	4 4 3
Do. Second 6 % Pref. ..	10	5	5	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½	4½	100—102	..	4 8 3	London Electric, Ord. ..	8	2	2½	1½—2	..	3 14 11
Brompton & Kensington, Ord. ..	5	10	10½	8½—8½	..	5 14 3	Do. 6 % Pref. ..	5	6	6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7	7	7½—8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4	4	92—95	..	4 4 3
Central Electric Supply, 4 %	100	4	4	98—101	..	8 19 3	Metropolitan ..	5	5	4½	5½—4½	..	6 1 3
Guar. Deb. ..							Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5	5	4½—5	..	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	101—104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	4 14 9	Do. 8½ % Mort. Deb. ..	Stock	8½	8½	84—87	..	4 0 6
Do. "City Undertaking"	5	4½	4½	3½—4½	..	5 2 10	Midland Electric Corporation	100	4½	4½	96—98	..	4 11 10
Do. 4½ % Cum. Pref. ..							4½ % First Mort. Deb. ..						
Do. Do. 4 % Deb. ..	100	4	4	95—98	..	4 1 8	Newcastle-on-Tyne 5 % Pref.,	5	5	5	3½—4½	..	5 14 3
Chelsea, Ord. ..	5	5	5	4½—4½	— ½	5 2 7	Non-Cum. ..						
Do. 4½ % Deb. ..	Stock	4½	4½	98—101	..	4 9 1	North Metropolitan Power Sup-	100	5	5	97—100 xd	..	5 0 0
City of London, Ord. ..	10	7	8	20—22	..	3 12 9	ply, 5 % Mortgages (Red.)						
Do. 6 % Cum. Pref. ..	10	6	6	16½—18½	..	3 4 10	Notting Hill, 6 % Non-Cum.	10	..	6	10½—11½	..	5 6 8
Do. 5 % Deb. ..	Stock	6	5	119—123	..	4 1 4							
Do. 4½ % Second Deb. ..	100	4½	4½	101—104	..	4 6 7	Oxford ..	5	7½	7½	5½—6½	..	5 13 9
County of London, Ord. ..	10	5	6	10½—11½	..	5 6 8	St. James' and Pall Mall, Ord.	5	10	10	8½—8½	..	5 14 3
Do. 6 % Pref. ..	10	6	6	11½—11½	..	5 2 7	Do. 7 % Pref. ..	5	7	7	6½—7½	..	4 16 7
Do. 4½ % Deb. ..	Stock	4½	4½	108—110	..	4 1 10	Do. 8½ % Deb. ..	100	3½	3½	85—87	..	4 0 6
Do. 4½ % Second Deb. ..	Stock	4½	4½	99—102 xd	..	4 8 3	Smithfield Markets, Ord. ..	5	Nil	2	1½—1½	..	..
Edmundson's, Ord. ..	5	Nil	Nil	3—3	..	Nil	South London, Ord. ..	4	5	5	2½—3½	..	5 8 0
Do. 6 % Cum. Pref. ..	5	Nil	Nil	3½—3½	+ ¼	Nil	Do. 5 % First Mort. Deb. ..	100	5	5	99—102	..	4 18 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86—89	..	5 1 2	South Metropolitan, 7 % Pref. ..	1	7	7	1½—1½	..	6 1 0
Folkestone ..	5	6	6	4½—4½	..	6 9 1	Do. 4½ % First Deb. Stock ..	100	4½	4½	96—99	..	4 11 0
Do. 5 % Cum. Pref. ..	5	5	5	4½—4½	..	5 5 3	Urban, Ord. ..	5	5	..	1—1	..	..
Do. 4½ % First Deb. ..	100	4½	4½	93—96	..	4 13 9	Do. 5 % Cum. Pref. ..	5	5	..	2½—3½	..	..
Hove ..	5	9	9	6½—7	..	6 8 7	Do. 4½ % First Mort. Deb. ..	100	4½	4½	86—89	..	5 2 3
							Westminster, Ord. ..	5	10	10	8½—9½	..	5 8 1
							Do. 4½ % Cum. Pref. ..	5	4½	4½	5½—6½	+ ½	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6	6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5	5	87½—89½	..	5 11 9
Calcutta, Ord. ..	5	8½	7½	7½—8½	+ ½	4 6 2	5 % 1st Mort. Deb. }						
Do. 5 % Pref. ..	5	5	5	5—5½	..	4 16 3	Montreal, Lt., H. and Power ..	\$100	7	8	207—212 xd	..	3 15 6
Calgary Power, 1st Mort. Bds.	100	5	5	94½—95½	+1	5 3 8	Northern, Lt., Power and Coal, }	\$500	5	..	39—41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7	7½	110—114	—3	6 2 10	5 % 1st Mort. Bonds }						
Do. 7 % Pref. ..	\$100	7	7	118—122	..	5 14 9	River Plate, Ord. ..	Stock	10	..	245—255	—7	3 18 6
Cordoba Lt., Power and T., Ord.	1	3	3½	1½—1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	112—117	+2	5 2 7
Do. 5 % Deb. ..	100	5	..	94—97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5	5	103—105	..	4 15 3
Eleo. Lt. and P. of Cochabamba, }	100	6	6	93—95	..	6 6 4	Roy. Eleo. Co., Montreal, 4½ % }	100	4½	4½	99—101	..	4 9 1
6 % Bonds }							1st Mort. Deb. }						
Eleo. Supply Victoria, 5 % 1st }	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4	5½	137—141	..	3 10 11
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds }	\$500	5	5	108½—110½	..	4 10 6
Elec. Dev. Ontario, 5 % 1st }	\$500	5	5	92—94	+ ½	5 6 5	Do. 4½ % Per. Deb. ..	Stock	4½	4½	104—106	..	4 4 11
Mort. Bonds }							Toronto Power, 4½ % Deb. ..	Do.	4½	4½	100—102	..	4 8 3
Kalgoorlie Eleo. P. and L., Ord.	10½	Nil	..	7—7	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6	6	1½—2½ xd	..	8 6 0	1st Mort. Deb. }						
Kaministiquia Power, 5 % G. Bs.	\$500	5	5	103—105	..	4 15 3	Victoria Falls Power, Pref. ..	1	Nil	11½d.	3½—3½	— ½	..
Madras, Ord. ..	5	..	..	2½—2½	+ ½	..	West Kootenay Power and Lt., }	100	6	6	104½—106½	..	5 12 8
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102½—105½	..	4 14 9	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½—88½	+2	5 13 0							
Mexican Lt. & Power, Common	\$100	4	4	86—87	+1½	4 12 0							
Do. 7 % Cum. Pref. ..	\$100	7	7	104—106 xd	..	6 12 1							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95—98	+1½	5 2 0							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1—1½ xd	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5	5	97½—99½	..	5 0 6	Do. 5 % Pref. ..	1	5	5	8½—8½ xd	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8½	148—150	—1	5 6 8	National Telephone, Pref. ..	Stock	6	6½	98½—102½	..	5 17 1
Do. Collat. Trust ..	\$1000	4	4	95—97	+1	4 2 6	Do. Def. ..	Do.	6	6½	157½—169½	+3½	3 15 0
Anglo-American Telegraph ..	Stock	3½	3	65—67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ..	5	5	5	6½—6½	+ ½	4 2 6
Do. 6 % Pref. ..	Do.	6	5	107½—108½	..	5 10 4	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100—101 xd	..	4 7 2
Do. Def. ..	Do.	80½	80½	25½—26½	..	5 14 3	Oriental Telep. and Elec. ..	1	8	8	1½—1½ xd	..	4 11 5
Anglo-Portuguese Tel., 5 % }	100	5	5	101—102	..	4 17 1	Do. 6 % Cum. Pref. ..	1	6	6	1½—1½ xd	..	4 16 0
Mort. Deb. }							Do. 4 % Red. Deb. ..	Stock	4	4	89—91	+ ½	4 8 0
Chill Telephone ..	5	7	..	7½—8	+ ½	4 10 4	Pacific and European Tel., 4 % }	Do.	4	4	99½—101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	83½—85½	..	4 13 7	Guar. Debs. }						
Cuba Telegraph ..	10	6	6½	9½—10½	..	5 11 7	Reuter's ..	8	5	5½	11—11½	..	3 12 6
Do. 10 % Pref. ..	10	10	10	17—18	..	5 11 1	Submarine Cables Trust ..	Cert.	6	6	127—130 xd	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4	4½	8½—8½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	99—101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10	10	7½—8½	..	6 1 3	Deb. Red. }						
Do. 4½ % Debs. ..	50	4½	4½	99—101	..	4 9 1	United River Plate Telephone	5	8	8	7½—7½	..	5 1
Direct United States Cable ..	10	4½	5	7½—8 xd	..	6 5 0	Do. 5 % Cum. Pref. ..	5	5	5	5½—5½	..	4 8 11
Direct W. India Cable, 4½ % }	100	4½	4½	99—101	..	4 9 1	West Coast of America ..	2½	2½	2½	1½—1½	..	3 6 8
Reg. Deb. }							Do. 4 % Debs., 1 to 1,500 }	100	4	4	98—100	..	4 0 0
Eastern Telegraph, Ord. Stock	Stock	7	5½	134—137	..	5 2 2	guar. by Braz. Sub. Tel. }						
Do. 8½ % Pref. Stock ..	Do.	8½	8½	79½—81½	—1½	4 6 0	West India and Panama Teleg.	10	1½	1½	3½—3½	— ½	3 4 6
Do. 4 % Mort. Deb. ..	Do.	4	4	99½—101½ xd	..	3 18 10	Do. 6 % Cum. 1st Pref. ..	10	6	6	10½—11	..	5 9 1
Eastern Extension ..	10	7	5½	12½—13½	..	5 5 8	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10½	..	5 17 1
Do. 4 % Deb. ..	Stock	4	4	99—101	— ½	3 19 3	Do. 5 % Debs. ..	100	5	5	102½—104½	..	4 15 8
East and S. Africa Tel. 4 % }	25	4	4	97—100 xd	..	4 0 0	Western Telegraph, Ltd. ..	10	7	6½	19—19½	..	5 3 8
Mt. Db. Mauritius Sub. }							Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3
Globe Telegraph and Trust ..	10	5½	6½	10½—11	..	5 9 1	Do. 4½ % Fdg. Bonds ..	\$1000	4½	4½	100—103	..	4 7 5
Do. 6 % Pref. ..	10	6	6	13—13½	..	4 9 0							
Great Northern Telegraph ..	10	18	18	30—31	— ½	5 16 2							
Indo-European Telegraph ..	25	18	5½	68—60	..	5 8 4							
Mackay Companies Common ..	\$100	5	5½	84—87	+1	5 15 0							
Do. 4 % Cum. Pref. ..	\$100	4	4	68—71	—2	5 12 8							
Marconi's Wireless Telegraph	1	5	..	7½—7½	+ ½	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	6½—6½	+ ½	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 7th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 7th.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. ..	1	1910. Nil	7 1/2	..	Nil	Metropolitan Railway Consol. ..	100	1910. 13 1/2	70 3/4	..	2 12 8
Do. 5 % Pref. ..	1	1911. 5	7 1/2	..	6 3 1	Do. Surplus Lands ..	100	22 1/2	68 — 70	..	4 3 4
Do. 4 1/2 % Deb. ..	100	4 1/2	78 — 83	+ 3 1/2	5 8 5	Do. 8 1/2 % Deb. ..	100	3 1/2	89 — 91	..	3 16 11
Brit. Elec. Trac., 5 % Pref. ..	100	..	12 — 14	..	..	Do. 8 1/2 % Pref. ..	100	8 1/2	86 — 88	..	3 19 7
Do. Do. Deferred ..	100	..	7 — 9	..	..	Do. 3 1/2 % Con. Pref. ..	100	3 1/2	87 — 89	+ 2	3 18 8
Do. Do. 6 % Cum. Pr.f. ..	100	..	92 — 94 xd	..	6 7 8	Metropolitan District Ord. ..	100	Nil	47 1/2 — 47 3/4	+ 1 1/2	Nil
Do. 7 % Non-Cum. Pr.f. ..	100	..	42 1/2 — 45 1/2	+ 3 1/2	..	Do. 6 % Deb. ..	100	6	144 — 146	..	4 2 2
Do. 5 % Perp. Deb. ..	100	5	93 1/2 — 96 1/2	..	5 3 8	Do. 4 % Deb. ..	100	4	96 — 98	..	4 1 8
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	78 — 82 xd	..	5 9 9	Do. 4 % Prior Lien ..	100	4	98 — 100 xd	..	4 0 0
Central London Railway, Ord. ..	100	3	83 — 85	..	3 10 7	Do. 4 1/2 % First Pref. ..	100	4 1/2	90 — 92	..	4 17 10
Do. Pref. ..	100	4	86 — 88	..	4 11 0	Do. 3 1/2 % Gtd. ..	100	3 1/2	76 — 78	..	4 9 9
Do. Def. ..	100	2	84 — 86	..	2 6 6	Metropolitan Elec. Trams, Ord. ..	1	5 1/2	1 — 1	..	6 0 0
Do. 4 % Deb. ..	100	4	101 — 103	..	3 17 8	Do. Def. ..	1	Nil	..	..	Nil
City & South London, Ord. ..	100	1 1/2	39 — 40	..	4 1 3	Do. 5 % Pref. ..	1	5	..	..	5 10 6
Do. 5 % Pref., 1891 ..	100	5	108 — 110	..	4 11 0	Do. 4 1/2 % Deb. ..	100	4 1/2	99 — 101	..	4 9 1
Do. Do. 1896 ..	100	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	97 — 99	..	5 0 0
Do. Do. 1901 ..	100	5	104 — 106	..	4 14 4	Potteries, Ord. ..	1	2	..	..	..
Do. Do. 1903 ..	100	5	103 — 105	..	4 15 3	Do. 5 % Pref. ..	1	5	..	..	6 19 3
Do. 4 % Deb. ..	100	4	99 — 101 xd	..	3 19 3	Do. 4 1/2 % Deb. ..	100	4 1/2	89 — 92	..	4 17 10
Dublin United Trams, 5 % Pref. ..	10	6	103 — 11 1/2	..	5 2 2	Do. 4 % Deb. ..	100	4	72 — 77	..	5 4 0
Great Northern & City, Pr.f. Ord	10	Nil	18 — 20 xd	..	8 0 0	Underground Elec. Railways	10	..	4 — 4 1/2	..	Nil
Hastings Trams, 6 % Pref. ..	5	Nil	..	..	5 18 5	Do. 4 1/2 % Bonds ..	100	4 1/2	99 — 101	..	4 9 1
Do. 4 1/2 % Deb. ..	100	4 1/2	71 — 76	..	4 6 11	Do. 6 % Income ..	100	1	90 — 92	..	Nil
Isle of Thanet Trams, 5 % Pref. ..	5	2 1/2	23 — 27	..	5 0 0	Yorkshire (West Riding), Ord. ..	5	Nil	..	..	Nil
Do. 4 % Deb. ..	100	4	75 — 80	..	5 17 8	Do. 6 % Pref. ..	5	Nil	..	..	Nil
Lancashire United, 5 % Deb. ..	100	5	83 — 85	..	4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	80 — 84	..	5 7
London Elec. Railwys, 4 % Deb. ..	100	4	97 — 99	..	..						
London United Trams, 5 % Pref. ..	10	Nil	..	..	..						
Do. 4 % Deb. ..	100	4	79 — 82	..	4 17 7						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 3/4 — 5 7/8	..	5 1 2	La Plata Elec. Trms, Ord. ..	1	..	..	..	..	..	..	..	..
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2 — 5 1/2	..	5 7 4	Do. Pref. ..	1	6	6	..	..	6 0 0	..	..	..
Do. 4 % Deb. ..	100	4	4	94 — 95 1/2	..	4 3 9	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6 1/2	..	..	4 8 0	..	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	102 — 104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	..	..	4 16 0	..	..	..
Do. 5 % Deb. ..	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	5	..	..	5 1 0	..	..	..
Auckland Trams, 5 % Deb. ..	100	5	5	104 — 106	..	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	..	..	4 19 0	..	..	..
Bombay Elec. S. & Trams, Pref. ..	10	6	6	11 — 11 1/2	..	5 4 4	Manas Trams & Lt., 1st Deb. ..	100	5	5	..	..	5 4 2	..	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98 — 100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	..	..	4 16 7	..	..	..
Do. 5 % 2nd Deb. ..	100	5	5	99 — 101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	..	..	5 14 9	..	..	..
Brisbane Trams Invt., Ord. ..	5	8	8	9 1/2 — 9 3/4	..	4 2 1	Do. Gen. Con. 5 % Bonds ..	..	5	5	..	..	5 2 0	..	..	..
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2	..	4 15 3	Do. 6 % Bonds ..	100	6	6	..	..	5 15 5	..	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	..	..	6 13 4	..	..	..
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	139 — 143	..	5 12 0	Do. 6 % Pref. ..	5	6	6	..	..	7 0 4	..	..	..
Do. Pref. Ord. ..	100	6	6	126 — 129	..	4 13 0	Do. 5 % 1st Deb. ..	100	5	5	..	..	4 17 1	..	..	..
Do. 5 % Pref. ..	100	5	5	111 — 114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2	..	..	..	1 18 4	..	..	..
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	98 1/2 — 101 1/2	..	4 8 8	Do. 5 % 1st Deb. ..	100	5	5	..	..	4 16 2	..	..	..
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	..	..	5 6 8	..	..	..
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	104 — 106	+ 1	4 5 0	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	..	..	4 9 1	..	..	..
Calcutta Trams, Ord. ..	5	6	7	6 1/2 — 6 3/4 xd	+ 1 1/2	5 5 8	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	..	..	3 16 8	..	..	..
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	..	..	4 15 3	..	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	..	..	5 2 0	..	..	..
Cape Electric Trams ..	1	Nil	2 1/2	..	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	..	..	4 10 6	..	..	..
City Buenos Aires Trams (1904)	5	5	5	5 1/2 — 5 3/4	..	4 5 1	Do. 5 % 1st Deb. ..	\$500	5	5	..	..	4 13 11	..	..	..
Do. 4 % Deb. ..	100	5	5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	..	..	5 19 1	..	..	..
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98 xd	+ 2	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	..	..	5 5 3	..	..	..
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101 — 104	..	4 16 2	Un. Elec. Trams Monte Video ..	5	6	7	..	..	6 1 11	..	..	..
Kaloorie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 6 % Pref. ..	5	5	6	..	..	5 12 11	..	..	..
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	..	..	4 17 1	..	..	..
Do. 6 % B Deb. ..	100	5	6 1/2	56 — 60	..	10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	..	..	4 6 2	..	..	..

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	3 — 7	+ 1/2	6 17 2	Dick, Kerr ..	1	5	..	..	..	5 3 1	..	..	..
Do. 6 % Pref. ..	1	9	6	3 1/2 — 4 1/2	..	7 2 2	Do. Pref. ..	1	6	6	..	..	5 12 11	..	..	..
Babcock & Wilcox ..	1	26	28	6 1/2 — 6 3/4	..	5 0 0	Do. Deb. ..	100	4 1/2	4 1/2	..	..	4 10 0	..	..	..
Do. Pref. ..	1	6	6	1 1/2 — 1 3/4	..	3 16 10	Edison & Swan, A, £3 paid	5	Nil	..	..	..	Nil	..	..	..
B.I. & Helsby Cables ..	5	10	10	6 1/2 — 7 1/2	..	6 18 0	Do. fully paid ..	5	Nil	..	..	..	Nil	..	..	..
Do. Pref. ..	5	6	6	5 1/2 — 6 1/2	..	4 16 0	Do. 4 % Deb. ..	100	4	4	..	..	6 11 1	..	..	..
Do. Deb. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb. ..	100	5	5	..	..	6 8 2	..	..	..
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	91 1/2 — 94 1/2	..	4 15 3	Electric Construction ..	2	Nil	2 1/2	..	..	..	..	..	..
British Westinghouse, Pref. ..	3	Nil	..	..	..	Nil	Do. Pref. ..	2	7	7	..	..	7 9 4	..	..	..
Do. Deb. ..	100	4	4	63 — 66	..	6 1 3	Greenwood & Batley, Pref. ..	10	7	7	..	..	3 6 8	..	..	..
Do. 6 % Prior Lien ..	100	6	6	99 — 102	..	5 17 8	Do. Deb. ..	100	5	5	..	..	5 4 2	..	..	..
Browett, Lindley, Ord. ..	1	Nil	..	1/6 — 2/6	..	Nil	General Electric, Pref. ..	10	5	5	..	..	5 5 3	..	..	..
Do. Pref. ..	1	Nil	..	5/6 — 6/6	..	Nil	Do. Deb. ..	100	4	4	..	..	4 8 11	..	..	..
Brush, 7 % Pref. ..	2	Nil	..	0 — 1	..	Nil	Henley's, Ord. ..	5	15	10 1/2	..	..	6 0 0	..	..	..
Do. 5 % Prior Lien Deb. ..	100	5	5	77 1/2 — 82 1/2	..	6 1 3	Do. Pref. ..	5	4 1/2	4 1/2	..	..	4 6 9	..	..	..
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	54 — 59	..	7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	..	..	4 4 11	..	..	..
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	87 — 92	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	..	..	..	..	..	..
Callender's Cable ..	5	15	10 1/2	11 1/2 — 12	+ 1/2	6 5 0	Do. Pref. ..	10	5	5	..	..	4 17 7	..	..	..
Do. Pref. ..	5	5	5	5 — 5 1/2	..	4 15 3	Telegraph Construction ..	12	20	10 1/2	..	..	6 13 4	..	..	..
Do. Deb. ..	100	4 1/2	4 1/2	99 1/2 — 101 1/2	+ 1/2	4 8 8	Do. Deb. ..	100	4	4	..	..	4 9 0	..	..	..
Castner-Kellner ..	1	17 1/2	20	9 1/2 — 9 3/4	..	5 6 8	Willans & Robinson ..	1	Nil	..	..	..	Nil	..	..	..
Do. Deb. ..	100	4 1/2	4 1/2	105 — 109	..	4 10 7	Do. Pref. ..	5	Nil	..	..	..	Nil	..	..	..
Crompton & Co. ..	8	Nil	Nil	..	..	Nil	Do. Deb. ..	100	4	4	..	..	6 11 2	..	..	..
Do. Deb. ..	100	5	5	58 — 68	..	7 7 1										

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

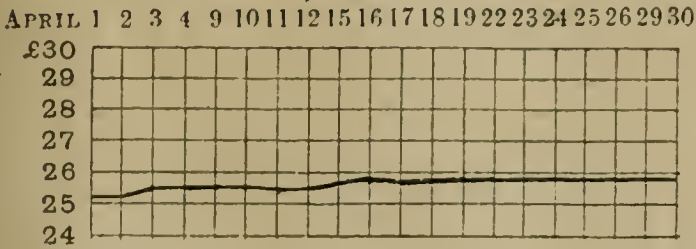
Bank rate of Discount 3 1/2 per cent., February 8th, 1912.



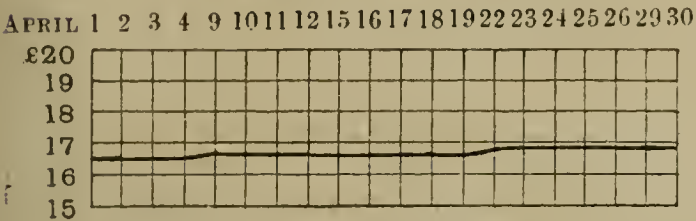
METAL MARKET.

Fluctuations in April.

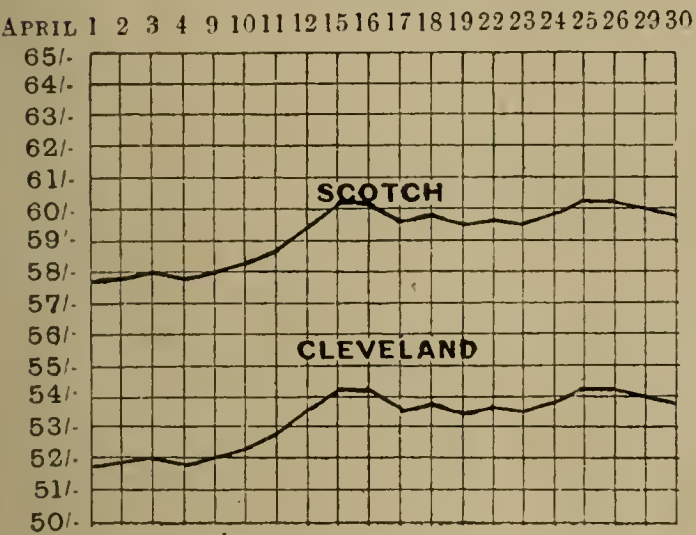
SPELTER (G.O.B's.).



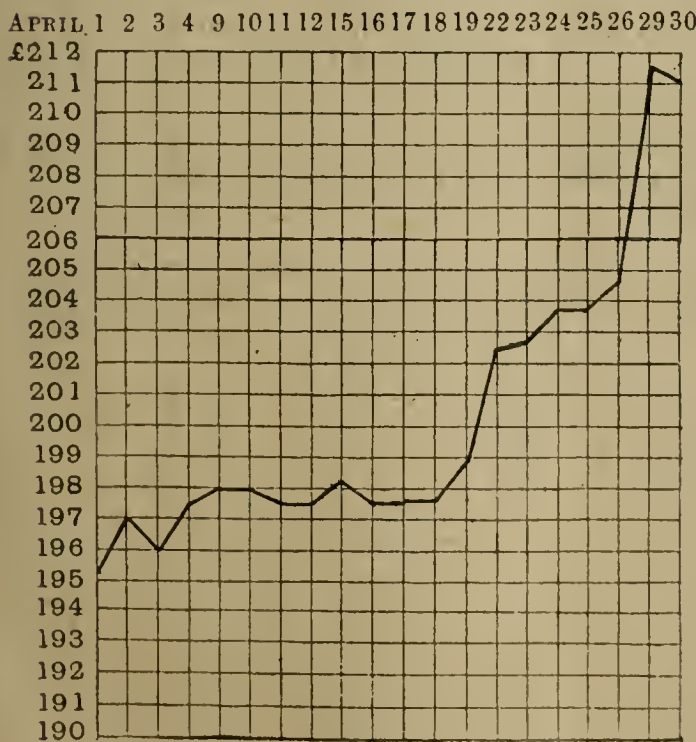
LEAD (ENGLISH).



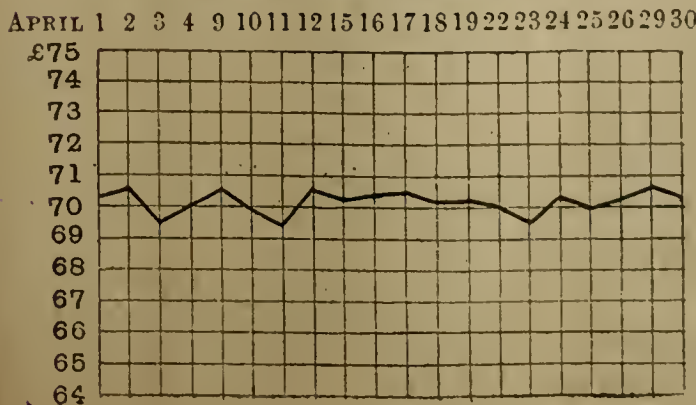
IRON.



TIN.



COPPER (G.M.B's.).



THE CHARACTERISTICS OF COPPER AND ALUMINIUM OVERHEAD LINE CONDUCTORS.

By E. V. PANNELL.

THE assertion has been made that in the sequence of processes involved in the production, distribution and utilisation of electric power the weakest link is in the transmission line, the same being far more liable to electrical or mechanical failure than any of the generating, transforming, or converting apparatus. Whether this statement be justifiable or no, it is certain that until recently considerably less attention and care have been devoted to the line than to the electro-dynamical plant, and only of late has the former received its due share of attention. In this country, of course, long-distance overhead transmission is only in its embryonic stage, and little in the way of operating data is available. When, however, the time is ripe, we shall undoubtedly profit by the experiences of transmission engineers in Europe and America who have accomplished the pioneer work in this field. Such engineers have by no means neglected to study the relative utility of various conducting materials, and it is far from being the claim of the author to have opened up a new subject. The object of this article is, however, to set forth a few rules by the use of which a comparison of line conductors may be readily made, and to attempt a few deductions from the same as far as apply to our British conditions.

In the field at the present day there may be said to be two active competitors as conducting materials, viz., copper and aluminium. In preference to the latter metal in its pure state, alloys have often been experimented with. Bearing in mind that the tensile strength of aluminium may be increased upwards of 60 per cent. by judicious alloying without a very great decrease in conductivity, this would seem to be justified. It is, however, found in practice that no such alloy is as resistant to corrosive effects as pure aluminium, and this disadvantage is sufficient to discount the use of alloys for bare overhead conductors. For abnormally long spans, stranded cables of steel have frequently been used both in Europe and America, but the drawbacks to their general use are quite apparent. To take advantage of the high tensile strength by spacing the supporting structures farther apart would result in so great an expenditure on the latter as entirely to off-set any saving on the conductors.

The comparative physical properties of copper and aluminium have been detailed at length on several occasions, and need not be dwelt on here. Such properties as are relevant to this investigation are set out in Table I below. It should be noted that the

TABLE I.—PROPERTIES OF COPPER AND ALUMINIUM STRANDED OVERHEAD CONDUCTORS.

		Copper.	Aluminium.
Relative conductivity %	...	100	60
Specific gravity	...	8.95	2.71
Relative weights for equal con-			
ductance	...	100	50
Relative cross-section	...	100	166
Tensile strength, lb. per sq. in.	...	60,000	30,000
Factor of safety	...	5	5
Maximum working stress	...	12,000	6,000
Modulus of elasticity	...	12,000,000	9,000,000
Specific extension $\lambda$	...	.00000008	.00000011
Coefficient of expansion $\alpha$	...	.0000093	.0000130
$\beta = \alpha/\lambda$	...	116	118
Extension in ft. for full working			
stress, 100 ft. span	...	.096	.066
Do. 200-ft. span	...	.192	.132
Do. 400-ft. span	...	.384	.264

physical constants are such as apply to stranded cables in both cases, as all schemes transmitting appreciable quantities of energy now use stranded conductors. This is more than usually true in this country, where it is doubtful if legislation will permit of the use of such high line voltages as render the use of a small solid conductor preferable to the equivalent stranded cable. Before leaving the question of fundamental properties, it should be mentioned that now



that such large quantities of high-grade aluminium are being produced for electrical work, the conductivity and tensile strength can be confidently guaranteed. Conductivity and freedom from corrosion are equally dependent on the purity of the metal, and improvements in production have rendered it possible to place upon the market aluminium of well over 99 per cent. purity.

The enormous outlay called for by the line conductors of a transmission scheme renders the economic question a vital one, and before a comparison such as this is justifiable the competing metal must show an advantage over copper in respect of capital invested. In this connection the diagram shown in fig. 1 gives a graphical means of estimating the

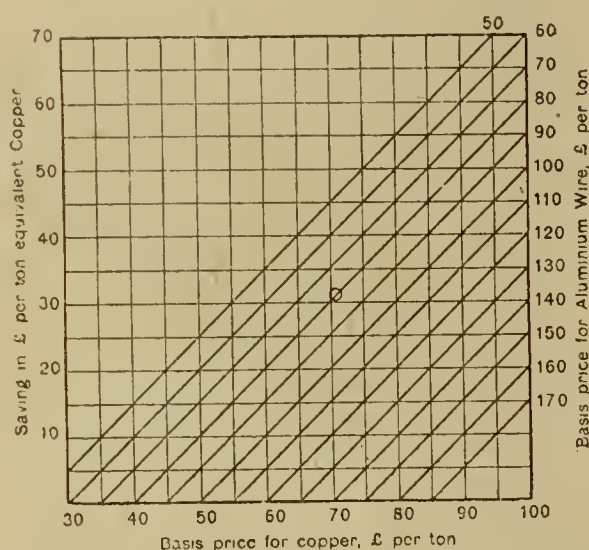


FIG. 1.—DIAGRAM FOR ESTIMATING THE SAVING EFFECTED BY THE USE OF ALUMINIUM.

difference of cost between the two metals, yielding the result in terms of pounds sterling by which aluminium is cheaper than copper per ton of the latter. The prices considered are the basis ones for wire in each case. A small circle has been inscribed to represent the approximate prices ruling at the time of preparation of this article (January, 1912), the figures being:—

Copper (per ton)	...	...	...	£71	0	0
Aluminium (half-ton)...	...	...	...	40	0	0
Saving in favour of aluminium	...	...	...	£31	0	0

This computation, of course, takes into account the fact of aluminium being for a given conductance exactly half the weight of copper. The extra charges for drawing and stranding are a function of the length of the cable, hence on a mileage basis are approximately equal for both metals. The saving as calculated on the above basis is therefore unaffected except where multi-stranded cables of small diameter wire are employed.

Turning to the technical problems involved, a starting point is fixed by the Board of Trade recommendations for overhead line construction. Briefly stated, these call for a stress in the conductor not exceeding one-fifth of the ultimate tensile, assuming a temperature of 22° F. and a horizontal wind pressure of 30 lb. per sq. ft. (corresponding to 18 lb. per sq. ft. on the projected surface of the wire). These values together with certain of the physical constants already set forth can by suitable manipulation be substituted in the standard equation for deflection and stress, where—

$$\text{Deflection at mid-span } \delta = w l^2 / 8 a s,$$

and in which  $w$  = loading per foot run, lb.;  $l$  = span in feet;  $a$  = cross-section of conductor, sq. in.;  $s$  = maximum working stress, lb. per sq. in. The deduction of this equation from the catenary need not be entered into here.

The loading on the wire ( $w$ ) is the resultant of its weight  $w$  and the wind pressure  $p$ —

$$w = \sqrt{w^2 + p^2}.$$

and the inclination of the plane in which the conductor will hang is given by—

$$\text{Angle with vertical } \theta = \tan^{-1} p/w,$$

the two forces  $p$  and  $w$  acting at right angles. In estimating these and other functions it has been found convenient to use as a basis the outside diameter of the cable. A relation

between this quantity and the sectional area has been plotted in fig. 2, and the approximation is very close indeed.

The loading ( $w$ ) is shown by the curves in fig. 3, which are plotted from the figures set out in Table II, and in which

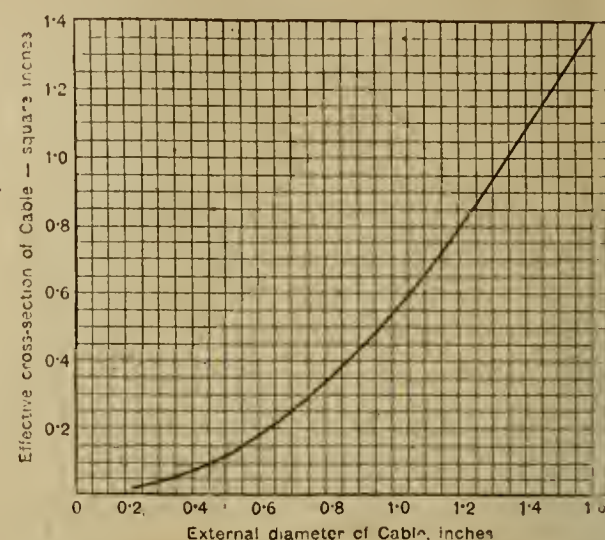


FIG. 2.—DIAMETER OF STRANDED CONDUCTORS.

both of the components and the resultant have been plotted as a function of the cable diameter. The enormous preponderance of wind over weight loading in the smaller sizes will be noted. This, however, only represents abnormal con-

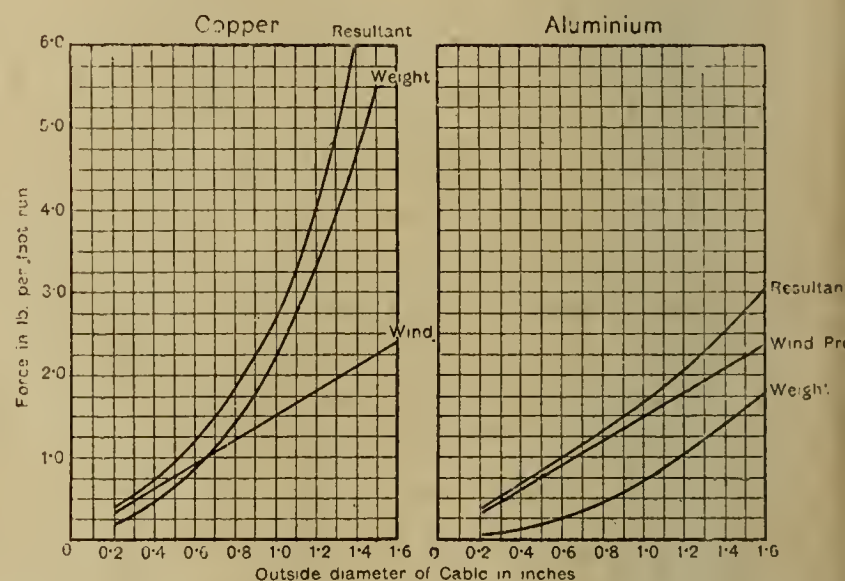


FIG. 3.—LOADING DUE TO WEIGHT AND WIND-PRESSURE ON OVERHEAD CONDUCTORS.

ditions, inasmuch as the specified pressure of 30 lb. per sq. ft. is only realised under extraordinarily tempestuous circumstances.

TABLE II.—PARTICULARS OF STRANDED OVERHEAD CONDUCTORS.

Dia. of cable, in.	Effective cross-section, sq. in.	Weight, per ft., lb.	Wind pressure per ft., lb.	Resultant force per ft., lb.
COPPER.				
0.40	0.10	0.40	0.60	0.72
0.60	0.22	0.81	0.90	1.21
0.80	0.38	1.43	1.20	1.80
1.00	0.60	2.24	1.50	2.70
1.20	0.84	3.34	1.80	3.90
1.40	1.15	4.65	2.10	6.00
ALUMINIUM.				
0.40	0.10	0.12	0.60	0.62
0.60	0.22	0.26	0.90	1.00
0.80	0.38	0.44	1.20	1.30
1.00	0.60	0.69	1.50	1.65
1.20	0.84	1.01	1.80	2.05
1.40	1.15	1.40	2.10	2.50

As already stated, the formula above given represents the conditions obtaining at minimum temperature, 22° F. With increase of temperature the factor of linear expansion will come into play and the deflection will increase. It is highly important to know the value of the maximum deflection under conditions of high summer temperature, in order that the minimum distance of the line above ground-level may be observed and the height of the poles chosen in accordance with the same.

Considering therefore the effect of a rise in temperature =  $t^\circ$  F., if  $a$  = expansion coefficient and  $L$  = total length of conductor, the expansion for a rise of  $t^\circ$  =  $La$ , and total length,  $L = l + La$ .



Now, from the properties of the catenary—

$$L = l + 8 \delta^2 3 l \text{ and } L_1 = l + 8 \delta_1^2 3 l$$

$$(L_1 - L) = 8 (\delta_1^2 - \delta^2) 3 l,$$

but  $L_1 - L =$  extension for temperature rise  $t' = l a t$ , hence—

$$l a t = 8 (\delta_1^2 - \delta^2) 3 l \text{ and } t = 8 (\delta_1^2 - \delta^2) 3 l^2 a.$$

It has been thought desirable to manipulate the temperature-deflection equation in the above form in order that a correction for the elastic stretch of the wire may be

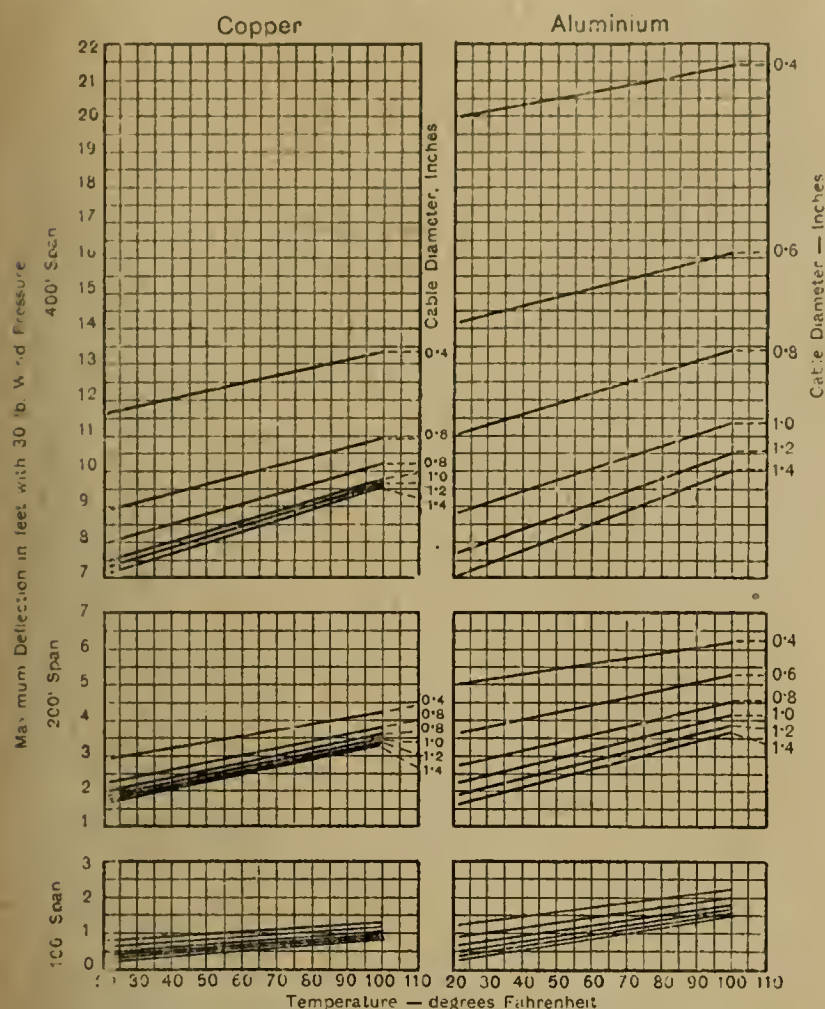


FIG. 4.—DEFLECTIONS ON OVERHEAD CONDUCTORS UNDER VARYING CONDITIONS OF TEMPERATURE.

more readily made. It will readily be seen that as the cable expands with increased temperature the stress is relieved. This reduction of stress, however, gives a diminution of strain, and the conductor will, therefore, extend, due to temperature rise, by an amount which is *less* than that calculated by the shortening due to reduction of stress. From the other standpoint it will be seen that the temperature rise for a

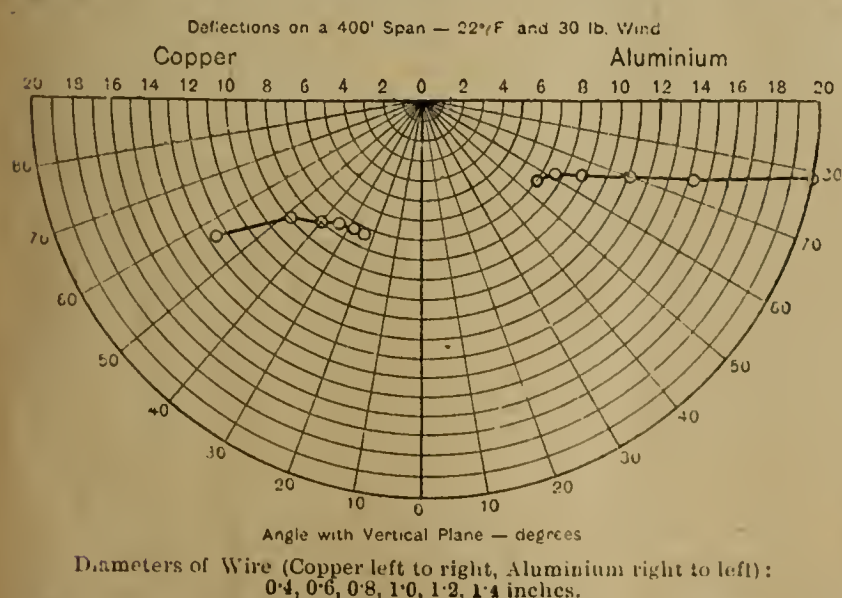


FIG. 5.—POLAR DIAGRAM SHOWING THE ANGLE BY WHICH CONDUCTORS ARE BLOWN OUT OF THE VERTICAL.

given deflection will be *greater* than that worked out from the above formula. The correction may, therefore, most conveniently take the form of an increment to the calculated temperature rise. The correction used is a modification of that suggested by Mr. Shields in the discussion on a paper by Burne on "Overhead Constructions" (*Journal I.E.E.*, Vol. XXXI., p. 432), which was read before this Institution some ten years ago.

This correction may be made as follows:— $a =$  per cent. extension per °F.  $\lambda =$  per cent. extension per lb. per sq. in. stress.  $\beta = a/\lambda$ .

Now for a change in deflection  $= \delta_1 - \delta$ , there is a change in stress  $= s_1 - s$ , and  $s_1 = s \delta/\delta_1$ ; hence the increment for correcting the above temperature  $= (s_1 - s)/\beta$ , and this should be added to the right-hand side of the equation.

On this basis the curves in fig. 4 have been plotted and the results tabulated. It will be noted that maximum wind pressure is assumed throughout, hence the deflection is not only considerably above the normal value, but the conductor will be swung out of the perpendicular by a considerable angle. As already shown the value of this angle is  $\tan^{-1} \beta/\mu$ . It is, therefore, unaffected by temperature, and only depends upon the wind pressure and the weight of the wire. Fig. 5 shows this feature graphically, the values of deflection for a 400-ft. span, at 22°F. and the maximum wind pressure, being plotted in polars.

From the curves in figs. 4 and 5 will be seen, as might be expected, the relatively greater deflections on aluminium conductors, and the greater effect of a given wind pressure. It should be noted, however, that this is largely due to the abnormal value assumed for the latter quantity. Moreover, as will be seen later, a deflection double that of a copper conductor need only call for a pole 10 per cent. higher. The fact that the greater factor in the loading on aluminium cables is this assumed wind pressure, is an advantage on the side of conductors of this material. Under normal circumstances, with moderate winds, the weight of the cable is the more potent factor of the loading, and this value being 50 per cent. lower for the aluminium cables, it follows that the *average* stress in such will be lower in value. This is by no means an unimportant point, as the lower the average stress on any section, the less is the liability to fatigue.

(To be concluded.)

## EXHIBITIONS AND LECTURES.

[COMMUNICATED.]

THE organisation of a local Exhibition is a task of no small magnitude, as all who have been responsible for one will admit. At the outset, one must be prepared to face almost every kind of difficulty, and to do a vast deal of thankless work. Things have a knack of going wrong at the last moment, and the organiser is so dependent upon others that his individual efforts do not count for as much as he could wish. The secret of a successful Exhibition is system. If it be well thought out beforehand down to the smallest details, and if the correspondence and records generally be properly conducted, much labour will be saved and trouble avoided; on the other hand, if the arrangements be made without the necessary amount of foresight and care, the task will undoubtedly prove an arduous one.

Of the value of an Exhibition, there can in most cases be no two opinions. It is conceivable that districts will vary in this respect, but, generally speaking, a really good and well-advertised show will draw a public of the right class, even when the supply has come to be looked upon as a matter of course, and is no longer a novelty. In small provincial towns Exhibitions are always popular, and the bulk of the residents may be counted on to attend; in larger towns the case is different, and one must be contented with a smaller proportion.

Assuming that conditions seem favourable for holding an Exhibition, and that it has been decided upon, the first step is to choose the right time of the year. In most instances this will be in the late autumn or early winter, as that is the time people begin to have the necessity for lighting and heating forced upon them. Local conditions, however, may materially alter this date, as, for instance, in the case of a pleasure resort, where the winter is a stagnant time and summer is the busy season. After having sounded local and other contractors, the next step will be to secure the hall in which the Exhibition is to be held, taking into full consideration such important details as position, size, and general suitability, and also in some cases, the capability of the distributing mains to carry the temporary excessive load.



As a rule, the Town Hall, Public Swimming Baths, and a Drill Hall are available, and the choice must fall upon the position which best meets the all-round requirements of publicity, convenience, and reasonable cost. An agreement will in all probability be asked for incorporating a clause to the effect that all damage to the premises will be made good by the hirer, and as this may easily run into a considerable sum, the exhibitors must be carefully watched when erecting their stalls.

The length of time the Exhibition shall last is an important point which must be given much consideration. Roughly, it should vary with the size of the town, from, say, three or four days in the provinces, to a fortnight in London or the larger cities. Interest will not be held for a greater period than a fortnight, and in a small provincial town a week is the most that can be counted on. The hours of opening should not be longer than from 11 a.m. to 10 p.m. excepting perhaps on the last night (preferably a Saturday) when closing might be postponed to 11 o'clock. Such preliminary details having been settled provisionally, the next step should be the preparation of a ground plan of the hall, fully dimensioned to scale, or better still, on squared paper, roughly setting out the proposed arrangement of stalls, &c. This will enable the exhibitors to choose their positions, the indication of which on the plan will obviate the possibility of any dispute later. It should not be forgotten that owing to the numerous calls made upon them to assist electricity supply exhibitions by the loan of apparatus, the majority of manufacturing firms have jointly agreed to refuse such applications, and will not now exhibit directly. This is, in a way, more satisfactory for the organisers, as it reduces the number of exhibitors with whom he has to deal and relieves him of some responsibility. The most effective and simplest means of getting in touch with firms willing to exhibit is an advertisement in the electrical papers, setting forth the date of the opening and closing, and the chief conditions with which exhibitors will be asked to comply. This brings us to a rather important question upon which there may be some divergence of opinion. Although not the rule, it seems only fair that each exhibitor should bear part of the cost and pay rental for the space he occupies. It is best to supply current free up to a certain definite maximum demand in kw. to be agreed upon in each case, but all other costs such as carriage, stall hire, and erection and attendance, should be defrayed by the exhibitor. It is as well, in each instance, to set this forth in the form of an agreement or stamped letter, making particular mention of the carriage item which is one that usually gives the most trouble. Responsibility for packing cases, damage to hall, and similar details, should be clearly defined, and the arrangements should of course be rigidly adhered to.

It is when the goods begin to arrive that the necessity for a thorough system becomes apparent. It must be one man's work to take charge of their reception and dispatch, carefully checking all arrivals with the advice notes, and signing for nothing unless he is certain it is undamaged. Further, he should see that all the cases are safely disposed of for the time being, and should ascertain that they bear the owner's name. It will also be his duty to superintend the packing and return of goods where necessary.

During the fitting up of the Exhibition it is most desirable that a representative of the organisers should be present the whole time to prevent damage being done to the building and generally to see that the work is carried out properly with all due precautions against fire or other mishap. Failure of any sort should be most carefully guarded against, and to this end it is necessary to check the operations of the temporary men so often employed on exhibitions.

The question of charging for entrance is a moot one, and it is impossible to recommend any definite course without studying the peculiar conditions of the district. In the writer's opinion, it is best in most cases to impose a small entry fee of, say, 6d., with the object of keeping out the undesirable section of the populace, such as roughs and children; but an equally good scheme, excepting for the loss of revenue, is to allow free admission on presentation of visiting cards. Neither system can be rigidly adhered to, and the door-keeper must be given discretionary powers in this respect. All actual consumers should be forwarded a

free pass, and there should be a certain number of season tickets for use in special cases.

Needless to say, the Exhibition must be well advertised, and so far as existing and prospective consumers are concerned there is no better way than to send a ticket and some particulars. To reach the general public, posters should be employed in conjunction with hand-bills and a good displayed advertisement in the local press. The hand-bills may be circulated cheaply and effectively through the medium of friendly tradespeople, who will often agree to place them on their counters; and the presentation of a free pass will generally induce the smaller shopkeepers to display a poster. Advertising should not be attempted earlier than a fortnight before the opening, as otherwise it is apt to get stale and become forgotten. Posters, too, will deteriorate and lose all their attractiveness by the time they are most needed if hung too soon.

The opening of the Exhibition should be performed by some person of good local social standing, such as the member, the Mayor, Mayoress or chief property owner. The Press should be provided beforehand with an article describing the exhibits and making mention of such points as the management wish brought into special prominence. This course is particularly desirable as the lay reporter is apt to get inextricably muddled with technicalities and may unintentionally do more harm than good. He will appreciate the courtesy equally with the lunch or light refreshment that should be provided for him.

If it be decided to issue a catalogue of the exhibits—and something in this line is generally desirable—the firms who are showing should be approached at an early date to furnish the matter and blocks for their space, a restriction being placed on the number of words. When this has all been collected and the best has been done for such firms as may have neglected to send full particulars, it should be made up in dummy form, including advertisements and any local matter deemed necessary. In pursuance of a policy which does not impose annoying extras on the exhibitors they should be allowed a certain amount of space free for advertisement, this item having been taken into consideration when arriving at the amount that shall be charged for floor space. The catalogues will generally sell at a penny, but if the finances appear flourishing they should be given away as they are by no means bad advertisements.

On the subject of the exhibits there is little to be said since it goes without saying that they should be as inclusive as possible. The matter not being entirely in the hands of the organisers it becomes necessary, within limits, to take whatever is offered and be duly thankful. There are, however, one or two special features that may be mentioned, including the office or stall of the supply management. It is not necessary to exhibit anything, as we can assume that the whole field is covered by the contractors; the function of the office is rather that of an inquiry department where information of any sort is available and can be dispensed to the accompaniment of a cigar, or in the case of ladies a cup of tea. It should be enclosed from the public view, tastefully fitted with hired or loaned furniture, and provided with a stock of the department's pamphlets, and price lists of every description. More business is done by such means than by any amount of talk in a crowded hall, and the slight extra expense should on no account be allowed to stand in the way. Diagrams should be prepared and hung on the walls showing, where possible, the increase in lamps connected, and illustrating such points as the comparative floor space taken up by motors and gas engines, and the amount of air vitiation by various illuminants. They will come in afterwards for the office or showroom, and are always useful.

A most effective way of demonstrating the value and convenience of electric light and heat is to fit up one or two model rooms, equipping them with up-to-date electrical apparatus in working order. An upholsterer will generally be found to lend the furniture, and the electrical exhibits can be obtained from the local contractors. Even a small hall will contain a couple of such rooms, which can be built at little cost with matchboarding covered with a cheap plain paper. What are generally termed side shows, and exhibits of a nature foreign to that of the exhibition, should, if possible, be dispensed with. The writer has seen gas



exhibitions where, to make both ends meet, all sorts of miscellaneous trades have been admitted, together with "flying ladies" and other denizens of the penny gaff. Proprietors of such shows will often pay handsomely for space, and hence the temptation is great, but the effect is bad in the extreme since the better class, whom it is chiefly desired to reach, are deterred from patronising the exhibition. If the noise of running machinery is not too great, a band performing at stated intervals will give an additional popularity, and failing this an electrical piano is a good substitute. Only in the largest undertakings would it be possible to include a restaurant of larger proportions than the usual tea stall, but in any case some such arrangement should be made, as it affords an excellent opportunity of demonstrating electrical cooking in actual practice. Plenty of caterers will be found willing to undertake the supply and management of the stall or restaurant, but in most cases it will be necessary to allot them space free as the business done is not great.

Before leaving the subject of Exhibitions, it may be helpful to tabulate the chief items of expenses and receipts. For anything but abnormal conditions, the following will be found practically to cover the ground on both sides:—

EXPENSES.	RECEIPTS.
Current at cost.	Rent of space.
Rent of hall.	Sale of admission tickets.
Insurance of exhibits.	Sale of catalogues.
Advertising.	
Catalogues and tickets.	
Office of management.	
Orchestra.	
Cost of main in hall, and—possibly— new service.	
Extra wages.	
Small sundries.	

Necessarily many of these items are difficult to arrive at, and in estimating the results beforehand a good sum should be allowed for contingencies.

Upon the subject of lectures little can be said beyond the general statement that although direct results cannot usually be traced to them, there is no doubt that in some instances they have proved of value. Assuming good organisation, success will entirely depend upon the locality. In some districts lectures dealing with modern applications of electricity illustrated by experiments and working apparatus have done much to help development; in others they have proved more or less fruitless, attracting little or no attention. Before inaugurating any such scheme it is necessary to consider very carefully the temperament of the local population, always bearing in mind that electric cooking, for instance, at present necessitates expensive apparatus, and, therefore, need not be preached to a working class audience. The value of lectures probably lies more in the interest they stimulate in electrical matters generally than in the publicity they give to any particular piece of apparatus. Perhaps the best manner of feeling the local pulse is to offer the services of a lecturer to some society which makes a feature of inaugurating series of educational lectures. If interest be awakened a special series might be started, tickets being sent to every consumer, actual and potential. The experiment is worth making, as the cost may easily be kept within reasonable bounds; if a good audience of the right class can be secured, there is no doubt that lectures will materially help in the task of educating the consumer.

Lectures to employes are a prominent feature in the organisation of several American electricity supply companies. In London, the Gas Light and Coke Co. have for some time past taken full advantage of this indirect means of expanding and improving their business, but little, if anything, has been done by electricity supply concerns, although there can be no question as to the value of a staff whose lay members, to say nothing of the engineering side, are equipped with sufficient technical knowledge to enable them to understand the why and wherefore of every detail of their work. This question is, perhaps, more one of general policy than publicity, but, at the same time it has an important bearing on the latter in an indirect way.

Having no example in this country beyond the enterprising Gas Light and Coke Co., it is necessary again to turn to America, where several instances may be found. The New York Edison Co. have taken up the matter very thoroughly,

and in their office building have provided a large lecture hall, which is used chiefly for this purpose. Direct and alternating current, and also a gas supply, are laid on to the lecture table, and the experimental equipment includes arc and incandescent lamps of all types, motors, and heating and cooking apparatus. In addition, there are the necessary measuring instruments, the readings of which are thrown on a screen by the aid of an electric lantern. The lectures extend over the whole field of electricity supply, including the necessary amount of theory. They are delivered twice on the same day, at 1.30 p.m. and 8 p.m., with the object of allowing all members of the staff to attend, and as proof that they are appreciated it is only needful to say that the first 12 lectures delivered were attended by a total of about 4,000 men. This company also provides a technical library for the use of its employes. The educational scheme has so far proved a great success, and besides awakening interest in the work has stimulated industry in many directions.

## PROCEEDINGS OF INSTITUTIONS.

### High-Tension Porcelain Line Insulators.

By J. LUSTGARTEN, M.Sc., A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, March 12th, 1912.)

ELECTRICAL porcelain is eminently suitable for permanent exposed insulation, for which it best fulfils the necessary requirements.

In England the body is made up of kaolin, plastic or ball clay, flint, Cornish stone, and felspar. On the Continent the mixtures generally contain only kaolin, felspar, and quartz, and the resulting porcelain is whiter, while the electric strength is probably greater.

Before glazing the English vitrified insulator, though hard and of good electric strength, has a surface which attracts moisture, though without sensibly absorbing it; this surface would gather dirt and soot, and, owing to the superficial irregularities, would be very difficult to clean. For this reason, and no other, a coating of smooth and durable glaze is used. The ingredients of this glaze are kaolin, borax, felspar, whiting, and lead monoxide. The glaze may contain different metallic oxides to give either a yellow, brown, green, blue, or black colour. These oxides are non-conducting, and therefore do not affect the insulating properties of the porcelain.

In German practice the unvitrified porcelain is dipped into glaze, which consists only of feldspathic materials and quartz, and is subjected to a second firing, which vitrifies the body and matures the glaze at one operation. Of the coloured glazes, brown and green are the only ones that can be successfully produced under these manufacturing conditions.

The American method is very similar to the German. The conventional design of American insulators is by nesting thinner and more shells together than in the European design.

The density of porcelain is about 2.3 to 2.4; English electric porcelains will not absorb water, whether glazed or unglazed. To detect absorption dip a broken piece of the insulator into water coloured with anilin or fuchsin. No coloration should be maintained at the break. Bad porcelain can be detected by its adhering to the tongue.

The linear expansion coefficient of hard porcelain is between 0.000045 and 0.000065 (C.), being less than that of glass. This is a recommendation as the porcelain will withstand changes of temperature better. The more felspar in it the greater the linear coefficient; flint has the opposite effect. The relative heat conductivity to that of silver (taken as 100 per cent.) is 0.045 per cent. Its specific heat is 0.17.

The surface leakage is more important than leakage through the material, and has nothing to do with the material itself, but depends upon the humidity of the air and other circumstances affecting the surface. With clean glazed porcelain at normal temperature and humidity the specific resistance on a test-piece amounted to  $2 \times 10^{12}$  megohms. The dielectric constant obtained with direct current is about 5.3. With alternating current the value for a frequency of 50 is about 10 per cent. less, diminishing a further 3 per cent. for a frequency of 100.

The requirement for a high electric strength is a thoroughly homogeneous and vitrified mass, which, however, is difficult to attain with increasing thickness. The puncture voltage of porcelain plates tested between a sphere and a plate is 30 kilovolts for 0.1 in., 55 for 0.2 in., and 94 for 0.4 in. (R.M.S. values).

The mechanical strength of porcelain in compression is about 30 tons per sq. in. The exact tensile strength is difficult to obtain; the mean is about 10 tons per sq. in. The shearing stress of good cement is about 1,600 lb. per sq. in.

The long spans which have come into use subject the insulator to very great stresses, especially at corners and dead-ends. In the pin type the pin is threaded up into the head of the insulator, so that the porcelain is only in compression but not in shear. The insulator can be designed to withstand such heavy testing loads as 3 to 4 tons, the pin bending before fracture of the porcelain commences. The suspension cemented type can be designed to withstand a con



tinued shear and tension up to 5 tons. In practice, conditions are arranged so that the wire will break or the pin will bend before the porcelain gives way.

In high-tension insulators the surface resistance is of subsidiary importance. The sparking between two electrodes on a surface does not depend upon the surface resistance (except when moisture is deposited).

Improvements in the process of manufacture have made it possible to produce a thickness of shell of  $\frac{3}{4}$  in. to withstand 100 K.V.; above this small cracks or flaws in the interior are likely

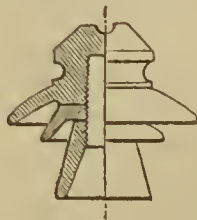
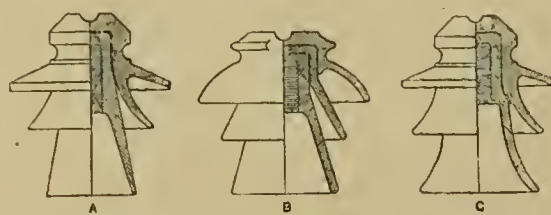


FIG. 1.—SOLID INSULATOR OF THREE SECTIONS BEFORE FIRING.

to occur. The practice in this country and America is to make two-piece insulators for line pressures from 10 to 30 K.V., and three-piece from 30 to 50 K.V.; above this in America four-piece insulators are made up to 70 K.V.; but suspension insulators are rapidly superseding the pin type from 60 K.V. On the Continent the single-piece insulator is general up to 20 K.V., and the two-piece to 60 K.V.

The necessity for providing large air-spaces is due to the flux density, which depends upon the thicknesses of porcelain and air encountered in the path of the flux. At the neck the flux density is greatest. The insulator with large masses of porcelain and narrow air-spaces will not only require a greater charging current, but will also have a tendency to glow in the air-pockets.

As the pin shell has the smallest diameter at the neck of the insulator, the flux penetrating will produce a greater potential



A, English (Bullers); B, American (Locke); C, German (Hermsdorf).

FIG. 2.—PIN TYPES FOR LINE PRESSURES OF 35 K.V.

gradient than the others. Out of 10,480 three-piece insulators tested to a dry flash-over voltage of 195 K.V. for three minutes, 4,172 failed, of which 2,317 failed in the pin shell, namely, about 55.5 per cent. Of the failures, 81.6 involved the pin shell.

The necessity for a large cylindrical air-space between the bolt and the lowest shed is evident. A narrow air-space may lead to brush discharges within, especially when the lowest shed is wet. Curving the lowest shed outwards, a greater striking distance between it and the bolt is provided.

Long insulator parts have a large capacity, and do not resist sudden stresses well. Shorter insulators give a better distribution of the flux, and enable the bolt to be shorter, thus securing additional mechanical strength. Large diameters give increased capacity. Wide and high insulators both give increased electric charge, and flash-over takes place by surface sparks.

The two forms of electric discharge—the brush and surface spark—are responsible for the flash-over of an insulator in the dry state, the brush predominating in the case of small pin insulators, the

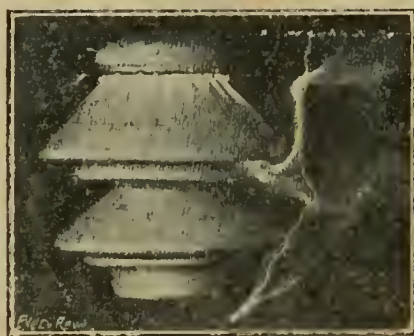


FIG. 3.—SURFACE, PILOT SPARK, AND ARC ON ITALIAN INSULATOR.

surface spark for very large insulators, and a combination of the two forms for medium-sized insulators.

As the pressure on the insulator is gradually increased a glow appears at the neck and extends to a surface brush down the shed, as in fig. 3. The glow may also commence within the pin shed and at joints if the flux densities are high and are sufficient to produce the requisite ionisation. With increase of pressure on the top shed, streamers or surface sparks will form. Meanwhile brush discharges start from the bolt and the line wire, commencing earlier from the wire if placed in the side instead of the top groove of the neck. On small insulators these brush discharges produce the pilot spark, which may reach to the neck via the surface brush or direct to the

line wire, as in fig. 3, according to the potential gradient acting along these respective paths.

The length of the surface brush is influenced by the humidity of the air, though not sufficiently to affect the flash-over of small insulators. For medium-sized insulators the flash-over voltage is increased 3 to 9 per cent. and for the largest constructed the maximum increase is about 20 per cent. with increase of humidity. When the humidity is 100 per cent. moisture is deposited on the surfaces, and a lowering for all sizes will be produced.

Rain alters the appearance of the discharges, the alteration depending upon the amount and the direction of rainfall. With a fine drizzle and no wind the top surface becomes wet and the glow and surface brush disappear, but give place to glowing drops of water at the edge of the top flange. The flash-over voltage is reduced on account of the diminished spark distance and the point action of the elongated drops. With a more intense rainfall the brush discharges take place from glowing raindrops of one shed to the moist part of another, and the spark selects the shortest path to these conducting places. When the rain stops the moist surfaces are soon dried by the heating effect of the leakage current and by the action of the electric field.

A high potential surge due to a direct lightning stroke or to induction in the neighbourhood of the line may cause one or more

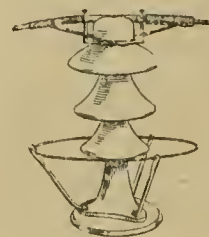


FIG. 4.



FIG. 5.

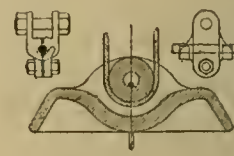


FIG. 6.

FIG. 4.—LONG SHEDDED INSULATOR WITH NICHOLSON'S ARCING RINGS.

FIG. 5.—HERMSDORF METAL SHED PIN TYPE INSULATOR.

FIG. 6.—HEWLETT INTERLINK SUSPENSION TYPE, AND BULLERS' CABLE CLAMPS.

insulators to flash over, on account of the difficulty with which the charges travel along the line to the protective devices. Since insulators are now designed to flash over—rather than to puncture—the question of affording complete protection against damage by arcs is important. A simple method has been devised by Nicholson. He uses two metal rings concentric with the insulator, the lower (of greater diameter than the insulator) attached to the pin, and the upper ring (somewhat larger than the neck of the insulator) suspended from and connected to the transmission line (fig. 4). The rings serve as a safety gap for the arc. That this device has been effective has been shown by tests made on the 60-K.V. three-phase transmission line of the Niagara, Lockport and Ontario Power Co.



FIG. 7.



FIG. 8.

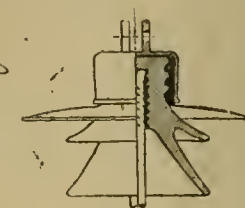


FIG. 9.

FIG. 7.—SUSPENSION SERIES.

FIG. 8.—HERMSDORF SUNKEN-CAP TYPE.

FIG. 9.—HERMSDORF METAL SHED TYPE.

with a 30,000-KW. arc at the line pressure. In no instance was an insulator damaged.

A shorter insulator has been designed which replaces the topmost insulator of the line. Experience shows that more than three-fourths of the insulators broken were top insulators.

The earthed metal ring effects a redistribution of the field. It takes up part of the flux which would otherwise enter the pin shed, thus producing a less flux density and causing a more uniform distribution among the other sheds, with less danger to all the sheds.

Fig. 5 shows the Hermsdorf patent metal-shed insulator. The metal shed of large diameter effectively protects the porcelain parts against wetting, and its weight and price are less. These advantages are greatest at voltages between 40 and 70 K.V., but below 25 K.V. they are not maintained. The diminution in leakage-path in this insulator is counterbalanced by the protection it offers to rain. Since the brush discharges occur later, and since the production of surface sparks is minimised (being less wet), the insulator can be made shorter.

The increase in line voltage to 110 K.V.\* has brought about the introduction and development of the suspended type of insulator, on account of the large increase in weight and cost of the pin insulator required. Above a pressure of 50 K.V. the weight and size of the pin insulator increase rapidly, almost as the third power of the voltage. The price will have a similar relationship.

The weight and price of the suspension units, on the other hand, will increase linearly with increasing voltage, each disk added for increased line pressure being identical: 60 K.V. may be taken as the pressure at which the suspension insulator becomes economical.

\* A line of 135 K.V. is at present under construction, and higher pressures will be only a question of time until corona on the line wires will be the next question to consider.



The suspension type is better cleansed by rain, its simple construction and comparatively small size give no difficulty in manufacture, and the suspension of the wire below the earthed cross-arm causes less disturbance of the line due to lightning.

One type—the link insulator—has two interlinked, semicircular holes for tie wires. The second type has the metal parts concentric. These consist of a metal cap and a bolt cemented to the porcelain.

With the first type, in case an insulator breaks, the tie wires will still hold the other units together, and, with the ample safety factor, prevent a shutdown. The tie wires may break from the constant rubbing in the holes and from a possible corrosion by ozone produced by any electric discharge in the holes.

Fig. 6, the Hewlett form of the General Electric Company, is made in two diameters, 6 in. and 10 in., of lengths  $2\frac{1}{2}$  in. and  $2\frac{3}{4}$  in. respectively. The larger unit has a dry flash-over of about 80 to 95 k.v., and wet 50 to 56 k.v. It is rated for a line voltage of 25 k.v. Four in series are being used on the 80 k.v. Victoria Falls and Transvaal Power Company's transmission line (length 45 miles) in South Africa; but on a new line of the same company five are being specified. The 6-in. diameter unit gives a dry flash-over of about 50 k.v., and wet 30 k.v. Two units in series are used at Hayle, Cornwall, on a 10 k.v. line of Edmundson's Electricity Corporation.

The larger insulators are tested to 3 tons (compression), and the smaller to  $1\frac{1}{2}$  tons.

The cemented type can be made so that the porcelain is partly in compression and partly in tension. When an insulator of this type fails under mechanical stress, it is by shear and tension combined.

Fig. 8 is a Hermsdorf type, with a sunken cap, which gives the unit greater mechanical strength and enables the units to be brought nearer together. A mechanical test shows that the first fracturing of the porcelain occurs at  $5\frac{1}{2}$  tons: at 8 tons the bolt is torn out. It is to be employed five in series on the first European 110 k.v. transmission line—Lauchhammer-Gröditz. The total height of the



FIG. 10.—SPARKING OVER FLANGES OF A SUSPENSION SERIES UNDER RAIN.

group will be 3 ft. 9 in., whereas on the American lines the height of suspension groups is 4 to 6 ft. Fig. 9 is a metal-shed form. By curving the metal shed more, better mechanical protection and provision against weather are obtained.

The separation of the shells has introduced large air-spaces, thus the total capacity and charging current have decreased considerably. The distribution of flux density is more uniform than before separation, and therefore there is less liability to puncture. The larger number of units which can be used in contrast with the number of sheds in the pin type, diminishes the flux, the flux density, and the puncture risk; as the line pressures are increased the addition of units gives still the same displacement current. Contrast this with the pin-type insulator, which *increases* in capacity for the higher line pressures.

The relation of dry flash-over voltage is not proportional to the number of units. But the safety factor against flash-over (*i.e.*, ratio of flash-over to line voltage) is made smaller for higher pressures, hence as a first approximation the number of units is proportional to the line voltage.

The curve of (wet) flash-over voltage and number of units is practically linear. This is a great contrast to the pin-type insulator. Thus the factor of safety—namely, ratio of wet flash-over voltage to line voltage—is higher for a suspension series for 110 k.v. than for a pin-type insulator of even 60 k.v.

Flashing over individual units is not desirable, as large power arcs tend to fracture the porcelain.

To safeguard suspension insulators the arcing rings mentioned above can be utilised. For instance, for six units of the type shown in fig. 10 a ring on the topmost cap, another on the line-wire clamp, and one on the middle unit, should amply protect the series from a large power arc.

In view of the increasing demand for high pressure, many electrical porcelain works have installed transformers up to 300 k.v. There are three methods of measuring the pressure: (1) by transformer ratio; (2) by the Kelvin electrostatic voltmeter reading to 100 k.v. and (3) by a spark-gap. In the first method the pressure of the primary is obtained on a Kelvin electrostatic voltmeter (with mirror attachment) and a scale length of 3 ft., corresponding to 120 volts. The range of the voltmeter is increased to 600 volts by

a resistance of 100,000 ohms placed across the primary and tapped in five sections. A high resistance (20,000 ohms per kilovolt) placed on the secondary winding of the transformer enables the same voltmeter to read up to 60 k.v. Oscillograph records and the spark-gap enable the maximum values of the pressure to be determined.

With regard to the spark-gap, there is a tendency to measure voltage by the needle-point spark-gap standardised by the American Institute of Electrical Engineers. Those who have worked with the gap specified know that it is difficult to check the American values and even to repeat their own results on successive days. The reason for this lies in the effects on the brush discharge of humidity, pressure, and temperature, position of the needles with respect to the supports and neighbouring objects, and the local conditions of the circuit. The author uses spheres, the diameters being chosen so that no brush discharge, or rather no glow, shall be observed at the sparking voltage. The effect of humidity is eliminated. The effect of temperature can be corrected—the spark potential varying inversely as the absolute temperature. Variations in atmospheric pressure affect the spark potential less before the brush stage than after. Up to 70 k.v. (R.M.S. values) 2 cm. diameter spheres are suitable, to 125 k.v. 5 cm., and 200 k.v. 10 cm.

The spark voltage is determined by the maximum, and not by the R.M.S. value, so that dividing the results obtained with the spark-gap by  $\sqrt{2}$ , the equivalent R.M.S. sine volts are obtained.

The puncture test is the routine factory test applied to each shell, and the completed multi-piece insulator, to ensure against faults. The shells are tested by inverting and filling with water the unglazed parts where the cement is to be attached to the groove of the neck of the head-piece, and to the bolt-hole in the case of the pin shed. Connections are made to the water inside by brass chains hanging from rods overhead.

Each shell of a large multi-piece pin insulator is designed to have a flash-over voltage equal to the line pressure, the assumption being that it may be subjected to full potential. In the case of a smaller insulator the shells are made to flash-over at nearly twice the line pressure. In general the testing pressure is adjusted to almost the flash-over voltage for each shell and for the complete insulator. The whole insulator cannot, of course, be tested by a voltage equal to the sum total of the testing pressures of the individual shells, as this will be much in excess of the flash-over voltage.

Suspension units, except the interlink type, are tested in the same manner as the pin insulator. The units of the interlink type are each tested between the tie-wires.

There seems to be no uniformity in the duration of test chosen by different firms. In America one minute is chosen, and at one of the German works two hours. At Hermsdorf 15 minutes are taken, but if a puncture occurs, the pressure is applied for another 15 minutes, and so on. There is no doubt that one minute is too short. A total duration of one half hour is quite ample to eliminate the defective shells. A further test when the parts are cemented ensures the elimination of faulty shells.

To determine the puncturing voltage of the insulator, it should be tested under oil. One of the guarantee tests—the dry flash-over voltage—should be made on one of the samples of a batch supported on the pin and (if possible) on the cross-arm, as used under service conditions. The practice of screwing the pin direct into the porcelain leads frequently to breakage of the screw-threads if not of the pin shell. This may be avoided by wrapping the screw-end of the pin with hemp or cementing with Portland cement. An effective practice is to use a lead or malleable iron thimble cemented to the porcelain and threaded to receive the pin. The pin must not be screwed well home, but a small turn-back should be given to allow for expansion, especially for insulators in tropical countries. In the absence of a cross-arm of the exact size as in practice, a bar 2 in. wide will suffice. The bottom shed of the insulator must be at a height above the cross-arm at least equal to its radius. A half-inch solid conductor attached to the side groove with a coiled spring or with a pair of tongs gives the dry test for insulators on corner and dead-end towers. Fixing the conductor on the top groove as ordinarily attached gives a higher flash-over voltage for the insulator. Suspension insulators are tested with the top unit suspended from the cross-arm and the half-inch conductor fixed in the clamp of the lowest unit.

The voltage at which the pilot spark occurs constitutes the flash-over voltage. The humidity, pressure, and temperature should be recorded for each insulator test. This will enable the testing engineer of the insulator works to state the flash-over voltage of insulators for such different localities as a dry and cold mountainous region and a moist and warm plain.

To obtain the flash-over voltage of an insulator under rain conditions in a test room a spray apparatus is employed. A spray which is allowed to fall in a parabolic path gives the most accurate imitation of rain, the inclination of the falling drops being adjusted by tilting the nozzles.

The greatest rainfall ever recorded in this country was 0.3 in. per minute, in Spain 0.4 in. The normal maximum for heavy storms in this country is about 0.16 in. If 0.2 in. per minute be chosen, this will amply cover the normal maximum obtaining. The flash-over voltage is not reduced much with (vertical) precipitations greater than  $\frac{1}{2}$  in. per minute, but within this value the differences in the flash-over voltages are great.

The direction of the spray influences the wet test; with greater inclinations a wider area of the surfaces become wet. From actual tests an angle of  $45^\circ$  gives a mean result, and it is about the direction of rain in a strong wind. The standard precipitation in England and America is  $\frac{1}{2}$  in. per minute, and in Germany 4 mm. at an angle of  $45^\circ$ . It is incorrect to incline the insulator at  $45^\circ$  and have the spray falling vertically on it. A false value of the flash-



over voltage is obtained on account of the water running away in a stream on one side.

To prevent too much splashing, due to the pressure of the water and giving low readings, the minimum distance employed by the author is 5 ft. from the nozzle to the vertical line passing through the centre of the insulator; the tap pressure of water employed is 40 lb. per sq. in. The time element is also very important. No readings should be taken at less than 15 minutes. The humidity, temperature, and pressure should be duly recorded.

Water in the frozen state, as hoar frost, icicles, and snow, is a fair insulator. With a heavy deposit of hoar-frost on all surfaces the leakage is not much greater than with a mist or fog.

Snow falling at a temperature below freezing point will generally form a cap on the head piece of the pin insulator and on the top-most unit of the suspension type. The flash-over voltage is unaffected. Driven snow falling at a temperature above freezing point forms a thawing mass between the sheds or units, and we then have the severest conditions with which an insulator meets. Brush discharges (and even surface sparks) can take place at the line pressure. The following table indicates the leakage loss of an insulator for a line voltage of 6,500 volts under various outside weather conditions.

Weather conditions.	Measurements taken on 300 insulators.	Calculated for 1 insulator.
Dry ... ..	15 watts (about)	0.05 watt
Fine dust ... ..	46 " "	0.15 "
Fall of snow below 0° C. ...	70 " "	0.25 "
Heavy rain ... ..	300 watts max.	1.00 "
Continued drizzle with 100 per cent. humidity ...	320 watts	1.10 "
Stormy wind and very heavy downpour ...	450 "	1.50 "
Heavy sleet with strong driving wind ... ..	650 "	2.20 "

Iceicles below freezing point are as good insulators as snow.

The behaviour of sooty and soiled insulators depends upon the state of the weather. The author has obtained scarcely any difference in the dry flash-over voltages in most severely soot-blackened and dirty insulators, and only a small difference in the voltage at which the initial discharges commence. On a damp day the soot or dirt will attract moisture, which tends to lower the insulation resistance and to start the initial surface discharges with ultimate flash-over earlier than for a clean insulator. Experiments conducted in Switzerland on insulators of various patterns of normal working voltages ranging from 3,000 (Simplon tunnel) to 25,000 (Bezau-Löntsch), blackened under severe conditions, indicate a lowering in the flash-over voltage of 10 per cent. in the dry state and 15 per cent. under the rain test. From a large number of insulators exposed for a number of years to the smoke and dust of a porcelain works, measurements of leakage loss indicate that for clean insulators it is half that of soiled ones. It has been observed that the leakage current over the surfaces attracts soot and dust, especially to the strong parts of the electric field. This attraction for smoke must be duly considered in lines which cross, or are near, steam railways.

The conditions near a sea-coast with its salt fogs are more severe than for an insulator in dry mountainous regions. The salt, perhaps, mixed with dust, encrusts the sheds, and, becoming damp, offers an easy path for discharges. Chemical works adjacent to the line may also produce trouble. In the case of a 50-K.V. transmission line in Norway, near some carbide works, the heavy brush discharges between the bolt and the bottom shed necessitate a periodic cleaning once a month. The suspension type has the advantage of being cleansed by rain and wind in a better manner than the pin type, and for such localities provides considerably less leakage.

#### DISCUSSION.

PROF. MARCHANT said that one of the best ways of investigating the distribution of stress in the material of an insulator would be by using a modification of the stream line apparatus developed by Prof. Hele-Shaw and others. Regarding the breakdown voltages between two wires wound on a porcelain cylinder, the cube law stated by Mr. Lustgarten was open to criticism. If, in the experiments, the wires had been increased in diameter in proportion to the distance between them, and the cylinder on which they were wound also in the same proportion, a linear law between the voltage and breakdown distance should have been obtained.

MR. J. BURTON said that in the question of design, the Continental makers had certainly stepped in advance of us. The nature of the English body enabled our insulators to be made in one piece on the thrower's wheel and not in moulds, and this made them a much more compact and solid article; it also enabled the finished article to withstand a greater tensile strain than was the case with porcelain. The English ware was not so brittle; it was a little stronger, and its puncture value was not quite so high. The design of the insulator was very much more important than the material of which the insulator was made, within certain limits.

MR. H. D. SYMONDS considered that surface discharges, and arcing over porcelain insulators, under service conditions were much more severe than those shown in the photographs, which were taken with a testing transformer. Mr. Lustgarten recommended a 30-minute test, and for porcelain manufacturers with a test room equipped to test many insulators at once, this would be quite satisfactory. For the electrical manufacturer, however, a voltage test of 2½ to 3 times normal working voltage maintained for 5 minutes would be a fair and satisfactory one for discovering faulty insulators. If, at the end of that time any rise in tem-

perature had taken place on any insulator, it should be continued for half-an-hour. He endorsed the author's recommendation that puncture tests on porcelain should be conducted under oil; only under such conditions was it possible to obtain an accurate and reliable value for the dielectric strength. It had been his experience that, on the whole, the English porcelain was superior from an electrical point of view to the German material. The dielectric strength of the English porcelain was generally a little higher, and the material was tougher and more free from air bubbles than the German porcelain. Tests that were made with dirty insulators depended so much on the dirt that was used, that it was not safe to assume that the flash-over voltage was not appreciably reduced by the accumulation of dirt on the insulator. The condition of the dirt and its ingredients enormously effected the result, and often the difference was only apparent on long-time high-voltage tests.

MR. POLLARD DIGBY said that the author's experiments had been conducted presumably with Manchester tap water, which was probably far purer than Manchester rain water. The author's commercial tests were both excellent and practical. The note in regard to sooty insulators, which, in a dry condition, are practically as good as clean insulators, offered an interesting parallel to the case of switch oils, which had practically the same dielectric strength when black through suspended carbon as when newly received.

MR. A. B. MALLINSON said that one of the first things which impressed one when proceeding to install a high-pressure line, was the great variety of insulators offered, each type being claimed by its maker to be better than any others. He had found by actual experience that it was necessary to multiply what the manufacturer said by about four, to get an insulator which was really satisfactory. It was not that he had experienced flashing-over on them, but that on a line in a manufacturing or colliery district, such a poor insulation test was obtained, that it was not possible for the engineer in charge to get a true idea of the state of his equipment without insulating the line, and individually testing the sections of the equipment. For instance, at a colliery working at 2,500 volts, the insulators supplied by the maker for a 5,000-volt line were quite useless, as unless they were cleaned every month or so, it was impossible to get an insulation test of more than about 0.1 megohm on a line only 0.4 mile in length.

MR. R. G. CUNLIFFE said he thought many engineers who had used porcelain insulators would appreciate the difference between moulded and disk spun insulators. It had been his experience that moulded insulators broke, owing to internal stresses, under the action of very slight shock. He agreed that there was objection to artificial rain water tests, as he had found great variation in specific resistance between different samples of tap water. The water used by the author from the Corporation mains was of very high specific resistance. He agreed that a coating of soot or carbon on the surface of an insulator would not have any effect in dry weather, but thought that in wet weather the effect of such a conducting coating would be to give the insulator the properties of a "metal shed" insulator.

MR. A. TEIXEIRA said he noticed the author stated that the metal shed units did not insure the arc passing from metal to metal. The arc started from the bolt to the metal shed in each insulator, and not from metal shed to metal shed. This was due to the fact that the distance between the metal sheds was very great. The arc would pass from metal shed to metal shed if the sheds were near together, as in the case of the sunken cap insulators.

MR. W. CRAMP said the author had done the electrical and porcelain industries a great service by calling their attention to the fact that surface leakage was not really important, if the question of capacity was looked after properly. This point could not be too often emphasised.

MR. LUSTGARTEN, in reply, said that the cube relation of the spark distance and spark voltage was referred to in the paper only when the surface spark condition obtained. When, irrespective of the size and curvature of electrodes, and irrespective of the thickness of the dielectric, a high potential gradient and a great charge density produced the surface sparks, the relation would be cubic so long as the flashing-over was wholly due to those sparks; but if flashing-over was due to a combination of the surface spark and the brush discharge, as in the case of a medium-sized pin insulator, or as in the case of the large interlink-suspension insulator, the relation would be intermediate between a linear and a cubic law. The greater the dielectric constant of the medium between the electrodes, the greater the tendency to produce the surface sparks. Given large capacities, whether due to suitable dimensions of electrodes, to dielectric between or to ionised air adjacent to electrodes, the surface spark resulting would give a cube (for large distances a fourth power) relation for the spark length and spark voltage. Near chemical works and the sea-coast the curved insulator underwent a better cleansing action by rain, and could be more efficiently cleansed during a periodic overhauling by the linesmen. As the working of a transmission line depended largely on complete safety against puncture of an insulator, the duration of the routine factory test of the pieces and the whole insulator should not be curtailed. The puncturing of the faulty insulators became less as the time of test increased, but was never entirely eliminated; the reliability against puncture was, therefore, greater after half an hour's test than five minutes. The insulator whose temperature rise was 50° C. and above should be discarded. The corrugated tube had been largely superseded by the smooth tube for bus-bar and switch insulators. Artificial rain experiments with salt and distilled water gave no difference in the wet flash-over voltage. The voltage would depend on the brush discharge, and the potential gradients at the water drops would not be sensibly different for salt or distilled water, especially as the leakage currents were so small.



## Domestic Electricity.

(Third Informal Discussion at the INSTITUTION OF ELECTRICAL ENGINEERS, London, May 2nd, 1912.)

IN opening this meeting, the President observed that more speakers than ever had handed in their names, but that it would be impossible to prolong the discussion beyond that night.

MR. W. R. RAWLINGS said that from his experience of the consumer, it was surprising how many people had no idea that heat was obtainable from electricity, and as there was also an impression that electricity was costly, there was considerable scope for the publicity people to remedy this. The consumer had great difficulty in understanding many of the tariffs, and he (the speaker) considered that no tariff should necessitate the use of more than one supply service. He had known cases where as many as four services were used, any one of which should have been sufficient; moreover, apparatus was very frequently returned by people who discovered that the alternatives were paying for energy at higher prices or installing separate wiring. The supply authorities had too many fads and special fittings. He disagreed with Mr. Faraday Proctor's views, as that gentleman had shown that municipal councils could not be trusted to manage their departments on commercial lines, while he claimed that the contractor did know his own business. There was a great need of co-operation amongst all parties, also for some standard of apparatus which would reduce the amount of stock. Politically, he would grant full powers to municipalities to hire out all expensive apparatus, as they were better fitted financially than the contractor for this work; and if the municipal authorities would agree to others fixing the apparatus, he felt sure they would work together harmoniously. If the engineers, contractors and manufacturers would meet together amicably and discuss matters, the industry would go ahead.

MR. HOLMES (Marylebone) said he was in the position of selling both apparatus and energy to consumers. Price was now no deterrent to electrical heating, providing a suitable tariff, not requiring duplication of services, was offered, and that suitable apparatus was installed and properly used. Those who had experience with electric cooking knew its superiority; a suitable tariff was not so essential as regarded the wiring question, because some extra wiring would be necessary. The chief fault was in the apparatus, although the manufacturer would not admit it: he could see no advance in the design of apparatus during the past five years. The manufacturer and contractor had no interest in apparatus after it was paid for, but its subsequent service particularly affected the consumer, and it was necessary to keep in touch with it. There was no serious reason why electric cooking should not be adopted at 1d. per unit. It did not necessarily add to the peak load, as there was a great diversity factor. In regard to the last speaker's remarks, he believed the contractors had consistently opposed "hiring out" by local authorities, and he asked whether the announcement was official. In conclusion, he urged the necessity of a special advertising and sales organisation, which could do work which many contractors were obviously unfitted to do—the consumer must be the first and last consideration.

MR. LEONARD TATE (Electrical Contractors' Association) pointed out that the contractor could not afford to neglect the consumer at any time, as the latter influenced future work. Moreover, "hiring powers" had been available to any municipality who cared to adopt them, for some years. He quoted figures to show that a higher energy consumption per lamp had been obtained in towns where all the work was in the hands of contractors. The "Hackney" clause, to which reference was made in a previous meeting, was in the L.C.C. General Powers Bill. He added that the different pressures in use in various areas deterred the consumer from buying expensive apparatus, which might be only suitable in one place, and for this reason the Electrical Contractors' Association had agreed to the question of "hiring powers," as mentioned by Mr. Rawlings.

SIR JOHN McDONALD said in this country we always distrusted anything new, but in America a new thing was carefully considered to see what use could be made of it. Speaking as one of the public he thought that popular lectures would reach a great many people, who could not be reached in other ways. The industry must be prepared to spend money on advertising, as in the case of any other commercial undertaking.

MR. C. S. VESEY BROWN considered that the industry would expand more rapidly if certain legislation, individual, and tariff defects were removed. The rigid adherence, in the case of a municipal supply, to the principle of making every consumer contribute to the profit (not only to the revenue) tended to check the use of electricity—he recalled the case of the "Swings and the roundabouts." He had used electric cooking for six years, and during that period had never had anyone in to replace heating elements, because they were easily replaced at home. He further added that the unit was an indefinite quantity to the ordinary consumer, who also held back sometimes because of the contradictory advice he received as to whether A.C. or D.C. was the best in his particular case. He suggested that an effort might be made to standardise supply pressures, and thus simplify the supply of lamps, apparatus, &c., as this had caused considerable annoyance to consumers in the past. He considered that the electrical industry suffered from too much individuality; while this was a good thing in its way, it would be better if the introduction of new and untried appliances were controlled by responsible bodies.

MR. A. C. CAMPBELL SWINTON disagreed with the last speaker's views as to new appliances; it was very often the people who knew most who ventured the least, while the outsider, undeterred by future difficulty, plunged in and accomplished something. Still, it was necessary to keep in touch with apparatus after it was in use. He asked—Was it possible for electric cooking apparatus to be

placed on the market with the same relative profit margin as in the case of gas apparatus?

MR. DOWSING discussed the early efforts at electrical heating and cooking following the Crystal Palace Exhibition of 1890. The business lasted for a year or two in connection with private installations, there being no public supply then. When the latter came the price was too high. The supply engineers had hindered the introduction of electric cooking, and he believed the gas engineers adopted the same attitude until the coming of electric lighting compelled them to turn their attention to its possibilities. He strongly urged the value of a school of electric cookery, granting suitable diplomas, the graduates of which would spread the knowledge of, and demand for, electric cooking.

MR. J. S. HIGHFIELD agreed as to the necessity for simple charges (involving not more than one service per house), and as to the utility of standard voltages, if only they were possible. The hiring out of apparatus was the great thing to aim at, and apparatus should be made convertible for various voltages, so that its utility would be increased. He thought the electrical industry was going ahead more than ever before, but joint action was necessary in order to push business. He emphasised the necessity of keeping in view the earning of sufficient profit to induce people to put money into the business.

Another speaker, who had apparently adopted electricity for every possible purpose in his house, said that his total bill for light and heat (including two tons of coal) amounted to £10 per annum; his maximum load was 5 kw.

## EXPIRING PATENTS.

(Continued from page 739.)

15,203. July 11th, 1898. "Dynamos." M. DERI. Relates to field magnets for continuous current generators or motors, with two or more poles. The iron of the magnet is a hollow cylinder of uniform section surrounding the armature, and is wound with two groups of coils, one group being permanently connected in series with the armature, and tending to produce a field in opposition to the current in the armature. By this means the field produced by the other group of coils remains in a fixed position while the armature current may be varied, or the rotation reversed.

16,129. July 23rd, 1898. "Electrolysis." O. IMRAY. (Oesterreicher Verein für Chemische und Metallurgische Produktion; Aussig on the Elbe, Bohemia). Relates to the continuous electrolysis of solutions of alkaline salts, especially alkaline chlorides, to obtain the corresponding hydrate solution and chlorine gas. The anode is covered by a bell which extends some distance below it, while the cathodes are outside the bell and generally at a lower level. The electrolyte is introduced through a tube to the top of the anode compartment. The chlorine, as it is formed, passes up through the anolyte thereby agitating and mixing it, and escapes through a tube. By this arrangement the layer formation of the anode and cathode liquids is maintained without the use of a diaphragm.

16,814. August 3rd, 1898. "Photo-telegraphy." F. SILBERSTEIN, A. POLLAK and J. VIRAG. Relates to a system of photo-telegraphy in which light passed through or reflected from a message, &c., is projected by lenses on to a number of selenium cells. The cells are connected to a distributor and to a line wire. Light from a source is reflected from a mirror on to the face of a reflecting polygonal prism, after which the beam of light falls on a slit in a chamber containing photographic paper. The receiver is synchronised with the transmitter. The receiver source of light is preferably a triangular hole in a screen. To produce damping in the telephone vibrations the distributor contacts may be doubled, two contact brushes or arms being employed; two reversed batteries may also be used, one of them being permanently to line. In a modified form of receiver, a number of magnets operating wedge-shaped shutters, are operated by a distributor similar to that used at the transmitter station. The wedge shutters control a series of openings corresponding in number to the selenium cells.

18,261. August 25th, 1898. "Telegraph relays." S. G. BROWN. Relates to relays for cables and other telegraph work. A coil is connected to line and mounted in the field of a magnet, and is either connected by two threads or by a rigid attachment to a second coil arranged in the field of an alternating-current magnet. The coils of the alternating-current magnet and the coil are connected respectively to a commutator and a rectifier. The commutator is also in circuit with a battery and the rectifier is connected by lines to the receiver or the next section of the cable, &c.

18,613. August 30th, 1898. "Telephone systems." J. E. KINGSBURY. (Western Electric Co., U.S.A.). Relates to improvements in telephone systems. At the subscriber's station a high-resistance microphone having about one-third the usual amount of carbon granules may be employed, an ordinary receiver being connected in a loop circuit with a condenser. The bell may be arranged as a shunt across the receiver. The current is supplied from a central station generator arranged across the loop, and having impedance coils on either side connecting it to the loop. When a dynamo charging secondary cell is employed, the interruptions of the current are deadened either by the insertion of impedance coils in the generator mains, or by making the armature and commutator with a large number of sectors, so that the interruptions would form a very high note.

19,246. September 9th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 10th.) "Electric distribution." B. G. LAMME. Relates to the transformation of direct currents to alternating currents by means of a rotary transformer or converter. In order that the speed or rate of alternation may be approximately constant, irrespective of changes in the inductive load, a small direct-current generator is employed for exciting the field magnets of the rotary converter.

20,008. September 21st, 1898. "Electric switches: cut-outs." M. LAWTON (trading as J. Lawton & Sons). Relates to the manufacture of metallic covers for switches. The blanks are stamped or rolled out of a thick plate, and the rolls, &c., are so formed that the centres or edges of the plate are left sufficiently thick.

20,206. September 23rd, 1898. "Ozone." E. ANDREOLI. An ozoniser consists of a glass tube coated internally with metal foil or deposited metal, or with a thin layer of a metallic or carbon powder and surrounded externally by metal rings connected by slotted longitudinal bars. The distance is maintained by providing the tube with enlargements on which some of the rings rest.

20,274. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." F. E. CASE. Relates to means whereby any number of electric motors on cars, when coupled to form a train, can be controlled from a single point on the train. Each master controller has three switches for power, reversing, and braking respectively and the motor controllers are similarly divided. An additional source of power carried on the vehicle supplies current for working the motor controllers and the brakes. This current is obtained from a battery which is charged by a motor generator worked from the main circuit, an automatic cut-out being interpolated.



20,275. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." E. THOMPSON. Relates to means whereby any number of electric motors or cars when coupled to form a train can be controlled from a single point on the train. Each car is complete in itself, with motor and controller equipment, and master controllers are provided on the train in the different cars to work the motor controllers by a shunt off the main current.

20,276. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." W. B. POTTER. Relates to means whereby any number of electromotors on cars when coupled to form a train can be controlled from a single point on the train. Each car is complete in itself, with motor and controller equipment, and master controllers are provided on the train in the different cars. The motor controllers are worked from the pneumatic pressure brake pipes, but the valves which determine the admission to the operative parts are electrically controlled from any one of the master controllers.

20,440. September 27th, 1898. (Date claimed under Sec. 103 of Act of 1883, May 7th.) "Measuring electricity." H. P. DAVIS, F. CONRAD. Relates to current meters for alternating currents. A laminated electromagnet is excited by current supplied to a coil. Closed circuit coils surround parts of its poles, the currents induced in them producing a shifting of the magnetic field in the air-gap of the core and turning a conducting disk carried by a shaft in opposition to a spiral spring. The shaft carries a pointer over a graduated circular dial.

(To be concluded.)

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,442. "Portable electric reading lamp." S. J. LEVI, T. A. ROSE, and A. H. ROSE. April 22nd.

9,466. "Automatic brakes for electric tramcars and the like." COUNT F. C. V. DI CASTELLETO. (Convention date, April 22nd, 1911, Germany.) April 22nd. (Complete.)

9,492. "Electric-ignition device for combustion engines." H. BAUER and M. ECKMEIER. April 22nd. (Complete.)

9,499. "Methods of and application for obtaining simultaneous radiographs." SIEMENS & HALSKE AKT.-GES. (Convention date, April 21st, 1911, Germany.) April 22nd. (Complete.)

9,502. "Electro-magnetic vibrators." A. H. NICHOLSON. April 22nd. (Complete.)

9,520. "Means for attaching wires and cables to insulators." H. PARRA. (Convention date, May 1st, 1911, France.) April 22nd. (Complete.)

9,539. "Magneto attachment." J. WELLER. April 22nd.

9,580. "Luminous electric devices." L. H. WALTER. April 23rd.

9,587. "Anodes used in the electrolysis of metallic solutions." F. HODGSON. April 23rd.

9,593. "Method of charging storage batteries." D. H. WILSON. (Convention date, April 24th, 1911, United States.) April 23rd. (Complete.)

9,596. "Mechanically-operated search-lights." M. L. SEVERSON and W. S. SPIEGELBERG. April 23rd. (Complete.)

9,609. "Electrolytic process for cleaning metal articles." LANGBEIN-PFANHAUSER WERKE AKT.-GES. (Convention date, April 25th, 1911, Germany.) April 23rd. (Complete.)

9,612. "Electrolytic process." C. J. REED. April 23rd. (Complete.)

9,637. "Apparatus for actuating conduit covers and collector ploughs of electric railways." D. SAMARA. (Addition to 23,495, 1911.) April 23rd. (Complete.)

9,644. "Synchronous dynamo-electric machines." E. ROSENBERG. April 23rd.

9,647. "Electric circuit-breakers and the like." E. A. FAGERLUND. (Convention date, April 24th, 1911, Sweden.) April 23rd. (Complete.)

9,706. "Electric incandescent lamps." G. A. LEE. April 24th.

9,714. "Telephones." C. F. KILLAR and J. C. GROVE. April 24th.

9,733. "Telegraphy." E. S. HEURTLEY. April 24th.

9,734. "Insulators." T. WITTRIN. April 24th. (Complete.)

9,735. "Methods and apparatus for charging storage batteries." D. H. WILSON. (Addition to 9,593, 1912.) April 24th. (Complete.)

9,751. "Apparatus for phonographically recording telephonically transmitted conversations." FIRM WALSECK & STARCKE. (Convention date, October 30th, 1911, Germany.) April 24th. (Complete.)

9,752. "Apparatus for phonographically recording telephonically transmitted conversations." FIRM WALSECK & STARCKE. (Convention date, November 25th, 1911, Germany.) April 24th. (Complete.)

9,753. "Protective arrangements for electric distribution systems." A. REYROLLE & Co., LTD., and H. K. TRECHMANN. April 24th.

9,771. "Electric-sign system and apparatus therefor." E. M. WILDEY and H. C. MERRETT. April 25th.

9,789. "Magnetic toys." A. G. OWEN and J. F. BENNETT. April 25th.

9,804. "Electro-magnets." A. T. DOWDELL. April 25th.

9,806. "Electric incandescent lamp-holder with locking device." J. G. J. MACSHEEHY. April 25th.

9,814. "Rheostats, motor-starters, and like apparatus." A. E. RALPH and L. WEEKES. April 25th.

9,823. "Disk armatures for continuous-current electric meters." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, April 26th, 1911, Germany.) April 25th. (Complete.)

9,826. "Wireless signalling and the like." E. O'TOOLE. April 25th.

9,861. "Construction of electric-heating devices." G. COOPER. (F. Boelling, Germany.) April 25th. (Complete.)

9,876. "Apparatus for controlling direct-current electric motors." SIEMENS BROS. DYNAMO WORKS, LTD., and F. LYDALL. April 25th. (Complete.)

9,900. "Devices for adjustably suspending electric and other lamps, electroliers, gas pendants and the like." W. H. STURGE. April 26th. (Complete.)

9,901. "Grip fittings for electrical conduits, junction boxes, ceiling boxes, cut-out boxes and the like." F. E. FORRESTER. April 26th.

9,908. "Obtaining motive power in combination with electricity and the apparatus employed therein." J. MACNAB. April 26th.

9,909. "Electric fixtures." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,910. "Outlet boxes." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,911. "Electric fittings." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,941. "Manufacture of electric incandescent filaments or bodies." F. HANSEN and W. F. MOHR. April 26th.

9,981. "Process for the manufacture of drawn tungsten wires or the like." C. H. FISCHER. April 26th.

9,983. "Incandescent electric lamps." W. J. LUSTED. April 26th. (Complete.)

10,009. "Electrically-heated ovens." VERITYS, LTD., and W. G. PIRKIN. April 27th. (Complete.)

10,029. "Electrical heating units." E. C. R. MARKS. (Landers, Frary, and Clark, United States.) April 27th. (Complete.)

10,032. "Protective devices for electric power systems." G. ELLISON and M. R. H. MUELLER. April 27th. (Complete.)

10,041. "Telephonic headgear." E. A. GRAHAM. April 27th. (Complete.)

10,053. "Submarine cables." SIEMENS & HALSKE AKT.-GES. (Convention date, April 28th, 1911, Germany.) April 27th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

ELECTRICAL HEATING APPARATUS. E. G. Byng and C. H. Archer. 28,779. December 21st.

THERMO-ELECTRIC GRAVITY MOTOR. E. E. Rouse. 7,386. March 24th. (September 25th, 1911.)

ELECTRICAL TIME-SWITCHES. S. Chiger. 8,585. April 6th.

BRUSHES FOR DYNAMO-ELECTRIC MACHINES. G. Engich. 8,666. April 7th.

ELECTRICALLY-CONTROLLED GRAB HOIST GEAR. K. Brüll. 8,798. April 8th. (October 10th, 1910.)

WIRELESS TELEGRAPHY. Sir O. J. Lodge and E. E. Robinson. 8,806. April 8th.

METHODS OF AND MACHINES FOR MAKING BATTERY PLATES. W. E. Lake. (United States Light and Heating Co.) 8,814. April 8th.

HAND AND BELT ELECTRIC LAMPS. W. Thomson. 8,846. April 10th.

ELECTRICAL MEASURING INSTRUMENTS. W. E. Lake. (Weston Electrical Instrument Co.) 9,000. April 11th.

ELECTRIC ARC LAMPS. J. S. Hecht and A. T. Dowdell. 9,072. April 12th.

MAGNETIC COMPASSES. Kelvin & James White, Ltd., F. W. Clark and H. W. P. Chetwynd. 9,347. April 15th. (Cognate application, No. 18,630 of 1911.)

CONSTANT-SPEED DEVICES FOR DRIVING MOTOR-CAR, LIGHTING, AND LIKE DYNAMOS. L. van Celst. 11,738. May 15th. (May 14th, 1910.)

SOLDERING OF ELECTRIC CONDUCTORS AND THE LIKE. C. E. Egner. 11,841. May 16th.

AUTOMATIC REGULATORS FOR DYNAMO-ELECTRIC MACHINES. H. Hirst and A. E. Angold. 13,477. June 6th.

REGULATION OF ELECTRIC GENERATORS DRIVEN AT VARYING SPEEDS. British Thomson-Houston Co. and A. P. Young. 13,650. June 7th.

MEMORANDUM AND LIKE APPLIANCES FOR USE IN CONNECTION WITH TELEPHONE AND OTHER PURPOSES. E. F. M. Branson and F. H. Bowden. 16,394. July 24th. (Cognate application, No. 120 of 1912.)

AUTOMATIC REGULATING MECHANISM APPLICABLE TO ELECTRIC GENERATORS. L. V. Grillet and J. B. Truchetet. 17,419. July 31st.

INDUCTIVE WIRELESS TELEPHONE AND TELEGRAPHIC INSTALLATIONS. H. von Kramer. 17,634. August 3rd.

ELECTRIC SWITCHES. H. A. Crabb, A. H. F. Perl and C. H. Hutchinson. 18,667. August 19th.

ATTACHMENT FOR INSULATOR-CARRYING ARMS TO TELEGRAPH AND LIKE POLES. Bullers, Ltd., and E. H. Chambers. 18,680. August 19th.

MANUFACTURE OF ELECTRICAL COILS. W. E. Lake. (Weston Electrical Instrument Co.) 19,116. August 24th. (Divided application on No. 9,000 of 1911. April 11th.)

SYSTEM OF ELECTRIC PROPULSION FOR VEHICLES. J. T. Lister. 19,747. September 5th.

AUTOMATIC ELECTRIC CIRCUIT-BREAKERS. J. Cuculic. 20,161. September 11th.

ELECTROMAGNETIC RECIPROCATING MOTORS. W. E. Lake. (Dulles-Baldwin Electric Drill Co.) 21,806. October 3rd.

ELECTRICALLY-HEATED SOLDERING IRONS. Evershed & Vignoles, Ltd., S. Evershed and W. Clark. 24,933. November 8th.

TELEPHONE CABINET TO ENSURE PRIVACY OF CONVERSATION. J. J. Webb. 26,296. November 24th.

ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering. 28,539. December 19th. (Divided application on No. 5,902 of 1911. March 9th.)

### 1912.

ELECTRIC VAPOUR APPARATUS WITH SEVERAL LIQUID ELECTRODES. Ges. für Elektrotechnische Industrie. 4,588. February 15th. (November 10th, 1911.)

MEANS AND APPARATUS FOR STORING AND TRANSPORTING INCANDESCENT ELECTRIC LAMPS. E. H. Archer. 2,319. January 29th.

INTERCOMMUNICATION TELEPHONE SYSTEMS. E. R. Corwin. 3,098. February 7th.

**The Lighting of the Ideal Home.**—The Exhibition at Olympia is over, but perhaps it is not too late to draw attention to the inefficient, inartistic and altogether un-ideal methods of lighting employed in the Ideal Home. The organisers, who had built, decorated and furnished the house in an extremely beautiful and convenient manner, seem in the matter of artificial lighting to have had no ideas beyond the glare-accentuating conical opal shade and some common patterns of so-called ornamental shades which do nothing but absorb from 20 to 50 per cent. of the available light. Why was no advantage taken of the several types of efficient prismatic glass reflectors, or of one of the recent forms of indirect lighting? Either of these systems of lighting would have provided an illumination far and away more economical and beautiful than the unfortunate method actually employed. The least we can hope is that the organisers of the next Ideal Home Exhibition will have learned in the interim to appreciate the importance of efficient lighting in the domestic scheme.



# THE ELECTRICAL REVIEW.

VOL. LXX.

MAY 17, 1912.

No. 1,799.

## ELECTRICAL REVIEW.

## THE I.E.E. AND THE NEW ARTICLES.

Vol. LXX.]	CONTENTS: May 17, 1912.	[No. 1,799.
		Page
The I.E.E. and the New Articles ...	...	781
The British Engineers' Association ...	...	782
Manager and Scientist ...	...	782
The Law and Profits ...	...	783
Escaping Electricity ...	...	783
Short-sighted Economy ...	...	783
Copper and Aluminium ...	...	783
The Royal Society Conversazione ...	...	784
Indian Notes ...	...	784
The Ozonair Plant of the Central London Railway ( <i>illus.</i> ) ...	...	785
Correspondence:—		
Trade with Canada ...	...	786
Colonial References ...	...	786
The I.E.E. Students and the New Articles ...	...	786
A Chilean Concession ...	...	786
The Commercial Assistant ...	...	787
Legal ...	...	787
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	790
Parliamentary ...	...	791
Business Notes ...	...	793
W. T. Henley's Telegraph Works Co.'s Cable Factories, Woolwich and Gravesend ( <i>illus.</i> ) ...	...	800
Notes ...	...	805
City Notes ...	...	807
Stocks and Shares ...	...	811
Electric Tramway and Railway Traffic Returns ...	...	812
Share List of Electrical Companies ...	...	813
The Characteristics of Copper and Aluminium Overhead Line Conductors ( <i>illus.</i> ) ( <i>concluded</i> ) ...	...	815
Recovery of Contract Prices without the Engineer's Certificate ...	...	817
Proceedings of Institutions:—		
Yellow Flame Arcs ( <i>illus.</i> ) ...	...	819
The Brain as an Electrical Organ ...	...	822
Our Legal Query Column ...	...	822
Expiring Patents ( <i>concluded</i> ) ...	...	823
New Patents Applied For, 1912 ...	...	824
Abstracts of Published Specifications ...	...	824
Contractors' Column ...	Advertisement pages xxvi and xxviii	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ON Thursday last week, at an extraordinary general meeting of the Institution, the new and revised Articles of Association were adopted with almost unanimous consent: the basis is broadened, the subscriptions are raised, and the other amendments to which we have already referred have been approved—subject only to the formality of a confirmatory resolution at a meeting to be held on May 30th. The new Articles will come into force on July 1st, with the exception of those relating to fees and subscriptions, which do not take effect until the end of 1912. The fact that the Committees of the Local Sections have expressed their approval of the Articles in their amended form augurs favourably for their satisfactory working. The upheaval which took place in November last has not only proved highly beneficial in the result to the Institution, in more ways than one, but also should serve as a very useful indication to the Council that no harm will be done in the future conduct of the affairs of the Institution by taking the general body of the members more fully into its confidence and consulting their views when occasion arises—in fact, by keeping as closely as possible in touch with the members as a whole. It cannot be denied, we believe, that the revised Articles are much better than the original proposals, and this result has been achieved simply by direct contact with the Local Sections and the members generally.

It is true that some of the provisions are still viewed with distaste by certain members, but it is impossible to please everybody, no matter how much and how often the clauses are altered, and it is to be hoped that the objectors, having regard to the strong body of support accorded to the new code, will loyally accept it as the considered judgment of the Institution, and do their best to assist the Council in carrying it into effect. We cannot help thinking that some of the criticisms that are still directed against the Articles are based upon misapprehension. For example, the bulk of the Council will, as formerly, consist of full Members, together with three Associate Members and three Associates. It is argued that, as the Associate Members form by far the largest class—numerically equal almost to all the other classes together, including the Students—they ought to be much more strongly "represented" on the Council. But this is a totally wrong point of view. As the President has pointed out more than once, there is no intention of "representing" individual classes on the Council at all: the important thing is to get the best men on the Council, and the provision enabling Associate Members and Associates to sit on the Council was framed purely with this object in view—for many members of these classes are men of undoubted ability, although for various reasons they have not chosen or have not possessed the necessary statutory qualifications to enter the class of Member. Every member of the Council is in duty bound to act, as far as possible, in the best interests of



every class and section of the Institution, and the question of class representation is totally irrelevant.

Again, there is a strong tendency to raise the question of value for money—to ask “What do I gain by belonging to the Institution?” But there is such a thing as patriotism—not only national, but also local, and again, professional. Every member of the electrical profession and industry should rather ask himself whether it is not his duty to afford support to the Institution which represents those interests, to add to it the strength of numbers and the monetary means to enable it to act effectively. He may or may not receive what he considers an adequate direct return; but he will certainly benefit indirectly by the improved standing of his profession and the reforms which can be brought about by a strong united body. Even from the more selfish standpoint, the question should not now be “What do I get for it,” but rather “What shall I get,” for it has been clearly shown that with increased funds at its disposal, the Council will be able to carry out many desirable projects which at present it cannot accomplish for lack of means. These points were well brought out by Mr. Hammond in November last, and we do not propose to insert a list of the proposed new schemes. Suffice it to say that many very desirable departures from precedent are under contemplation, which, when carried out, should place the Institution in the foremost rank of up-to-date societies.

We hear a good deal, too, of the “broader policy” of the President, who has laboured so indefatigably to arouse the Institution to a fuller realisation of its possibilities and duties. It would be well that there should be no misapprehension on this point, lest those who expect to see a sudden change of policy should meet with disappointment. If we rightly interpret the intentions of Mr. Ferranti, he does not contemplate anything of the kind. He has endeavoured rather to accelerate the progress of the Institution, to instil broader views of its proper functions, and to imbue its members with his own unfailing optimism; he has seen the danger of stagnation, of falling into a rut, of lack of co-ordination of effort, and has striven to make the members all pull together in the same direction—that of the common welfare. We believe that his efforts will bear, and have already borne, abundant fruit, and that the effects of his two years of office will continue to be felt for many years to come. What we all want to see—he most of all—is the Institution a great power working for the true benefit of the industry in every possible way, and we hope that, under the new *régime*, we shall soon see that desirable object in great measure attained.

#### The British Engineers' Association.

AN important Association has just been formed under the above title, with the object of establishing itself as a great national organisation for the promotion of the overseas interests of the British engineering industry as a whole—not to serve the interests of any one firm or clique, or to carry on trade in any way, but to overcome the obstacles by which our trade is hampered. The Association was formed by 22 well-known British engineering firms, and even before incorporation (which took place on April 26th) it included some 60 members, most of them being firms of the highest standing, while others were awaiting election.

The efforts of the Association will be directed for the present exclusively to China, where the organisation and strengthening of British engineering interests is urgently needed; the constitution is drawn up on broad lines by no means restricting the action of the Association to foreign trade alone, and includes the promotion or opposition of legislation, the circulation of information and statistics, support to the British Government and other influential organisations, and keeping a watch upon the methods and progress of foreign competitors. Other objects are to encourage the predominance of British technical instructors in Asiatic and other schools, to facilitate the training of Oriental engineers in British colleges and works, and to promote the use of the English language as the recognised medium of engineering business.

A Commissioner will be established in China, communicating direct with the head office of the Association in London, and will assist members visiting China with advice and information.

Candidates for admission must be *bona fide* British manufacturers of engineering products or articles accessory to engineering plant, “other than those whose interests in foreign manufactures or otherwise might be antagonistic to the objects of the Association.” Whether this is so will be determined by the Council, each case being considered on its merits. The members will receive prompt reports on Chinese trade matters, which will be issued only to members, and will be warned against undesirable business connections in China; they will also be enabled to collaborate and to gain other advantages.

The importance of China as a market for British engineering products is so self-evident as to need no emphasis, and under the new *régime*, when things have settled down, there is every prospect that an enormous development will rapidly take place; China, in fact, will probably become one of the greatest markets for engineering plant, but whereas in the case of Japan our early influence was deeply established, and its effects are still active, in China we find ourselves at the outset in competition with our modern rivals, whose Governments, moreover, effectively assist their agents in diverting trade to their own people. In the absence of any similar support our manufacturers are well advised to join hands with a view to counteracting the strenuous campaign which is being conducted by Germany and the United States in the Far East. That immense benefits can be secured to British interests by energetic and judicious action is certain, and we gladly extend a hearty welcome to this very excellent Association.

#### Manager and Scientist.

THE relations between the manager and the scientist form the subject of an interesting article by Mr. H. F. Stimpson in *Cassier's Magazine* for April, the “scientist” referred to in this connection being representative of the investigators needed by large manufacturing firms to supply special knowledge for the improvement of their methods and products.

According to Mr. Stimpson, suggestion systems and committees of foremen are expedients devised by the manager to cover his deficiencies, as, if he were “able to formulate complete and competent directions the possibility for suggestions on the part of those managed could not exist.” The committee system is described as one “whereby employes, especially the overworked and underpaid foremen, are tickled with an appeal to their vanity into giving information which the employer is either too ignorant to get for himself or too stingy to pay for,” while it is contended, as already advocated in these columns, that “the maker of a suggestion resulting in a commercial or industrial improvement should derive a similar advantage to that which a patentee derives as long as the patent system is in effect.”

As an alternative to these expedients the employment of “scientists” is advocated, by whose assistance the manage-



ment is enabled to issue complete and competent directions instead of "mere descriptions of desired results which are gradually and imperfectly expanded into directions as they trickle down through the organisation."

These scientists, known as the "advisory staff," are to have no executive authority, but they should have free access to the works where the results of their labours are being embodied in practical form. It is also contended that good men should be attracted by a high rate of pay.

This article is obviously based upon American methods, and, whatever the practice over there may be, the system advocated by the writer is already in vogue in British works, at any rate, as regards electrical and mechanical designers, chemists, rate fixers, jig and tool designers, and others whose duties are scientific rather than executive. The system has not, however, been adopted to anything like the extent it might be, and we still find such duties being thrust upon executive officers, whose hours of work are thereby unreasonably lengthened. Then, again, the rate of pay and the position offered to such specialists as are retained are not sufficient to attract the best men. A further extension of the system is recommended by Mr. Stimpson to include "the scheme of organisation, the routine for its operation, the detailed plan of finance, the lines upon which the sales campaign should be conducted, and the statistical scheme," but the consideration of these matters, although of great importance, would not take up anything like the whole time of a number of experts, hence either outside assistance must be invoked, or these features must be referred to the executive officers concerned. Of these alternatives, the advice of independent experts who have opportunities of studying the methods practised by other firms, should give far better results than a recourse to the executive staff.

#### The Law and the Profits.

It is seldom that we are favoured with such a clear legal declaration in regard to depreciation as that contained in the recent judgment of Justice Swinfen-Eady in *re* Crabtree, although the necessity for ascertaining and writing off depreciation before profits can be determined is perfectly obvious to the commercial world. The passage in the judgment referred to, which was endorsed by the Master of the Rolls and Lord Justice Fletcher Moulton, runs:—"But in the ordinary course of ascertaining the profits of a business where there is power machinery and trade machinery, which are necessary in order to perform the work of the business, it is, in my opinion, essential that in addition to all sums actually expended in repairing the machinery or in renewing parts, there should be written off a proper sum for depreciation, and that sum ought to be written off before you can arrive at the net profits of the business, or at the profits of the business, and it is not profit until a proper sum, varying with the class of machinery, with the nature of the business, and with the life of the machinery, has been written off for depreciation."

That view we have frequently repeated in our columns, and we are glad to see it in legal terms.

#### Escaping Electricity.

A CASE recently heard by Judge Parry, at the Lambeth County Court, involved a question which is of great interest to those who supply gas, and may also affect those who supply electricity. An action was brought to recover £60 damages for injuries alleged to have been caused by an explosion of gas. The judge said the counsel had put the case in a nutshell by asking him to decide that gas was a wild beast. Was the owner of a house in which gas was laid on in the same position as a man keeping a savage and ferocious animal, whose liability was well known? A man who owned an article dangerous in itself, such as gas, poison, firearms or gunpowder, must take every precaution to prevent accidents, but having done that, he was not liable because an accident happened. In this case his Honour was satisfied that there was no evidence of negligence, and the defendant accordingly had judgment. The reasoning of the judge probably applies also to escaping electricity. If there was a short circuit on

the wires in A's house, which caused damage to B's premises, it is conceived that A would not be liable unless negligence were proved. In the case, however, of a supply authority, the clause to be found in the customary form of provisional order, providing that they shall be liable for nuisance, would probably expose them to an action.

#### Short-sighted Economy.

THE extraordinary and perverted views which are sometimes held by Councillors in connection with industrial undertakings are exemplified by an incident which recently occurred at Nuneaton. The Electricity Committee had recommended the acceptance of tenders amounting to over £2,600, for cables to supply electricity to Griff. At a special meeting of the Town Council to consider the proposal, a certain Councillor, according to the *Birmingham Post*, said he would like the Council to understand that they were spending this large sum simply to supply the Griff Granite Co. with power; he had voted against the expenditure in committee. We wonder whether it has ever occurred to this gentleman to ask himself what the Nuneaton Electricity works are meant for. Has he not yet realised that they were built for the supply of energy to consumers, and that the laying of cables for that purpose is an essential part of the duty of the undertaking with the management of which he is connected? Further, does he not know that the development of the natural resources of the locality is, or certainly ought to be, one of the most important aims of the Council of which he is a member?

We cannot understand this attitude of hostility towards private enterprise, which, though less bitter than formerly, is still manifested from time to time on the part of representatives of the public. Legitimate industrial undertakings ought to be welcomed and assisted in every possible and lawful way by local authorities; the latter, however, though sometimes willing enough to welcome them, are apt to display symptoms of "cupboard love" as soon as they are irrevocably established in a district, and proceed to bleed them with vindictive relish.

Our national prosperity depends upon the promotion and support of genuine industry, and to oppose it simply because it is carried on by a "company" is an act of blind folly, besides inflicting serious injury upon the industrial population.

Fortunately, the Council recognised that the Griff Granite Co. were spending a large sum in developing the quarry, and that it would be worth while to support them; but it is nevertheless deplorable that any member of a council should display the narrow spirit to which we have referred.

#### Copper and Aluminium.

IN this issue we conclude an article by Mr. E. V. Pannell on the relative merits of copper and aluminium, which, though the author modestly disclaims any pretensions to exhaustive treatment of the subject, none the less contains a mass of information in a handy and convenient form. The author shows that there are sound arguments in favour of the use of aluminium in preference to copper for aerial lines, particularly in cases where conductors of large cross section are necessary. At very high pressures the larger diameter of the aluminium cable is of obvious advantage as lessening the corona loss: that is a consideration which is not likely to become of importance in this country in the immediate future, but it appeals to engineers who have to carry out the very numerous transmissions which are under construction or contemplation in our Colonies and foreign countries. The fact that pressures here are lower, however, carries with it the corollary that currents must be larger, and for this reason the economy effected by the use of aluminium for heavy lines is of direct interest at home. The durability of aluminium has been abundantly demonstrated, and there appears to be no good reason why the metal should not be more extensively employed than it is, not only for outdoor lines, but also for bus-bars and other bare conductors of large cross-section.



## THE ROYAL SOCIETY CONVERSAZIONE.

THE Royal Society Conversazione provides an opportunity for the exhibition of new scientific applications and ideas, as well as serving its more general purpose of recording the progress made in the various sciences during the year.

In this year's Exhibition, held on May 8th at Burlington House, this latter function was well illustrated in the geological and astronomical exhibits, and by the photographs of bird migration and butterfly mimicry, while among the recent applications of science a number of electrical novelties were shown.

The properties and practical applications of the gyrostat were demonstrated by means of continuous-current motor gyrostats, consisting of very simple motors of the Gramme-ring type. The production of gyrostatic stability in aeroplanes using gyrostats of this kind on a 4-ft. model appeared to be a matter of no great difficulty. Similar motor gyrostats were shown mounted in various ways in wooden boxes. By operating the gyrostats by means of electromagnets the boxes, which were provided with arms and legs, were made to walk on the floor and perform various tight-rope feats.

Perhaps a more important exhibit, from the industrial standpoint, was that of copper wires sealed into glass directly by means of an apparatus constructed in the University of Glasgow. It is claimed that the joints produced by this method are perfectly air-tight, and satisfactory for vacuum tubes and electric lamps.

The Cambridge Scientific Instrument Co. were responsible for an Einthoven string galvanometer arranged for recording heart sounds. This apparatus forms an important addition to the application of electrical methods to clinics—a subject to which more attention may profitably be paid. The Einthoven galvanometer has already been applied to taking electro-cardiograms, with conspicuous success. The E.M.F. obtained by holding electrodes in the two hands is sufficient to produce a characteristic trace on a dropping photographic plate.

In the arrangement exhibited, a stethoscope was connected by a flexible rubber tube to a microphone supported by a heavy metal ring hung by three springs. The microphone circuit was placed in series with a four-volt accumulator in the primary of an induction coil, and the secondary connected to the fibre of the galvanometer. The photographic records were taken with the same type of camera as was used for the electro-cardiograms. The fact that the ordinary noises in the room are sufficient to cause the continuous vibration of the galvanometer does not appear to be an unmixed blessing, although it is claimed as an advantage of the apparatus. The records taken show almost as much "character" as the electro-cardiograms from which Prof. Einthoven claims to be able to recognise any individual.

Some exhibits connected with recent researches on the properties of pure fused boron and on the metals of the platinum group were shown, and some interest attaches to these on account of the extensive use made of the electric arc in decomposing the volatile boron compounds. Pure fused boron has a remarkably abnormal temperature coefficient of resistance. A small piece of boron mounted in series with an electric lamp, at room temperature, obstructs nearly all the current. Warming the boron reduces the resistance enormously and the lamp lights.

The wave-form sifters for alternating currents, recently described at the Physical Society of London by Mr. A. Campbell, were shown. The sifter consisted of a capacity and an adjustable mutual resistance, and the possibility of suppressing either the fundamental or any one of the harmonics was demonstrated.

Undoubtedly the most beautiful electrical experiment shown at the conversazione was that of Mr. C. T. R. Wilson, for making visible the tracks of ionising particles by vapour condensed upon the ions set free along their paths. By the sudden dropping of the floor of a cloud chamber, suitably illuminated, the moist air within it was cooled sufficiently to make the water condense on the ions present. The dropping of the plate caused no appreciable air stirring. A small fragment of radium was placed at one point on

the edge of the condensing chamber, and the trails of the ionising particles emitted were made visible by cloud particles condensed on the ions. In connection with this exhibit some photographs showing the nature of the ionization produced by different kinds of rays were on view.

Mr. S. Cowper-Coles exhibited a number of specimens, representing the work of some 12 years' investigations on the constitution of fused and electro-deposited metals.

These investigations prove that the tensile strength and electric conductivity of a metal are not dependent on mechanical treatment and heat, but that even higher tensile strengths and conductivities can be obtained by a wet electrolytic method than by fusion, and this with less expenditure of energy.

## INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

*Allahabad.*—This city is open to receive applications from enterprising capitalists who are willing to finance an electric lighting scheme. The Commissioner of the district would probably give all information to *bona fide* inquirers.

*Lucknow.*—The provincial Government has caused a scheme to be drawn up for an electric lighting undertaking here, and it may be expected that very shortly applications for a licence under the new Indian Electricity Act will be forthcoming. There is every prospect of good returns at Lucknow for invested money, as with its dense native and fairly large European population there should be a good fan and lighting load. There are several large isolated electric plants already in and about the town, which are almost certain eventually to become absorbed in the larger unit.

*Delhi.*—The new temporary city is now in course of erection, and a good deal of electric work will take place shortly. The Durbar central power station remains standing, and will supply current for some years to come. An immense amount of public road lighting is contemplated, to consist mostly of high-candle-power metal lamps, which were such a conspicuous success at the last Durbar. The electric work of the new capital is entrusted to the safe hands of Mr. J. S. Pitkeathly, C.V.O., and his newly-appointed assistant, Mr. W. Symes.

**Light-Weight Diesel Engines.**—Our contemporary *The Motor-Boat and Marine Oil and Gas Engine*, writing on the above subject, says:—"It will not be long now before the six-cylinder M.A.N.-type engines, building by White, at Cowes, make their appearance, and, running at 550 R.P.M., will make a notable step in the development of the high-speed light engine. But a number of Diesel engines that may be placed in the light, fast-running class are already in existence—notably, a six-cylinder Krupp engine for a pinnacle. . . . Here we have a 100-H.P. engine of no more than 3½ tons, inclusive of all gear, and running at 500 R.P.M.—a notable engine in its way; and the same firm has produced a four-cylinder Diesel engine of only 40 H.P., coupled to a reverse gear, and built on conventional petrol-engine lines. It is in Russia . . . that the most notable examples of light construction are to be found, and the most extreme of all is unquestionably an eight-cylinder V-type engine with copper jackets. This engine, giving 150 H.P. at 500 R.P.M., weighs . . . only two tons complete, which is considerably less than that of many petrol engines giving the same power at much higher speed. As Dr. Diesel has recently shown, an engine running at 1,000 R.P.M. will soon be quite a practicable proposition, and, though the problem of first cost has not yet been overcome, it seems certain that Diesels will soon be on an equal footing as regards power-weight ratio with all petrol engines except those specially designed for racing. Meanwhile, a submarine engine . . . has cylinders cast in pairs, copper jackets, a typical petrol-engine crankcase, and many other features seldom associated with Diesels. Moreover, the usual position for the camshaft, with its attendant layshaft and rockers, has been abandoned in favour of a direct-acting set of cams over the centre line of the cylinders, whereby a great deal of weight is saved."



## THE OZONAIR PLANT OF THE CENTRAL LONDON RAILWAY.

On Friday last, through the courtesy of Messrs. Ozonair, Ltd., and the Central London Railway authorities, the recently-installed Ozonair ventilating system on the one-time

copper mesh filter screen, over the surface of which a thin film of water continually flows. This washes the incoming air, removing dirt and smuts, and deleterious gases.

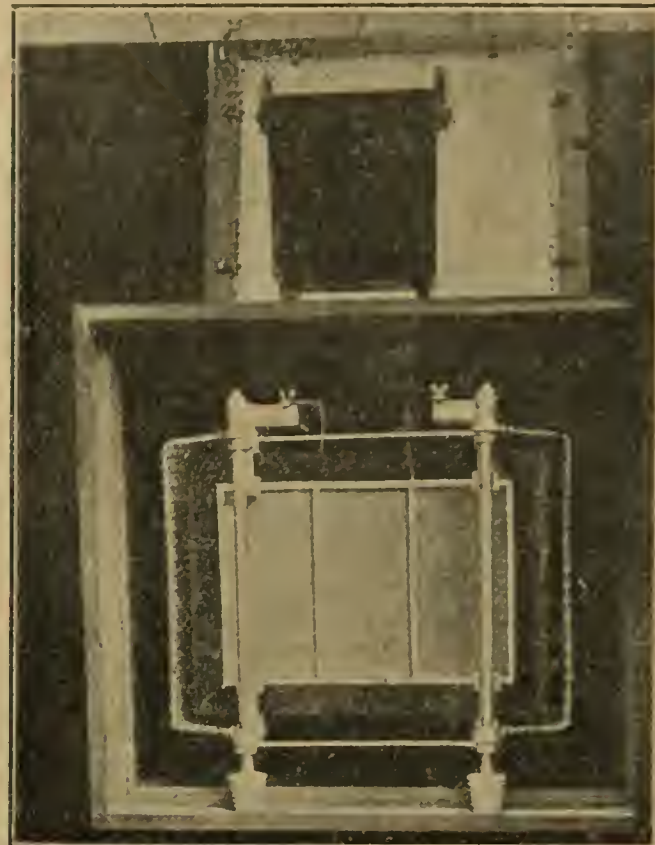
The air is drawn into a Sirocco ventilating fan driven by a motor, usually of 7 H.P., where it meets a comparatively strong ozone mixture delivered from an adjacent ozone generator, and is discharged in its ozonised and purified



TYPICAL STEEL TRUNKING FOR CONVEYING AIR TO PLATFORMS AND TUNNELS.

"tuppenny tube" was thrown open to inspection on the part of the Press and others. That this modern method of improving the air in its stations and tubes has been adopted by the company, and that the results are so strikingly better than those obtained with previous methods, is in every way satisfactory, reflecting great credit on the Ozonair Co.

The equipment consists of an independent Ozonair plant at each station except Shepherd's Bush, which is near the open



OZONE GENERATOR, WITH GUARD REMOVED, AND TRANSFORMER ABOVE.

condition through trunking to the station platforms down below.

The ozone apparatus installed in the Central London stations, consists of 10 mica and gauze generating units, the gauze sheets being supplied with current at 5,000-6,000 volts pressure from the secondary of a small transformer, the primary of which is connected to the 380-volt A.C. side of a small rotary converter, running on a 550-volt D.C. circuit.

A suitable switchboard is provided for controlling the fan motor and converter, and the whole apparatus is exceedingly compact and controllable as to the amount of air delivered and strength of the added ozone mixture, according to temperature or barometric requirements; moreover, the working is practically automatic.

Apart from the Ozonair plant, the system of galvanised steel ducts which have been carried along stair and passageways, &c., with a minimum of obstruction both to the passer-by and to the air inside, is an interesting feature in the equipments.

In each station a small proportion of the clean treated air is supplied to the booking hall, lavatories, &c., on the surface: the remainder passes down a main trunk to a distributing duct under each platform, rising branches delivering air at a height of about 7 ft. above platform level.

The large ducts under the platforms are continued about 40 ft. along the tunnels in the direction in which the trains leave, with a view to the trains themselves assisting in the circulation of the treated air through the tunnels. About a

third of the total air delivered is distributed over the platforms, the remainder being delivered into the tunnels.

At the conclusion of the inspection, the visitors were entertained to luncheon by the Ozonair Co., those present including Mr. Duddell, president-designate of the Institution of Electrical Engineers, Dr. Leonard Hill, representatives of the Ozonair Co., and of various London tube railways.



FILTER SCREEN AND HOUSING OF OZONAIR MACHINERY.

MOTOR-DRIVEN FAN AND CONVERTER FOR OZONAIR APPARATUS

end of the tunnels. The average plant delivers from 5,500 to 7,500 cub. ft. of air per minute, but in two cases this amount of air is exceeded, 20,000 and 12,000 cub. ft. per minute respectively being supplied. Altogether over 80 million cub. ft. of ozonised air is pumped into the tunnels every working day.

In each plant air is drawn from outside through a fine



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## Trade with Canada.

I have read your article and notes on Canadian trade in the current issue of the REVIEW with great interest, having had considerable experience in Western Canada.

I would suggest that one way of increasing confidence in British manufactures, and consequently increasing trade, would be to carry on a serious advertising and educating campaign amongst the emigrants, especially those from North Britain, averaging 2,000 weekly, each imbued with a strong bias and prejudice against anyone born or anything manufactured south of the magic Border line.

W. E. Philbrow.

Glasgow, May 8th, 1912.

[Perhaps some of our readers can furnish information as to the extent of this prejudice, and as to whether it is retained when the emigrant gets abroad.—EDS. E.R.]

## Colonial References.

It is exceedingly refreshing in this far away and dusty Rand, to read in your issue of March 29th the remarks of "Colonial" (who is evidently bubbling over with wisdom) when he refers to the central station engineers of South Africa.

I would indeed like to know what "Colonial's" idea of a central station really is. I have no doubt it would be an education to have his views on the subject. Apart from such stations as are at Cape Town, Durban, Johannesburg or Kimberley, the capacity of the majority of the plants in the towns of South Africa does not exceed 50 kilowatts, and the chief engineer, manager, linesman, &c., is often the same individual, which seems a deplorable state of affairs, and I cannot help feeling glad that a champion (a Colonial one at that) has come forward to show how these things can be put right.

From his remarks it is evident that a number of experts should be imported into this country to run these stations. These experts must, of course, have assistants, and by the time their first quarter's salary was paid, the creditors would receive about twopence in the pound and the chief engineer would annex the plant in part payment of his salary.

"Colonial" seems to have had some difficulty in obtaining a billet in the Old Country, but, if his capabilities are not up to the mark, it is most unjust and unfair to insinuate that the engineers out here are not better men than he is. It is an acknowledged fact that there are more brains to the square inch on the Rand than there are in most parts of the world, but perhaps "Colonial" felt as much out of place out here as he appears to do at home.

This is a country that has many ups and downs, and many an engineer in an excellent position suddenly finds himself out of a billet through no fault of his own. These men have brains, and being practical, sensible men, when they find that they cannot get a whole loaf, they take a half in preference to none at all. They do not lose their brains, dignity or self-respect by soiling their hands by honest labour—dirt will wash off—and when the opportunity arrives they step up again into their proper position. Evidently "Colonial" could not stoop to do such a thing as this.

I do not know in what part of South Africa "Colonial" has lived, but if he has never been in the Transvaal, it is his misfortune. There is not a place in the world of the same area as the Rand, that can show the same amount of electrical plant installed that is of the highest efficiency.

I would like to ask "Colonial" if there are any old or obsolete plants in England, or are they all out here? Does he know that many country houses in England have an electrical plant considerably larger than the plant of many of our country towns? If he does, perhaps he can tell us what class of men run those plants: and would he call those plants central stations?

May I ask "Colonial" how many pounds of coal per k.w.h. he would save on a 40 or 50-kw. plant (what he

calls a central station), running, say, four or five hours a night, by installing a turbine instead of a reciprocating engine of the Belliss type?

Some time back we had some brainy (?) engineers out here: their stock-in-trade appeared to be a 4-in. starched collar, riding breeches, leggings and a slide rule. They have gone home now—they could not make a living; and without these hindrances we are, I am glad to say, plodding on somewhat faster and making some progress.

In conclusion, I would like to offer a word of advice to "Colonial." Don't sneer at small beginnings—they may lead to great ends. Don't think, because there are one or two indifferent engineers in South Africa, that they are all the same. Learn how to lower yourself to tackle any part of the work in connection with a power station—without losing your dignity. It can be done; and when you have mastered it, perhaps you will find your Colonial references will be of more use to you.

Rand.

## The I.E.E. Students and the New Articles.

I have read with amusement, in view of the letter following his own, Mr. Adolf Stelling's letter in to-day's issue of the ELECTRICAL REVIEW, and am glad to know that I have his personal assurance that the printing of the Students' papers, as well as many other ideals of our Section, is receiving the sympathetic consideration of the Council, which, I believe I am correct in saying, has been the case for some time past, and there unfortunately the matter appears to stop, for nothing has yet been done.

Ill-timed my protest may have been, from Mr. Stelling's outlook *alone*, but the fact that the Students' views are not studied sufficiently is shown strikingly in the letter directly following Mr. Stelling's, to whom I would refer the last paragraph without comment, which is quite unnecessary in the circumstances.

I was fully aware that certain Students made their protest last November, individually as well as collectively, and why mine of last week should have been thought ill-timed, though, evidently, only by Mr. Stelling, it is hard to conceive.

My views are fully shared by other Students besides myself, with whom I have been brought into contact during my college training. As regards my interest in the Institution, I have done my best to induce fellow-students to join the Students' Section, but in the majority of cases the reply one receives is simply "What do I get in return for joining?" This year it is certainly an easy matter to reply that unless a would-be Student member joins before December 31st next, he will have to pass some exam., if he has not passed one, such as the London Matriculation, already; and it will no doubt be seen that there is a substantial increase in the number of Students joining this year, for that sole reason.

In conclusion, I, of course, stand unhesitatingly by the views expressed in my former letter, which, I repeat, have the support of others besides myself.

H. Douglas-Steers, Stud. I.E.E.

Rugby, May 10th, 1912.

## A Chilean Concession.

In your issue of May 3rd, page 175, under the heading of "A Chile Hydro-Electric Concession" it is stated that "Mr. W. T. Taylor, representing Messrs. Preece, Cardew & Snell and others, has been studying in Santiago, &c."

We desire to point out that this is an incorrect statement. The facts are these:—Mr. Taylor placed this matter in our hands last week, this being the first we had heard of the scheme, and he is in no sense our "representative," though he has now consulted us on this matter. The paragraph in your paper is, we understand, a communication from your correspondent at Santiago, who no doubt has styled Mr. Taylor as our representative on the ground that Mr. Taylor had, quite unknown to us, informed the officials there that he intended to consult us.

We should be glad if you would publish this, as we desire it to be known that we do not employ representatives or agents of any kind.

Preece, Cardew & Snell.

Westminster, May 11th, 1912.



### The Commercial Assistant.

In your issue of March 29th was inserted a most imposing advertisement by the Gillingham Corporation, inviting applications for the post of commercial assistant for their Electricity Department.

It strikes me as rather amusing that they have appointed a stores clerk and timekeeper from the Borough Surveyor's Department. What can his qualifications be for the job?

### A Qualified Applicant.

May, 13th, 1912.

## LEGAL.

OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(Continued from page 754.)

DR. LIEBMANN re-examined by MR. ASTBURY: Do any of the documents that have been cited, or that have been put to you, in your opinion in any way disclose the invention of weighting a tungsten filament during the process of this disintegration?—No.

Now we will deal with the first patent. It was first of all suggested to you that there was no subject matter in the first specification because of Welsbach. He says:—"When it is fixed it is gradually raised to a high temperature in a reducing atmosphere containing water vapour or hydrogen preferably of the kind before referred to, which is obtained from the Bunsen flame." Does the gas that comes from a Bunsen flame contain carbon?—Yes.

If you tried to make a tungsten filament from a gas obtained from a Bunsen flame, would you or would you not get a successful filament?—You could not; you would put carbon on.

Then he says:—"Mixtures of steam and hydrogen, or of carbonic monoxide, carbonic dioxide, and hydrogen can also be used." Do you know any gas except the steam and hydrogen, and the nitrogen and hydrogen in our first two patents, that will work to make a commercial filament?—Only those two.

Mr. Terrill suggested that if you reduced tungsten oxide with hydrogen, you would form water, and that then you would have your mixture already there with your steam and hydrogen, which, he suggested, was the same thing as you have got in our patent. Would you form any water appreciable at all in the old process, by which the products were always carried off in the stream?—You would form very little water, and that would be carried off.

Suppose you want to-day to reduce tungsten oxide to tungsten; is it still necessary to have a stream in order to carry off the water vapour as you proceed with the reduction?—Naturally, you always do it.

Given the condition of the metal when you are going to make it into filaments, is there any other necessity except that of fine comminution?—No.

Is there anything whatever which had to be learned over and above the thing plainly described in Voelker's patent, for instance, as to the manufacture of the paste?—It is most excellent in Voelker, and I see nothing to add to it.

It has been suggested that very rapid sintering is necessary for success?—I have seen filaments sintered in an atmosphere of steam and hydrogen for five minutes. One filament I exposed myself for about 80 minutes.

Is there anything at all in the point that unless the sintering is very rapid, the lamp is not a good one?—Nothing whatever.

After all you have done, and after all that has been put to you, have you any doubt what it is that takes out the carbon substantially during the first part of the defendants' process?—There is no doubt possible. I have measured the oxygen that comes out under these conditions, and it is carbon monoxide.

WITNESS was further examined on the subject of the dark deposit on the bell jar during the process of sintering, and stated that it was found chiefly parallel to the filaments and consisted of carbonaceous matter contained in the gases, which tended to settle on the hottest parts of the jar.

When you got these tungsten filaments and the globe in practice begins to blacken, it used to be thought that it was a carbon deposit on the globe, did it not?—Yes, but it was not. It is tungsten. Witness added that he never saw those black streaks as long as the weights were on at the inspection.

MR. ASTBURY: I want to sum this up. Mr. Ballantyne thinks that this deposit contains carbonaceous matter. Under the circumstances when this operation is performed, could it possibly be otherwise in your opinion?—It is utterly impossible.

SIR JAMES DEWAR, F.R.S., was examined by MR. COLEFAX. Witness said he had attended the defendants' works for inspection on two occasions. He did not, however, see the last stage which had been referred to in the case as the secret process. Some filaments were taken at the "Z" Co.'s works on February 5th, 1912, by himself, Dr. Liebmann and Dr. Oberlander. Witness handed those filaments over to Mr. Crookes for the purpose of analysis. The next batch bore date

February 20th. That was two grammes of baked filaments from 10,000 filaments taken on February 12th. There were also filaments taken at the "Z" Co.'s works and similarly analysed, the results of which were recorded. Witness also spoke of other analyses that had been made of other lots.

MR. COLEFAX: Prior to the date of Just and Hanaman's patents had anything been published in chemical literature that would tell you that in any of those built-up tungsten filaments, that is to say containing tungsten and carbon, you could oxidise out the carbon without oxidising the tungsten?—No.

Was chemistry in such a state that you could have told without experiment using an atmosphere of steam and hydrogen, that you could oxidise the carbon without oxidising the tungsten?—No.

With respect to that process as you saw it. What is your view as to the agent by which the carbon is removed from the carbonised filaments?—I came to the conclusion at once that it was by a process of oxidation.

Having regard to the results that have been obtained from the standpoint of moisture recovered and determined, do those experiments confirm, or otherwise, your view as to the agent by which the carbon was removed?—Absolute confirmation.

I think you said that when at the works you noticed moisture in the bell jar, and also the absence of any proper precautions to dry the hydrogen?—Yes.

Of course the calcium chloride tube cannot possibly dry it?—It is hopeless.

As contrasted with what they do at the earlier stage when they are carbonising as distinct from decarbonising you noticed what precautions they took to dry their hydrogen there?—In the carbonising and in the hydrogen they use there, they take double precautions. They remove all the traces of oxygen by passing over red hot copper first, and then they pass it not only through chloride and calcium, but over phosphoric anhydride, not only in front of the carbon tube but on the other side, so they use every possible precaution for chemical drying.

They took the precautions to remove the oxygen, and then they have certain precautions for drying the hydrogen as well?—Yes, they do not want to oxidise any of the carbon during the carbonisation, and they want, therefore, to avoid water and any trace of oxygen, and they do not want to diffuse backwards.

You appreciate what is suggested that the carbide is formed and the carbon is volatilised from the carbide, and is not oxidised?—I understand so.

What is your view as to a carbide being formed, given that the tungsten containing carbon is heated in this atmosphere of moist hydrogen?—My view is that there is no carbide formed.

Supposing the carbide is formed, what in the first place is your view as to the suggestion that that dissociates, and the carbon is volatilised from the carbide? Are there any scientific facts known in reference to that question; and if so, are they in conflict or not with the suggestion?—Moissan never succeeded in making tungsten by volatilising the carbon out of the carbide, but he did it by oxidation.

In that connection is there any scientific knowledge that you are aware of that in any way suggests that of the two elements tungsten and carbon, carbon is more volatile than tungsten?—I never heard of such a suggestion. Experiments of my own and of my colleague, Prof. Living, prove to the contrary. It is perfectly ridiculous to suggest there is any proof that carbon is more volatile than tungsten.

Is there any scientific publication suggesting that you can volatilise carbon at any temperature under that which you have mentioned, 3,500°, or something of that kind, and even then volatilise it in substantial quantities?—None whatever. But you see what is suggested is a good deal worse. In this circumstance, as I understand, what is suggested is that the carbon is volatilised before the tungsten melts. Wartenburg in 1907 found the temperature of melting tungsten to be 2,850°, and Weidner and Burgess, two Frenchmen, found the temperature 2,892° or 2,900°.—That is going to make the thing infinitely worse. To suggest now that carbon will volatilise at below 2,900—well, I have nothing more to say on the matter.

Is 3 per cent. the quantity of carbon in the carbide of tungsten that is ordinarily formed?—Yes, that is Moissan's definite carbide of tungsten.

Let us assume that some of the carbon in the carbonised filament, or at some stage in its carbonisation, is in the form of carbide, and assume that is present in an atmosphere of moist hydrogen—is or is not the carbide of tungsten oxidisable under such conditions?—Certainly.

Do you or do you not, having heard what the defendants have, through their counsel, put as to the method by which they remove carbon, accept their explanation as the true one?—I think it is perfectly ludicrous from the scientific point of view.

Is it or is it not the fact that hydrogen and nitrogen will react on carbon—carbon alone—at a temperature of anything like 1,600 degrees?—There is no possibility.

With regard to the action of the hydrogen and nitrogen upon carbon in the presence of tungsten as you find it in one of these filaments. You have made certain researches, and you are aware of the experiments which have been carried out. Do hydrogen and nitrogen react upon the carbon in a tungsten filament?—Yes; they form hydrocyanic acid.

Notwithstanding your research upon the action of nitrogen and hydrogen upon carbon in the arc, could one at the date of the second patent, without experiment, have foretold that you could remove carbon from a tungsten filament by such a gaseous mixture?—I have not heard of any manufacture until this circumstance utilising this reaction for the purpose of a practical invention.

Could it have been foreseen that you could use it practically and



with success to remove carbon from a filament without experiment?—It would not have occurred to me.

COUNSEL then put to witness in great detail certain experiments which had been made to test the second part of defendants' process, and asked: What is your view as to whether or not, in the second stage of defendants' process, some carbon is removed by the action of nitrogen and hydrogen upon it for the formation of hydrocyanic acid or cyanogen compounds?—I have no doubt about it from the description Dr. Passmore gave that phospham was being used, that undoubtedly ammonia was being evolved, and that the conditions were perfect conditions for the interaction, so as to produce cyanogen bodies.

Cross-examined by MR. TERRELL: With regard to the dispute on the first patent, plaintiffs say that the defendants are using an oxidising process for removing the carbon in a sintering bell. Defendants say they are not using the oxidising process at all substantially, but are removing carbon by evaporation, either as a carbide or as carbon?—Yes, you are putting it alternatively.

A long argument then ensued as to the conditions for carrying out an experiment proposed, with a view to demonstrating that carbon could be removed from a filament containing 7 per cent. of carbon by heating it in a bulb containing perfectly pure hydrogen. SIR JAMES DEWAR explained the precautions that must be taken to eliminate water and oxygen in detail.

Supposing these filaments when they are taken out of the globe are carbon free, as carbon free as they generally are after sintering. What will you say to that?—I will wait till I see the result.

May I take it that you do not believe that result will be seen?—I have told you that I know of nothing in scientific literature to suggest that carbon is more volatile than tungsten, and I have given other reasons. That would be something that would be an improvement on what you have put to the Court. I do not say it would satisfy my mind even then.

I am trying to find out what would satisfy you?—You see you can never satisfy the pure experimentalist; he knows the tricks, how he is deceived if he is a real researcher.

Supposing you have got phospham in the lamp on the stem, and that lamp gets heated very considerably in the way which it gets heated when it is being sealed up, and when it is being evacuated you would expect to get ammonia off?—Certainly.

And in that case you would expect to find cyanogen if there were carbon present in the filament?—Yes.

You have never been able to prove it?—Further than by the spectroscope. You cannot weigh the quantities that you detect by the spectroscope.

You do it I understand by taking a Geissler tube and passing a spark through it?—Yes.

The mere passage of the spark destroys cyanogen does it not?—Not at all, otherwise we should never have been able to prove the genesis of the cyanogen spectrum at all.

The observation is only a very instantaneous observation that you can get?—No, it is perfectly continuous.

MR. TERRELL: My lord, I think that the experiment I have suggested to Sir James Dewar should be done in the presence of witnesses that there may be no dispute.

HIS LORDSHIP: The difficulty I feel about these experiments which you propose to do with what you say is perfectly pure hydrogen and no oxygen is, they seem to me, to be inconclusive. Suppose, contrary to Sir James's opinion, you had got rid of the carbon, it does not follow that if you have got oxygen there you do not get rid of the carbon by oxidation.

MR. TERRELL: I want to prove that the theory I put forward is a possible one, and then to show by direct evidence that the process as carried out by us is, at any rate, more likely to be the removal of the carbon in the way in which I say, than the way in which they say.

HIS LORDSHIP: I do not think I can give any direction about it.

MR. HENRY CROOKES, examined, said that for the last 20 years it had been his duty under the supervision of Sir James Dewar and Sir William Crookes to analyse the water of London and many other places. He had carried out the experiments on the filaments given to him by Sir James Dewar by a similar process to one which he generally used for the organic combustion of water residues, but as a higher temperature had to be used, and it was expected that the tungsten filaments would be more difficult to oxidise, instead of using oxide of copper he used chromate of lead, which was a more powerful oxidising agent, and he used quartz tubes instead of glass tubes. He also took the precaution of having the quartz tube not touching anything. It was not in contact with anything as was suggested on the previous day, so that there was no trace of vitrification or porosity. That had also been determined by direct experiment afterwards. There was no leakage whatever. The results were quite correct.

MR. WALTER then summed up the plaintiffs' case. On the first patent there were two issues only so far as he could see which had really been dealt with in the case. The first was non-infringement, and the second one was no subject matter. Non-infringement he would not deal with at present, because he did not at the moment fully understand what was now, in view of what the Court had heard, going to be the suggested case of non-infringement. As regarded the second patent, the only points which he had been able to understand in connection with that were no infringement, and that hydrogen and nitrogen would not work.

HIS LORDSHIP: And prior grant.

MR. WALTER: Your Lordship is quite right. It is a prior grant on Specification No. 15,510, of 1907. I will deal with that. On the third patent, continued counsel, the only point I apprehend is no subject matter.

MR. TERRELL: There is a question of prior user in the third patent.

MR. WALTER, proceeding on the question of subject-matter, said the defendants said that Dr. Welsbach suggested the use of osmium for filaments, and that amongst several other processes he suggested the use of steam and hydrogen for osmium. It was one amongst several processes to which attention would be called, all of which would work for osmium, and they said there was no invention in using steam and hydrogen for the formation of a tungsten filament.

HIS LORDSHIP, it seems to me, that your case is that the plaintiffs by their patent make a new manufacture. That is to say they make a tungsten filament which had never been made before, and it is none the less a new manufacture, because someone else had made an osmium filament, and had made it by the same process. That is what seems to be your case.

MR. WALTER said that was so. It was said either by Dr. Passmore or Dr. Liebmann, that all chemical processes were the tools with which a chemist worked, and it was *nihil ad rem* to say that because a process worked and produced one manufacture, it was going to produce another manufacture of a different material altogether. That summed up the whole position. He would draw his Lordship's attention to one question. It was a new manufacture altogether, but what was it to the chemist? In order to make their case, they must go as far as this. That everyone who read that osmium patent, would know without trial or experiment, that one of the processes, viz., steam and hydrogen, would make the new article manufactured, viz., tungsten filament. But chemistry was an experimental science; no one could predict. If it was so obvious, Welsbach having said that this was a process which applied to the platinum group, why did everyone when he came to mention tungsten in his specification, go to different processes altogether? All the subsequent inventors, including Siemens, so far from trying such a process had only applied it to the platinum group. That was the whole case as regards subject matter. Dealing with the question of infringement, counsel then detailed at great length the process as carried out by the defendants in the manufacture of their filaments. He said there were apparently three theories by which the defendants sought to explain what took place in their sintering jar. The theories put forward were that carbide of tungsten was formed and volatilised as such; that carbide was formed and split up, eliminating carbon as such; and the last one was what he would call the football theory, viz., that the filament kicked out bits of carbon mechanically in some way. Those theories had been put forward as the explanation of what was apparently a very simple chemical operation. It had been suggested that there was a point on subject matter outside Welsbach, viz., Just and Hanaman's German specification of 1904, which was one plaintiffs disclaimed. The first part of that specification said: "If a carbon filament is subjected by means of an electric current to a high temperature in the vapour of tungsten oxychloride in the presence of only very little hydrogen, a most remarkable reaction occurs. The carbon filament is gradually transformed completely into a filament of pure tungsten, a process which has already been employed in an analogous manner for the manufacture of osmium filament." It was, said counsel, suggested that although that was expressly disclaimed, it had some bearing on the subject-matter of the first patent. From the point of view of law—assuming there had been no disclaimer at all—how did the disclosure of the fact that in an oxychloride solution of tungsten (assuming it would work) with a filament of carbon surrounded by tungsten, you could eliminate carbon, affect a process of manufacture which got rid of carbon by means of steam and hydrogen?

HIS LORDSHIP: All that could be said about this is that this showed one means of making a tungsten filament.

MR. WALTER here detailed to his Lordship the objections to the second patent.

HIS LORDSHIP: The defendants, you say, accept your first patent, and they remove the carbon by steam and hydrogen.

MR. WALTER: That is so.

HIS LORDSHIP: Do you go as far as this:—Supposing this process, the second part of their process, has nothing in their minds to do with the removal of carbon, its purpose is a different one altogether, but that, incidentally, it does remove carbon, do you say they are infringing your patent?

MR. WALTER: Yes, my lord.

COUNSEL then dealt with the third patent and said that Dr. Liebmann called the invention "an act of inspiration." The history of the art in itself was the best refutation of the idea that there was not invention. If anyone had thought it out he could not have arrived at the conclusion that he was not doing the most dangerous thing, when he was going to pass through the stage of decarbonising prior to sintering. It was an act of invention of a high order.

MR. TERRELL, opening the case for the defence, said when his learned friend opened the case, in dealing with the first patent, he did so as though this was the patent which had made the success of the carbon-filament industry. His learned friend had not brought before the Court any evidence of any lamp maker who could tell what the history of the thing was, or what was being done at the time of this patent or afterwards. He simply opened it and left it there. He (Mr. Terrell) proposed to call evidence as to what the real state of things was. He would first of all ask his Lordship to look at some dates which appeared on the specification itself. The register of this patent had been searched, and it was dated 1904. It was bought by the predecessors in title of the present plaintiffs—they were the same people, only a change of name took place, viz., on August 2nd, 1907. Between those two dates nothing whatever had been done with it.



either in this country or any other country. At the end of 1907 the defendant company was formed amongst other companies; that was to say, there was the "Z" Co., of Germany, the "Z" Co., of France, and the "Z" Co., of England, which is connected with the present action. They were formed sometime in June, 1907, and commenced actively manufacturing and selling tungsten filaments. The persons who owned this patent had not put it into operation in any way. His Lordship would be told that the secret of the success with which it met was that they had discovered the hard paste process, and that they were able to make, for the first time, high-voltage lamps which had never been made before, and that the "Z" Co. really were the pioneers in this country of the tungsten-filament industry. Having bought a patent in 1907, at sometime in 1908 the plaintiffs woke up to the fact that it might be amended, and they made an application to amend. The document which they lodged at the Patent Office stated they sought to amend because certain parts of the specification were of doubtful novelty. In January, 1909, they obtained leave to amend. At that time defendants had built up a big industry in tungsten filaments in this country, and in 1910 that industry further increased. They brought no action upon this patent, until some time in May, 1910, they issued a writ against some other people—that action was settled. In 1911 they began issuing writs against defendants' customers, and it was with some difficulty that in the end defendants succeeded in getting the trial of this matter, as against themselves, where the position could properly be defended. Then the writ was issued in this action. His Lordship would therefore see that it was not the case of defendants who were trying to get the industry and the work of other people, but it was the case of a company who had bought a patent which they themselves admitted, when they bought it, was invalid, but which they thought that they could make wide enough to capture on it the tungsten filament industry.

MR. ASTBURY said the Osram Co. began to manufacture these lamps in 1907, and before that the patent was worked in Germany.

MR. TERRELL, resuming, said this was originally a patent for tungsten and molybdenum manufactured in two different ways, and they came to his Lordship and said: "Our invention is one of selection." It was found that it was well known that certain metals were highly refractory—they had the power of resisting high temperature without fusion; it was also known that these highly refractory metals for the most part were non-ductile metals. One of them which could not be drawn was osmium, which belonged to a group of metals different from the group to which tungsten and molybdenum belonged; therefore the difficulties were exactly those in the way of making a filament out of tungsten and molybdenum. Welsbach devised a method of using osmium in a very finely divided condition mixed with a binding material. The paste was forced through a die to produce the filament, which was subsequently baked and electrically treated. At the date of Welsbach's invention that was absolutely new. After that came Sander's specification, which belonged to the "Z" Co.; in that Sander was dealing with uranium. He got the idea of producing the metal wire by incorporating the powdered and finely-divided metal with a cellulose solution and forcing it through a die—"in the usual manner"—so that now it would be seen that it was usual to do it in that way. Then he dried the filaments by heating at about 250° C. or up to 300° C. in order to carbonise the binding agent, preferably in an atmosphere of hydrogen or nitrogen, or at least in a receptacle from which atmospheric air is excluded as much as possible. That was Sander's idea. He says: The filaments are then fire-heated by being attached to auxiliary electrodes and placed in a receiver provided with conducting wires by means of which electric current can be conducted through the filaments. Then the air is exhausted from the receiver and hydrogen or other suitable gas or gas mixture may be conducted into the receiver, whereupon the filament is very carefully and slowly brought to a glow by means of an electric current of suitable tension, and then brought to the highest degree of white heat." Sander brought into Welsbach the idea that we now have of sintering. The whole process was there. If Sander was put into practice, and if his learned friend's story was true, Sander was sintering his uranium filaments in an atmosphere of steam and hydrogen, although he only said hydrogen. Certainly it was a uranium filament, but it was being treated in exactly the same way as defendants treated it. That being the state of affairs with regard to Sander, what was wanted now was to get the practical details by which all of this was ultimately accomplished. Before Just and Hanaman, several people had pointed out that tungsten was capable of being brought to a very high degree of heat without fusion or dispersion.

HIS LORDSHIP: Your point is, with regard to that, that if the making of a tungsten filament is in itself a new manufacture, they made it. MR. TERRELL: Yes, and published it; therefore, the article had been made before, although not in the same way. I come now to ask your Lordship to put a construction on the specification which is sued on in this action.

HIS LORDSHIP: You have to find out what it would convey to a skilled person knowing the art and having this document put before him.

COUNSEL then referred to the specification sued upon in the case, No. 23,899, of 1904, and read up to the passage: "... Now, in accordance with the present invention, it is possible to produce filaments consisting of pure tungsten, and which do not, therefore, present the defects above referred to. For the manufacture of filaments of this kind, finely divided tungsten or tungsten compounds, such as tungstite, tungstic acid, tungstic sulphide . . . ." When I am reading this, I may say that I shall be describing exactly Welsbach's process if I substitute the word osmium for tungsten.

HIS LORDSHIP: Yes, I have seen that for some time; I think that is so.

MR. TERRELL: Tungsten as a filament is old; the production of a pure tungsten filament by one process is old. Welsbach has described a process which a chemist, being told of the qualities of tungsten, would know is applicable without any invention to the metal tungsten. If that is so, there is no invention in applying the process revealed by Welsbach for getting a wire to a metal which presents the same difficulties as the metal which Welsbach used. If my friend's witness had said, "Yes; but you had to get over this difficulty or that difficulty in using tungsten," then, I concede, that there would have been invention even in applying the process of Welsbach. Tungsten is reduced by hydrogen, and, therefore, as a consequence, is not oxidisable by water in the presence of hydrogen at reasonable temperatures.

HIS LORDSHIP: The word "reduces," as I understand it, means brings back the metal from the oxide.

MR. TERRELL: Yes.

HIS LORDSHIP: It is reducing in that sense.

MR. TERRELL: Yes; therefore it follows that it was very well known that tungsten was not oxidised by steam.

MR. ASTBURY: When you say not oxidised by steam you do not mean other than in the presence of hydrogen?

MR. TERRELL: It is not oxidised by steam at that temperature at all.

MR. WALTER: Whether the hydrogen is there or not?

MR. TERRELL: It is oxidised in the air, but if the air is not there it is not oxidised by steam. That is what I say.

MR. ASTBURY: It is far more oxidisable even than iron.

MR. TERRELL: Not by steam.

MR. TERRELL: I say that this patent discloses no subject matter because there was no problem to be solved and no difficulty to be got over which had not been solved and got over before by Welsbach under similar circumstances. Counsel then dealt at some length with the experiments that had been put before the Court by plaintiffs, and said:—If plaintiffs are accusing a man of infringing their patent, they ought to bring experiments which are on the sort of thing that he is doing, not on something imaginary which he is not doing.

MR. ASTBURY: Might I make an application now as this point is being taken, viz., that we should have a sufficient quantity of the various filaments they make because we have used them all up, and also a sufficient number of samples of all the filaments that are complained of by way of infringement in this action, in order that we may have further tests made with their filaments. We thought making them with ours made no difference.

HIS LORDSHIP eventually agreed that further experiments should only be conducted if required.

MR. TERRELL resuming on the issue of infringement, he would suggest to his Lordship not one of plaintiffs' experiments, even although they might show that defendants had moisture with their hydrogen, and although they might show that defendants had moisture in the sintering, not one of plaintiffs' experiments showed that the filaments, such as defendants made, were sintered by chemical operation. With regard to insufficiency of description—there was no description at all in the patent sued upon as to what had to be done. It was a statement of chemical reactions, but what had to be done was not told. This specification, he submitted, was hopeless. This patent had been bought up, and had been amended long after it was taken out, and it was hoped now that some Court would give it a construction which would give them a monopoly of squirted tungsten filaments. With regard to patent No. 2, a very curious state of things arose. He was going to submit that this patent, and his witnesses, as at present advised, were going to say that patent No. 2 as a chemical fact was nonsense. This man was actually taking out a patent for reducing the quantity of water vapour and increasing the percentage of hydrogen. Although he (Counsel) knew that his Lordship could not construe the first patent by the second patent, this one could be used as a piece of literature to show what men at the time meant by steam and meant by water vapour. With regard to the question of prior grant, which was specification 15,510 of 1907, he submitted that defendants did not infringe that patent by anything that they did, and in respect of that patent he contended there was a prior grant. As to the question of prior user, this was done by Popham in the west-end of London at Mr. Stearn's works. Mr. Stearn was a lamp manufacturer in London, and the purchaser of a process in Germany for making metal-filament lamps. He saw the weights put on for a considerable time before the defendants' and plaintiffs' patents, in Germany. He and his man Popham were there, and they came over to England, and continuously manufactured lamps by putting the weights on some time before the date of this patent, and after the date of this patent. The question would arise, did they do it in public in such a way as to be a publication. Supposing your Lordship found that although the lamps were made in public, and this particular operation was not done in public then, this consideration was arrived at. This was a process which at the time of the grant of this patent, was being used by someone else, and came within the terms of the grant of this patent, which others at the time of the grant should not use. It was not a question of prior publication, but it was a question that this was being used by someone else, to grant a patent for which would be to stop the man who was using it, and who had a right to use it, from continuing to use it. If prior user was established, and he could not see any reason why it should not be established, that was an end of patent No. 3. When his Lordship had heard the evidence, he (counsel) would ask him to say, first, with regard to patent No. 1, that there was no subject-matter



and that defendants had clearly not infringed on the first construction, and on the second construction that they had not infringed on the evidence. With regard to the second patent, that there was no subject-matter, and that there was no infringement. In respect of the third patent, that there had been a clear prior user, and also that there was no subject-matter, because it was no improvement on what was done before, and what was admitted to have been done before.

(To be continued.)

[The hearing was concluded on May 13th, when his Lordship reserved judgment.]

#### TRAMWAYS AND HEAVY TRAFFIC.

THE interlocutor of Sheriff-Principal Wilson has been issued in an appeal made to him by the Greenock and Port Glasgow Tramways Co. against the decision of Sheriff Welsh, in an action for interdict and damages raised by them against Messrs. Rankine & Blackmore, engineers and ironfounders, Greenock. The pursuers sued for compensation for damage alleged to have been caused to their track by the haulage of boilers and machinery over the roadway, and also sought to interdict defenders from conveying such loads over their track.

Sheriff Welsh decided against the pursuers in the original action, finding that the condition of the track at the times complained of was not brought about primarily by the defenders' traffic, but partly by said traffic, and partly by the worn condition of the track at the time, and primarily by the pursuers having laid down setts of a soft and inferior wearing quality. That decision has been upheld by Sheriff Wilson, who states that pursuers' action was not well founded in fact or in law. The traffic was not a nuisance, and the streets must be kept in a fit state to receive it. The real reason of the track setts becoming broken was that they were unequally laid, were not of sufficient depth, and contained soft granite, which could not stand ordinary traffic.

The appeal was refused, with additional expenses against the tramway company.

#### ELLIS v. OSRAM LAMP WORKS, LTD.

THIS action, which related to an alleged nuisance caused by the defendants' works, was before Mr. Justice Neville on May 9th, in the Chancery Division, but was dismissed, the plaintiff not appearing.

MR. WERTHEIMER, who, with MR. JENKINS, K.C., appeared for the defendants, said that Mr. Cavanagh, who had drawn the statement of claim, did not now appear for the plaintiff, and he understood no other counsel had been instructed. The action was brought to restrain an alleged nuisance of noise and vibration, and there was a counter-claim by the defendants for damages for delapidations under a tenancy agreement. The defendants were, however, willing to waive any claim on the counter-claim, and have the action dismissed with costs.

The plaintiff not appearing, his Lordship dismissed the action accordingly.

#### WILSON v. LANCS. UNITED TRAMWAYS CO.

HANNAH WILSON, aged two years, of Bolton, near Atherton, was on Friday at Leigh County Court, awarded £100 from the Lincs. United Tramways Co. for damages for an accident on December 19th. She tried to cross the road as a tramcar was coming along, and was knocked down and injured so badly that her right foot had to be amputated. The driver had previously stopped to allow her sister to run across.

#### ELECTRICAL ENGINEERING CO.'S AFFAIRS.

IN the Chancery Division, on Tuesday, May 14th, Mr. Justice Swinfen Eady heard a petition by Edward Foster & Son, Ltd., electrical and sanitary engineers, &c., of Halifax, to confirm a special resolution to reduce the company's capital by £14,665.

MR. F. K. RUSSELL, K.C. (with Mr. Ashton Cross), appeared for the company, and said the whole burden of the reduction was to be borne by one shareholder—Mr. Foster, the chairman of the company. The company was incorporated in 1897 with a capital of £50,000, divided into 5,000 £5 preference and 5,000 £5 ordinary shares. All the preference and 3,000 of the ordinary shares were issued, and of these 1,000 preference and 2,000 ordinary shares were issued as fully paid to Mr. Foster, who was the vendor to the company. It was proposed to cancel a block of each of these shares. How the money had been lost was proved by Mr. Foster and the company's accountant, and it was to be met by a revaluation of the company's goodwill.

HIS LORDSHIP: Has this petition been advertised?

MR. RUSSELL: No; in the peculiar circumstances of the case the Registrar dispensed with both the advertising and the use of the words "and reduced." Continuing, counsel said that they proved the loss at £14,665, and it was proposed to cancel 1,981 of the vendor's ordinary shares, equal to £9,905, and 952 of his preference shares, making altogether £14,665.

HIS LORDSHIP said he could not deal with this petition in the absence of evidence as to the deferred shares mentioned in the balance-sheet. He did not accept the view that the other shareholders were not affected by the reduction of the ordinary capital. He thought they were materially affected.

MR. RUSSELL said they all had complete notice of it, and the resolution was passed unanimously.

HIS LORDSHIP: That may be, but the question is whether they are affected.

MR. RUSSELL: The loss is going to fall upon Mr. Foster.

HIS LORDSHIP said the petition must be advertised, and he would adjourn it for a week for that purpose and for further evidence. His Lordship asked what dividend the company had paid.

MR. RUSSELL replied that for the first 10 years the preference shareholders got their 5½ per cent. cumulative dividend, and the ordinary shareholders their 5 per cent., but for the last three years no dividend had been paid, there having been a loss on trading.

HIS LORDSHIP directed the petition to stand over for a week.

#### SPITTING IN TRAMCARS.

AT Bacup, on Monday, the first prosecution by Rawtenstall Corporation for the offence of spitting in tramcars was heard against a defendant named Patrick O'Brien, quarryman. Wm. Riley, conductor, said that on the 14th ult., defendant persistently spat in a car travelling from Rawtenstall to Bacup, and when cautioned, defied the conductor and gave a wrong name and address. Mr. C. L. E. Stewart, electrical engineer and manager of the Rawtenstall Corporation tramways, said they had had great trouble on account of the exceedingly offensive condition of the tops of the cars, through spitting, so that ladies would not go on top. Notices had been posted in all the cars for some time prohibiting the practice. Dr. Brown, M.O.H., Bacup, gave evidence, and the Magistrates imposed a penalty of 10s. and costs.

#### IN re THE CONSOLIDATED ELECTRIC WORKS AND APPLIANCES, LTD.

THE affairs of this company came before Mr. Justice Parker in the Chancery Division on Monday, May 13th, in a debenture-holders' action instituted by Mr. Clarke and Mrs. Squire.

MR. CROSSFIELD, who represented Mrs. Squire, said that she held the whole of the first mortgage debentures issued by the company, and the defendants, who were the company, and subsequent incumbrancers, had put in no defence to the action. The action, therefore, came on upon motion for judgment, the plaintiff asking for a declaration that she was entitled to a charge in respect of 50 debentures for £50 each, and the usual accounts and inquiries. The company and Mr. Clarke appeared, and assented to the order, but Mr. Wicks, who held debentures, was not represented.

MR. STEPHEN LYNCH said he appeared for the company, and raised no objection to the proposed order.

HIS LORDSHIP said he would make a declaration that the plaintiff was entitled to a charge, and, in addition to the usual accounts and inquiries, would direct an inquiry as to whether the Wicks claim was subsequent to or prior to the plaintiff's. He continued the manager, who had been appointed until June 30th, until October 31st next.

#### WORKMEN'S COMPENSATION ACT.

AS the result of the death of Henry Andrews, who was killed by electric shock at the Pigeon House Electricity Works, Dublin, on February 23rd, his mother sued Messrs. Ferranti, Ltd., his employers, for compensation, he having been her sole support. The Recorder last week awarded £150 compensation.

### NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

#### Thermo-Electrical Combustion Calorimeter.

Prof. Ch. Féry recently submitted to the French Academy of Sciences a novel thermo-electrical calorimeter, which, like the Mahler apparatus, is well adapted for determining the heat value of fuel. A distinctive feature of this apparatus is the fact that the heat value is read immediately from a dial without any correction.

The calorimeter bomb A, fig. 1, has been made as light as possible, the water mass—which in the Mahler apparatus serves as the main heat mass—being dispensed with. The bomb is kept in the centre of a metal cylinder B by two constantan disks K K, and forms the hot junction of a large thermo-electric element, the cold junction being constituted by the cylinder B. After introducing the fuel, according to usual practice, into the crucible C, the bomb is filled with compressed oxygen and ignited by means of the battery P.

The deflection of the milli-voltmeter V, the range of which corresponds to the combustion of one gramme of pure carbon, yields without any correction the heat value desired. The heat losses due to the conductance of the constantan disks have been made great enough to allow any losses by convection and radiation, which are not proportional to the difference in temperature between the bomb and the cylinder, to be neglected. The only correction left accordingly corresponds to the loss of heat due to conductance, and as this is proportional to the figure to be measured, it does not in any way alter the relative values of the deflections corresponding to each fuel.



Experiments made at the Laboratoire des Arts et Métiers have borne out these theoretical previsions, showing the value of a division of the milli-voltmeter, as given in heat units, to be independent of the weight and kind of fuel.

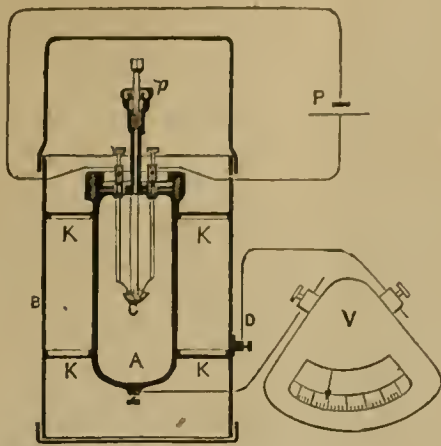


FIG. 1.—FERY THERMO-ELECTRICAL CALORIMETER.

This apparatus, which is mainly intended for industrial purposes, can, with a few trifling alterations, be adapted to laboratory use.

#### Patent Tilting and Rise-and-Fall Fitting.

MESSRS. C. J. THURSFIELD & CO., LTD., of Cecil Works, Clement Street Parade, Birmingham, have introduced an ingenious cord pendant which has a vertical rise-and-fall movement in addition to

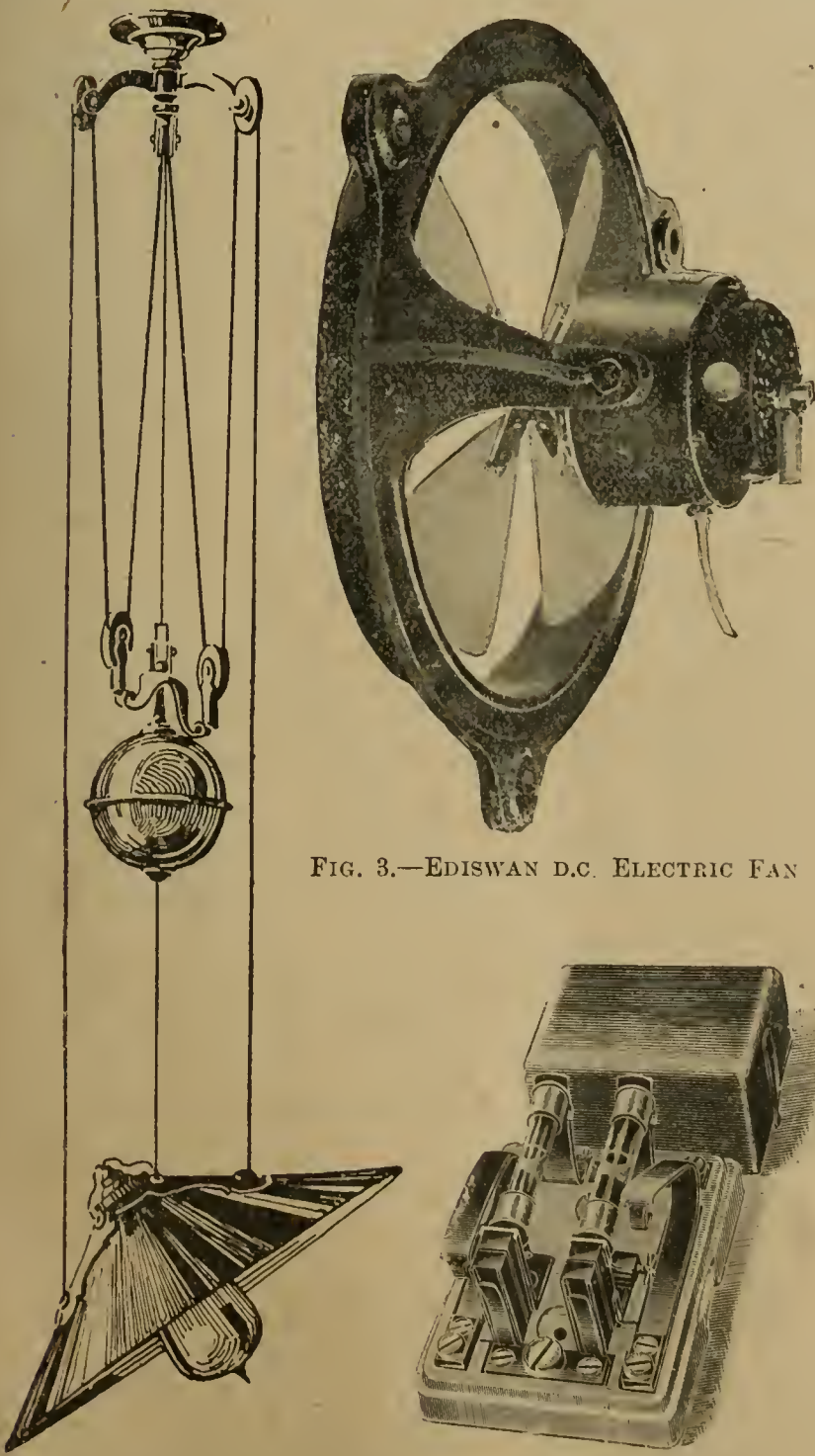
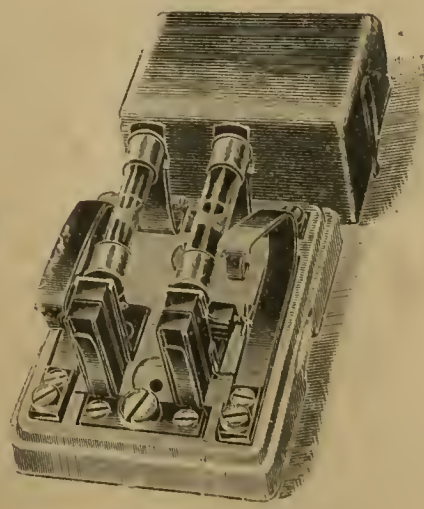


FIG. 3.—EDISWAN D.C. ELECTRIC FAN

FIG. 2.—THURSFIELD PATENT  
ADJUSTABLE SUSPENSORY  
FITTING.FIG. 4.—W. E. INSTRUMENT  
PROTECTOR.

efficient loading of this weight is important, as it also balances the shade when tipped at an acute angle. The fitting is particularly useful for drawing offices, picture galleries, bedrooms (for reading in bed), for lighting music, and also for hospitals. It can be supplied in a larger size for operating theatres in hospitals.

#### Ediswan Electric Fans.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of Queen Street, E.C., have recently introduced a special type of electric fan, suitable for use on direct-current circuits. These are supplied in the convertible table or bracket pattern, also as port-hole fans, one of which we illustrate (fig. 3), the blade diameter being 12 in., and the power consumption 40 watts at about 1,300 R.P.M.

Particular attention has been given to the design of these fans, which are recommended as being both sparkless and noiseless in operation, and embodying the best construction. Full particulars and prices are contained in leaflet No. H 2,248.

#### W. E. Instrument Protector.

The WESTERN ELECTRIC CO., LTD., of North Woolwich, London, have sent us details of their instrument protector which are of considerable interest to the telephone engineer. It is claimed that this protector, which is known as the No. 5,054, is the best in design yet produced for the protection of instruments against abnormal currents. The special feature is the self-soldering heat coil, an ingenious device which obviates the trouble of replacing the coil after it has been operated. It consists of a coil carrying a star-wheel, which holds a contact spring in place. A flow of current through the coil melts a fusible solder and allows the star-wheel to turn and thus release the spring and break the circuit. In a few seconds the solder sets and the contact spring may be replaced, provided the fault has been cleared. In addition to the heat coils there are the usual carbon block cut-outs with mica separators, and also fuses, all very compactly arranged on a porcelain base  $3\frac{1}{2}$  in.  $\times$   $2\frac{3}{4}$  in. only, with cover (fig. 4).

Protection is thus given against sneak currents (small currents which cause damage after protracted flow), moderate currents such as in electric lighting mains, high-pressure current up to 600 volts, and also lightning. This protector is not suitable for pressures above 600 volts, although it is quite effective against lightning, due to the fact that the latter has very high voltage but little energy. In other words a minute current, and the carbon cut-out is operated immediately and the energy all expended. The conditions are different in the case of a power circuit of, say, 1,000 volts, as a sufficiently heavy current may flow to maintain the arc across the carbons.

The heat coils and fuses are in series with the carbon cut-outs looped across the lines (with centre points earthed) between fuses and heat coils. The necessity for both fuses and heat coils is apparent, if we suppose that the lines are in contact with electric mains. A current will flow through the fuses but not through the heat coils, so that if the fuses were not fitted, the line might be destroyed. The protector is adapted either for central-battery or magneto circuits, and is also largely used for fire-alarm circuits.

#### PARLIAMENTARY.

##### Light Railways Bill.

STANDING COMMITTEE B, under the chairmanship of Sir A. Griffith Boscawen, continued the consideration of the Light Railways Bill on May 10th.

Clause 2, as amended, read as follows when the Committee resumed:—

2.—(1) A trackless trolley system along any road or street may, with the consent of the road authority of the district in which such road or street is situate, which consent shall not be unreasonably withheld, be authorised by order under the principal Act in the same manner and subject to the same conditions as a light railway, and that Act and any Act amending the same shall accordingly be construed as if the expression "light railway" included a trackless trolley system.

Provided that any such order shall contain provisions requiring the company, body, or person upon whom the powers thereof are conferred to pay the cost of any alterations or improvements in the road or street made for the purposes of, or rendered necessary by, the trackless trolley system, and to make a contribution towards the cost of maintaining the road or street, regard being had in determining the amount of such contribution to (amongst other things) the additional expense incurred by the authority by whom the road or street is maintained.

(2) The expression "trackless trolley system" means a system of running on roads or streets without any defined track or line of rails mechanically propelled vehicles moved by electrical power transmitted thereto from some external source, and includes all apparatus necessary for working the system.

(3) Mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section shall not be deemed to be light locomotives within the meaning of the Locomotives on Highways Act, 1896, or the by-laws and regulations made thereunder, nor shall they be deemed to be motor-cars within the meaning of any provisions of the Motor-Car Act, 1903, except sub-Sec. (1) of Sec. 1 of that Act, and the provisions necessary for enforcing that sub-Section, and subject to that exception

the tilting of the shade (fig. 2). Apart from this advantage, the shade remains fixed in the position in which it was tilted, and has no tendency to turn round and alter its position after it has been tilted. To economise flex and to ensure smooth running it should be wired with single flexible cords, not twin, two of which are used for current leads.

The balance weight should be loaded sufficiently with shot so that the fitting remains quite stationary at varying heights; the



neither that Act nor the regulations made upon that Act nor the enactments mentioned in the schedule to the Locomotives on Highways Act, 1896, nor the Locomotives Act, 1898, shall apply to any such mechanically-propelled vehicles except in so far as they are incorporated or applied by the order authorising the system. Provided that nothing in this provision shall affect any duties of excise (including the duties charged by Sec. 8 of the Locomotives on Highways Act, 1896) for the time being made in respect of any such vehicles.

VISCOUNT HELMSLEY moved the addition of the following words to the clause: "Provided that the Board of Trade shall make regulations specifying the dimensions and material of tires of all such vehicles and that such regulations shall be periodically revised." He said his object was to ensure that the use of the roads by these vehicles was a reasonable one, and that they should not be allowed to use such tires as would do more than usual damage to the roads.

MR. J. M. ROBERTSON said that any order issued by the Board of Trade would secure what the hon. member wanted, and, in fact, the control already exercised by the Board of Trade afforded better precautions than that suggested by the amendment.

It was agreed to insert words to the effect that the material for tires for the trackless trolleys should be regulated by an order issued by the Light Railway Commissioners.

MR. J. M. ROBERTSON then moved the addition of the following sub-clause:—"(4) Sec. 48 of the Tramways Act, 1870 (which applies to tramways certain enactments relating to hackney carriages), shall apply in the case of any mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section in the same manner as it applies in the case of carriages used on a tramway."

ε The amendment was agreed to.

ω MR. H. LAWSON moved to add the words "provided that the provisions of this section shall not apply to the County of London." He pointed out that London had always been treated by Parliament as being the subject for separate legislation as regarded tramways, and the Metropolitan Borough Councils had special powers with regard to tramways passing through their areas. He did not think anyone would suggest that there was any need for trackless trolleys within the County of London, because the London County Council had linked up the different parts by the tramways, and had running powers over the lines of outside authorities.

MR. J. M. ROBERTSON said the Board of Trade saw so little likelihood of trackless trolleys being required in London that he would offer no objection to the amendment.

The amendment was then agreed to.

The Committee next considered Clause 3, which read: "The sum of £750,000 shall be substituted in Sec. 6 of the principal Act for £250,000 as the limit of the amount which may be expended for the purpose of special advances under that Act."

Replying to MR. HICKS-BEACH, MR. ROBERTSON said the amount actually advanced for light railways up to the present under Sec. 5 of the 1896 Act was £126,945, by way of free grants, and £22,200 by way of loan. In addition there had been promised £68,000 in free grants, and £16,000 in loans, which only left £16,742 out of the £250,000 as fixed by the Act. If the Light Railways Act was to be extended, Parliament would undoubtedly have to contemplate giving free grants. Light railways had done a great deal for agriculture and industry in various parts of the country, but the Act had not worked so extensively as was desired.

Clause 4 was agreed to as follows:—" (4) Notwithstanding anything contained in Sec. 11 of the principal Act, provision may be made by an order under the principal Act for carrying Sec. 92 of the Lands Clauses Consolidation Act, 1845, as incorporated in the order in such a manner as to provide for the taking of part only of a house, building, or manufactory, except where it is shown to the authority to whom the question of disputed compensation is submitted, that that part cannot be severed from the remainder of the property without material detriment thereto, but no such provision shall be made unless the Light Railway Commissioners are satisfied that special notice of the proposal to acquire part only of the house, building, or manufactory has been given under paragraph (b) of sub-Section (2) of Sec. 7 of the principal Act to the owner, lessee, and occupier of the house, buildings, or manufactory."

The Committee counted out before the hour fixed for the adjournment.

On Tuesday, Standing Committee B concluded its consideration of this Bill.

Clause 6 dealt with the important question of local authorities guaranteeing dividends and read as follows:—"Clause 6 (1) The powers of the Council of a county, borough, or district, under Section 3 of the principal Act shall include a power, subject to such conditions as may be prescribed by the order, to guarantee the payment of interest or dividends on such amount of the loan or share capital of a light railway company as may be fixed by the order, and in fixing that amount regard shall be had to the benefit which may be expected to accrue to the area from the construction of the railways. (2) The reference in Section 4 of the principal Act to a Council advancing or agreeing to advance any sum shall include a reference to a Council guaranteeing, or agreeing to guarantee, any interest or dividends under this section, and as respects any case in which a Council have so guaranteed, or agreed to guarantee, any interest or dividends the words "the amount for the time being advanced by the Council," in the said Sec. 4, shall be deemed to mean the nominal amount of the capital the interest or dividends on which are guaranteed by the Council: (3) Sec. 11 of the principal Act shall have effect as if the following paragraph were inserted therein after paragraph (g):—

"(gg) Authorising a Council to guarantee the payment of interest

or dividend on the loan or share capital of a light railway company, and the payment of any amount by which the receipts from the undertaking are insufficient for the purpose of providing the sums required for the maintenance and working of the light railway when constructed, and limiting the amount of capital in respect of which, and regulating the terms on which, the guarantee may be given."

MR. J. ROWLANDS moved that the clause be postponed.

MR. H. LAWSON considered the clause was unfair, and would be a dangerous power, open to abuse.

MR. J. M. ROBERTSON (Parliamentary Secretary to the Board of Trade) said that no such danger was incurred as was suggested. The original Act went quite as far in the way of allowing local authorities to incur liability. The clause before them simply varied the mode in which local authorities might incur the liability; the power it gave was a more restricted and a less precarious permission than was given in the original Act. It simply gave the local authority an easier opportunity of assisting the scheme.

MR. LANE FOX submitted that the ease of the operation would make the clause more dangerous.

MR. J. SAMUEL said he considered it a serious departure from the existing law.

MR. WOOD objected to the fundamental principle on the ground that if they passed such a clause he did not see how they could object to a local authority advancing money and guaranteeing dividends to any company for any purpose.

To enable a decision to be taken on the question, Mr. Rowlands withdrew his amendment, and

MR. WAKDLE moved the omission of sub-Clause 1.

MR. ROBERTSON pointed out that the whole object of the Bill was to assist light railways, but after the line which the Committee seemed to take it was no use trying to pass the clause.

MR. WARDLE'S amendment was formally carried, and the whole clause was negatived. The remainder of the clauses, which dealt with no point of principle, were carried without discussion.

MR. ROBERTSON proposed the following new clause to be inserted after Clause 3:—"In the case of an application for an advance under Part I of the Development and Road Improvement Funds Act, 1909, for the purpose of a light railway in Great Britain by any body or person other than a Government department, the Light Railway Commissioners shall, for the purposes of Sec. 4 of that Act, be taken to be the Government department concerned, and accordingly the application shall be sent by the Treasury under that section to the Light Railway Commissioners, to be by them referred together with their report thereon to the Development Commissioners."

The clause was agreed to without discussion.

VISCOUNT HELMSLEY proposed the addition of the following new clause:—"The term 'road authority,' or 'local authority,' in this Act, shall, as regards main roads vested in the County Council, include the County Council." The addition was carried on the casting vote of the chairman, and the Bill as amended was ordered to be reported to the House.

### Railless Trolley Schemes.

MR. FRED. HALL asked the President of the Board of Trade whether it was proposed under the Light Railways Bill to make the promoters of railless trolley schemes responsible for road alterations and maintenance; whether road rates would also be leviable in respect of such lines; and whether, in view of the fact that no greater wear and tear had been shown to arise from railless trolley vehicles than in the case of motor omnibuses, he would consider the desirability of placing the two forms of locomotion on the same footing in these respects. MR. BUXTON replied that the Bill, as introduced on behalf of the Board of Trade, did not require a contribution for road maintenance from promoters of railless trolley schemes, nor did it expressly provide that promoters were to be liable for road alterations necessitated by their schemes, but this would be provided for in any order made under the powers of the Bill. The Standing Committee, to which the Bill had been referred, had adopted an amendment requiring that every order authorising a railless trolley scheme should provide for a maintenance contribution. Promoters of railless trolley schemes would be liable to be rated on their undertakings in respect of the posts and wire erected by them as part of their system. He saw no evidence that railless trolley vehicles caused greater wear and tear to roads than motor omnibuses.

### Bognor Electric Lighting.

ON May 7th Sir H. Kimber's Select Committee of the House of Commons commenced the consideration of the Bill promoted by the Bognor Gas Light and Coke Co., asking for powers to erect a generating station and to supply electricity, and to raise £30,000 additional capital. The Committee considered at the same time Electric Lighting Provisional Order Confirmation Bill (No. 1), so far as it related to the confirmation of the order granted by the Board of Trade to Mr. William Tate, of Tower House, Felpham, which contained the provision that the powers were not to be exercised unless the order was transferred to a company, and that the local authority should be empowered to purchase at the expiration of 15 years.

MR. BALFOUR BROWNE, K.C., on behalf of the Bognor Gas Co., said that if the Committee passed the Bill, he undertook to say that district would get a supply of electricity and power in a much



shorter time than if the provisional order was confirmed. Mr. Tate was a land agent, and had put up an arcade and kursaal and theatre and other building at Bognor, and he had also a little private electric lighting undertaking, which was supplying current to his own tenants. If the order was confirmed, everything would depend upon Mr. Tate getting a company formed to take over the order within a year. On the other hand, the Gas Co. was a sound concern, paying large dividends, and would be able to raise their capital economically in the interest of the community. If the company got their Bill they were prepared to pay Mr. Tate the cost of his plant on Land Clauses terms.

MR. CAMPBELL SWINTON, electrical engineer, was called on behalf of the Gas Co., and said that the company proposed to erect new works outside the town and use gas power to drive the dynamos for the generation of electricity. There had undoubtedly been a difficulty in making electric lighting undertakings in small towns profitable unless the local company had been in a position to stand a loss at the commencement. In the case of an existing gas company, undertaking the supply of electricity, they had, of course, their existing undertaking to fall back upon, and there was also saving of administration expenses and in road work. He did not think it would be a proper thing to make the statutory maximum price of such a concern 6d. per unit, in view of the general use of the metallic-filament lamp and the rise in the price of fuel. The Edmundson Electricity Corporation, with which he was connected, and which had a large number of towns associated with it, had a system of charges by which the maximum price was 8d. per unit, and it went down with increased supply to an average from 4d. to 6d. With regard to the provisional order of Mr. Tate, the fact that the concern would be purchasable at the end of 15 years would militate against the raising of capital. He also considered that the estimate of Mr. Tate, that the consumption of electricity would be 180,000 units per annum at the end of four years, was not reasonable.

Questioned by the CHAIRMAN as to what Mr. Tate's view was of the offer of the Gas Co. with regard to purchasing his plant, MR. VESEY KNOX, K.C., said he thought, if the Gas Co. got their Bill, they ought to be compelled to buy the Tate Co. out.

The CHAIRMAN pointed out that if, in the public interest, the Committee decided to grant the company their Bill, then Mr. Tate would be in the position of a private proprietor who simply lit his private establishment without public authority.

MR. VESEY KNOX intimated that his client would take the risk, and that he declined the company's offer.

MR. CAMPBELL SWINTON continued his evidence, and criticised the estimates of the Tate scheme.

In cross-examination by MR. VESEY KNOX, WITNESS said he considered that in a short period the Gas Co. would be able to pay 4 or 5 per cent. on the electrical undertaking, because the administration and upkeep expense, as he had explained, would be small.

On May 8th the parties came to an agreement under which the provisional order granted to Mr. Tate was withdrawn, and the following clause was agreed to:—“(1) The company to lay mains and provide supply in the compulsory area in two years; (2) The company not to raise the price per unit to consumers at present supplied by Mr. Tate, and to supply Mr. Tate with electricity for use in daylight hours at 1½d. per unit (minimum payment £100 per annum), at 1½d. for the theatre, arcade, and kursaal; (3) The company to treat within six months after the passing of the Bill, and to purchase under the Land Clauses Act, Mr. Tate's electrical undertaking, including his premises in Richmond Road, and the machinery, mains, and services; (4) The company to pay £250 towards the cost of the provisional order on Royal Assent.”

### Stockport Railless Traction Scheme.

THE Select Committee of the House of Lords presided over by Lord Ribblesdale last week considered the Bill promoted by the Stockport Corporation, which, among other things, authorised the Corporation to install and run railless trolley cars in connection with the tramways. The only opposition came from Mr. John Bateman and a number of other owners of property in the district through which it was proposed to run the cars.

MR. H. LLOYD, K.C., appeared with Mr. Jeeves for the Corporation, and explained that the original intention was to have run railless cars to Marple from St. Petersgate for the convenience, as it was thought, of the districts lying outside the borough, but the demands of these outside local authorities were so great that the proposal was now limited to a route within the borough, of a length of about 1½ miles. In 1900 the Corporation were authorised to construct a tramway along this route, but, on the ground of cost, it had never been constructed, although the other tramways for which they were given power had been constructed. It was now felt that the adoption of the railless system on the route would meet the needs, and the route had been approved by the Board of Trade. The petitioners were owners and occupiers of property in the St. Petersgate district. St. Petersgate was a narrow thoroughfare leading from the chief railway station to the market, and the petitioners alleged that the running of trolley vehicles would constitute a danger. The Corporation had considered every conceivable route and had come to the conclusion that the one proposed was the best in every way.

After evidence had been given, the Committee passed the preamble of the Bill, but imposed the restriction that with regard to the 175 yards in St. Petersgate, there should be a speed limit of 4 miles an hour. Further, the railless trolleys were not to pass or cross each other at all on these 175 yards, or anywhere else on the route where the roadway was less than 21 ft. clear. In the manipulation of the railless vehicles the promoters were to

secure by by-law or regulation that the proper rule of the road should be observed. The trolleys were also only to stop at fixed points, and were not to run through St. Petersgate on Fridays and Saturdays, which were market days.

MR. LLOYD, K.C., said the terms of the decision would be communicated to the Board of Trade.

## BUSINESS NOTES.

**The One-Break System.**—During the recent coal strike THE ELECTRIC CONSTRUCTION CO., LTD., Bushbury, introduced into their works the “one-break system,” and it has worked so well that the management have decided to continue it in the future. The workpeople greatly appreciate the change, particularly as it reduces their working time from a total of 53 to one of 50 hours a week. The men begin at 7.30 each morning and work until 12.30. The resumption takes place at 1.30, and work is continued until 5.30.

**Book Notices.**—*Sixty Years of Progress and Fiscal Policy.* By Earl Brassey. New edition. London: Free Trade Union. 1s. 6d.—This is a revised edition of a volume published in 1906. The contents of the eight chapters are as follows: Mr. Chamberlain's Proposals; General Statistics of Trade; Free Trade and Protection; Social and Economic Conditions at Home and Abroad; Retaliation; Trade in Neutral Markets; Imperial Unity by Tariffs; The True Bonds of Empire.

**Trade Announcements.**—MR. THOMAS S. WALLACE, who has started business as an electrical contractor at Breadalbane Place, Oban, desires to receive price lists from electrical manufacturers.

The address of the MARCONI COMPANIES is now Marconi House, Strand, London, W.C.

MESSRS. OSBORNE & HUNTER have removed to new premises at 99, Douglas Street, Glasgow. New telephone number, Central 5,221.

MR. LASCELLES PARRINGTON, late manager of the Welsbach Light Co.'s electrical and engineering business in Melbourne, who is now in business as a manufacturers' agent, is on a visit to London. He is open to represent a few first-class manufacturers in Australia (see advertisement pages).

The business of Messrs. Brown Bros., electrical engineers, of Middlesbrough, has been taken over by MESSRS. R. S. HIGSON & CO., of 6, Bridge Street, Middlesbrough.

**Bankruptcy Proceedings.**—WYCLIFFE GALLAND EVERINGHAM, electrician, 37, Auckland Road, Ilford, Essex.—An application was made to his Honour Judge Tindal Atkinson, sitting at the Shire Hall, Chelmsford, on Monday last, for the discharge from bankruptcy of the above-named debtor. The Official Receiver reported that the failure occurred in 1910. The debtor went into partnership in an electrical company, which was dissolved later. He attributed his failure to want of experience. The deficiency totalled £591 14s. 9d. Proper books of account had not been kept by the debtor, who had continued to trade knowing that he had not sufficient to pay his debts in full. The discharge was granted subject to a suspension of two years and three months.

C. H. STEEL, electrical engineer, Bradford, lately of Cardiff and Merthyr Tydfil.—Receiving order made May 6th on debtor's own petition.

GEO. BARKER, electrical engineer, Roundhay and Harrogate.—Date of release of trustee (D. S. Mackay), January 29th, 1912.

**Liquidation.**—NORTH BRITISH ELECTRICAL CO., LTD.—A meeting is to be held at 22, Brazennose Street, Manchester, on June 15th, to hear an account of the winding up from the liquidator, Mr. J. R. Hesketh.

**Private Meeting.**—ROWLAND & HULTON, LTD., 109, Great Eastern Street, London, E.C., electrical engineers and contractors.—An adjourned meeting of the creditors herein was held on April 25th for the purpose of hearing the result of negotiations with a view to securing payment of a composition of 10s. in the £, but this had not been successful, and, unless it was forthcoming in the next few days, it was decided that the company be wound up voluntarily. According to the statement of affairs, the liabilities amount to £720, and the assets were estimated at £392 net. The liabilities were made up of the claims of unsecured trade creditors, £520, and cash creditors' claims £200. The assets included book debts, good and doubtful, £230. The estate disclosed a deficiency of £328. The following are creditors:—

Armorduct Manufacturing Co. . .	£29	Siemens Bros. Dynamo Works, Ltd. . .	£76
Edison & Swan Co. . .	29	Siemens Bros. & Co., Ltd., Woolwich . .	33
General Electric Co. . .	40	Walsall Hardware Manufacturing Co., Walsall . .	19
Greener, J. & H. . .	44		
Holophane Glass Co. . .	19		
Krupka & Jacoby . .	50		
Maltzahn & Springer . .	35		

**Belgium.**—LA SOCIÉTÉ BELGE BROWN-BOVERI is the name of a new company which has just been formed in Brussels, with a capital of £20,000, to develop the trade in Brown-Boveri electrical plant in Belgium.

**Austria.**—It is reported that efforts are being made to form a syndicate of all the manufacturers of cables in which lead is not employed, in Austria and Hungary.



**Price Advance.**—THE WALSALL ELECTRICAL CO., LTD., inform us that owing to the increase in price of raw material they have increased their prices by 10 per cent. This increase is not retrospective on outstanding quotations for specified items.

**For Sale.**—The Birmingham City electricity department has for disposal one 200-KW. steam dynamo, with emergency governor, spare parts, &c. The Aberdeen Corporation electricity department has for sale one 300-KW. Belliss-Mather & Platt D.C. generator, one 200-KW. Willans-Crompton D.C. generator, one surface condenser and one Edwards air pump. The Walthamstow U.D.C. has for disposal four 50-KW. vertical Westinghouse gas engines direct-coupled to 460-volt D.C. generators. Messrs. Percy Huddleston & Co. will, on May 22nd, sell by auction at Dalling Road, Hammersmith, a large quantity of electrical apparatus. See our advertisement pages to-day.

**Catalogues and Lists.**—STOLZENBERG PATENT FILE CO., LTD., 210-212, Bishopsgate Street, London, E.C.—Catalogue—illustrated and priced—relating to Stolzenberg filing cabinets and other office furniture.

LANGDON-DAVIES MOTOR CO., LTD., 110, Cannon Street, London, E.C.—Desk blotting slips, the upper side of which tells of the firm's one, two and three-phase electric motors. By the way, we are asked to say that a rumour that has gained currency that the company is no longer in existence is far from being correct. The statement is "grossly exaggerated," like the premature report of a noted humourist's decease. No careful reader of the business columns of the ELECTRICAL REVIEW could have overlooked our references to the company's recent activities.

MESSRS. SCHAFER & BUDENBERG, LTD., Whitworth Street, London Road, Manchester.—Revised price lists have been issued of pressure and test gauges (Catalogue, Section 1, pages 1 to 20 and 47 to 58) for incorporation in the firm's catalogue. These lists refer principally to their ordinary standard Schaffer, Bourdon, hydraulic and test gauges, and give particulars of sizes and pressures stocked at Manchester. A new list of gauge-testing apparatus (Section 3, pages 1 to 32) has also been issued.

MESSRS. DONOVAN & Co, 47, Cornwall Street, Birmingham.—"Electrical Accessories" section of their catalogue; list of upwards of 1,000 different accessories: ceiling roses, lamp-holders, adapters, wall-shoes, switches, &c., including a watertight china suspension lamp and a watertight china switch.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester.—Leaflet relating to the Westinghouse-Leblanc dry air pumps.

THE BENJAMIN ELECTRIC, LTD., 117, Victoria Street, S.W.—Section List 44, describing the Benjamin patent reflector fittings and weather-proof accessories.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.—Leaflets Nos. 99 and 100, relating to their electric propeller fans and ventilating sets.

MESSRS. JAEGER BROS., 18, Christopher Street, London, E.C.—Catalogue of electrical accessories, including lampholders of all kinds, ceiling roses, cut-outs, tumbler and turn switches, plugs, fittings, fuse-boards, main switches, bells, lanterns, insulators, and lamps.

MESSRS. SWITCHGEAR & COWANS (1911), LTD., Springfield Lane, Salford, Manchester.—Leaflets No. 1, 4, 21B, 21C, 23, 29 and 39, for insertion in their standard folder; these deal with regulating transformers, current transformers, oil circuit-breakers, auto-lift controllers, auto-starters and regulators, and traction circuit-breakers with the Statter time-lag. The last three are additions to the firm's standard lines.

MESSRS. SCHOLEY & Co., LTD., 151, Queen Victoria Street, London, E.C.—Two bulletins relating to manufactures of the Electric Speedometer Co., of U.S.A., for whom the firm are sole agents. One of 12 pages fully describes, with illustrations and prices, the Hopkins electric tachometers for all classes of stationary service; the other (four pages) is devoted to the Hopkins aeroplane tachometers. These instruments are being largely used in the States, among the uses to which they are put being in connection with steam locomotives, large stationary engines, motor-cars and electric launches.

MESSRS. SIEMENS BROTHERS DYNAMO WORKS, LTD., 38 and 39, Upper Thames Street, London, E.C.—Several new price lists just issued particularise the following:—No. 215.2, new designs in electric kettles with easily renewable elements; No. 215.3, new designs in electric heaters (convectors and incandescent radiators with replaceable elements); No. 204, insulated lampholders for factory and workshop service. The contents of list No. 215.3 include two attractive designs of "Blaze" and "Cosy Corner" incandescent radiators, which are constructed on the quartz tube principle with incandescent wire spirals, in connection with which a novel form of reflector is employed, diffusing a blaze of light over the whole heating surface and giving a cheerful effect.

THE PARSONS MOTOR CO., LTD., Town Quay, Southampton.—Catalogue of 84 pages, containing very full information accompanied with half-tone views and line drawings, relating to the Parsons engines, of petrol and paraffin types, for marine and stationary purposes. In the stationary engine section of the list, a number of small engine and dynamo sets are shown, and sectional views, together with full instructions for installing and running, are given. Sundries and spare parts are also detailed. Every item in the catalogue is priced and code-worded for the convenience of foreign buyers.

THE FOSTER ENGINEERING CO., LTD., Wimbledon, S.W.—New catalogue of effective and artistic design, containing particulars with illustrations, code-words and prices of the following arc lamps:—"Orion," "Regulus," and "Comus" single-enclosed types,

"Actinus" photo-printing, "Thermos" single-enclosed hot wire, "Martian," "Solus" flame arc, Brockie-Pell open type. Other contents are:—Foster metal lamps, auto-transformers, electric bell transformers, and contactless electric bells. Further accompanying literature relates to the "Beck" flame lamp, which the company have taken over, dimming switches, electric furnace transformers, "B.P." accumulators for ignition, car lighting, and launch service, &c.

MESSRS. MATHER & PLATT, LTD., Park Works, Manchester.—20-page pamphlet setting forth full information, illustrated by numerous exterior half-tones and line drawings as to their patent high lift turbine pumps, the principles of construction and working, and giving tables of outputs and dimensions, &c. The firm have pumps made and on order for over 27,000,000 gallons per hour.

MESSRS. BABCOCK & WILCOX, LTD., Oriel House, Farringdon Street, London, E.C.—The new catalogue just issued by this firm is, we think, the finest that we have yet seen devoted exclusively to electric cranes. It is a revised and enlarged edition, and contains among its interesting pictures, illustrations showing a number of recently executed contracts. The book consists of 124 pages of art paper, and while here and there there is a sufficient amount of letterpress, the contents are mainly pictorial; they include electric capstans, winches, hoists, goliath cranes, jib cranes, portal and semi-portal jib cranes, electric charging machines for open-hearth and reheating furnaces, electric overhead cranes, electric overhead cranes for handling hot metal, ditto with underhung jibs, and electric transporter cranes.

## LIGHTING and POWER NOTES.

**Algeria.**—La Compagnie Centrale d'Energie Electrique, of Paris, has recently acquired a central station at Algiers, and is extending the plant by putting down two new 2,000 KW. steam turbines and dynamos.

**Australia.**—The Port Melbourne Council has considered an electric lighting proposal, which includes the purchase of energy in bulk for some years from the Melbourne Electric Supply Co., which offered more favourable terms than the Melbourne T.C. The various municipalities forming North Sydney have also had under consideration a scheme of electric supply by the Pastoral Finance Association, which includes refuse destruction, and would involve the expenditure of £250,000.

**Ballybay (County Monaghan).**—The Monaghan County Council has granted the necessary permission to Mr. R. McMurray of that town to erect poles and wires for the electric lighting of the town.

**Banbridge.**—The U.D.C. has adopted a scheme of electric lighting reported on by Messrs. Woodside & Co., of Belfast. The estimated capital expenditure is £3,200.

**Barrow.**—The Electricity Committee has under consideration the purchase of a conveyance for the use of the Department, and sanction has been given to the electrical engineer to purchase apparatus for heating, cooking and other domestic purposes, with a view to exhibition and letting it out on hire.

**Beckenham.**—It was reported to the last meeting of the U.D.C. that the West Kent Electric Co. had made a provisional arrangement with the Croydon Corporation to supply power in bulk for West Wickham. The Council decided to oppose it, and to apply to the B. of T. for an order to supply power for public and private purposes at West Wickham.

**Blackburn.**—The Corporation electricity department has issued a 32-page pamphlet covering the regulations to be observed in connection with electricity supply for lighting and power from the Corporation mains. Wiring, switches, lamps, heating and cooking apparatus and motors are dealt with in numbered paragraphs, the numbers being included for reference in the alphabetical index at the end of the pamphlet, where also a wiring table is inserted.

**Blackpool.**—The second application made by the Corporation, this month, for loans from the L.G.B. has been inquired into this week at the Town Hall, when £10,000 was asked for on account of extensions at the Corporation electricity works.

The assessment of the electricity undertaking has been increased from £2,522 to £5,940, an increase of 136 per cent. Formal notice of appeal against the increase is to be lodged in the proper quarter.

**Bolton.**—The Electricity Committee has decided to transfer £3,250 out of the profits of the department for last year to the relief of the rates. The amount allocated in the previous year was £6,500. The estimated profit for the current year is £5,000.

**Boulter's Lock.**—In connection with the rebuilding, &c., of this lock, an electrically-driven conveyor, 190 ft. long, has been provided for punts and skiffs; the boats will float on to the conveyor and be automatically carried along and re-launched on the other side.



**Bury.**—Negotiations have recently been completed for the erection of a big weaving shed on a site at Pits-o'-th'-Moor. The weaving is to be by a special process, and the mill is to be run throughout by electricity. The new weaving shed for the Co-operative Wholesale Society at New Bridge, between Bury and Radcliffe, is nearing completion, and it has been decided to drive the machinery by electric current from the Corporation supply. The whole of the sheeting looms at the Victoria Mills, Rishton, are now running by electric power, being individually driven. So far the experiment is said to be entirely satisfactory to the management.

**Cheltenham.**—The R.D.C. on May 9th decided not to consent to the extension order for E.L. applied for by the T.C., unless a suitable purchase clause is agreed to. The B. of T. has intimated that unless an agreement is promptly arrived at, it would issue the order without any clause as to purchase. A purchase clause has been submitted by the T.C., but it is deemed unsuitable by the Rural Council, and counter clauses have been framed by the latter body.

**Continental Notes.**—**AUSTRIA.**—The Austrian Siemens Co. has prepared the plans for a large generating station at Menzing, in the Vorarlberg, utilising the water of the Meng. The works will have a plant capacity of 12,000 H.P. A dam, 31 metres high, is to be built, yielding a head of 300 metres. The equipment of the power station will consist of two turbines, each of 6,000 H.P. (300 R.P.M.), directly coupled to dynamos, room being reserved for a third similar machine. The current will be stepped up to 50,000 volts in a neighbouring transformer building. The total cost of the undertaking, including distribution network and transformer stations, is estimated at 3,600,000 kronen.—*Der Elektrotechniker.*

**GERMANY.**—The firm of Krupp has acquired the iron ore fields near Bübsberg and Kirburg, and intends to work them by means of electric power. A syndicate is also acquiring three brown coal-fields in the same region, and intends to build a power station for the supply of current to the vicinity. These schemes promise an era of prosperity for the Westerwald district generally, and the city of Neuwied in particular.—*Zeit. Elek. u. Masch.*

**FRANCE.**—Paris is to be supplied with electricity generated from the water-powers of the Rhone. 200,000 H.P. will in a short time be supplied to the French capital. The distance of the power stations from Paris is 500 km. Not only the Rhine, however, but the Dordogne will participate in this scheme, and Bordeaux will be included in the network projected.—*Der Elektrotechniker.*

**ITALY.**—La Societa Bolognese di Elettricit , which has recently acquired the plant of the Societa di Brasinone, has established a H.T. line connecting the two power stations, and the whole of the energy now supplied—amounting in 1911 to 4,794,000 units—is now generated by water-power.

**RUSSIA.**—La Soci t  des Tramways et Eclairage Electriques de Vladicaucase is now supplying current to 16,644 incandescent lamps, 107 arc lamps, and 67 electric motors in the town of Vladicaucase.

**Coventry.**—The annual accounts of the electricity undertaking show a profit for the year of £16,175, as compared with £16,414 last year. Adding £379 brought forward from last year, the available surplus is £16,552. The Committee has decided to recommend to the City Council to deal with this surplus by paying over £4,000 to the general district fund in relief of the rates, as against £3,500 last year; to pay £12,504 to the reserve fund and transfer from that fund to capital account for the purchase of further plant in lieu of raising a loan; and to carry forward the balance of £48 to the next account. The Committee will also recommend that certain further reductions be made in the scale of charges for power, and also that all rentals for meters be abolished as from April 1st, 1912.

**Crewe.**—The returns of the Council's electricity department for the past year show a total revenue of £8,204, and £3,998 carried to the net revenue account; after meeting financial charges a surplus remained of £1,042. Contributions were made to the rates and to reserve, and the latter now amounts to £4,326, while £1,720 stands to the credit of the appropriation account. During the year 700,000 units were sold, the maximum supply demanded being 545 kW.

**Donaghadee (County Down).**—Correspondence regarding the loan for the electric light scheme for this watering place was read at the last meeting of the Urban Council. From this it appeared that the negotiations for the loan were almost complete.

**Edinburgh.**—Treasurer MacLeod, submitting the draft provisional estimates for the ensuing year to the T.C., referred to the estimates by the Electric Lighting Committee, which anticipates a surplus of only £315. This, he said, was a very narrow margin on a turnover of about £135,000. It compared with an estimated surplus for the current year of £405, which the convener had assured them might be converted into a loss. As regards capital expenditure, the amount proposed to be expended for the coming year was £34,140, which was the lowest figure for the last twenty years. The Electric Light Committee required £20,150 in connection with the cooling towers, new machinery, and plant and new mains throughout the city. The treasurer pointed out that although there was no promise of a surplus from the electric light, he hoped to get hold of the balance of £2,500 on last year's working, a remark which met with some dissent.

**Felixstowe.**—An Exhibition of Women's Work was opened on May 8th, one of the most interesting and popular exhibits being organised by the Suffolk Electricity Co., to demonstrate the advantages of electrical cooking. The apparatus provided consists of two Prentice's Diving-bell ovens, Lightning grillers, Premier and B.T.-H. pans, and Eastman & Warne hot plates, while irons and other utensils provide variety. We congratulate Mr. Prentice's company on its enterprise, as it is only a year since the company was a very popular exhibitor at a similar occasion.

**Glastonbury (Somerset).**—It is proposed to obtain professional advice as to the advisability of applying for an electric light order, and to report to the Council at a later date. A Committee of the whole Council will consider the matter.

**Gravesend.**—The T.C. has applied to the L.C.B. for a loan of £10,000 for mains, house services, a coal store and an automatic stoker.

**Hazel Grove-cum-Bramall.**—The U.D.C. has granted permission for the Stockport T.C. to supply current for power to the works of Messrs. Briggs & Armstrong, Hope Street. A sub-Committee has been appointed to consider the question of applying for a prov. order for E.L., and, if advisable, to engage expert assistance in the preparation of a report.

**Heywood.**—At the T.C., on the 9th inst., it was stated that there was a loss on the electricity department of £2,532, and a loss on the tramways department of £742 for the past year. The results were not so satisfactory, on account of the heavy charges for interest and sinking fund, for discarded plant, and for the taking over of the old tramways.

**Ipswich.**—The electric supply department has had a very successful year, as disclosed by the annual report and accounts presented to the T.C. by the engineer and manager, Mr. Ayton. The surplus is £2,347 on the year's working. This has been disposed of by a contribution of £1,281 to the capital account to cover the cost of meters purchased, changing over street lamps to electricity and other items, while the remainder, representing a sum of £1,066 has been placed to the credit of the reserve fund, which now stands at £2,522. The gross turnover of the installation department was £4,851, of which £1,123 was for rental wiring. The lighting supply shows an increase of 14½ per cent., while the units sold for power, excluding traction, show an increase of 88½ per cent. over the previous year's figures. The total capital outlay stands at £104,415. The sums expended upon canvassing and general publicity work during the year were respectively £99 and £247, or a total of 1½ per cent. on the revenue. A 1,000-KW. D.C. turbine generating set should have been ready for use in November, but was not completed even at the end of March, so that the station has been working without any spare plant during the winter peak loads. Owing to the growth of the business, a second turbine set has been ordered of the same size.

From the report we gather that there are now 402 motors of 1903 H.P. connected to the mains, and that of the 2,050,885 units sold for all purposes, ordinary power supply accounted for 763,183, and for the first time exceeded the traction units—viz., 667,441. We also note that public lighting took 24,750 units as compared with 9,625 units in the previous year.

**Japan.**—The new electric power station put down by the Sagami Hydro-Electric Co., to utilise certain available water power, has just been inaugurated.

**Llanfairfechan.**—The U.D.C. has appointed Mr. W. R. Walton, consulting engineer, Manchester, to report on the feasibility of lighting the district with electric light.

**London.**—**WOOLWICH.**—The Electricity Committee reports the receipt of a letter from the L.C.C. with reference to the Council's application for sanction to the borrowing of £36,570 for the extension of the electricity undertaking, and urging the necessity of obtaining expert advice thereon. A reply is to be sent to the effect that an expert was being consulted, and further urging the Council to sanction, without delay, the purchase of a turbo-alternator referred to elsewhere. Arising from this letter the Committee considered a report from the electrical engineer. In view of the fact that turbine plant can be obtained in much less time than Diesel oil engines, the Committee decided to substitute turbine plant. If this proposal was carried out it would be necessary to purchase two further alternators, and the Committee submitted a recommendation to the effect that the tender of Fraser & Chalmers should be accepted at £4,592 for one turbo-alternator, and that the tender of Jas. Howden & Co., Ltd., at £4,445 should also be accepted for the other. At the meeting of the Council, however, after discussion, this report was taken back. Application is to be made to the L.C.C. for sanction to borrow £7,125 required to cover overspent balances, and the estimated requirements of the undertaking for the ensuing 12 months. The amount stated includes £2,000 for general mains extensions £1,500 for services, and £2,500 for hire purchase.

**Mansfield.**—The B. of G. has been recommended by the House Committee to take steps for the lighting of the workhouse by electricity, and this has been agreed upon by the Board.

**North Berwick.**—An early start will be made with the introduction of electric lighting. Messrs. Crompton have the preliminary arrangements practically completed, and the T.C. has granted a six months' extension of time to enable a company to be formed. A central site for the generating station has been approved by the T.C.



**Northants.**—The B. of T. has granted a prov. order for electric supply to Messrs. F. H. Thornton, Brook Sampson, and John Clark for the districts of Rushden, Higham Ferrers and Irthlingborough. The engineer for the scheme is Mr. G. H. Jackson, of the Northampton Electric Light and Power Co., Ltd.

**Oswaldtwistle.**—At a meeting of the D.C., on May 10th, the question of providing an electric supply for the district was referred to the General Purposes Committee.

**Radeliffe.**—The U.D.C., on Monday last, received from the L.G.B. sanction to the Council's application for consent to borrow £17,750 for the purpose of extending the electricity undertaking.

**Rochdale.**—The Electricity Committee has decided to apply to the L.G.B. for sanction to a loan of £5,000 for plant for the extensions, and for a further £10,000 for cables, transformers and other equipment. This is mainly to meet the growth of the demand during the next 18 months.

**Runcorn.**—The U.D.C. has decided to electrify the pumping plant at the water pumping station. Plans of mains to be laid in five thoroughfares in the town by the Mersey Power Co., Ltd., have been approved by the Council.

**St. Anne's-on-Sea.**—The electrical engineer has submitted interesting figures to the Council on the progress of the electricity department, which has now been in existence for 11 years. The month of March showed an increased consumption of current of nearly 5,000 units compared with a year ago; whilst for the full municipal year the units sold were 870,692, against 814,032. The usage was distributed as follows:—Private lighting, 279,123; power (industrial), 40,343; power (domestic), 45,583; public lighting, 98,152; tramway company's arcs, 5,700; and traction (Blackpool and Lytham trams), 401,791. The consumers numbered 1,131, an increase of 126. A comparative return shows that the increased consumption in 1909 over 1908 was 39,935 units; 1910 over 1909, 11,876; 1911 over 1910, 11,298; 1912 over 1911, 56,660. Mr. Clothier says the feature for the past year seemed to be the marked increase—50 per cent.—in consumption for power purposes, the bulk of which was used for domestic supply. A small 150-kw. turbine has been purchased from Blackpool Corporation, and the cost defrayed out of revenue.

**Sheffield.**—The City Council has appointed a special committee to inquire into the administration of the commercial and other departments (if necessary) of the electric light undertaking, and to make such suggestions to the Council as may be deemed advisable.

**Shipley (Yorks).**—The Electricity Department of the Council came out very well during the recent coal strike. In addition to being able to give a full supply of electricity for the tramways, lighting and power, and sewage pumping for several weeks, it kept the public baths, hospitals, slaughter-houses and Distress Committee supplied with coal, and during Easter week it supplied the Gas Department with 70 tons of coal. The stock of coal at the gas works had become almost exhausted, the street lighting having to be curtailed, but the Electricity Department kept them going.

**South Africa.**—The municipal authorities at Cape Town have been authorised to borrow a sum of £75,000 for the extension of the electrical system at that place. The scheme involves the linking up of the central station with the southern suburbs and the provision of the necessary cables, switchgear, transformers, and sub-stations. Contemplated expenditure during the current year includes the purchase of an economiser, steam turbine, &c.—*Board of Trade Journal*.

One of the leading Johannesburg newspapers has recently had installed a complete electrical plant for lighting, heating and power purposes. Some 500 incandescent and 10 arc lamps are included, the heating provides for 100 kW., and the power totals 120 H.P., the principal motors being of 45 H.P., of the interpole D.C. type, 460-500 volts.

The small, but growing, town of Nakuru, British East Africa, is about to have an electric lighting scheme installed, according to the *British and South African Export Gazette*.

**Torquay.**—The T.C. has decided to utilise electricity for cooking purposes at the kitchen of the new Pavilion. Current will be supplied at 1d. per unit.

**Tunbridge Wells.**—For illuminations during the cricket week the T.C. has decided to supply current at 3d. per unit, plus a small fee for making connections.

**Wadebridge.**—The U.D.C. has accepted the tender of the E.L. Co. for lighting a portion of the district for two years.

**Walsall.**—The T.C. has decided to apply to the L.G.B. for sanction to the Corporation borrowing £10,000 for the purposes of the electricity undertaking.

**Waterloo (Lancs.).**—The proceedings of the U.D. Council's Finance Committee, submitted to a recent meeting of the Council, stated that application had been received from the Town Clerk of Bootle asking the consent of the Council, under the Electric Lighting Act, 1909, to enable the Bootle Corporation to supply electricity to the Mersey Dock Board at the new Gladstone dock. Another letter was received from the general manager of the Liverpool District Lighting Co., from which it appeared that no application had been received by the company from the Dock Board on the subject, and pointing out that if the Dock Board required a supply of electricity in Seaforth it must apply to the company. If that supply was such that the company were unable

to undertake it, then the Dock Board would be justified in applying elsewhere. The clerk was instructed to communicate with the Town Clerk of Bootle on the subject.

**West Ham.**—The price of current charged for traction has been reduced to 3d. per unit. A communication has been received from Messrs. Willans & Robinson relative to the erection of a 5,000-kw. turbo-generator, to the effect that the best date they can guarantee for completion will be November 9th next, and offering to anticipate this date on payment of a bonus equivalent to the penalty for late delivery. The Electric Lighting Committee, after considering the engineers' recommendation, has decided to pay a bonus of £60 per week for a period not exceeding four weeks.

**West Hartlepool.**—The electricity department on the past year's trading showed a surplus of £2,029, which it is suggested should be placed to reserve; the latter fund stands at £5,048.

**Wolverhampton.**—The Electricity Committee has decided to extend the mains in various streets at an estimated cost of £863, including street lighting. The Corporation Markets have decided, for the purposes of the cold stores, to purchase a 45-H.P. motor from the electricity department.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—According to statements by the Premier and State Treasurer a Bill will shortly be presented constituting a Greater Melbourne Council, which will have control of matters of common interest to the various municipalities, including the tramways.

**Blackpool.**—At a meeting of the Tramway and Electricity Committee, on Monday last, the tramway manager and electrical engineer informed the members that he estimates a surplus of £10,000 from the tramways during the current year. In the electricity department he estimates a surplus of £4,300.

**Belfast.**—The Corporation has decided to double the Glengormley tramway from Chichester Park onwards to serve the new pleasure grounds which it proposes to establish at Drumna-drough, and upon which it intends to spend £20,000.

**Bournemouth.**—At the last meeting of the T.C., the general manager of the tramways presented his report for the year ending March 31st. The total revenue from all sources amounted to some £92,399, a record amount for the system, being some £1,852 above that of the centenary year, and some £5,219 above that of any other year. The total working expenses, exclusive of capital charges, amounted to £54,834, being £2,702 less than in the previous year, and a record for the past four years. The percentage of working expenses to receipts amounted to 59.83 per cent., as against 64.18 per cent. in the previous year. Under some few headings the expenses showed an increase, such as rates and taxes, £541, due to increased assessments; overhead repairs show an advance of £560, due to 7 miles of new trolley wire, &c.; miscellaneous equipments show an advance of £130, due to meters being fixed on all main cars. The cost of purchased current from the company showed a decrease of some £500, due to the drivers' more economical use of current and better driving, and mainly to the installing of meters on all main road cars. The conversion from the conduit to the overhead trolley system was completed at Whitsuntide, and the result has been a better and more efficient service, with a consequent increase of traffic receipts. The manager reminded the Committee that the change from a deficit of £13 in the previous year to a surplus of £3,410 in the present one was largely due to the alterations and reorganisation carried out by the late general manager, Mr. C. W. Hill. He then went on to deal with the salaries of the clerical staff, and proposed that the question could be suitably dealt with by means of a co-operative bonus scheme. He suggested that the surplus from the net revenue account at the end of the year should be treated as a basis, and an amount equal to 1½ per cent. on it be set aside for bonuses; 1 per cent. divisible among the clerical staff in the proportion of their present salaries; and the first year's bonus to be considered as a permanent increase; ½ per cent. to be divided among the three heads of departments, and the remainder of ½ per cent. among the inspectors (12). By this system every member of the staff becomes pecuniarily and personally interested in the efficient running of the system. The Committee approved the recommendations.

**Bradford.**—The new system of half fares on the workmen's cars has been in operation for a week. Under the old system the takings averaged £110 to £112 each morning before 9 o'clock. Last week they averaged from £75 to £80 for the corresponding hours.

**Burton-on-Trent.**—The annual report on the tramways for the year ended March 31st shows that there was a profit of £297. Last year there was a loss of £681.

**Continental Notes.**—BELGIUM. — The new central station at Malines of the Société Intercommunale Belge d'Electricité has lately been completed and put in operation. The plant has a



capacity of 4,000 kw. The company has secured the contract for the supply of the electrical energy required for the light electric railways of the Société Nationale des Chemins de Fer Vicinaux, in the Malines district, and for the current for the lighting of the railway station at Louvain.

**FRANCE.**—Trials are being made on the Paris-Lyons-Mediterranean railway of a single-phase locomotive for the Pyrenean railway. The current will be supplied overhead at a pressure of 12,000 volts, the mountain network having an extent of 300 km. The current will be generated by the ample water-powers in the hilly regions traversed.—*Der Elektrotechniker*.

The Chamber of Commerce, of Caen, is interested in a scheme for the electric lighting of the harbour of Caen.

**GERMANY.**—The present year's financial proposals of the T.C., of Kaiserslautern, include a sum for the establishment of electric tramways, the making of the city a garrison headquarters, under the new army extension scheme, ensuring the success of the undertaking.—*Zeit. Elek. und Masch.*

The Süddeutschen Eisenbahn Gesellschaft has drafted a project for the building of electric suburban lines from Karlsruhe, through Neureuth, Eppenstein, Linkenheim, Lindelsheim, Hochstetten and Leopoldshafen to Russheim, and has submitted it for the consideration of the T.C. of Karlsruhe. Its estimated cost is 1,980,000 marks.—*Zeit. Elek. und Masch.*

**SWITZERLAND.**—The Swiss budget for 1912 contains an item for the introduction of electric working on the St. Gothard Railway. The works are to be taken in hand shortly, the first portion to be undertaken being the stretch between Erstfeld and Airolo, where the smoke difficulty is most felt. The cost of the electrification is estimated at 67,000,000 fr. Three new generating stations will be built, namely, at Amsteg, Göschenen, and, the largest, near Plotta on the Rita Lake. Electric traction will ensure an appreciably quicker development of the traffic. It is also hoped to be able to reduce the working costs by 25 per cent. According to the experience gained on the electric line from Spiez to Frutigen it is likely that the working costs will be reduced to an even greater extent.—*Zeitschr. des Oest. Ingenieur und Architektenvereins*.

**Glasgow.**—The Tramways Committee has twice had before it a proposal that a car service after midnight should be instituted in the city. On both occasions the Committee recommended that such a proposal should be negatived. At the last meeting of the T.C., Bailie Russell, convener of the tramways, moved that the recommendation of the Committee should be upheld. In an amendment Councillor Lyon moved that the general manager should institute an all-night service as an experiment. He contended that people forced out between midnight and three in the morning were as important to the city as people who travelled during the day. The general manager's prophecies had seldom been fulfilled, and on this occasion he asked them not to take Mr. Dalrymple as a prophet in this instance. Bailie Alston seconded. It was agreed to preserve the *status quo* by a substantial majority. The T.C. had also under consideration a proposal by Cowlish Ward Committee that Corporation members should be allowed to ride free on tramcars. A lengthy discussion took place, in the course of which the opponents to the proposal suggested that the suggestion might lead to the insertion of the thin edge of corruption. Ultimately, on a vote, it was decided to pass on the Ward Committee's recommendation to the Tramways Finance Sub-Committee for report.

**Grimsby.**—In view of the opening of the Immingham Dock, we understand that the G.C. Railway Co. commenced a service on the electric railway between Grimsby and the new dock on Wednesday last. The line, which commences on Corporation Road, Grimsby, near to the Alexandra Dock, and runs to within half a mile of the new dock works, has already been passed by the B. of T. A service of 20 cars daily is to be given, the return fare being fixed at 5d.

**Haslingden.**—An experiment in express cars is being made by the Corporation. Beginning on May 18th, an electric car will be run from the Commercial Hotel, Haslingden, to Eagle Street, Accrington, to enable passengers to catch special excursions. There are to be only two stops on the journey of nearly 4 miles, and the car is timed to do the trip in 20 minutes. Only through passengers will be carried.

**Haxby-Brandsby.**—The Light Railway Commissioners have granted an order for the construction of a light railway from Haxby to Brandsby, in the area of the North Riding of Yorks., C.C.

**Ipswich.**—The tramway department, according to the annual report, had an increase of revenue of £1,201, with the result that on the last year's working, there was a small surplus of £293. As, however, the Council, on the advice of the engineer and manager, is putting aside out of the rates annually the sum of £3,422 to form a track renewals fund, it will be seen that there is a loss of over £3,000 a year on the tramways. The passengers carried numbered 5,526,496, and the car-miles run were 662,792; the units per car-mile dropped from 1'126 in the previous year, to 1'007 last year, Mr. Ayton remarking in his report that the adoption of meters had led to a net reduction of 10½ per cent. in the energy used. This, and reduced price paid for energy, were mainly responsible for a fall in the percentage of working expenses to receipts of from 82'5 in 1910-11, to 73'5 last year.

**London.**—It is stated that the Atkins-Lewis system of traction is to be demonstrated in practice, those interested in the system having been granted by the L.C.C. permission to build a temporary railway round the Aldwych site in the Strand.

**Nelson.**—In connection with a proposal for the through running of cars between Burnley and Colne, the Nelson T.C. has adopted a resolution passed by the Tramways Committee to the effect that, while not expressing any opinion as to the desirability of through running, it would be prepared to consider a scheme approved by the Burnley Corporation, and the Colne and Trawden Light Railways Co., provided that such scheme allowed the Nelson Corporation to share the traffic for the entire route.

**New Zealand.**—The *Mining and Engineering Review* states that Mr. Evan Parry has reported on the electrification of the steam railway between Christchurch and Lyttleton, and preliminary arrangements are being made for its conversion. The length of the line is 7 mils, including the Moorhouse tunnel, 1¼ miles in length. By the substitution of electric motors for steam locomotives in hauling goods, express and local trains, the installation of tunnel-ventilating appliances, to deal with the smoke nuisance, will not be necessary. The cost of the electrical equipment is estimated at £100,000. The existing rolling stock will be utilised as trailers. The overhead system is specified, the current returning by means of the running rails. The value of steam locomotives to be replaced by electric traction is £30,000. Operating expenses under electricity are estimated at £11,149 per annum, against £9,679 under steam. It is pointed out, however, that a faster and more frequent service would obtain, whilst the continuance of steam traction on this line would necessitate the expenditure of £12,000 on the ventilation of the Moorhouse Tunnel, involving an annual interest charge of £480, together with operating expenses £3,500, a total annual cost of £3,980. The annual expenditure would thus amount to £13,659, or £2,510 more than under electric traction. Current will be obtained from the Lake Coleridge hydro-electric system, and it is confidently anticipated that, after gaining experience of electric working on this section, it will be extended to the main lines.

Mr. Frederick Black has reported to the Palmerston B.C. on the question of electric tramways and lighting. The estimated cost of the two schemes amounts to £62,300, and it is understood that Diesel engines are to be adopted.

**Sicily.**—The new electric tramway system in the town of Palermo has just been completed. The power station, which is of 1,200 H.P., comprises Diesel engines built by Messrs. Tosi & Co., of Legnano, Italy, continuous-current dynamos by the Italian Westinghouse Co., of Vado, and a 660 amp.-hour battery by the Italian Tudor Co. The underground armoured cables were supplied by Messrs. Callender's, of London.

**Stalybridge.**—At the Ashton T.C., on the 9th inst., it was stated that in three weeks' time a system of through running of cars would be inaugurated between Stalybridge and Manchester. Over two miles of the Ashton tramway will be traversed, and residents in the west end of the borough will be able to travel to the Stalybridge boundary for 1d., against 1½d. at present.

**Tasmania.**—The Hobart T.C. has agreed to offer the tramways company £210,000 for its concern, this being £10,000 more than the previous offer.

**Walsall.**—The Corporation Tramways Committee has decided to purchase seven new tramcars fitted with vestibules, at a cost of £5,336, the cost to be defrayed out of money to be borrowed on mortgage, the repayment of which will be spread over a period of 15 years.

## TELEGRAPH and TELEPHONE NOTES.

**Austria.**—It is stated that the Austrian Government will place an order for 20,000 telephone apparatus in the near future. This order and those already on hand will provide work for the telephone factories for two or three years.

**Japan.**—According to the Japanese Department of Communications, the number of new telephones to be installed this year is 27,000, the expenditure in connection with the same being estimated at £650,000. New telephone exchanges are to be established in the towns of Osaka and Kobe.

**Motor-Cars and Telephone Line Maintenance.**—We learn from New York that the Western Electric Co. has purchased 50 small two-seated petrol cars for the use of the linemen of the New England Telephone and Telegraph Co.

**Submarine Cable.**—Notice is given in the *London Gazette* that an application has been received by the Board of Trade from the Western Union Telegraph Co., for a licence to lay down and maintain upon the foreshore and bed of Portmagee Channel a telegraph cable between Valentia Island and the mainland.

**The Telephone Service.**—In reply to a question whether the charge for extension telephones to subscribers on the unlimited rate had been raised since the National Telephone Co. was absorbed by the Post Office, and whether the Post Office declined to grant more than two extensions to a subscriber on the unlimited rate at Plymouth, the Postmaster-General recently stated that the answer



to the first inquiry was in the negative. As regarded the number of extensions allowed on unlimited-rate lines at Plymouth, the Post Office was only continuing the practice of the National Telephone Co. The effect of allowing a greater number of extensions on one unlimited-rate line was generally to overload the line, a course which was detrimental to the telephone service of other subscribers.

**Wireless Telegraphy and Aeroplanes.**—Some interesting trials with wireless telegraphy installed on an aeroplane were carried out at Chartres, France, last week. The system adopted is that invented by M. Rouzet, of the Société Radio-Électricité. The inventor himself went as a passenger on the Savary biplane, piloted by M. Frantz, and during a flight of about 80 miles, in the course of which the machine was frequently at a distance of 30 miles from the aerodrome, wireless messages were successfully and clearly recorded at the receiving station on the ground. M. Rouzet's apparatus, which is known as the T.S.F., weighs, complete, only 70 lb., yet it comprises a 110-volt alternator, driven by the engine of the aeroplane, a transformer which steps the voltage up to 30,000 volts, and a condenser. The trials are considered to mark a great step in advance.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Admiralty.**—Referring to a note under this heading in our issue of April 19th, the British Electric Calibrated Fuse Co., of Luton, state that they have two Admiralty contracts in hand at present, which amount to 89 per cent. of their total requirements for fuses from 3 to 200 amperes capacity.

**Australia.**—VICTORIA.—June 4th. 1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" April 26th.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9½ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—Apply to High Commissioner in London for Australian Commonwealth.

Deputy P.M.G., Melbourne.—June 11th.—Insulated wire. June 18th.—Cable distributing boxes, ironwork, cast-iron pipes (or alternatively, steel tubes, wood conduit pipes or glazed earthenware conduits), binders, sleeves and tapes, and 6,200 porcelain insulators. June 18th.—50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

NEW SOUTH WALES.—July 31st. For Newtown, Sydney, an automatic or semi-automatic switchboard and equipment (Schedule No. 154); also 20 sections of a common-battery switchboard and equipment (Schedule No. 131). For Balmain, Sydney, 14 sections of a common-battery switchboard and equipment (Schedule No. 122); an automatic or semi-automatic switchboard and equipment (Schedule No. 151). For Glebe, Sydney, automatic or semi-automatic switchboard with associated apparatus (Schedule No. 153).—*Australian Mining Standard*.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—June 10th and 18th. Steam piping and fittings for Ultimo Power House. June 17th.—Two coal elevators and conveyors, for White Bay Power House. July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

WESTERN AUSTRALIA.—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" May 10th.

NEW SOUTH WALES.—July 31st. Common battery and automatic switchboards, for Newton, Glebe & Baltimore, for the Postmaster-General's department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General department. See "Official Notices" to-day.

**Austria.**—May 28th. Installation of the electric light at the new station of St. Veit on the Glan, Villach. Particulars from Abteilung IV, K. K. Staatsbahndirection, Villach.

**Belfast.**—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" to-day.

**Belgium.**—May 25th. The municipal authorities of Ghent are inviting tenders for four steam boilers, with economisers, at the central electric lighting station.

May 20th. Supply of 80 pipes of silvered copper for the Telegraph Administration. Particulars from the Bureau des Adjudications, Rue des Augustins, 15, Brussels.

June 5th. Tenders are invited by the Société Nationale des Chemins de Fer Vicinaux of Brussels (14, Rue de la Science) for the contract (1) for the overhead equipment of the light electric railway between Brussels and Haecht and (2) for the laying of the feeders for the electric railways in the Namur district.

**Bettws-y-Coed.**—June 4th. Underground cables, transformer pillars and public lighting apparatus, two water-turbine-alternators and pipework, high and low-pressure switchgear and connections, for the U.D.C. See "Official Notices" to-day.

**Birkenhead.**—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" April 26th.

**Bohemia.**—SMICHOV.—May 22nd. Tenders are invited for the supply of a steam turbine and two dynamos. Particulars of the Canzlei, No. 10A des Stadtischen Rathhaus, Smichow.

**Constantinople.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Devonport.**—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" to-day.

**Egypt.**—May 27th. Tenders are invited by the Ministry of the Interior for the installation of water supply and electric lighting systems at Bilbeis. Specifications from "M. le Directeur de la Section des Mucicipalités et Commission Locales, Ministère de l'Intérieur," Cairo. It is necessary to have a responsible agent in Egypt.—*Board of Trade Journal*.

**Epsom.**—May 28th. Maintenance of storage battery at the U.D.C. electricity works. See "Official Notices" to-day.

**France.**—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

June 15th.—The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

**Glasgow.**—May 20th. The Tramways Committee invites tenders for the following works required in connection with a 5,000-KW. turbo-alternator to be installed at Pinkston power station:—Iron and steel works for turbine foundation, engine-room floor, &c., and steam and water piping and valves. Mr. J. Dalrymple, general manager, 45, Bath Street.

**Gloucester.**—Forty-five street-lighting lanterns for high-candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

**Huddersfield.**—May 20th. 1,000 single-phase meters, for the Corporation. See "Official Notices" May 3rd.

**Hungary.**—May 25th. Supply of cable, current meters, transformers, &c., for the municipal station, Nagyvarath. Particulars from the Direktor des Elektrizitätswerk.

**London.**—June 3rd. Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" May 10th.

HACKNEY.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, &c., pipework &c., travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" to-day.

ISLINGTON.—May 30th. Electric lighting installation at the Receiving Homes for Children, for the St. Mary, Islington, Guardians. See "Official Notices" to-day.

FULHAM.—May 22nd. 2,000 tons of nutty slack coal for the B.C. Electricity Works. See "Official Notices" to-day.

**Manchester.**—May 22nd. High-tension switchgear for Hulme Hall Road substation. Specifications and forms of tender from Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

**Newcastle-on-Tyne.**—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" April 26th.

**New Zealand.**—July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Rochdale.**—May 22nd. Contract A 57.—Overhead line for the supply of electricity to Roch Mills sewage disposal works. Contract B 58.—Paper-insulated lead-covered, and also lead-covered and armoured cable. Specifications, &c., from Mr. C. C. Atchison, borough electrical engineer.

**Rochdale.**—June 5th. Extra-high-pressure three-phase switchboard, for the Corporation. See "Official Notices" to-day.

**Rotherham.**—May 18th. Two automatically-controlled electrically-driven motor and pump sets. Borough Engineer.



**South Africa.**—June 26th. H.M. Trade Commissioner for South Africa reports that tenders will be received by the Town Clerk, Municipal Offices, Boksburg, for the supply and delivery of rolling stock, converter plant and overhead material for the railless trolley system to be installed in Boksburg. Copies of the specifications, together with forms of tender, may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal*.

**Spain.**—June 1st. The municipal authorities of Toledo are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Tenders have just been invited by the municipal authorities of Aldeamayor (province of Valladolid) for the concession for the electric lighting of the town during a period of four years.

**Twickenham.**—The Lighting Committee has decided to invite alternative tenders for supplying gas or electricity for lighting the whole, or a portion, not being less than 200, of the street lamps for a period of one, three or five years.

**Uruguay.**—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c.. Harbour Secretary, Calle Piedras No. 156, Montevideo.

**Walthamstow.**—May 31st. Stoneware conduits, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**West Ham.**—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall

**Workshop.**—May 28th. Storage battery and surface condensing plant for the U.D.C. See "Official Notices" to-day.

**Wrexham.**—May 21st. Two lifts for the Workhouse Infirmary, for the B. of G. Mr. J. T. Thomas, Workhouse master.

## CLOSED.

**Australia.**—The *Mining and Engineering Review* announces the placing of the following contracts:—

P.M.G.'s Department, Tasmania:—Four nauts submarine cable, £852—W. T. Henley's Telegraph Works Co., Ltd. Ten switchboards, £10 11s. 9d. each—Western Electric Co. (Aust.), Ltd. Five miles cable, £400—Noyes Bros. (Melbourne) Pty., Ltd.

P.M.G.'s Department, N.S.W.:—Sixty-nine switchboards, 200 lines, £60 each—British Insulated and Helsby Cables, Ltd.

Victorian Railways:—Two overhead travelling cranes, 5 tons, £170 each—Johns & Waygood. Cables and junction boxes, £1,334—British Insulated and Helsby Cables, Ltd. Lead-sheathed, paper-insulated concentric cables—British Insulated and Helsby Cables, Ltd. Turbo-alternator, £121—Wm. Adams & Co., Ltd. Twenty-five Morse telegraphic instruments, £365—Siemens Bros. Eight miles electric light wire, £104 15s.—Noyes Bros. Motor-driven booster, reversible, £400; one 266-cell Tudor storage battery for Elwood power house, £2,381—Siemens Bros. Dynamo Works Co., Ltd.

West Australian Public Works Department:—Albany Cold Stores electric light plant, £204—Leslie & Co.

Sydney Municipal Council:—The Council decided to purchase from the Austral Engineering Supply Co., Ltd., for the sum of £83, a "Leskole" distance thermometer, with switchboard arranged for 24 points and 24 elements, with alarm bell, for the purpose of indicating any rise in temperature within the bodies of reserve coal stored at the power house. It was also decided to purchase 18 single-phase induction wattmeters from the Australian General Electric Co.

Duplicate supply of 5,000-volt switch gear—£2,313 Noyes Bros. (Sydney) Ltd.

Messrs. Pfaff, Pinschof & Co., Pty., Ltd., Melbourne, were the successful tenderers for the supply of electrical equipment required by the Melbourne Harbour Trust for operating the Footscray swing bridge. A feature of the equipment consists of a patent Ganz. A.C. commutator motor of the compensated repulsion type. The installation it to be completed in five months.—*Mining and Engineering Review*.

**Ashton-under-Lyne.**—The contract for extensions and alterations to the electricity works has been secured by Messrs. E. Marshall & Sons, Ltd.

**Buxton.**—The U.D.C. has accepted the following tenders for supplies to the electricity works:—

Meters.—Ferranti, Ltd.  
Cables.—Callender's Cable Co.  
Oil.—Jas. Light & Sons.

**Bristol.**—The T.C. has entered into the following contracts for annual supplies:—

Joint boxes.—Strachan & Henshaw, Ltd., £239.  
Arc lamp carbons.—Wm. Gelpel & Co., £657.  
D.C. meters.—Ferranti, Ltd., £309.

**Cleckheaton.**—The U.D.C. has accepted the tender of Messrs. Newton, Bean & Mitchell for condensing plant for the electricity works, subject to sanction to a loan.

**Clifton.**—The North Riding of Yorks C.C. has accepted the tender of Messrs. Wright & Wood, Ltd., of Halifax, for electrical work in connection with the sewage lift at Clifton Asylum, York, at £124.

**Devonport.**—The Corporation has accepted the tender of the Walsall Electrical Co. for a new switchboard at £420.

**Glasgow.**—The T.C.'s Electricity Committee has recommended the acceptance of the following for the year —

Wooden troughing and cover.—Anderson & Henderson.  
Malleable iron tubes and fittings.—Wilson's & Union Tube Co.  
Cast-iron section pillars, joint boxes, &c.—Falkirk Iron Co., Ltd.; Carron Co., Ltd.  
Ironmongery and engineers' furnishings.—Wm. Landell; Peter Orr and Sons; John Stewart & Co.; G. M. Smith.  
Fire-clay bricks.—Glenboig Union Fire-clay Co.; Heathfield & Cardowan Fire-clay Co., Ltd.  
Arc lamp carbons.—Gloan Electrical Co., Ltd.  
Rubber cables.—Craigpark Electric Cable Co., Ltd.  
Flexibles.—W. T. Glover & Co., Ltd.  
Low-tension cables.—Callender's Cable Co., Ltd.  
Extra-high-tension cables.—W. T. Glover & Co., Ltd.

It was also agreed to recommend acceptance of the offers by the following firms for new meters (any size), in part exchange for an equal number of obsolete meters, viz.: British Thomson-Houston Co.; Chamberlain & Hookham, Ltd.; Ferranti, Ltd.

**Gravesend.**—The T.C. has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., for cables for mains extensions at £2,438.

**Newcastle-under-Lyme.**—The T.C. has accepted the tender of Messrs. Willans & Robinson, Ltd., for two 135-kw. Diesel engines, £3,471; two Electric Construction Co.'s generators, £546; Little's cooler, £200. The tender of the Diesel Engine Co., Ltd., was for two 135-kw. Diesel engines, £3,341; two Bruce Peebles generators, £559; Little's cooler £185.

**Nuneaton.**—The T.C. has accepted the following tenders in connection with the extension of the electricity supply to Griff Quarries:—

Underground cable.—R. W. Blackwell & Co., £871.  
Overhead aluminium line.—British Insulated and Helsby Cables, Ltd., £320.  
Joint boxes.—Callender's Cable Co., Ltd., £63.

For a year's supply of coal to the electricity works, the Council has accepted the tender of Mr. Geo. Smith for smudge at 4s. 1d. per ton; and that of Mr. J. Hurst for fine slack, at 4s. 3d. per ton.

**London.**—WOOLWICH.—The B.C. has received the following tenders for the supply of a turbo-alternator, the name given in parenthesis being the maker of the alternator:—Bellis and Morcom (General Electric Co.), 1,200 kw., £4,720; (Siemens Bros.), 1,200 kw., £5,028; British Thomson-Houston Co. (own make), 1,200 kw., £4,659; British Westinghouse Co., Ltd. (own make), 1,200 kw., £5,555; 1,500 kw., £6,055; Brush Electrical Engineering Co. (own make), 1,200 kw., with D.C. motors, £4,992, with A.C. motors, £5,110; Dick, Kerr & Co. (own make), 1,200 kw., £5,344; Fraser & Chalmers (General Electric Co.), 1,250 kw., £4,541; (Siemens Bros.), 1,250 kw., £4,592; Jas. Howden & Co. (Siemens Bros.), 1,250 kw., £4,445; 1,500 kw., £4,813; C. A. Parsons & Co. (own make), 1,200 kw., £4,670; Richardsons, Westgarth & Co. (Siemens Bros.), 1,250 kw., £4,628; 1,500 kw., £5,043; (General Electric Co.), 1,250 kw., £4,586; Willans and Robinson (Siemens Bros.), 1,250 kw., £4,389 (accepted); 1,500 kw., £4,782. The tender of Siemens Bros. & Co., Ltd., has also been accepted at £650 for the supply of 12 static transformers.

**SOUTHWARK.**—The tender of Kabelfabrik-und Drahtindustrie Joint Stock Co., Vienna (agent, Jas. Littauer, 72, Finsbury Pavement, E.C.), has been accepted by the B.C. for the supply of 440 yards each of triple concentric paper-insulated, lead-covered, and jute-served cable, 1 at £103 and 05 at £61 tenders were received, the total prices ranging from that accepted (£164) to £216.

**ST. PANCRAS.**—The B.C. has accepted a quotation from White, Jacoby, & Co. at £180 for rewinding the armature at the Regent's Park generating station.

**Rotherham.**—The tender of Messrs. Ed. Bennis & Co., Ltd., Little Hulton, has been accepted for mechanical stokers for the Corporation electric light and tramway station.

**West Ham.**—The following tenders have been accepted by the T.C.:—J. Spencer, Ltd., traction poles; British Insulated and Helsby Cables, Ltd., trolley wire; Messrs. Oaks, river service pipe work £4,230, plus a sum to be agreed upon for certain additional pipes for make-up lengths and templates. Orders are to be placed with the Rees Roturbo Mfg. Co., Ltd., for circulating water pumps, motors, and exhausters, &c., at £1,425; and with the London Electric Supply Corporation, on the best terms obtainable for two strainers.

**Torquay.**—The following tenders have been accepted by the T.C. in connection with the new municipal buildings:—R. Waygood & Co., electric lift, £95; Higgins & Griffiths, electric lighting, £537; Gent & Co., Ltd., complete telephone installation, £185.

**Walsall.**—The T.C. has accepted the tender of Chas. Ross at £119 for supplying and fixing electric wiring and fittings in connection with the new sewage purification works at Brockhurst Farm.

**Whitehaven.**—The T.C. has accepted the tenders of the Whitehaven Colliery Co., and Mr. G. W. Wilkinson for fine slack coal for the electricity works for a year.

**West Bromwich.**—The T.C. has accepted the following tenders for the electricity works:—

Coal conveyor.—New Conveyor Co.  
Overhead travelling crane.—Vaughan & Co.



## W. T. HENLEY'S TELEGRAPH WORKS CO.'S CABLE FACTORIES, WOOLWICH AND GRAVESEND.

THE company, whose works are described in the following article, was founded by one of the most striking characters associated with the early history of electrical engineering—W. T. Henley, who by turns was a light porter, dock labourer, instrument maker, and telegraph engineer. He commenced the manufacture of submarine cable at North Woolwich in 1853, and made the shore ends for the Atlantic cables which were laid in 1865 and 1866, besides many other cables far too numerous to mention, for all parts of the world. In the course of his life-time, Mr. Henley made some 14,000 miles of submarine cable, and laid most of it with his own cable ships. He also established works for making iron-wire rods and sheet-iron in Wales, and carried out the drawing and galvanising of iron wire at the Woolwich works. Unfortunately, after a period of great prosperity, encumbered perhaps by his too numerous undertakings, Mr. Henley's business got into difficulties, which led to the formation of the present company to carry on the manufacture of cables. Since then, under the able guidance of Mr. G. Sutton, M.I.E.E., the managing director, aided by Mr. R. J. Hatton, M.I.Mech.E., M.I.E.E., chief engineer and works manager, the business has been developed and extended into all branches of cable manufacture, steadily increasing in size and importance, as well as in prestige both at home and abroad.

The site of the factory at North Woolwich was chosen for convenience in dealing with submarine cable, which formed the principal product in the early days, and which had to be led direct from the works to the cable tanks on board ship; the factory was therefore established on the bank of the Thames at North Woolwich, the centre of the submarine cable industry of the world, and provided with a jetty for this purpose. On the opposite side it is bounded by the Great Eastern Railway, beyond which are the docks which convert this portion of the borough into an island. The remainder of the space thus cut off being fully occupied, there is no possibility of extension on the ground level, and, therefore, it has been necessary to erect buildings of several stories in order to provide adequate accommodation for the various departments. Moreover, as from time to time new manufactures have been introduced for which the works were not originally laid out, it has been difficult to carry out a satisfactory system of organisation.

Eventually, however, the business grew beyond the capacity of the North Woolwich works, and the company decided to erect an entirely new factory at Gravesend, to which the whole of the heavy paper-covered cable manufacture was transferred: this made possible the execution of a scheme of reconstruction which has been in progress for a considerable time, and which is now approaching completion.

The manufactures carried on at the Woolwich works include dry-core paper-insulated (air-space) telephone cables, rubber-insulated cables and flexibles of every description, bitumen-covered cables, submarine cables, gutta-percha covered wires (which are largely used by railway companies), and golf balls. All these products were in course of manufacture at the time of our recent visit, many of the shops being kept running night and day—especially those connected with the manufacture of rubber-insulated wires and cables, of which the company has an enormous output, doing a large export trade, in addition to the home demand—and the following notes and illustrations will give some idea of the plant and processes employed.

The whole of the machinery is electrically driven from generating plant in the works; owing to the very early adoption of this system, the pressure is only 110 volts—an example of the penalties of pioneering. Hitherto, although the company has shared the misfortunes of the Woolwich electricity supply undertaking, by way of the rates, it has not been able to derive any compensating benefit from the latter, the generating station being on the south side of the river. However, when the subway now under construction is completed, cables will be laid through it by the Borough

Council, and it will then be possible to obtain a supply of electricity for night work, &c., from the mains.

Starting with the rubber works, the first department is the raw material stores, where an enormous quantity of copper wire of various sizes is kept in stock. The wire is tinned, if required, and is then stranded into cable in a stranding shop on the ground floor; in order to cope with the demand, the machines in this shop are kept running day and night throughout the year. A flexible cable of exceptional design was being laid up at the time of our visit, the number of wires in the conductor amounting to about 760.

The rubber shops are being reorganised and accommodated in a new building; the mixing and calendering machines are already at work there, and the washing machinery will also be brought into it. One of our illustrations shows two calenders at work, driven by variable-speed motors, and producing "rolled sheet" rubber, which is rolled up on spindles together with a cloth separator and stored on racks. On the floor above are the "spreading" machines, of which also we give an illustration; the rubber, in the form of a thick solution, is spread in very thin successive layers on a cloth until the desired thickness is attained, after which the sheets are hung up as seen in the background, to allow the solvent to evaporate. The "spread sheet" rubber can then be stripped off the cloth. One of the machines shown is spreading rubber on calico to form waterproof tape. A noticeable feature of these shops is their lofty construction and the excellent lighting obtained, which is assisted by the whitening of all the walls.

In the rubber covering shop the rubber is applied to the wires and cables by lapping it spirally, or, in the case of the smaller sizes, by longitudinal application, and after winding them in one or two layers on long cylinders the cables are put into steam-heated cylinders or "cures" for the vulcanising process. After this they are immersed in water and tested, before proceeding to the braiding shops.

Braiding being a comparatively slow process, there are several of these shops; we give an illustration of one, where flexibles and other small wires are being braided with cotton, silk, &c. The cables are finally compounded, and again tested before passing into stock.

Turning next to the dry-core telephone department, this is naturally devoted now mainly to Post Office work, so far as the Home market is concerned; but a large amount of work is carried out for various Colonial and foreign postal authorities and telephone companies, and an exceptionally large and heavy armoured cable of this type, for laying under a river, was about to be shipped to the Bell Telephone Co. of Canada, when we visited the works.

The first process here is to measure the length of each reel of wire, for it is highly desirable, though not essential, that there should be no joints whatever in the cable—therefore each length of wire must be at least as long as the finished cable. Each wire is then covered with a paper tape, either lapped on spirally, or laid longitudinally and kept in place with a cotton whipping: the former construction is used mainly for short cables, such as those connecting subscribers with the exchange, while trunk and junction cables, in which the capacity must be kept down, are made on the latter system. We illustrate a row of the machines used for this purpose. A number of universal machines are being built in this shop by the company's staff, which will be applicable to a variety of uses—silk or cotton covering, making flexible cord, &c.

The floor below is the twinning shop, where the paper-covered wires are paired, and afterwards stranded into cable. One of our views shows a large laying-up machine in this room for dealing with the heavier cables used for trunk and junction lines. A similar machine, not shown, made by the company is provided for making the smaller cables, and is capable of carrying more than 250 bobbins.

On the ground floor are a large number of steam-heated chambers for drying-out the paper cables under a vacuum,



and the presses with which the lead sheathing is applied. As the paper is extremely sensitive to atmospheric humidity, a steam-heated chamber is provided for the reel to rest in whilst the cable is being drawn off it to the press. An

unless serving or armouring is specified. It is interesting to note, in view of the reports which we have published regarding the attacks of insects on lead-sheathed cables, that brass tape like that used to protect submarine cables from the



RUBBER MILL, NORTH WOOLWICH.



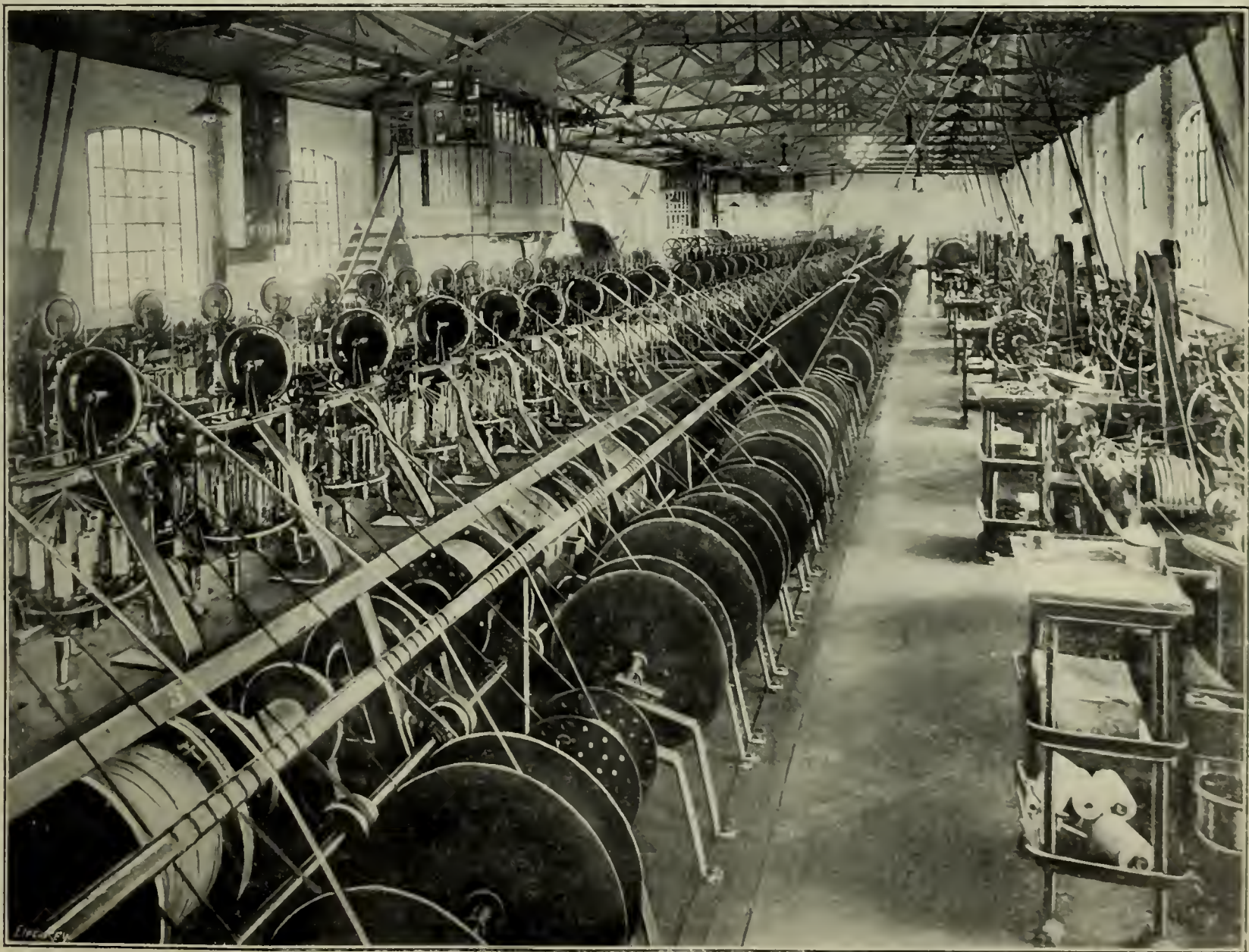
RUBBER SPREADING SHOP.

automatic counter measures the length of the cable entering the lead press, and a friction-driven gear, automatically controlled by the weight of the cable as it leaves the press, winds it up on a drum.

The cable is next immersed in water and afterwards tested

teredo is sometimes applied to cables for Australia and other countries.

In the gutta-percha shop, one of the new buildings, the raw gutta-percha is masticated and prepared for application to the conductors of submarine telephone and telegraph



BRAIDING SHOP, NORTH WOOLWICH.

in the test room, where two testing cabinets are provided. An additional test is applied by charging the cable with desiccated air at a pressure of 75 lb. per sq. in., which is left on for three hours. This completes the telephone cable,

cables, and it is worthy of mention that Messrs. W. T. Henley were pioneers in the treatment of raw gutta-percha. The process of making gutta-percha core is very simple in appearance, but demands great watchfulness to keep the



conductor central, and long cooling, the core passing to and fro in a long water tank several times before it is hard enough to be wound up on a reel. The gutta-percha is pressed round the conductor somewhat after the manner of lead sheathing, of which, however, it was the forerunner, and it is applied in several layers, cemented together by intermediate applications of Chatterton's compound.

A 28-core gutta-percha submarine cable was being made for the British Post Office at the time of our visit.

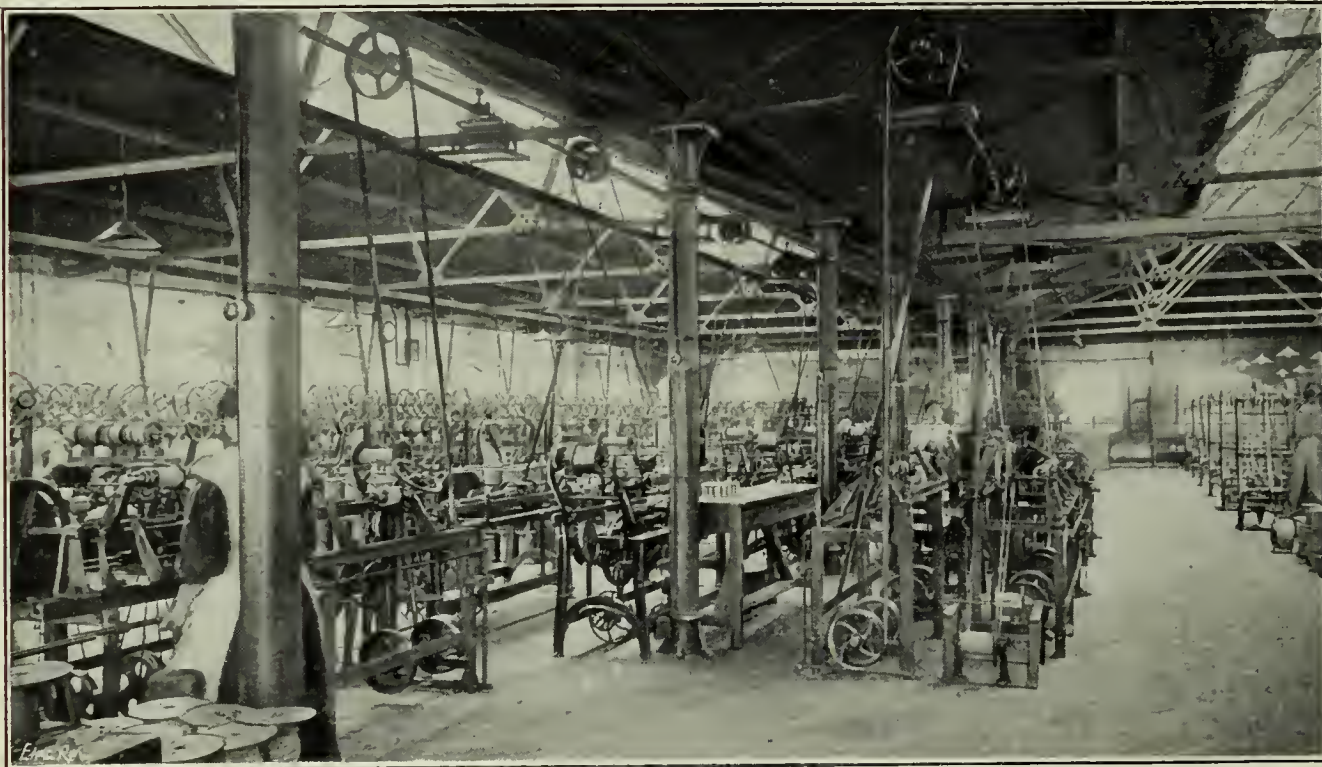
In a similar way bitumen-covered cables are made in this shop, but these do not require water cooling, the covered cable being received on an endless leather band, and double lapped with tape to afford mechanical support. These cables, with one or more cores, are mostly supplied to collieries, but are also largely used for power and lighting.

The power required to masticate raw

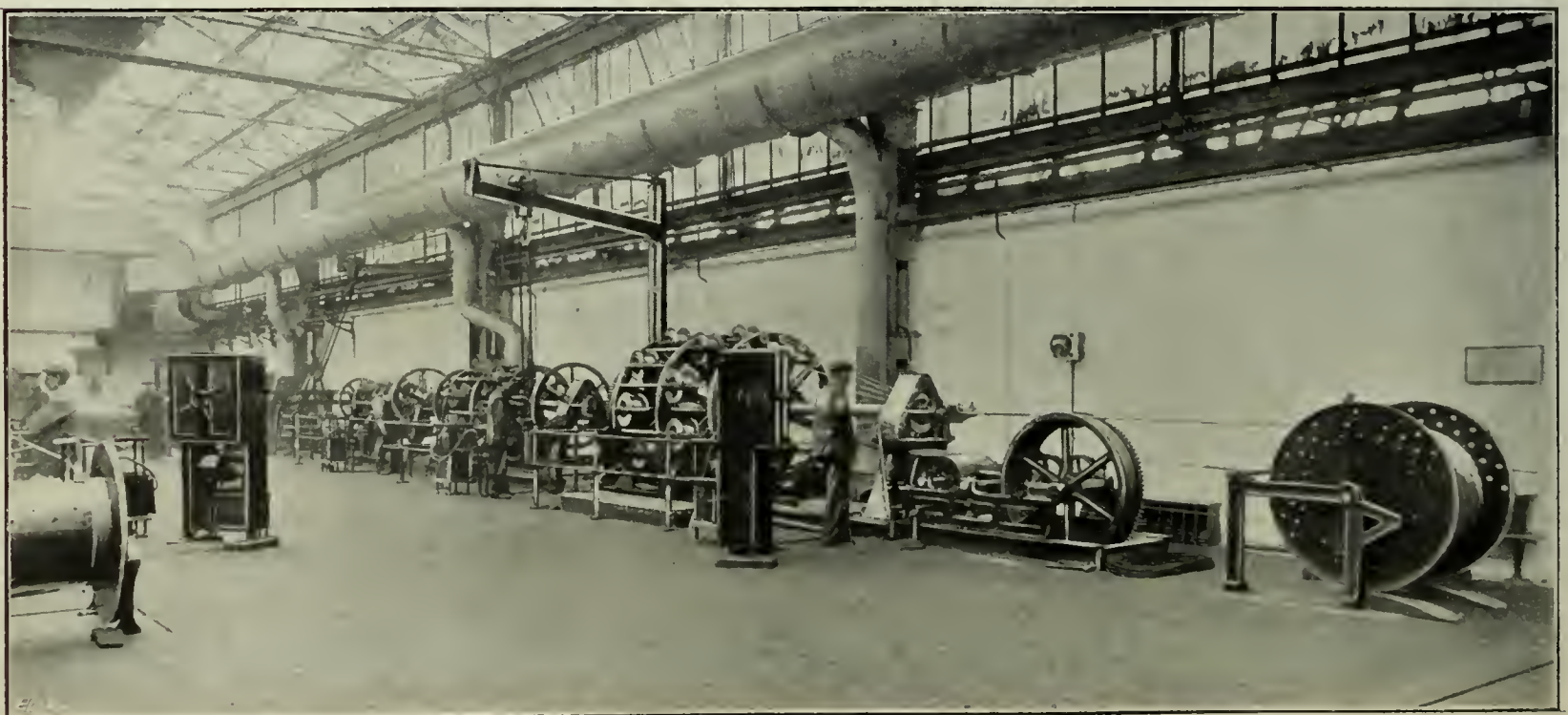


STRANDING MACHINE, NORTH WOOLWICH WORKS.

In another shop are several large machines for sheathing submarine cable, and bitumen-covered power cables, with wire or steel tape; here also a four-core submarine cable for the Post Office was being laid up and brass-taped when we visited the works. The several sections of a submarine cable, after being tested in tanks, are carefully joined together into one continuous length, each joint being separately tested, and finally they are coiled down in six huge cable tanks close to the roadway, across which they can readily be led into the corresponding tanks on



PAPER-COVERING MACHINES FOR TELEPHONE CABLES, NORTH WOOLWICH.



LARGE STRANDING MACHINE, GRAVESEND WORKS.

rubber and gutta-percha is very considerable; several of the motors employed for these purposes at Messrs. Henley's works are of 40 or 60 H.P., and as they are running for long periods they consume a large quantity of energy.

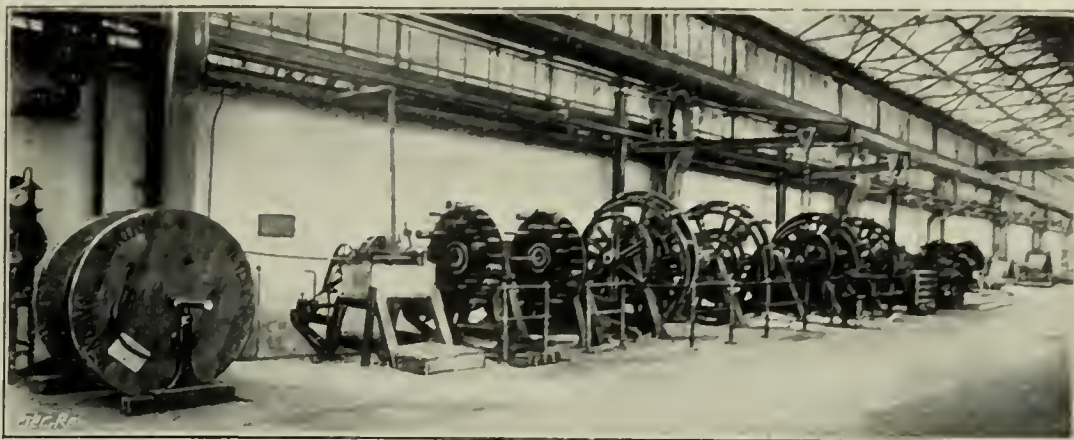
board ship at the jetty. In this shop the type of armouring prescribed by the new Home Office rules for cables in collieries—with copper sheathing under single armour, or double wire sheathing with tape between—is carried out, and there are a



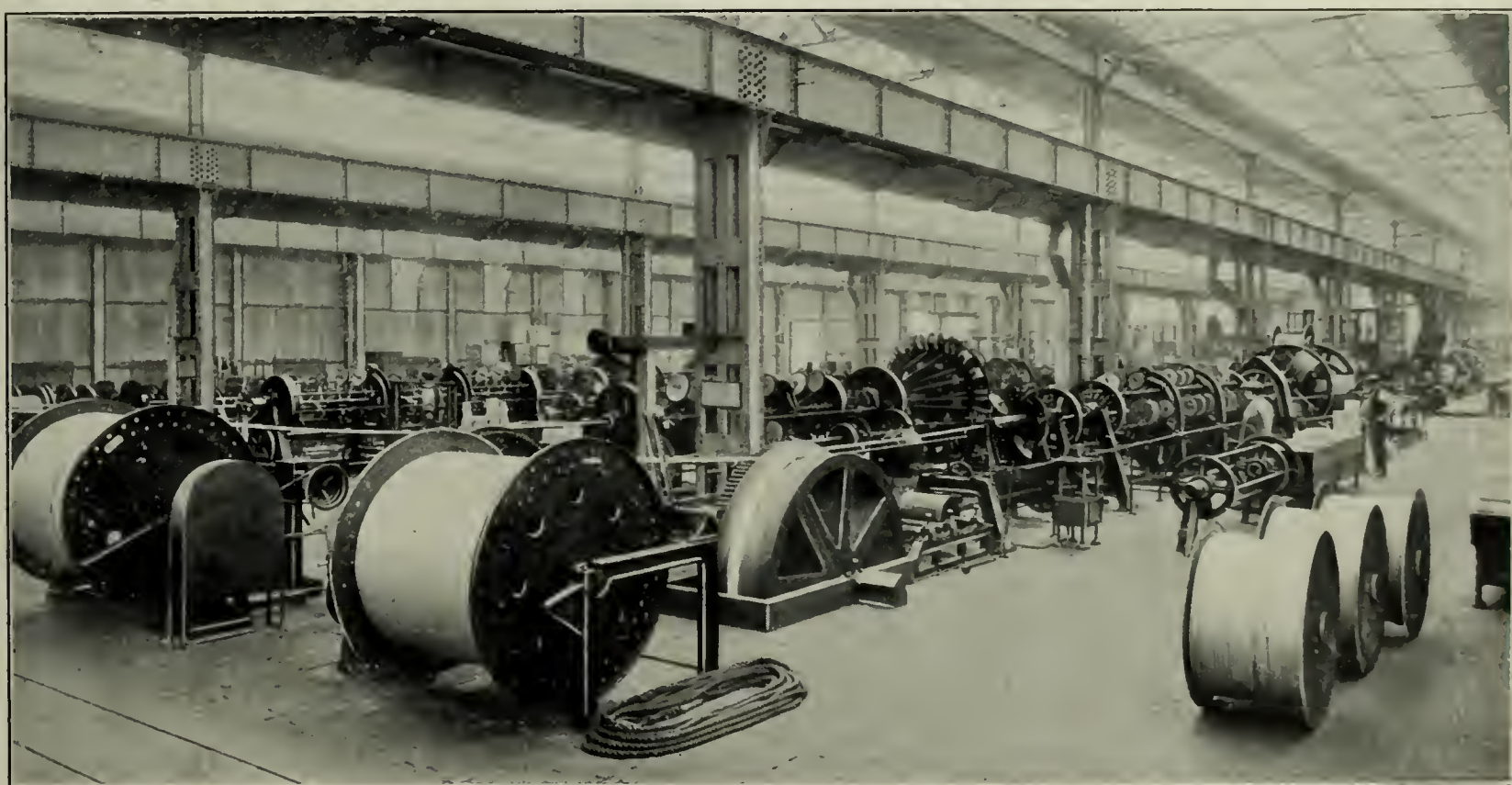
number of large machines for braiding the larger class of cables with jute. One of these was at work on a patent of the company's—a very flexible cable surrounded with a braiding of fine phosphor-bronze wire, which affords excellent mechanical protection without interfering with the flexibility of the cable, and of which very large quantities are used by the British Admiralty.

In the main tank room there are about 20 tanks for the immersion of cables prior to testing, but even these are insufficient to meet the requirements, as submarine core has to remain in water 14 days, thus monopolising a number of tanks for that period. This department is, therefore, being extended. All sorts and sizes of cables are tested here, and in order to handle them easily, each row of tanks—five in all—is provided with an overhead runway and

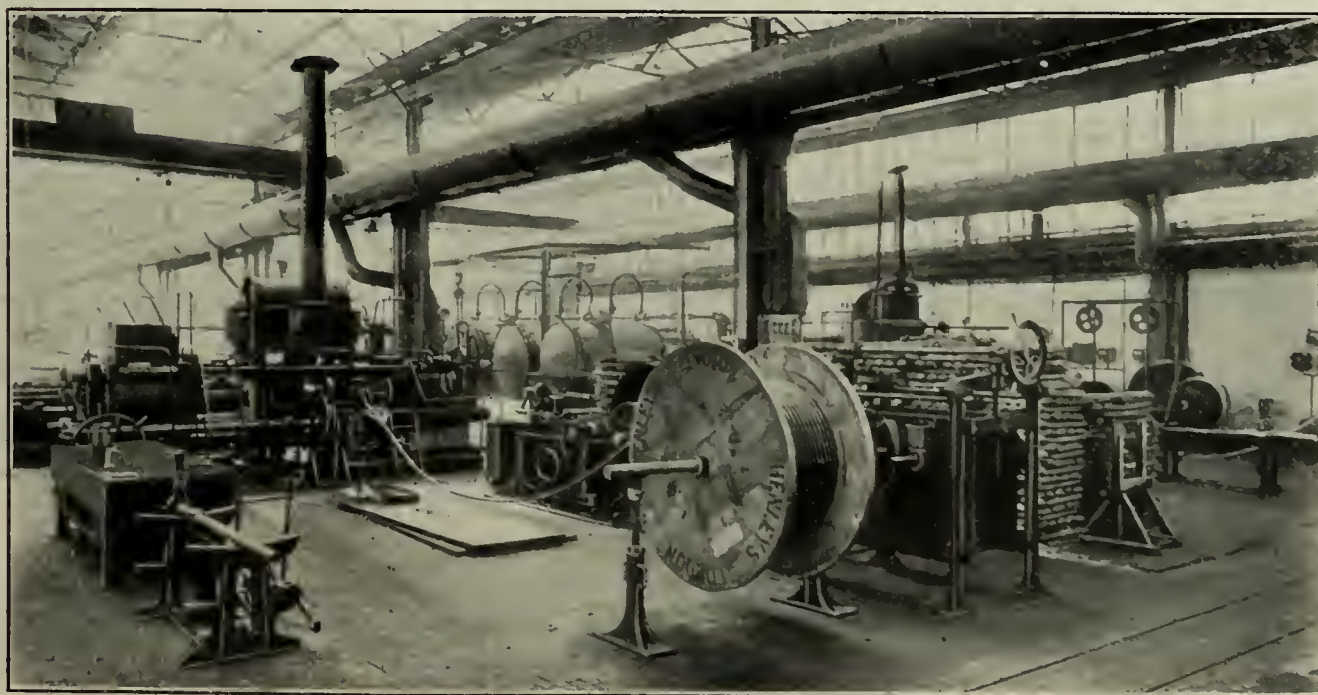
in conduit across the roadway to the large general test room, which is equipped with Sullivan galvanometers and universal shunts and all other necessary apparatus.



SHEATHING MACHINE. GRAVESEND.



PAPER COVERING MACHINES, GRAVESEND WORKS.



LEAD PRESS SHOP, GRAVESEND.

electric pulley blocks, the largest of which can lift drums weighing 5 tons. A motor-generator, transformer and inductance regulator are provided in this shop for pressure tests up to 40,000 volts. For insulation, &c., tests, leads are run

In the warehouse block, all the lighter cables are measured and cut to standard lengths for stock on the top floor, and stored in bins and racks in the middle floor, while the ground floor forms the packing and dispatching department. Quite

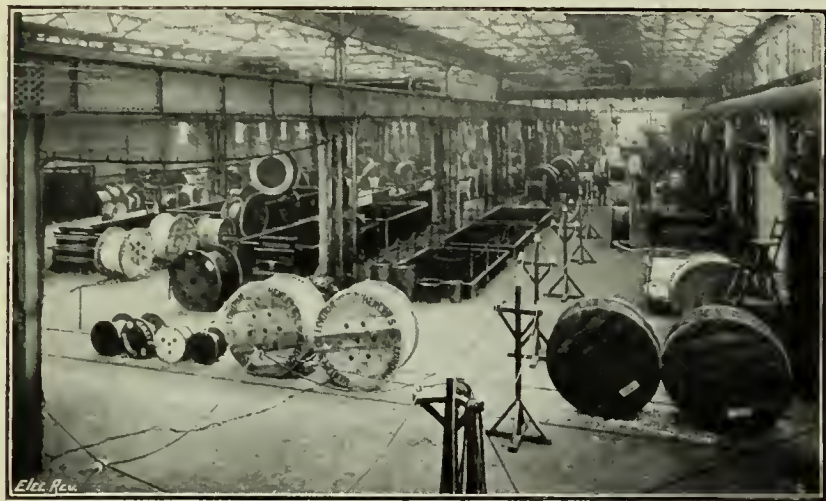
The testing leads are each provided with a continuous insulated sheathing performing the functions of a guard ring, which entirely eliminates errors due to leakage from the leads. There are in all six test rooms. Several small ones are provided for the convenience of visiting inspectors. There is also a chemical laboratory where samples of all materials are analysed, and the samples of coal, oil, flue-gases and softened water from the power station are tested. Another laboratory is devoted to physical tests of all raw and manufactured materials.



a large room is allotted to the preparation of samples of finished cable—an item which involves a good deal of expense.

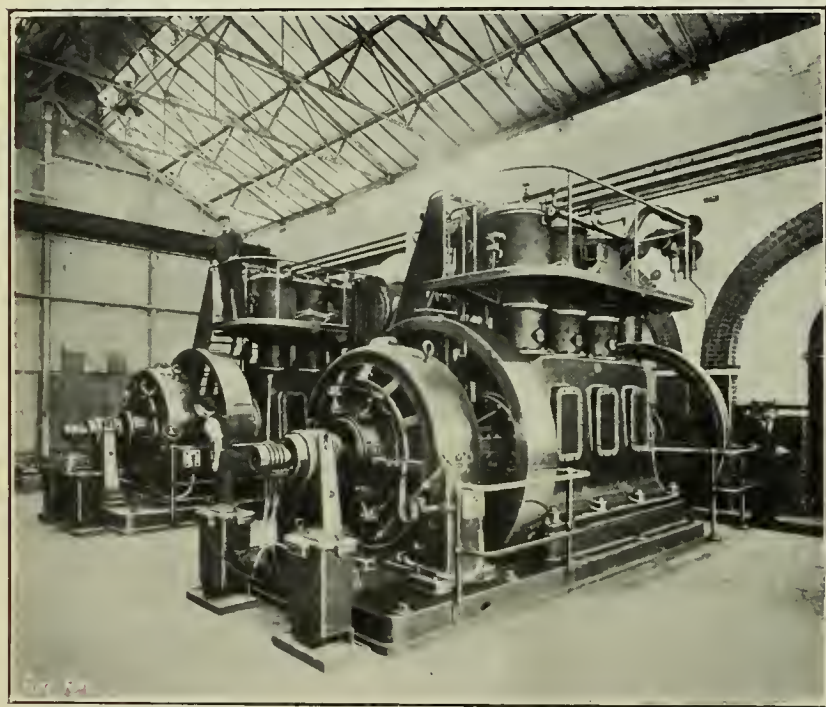
The offices include, besides the chemical laboratory above-mentioned, a drawing office, estimating department, general offices, and a staff dining room. Private telephone lines join the works to the head offices in Blomfield Street, E.C., and are found to be a great convenience.

We now pass to the Gravesend works, which are situated in a pleasant neighbourhood, close to the one-time famous Rosherville Gardens. Here the company purchased a site of 12 acres, adjoining the river, and erected buildings on the most modern and commodious lines. The advantages of being able to commence with a pre-arranged plan and to extend at pleasure on the ground level are strikingly mani-



TESTING TANKS, GRAVESEND.

fest, as will be gathered in part from the accompanying illustrations. Good lighting, which is so essential to manufacturing efficiency, is provided by double skylights running the whole length of each bay, with a ventilated lantern roof. The stores lie alongside the main shops, which are 700 ft. in length; a brick wall separates the stores from the shops, but the latter, in three bays, are entirely open to the opposite wall of the building, which temporarily consists of corrugated iron, providing for extensions to be readily carried out. An elaborate scheme of ventilation on the plenum system



WESTINGHOUSE GAS ENGINES AND DYNAMOS IN POWER STATION.

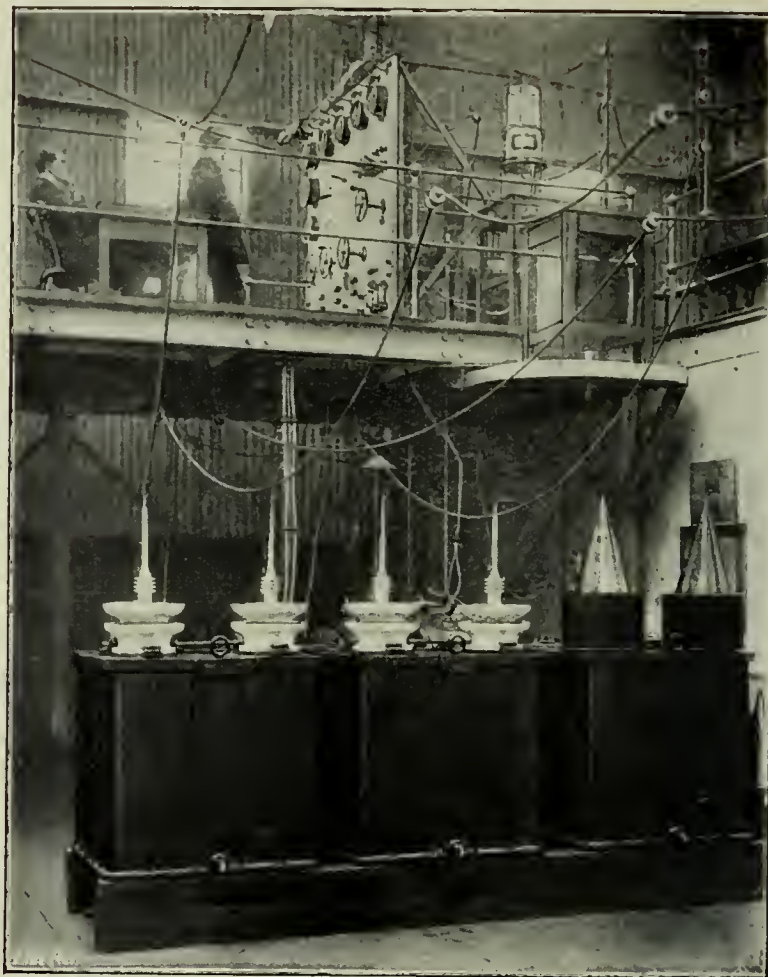
has been carried out, the trunks for which are visible in the illustrations.

Electric driving is, of course, employed throughout, and the departments are arranged, as far as possible, so that the work passes continuously forward through them. Each bay is provided with two electric travelling cranes, except that which constitutes the stores, &c., which is lower than the others.

Thus we commence with the wire-winding machines, by which the wire is wound off the loose coils on to reels for the stranding machines, which come next in order. One of

the larger of these, of which we give an illustration, is of the triple type, and lays up, therefore, 37 wires at once.

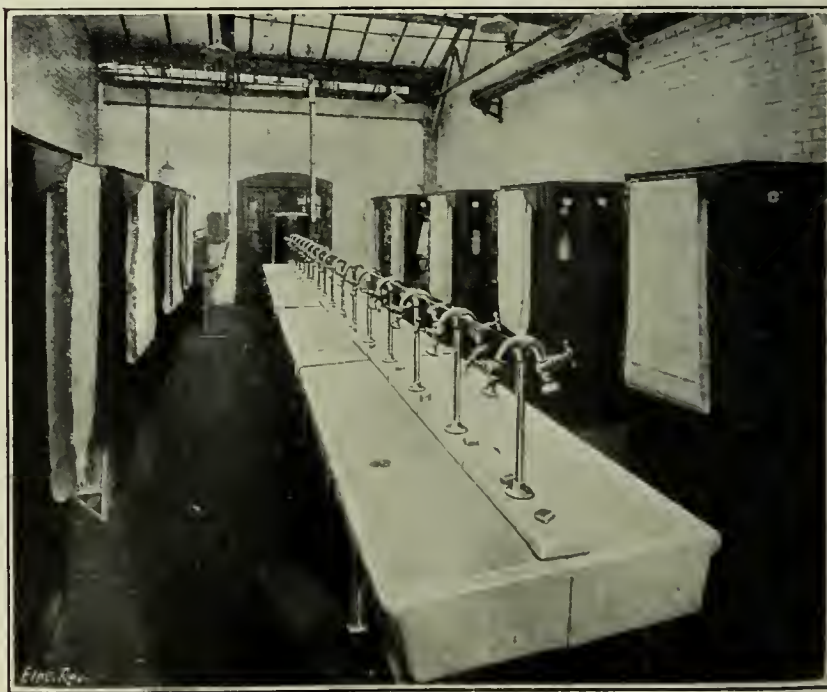
As we have indicated above, all the cables made here are



EXTRA-HIGH-PRESSURE TESTING TRANSFORMERS.

of the heavy paper-covered type; we come next, therefore, to the paper-covering machines, which lap the copper conductor with paper tape up to any desired thickness; we illustrate one of these machines. Cables are here insulated and laid up with one, two or three cores. In the paper store adjoining, the rolls of paper received from the manufacturers are slit on a large paper-cutting machine to suitable widths.

The next process is the drying and impregnating of the cables, which is effected in the large cylindrical chambers



WORKMEN'S LAVATORY AND LOCKERS, GRAVESEND.

seen in some of the illustrations. These are steam heated, and the cable is dried under a vacuum, after which hot impregnating compound is admitted to the chambers. A large number of these chambers is provided, some with their axes horizontal, for cable wound on reels, and others vertical, to receive the cable coiled on large perforated metal trays. Close by are the lead presses which apply the lead sheathing; these, it will be seen, are of the horizontal double-ram type, like those at North Woolwich, and are actuated by three-throw motor-driven pumps.



At this stage the cables are subjected to an immersion test, after which they are returned to the shop for completion. They are usually armoured with steel wire or tape, on the large sheathing machines of which one is illustrated herewith, which can put on 72 wires in one operation. The same machine can be used to put on jute serving over the lead, or over the tape armour, which is then compounded and whitewashed.

Many large tanks are provided for the use of the testing department, some of them being shown in the accompanying view from the testing gallery. Provision is made for the use of testing pressures up to 130,000 volts; for this purpose a motor-alternator is provided, working up to 500 volts, together with two sets of three single-phase transformers working up to 20,000 volts. By putting all the latter in series, the maximum above-mentioned is obtained. The pressure is controlled by an inductance regulator on the low-pressure side of the system, and is measured by a Jona voltmeter reading to 60,000 volts. Kelvin electrostatic voltmeters are also provided. The gallery shown in one of our illustrations runs the whole width of the building, and beneath it there is a number of small test rooms for the use of inspectors. The provision for testing, it will be seen, is exceptionally complete.

A complete equipment for wire-drawing, from the rough copper rod down to any size required in the works, forms an interesting feature of the plant. Pickling tanks for cleaning the rod, and annealing furnaces, are also provided.

In a separate building the company's well-known feeder pillars, joint boxes, &c., are made up, a variety of machine tools being provided for this purpose, together with a tool room. A drawing office on the first floor deals with the necessary plans, and there is an engineers' shop for repairs, besides a shop for making cable drums.

The power house plant is of more than usual interest. There are three Dowson gas producers, fed with anthracite fuel, which supply gas both to the shops for heating, melting lead, &c., and to the generating plant. The latter (see illustration) consists of two Westinghouse vertical gas engines driving dynamos at 500 volts, with static balancers. There are also two steam boilers, one of the Climax type, the other a special form of Babcock & Willcox boiler, to supply steam to the shops and to the gas-producer. Fuel is stored in a pair of steel bunkers, one for anthracite, the other for steam coal, into which it is raised from a hopper by mechanical elevators and conveyors. Above the bunkers are two tanks, one of which receives water from an artesian well sunk on the site, while the other, at a lower level, is a storage reservoir for softened water. The soft water is also passed through the jackets of the gas engines as cooling water, and the boiler feed-water is drawn from the hot return pipe. A further recuperation of waste heat is effected by mounting a Wilson patent multitubular boiler on the common exhaust pipe of the two engines; at about  $\frac{1}{3}$  full load, we understand, this boiler provides the steam for the gas producers, and at higher loads there is a surplus which assists the coal-fired boilers.

An interesting item is a supply of oxygen, which is provided in the engine room, and also in the works, as a restorative in case of gassing, as well as of electric shock. This, we hope, will never have to be called upon to prove its utility.

An electric trolley crane runs along the whole length of the yard adjoining the works, and out on the ferro-concrete jetty.

Mention should be made of the exceptionally good accommodation provided for the employees in both works. We reproduce a photograph of the wash-basins and lockers at the Gravesend works, and may add that, at the time of our visit, the whole place was spotlessly clean and tidy. Boiling water is provided for the men to make tea. The sanitary arrangements are carried out with equal care and efficiency.

In concluding this account of the works, we wish to express our appreciation of the courtesy and willing assistance which we received at the hands of all the members of the company's staff with whom we came in contact, especially Mr. W. F. Bishop, of the head office; Mr. W. C. McArthur, assistant works manager, and Mr. H. Savage, M.I.E.E., electrical engineer, at the North Woolwich works; and Mr. R. O. Wright, A.M.I.Mech.E., manager of the Gravesend cable factory.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, May 20th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.  
Tuesday, May 21st.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction, 7 p.m. to 10 p.m., for those not passed by the Adjutant as efficient.  
Wednesday, May 22nd.—All Companies. Annual course of musketry at Purfleet. Members should notify O.C. if they can attend, when railway tickets and necessary information will be sent to them.  
Thursday, May 23rd.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.  
Friday, May 24th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction as for Tuesday, the 21st inst.  
Saturday, May 25th.—Annual training at Fort Coalhouse, East Tilbury, Gravesend. The party detailed to this camp will parade at Headquarters at 1.30 p.m. Dress: Marching order, service dress, puttees, great coats on, band-ole, belts, frogs, haversacks and water bottles. Arms will be issued at Headquarters before the parade falls in. Kit bags should be packed and brought to Headquarters, properly labelled, with the owner's regimental number, rank and name and destination. Annual musketry.—Members are reminded that very few dates now remain for shoots. Every endeavour should be made to complete musketry.  
(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

## FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 17th.—At 8 p.m. At 89, Victoria Street, S.W. Paper on "Storage Battery Engineering," by Mr. G. C. Allingham.

Thursday, May 23rd. At 6 p.m. Visit the General Post Office Avenue Telephone Exchange, 22, Creechurch Lane, E.C.

Royal Institution.—Friday, May 17th. At 9 p.m. Discourse on "High-Frequency Currents," by Mr. W. Duddell.

Friday, May 24th. At 9 p.m. Discourse on "Recent Advances in Agricultural Science—The Fertility of the Soil," by Mr. A. D. Hall.

Royal Society of Arts.—Monday, May 20th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture IV.)

## NOTES.

**Fatalities.**—Last week a fatal accident occurred at the Pigeon House electrical works of the Dublin Corporation. John Kidd, a labourer, aged 24, whilst assisting at the overhauling of an engine was struck by a bar, and received fatal injuries. The jury found that deceased was accidentally killed, and a rider was added that more supervision should have been exercised. Two years ago a brother of the deceased man was killed at the same works.

John Davidson, a boy of seven years, living at Wallsend, was killed by electric shock on the North-Eastern Railway, near Wallsend, on Sunday.

**B.I. Engineering Society.**—By the kindness of the Liverpool University authorities, the closing meeting of the season was held in the Physical Laboratory on Friday evening, the 10th inst., when Prof. Wilberforce gave an interesting lecture on "Vibration and Waves," with demonstrations by model and lantern. The President of the Society (Mr. W. Aitken, M.I.E.E.) expressed their thanks to the University for allowing these meetings to be held on their premises, and to the professors and assistants for their valuable lectures and demonstrations.

**Fire Brigade Competition.**—The seventh annual competition of the City of London Private Fire Brigades Championship was held at the Guildhall on Saturday. Out of the 16 competitors, the Osram Lamp Works Fire Brigade ran second in 273 $\frac{1}{2}$  sec., and the Robertson Lamp Works Fire Brigade ran third in 276 $\frac{1}{2}$  sec.

**Electrical Exhibition.**—We have received the prospectus of the second North-Eastern Counties Electrical Exhibition, which will be held from September 7th to 28th, 1912, at Newcastle-on-Tyne, under the auspices of the local supply companies, the I.E.E., the E.C.A., the B.E.A.M.A., &c. The first was held in 1906, and was very successful. The Exhibition Hall has a floor space of 25,000 sq. ft., and the stand rent will be returned to the exhibitors in the form of free tickets of admission. The object of the Exhibition is to acquaint the general public with the great development in the applications of electricity for domestic purposes, with the aid of practical demonstrations. Full particulars can be had from the Secretary, Newcastle Exhibitions, Ltd., 15, Grey Street, Newcastle-on-Tyne.

**Appointments Vacant.**—Railway telegraph engineer for the Government of Southern Nigeria (£400 + £80 duty allowance). Assistant professor of electrical technology, for the Institute of Science, Bangalore, India (£600). See our advertisement pages in this issue.

**Fire.**—On Monday a fire occurred at the electrical works on the estate of Mr. W. A. Thornton, Partridge Green, Sussex, and the place was practically gutted. The outbreak was caused by the bursting of some oil tanks.



**Live Wire Accident.**—Last week the son of a pit worker at Carronshore, Falkirk, was searching for birds' nests at a disused pit, and climbing an engine house he caught hold of a live electric wire. He was so badly injured that it is feared his arms will have to be amputated.

**Institution and Lecture Notes.**—THE CONCRETE INSTITUTE.—The second annual dinner of the Institute took place on May 9th, at the Trocadero Restaurant, Mr. E. P. Wells, President, in the chair. In the afternoon of the same day the annual general meeting took place, Sir Henry Tanner presiding. The annual report of the Council was adopted unanimously. It stated that the membership amounted to 916 on April 30th, and that the finances were in a satisfactory condition, there being a surplus in hand of £159. The chairman, as retiring president, then installed Mr. E. P. Wells as president of the Institute for the ensuing two years.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH STUDENTS' SECTION).—The report for the session 1911-12 shows that the attendance on the whole has been good, averaging 21; the total membership is 68. The special grant from the Local Section to cover the cost of printing of Students' papers was renewed, and copies of the papers read were sent out before each meeting. The chairman for next session is Mr. W. W. Lackie, and the hon. secretary, Mr. H. A. Stewart.

INSTITUTION OF MUNICIPAL ENGINEERS.—A discussion on "Water Softening," will take place in the Council Chamber, 4, Southampton Row, London, W.C., on May 22nd, at 7.30 p.m. Open discussion, in which it is hoped that several experts will take part, is invited.

INSTITUTION OF ELECTRICAL ENGINEERS.—Last night the annual general meeting was to be held to receive the Report and Accounts, and to hear the result of the election of Members of Council, if counting of the ballot papers is completed in time. A marble bust of the late Lord Kelvin was to be presented to the Institution on behalf of Lady Kelvin.

We have received the provisional programme of the Glasgow meeting, which will be held on June 12th to 14th. It includes a paper by Mr. J. S. Highfield on "The Transmission of Electrical Energy by Direct Current in the Series System," a lecture by Prof. S. P. Thompson on "The Magnetism of Permanent Magnets," and another paper not named; there will also be visits to works, receptions, a steamer excursion on the Clyde, and a dinner. Those who wish to take part in what will, no doubt, be a very enjoyable and interesting meeting, should apply to-morrow to the Secretary.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements*

**Central Station Officials.**—On Saturday, April 20th, MR. D. NORDWALD, shift engineer at the Pietermaritzburg Corporation electricity works, was presented by Mr. A. S. Munro, borough electrical engineer, on behalf of the staff, with a fruit knife, stand and butter dish, on the occasion of his marriage to Miss E. S. Young, of London.

MR. H. L. HOWARD, who recently resigned the post of electrical engineer and tramways manager to the Barking U.D.C., has been presented with a handsome testimonial by the staff and employes of the departments which have been under his control, in the shape of a solid silver table service. The presentation was performed by Mr. W. Holmes, his successor, who bore witness to the respect and esteem they all felt towards their chief. Mr. Howard feelingly responded, and remarked that he was leaving municipal service, which was not now what it was 15 years ago. Mr. J. Coaffee, on behalf of the men, also expressed their wishes for Mr. Howard's future success and prosperity.

The Croydon T.C. has increased the salary of MR. A. C. BOSTEL, electricity showrooms superintendent, from £169 per annum to £190, with annual increments of £20 to a maximum of £230.

The Gillingham (Kent) T.C. has appointed MR. W. MIDDLETON, of Sheerness, as shift engineer, and MR. A. C. LINES, stores clerk and timekeeper, as the commercial assistant at the electricity works at £100 a year, rising by annual increments of £10 to £150.

The Blackpool T.C. is increasing the salary of MR. W. W. PARKINSON, electricity works superintendent, from £200 to £225 per annum, and that of MR. H. SPANNAHAN, mains superintendent, from £3 5s. to £3 15s. per week.

MR. J. M. HENDERSON, late engineer-in-charge of the meter testing, and motor hire and maintenance department at the Brighton Corporation Electricity Works, who is leaving for Canada, was on Friday last presented by his colleagues with a complete microscopic equipment in mahogany case.

MR. F. C. BOWEN, of Stoke, has been appointed shift engineer at Leek Electricity Works.

**Tramway Officials.**—MR. ARTHUR J. POWELL, joint manager of the Madras electric tramways, has been granted six months' leave, and expects to arrive in London about May 28th.

The Blackpool Tramways Committee has decided to increase the salary of MR. C. BAKER, tramways superintendent, from £200 by successive annual increments of £25 to £250.

The Wolverhampton T.C. on Monday granted an increase of salary to MR. W. A. LUNTLEY, tramways manager, from £350 to £400 per annum.

MR. H. B. CROKER, formerly engineer and assistant manager during both steam and electric traction for 10 years with the New St. Helens and District Tramways Co., sailed last Friday for Vancouver, Canada, where he is taking up engineering work shortly.

**General.**—MR. F. DOUGLAS WATSON, general manager and secretary of the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople), left London on Wednesday, 15th inst., for Constantinople. MR. A. S. DUNCAN, assistant electrician, late of Glasgow, has also left London to take up his duties in Constantinople.

On the occasion of his marriage, the staff of the British Insulated and Helsby Cables, Ltd., of Prescott, have presented a case of silver-plated fish slicers, knives and forks, to MR. H. D. TAYLOR, a member of the staff, and eldest son of Mr. Jas. Taylor, a director of the company.

After two years' stay in Germany, MR. THOMAS HAMILTON RIGG, formerly Midland representative to the Chloride Electrical Storage Co., Ltd., has returned to England to represent the "Dac" Accumulator Syndicate, Ltd., of Cheshunt, Herts.

MR. B. RATCLIFFE, chief electrician at the boiler works of Messrs. Thompson, of Ettingshall, who is proceeding to Canada, where he has obtained an appointment, has been presented by his colleagues with a gold signet ring.

MR. W. J. PALMER REES, of Penally, South Wales, and formerly of Wolverhampton, has been appointed assistant electrical superintendent of the whole system of the Great Indian Peninsular Railway.

MESSRS. LASCELLES PARRINGTON and E. BRIDGER, electrical engineers, of Melbourne, have come to England.

MR. W. A. PURDON, manager of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd, for New South Wales, has come to England for a visit.

MR. ARTHUR ALLISON, electrical engineer for the Cassilis G.M. Co. (Vic.); is on a holiday trip in this country, accompanied by his wife.

Mr. Albion T. Snell, consulting engineer, Suffolk House, Cannon Street, E.C., has taken into partnership Mr. Maurice G. Bland and Mr. Hugh Bourne. The business will be continued at the same address in the name of ALBION T. SNELL & PARTNERS.

MR. J. S. B. PLUMMER, who sailed on Thursday last for a business tour round the world on behalf of the Armorduct Manufacturing Co., was entertained to a farewell dinner by the Kensington Rowing Club and friends on the evening preceding his departure. The club's captain, Mr. C. George, presented Mr. Plummer, on behalf of the members, with a gold watch suitably inscribed.

The marriage took place at St. Andrew's Church, Rugby, on April 20th, of MR. J. E. ROBERTS and Miss K. A. H. Atkinson, eldest daughter of Mr. W. G. Atkinson, of Rugby. Amongst the numerous presents was a brass reading lamp from the B.T.H. Co.'s construction staff on their Aberpergwm contract.

**Obituary.**—MR. L. J. B. WALL.—We regret to record the death of Mr. Wall, which occurred on April 5th at Perth, Western Australia. He underwent an operation for appendicitis, when it was found that he was suffering from a far more serious malady, and he never afterwards rallied. The late Mr. Wall, who was born at Chiltern (Victoria), on May 11th, 1870, was a member of the firm of Splatt, Wall & Co., electrical engineers. He entered into partnership with Mr. Splatt in 1896, and from a small beginning the business expanded to such an extent that the firm was compelled to build commodious premises in Perth. Latterly the firm has taken an active part in developing the Scottish Collieries at Collie Burn. Mr. Wall was a member of the Institution of Electrical Engineers, and also of the American Institute of Electrical Engineers. He took a prominent part in social life, and was universally held in high esteem both in Australia and by his many friends in this country. The deceased married Miss E. Broadbent, sister of the managing engineer of the Perth Electricity Works, and leaves a widow and four children to mourn his loss.

MR. PAUL DE LA COUR.—We regret to announce the death, on the 11th inst., of Mr. Paul de la Cour, following an operation for appendicitis. Mr. la Cour was born in Denmark in the year 1879, and he has thus died at the early age of 33. He received his education at the Technical College, Aarhus, Denmark, and subsequently at the Technical College of Zurich, Switzerland. In 1901 he was appointed assistant to the late Prof. Engelbert Arnold, of Karlsruhe University, afterwards becoming assistant to the chief engineer of the Akt. Ges. "Volta," at Reval, Russia. In this position he remained until 1905, when he joined Messrs. Bruce Peebles & Co., as chief of their design department, which position he held until his death. Mr. la Cour's exceptional capabilities have been fully appreciated by electrical men, and his loss will be felt by his many friends both in this country and abroad.

**Shanghai Electric Construction.**—The directors report for the year 1911 that the accounts show a profit of £14,139, as compared with £7,583 for 1910. The total standing to the credit of profit and loss account at the end of the year, including the balance brought forward, was £20,773, which has been disposed of as follows:—Amount written off general expenditure during construction, £7,472; transfer to reserve for renewals, £10,000; carried forward to next account, £3,301. The percentage of loss by exchange on subsidiary coinage was on the average somewhat lower in 1911 than in 1910, but has recently shown a tendency to increase. The loss under this head for the year was £15,477, equivalent to over 4½ per cent. on the capital of the company.—*Financial News.*



## CITY NOTES.

**Kidderminster and District Electric Lighting and Traction Co., Ltd.**

MR. C. SHIRREFF HILTON, chairman, presided, on Monday, at the Electrical Federation Offices, Kingsway, over the 14th ordinary general meeting of the company.

In moving the adoption of the report (ELECTRICAL REVIEW, page 765), the CHAIRMAN said there was very little change to report during the year, but there was some improvement. An expenditure out of revenue had taken place of £664 5s. 8d. in connection with the laying of additional mains, &c., and that expenditure would bring in revenue. It was always very carefully calculated before any expenditure on mains was undertaken. The capital account otherwise remained the same as in the previous year. The dividend received from the Kidderminster and Stourport Tramway Co. was at the same rate as in the previous year, viz., 3½ per cent. Their investment in that company was an improving one, although there was no improvement in dividend. There was an improvement shown in receipts of £300, while the working expenses had been kept at a low level. They had provided £873 for renewals, as compared with £369, and placed £250 to depreciation and reserve account, against £150. The income from the sale of current showed a considerable improvement of £711, as compared with £362 in the previous year. The total revenue for the year was £10,330, compared with £9,599, which enabled a balance to be carried forward to revenue account of £4,076, compared with £3,496. It would be seen from the statement of electricity generated and consumed that the total maximum demand improved by 95 KW., or nearly 15 per cent., and the number of units sold increased by over 10 per cent., or 138,500 units, compared with 104,500 in the previous year. In a small place like Kidderminster this was a very satisfactory increase. What change there was had been to the good, and they had been able this year to put rather more to renewals and depreciation than the year before, and had credited the debenture redemption fund with the same figure. It was satisfactory that after making these various provisions to reserve, which were in excess of anything they had made before, they were able to pay an increased dividend by ½ per cent., and carry forward a considerably larger sum to next year. In the report they had referred to the fact that the Board of Trade had rescinded the Kidderminster and Stourbridge Electric Lighting Order of 1906, in so far as it related to the town of Stourport. The company made no objection, as there was so small a demand from Stourport that they did not see their way to give a supply from the power station at Kidderminster. The portion of the order in respect of the Kidderminster foreign area was being developed by the company, and was, so far as it went, satisfactory, and they derived a small revenue from it.

MR. J. A. LYCETT seconded the motion, and the report was adopted without discussion.

On the motion of MR. HERRING, the remuneration of the board was fixed for the year at £50 for the chairman, and £25 each for the other directors.

**Cuba Submarine Telegraph Co., Ltd.**

MR. GEO. KEITH (chairman) presided, on May 8th. at the offices, 58, Old Broad Street, E.C., over the meeting of this company, and, in moving the adoption of the report (see ELEC. REV., page 724), said the accounts formed a very satisfactory record for the half-year. Last year Cuba did not suffer from any cyclones, and they were in the happy position of not having had to repair any damage to their property from interruption from that cause, nor did they have any interruption of their landline connections as unfortunately took place in 1910. They would see from the revenue account that the traffic receipts showed an increase of £459. Interest came out £118 less, due to a reduction in their invested funds, which was necessary to meet the cost of the new Cienfuegos and Cape Cruz cable and the repair of existing cables. The gross revenue, including transfer fees, amounted to £18,991, or £340 more than in 1910. The total expenses amounted to £6,499, or £173 less than in 1910. The reserve fund now stood at the reduced figure of £88,000, whilst, on the other side of the balance-sheet, the items of investments and cash, together showed a similar reduction, all due to the expenditure incurred in connection with the cables during the half-year. Sundry creditors had been increased by the last instalment on the new cable which did not become payable until after the accounts had been closed, whilst spare cable in stock had been increased by the value of the surplus cable left over after laying the new cable. Altogether he thought they might be well satisfied with the operations of the past half-year. Their main cables were now duplicated from end to end, and were in perfect condition, and they were in a position to give a rapid and most efficient service, all of which was in favour of the business. As regarded the current half-year, business generally in Cuba and the West Indies continued good and active, and up to now the traffic passing over their cables showed a considerable increase over what it was last year.

MR. G. LYDDON asked if the board apprehended any difficulty with regard to the Marconi Co., which seemed to have been making a certain amount of advance. He also asked if the amount set aside for depreciation on investments brought the sum stated in the balance-sheet to the real value.

The CHAIRMAN said that the investments now stood at less than £1,000 above their market value. He did not think that cable shareholders need trouble themselves much about wireless competition. The *Titanic* disaster showed that wireless was invaluable on board ship, but the confusion which took place in reporting the disaster showed clearly that the system was quite unfit to compete with cables or landlines as regarded secrecy and accuracy, which were absolutely essential for the transmission of commercial and private messages.

The report was then adopted, as was also the resolution for the payment of the dividend.

**Electric Supply Corporation, Ltd.**

THE annual meeting of this company was held on May 9th at Salisbury House, E.C.

MR. J. G. B. STONE, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 766), said that, at the end of the year, the company had connected the equivalent of 172,202 lamps, or an increase of 36,483 over the previous year. The increase was a satisfactory one, and was mainly due to the increased demand for power. They were still feeling the effect of the smaller energy consumption of the metal-filament lamp, as compared to the old carbon lamp, in the lighting side of the business, but this was gradually being offset by the increase in the number of consumers. With regard to their investments in other companies, they were this year receiving their first dividend of 5 per cent. on the Hendon Electric Supply shares, and they looked for increased returns from the excellent progress which that company was making. They had not as yet received any return on the 29,490 ordinary shares in the Dumbarton Tramway Co., but their representative on the board of that company told them that they might shortly expect a better state of things in view of the progress that was now being made. The Dawlish Electric Light and Power Co. appeared for the first time among their investments. That was a small limited company which was started last June, and their holding represented the amount they were able to secure in return for the money they had expended in getting and retaining the lighting orders which, for financial reasons, they were unable to work themselves. He was pleased to say that for the first time the board were able to come before the shareholders with a proposal to distribute a small self-earned dividend. He admitted it was smaller than they at one time anticipated, but it gave the shareholders a small return, which would increase as the business extended year by year. During 1911 they had spent rather over £1,200 upon repairs and renewals, and they proposed to set aside from the earnings a further £800, and to carry forward the balance of £2,207. The table of progress in the report showed that the rate of previous years had been well maintained last year, and this, though the working conditions during that period had been most difficult to cope with, owing to the railway strike and other causes. The capital account again showed increased expenditure due, in most part, to providing for new customers, which was a healthy sign.

MR. F. R. REEVES, in seconding the motion, said he thought the shareholders were to be congratulated upon that, the first occasion, on which the company had been able to pay a dividend out of its own earnings. They possessed a number of stations, and by the careful working of the staff, in whom they had the greatest confidence, they had showed steady and satisfactory progress. The progress was the more satisfactory, because it had been steady and not jumpy, and he thought they might look forward with great confidence to increased dividends in the future.

The report was adopted.

**Stratford-on-Avon Electricity Co., Ltd.**—The directors' report to the shareholders for the year 1911, states that the company has again made considerable progress during the year, the total connections being increased from 9,605 to 10,858 equivalent S.C.P. lamps, and the amount of current sold being 142,406 units, as compared with 98,289 units for 1910. Such a satisfactory increase fully justifies the extension of the plant and machinery recently carried out at the works. After writing off £200 to reserve and depreciation account and building sinking fund, the net revenue account shows an available balance of £484, which the directors recommend should be appropriated as follows:—To payment of directors' fees, £50; to payment of 3 per cent. dividend, £216; balance carried forward, £218.

**Craigpark Electric Cable.**—At the annual meeting in Glasgow, Mr. Peter Rintoul, C.A., who presided, proposed the adoption of the annual report (ELEC. REV., page 724), stating that the position of the company was rather better, and that in spite of one factor, the coal strike, which had affected them adversely. Dr. Magnus McLean seconded. Mr. R. B. McCaig said that before paying a dividend of 6 per cent., he thought they ought to have the item of goodwill written off, and that they should write off about 10 per cent. for machinery, &c. The chairman, in reply, said the item of goodwill appeared in many balance-sheets, he thought that any business earning the profits which they were earning was quite entitled to say that it had a goodwill which could be realised if it was sold as a going concern. As to depreciation, that was a matter which they must leave to the directors. With regard to debts outstanding, that was due to some extent to the coal strike, which had landed them with abnormal stocks. The report was adopted.



### Eastern Extension, Australasia and China Telegraph Co., Ltd.

THE seventy-seventh half-yearly ordinary meeting of the shareholders of the above company was held on Tuesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., presiding.

The CHAIRMAN, in moving the adoption of the report, said that the gross receipts for the half-year amounted to £359,000, against £336,000 for the corresponding period in 1910, or an increase of £23,000, which it was satisfactory to find was spread over the whole of the company's system. The working and other expenses had amounted to £159,000, as compared with £154,000, or an increase of £5,000, which was entirely due to their having debited revenue with the cost of new apparatus for extending the relay and other improved methods of working to additional stations on their main lines. They had spent £6,000 in that connection last half-year, and the further expenses that would be incurred during the current year would be charged to revenue in a similar manner. But for this special expenditure a small reduction in working expenses would have been shown for the period under review. Comparing the figures for the whole year, the results were as follows:—The gross receipts amounted to £689,000, against £681,000 for 1910, or an increase of £8,000; whilst the expenditure amounted to £310,000, against £306,000, showing an increase of £4,000. Consequently the net profit for the year 1911 was, roundly, £4,000 more than in 1910. The net profit for the past half-year was, roundly, £182,000, and after adding £51,000 brought forward from the previous half-year, there remained an available balance of over £233,000. The usual quarterly interim dividends of 2s. 6d. per share were paid during the past year, and it was now proposed to distribute a like amount, making a total dividend of 5 per cent. for the year. It was also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for 1911. After making the usual additions to the maintenance ships, insurance and depreciation funds, and applying £75,000 of the revenue balance to the general reserve fund, nearly £24,000 was carried forward. When he had the pleasure of addressing them six months ago he referred to the proposal submitted by the British Postmaster-General to the various cable companies interested, for the introduction of a reduced rate for deferred telegrams in plain language, and stated that it was expected that the Postmaster-General would soon be in a position to make an official announcement on the subject. This expectation had since been fulfilled, and the arrangement was brought into operation on January 1st last. Sufficient time had hardly yet elapsed to enable any reliable opinion to be formed as to the success of the experiment, but it might interest them to learn that although the number of deferred messages transmitted over their lines had so far been comparatively small, this new source of traffic appeared to be steadily increasing without unfavourably affecting their general revenue. They would probably remember that at the last general meeting he referred to the situation brought about by the revolution in China having caused them considerable anxiety, owing to the confusion created throughout the Chinese telegraph service by the disturbances. Fortunately, however, with the assistance of the British and other foreign Ministers at Peking, they were enabled, after considerable difficulty and delay, to arrange an agreement with the Provisional Government for exchanging traffic, settling accounts, &c., which greatly improved the situation. Apparently the country was now quieting down, and he was glad to say, the new Chinese Government were working cordially with them and redeeming their pledges in a satisfactory manner.

SIR J. DENISON-PENDER, K.C.M.G., seconded the motion, which was carried.

### South Staffordshire Tramways (Lessee) Co., Ltd.

MR. W. S. SCHUSTER presided at the Electrical Federation Offices, Kingsway, on May 2nd, over the annual meeting of this company.

In moving the adoption of the report, the CHAIRMAN said that expenditure on the reconstruction at Darlaston, debited during the year, was £742, which, with the expenditure of the previous year, they were supposed to write off out of profits. In addition, the net cost of the Dudley Arbitration had been written off out of profits, and this item now disappeared from the balance-sheet. There had been no further expenditure on capital account during the year, but arrangements had since been made to acquire some additional rolling stock for use after the introduction of the through service into Birmingham, and the cost of these additional cars would appear in the next balance-sheet. The loan account stood at £49,650, the same amount as in the previous year. Sundry creditors were considerably less than in the previous year, viz., £7,927, compared with £13,575. £1,000 had been transferred from profits to the renewals account, and £1,014 had been charged for renewal works carried out during the year, leaving a balance of £3,577 to the credit of that account. No provision was made for renewals for the year 1910. Turning to the profit and loss account, the traffic receipts showed an increase of £1,700 over the previous year, and £1,946 was received as dividend on the shares held in the South Staffordshire Tramways Co., against £1,621 in the preceding year, the total receipts being £50,598, as compared with £47,399 in 1910. The expenses of operation and administration showed an increase of only £680, while the cost of repairs and maintenance was just under £1,000 less, in spite of the fact that over 880,000 more passengers were carried, or more than 10 per cent. over the preceding year. That was, he thought, a most favourable statement. The amounts payable under agreements to local authorities showed a slight reduction, owing to the falling in of the lease of a short length of line in Handsworth on June 30th. The net result of the

year's working, after making the provision for renewals, and writing off the cost of the Dudley Arbitration was a credit balance of £3,019. Deducting the debit balance brought forward from the previous year, an available balance of £2,286 remained, which the directors recommended should be applied to writing off the cost of the Darlaston depot reconstruction, and to reserve and depreciation fund. The amount expended in rates and taxes during last year amounted to £930, but this, it was hoped, would be considerably reduced in future, owing to the decision recently given in the Court of Appeal, in the case of the Metropolitan Electric Tramways Co. and the Tottenham Urban District Council. The company claimed that, for the purpose of rating, a tramway, like a railway, should only be assessable for the general district rate on a quarter of the net annual value, instead of the full rate hitherto charged. The judges in the Court of Appeal unanimously gave their decision in favour of the company's contention, holding that the tramways were entitled to the three-quarters exemption. The Tottenham U.D.C., of course, had a right of appeal to the House of Lords, but the matter was in abeyance. The directors regretted the delay which had taken place in commencing the operation of a through service from their tramways over the lines of the Birmingham Corporation, but delay was caused by the reconstruction of the tramway in Birmingham formerly worked by cable traction. It was anticipated that the through service would be inaugurated very shortly, and it was hoped that the receipts of the future would be benefited thereby. The receipts this year had been well maintained, in spite of the coal strike, and with a continuance of the improvement in trade which had taken place in the district, it was hoped that the results for the present year would show a material improvement.

MR. E. GARCKE seconded the motion, and the report was adopted.

### Leamington and Warwick Electrical Co., Ltd.

THE annual report states that the capital expenditure during the year amounted to £1,653, making a total of £111,283. For the year from the traction and electricity supply, &c., the receipts were £5,905. After deducting administration and general expenses, £1,363, debenture interest £1,575, and charging profit and loss account with £350 for provision for renewals, there remains a surplus of £2,617, plus £128 brought forward. The amount available for distribution is £2,745. The directors recommend that there be placed to reserve account £1,000; to renewals account, £500; a dividend of 5 per cent. on the cumulative preference shares absorbs £120; a dividend at the rate of 1½ per cent. per annum on the ordinary shares for the year absorbs £1,014, and there is carried forward £111. The reserve account will now stand at £6,626, and the renewals account at £1,297, after allowing £953 for the cost of renewals during the year. Under the heading of traction the gross receipts amounted to £9,360, being an increase of £46 compared with 1910, and the working expenses amounted to £4,750, being a decrease of £914, a net improvement of £960. In the year 1910 an amount of £738, which had been expended on repairs to motor-buses, was included in the working expenses, while, during the year 1911, £800 was expended on motor-buses, which was in the nature of renewals, and has been charged against renewals account. The total revenue from electric supply amounted to £3,394, an increase of £394 over 1910, while the working expenses amounted to £2,142, an increase of £105, the net result being an improvement of £289. The installations connected to the mains at December, 1911, excluding the tramway load, represented the equivalent of 10,469 lamps of 8 C.P. The number of consumers was 292, as compared with 276 in the previous year.

### British Thomson-Houston Co., Ltd.

THE seventeenth annual meeting was held at the offices, 83, Cannon Street, E.C., on May 9th, Mr. J. F. Nauheim presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 723), said that it was with very great satisfaction they were enabled to state that the substantial improvement shown over last year still continued. The board visited the Rugby works only a fortnight ago, and noticed with great pleasure that the whole of the available space was filled with material in process of manufacture. They also inspected the new buildings approaching completion, which would shortly add considerably to the output of the company's manufactures. From all that they might fairly hope that the result of this year's work would show still further improvement over the accounts for the past nine months. Naturally their output would be somewhat affected by the unfortunate coal strike. They had made full provision both for coal and raw materials, and were able to keep the works going throughout the strike, but, of course, they had to give up all overtime and night work, as no fresh supplies could be obtained, and, in fact, even now they were still experiencing difficulties in getting all the material they required. He took that opportunity of expressing on behalf of the board their deep regret at the death of Mr. Hinsdill Parsons—one of the vice-presidents of the General Electric Co., of New York. Mr. Parsons was always greatly interested in the progress of that company, and was most friendly disposed towards it, and they heartily sympathised with the executive of the General Electric Co., to whom his loss was a very severe blow.

MR. G. FRANKLIN seconded the resolution, and the report was adopted.



### City of Birmingham Tramways Co., Ltd.

THE ordinary general meeting of shareholders of the above company was held on May 14th, at the Holborn Restaurant, Mr. Emile Garcke in the chair.

In proposing the adoption of the report, the CHAIRMAN remarked that there was a special meeting to follow, at which he would enter fully into the proposals for the liquidation of the old and the formation of a new company. The leases reverted to the Corporation at the end of June last year, and it became a matter for serious consideration whether they should continue to work for many years the fragments of tramways which remained to them. After giving the question very careful consideration, the board came to the conclusion that it would be more in the interests of the shareholders that they should endeavour to realise the remaining properties and close up the business. The negotiations had proved successful and the price they obtained was quite up to their anticipations, and he congratulated the shareholders upon the conclusion of a very difficult business with very satisfactory results to the company. The traffic receipts were much lower than in the preceding year, which was explained by the fact that they only had the working of the lines for six months, although they continued to work the lines after July 16th on behalf of the purchasers. The expenses of working necessarily increased, because they could not immediately reduce the standing charges in direct proportion to the reduction of the mileage. The receipts amounted to £76,500, and the working expenses came to £59,600, giving a net profit of £39,063 for the 14 months. In former years they had never divided the profits up to the hilt, but had contented themselves with a return of 10 per cent., placing the balance to reserve. In view, however, of the liquidation there was no object for further increasing the reserve fund, and therefore they recommended a dividend to the full extent of the balance, at the rate of 19 per cent. for the 14 months.

MR. G. SHIRREFF HILTON seconded the motion, and the report was adopted.

An extraordinary general meeting followed, at which the CHAIRMAN proposed a resolution for the voluntary winding up of the company and authorising the liquidators to sell the assets to a new company, to be known as the Electrical and Industrial Finance Corporation, or other similar name that might be decided upon. He said that the reason for proposing to wind up was that this company, being a tramway company and having parted with its tramways, it would not be correct to continue it merely for the purpose of investing its surplus funds. The company had been very successful, and had accumulated a large surplus. They had paid regular dividends for many years at the rate of 10 per cent. per annum on the ordinary shares and for the 14 months they had paid a dividend on the ordinary shares at the rate of 19 per cent. per annum. The financial position of the company as shown by the balance-sheet showed that the total capital and liabilities were £584,202. The total assets amounted to £786,467, so that after paying off all liabilities and the debentures and repaying the preference and ordinary capital, there was a surplus of £202,264. The book surplus of £202,264 was not, however, all realisable in cash, for there was a depreciation on the trustee securities of about £18,000. Deducting this, they had a surplus of £184,264, or sufficient to make a bonus return to the ordinary shareholders of £3 per share, in addition to the return of the £1 subscribed, which left a residue of £4,264. There were two courses open to the shareholders, either to liquidate the company and realise the securities and distribute the proceeds, or to accept the proposal which had been made for the formation of a new company. Under the first course the liquidators would realise the investments gradually, and the proceeds would be distributed among the shareholders from time to time, but, of course, there would be no certainty as to the amount that would be realised by the sales and distributed to the shareholders. It might be a little more than £3 plus £1 per share on the ordinary shares if the market values of the investments improved, but, on the other hand, there was also a risk of the distribution as a result of forced realisation, however gradual, being less than £3 plus £1 per share on the ordinary shares, and in the opinion of the directors the latter result was the more likely one, because the duty of the liquidators would be to realise, and forced sales were never compatible with the obtainment of high prices. Under the proposal which had been obtained, the debenture-holders and shareholders of the company were offered immediate cash to the same amount as they could hope to get by the realisation of the investments, and, moreover, they had an option to invest the cash in the securities of the new company. The holders of the existing 4 per cent. debentures were entitled to subscribe for 4½ per cent. debenture stock of the new company; the holders of the existing 5 per cent. cumulative preference shares had the right to subscribe for 5½ per cent. debenture stock of the new company, and the holders of the ordinary shares had the right to subscribe for £1 in 6 per cent. cumulative preference shares with priority as to capital and £3 in ordinary shares. The debenture holders would receive their interest up to June 30th next. The preference shareholders would receive a dividend at the rate of 5 per cent. on their shares up to the date of commencement of the liquidation, and the ordinary shareholders would receive a further dividend at the rate of 19 per cent. per annum from March 1st last up to the date of commencement of the liquidation, and the interest on the new 4½ per cent. debentures would accrue as from July 1st. The interest on the 5½ per cent. debentures, and the dividend on the new preference shares and ordinary shares would accrue as from the date of commencement of the liquidation of this company, so that debenture holders and preference shareholders who decided to invest in the new company would not lose a single day's interest, but, on the

contrary, would, from the day of the commencement of the liquidation, receive interest at a higher rate. In the opinion of the directors, the debenture holders and shareholders would do well to invest in the new company the cash which they would receive, but it was a matter entirely for the judgment of each holder. The directors had received proxies in favour of the proposal from holders of over 90 per cent. of the ordinary shares and from a large number of the preference shareholders. One aspect of the proposal he ought to make quite clear to the shareholders was that no promotion money would be paid to anyone in connection with the transfer of the business to the new company. The British Electric Traction Co. would carry out the proposal without any profit other than that which they would make as subscribers of the capital of the new company, on the same terms on which it was offered to the shareholders. They had guaranteed the subscription of at least £240,000 of share capital, and as much more as might be necessary to make the share capital equal to the subscribed debentures, and their only consideration was an option for two years to subscribe at par for any unissued shares, and to subscribe for any unissued debentures on the same terms on which the company could issue them to other parties. The new company would have an authorised share capital of £200,000 in ordinary shares, £200,000 in 5 per cent. preference shares, and debenture issues of £200,000 4½ per cent. first debenture stock, and £200,000 5½ per cent. second debenture stock. They would no doubt desire to have from him a statement of the policy of the new company. The electrical industry was much in need of further organisations which commanded full and intimate knowledge of electrical undertakings at home and abroad, and were able to assist in their financial development. This need the new company would endeavour to meet, but the company would not confine its operations exclusively to the electrical industry.

MR. NEALE, a shareholder, seconded the resolutions, and said that, taking everything into consideration, he thought the proposed new company was a very good way out of the difficulty.

The resolutions were carried unanimously without discussion.

### Lisbon Electric Tramways, Ltd.

THE meeting of this company was held on May 8th, at the offices, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer presiding.

The CHAIRMAN, in moving the adoption of the report (ELECTRICAL REVIEW, page 767), said that the number of passengers carried by the company was 51,852,719, earning £343,013, as against 49,925,167 passengers, earning £328,600, an increase of 1,927,552 passengers, of £14,414 receipts. In the early part of last year the general unrest and uncertainty following on the revolution in Portugal reflected adversely on their earnings; happily, however, during the remainder of the year traffics so quickly recovered, that, with the aid of record receipts during the celebration festivities of the anniversary of the Republic, it became possible to obtain the before-mentioned increase. The working expenditure, as was only to have been expected, had gone up by £17,265. The onerous conditions imposed upon the company under the arbitration award had largely increased their wages bill, and were wholly responsible for this result. The balance of profit for appropriation, after payment of all expenses, was £109,616. Out of this the usual reserves had been made, the preference dividend paid, and also an interim dividend on the ordinary shares at the rate of 3 per cent. That left a sum of £25,062 to be dealt with. Of this amount the board now recommended a final dividend at the rate of 3 per cent., making a total of 6 per cent. net for the year. That would absorb the sum of £19,021; and the rate compared favourably with the 5½ per cent. paid last year. The balance of £6,042 it was proposed to carry forward to the next year's account. The general political and social uncertainty in the country had given, and continued to give, the directors much cause for anxiety; it had nevertheless been possible to continue the operation of the system without interruption throughout the year, excepting only a short period in March of last year, on the occasion of a general strike being declared, when it was found necessary to reduce the service slightly. Their employees then showed their loyalty to the company by not joining the movement, and, in consequence, only a small diminution in revenue was experienced.

The CHAIRMAN, in reply to a shareholder, said there could not be competition with them, as the company had a monopoly of mechanical traction. They were making an experiment this year in starting motor-omnibuses to run through the various outlying districts to act as feeders to the general system.

The report was adopted.

MR. ROGERS, a shareholder, proposed that an additional remuneration of 1,500 guineas be voted to the directors for their services during the past year. He remarked that, by the articles of association, the directors' fees were only £500, which, considering the magnitude of the operations of the company, and the successful position it had attained, was quite inadequate.

MR. E. GAPE seconded the resolution, which was carried and acknowledged by the chairman.

**Dorman, Long & Co., Ltd.**—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the half-year ended March 31st.

**Held Over.**—We are again obliged to hold over a number of items to a later issue.



### Great Northern Telegraph Co., Ltd., of Denmark.

AT the general meeting of this company, held at Copenhagen on April 29th, the chairman, Commodore E. Suenson, D.R.N., said that during the year there had been 15 interruptions on eight cables in Europe and 18 on six cables in the Far East, which compared favourably with the previous year. Notwithstanding the constant renewals and strengthening of their cables, they must be prepared for more frequent interruptions in the future, on account of the introduction into China and Japan of steam trawlers, the arch-enemy of their cables in Europe. Cable repairs and renewals, together with the laying of the new cable between Russia and Sweden, had kept their cable steamers occupied: the *H. C. Orsted* in Europe for 165 days; the *Store Nordiske* and the *Pacific* in the Far East for 281 days, of which 32 in Europe and 120 in the Far East were for the account of other administrations. The new cable between Sweden and Russia, 107 N.M. long, was successfully laid between Grisslehamn, in Sweden, and Nystad (Sundholm), in Finland, by the *H. C. Orsted* early in June, and was opened for traffic on June 6th. It was the fourth cable connecting these two countries. In November the company laid a short cable (15 N.M.) for the Chinese Government across the strait separating the large island of Hainan from the Chinese Continent. In spite of the social and political disturbances which had ravaged China and its dependencies, the two lines connecting the company's European and Asiatic systems had worked very satisfactorily, although the Kiachta line passed through the whole of Mongolia and that of Vladivostock along the entire frontier between Manchuria and Siberia. The revolution in China had, however, afforded an exceptional opportunity of demonstrating the superior speed of the lines, and how indispensable they were, particularly for Europe's telegraphic communication with Japan, Peking and the whole of North China.

In regard to the Chinese revolution, the greatest care was taken everywhere to ensure the safety of the foreign residents. The consideration thus shown was certainly not due to a general sympathy with the foreigners, but principally to the more enlightened spirit now prevailing in China, and to the desire of both parties to gain the confidence of the Great Powers and other foreign nations having friendly and mutually profitable relations with that country. This company, as well as the other cable companies participating in the transmission of China's international telegraph correspondence, had nevertheless had great difficulties in maintaining an efficient and satisfactory service. This had, however, not been due to any want of goodwill on the part of the Chinese, but exclusively to the force of circumstances.

With a view to preventing the transmission of political and strategical communications, the two parties had often interrupted and sometimes even destroyed the telegraph lines in the interior of the country, while the transmitting offices were alternately in the hands of the Imperialists and the Republicans. In several of the treaty ports where this company's cables were landed, and where they had offices, the chiefs and the whole of the staff of the Chinese offices went over quite spontaneously to the Republican cause, no longer recognising the Central Authority in Peking, and submitting to a locally improvised authority quite devoid of administrative knowledge, financial resources and credit.

As the company has constantly most important relations with these offices and with the local representatives of the Central Telegraph Administration, not only with regard to the daily exchange of telegrams, but also to questions relating to the control, accounts and monthly settlements in connection with the traffic, the revolution had created great difficulties and numerous irregularities in these important relations. For want of money in the Chinese offices it had thus become necessary to keep the settlement of certain accounts in abeyance. They hoped, however, knowing from long experience what exact and conscientious debtors the Chinese were, that the accounts in arrear would be settled as soon as the new Government was definitely organised and consolidated and in a position to obtain the foreign loan indispensable for establishing the necessary order in the interior, and for further advancing their liberal and progressive ideas. In this connection they confirmed what was lightly touched upon in the last report, that they had increased their participation in other telegraph undertakings by £250,000, being their half-share of an amount of £500,000 advanced jointly by this company and the Eastern Extension Telegraph Co. to the Chinese Administration in accordance with an arrangement made at the beginning of last year. In view of the excellent relations with this Administration and its intention to apply the money advanced for improving the lines and instruments and perfecting the service, which was of the greatest importance for China's international telegrams passing over the lines of the companies, they had been happy to supply the money to the Administration on very favourable conditions for China, viz., at par with 5 per cent. interest per annum and with amortisation spread over a number of years. It was, however, to be regretted that the revolution towards the end of the year had delayed the prompt realisation of the contemplated improvements.

The company's negotiations with Japan as to their future relations with that country after the expiration of their exclusive privileges at the end of 1912 had not been resumed during this eventful year. They had, however, in accordance with a request from the Imperial Administration submitted for their consideration proposals for an arrangement, and the definite negotiations had now been fixed for July next.

The financial results of 1911 showed, as anticipated, a considerable decrease in the traffic receipts, owing to the loss of the Norwegian concessions, to the sale of the Korean cable, and to the great tariff reductions, but this decrease had been compensated to a certain extent by the increase of the Government and Press traffic caused by the extraordinary events of the year. A portion of the revenue, due to the revolution, had not yet been received. The increase of work and of staff, and the measures taken in China in order to maintain the telegraphic communication and the safety of the staff, both Danish and native, had necessitated considerable extra expenses. Consequently the net receipts for 1911 had been about £24,000 lower than the preceding year, but as this figure did not exceed what had been anticipated and a larger balance than usual was carried forward to meet this contingency, the board did not hesitate to propose a total dividend and bonus of 18 per cent. for 1911, including 5 per cent. already paid, and to place the same amounts to the reserve and pension funds as in the previous year. The calm which for some years past had reigned in the quotation of their shares, and which had not even been influenced by the progress of wireless telegraphy, was a proof that their shareholders considered their investment too good and secure to allow it to be subject to large fluctuations as in former days. Traffic receipts had decreased in round figures by £11,300, whilst interest had increased by £200 and sundries by £3,800, due to the increased use of their cable steamers for the account of other administrations. Under expenses nearly all the items had been considerably increased, and particularly salaries and wages by

nearly £12,000, due to the extraordinary circumstances mentioned above; ordinary supervision by £650; instruments and cells by £1,700; rates and taxes by £1,400; travelling expenses by £920; and sundries by £650; whilst the other items were nearly unchanged. The balance-sheet showed the following alterations under assets: Cables and landlines in Europe, &c., had been decreased by £400,000, the amount of the amortisation account which had been written off; and participation in other telegraph undertakings had been increased by £250,000. Investments had been increased by £8,600; advances guaranteed by banks had been decreased by £111,000; cash in hand by £22,000, whilst sundry debtors had been increased by £18,600. Under liabilities the amortisation fund had disappeared, and the reserve and renewal fund had been increased by the usual amount, but it had had to cover extraordinary expenses of about £34,000, and this amount would probably be larger for 1912. The dividend equalisation fund had been credited with the usual interest, and sundry creditors had been increased by £24,600.

### British Westinghouse Electric and Manufacturing Co., Ltd.

THE twelfth annual meeting was held on May 9th at Hamilton House, Mr. J. Annan Bryce, M.P., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, May 10th, page 765), said that the 6 per cent. prior lien debentures had been reduced by £6,100 in respect of 61 debentures drawn on December 15th, 1911, for repayment on January 1st, 1912. Sundry creditors and credit balances (£200,198) was nearly £14,000 in excess of last year, but when they came to the figures on the other side of the balance-sheet in respect of contracts and sundry debtors, they would find there an increase of over £31,000. Those increases were normal, having regard to the increased output. With regard to the reserve for employers' liability, the directors considered that ample to meet any liability in respect of past accidents, and he was glad to be able to state that their policy of being their own insurers against accidents to their workmen continued to be justified by results. Turning to the other side of the balance-sheet, the item of patents and goodwill remained as before, although a considerable number of new patents had been taken out during the year, the expenses connected with which had been charged against revenue. Machinery, plant, tools, &c., stood at £786,424, over £42,000 having been expended in maintenance and renewals during the year, which had been charged to revenue. In addition, £15,868 had been written off for depreciation, and further sums aggregating £21,700 had been placed to special reserve for the same purpose. This reserve now amounted to £51,912. Referring to the loss on the sale of the apparatus and plant in the steel foundry, amounting to £36,720, the chairman said he had already on a previous occasion discussed that matter fully, and need only add that the plant was disposed of with the approval of the trustees for the debenture holders, the proceeds being applied to the purchase of additional plant for other departments, and added to capital expenditure, while the floor space was being utilised for the extension of other branches of the business. In view of the general reserve for depreciation of over £50,000, the directors did not think it necessary to depreciate specifically against this loss of £36,719. He might, however, again remind them that the works were originally designed on too large a scale in many respects. When the capital was reduced in 1907, a large provision was made to meet this, but in view of what had since happened, it had for some time been the opinion of the board that before they could enter upon a dividend-paying stage, there must be a further reduction of capital. Proposals to that effect would probably be laid before the shareholders at no distant date. Stock and material on hand, £622,264, showed an increase of £89,109. The output of the factory was improving all the time, and special efforts were now being made to keep the stock as low as possible, bearing in mind always the importance of maintaining sufficient to ensure prompt deliveries, upon which often very important orders depended. The output in value of their own manufactures for 1910 showed an increase of over 22 per cent., as compared with 1909, and 1911 an increase of over 17 per cent. over that of 1910, or about 42 per cent. in excess of 1909. Completed works on contracts stood at £292,024. This year they showed this item in a different form from last year. In the 1910 accounts the amount due by the Underground Electric Railway Co. of London and the expenses incidental to the arbitration proceedings were included under this head. This year they had thought it better to show those items separately, and it would be seen that the amount involved in the dispute between the two companies was nearly £120,000. Into the merits of the dispute it was not desirable for him at that time to enter, as proceedings were still pending before the House of Lords. The item, sundry debtors £189,435, compared with £166,388 last year, an increase of £14,047, a very small increase considering that their invoices rendered for apparatus delivered were very appreciably higher than during the same period of last year, thereby showing that their rate of collection was improving. The trading profits for the year amounted to £126,144, as against £112,539 in 1910, an increase of £13,505. On the other side, the fixed charges came to about the same, but the amount for depreciation was £30,868, as against £24,423 last year, an increase of £6,445. The profit for the year was £20,708, as compared with £12,437 last year and a loss in 1909 of £798. In conclusion, the chairman said he would remind the shareholders that their business was not confined to Great Britain and its Colonies, as was the case when the company was originally founded; they were now, with the consent of their American friends and the various Continental companies, doing



business in all parts of the world. It was not possible for him to say at the present moment how far their output from the works during the current year would be affected by the coal strike which had unfortunately intervened, but it must have some bad results. They had a sufficient supply of coal to carry them through the whole period of the strike, but were hampered by non-delivery of supplies from other makers, and, in consequence, were obliged to shut down partially during the strike, and they had not yet been able to resume their normal output. Their orders were coming in well, and showed a decided advance over the corresponding period of last year, and barring unforeseen circumstances connected with labour unrest, the directors hoped the next accounts would show a still further improved position. Prices were still ruling low on account of keen competition. Terms of payment were also very unfavourable in many cases to contractors, but continued efforts were being made to improve those conditions.

MR. E. GOULDING seconded the motion, and the report was adopted.

### Altrincham Electric Supply, Ltd.

THE directors report that during 1911 115 installations, representing 9,098 equivalent 8-C.P. lamps, were connected to the mains; after allowing for disconnections and re-connections, there were, on December 31st, 1911, 1,318 actual consumers with 77,202 equivalent 8 C.P. lamps. In progress there were 23 installations with 1,069 equivalent 8-C.P. lamps. They had installed additional generating plant in the station in view of the increasing demand for current for light and power. After providing £1,685 for interest on loans and debentures and adding £1,500 to reserve for depreciation, the net profit for the year was £3,059, plus £84 brought forward. After allocating £1,000 to reserve fund, the directors recommend that a dividend of 7 per cent. be declared on the shares, absorbing £1,750, and leaving a balance of £393 to be carried forward, subject to provision for directors' fees.

The meeting was held at the offices, 36 and 37, Queen Street, E.C., on April 18th.

Units generated—Gross .. .. .	1,009,683
Pumps, &c., motors .. .. .	49,687
Net .. .. .	959,996
Sold by contract .. .. .	125,792
Sold by meter—Private consumers .. .. .	353,544
Total sold .. .. .	479,336
Used on works .. .. .	35,777
Total accounted for .. .. .	515,113
Not accounted for .. .. .	444,883
Total maximum supply demanded, KW. .. .. .	480

### Calcutta Electric Supply Corporation, Ltd.

THE annual meeting was held on May 9th, at Salisbury House, E.C., Mr. P. V. Luke presiding.

THE CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 724), said that capital expenditure during the year had been about £210,000, but of this nearly £160,000 had been spent on their new high-tension plant, and £32,555 on freehold land and buildings in connection therewith. The remainder of the expenditure had been due to ordinary expansion of the business. The major part of the new high-tension cables was laid during the year, and the whole of the cable laying originally contemplated was now completed. The new buildings and the sub-stations were practically completed at the end of last year, and much of the machinery erected, and, if all went well, they hoped to commence supply from their new Cossipore station in July or August next. It was satisfactory to note that while the expenditure on capital account increased, the percentage of net profits to capital expenditure also increased. The area covered by their business was evidenced by the length of the mains, which at the close of 1911 was nearly 330 miles, and they were constantly expanding. The gross revenue had increased during the past four years by £36,600, and the percentage of total working costs to revenue had been reduced during the same period from 50 per cent. to 36 per cent., a fact which reflected the highest credit on the management. The year under review was a normal one, as regarded demands on the business, and the net profit—nearly £96,000—was satisfactory. Metallic-filament lamps were practically universal, and had affected their receipts from the sale of energy for lighting purposes to a certain extent, with the result that the increase in those receipts was less than in the previous year. The sale of energy for power purposes continued to increase satisfactorily, and promised well for the future. The directors were quite alive to the difficult period through which the company was passing owing to the change of system, and the consequent necessity for scrapping a quantity of costly plant. They hoped to be able to dispose of a good deal of that plant, and some would be utilised at Cossipore; but, at the best, there would remain a large sum to be written off. With this in view, the strictest economy was necessary, and the need for increasing their reserves for renewals and depreciation was fully recognised. It was expected that the introduction of the high-tension system would result in considerable economies in working costs, partly in a reduction of the engineering staff, and more especially in coal consumption. A demand for current on a large scale had arisen at Howrah, where they now had a small generating station. As their plant there was too limited to meet the expected demands, they were, on the advice of their consulting engineer, about to turn Howrah into a sub-station to be supplied with high-tension current from Cossipore. A very heavy strain was put on the company's resources in connection with His Majesty the King's visit to Calcutta, but, thanks to the efforts of the staff, everything passed off most brilliantly, without

a hitch of any kind. Regarding the transference of the capital of India from Calcutta to Delhi, the chairman said that, at first sight, it seemed as if industrial companies might suffer, but on further consideration they agreed with their Calcutta manager in thinking that, on the whole, they would not be adversely affected by the change. With regard to the future, it was satisfactory to be able to state that during the first quarter of the current year the number of units sold to consumers showed a very considerable increase over the corresponding period in 1911. They had tendered for a certain amount of street lighting in the suburbs of Calcutta, but whether or not their tenders would be accepted it was impossible to say. Several firms were reported to be ready to take current for power purposes on a large scale as soon as they were in a position to supply them. Applications from new consumers continued to be received in large numbers; the increase in revenue showed steady progress, and the prospects of the company were decidedly good.

SIR GUILFORD L. MOLESWORTH, K.C.I.E., seconded the motion.

THE CHAIRMAN, in reply to questions, said that the ultimate cost of the high-tension station as at present planned would be between £300,000 and £350,000. It might turn out to be more, as they now proposed to turn Howrah into a sub-station.

The report was adopted.

### West Coast of America Telegraph Co., Ltd.

THE fifteenth ordinary general meeting of the shareholders of the above company was held on Tuesday, at Electra House, Finsbury Pavement, Sir John Denison-Pender, K.C.M.G., presiding.

THE CHAIRMAN, in proposing the adoption of the report, said there was no alteration in the capital account, which stood at £112,520 in shares, income bonds £20,000 and the debenture debt £150,000, making £282,520 as the total capital of the company. The receipts for the year amounted to £53,891 against £51,217 for the preceding year, an increase of £2,674. That was chiefly due to the greater activity of trade on the coast, and to the activity of those who were in charge of the company's affairs. The working expenses were £39,690 as against £39,357, an increase of £333. Salaries showed an increase of £313; rent, taxes and agencies an increase of just over £250, but, on the other hand, there had been a diminution of about £257 in respect of maintenance of cables. He thought they were in a prosperous condition as long as they could go on paying their dividend, although it was a small one, and add considerably to the reserve fund.

SIR ALBERT J. L. CAPPEL, K.C.I.E., seconded the motion, and the report was adopted.

### Oldham, Ashton, and Hyde Electric Tramway, Ltd.

THE directors' report states that the total revenue for the year amount to £32,183, and the expenditure (including £1,600 for debenture interest and £2,000 placed to provision for renewals account) to £25,405, leaving a net profit of £6,778, which, added to £152 brought forward, makes an available balance of £6,930.

MR. E. GARCKE presided at the Electrical Federation Offices, Kingsway, on Tuesday, over the fifteenth annual meeting of the above company.

THE CHAIRMAN, in proposing that the report be adopted said the revenue was about £1,100 better than the previous year, and they proposed to place £1,250 to the reserve fund, and pay a dividend at the rate of 7 per cent., making 6 per cent. for the year. The increase in the traffic receipts during the year under review was mainly attributable to the improvement in trade generally. A sum of £2,000 had been placed to renewals account from profit and loss, as against £1,000 in 1910.

MR. J. VINCENT KITCHENER seconded the motion, which was carried without discussion.

On the motion of the CHAIRMAN, seconded by MR. W. E. WOODROFFE, the retiring directors (Mr. Atherley Jones, K.C., M.P., and Mr. R. Whittaker), were re-elected.

## STOCKS AND SHARES.

Tuesday Evening.

THAT too many people bought more than they could carry conveniently, as we remarked last week, was proved by the evidence which has now come to light of the existence of a big bull account, to adopt the Stock Exchange phrase. In spite of the reduction of the Bank Rate to 3 per cent., carrying over some of the Underground stocks cost no less than 11 per cent. this week—a rate which would be utterly absurd to any but a weak bull to elect to pay. The effect of over-speculation has been to lower Home Railway prices sharply enough, but Undergrounds have not suffered so much as some of the Southern passenger stocks.

Metropolitans and Districts are both lower, the latter being 24 down on the week, while Metropolitans are a point off. The drop in Metropolitans is so comparatively slight, having regard to the big rise that took place earlier, as to suggest important interests at the back of the buying which can afford to support the market in the



face of the weak speculative position. Underground Electric Railways shares, which have been avidly bought by the punting operator, are 5s. higher, and the Income Bonds are 1 up at 92. Underground Electric "A" shares spurred to 17s., and then eased off to 16s. 6d. They are, of course, of the nominal value of 1s. each, the special settlement having taken place quite lately.

Of the other Underground stocks, Central London Ordinary and Deferred fell 1, while City and South London shed  $\frac{1}{2}$ ; but business here is on a retail scale. London United Tramways Preference touched 5 $\frac{1}{2}$ , reacting to 5 $\frac{1}{4}$ , and the 4 per cent. Debenture is a point lower on the week. British Electric Traction 7 per cent. Preferred has again been bought in fair quantities, and is 2 higher, this making a rise of 5 $\frac{1}{2}$  within a fortnight. There are some optimists who profess to look for a dividend on this stock in respect of the coming year. The company's Deferred stock, however, is  $\frac{1}{2}$  down.

In the list of English Electricity Supply issues, City Ordinary and Preference stand out with an advance of £1 each. The air has been thick with rumours that an important announcement might be expected at any moment with reference to the negotiations which are even now said to be proceeding with the object of the company's control coming under the City Corporation at once. Lively speculation is in progress, although to the ordinary man the game is too dangerous for him to take a hand unless he happens to have special knowledge. Edmundsons' Ordinary at 12s. 6d. are  $\frac{1}{4}$  higher, but the Preference fell  $\frac{1}{4}$ . Gains of  $\frac{1}{4}$  are registered in Bournemouth and Poole Ordinary and Preference. Anyone who will take the trouble to look up the Bournemouth and Poole Company's order will probably see for himself the reason for the rise that has lately taken place in the company's shares. Westminster are  $\frac{1}{4}$  lower, and so are St. James', these two being the only examples so far of the dullness which generally comes over the electric lighting market on the verge of the summer season.

Foreign Electrical issues are unusually quiet. What animation there is centres principally around the shares and bonds of the Mexican companies. News from Mexico continues to be as contradictory as ever. One day the rebels are driven to their very last fortress; on the next, the Government forces are in full retreat. It is practically impossible to gauge what is happening with any degree of accuracy, and the observer is obliged to rely upon newspaper items, added to intelligence conveyed in private letters to houses on this side with Mexican connections, such correspondence being almost unanimous in the opinion that it will not take long to stamp out the revolution.

Mexican Light and Power common shares fell back a little, but Mexico Trams continue to improve, and the latter company's bonds are also higher. The feature in this section, however, is a further jump of 5 $\frac{1}{2}$  points in Rio Tramway shares, bringing the price to 135. The statistical position of the undertaking is so strong that the rise is not difficult to justify, and it is being talked still further. Sao Paulo Trams are 6 up, following upon their rise of 3 last week. There are slight falls in Para Ordinary and United Electric Monte Video Preference. Canadian General Common and Kaministiquia Common show substantial gains. Several of the bond issues are  $\frac{1}{4}$  to a point higher.

The rise in National Telephone Deferred stock has gone rather more slowly this week, but the Third Preference shares gained  $\frac{1}{16}$ , and the market is still a strong one. Cable shares as a whole are firm, more attention being paid to the Eastern group. The report from the Eastern Extension Company led to a rise of  $\frac{3}{8}$  in the price of the shares, while Eastern Telegraph Ordinary stock added 1 $\frac{1}{2}$  in sympathy. The Anglo group is steady, without attracting any particular attention. Anglo Preferred lost  $\frac{1}{4}$ , while American Telephone Capital stock regained the round figure of 150. Western Telegraph shares are  $\frac{1}{8}$  higher, but West India and Panama Telegraphs again slumped. Business in them has been done as low as 3 $\frac{1}{2}$  this week, from which there was a recovery of about 5s., this leaving them with the substantial loss of  $\frac{3}{8}$  on balance. Speculators are sorely disappointed with the report, and for the time being the shares are very much out of favour. Which, by the way, is not to say that, after the fall, West India and Panama Ordinary may not turn out to be a good gamble for those who care to take the risk.

The Marconi excitement continues almost unabated, but there have been violent falls in the principal issues this week. Heavy contango rates bear witness to the over-loaded bull account which still prevails, and the shares were dragged down by this to 6 $\frac{3}{8}$ , rebounding to 6 $\frac{1}{16}$ . Canadians, Americans, and Spanish, have all followed the course of the parent company's shares, and it requires a good deal of courage to deal now, one way or the other.

Manufacturing companies' descriptions are extremely quiet. Arons moved off  $\frac{1}{16}$ . Babcock & Wilcox are a shade higher, and Electric Constructions rose  $\frac{1}{8}$ , the shares at the present price paying 7 per cent. on the money. Henleys and Callenders maintain their rises. A shake-out occurred in the Rubber share market on the anticipation of poor prices being obtained at the Mincing Lane auctions this week, which expectations, however, have been falsified. No public interest is being taken in the Rubber market at present, and dealings have shrunk to a minimum.

**The A.E.G. in South America.**—The A.E.G.-Sud-Amerikanische Elektrizitäts Gesellschaft is the title of a limited company which has been formed in Berlin to represent the A.E.G. in South America. The share capital amounts to £100,000.

**General Electrolytic Parent Co., Ltd.**—The report states that the accounts for the year to January 31st show a profit of £156, increasing the credit balance brought forward to £5,150. —*Financier*.

ELECTRIC TRAMWAY AND RAILWAY  
TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen .. ..	May 8	2,826	— 47	49	71,838	+ 3,337	14.4	..
Ayr .. ..	" 11	497	+ 36	52	14,952	+ 201	8	..
Bath .. ..	" 11	1,614	+ 10	19	13,869	+ 450	14.75	..
Birkenhead .. ..	" 12	2,255	— 79	6	6,464	— 485	19.68	..
Birmingham Corp.	" 4	20,370	+ 6,228	5	51,008	+ 13,138	57.17	..
Blackburn .. ..	" 8	2,285	+ 93	6 $\frac{1}{2}$	7,271	— 118	14.62	..
†Blackpool Corp. ..	" 2	1,128	+ 388	..	4,632	— 91	11.87	..
Blackpool-Fleetw'd	" 11	1,059	+ 238	18	6,658	+ 168	8	..
Bournemouth .. ..	" 8	3,864	+ 132	5 $\frac{1}{2}$	10,047	+ 472	21.95	..
†Bradford .. ..	" 4	5,207	+ 48	5	27,674	— 675	56	1.2
Brighton .. ..	" 12	1,828	— 98	6	5,783	— 175	9.5	..
Bristol .. ..	" 10	12,842	+ 523	..	118,689	+ 10,780	30.5	..
Brit. Elec. Trac. Co.								
Airdrie .. ..	" 3	566	+ 128	18	5,025	+ 1,265	3.65	..
Barnsley .. ..	" 3	338	+ 1	..	2,808	— 303	..	..
Barrow .. ..	" 3	716	+ 161	..	5,812	+ 1,477	5.37	..
Devonport .. ..	" 3	1,114	+ 219	..	9,233	+ 1,465	8.85	..
Gateshead .. ..	" 3	1,910	— 43	..	17,821	— 166	11.25	..
Gravesend .. ..	" 3	385	— 1	..	3,521	+ 220	6.5	..
Greenock .. ..	" 3	1,610	+ 198	..	13,166	+ 1,576	7.25	..
Hartlepool .. ..	" 3	484	+ 33	..	4,217	+ 314	6.72	..
Kidderminster .. ..	" 3	201	+ 20	..	1,693	+ 100	..	..
†Leamington .. ..	" 3	292	+ 12	..	2,587	+ 155	..	..
Merthyr .. ..	" 3	319	— 72	..	3,130	— 300	2.9	..
Metropolitan .. ..	" 3	17,827	+ 721	..	150,824	+ 9,380	22	..
Middleton .. ..	" 3	690	+ 19	..	5,811	+ 19	8.5	..
Mid. Joint Com'tee	" 3	6,077	+ 214	..	55,005	+ 1,949	..	..
Oldham—Ashton ..	" 3	1,275	+ 211	..	10,303	+ 688	9.13	..
Peterborough .. ..	" 3	229	+ 14	..	2,022	+ 179	5.31	..
Potteries .. ..	" 3	3,674	— 1.7	..	31,267	— 2,479	29	..
Rothsay .. ..	" 3	243	+ 5	..	1,384	+ 110	2.75	..
Southport .. ..	" 3	598	+ 70	..	4,493	+ 126	8.17	..
S. Metropolitan ..	" 3	1,794	+ 164	..	13,817	+ 833	..	..
Swansea .. ..	" 3	2,145	— 56	..	19,073	+ 225	12.5	..
Tynemouth .. ..	" 3	392	+ 37	..	2,871	+ 8	3.75	..
Weston-s-Mare ..	" 3	169	+ 3	..	703	+ 10	3	..
†Worcester .. ..	" 3	524	— 61	..	4,473	+ 55	5.75	..
Wrexham .. ..	" 3	279	+ 100	..	1,883	+ 206	..	..
Yorks. Wool. Dist.	" 3	2,150	+ 154	..	18,277	+ 547	17	..
Miscellaneous .. ..	" 3	447	+ 19	..	2,986	+ 154	..	..
Burnley .. ..								
Burnley .. ..	" 11	2,855	+ 116	..	..	..	11.73	..
Burton-on-Trent ..	" 12	50	+ 2	6	1,392	— 7	6.6	..
Bury .. ..	" 12	2,555	+ 59	6	8,109	+ 82	22.5	..
†Cardiff .. ..	" 4	2,174	— 72	5	9,687	— 2,299	17.35	..
Chatham and Dist.	" 2	1,614	+ 28	18	14,047	+ 295	14.98	..
Cork .. ..	" 9	1,055	+ 46	19	8,472	+ 79	9.89	..
Croydon .. ..	" 3	3,691	+ 2.9	5	8,482	+ 45	11.6	75
†Darlington .. ..	" 4	193	— 10	5	1,003	— 22	4.87	..
Darwen .. ..	" 12	524	+ 80	6	1,620	+ 39	4.36	..
Dover .. ..	" 11	424	— 22	6	1,333	— 76	4.73	..
Dublin .. ..	" 10	11,717	+ 395	..	103,128	+ 6,975	54.25	..
East Ham .. ..	" 11	2,120	— 6	6	6,316	+ 154	7.87	..
Exeter .. ..	" 10	622	— 14	6	1,800	— 121	5.5	..
Glasgow .. ..	" 11	38,466	— 1,785	..	932,127	+ 44,930	98	27
Hastings .. ..	" 9	1,664	— 358	..	..	..	451	19.3
Huddersfield .. ..	" 11	3,717	— 54	6	11,321	— 474	29.6	1
Hull .. ..	" 11	5,471	— 21	6	16,635	— 92	13.5	1
Ilkeston .. ..	" 9	191	— 18	6	855	— 427	..	..
Ipswich .. ..	" 11	791	— 15	6	2,484	+ 84	10.5	..
Kilmarnock .. ..	" 4	293	— 15	51	8,126	+ 445	4.25	..
Lancashire United	" 8	2,69	— 28	19	22,952	— 466	39	..
Leeds .. ..	" 11	15,019	+ 429	6	41,214	+ 1,004	57.5	..
Leicester .. ..	" 11	5,006	— 9	..	..	..	20	..
Leith .. ..	" 11	1,340	+ 123	5 $\frac{1}{2}$	33,673	+ 3,146	3.72	..
Liverpool .. ..	" 4	23,510	+ 671	17 $\frac{1}{2}$	207,261	+ 10,483	116	..
†L.C.C. .. ..	" 1	86,676	— 300	4	198,408	— 427	140.2	2
London United ..	" 11	12,669	— 899	19	110,369	+ 835	..	..
Lowestoft .. ..	" 11	259	— 44	52	4,912	— 87	8.5	..
Manchester .. ..	" 11	32,819	+ 1,001	6	98,557	+ 4,821	105	..
Newcastle .. ..	" 11	8,263	+ 237	..	14,470	— 1,173	31.3	..
Newport .. ..	" 4	1,259	— 92	5	3,123	— 571	7.25	..
Oldham .. ..	" 12	4,093	+ 256	7	14,357	+ 202	23	..
Pontypridd .. ..	" 11	736	— 74	6	1,376	— 680	5.5	..
Portsmouth .. ..	" 4	4,024	+ 116	5	10,448	+ 261	15.75	..
Preston .. ..	" 8	1,504	— 1	6	4,641	+ 146	10	..
Rotherham .. ..	" 8	1,244	..	5 $\frac{1}{2}$	3,493	— 251	12	..
Salford .. ..	" 6	9,542	+ 160	5 $\frac{1}{2}$	25,455	+ 470	41	..
Shffield .. ..	" 14	13,112	+ 246	7	42,187	— 525	40	..
Southampton .. ..	" 8	2,401	+ 115	5	6,568	+ 479	11	..
Southend-on-Sea ..	" 8	1,28	+ 167	6	3,721	+ 586	7	..
South Shields .. ..	" 11	1,162	— 3	6	3,363	— 134	10.25	..
Tyneside .. ..	" 8	891	+ 22	19	8,286	+ 467	11	..
Wallasey .. ..	" 11	2,030	— 101	5 $\frac{1}{2}$	6,316	— 282	8.72	..
Walthamstow .. ..	" 11	1,106	+ 16	6	4,595	+ 161	9	..
West Ham .. ..	" 2	5,349	+ 223	4 $\frac{1}{2}$	12,455	+ 173	15.25	..
Wolverhampton ..	" 3	1,930	+ 75	6	5,295	+ 16	13.75	..
Gen. London Rly. ..								
City & S. Lon. Rly.	" 12	5,915	— 572	19	60,781	— 4,187	7.26	..
Dublin-Lucan Rly.	" 10	288	+ 4	19	2,266	+ 57	7	..
G.N. and City Rly.	" 11	3,123	+ 156	19	31,453	+ 1,798	8.5	..
†Pool Overh'd Rly.	" 12	8,118	+ 1.9	19	28,427	+ 1,750	6.6	..
Llandudno-Col. Bay	" 10	405	+ 28	23 $\frac{1}{2}$	3,706	+ 210	6.5	..
Lon. Elec. Ry. Co.	" 11	27,065	— 420	19	270,900	+ 3,490	21.25	..
Mersey Railway ..	" 11	4,826	+ 26	19	89,221	— 118	4.5	..
Metropolitan Rly. ..	" 12	82,880	— 849	19	811,886	— 9,605	25.75	..
Met. District Rly. ..	" 11	24,788	+ 781	19	287,241	+ 8,605	25	..
Anglo-Argentine ..	" 18	104,863	+ 9,715	..	981,263	+ 87,426	..	..
†Auckland .. ..	April 5	17,472	+ 1,088	..	172,044	+ 18,495	23.8	..
Bombay (B.E.T.) ..	Mar. 29	6,106	+ 322	18	89,005	+ 2,546	..	..
†Brisbane .. ..	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta .. ..	May 11	8,063	+ 405	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
†Kalgoorlie, W.A. ..	April	3,084	..	4	12,036	..	20.5	..
†Lisbon .. ..	..	..	..	..	..	..	..	..
Madras .. ..	April 30	1,708	+ 144	..	19,067	+ 1,157	19.5	..
†Montevideo .. ..	April	2804	+ 2,778	6	185,361	+ 19,185	..	75
Perth (W.A.) .. ..	May 10	3,734	+ 512	..	35,867	+ 4,576	29	..

\* Compared with the corresponding period of 1911. † One week only.  
‡ Includes horse, steam and other receipts. § One month.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 14th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations May 14th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.						1910.	1911.			
Bournemouth & Poole, Ord. ..	10	5½	5½	9½—10½	+ ½	5 4 9	Kensington & Knightsbridge, Ord.	5	9	9	7½—7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½	4½	8½—9½	+ ½	4 12 2	Do. 4 % Deb. ..	Stock	4	4	92—95	..	4 4 3
Do. Second 6 % Pref. ..	10	6	6	10½—11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½	4½	100—102	..	4 8 3	London Electric, Ord. ..	8	2	2½	1½—2	..	3 14 11
Brompton & Kensington, Ord. ..	5	10	10½	8½—8½	..	5 14 3	Do. 6 % Pref. ..	5	6	6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7	7	7½—8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4	4	92—95	..	4 4 3
Central Electric Supply, 4 %	100	4	4	98—101	..	3 19 3	Metropolitan ..	5	5	4½	8½—4½	..	6 1 3
Guar. Deb. }							Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	4 17 4
Charing Cross, West End & City	5	5	5	4½—5	..	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	101—104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½	4½	4½—4½	..	4 14 9	Do. 8½ % Mort. Deb. ..	Stock	3½	3½	85—88	+1	3 19 7
Do. " City Undertaking " }	5	4½	4½	8½—4½	..	5 2 10	Midland Electric Corporation	100	4½	4½	96—98	..	4 11 10
4½ % Cum. Pref. }							4½ % First Mort. Deb. }						
Do. Do. 4 % Deb. ..	100	4	4	95—98	..	4 1 8	Newcastle-on-Tyne 5 % Pref.,	5	5	5	3½—4½	..	5 14 3
Chelsea, Ord. ..	5	5	5	4½—4½	..	5 2 7	Non-Cum. }						
Do. 4½ % Deb. ..	Stock	4½	4½	98—101	..	4 9 1	North Metropolitan Power Sup-	100	5	5	97—100 xd	..	5 0 0
City of London, Ord. ..	10	7	8	21—23	+1	3 9 7	ply, 5 % Mortgages (Red.)						
Do. 6 % Cum. Pref. ..	10	6	6	17½—19½	+1	3 1 6	Notting Hill, 6 % Non-Cum.	10	..	6	10½—11½	..	5 6 8
Do. 5 % Deb. ..	Stock	5	5	119—123	..	4 1 4	Pref. }						
Do. 4½ % Second Deb. ..	100	4½	4½	101—104	..	4 6 7	Oxford ..	5	7½	7½	5½—6½	..	5 13 9
County of London, Ord. ..	10	5	6	10½—11½	..	5 6 8	St. James' and Pall Mall, Ord.	5	10	10	8—8½	—½	5 14 3
Do. 6 % Pref. ..	10	6	6	11½—11½	..	5 2 7	Do. 7 % Pref. ..	5	7	7	6½—7½	..	4 16 7
Do. 4½ % Deb. ..	Stock	4½	4½	108—110	..	4 1 10	Do. 8½ % Deb. ..	100	8½	3½	85—87	..	4 0 6
Do. 4½ % Second Deb. ..	Stock	4½	4½	99—102 xd	..	4 8 3	Smithfield Markets, Ord. ..	5	Nil	2	1½—1½	..	6 8 0
Edmundson's, Ord. ..	5	Nil	Nil	½—½	+ ½	Nil	South London, Ord. ..	4	5	5	2½—3½	..	6 8 0
Do. 6 % Cum. Pref. ..	5	Nil	Nil	3—3½	..	Nil	Do. 5 % First Mort. Deb. ..	100	5	5	99—102	..	4 18 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86—89	..	5 1 2	South Metropolitan, 7 % Pref. ..	1	7	7	1½—1½	..	6 1 0
Folkestone ..	5	6	6	4½—4½	..	6 3 1	Do. 4½ % First Deb. Stock ..	100	4½	4½	96—99	..	4 11 0
Do. 5 % Cum. Pref. ..	5	5	5	4½—4½	..	5 5 3	Urban, Ord. ..	5	5	..	1—1	..	..
Do. 4½ % First Deb. ..	100	4½	4½	93—96	..	4 13 9	Do. 5 % Cum. Pref. ..	5	5	..	2½—3½	..	..
Hove ..	5	9	9	6½—7	..	6 8 7	Do. 4½ % First Mort. Deb. ..	100	4½	4½	86—88	..	5 2 3
							Westminster, Ord. ..	5	10	10	8½—9	—½	5 11 1
							Do. 4½ % Cum. Pref. ..	5	4½	4½	5½—6½	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6	6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5	5	87½—89½	..	5 11 9
Calcutta, Ord. ..	5	8½	7½	7½—8½	..	4 6 2	5 % 1st Mort. Deb. }						
Do. 6 % Pref. ..	5	5	5	5—5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7	8	207—212 xd	..	3 15 6
Calgary Power, 1st Mort. Bds.	100	5	5	94½—96½	..	5 3 8	Northern, Lt., Power and Coal, }	\$500	5	..	39—41	..	12 8 10
Canadian Gen. El. Com. ..	\$100	7	7½	114—118	+4	5 18 8	5 % 1st Mort. Bonds }						
Do. 7 % Pref. ..	\$100	7	7	118—122	..	5 14 9	River Plate, Ord. ..	Stock	10	..	245—255	..	3 18 6
Cordoba Lt., Power and T., Ord.	1	3	3½	1½—1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	112—117	..	5 2 7
Do. 5 % Deb. ..	100	5	..	94—97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5	5	103—105	..	4 15 3
Elec. Lt. and P. of Cochabamba, }	100	6	6	93—95	..	6 6 4	Roy. Elec. Co., Montreal, 4½ % }	100	4½	4½	99—101	..	4 9 1
6 % Bonds }							1st Mort. Deb. }						
Elec. Supply Victoria, 5 % 1st	100	5	5	83—86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4	5½	137—141	..	3 10 11
Mort. Deb. }							Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	108½—110½	..	4 10 6
Elec. Dev. Ontario, 5 % 1st	\$500	5	5	92—94	..	5 6 5	Do. 4½ % Per. Deb. ..	Stock	4½	4½	104½—106	..	4 4 11
Mort. Bonds }							Toronto Power, 4½ % Deb. ..	Do.	4½	4½	100½—102½	+ ½	4 7 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7½—7½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5	5	92½—94½	..	5 5 10
Do. 6 % Pref. ..	1	6	6	3½—2½ xd	..	8 6 0	1st Mort. Deb. }						
Kaministiquia Power, 5 % G. Bs.	\$500	5	5	103—105	..	4 15 3	Victoria Falls Power, Pref. ..	1	Nil	11½d.	8½—8½	..	..
Madras, Ord. ..	5	..	..	2½—2½	..	..	West Kootenay Power and Lt., }	100	6	6	105—107	+ ½	5 12 2
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	102½—105½	..	4 14 9	1st Mort. 6 % Gold }						
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87½—89½	+1	5 11 9							
Mexican Lt. & Power, Common	\$100	4	4	85½—87½	—½	4 11 5							
Do. 7 % Cum. Pref. ..	\$100	7	7	105—107	+1	6 10 10							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96—98	..	5 2 0							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½	7½—7½	..	..	Monte Video Telephone, Ord. ..	1	6	6	1—1½ xd	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5	5	97½—99½	..	5 0 6	Do. 5 % Pref. ..	1	5	5	9½—9½ xd	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8	8½	148½—150½	+ ½	5 6 4	National Telephone, Pref. ..	Stock	6	6½	99½—102½	..	..
Do. Collat. Trust ..	\$1000	4	4	95—97	+1	4 2 6	Do. Def. ..	Do.	6	6½	169—161	+1½	..
Anglo-American Telegraph ..	Stock	8½	3	65—67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref.	5	5	5	6½—6½	+ ½	..
Do. 6 % Pref. ..	Do.	6	6	107½—108½	— ½	5 10 7	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100—101 xd	..	4 7 2
Do. Def. ..	Do.	30/-	50/-	25½—26½	..	5 14 3	Oriental Telep. and Elec. ..	1	8	8	1½—1½	—½	4 13 0
Anglo-Portuguese Tel., 6 % }	100	5	5	102—104	+1	4 16 2	Do. 6 % Cum. Pref. ..	1	6	6	1½—1½ xd	..	4 16 0
Mort. Deb. }							Do. 4 % Red. Deb. ..	Stock	4	4	39—91	..	4 8 0
Chill Telephone ..	5	7	..	7½—8	..	4 10 4	Pacific and European Tel., 4 % }	Do.	4	4	99½—101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82½—84½	—1	4 14 8	Guar. Debs. }						
Cuba Telegraph ..	10	6	6½	9½—10½	..	5 11 7	Reuter's ..	8	5	5½	11½—11½	+ ½	3 8 0
Do. 10 % Pref. ..	10	10	10	17—18	..	5 11 1	Submarine Cables Trust ..	Cert.	6	6	127—130 xd	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4	4½	3½—3½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½	4½	99—101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10	10	7½—8½	..	6 1 3	Deb. Red. }						
Do. 4½ % Debs. ..	50	4½	4½	99—101	..	4 9 1	United River Plate Telephone	5	8	8	7½—7½	..	5 1
Direct United States Cable ..	10	4½	5	7½—8 xd	..	6 5 0	Do. 5 % Cum. Pref. ..	5	5	5	7½—7½	..	4 8 11
Direct W. India Cable, 4½ % }	100	4½	4½	99—101	..	4 9 1	West Coast of America ..	2½	2½	2½	1—1½	..	3 6 8
Reg. Deb. }							Do. 4 % Debs., 1 to 1,500 }	100	4	4	94½—97½	—2½	4 2 1
Eastern Telegraph, Ord. Stock	Stock	7	5½	135½—138½	+1½	5 1 1	guar. by Braz. Sub. Tel.						
Do. 8½ % Pref. Stock ..	Do.	8½	8½	80½—82½	+1	4 4 10	West India and Panama Teleg.	10	1½	1½	3½—3½	—½	3 11 5
Do. 4 % Mort. Deb. ..	Do.	4	4	99½—101½ xd	..	3 18 10	Do. 6 % Cum. 1st Pref. ..	10	6	6	10½—11	..	5 9 1
Eastern Extension ..	10	7	5½	12½—13½	+ ½	5 2 9	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½—10½	..	5 17 1
Do. 4 % Deb. ..	Stock	4	4	99—101	..	3 19 3	Do. 5 % Debs. ..	100	6	5	102½—104½	..	4 15 8
East and S. Africa Tel. 4 % }	25	4	4	97—100 xd	..	4 0 0	Western Telegraph, Ltd. ..	10	7	6½	13½—13½	+ ½	5 2 9
Mt. Db. Mauritius Sub. }							Do. 4 % Deb. ..	Stock	4	4	98—100	—1	4 0 0
Globe Telegraph and Trust ..	10	5½	6½	10½—11½	+ ½	5 5 6	Western Union 4½ % Fdg. Bonds	\$1000	4½	4½	100—109	..	4 7 5
Do. 6 % Pref. ..	10	6	6	13—13½	..	4 9 0							
Great Northern Telegraph ..	10	18	18	30½—31½	+ ½	5 15 2							
Indo-European Telegraph ..	25	13	5½	68—60	..	5 8 4							
MacKay Companies Common ..	\$100	5	5½	87—90	+3	5 11 1							
Do. 4 % Cum. Pref. ..	\$100	4	4	69—72	+1	5 11 1							
Marconi's Wireless Telegraph	1	6	..	6½—6½	— ½	..							
Do. 7 % Cum. Partic. Pref.	1	16	..	5½—6½	— ½	..							

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 14th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 14th.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. ..	1	1910. Nil	1911. Nil		£ s. d.	Metropolitan Railway Consol. ..	100	1910. 13	1911. 17		£ s. d.
Do. 5 % Pref. ..	1	5	5		6 3 1	Do. Surplus Lands ..	100	24	24		67 — 69
Do. 4½ % Deb. ..	100	4½	4½		5 8 5	Do. 3½ % Deb. ..	100	3½	3½		89 — 91
Brit. Elec. Trac., 6 % Pref. ..	100	..	..		..	Do. 3½ % Pref. ..	100	3½	3½		86 — 88
Do. Do. Deferred ..	100	..	..		..	Do. 3½ % Con. Pref. ..	100	8½	8½		87 — 89
Do. Do. 6 % Cum. Pr'l. ..	100	..	6		6 7 8	Metropolitan District Ord. ..	100	Nil	..		45 — 45½
Do. Do. 7 % Non-Cum. Pr'l. ..	100	..	..		..	Do. 6 % Deb. ..	100	6	6		144 — 146
Do. Do. 5 % Perp. Deb. ..	100	5	5		5 3 8	Do. 4 % Deb. ..	100	4	4		96 — 98
Do. Do. 4½ % 2nd Deb. ..	100	4½	4½		5 9 9	Do. 4 % Prior Lien ..	100	4	4		98 — 100 xd
Central London Railway, Ord.	100	8	8		3 11 5	Do. 4½ % First Pref. ..	100	3½	4½		90 — 92
Do. Pref. ..	100	4	4		4 11 0	Do. 3½ % Gtd. ..	100	3½	3½		76 — 78
Do. Def. ..	100	2	2		2 7 1	Metropolitan Elec. Trams, Ord.	1	5½	6		1 — 1
Do. 4 % Deb. ..	100	4	4		3 17 8	Do. Def. ..	1	Nil	..		..
City & South London, Ord.	100	1½	1½		4 2 3	Do. 5 % Pref. ..	1	5	5		..
Do. 5 % Pref., 1891 ..	100	5	5		4 11 0	Do. 4½ % Deb. ..	100	4½	4½		98 — 100
Do. Do. 1896 ..	100	5	5		4 15 3	Do. 5 % Deb. ..	100	5	5		98 — 100
Do. Do. 1901 ..	100	5	5		4 14 4	Potteries, Ord. ..	1	2	..		..
Do. Do. 1903 ..	100	5	5		4 15 3	Do. 5 % Pref. ..	1	5	5		..
Do. 4 % Deb. ..	100	4	4		3 19 3	Do. 4½ % Deb. ..	100	4½	4½		89 — 92
Dublin United Trams, 6 % Pref.	10	6	6		5 2 2	South Metro. Trams, 6 % Pref.	1	6	..		..
Great Northern & City, Pr'l. Ord	10	Nil	..		Nil	Do. 4 % Deb. ..	100	4	4		72 — 77
Hastings Trams, 6 % Pref. ..	5	Nil	..		8 0 0	Underground Elec. Railways	10	..	..		41 — 43
Do. 4½ % Deb. ..	100	4½	4½		5 18 5	Do. 4½ % Bonds ..	100	4½	4½		99 — 101
Isle of Thanet Trams, 5 % Pref.	5	2½	2½		4 6 11	Do. 6 % Income ..	100	1	1½		91 — 93
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil	..		..
Lancashire United, 5 % Deb. ..	100	5	5		5 17 8	Do. 6 % Pref. ..	5	Nil	..		..
London Elec. Railw'ys, 4 % Deb.	100	4	4		4 0 10	Do. 4½ % Deb. ..	100	4½	4½		80 — 84
London United Trams, 5 % Pref.	10	Nil	..		..						
Do. 4 % Deb. ..	100	4	4		4 18 9						

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5½ — 5½	..	5 1 2	La Plata Elec. Trms, Ord. ..	1	..	..	..	..	..	..
Do. 2nd Pref. ..	5	5	5½	5½ — 5½	..	5 7 4	Do. Pref. ..	1	6	6	6	6	6	6 0 0
Do. 4 % Deb. ..	100	4	4	94 — 95½	..	4 3 9	Lisbon Elec. Trams, Ord. ..	1	5½	6½	1 — 1½	..	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	102 — 104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	1 — 1½	..	..	4 16 0
Do. 5 % Deb. ..	100	5	5	103 — 105	..	4 15 3	Do. 5 % Deb. ..	100	5	5	95 — 99	..	..	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	104 — 106	..	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	99 — 101	..	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93 — 96	..	..	5 4 2
Do. 4½ % Deb. ..	100	4½	4½	98 — 100	..	4 10 0	Manila Elec. R. and Ltg., Bonds	\$1000	5	5	101½ — 103½	..	..	4 16 7
Do. 5 % 2nd Deb. ..	100	5	5	99 — 101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	122 — 124	+2	..	5 13 0
Brisbane Trams Invt., Ord. ..	5	8	8	9½ — 9½	—½	4 2 1	Do. Gen. Con. 5 % Bonds ..	..	5	5	96 — 98	..	..	5 2 0
Do. 5 % Pref. ..	5	5	5	48 — 5½	..	4 15 3	Do. 6 % Bonds ..	100	6	6	103 — 105	+1	..	5 14 3
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7 — 7½	—½	..	6 15 7
B. Columbia Elec. Rly., Def. ..	100	8	8½	139 — 143	..	5 12 0	Do. 6 % Pref. ..	5	6	6	6 — 5½	..	..	7 0 4
Do. Pref. Ord. ..	100	6	6	126 — 129	..	4 13 0	Do. 5 % 1st Deb. ..	100	5	5	102 — 104	+1	..	4 16 2
Do. 5 % Pref. ..	100	5	5	111 — 114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1½ — 1½	..	..	1 18 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98½ — 101½	..	4 8 8	Do. 5 % 1st Deb. ..	100	5	5	101 — 104	..	..	4 16 2
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	58 — 58	..	..	5 6 8
Do. 4½ % Con. Deb. ..	100	4½	4½	104 — 106	..	4 5 0	Do. 4½ % 1st Deb. ..	100	4½	4½	99 — 101	..	..	4 9 1
Calcutta Trams, Ord. ..	5	6	7	6½ — 6½ xd	..	5 5 8	Rio de Janeiro Trams ..	\$100	4½	5½	134 — 136	+5½	..	3 13 6
Do. 5 % Pref. ..	5	5	5	100 — 103	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	104 — 105	..	..	4 15 3
Do. 4½ % Deb. ..	100	4½	4½	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	97½ — 98½	+½	..	5 1 3
Cape Electric Trams ..	1	Nil	2½	..	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10½	222 — 227	+6	..	4 8 1
City Buenos Aires Trams (1904)	5	5	5	58 — 58	..	4 5 1	Do. 5 % 1st Deb. ..	\$500	5	5	104½ — 106½	..	..	4 13 11
Do. 4 % Deb. ..	100	5	5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	79 — 82	..	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98 xd	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101 — 104	..	4 16 2	Un. Elec. Trams Monte Video ..	5	6	7	5½ — 6	..	..	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 6 % Pref. ..	5	6	6	5 — 5½	—½	..	5 14 3
Do. 5 % A Deb. ..	100	5	5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	100 — 103 xd	..	..	4 17 1
Do. 6 % B Deb. ..	100	5	6½	56 — 60	..	10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	102½ — 104½	..	..	4 6 2

MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	14 — 14	—½	7 7 8	Dick, Kerr ..	1	5	..	..	..	..	5 9 1
Do. 6 % Pref. ..	1	9	6	14 — 14	..	7 2 2	Do. Pref. ..	1	6	6	..	..	..	6 12 11
Babcock & Wilcox ..	1	26	28	6½ — 6½	+½	4 5 4	Do. Deb. ..	100	4½	4½	97 — 100	..	..	4 10 0
Do. Pref. ..	1	6	6	14 — 14	..	3 16 10	Edison & Swan, A, £3 paid	5	Nil	..	..	..	..	Nil
B.I. & Helsby Cables ..	5	10	10	6½ — 6½	..	6 18 0	Do. fully paid ..	5	Nil	..	..	..	..	Nil
Do. Pref. ..	5	6	6	5½ — 6½	..	4 16 0	Do. 4 % Deb. ..	100	4	4	68 — 72	..	..	5 11 1
Do. Deb. ..	100	4½	4½	101 — 103	..	4 7 5	Do. 5 % Second Deb. ..	100	5	5	75 — 75	..	..	6 8 2
British Thomson-Houston, Deb.	100	4½	4½	91½ — 94½	..	4 15 3	Electric Construction ..	2	Nil	2½	..	..	..	..
British Westinghouse, Pref. ..	3	Nil	..	..	..	Nil	Do. Pref. ..	2	7	7	1 — 2	+½	..	7 0 0
Do. Deb. ..	100	4	4	63 — 66	..	6 1 3	Greenwood & Batley, Pref.	10	7	7	72 — 8½	..	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	99 — 102	..	5 17 8	Do. Deb. ..	100	5	5	94 — 96	..	..	5 4 2
Browett, Lindley, Ord. ..	1	Nil	..	1/6 — 2/	..	Nil	General Electric, Pref. ..	10	5	5	9 — 9½	..	..	5 5 3
Do. Pref. ..	1	Nil	..	5/ — 6/	..	Nil	Do. Deb. ..	100	4	4	85 — 90	..	..	4 8 11
Brush, 7 % Pref. ..	2	Nil	..	0 — ½	..	Nil	Henley's, Ord. ..	5	15	10½	11½ — 12½	..	..	6 0 0
Do. 5 % Prior Lien Deb. ..	100	5	5	77½ — 82½	..	6 1 3	Do. Pref. ..	5	4½	4½	4½ — 5½	..	..	4 6 9
Do. 4½ % Deb. ..	100	4½	4½	54 — 59	..	7 10 6	Do. Deb. ..	100	4½	4½	103 — 105	—1	..	4 5 9
Do. 4½ % Second Deb. ..	100	4½	4½	87 — 42	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	8½ — 9½	..	..	..
Callender's Cable ..	5	15	10½	11½ — 12	..	6 5 0	Do. Pref. ..	10	5	5	94 — 10½	..	..	4 17 7
Do. Pref. ..	5	5	5	5 — 5½	..	4 15 3	Telegraph Construction ..	12	20	10½	31 — 36	..	..	6 13 4
Do. Leh. ..	100	4½	4½	99½ — 101½	..	4 8 8	Do. Deb. ..	100	4	4	99½ — 101½	..	..	4 9 0
Castner-Kellner ..	1	17½	20	8½ — 3½	..	5 6 8	Willans & Robinson ..	1	Nil	..	..	..	..	Nil
Do. Deb. ..	100	4½	4½	105 — 109	..	4 10 7	Do. Pref. ..	5	Nil	..	..	..	..	Nil
Crompton & Co. ..	3	Nil	Nil	..	..	Nil	Do. Deb. ..	100	4	4	59 — 61	..	..	6 11 2
Do. Deb. ..	100	5	6	58 — 68	..	7 7 1								

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## THE CHARACTERISTICS OF COPPER AND ALUMINIUM OVERHEAD LINE CONDUCTORS.

By E. V. PANNELL.

(Concluded from page 773.)

In predetermining the forces acting on the conductors at the lower temperature limit of 22° F. it is necessary to take into account the wind pressure. In calculating the maximum deflection due to the highest summer temperature, however, wind pressure must be eliminated. Apart from the physical impossibility of a hurricane blowing at 100° F., it is necessary to calculate the maximum deflection in a vertical direction in order to estimate the necessary height of the pole or other supporting structure; in other words, the deflection in still air is what is required. Some manipulation is necessary to allow for this change in the conditions, and the author has found it convenient to use a graphic method for effecting this.

The conditions obtaining at 22° F., as has been seen, are expressed by—

$$\delta = w l^2 / 8 a s.$$

It will be noticed that all save  $\delta$  and  $s$  are constant; hence—

$$\delta = K/s, \text{ and } \delta s = K.$$

If, now, the wind pressure disappears, the state of affairs is given by—

$$\delta_1 = w l^2 / 8 a s_1, \text{ i.e., } \delta = K_1/s_1.$$

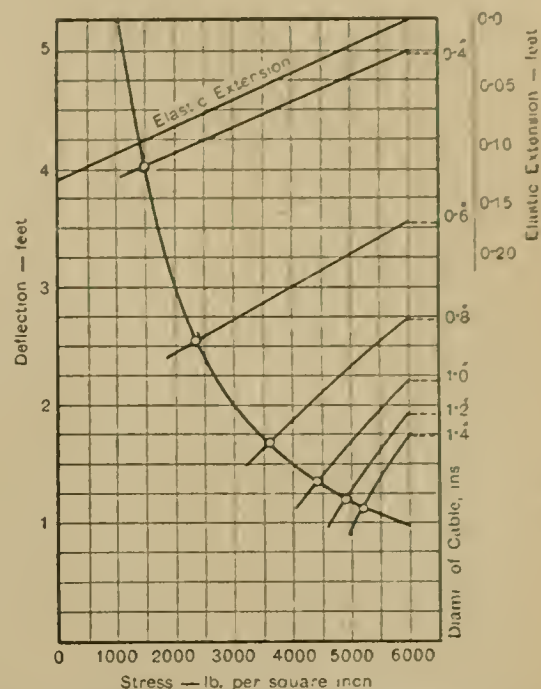
Ample information is available for the estimating of  $K$  and  $K_1$ ; the latter being obtained, a locus is fixed for  $\delta_1 = K_1/s_1$ . This curve plotted for a 200-ft. span in aluminium is shown in fig. 6, whilst at the top of the diagram is the elastic extension curve plotted downwards to represent a contraction. This is obtained simply by multiplying the stress by the elastic constant and by the length of span. The variation of deflection with extension of the cable is calculated from the equation already given—

$$L = l + 8 \delta^2 / 3 l,$$

hence a series of deflection curves can be plotted from the values in the elastic extension curve. The points where these lines intersect the  $\delta_1/s_1$  hyperbola show the positions

The accuracy of the method depends wholly upon the values chosen for elasticity, and there is room for a considerable amount of experimental work in this connection. Very little reliable information is available respecting the physical properties of stranded cables, and with the broadening of the field of electric power transmission such data must be extended.

The respective deflections on the copper and aluminium cables with and without wind-pressure are shown in fig. 7. These curves, together with the figures in Table III, sum-





conductors than the matter of deflection, and that is the phenomenon of corona. It has long been known that high transmission pressures occasion a loss due to brush discharge from the conductors, and more recent investigations have shown that the glow which surrounds the conductor below

TABLE III.—DEFLECTIONS UNDER EXTREME CONDITIONS.

Section, sq. in.		100-ft. span.		200-ft. span.		400-ft. span.	
Copper.	Alum'm.	Copper.	Alum'm.	Copper.	Alum'm.	Copper.	Alum'm.
(1) Temperature 22° F. 30 lb. wind pressure. Deflections in feet.							
0'10	0'16	0'73	1'08	2'92	4'30	11'68	17'20
0'20	0'33	0'59	0'76	2'36	3'04	9'45	12'20
0'30	0'50	0'52	0'62	2'07	2'48	8'30	9'90
0'40	0'66	0'49	0'54	1'95	2'16	7'80	8'65
0'50	0'83	0'48	0'51	1'90	2'04	7'60	8'16
0'60	1'00	0'47	0'48	1'89	1'92	7'51	7'70
0'70	1'17	0'47	0'46	1'88	1'84	7'50	7'36
0'80	1'33	0'46	0'45	1'88	1'80	7'50	7'20
(2) Temperature 22° F. No wind.							
0'10	0'16	0'45	0'48	2'17	3'10	10'50	15'30
0'20	0'33	0'41	0'40	1'85	1'85	8'40	10'90
0'30	0'50	0'405	0'35	1'80	1'45	7'70	8'50
0'40	0'66	0'40	0'30	1'75	1'35	7'30	7'30
0'50	0'83	0'40	0'28	1'70	1'25	7'10	6'65
0'60	1'00	0'40	0'27	1'65	1'20	7'00	6'20
0'70	1'17	0'39	0'26	1'60	1'15	7'00	6'00
0'80	1'33	0'39	0'26	1'59	1'10	6'90	6'00
(3) Temperature 100° F. No wind.							
0'10	0'16	0'96	1'45	3'50	4'70	12'10	16'50
0'20	0'33	0'90	1'40	3'40	3'65	10'20	12'70
0'30	0'50	0'90	1'35	3'35	3'30	9'60	11'00
0'40	0'66	0'89	1'32	3'29	3'25	9'40	9'80
0'50	0'83	0'89	1'30	3'38	3'20	9'30	9'40
0'60	1'00	0'89	1'25	3'25	3'15	9'25	9'15
0'70	1'17	0'88	1'20	3'22	3'12	9'22	9'00
0'80	1'33	0'88	1'20	3'20	3'10	9'20	8'90

the limits of the brush discharge is, in itself, a source of considerable loss. The most recent theories on the subject are those of Watson ("Losses off Transmission Lines due to Brush Discharge," *Journal I.E.E.*, Vol. 45, No. 202) and Peek ("Law of Corona," *Proceedings Am.I.E.E.*, Vol. XXX,

such high working pressures are by no means imminent for British transmission schemes, it should be remembered that in our climate corona will form at an appreciably lower voltage than in the drier atmospheric conditions obtaining on the American Continent. There is thus every reason for believing that, other things being equal, the larger diameter conductor will carry a given pressure with a lower corona loss. This is the main reason which dictated the exclusive use of aluminium on the transmission system of the Ontario

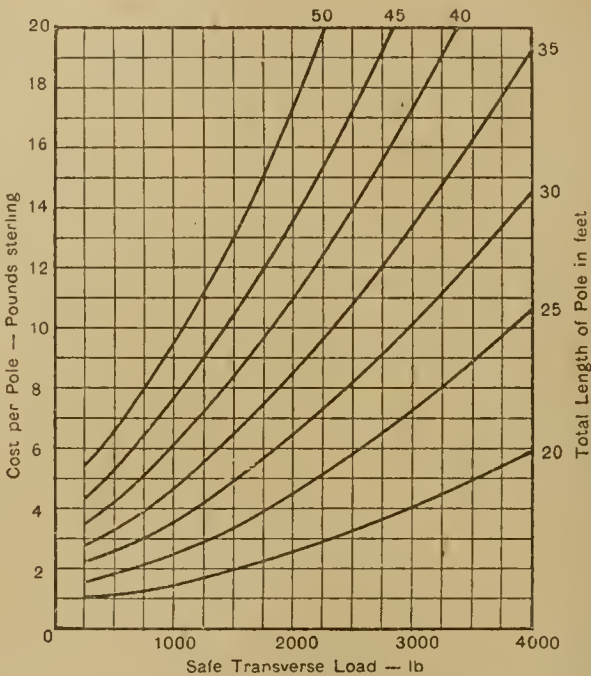


FIG. 8.—DIAGRAM SHOWING COST OF A-TYPE WOODEN POLES.

Commission, which operates at 110,000 volts. The 30 per cent. greater diameter of the aluminium conductor over the equivalent copper is a powerful advantage for high-pressure systems.

The matter of supporting structures for the conducting line has next to be considered, and on this point considerable diversity of opinion prevails. The single wooden pole has been almost totally displaced in America by the built-up lattice steel tower, mainly on the score of mechanical stability. Whilst this is justifiable in the very large transmission

schemes common on the American Continent, it is doubtful whether the advantages of steel towers would be as great in this country. Not only would the cost of such structural steelwork be greater on account of the necessarily lower aggregate weight required, but wooden poles can be obtained in England far superior in durability and scientific design to those hitherto used abroad. For span lengths, such as have been considered in this investigation—viz., up to 400 ft.—the A type of pole amply takes care of the stresses due to a double three-phase network, except with abnormally large sections of cable, or with extremely high voltages. Neither

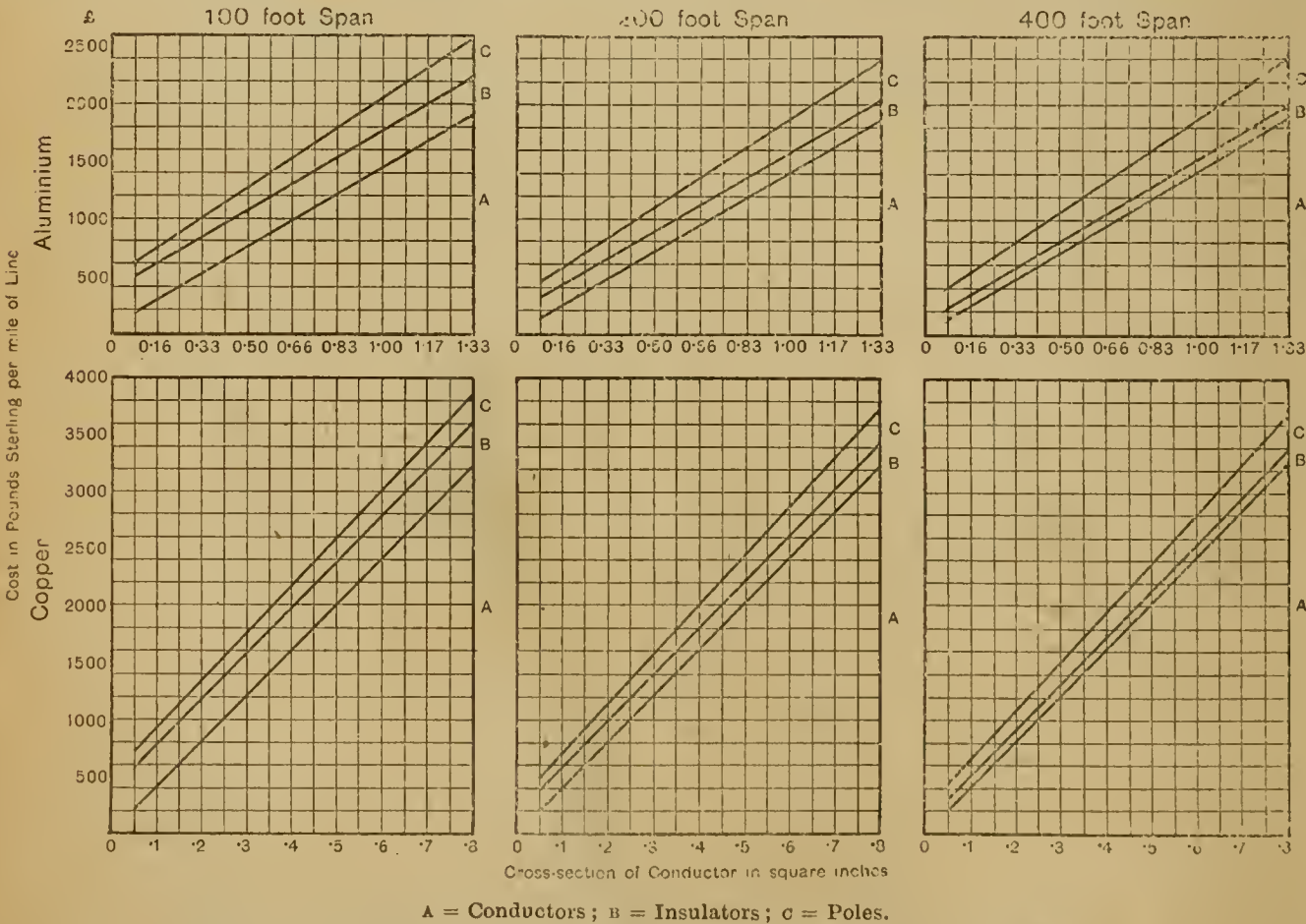


FIG. 9.—APPROXIMATE FIGURES FOR COST OF MATERIAL PER MILE.

No. 7), both of which are masterly investigations of an extremely involved problem. The feature which has been brought out most strongly is the rapid augmentation of corona loss, with a reduction in the size of the conductor. At working pressures of 80,000 volts and over, this difficulty is a very real one, and the use of tubular conductors has been proposed in order to increase the radius and diminish the liability to discharge. Although

of these latter conditions need be anticipated in the immediate future of British transmission schemes, and it would seem that this type of pole is amply sufficient for such projects. In estimating the cost per mile of line, therefore, A-type poles have been assumed of appropriate strength and of sufficient height to maintain a minimum distance of 22 ft. between the ground and the lowest point of the wire. The approximate cost of such poles is shown



in the curves of fig. 8, and values have been chosen from these curves for plotting in the "cost per mile" diagrams (fig. 9). The latter represent the cost per mile of material for a high-pressure double-circuit three-phase line, comprising the costs of metal, poles and insulators. Analysis of these curves will show that in no case does the extra cost for the poles on the aluminium lines approach the value of the saving effected on the line conductors.

This is a most important result, as it refutes the statement often made, that a saving on the cost of line conductors does not imply a saving on the whole expenditure. For very small amounts of power, of course, the cost of poles and insulators will be of relatively greater magnitude, but in such cases the nearest stock size of pole would be requisitioned, and would be pressed into service regardless of the line conducting material.

If it be granted that the poles along the run of the line need to be somewhat stronger and more expensive for aluminium than for copper, the reverse is the case with strain poles, and all structures which have to take the longitudinal stress of the line. The stresses in the aluminium conductors being some 20 per cent. lower than the equivalent in copper, there is much less liability of the poles coming down due to a breakage of one or more conductors. Where, however, steel towers are used they will be designed especially for a copper or an aluminium line. In the former case, the towers will have a greater strength in the direction of the line than the latter, whilst the transverse strength will be in the reverse proportion. Hence, it is reasonable to believe that steel towers for an aluminium transmission line need not cost much more than those for a copper line.

Problems connected with erection are for the most part common to both conducting materials, and for this reason scarcely need treatment in this article. The jointing problem has been solved in both cases by the adoption of the torsion joint, in which the conductor ends are run into a fig. 8 or oval section sleeve and twisted up. In straining up the conductors the dynamometer should always be used with reference to a table of stresses. Adjustment by gauging the deflection is unsatisfactory, whatever be the method employed. It should be remembered that the cable should be stressed up to its elastic limit and then let down again, for the reason that if this be not done it will take up a permanent set in the first gale of wind and deflect considerably more than the calculated amount. Neglect of this precaution has been largely responsible for the abnormal deflections reported on certain aluminium lines. This operation, of course, calls for the use of a dynamometer, and can in no wise be accomplished by merely sighting from pole to pole. In this paper deflection instead of stress curves have been plotted, but from the former a table of stresses can be readily prepared and should always be employed on erection work.

In conclusion, the author would say that this short thesis was intended to be by no means an exhaustive treatise on the subject of the title, but merely an example in the use of some simple rules to facilitate comparison between copper and aluminium line conductors. Much of the information relative to the use of the latter metal is here published for the first time, and the author's best thanks are due to Mr. Arthur Jacob, of the British Aluminium Co., Ltd., for permission to use the same.

## RECOVERY OF CONTRACT PRICES WITHOUT THE ENGINEER'S CERTIFICATE.

[FROM OUR LEGAL CONTRIBUTOR.]

THE contractor who has undertaken to carry out work "subject to the approval of the engineer," sometimes finds himself in the awkward position of having failed to secure that approval. The result is that he fails to obtain the certificate, which, according to the terms of the contract, is a condition precedent to the payment of any part of the contract price. In these circumstances, he not unnaturally asks himself—In what circumstances may the certificate be dispensed with?

It is clear law that in the ordinary course a certificate may be made a condition precedent. As Lord Justice Mellish said, in *Sharpe v. San Paulo Railway*, 1873, L.R.B., Ch. 597: "A contract may be so framed as under ordinary circumstances to take away the jurisdiction of Courts of law and Courts of equity to determine what is the amount payable under the contract. Wherever, according to the true construction of the contract, the party only agrees to pay what is certified by the engineer, or what is found to be due by an arbitrator, and there is no agreement to pay otherwise—that is to say, in every case where a certificate of the engineer or arbitrator is made a condition precedent to the right to recover, then the Court has no right to dispense with that which the parties made a condition precedent, unless, of course, there has been some conduct on the part of the engineer or company which may make it inequitable that the condition precedent should be relied upon."

It is to the proviso of this very clear statement of the law that the harassed contractor will turn in order to escape from what he considers the unjust decision of the engineer; for it is obvious that if a certificate has been fraudulently or collusively withheld, or if there has been a prevention by the employer, whether by collusion with the engineer or otherwise, a certificate may be dispensed with.

In this matter of granting certificates, an engineer is in a position very similar to that of an arbitrator. He must be impartial as far as he can be, consistently with the natural bias due to his position as adviser of one of the parties, and he must do nothing inconsistent with a judicial position. Any bias, therefore, unknown to one of the parties, or any conduct inconsistent with his judicial capacity would, it would seem, dispense with his certificate.

The offence may consist not merely in withholding a certificate, but in granting a certificate for less than is justly due. For instance, to borrow an illustration which concerned an architect and a local authority (*Page v. Llandaff R.D.C.* (1901) 2 Hudsons' "Building Contracts," 347), it appeared that the plaintiff was employed by the defendant Council to construct certain works. In the contract it was provided that "the decision of the surveyor with respect to the value, amount, state and condition of any parts of the works executed, or of any part thereof, altered, omitted or added, and also in respect to any and every question that may arise concerning the construction of this contract, or the said plans, drawings, specification, or bill of quantities, or schedule of prices, or the execution of the works hereby contracted for, or in anywise relating thereto, shall be final and without appeal." Disputes arose, and, after protracted negotiations, the surveyor gave his final certificate. The plaintiff brought an action against the Council, in which he alleged that the surveyor's final certificate "was not honestly made or given in the exercise of, or reliance upon, his own judgment, but was made and given by reason of the interference of, and in obedience to, the directions and orders of the Council." It was held that as the Council had interfered (though without any fraud on their part) with the surveyor in the exercise of his functions as quasi-arbitrator between the parties, the final certificate was not conclusive and binding on the contractor.

Mr. Hudson, in his "Building Contracts," divides the cases in which a certificate possibly may be dispensed with into four classes, viz.: (i) Those where fraud or collusion is alleged; (ii) those where fraud only is alleged; (iii) those where, before or after the giving of the certificate, the engineer has shown that he will not be, or is not, impartial; (iv) those where the employer interferes with the engineer either before or after the giving of the certificate.

1. *Cases of Fraud and Collusion.*—It is obvious that fraud and collusion between the engineer and the employer are followed by injustice to the contractor, and it is not necessary to quote authorities in support of the proposition that such conduct vitiates a certificate when granted, or justifies the contractor in suing the employer direct. When no certificate is forthcoming, the difficulty is to prove the fraud and collusion as illustrating the circumstances in which a jury will be ready to find collusion: reference may be made to a case heard in the Colony of Victoria. There an action was brought by contractors against Water Commissioners on an engineering contract; the



plaintiff alleged due performance, and that the engineer fraudulently, and in collusion with the employers, had refused to certify. It appeared that the Commissioners had passed a resolution that a certificate should be given; the engineer professed to comply, but gave a document which was useless as a certificate, but expressed his willingness to certify if he were personally released from all responsibility. The contractors applied to the Commissioners to dismiss the engineer and appoint another who would act according to the contract. This the Commissioners refused to do. The jury found that there was collusion. On demurrers: Held that, though the engineer refused to give a final certificate, it was open to the jury to find from his acts and conduct that the work had been completed to his satisfaction. But that the contractor cannot recover from the employer unless it be alleged and proved that the certificate was refused in collusion with the employer. Held also, that an engineer to whose satisfaction work is to be done is not an arbitrator, but a skilled agent of the employer; but that he owes a duty to the contractor as well as to the employer, and is bound to act fairly towards both parties. *Young v. Ballarat Water Commissioners* (1879), 4 Vict. L.R. (Law) 306.

Fraud on the part of an engineer and collusion with the employer may also be sufficient to support an action by the contractor against the engineer alone for damages occasioned by the withholding of a certificate. For instance in *Ludbrook v. Barrett* (1877) 46 L.J.C.P. 798, when, under a building contract, it was a condition precedent to payment that the builder should execute the works to the satisfaction of a named architect: Held, that an action could be maintained against the architect for collusively, fraudulently, and to the injury of the builder, refusing to certify that he was satisfied with the works.

2. *Where Fraud alone is Alleged.*—Where fraud on the part of the employer leading to the withholding of a certificate can be proved, he may be made liable; but he cannot be held liable for the fraud of the engineer, unless he also colluded with him. In the case of *Smith v. Howden Union Rural Sanitary Authority and Fowler* (H.B.C. 151) it appeared that the plaintiff by agreement in writing, dated August 5th, 1885, contracted to construct certain specified sewers for the defendant Union for the price of £2,616, payable on certificates by the engineer of the Union. There was also a clause providing that extras must be ordered in writing. The plaintiff commenced in August, 1885, and though the work was not a success, proceeded according to the specification and following the directions of the engineer, and was not in default when, on July 10th, 1886, the defendants took possession of the works, and excluded the plaintiff. At that time £2,318 only had been paid to the plaintiff.

The plaintiff sued for the balance of the contract price and for money due for extras, part of such extras not having been ordered in writing, and it was found by the Referee that the engineer had *mala fide* and wrongfully refused to certify, but that the defendant Union had not colluded with the engineer; held that the plaintiff's remedy was damages for wrongfully preventing the plaintiff from completing the contract work by wrongfully taking possession, the measure of damages being the amount to which presumably the plaintiff would have been entitled if the work had been completed, and had the engineer thereupon issued such certificates as he ought to have issued. In the result the plaintiff had judgment for a large amount due for extras never certified for. Fraud and collusion will, however, be inferred where the employers know of the engineer's wilful refusal to certify and take advantage of it. Thus in the case of *Kellett v. New Mills U.D.C.* (1900) 2 H.B.C., 329, the plaintiff agreed to do work for the defendants, to the satisfaction of the engineer, and the defendants agreed to pay the plaintiff upon the certificate of the engineer. The engineer never addressed himself to determine and certify, but wrongfully refused, or wrongfully and unreasonably delayed, so to determine and certify, and the defendant took advantage of his refusal and delayed payment. Fraud was not alleged. Held, that the plaintiff could recover from the defendants without a certificate.

Mr. Justice Phillimore said: I think they knew here not merely that their man was not certifying, but that he was going through the process of pretended inquiry, which was almost worse than his refusing to inquire: and I think that

they were bound in those circumstances to have taken some very decided action on their part.

3. *Where the Engineer has shown that he will not be, or is not, impartial.*—Although it is often pointed out in legal text books that a contractor cannot expect absolute impartiality from an engineer on the ground that, when he signs the contract, he knows that the engineer is employed and paid by the employer, yet engineers must show no bias in coming to a decision about a certificate. In *Pawley v. Turnbull*, 1861 (3 Giff, 70), an architect took possession under a forfeiture clause, and finished the buildings. The builder filed a bill against the building owner and the architect, alleging unfair conduct on the part of the architect. Held, that it was necessary for the plaintiff to succeed to have proof of grossly improper conduct on the part of the architect, that the conduct of the architect (without imputing fraud) had not been of that discreet, impartial and fair description which it ought to have been; and decreed payment to the plaintiff of the balance due under the contract, subject to a deduction for non-completion, relieved the builder from liquidated damages, declared the architect's certificate was not binding and ordered both defendants to pay the costs of the suit.

4. *Interference by the Employer.*—The last case in which the contractor is entitled to ignore the provisions of the contract as to a certificate and to sue the employer direct is that in which the employer interferes with the engineer. The question whether there has been such interference is, of course, one of fact for a jury to decide. For instance, where an action was brought by a builder against a building owner under a contract by which the architect's certificate was a condition precedent to payment, plaintiff alleged that the employer, after the work was completed, complained to the architect of alleged defects therein, and told him he should not accept his certificate unless those defects were attended to and remedied. The defendant denied this, and produced evidence to the effect that there had been no communication at all between the defendant and the architect:—*Watkin Williams, J.*, to the jury: "If you think that the architect, acting upon his own judgment, withheld this certificate, you must find a verdict for the defendant. If, however, you are of opinion that the withholding of the certificate was due to the improper interposition of the defendant, and that he prevented the architect from giving his certificate, you must find a verdict for the plaintiff." The jury found a verdict for the plaintiff, *Brunsdon v. Beresford*, 1883, 1 Cab. and El. 125.

It remains to consider other circumstances in which the certificate of the engineer will be regarded as dispensed with. If, for instance, the contractor is prevented from carrying out the work by the act of the employer, or by any act of the engineer for which the employer is in law responsible, the certificate will not be a condition precedent. The following may be cited as illustrations: Failure by the engineer to deliver plans, the absence of which prevents the contractor getting on with his work; dismissal of the engineer, failure to invest the engineer with the necessary authority to grant certificates.

The question whether acceptance of the completed work by the employer operates as a waiver of the certificate is one of fact to be decided in each case.

It is at least clear that mere acceptance of a complete building does not constitute a waiver, because the building being on the employer's land, he cannot avoid taking possession. Thus, where there was a contract between a builder and a building owner, it was agreed that the work was to be done to the satisfaction of the surveyor, upon whose approval payment was to be made by a time fixed. The works were not completed by the time, but were alleged to have been completed within five days afterwards, when plaintiff applied for payment. The building owner refused to pay without the certificate of the surveyor, who declared them incomplete, and refused to certify. In an action by the builder for the contract price, and in the alternative for a *quantum meruit*, the defendant pleaded that he did not dispense with completion within the fixed time, and that the work was not completed to the approval of the surveyor. Held, on demurrer, that both pleas were good. At that time the building owner was in occupation of the house. There being no other evidence but bare possession: Held, that the plaintiff could not



recover in the absence of a certificate, and that the mere fact of the owner's taking possession of his own land, on which the buildings had been erected, did not afford an inference that he had dispensed with the conditions in the contract, or of a new contract to pay for the work and labour actually done.

What is true of a building is also true of works which form the subject of a large contract.

PROCEEDINGS OF INSTITUTIONS.

Yellow Flame Arcs.

By M. SOLOMON, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Birmingham, April 24th, 1912.)

ALTHOUGH it is now over 10 years since the first introduction of the flame arc, there has not been presented to the Institution any paper dealing with this subject. Development has been rapid during the past five or ten years, and the flame carbon has not only been brought to a state of great perfection, but has also been to a large extent standardised. To-day the flame arc stands unchallenged as the most efficient form of artificial illuminant yet produced by man.

There are two respects in which the flame arc lamp differs more or less radically from the open type arc lamp. The first is the more or less universal use of carbons inclined to one another at a slight angle with the arc burning across their lower ends; in the place of carbons arranged vertically one above the other, though this type of lamp is still used in some special cases. This arrangement, rendered possible by the length of the flame arc, contributes to some extent to the efficiency of the flame lamp since it exposes fully the crater of the positive carbon. The second characteristic of the flame lamp is the use of the economiser; this is the inverted bowl in which the arc burns. The economiser acts as a good reflector above the arc and retards the rate of consumption of the carbons; in addition, it greatly assists the steady burning of the arc by the way in which it partly confines the flame and corrects to a certain extent irregularities in the burning of the carbons. The shape of the economiser varies in different lamps, but in all the same end is attained that the red-hot tips of the carbons are situated in an atmosphere which has been partly robbed of its oxygen; as a result the carbons burn away more slowly, but in addition the economiser tends to make them burn away at equal rates. For if one carbon burns more slowly than the other, its point will project beyond the base of the economiser into the atmosphere richer in oxygen, and its rate of burning will be accelerated.

Apart from these two features, the flame arc lamp does not differ materially from the open type arc lamp. In many respects, indeed, the flame arc presents a much simpler problem to deal with than the ordinary arc. The great length of arc which renders possible the use of magnetic control of the arc itself, the fact that slight variations of voltage are naturally of less importance when the arc length is 10 to 15 mm. instead of only 2 mm., and the fact that small changes in the length of arc are without so great an effect on the volume of light have, indeed, led to the development of arc lamps of much simpler construction. Another noticeable feature in the history of the flame lamp during recent years has been the perfecting of the magazine lamp.

The flame carbons originally patented by Bremer were solid carbons made from a homogeneous mixture of carbon and colouring material. This type of carbon has not, however, proved satisfactory in practice mainly on account of the difficulty of preventing the formation of slag on the tip of the carbon during burning. The real advance due to Bremer is, therefore, the demonstration of the gain in efficiency to be obtained by incorporating fluorides in the carbon, and the discovery of the most suitable percentages of fluoride to use.

The standard flame carbon in use to-day is simply a cored carbon having a core of special composition. The outer shell is pure carbon made from the same material as the carbons used in open or enclosed type arc lamps. This material is a mixture of finely-ground gas retort carbon and lampblack, or soot; these materials are mixed with tar as a binding agent, pressed into tubes under great pressure, and baked at a high temperature. High-grade open-type carbons are made from a base mixture containing 70 to 80 per cent. of soot, and low-grade carbons (the standard in use in this country) from base mixtures containing 30 to 50 per cent. of soot. The advantages of the high-grade carbons are increased efficiency of the light, steadier burning, and the production of less residue during burning; the disadvantages are higher cost and shorter burning hours. Nearly all manufacturers make the shells of their flame carbons from a high-grade "soot" mixture.

The figures in Table I for the diameters of the cores are correct for the carbons made by my own company, but will be found to vary slightly in carbons of different makes. The table brings out a point of the first importance—namely, that the diameter of the core in a carbon used as a positive in a direct current lamp is considerably larger than that of a carbon of the same size used as a negative; we may at once divide the standard flame carbons into two classes, based on this difference—namely, large core and small-

core flame carbons. In both cases the cores are large compared with ordinary carbons.

The diameter of the core in the large-core carbons is, as will be seen from the table, one-half the diameter of the carbon; its area is, therefore, one-quarter of the total area. In the small-core carbon the core diameter is one-third and the area of the core one-ninth. The size of the core is determined by the current, and the size of the carbon by the necessity for obtaining equal rates of burning for the core and the shell. The diameter of the core should be such that the area of the arc

TABLE I.—DIAMETER OF CARBONS AND CORES USED IN D.C. LAMPS.

	OPEN TYPE LAMPS.				FLAME LAMPS.			
	Positive.— Carbon. mm.	Core. mm.	Negative.— Carbon. mm.	Core. mm.	Positive.— Carbon. mm.	Core. mm.	Negative.— Carbon. mm.	Core. mm.
6 amp.	14	3.0	9	solid	8	4.0	7	2.3
8 "	16	3.5	10	solid	9	4.5	8	2.7
10 "	18	4.0	12	solid	10	5.0	9	3.0
12 "	20	4.5	13	solid	11	5.5	10	3.3

crater is equal to, or slightly larger than, the area of the core; if the crater is much larger there will be a loss of efficiency; if smaller, the arc is likely to wander and to be unsteady. These considerations produce two undesirable results, first, that the rate of burning of the carbons is rapid, and second, that their resistance per unit-length is high. The high lineal resistance is increased by the large diameter of the core, which is itself of very low conductivity. The rapid rate of burning of the carbons is corrected to a certain extent by the economiser; but it is necessary to use long carbons in order to obtain reasonable burning hours with one trim, and the majority of single-carbon flame lamps are constructed for carbons from 16 in. to 30 in. long. This accentuates the second disadvantage of the high lineal resistance, for if a lamp is constructed for 24-in. carbons and current is led into the carbons at their upper ends, as is usual, there will be at the start a fall of voltage along the carbon due to 48 in. of carbon, which will gradually decrease as the carbons burn away. Apart from the loss of power which would occur at the beginning of the test, the voltage available at the arc itself will vary so much from the beginning to the end of the run that a satisfactory arc cannot be maintained throughout. One method which is used to overcome this difficulty is to construct the lamp so that a sliding contact is made to the

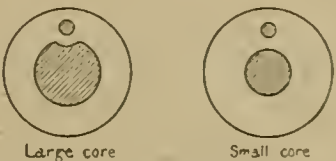


FIG. 1.—CROSS SECTIONS OF METAL-CORED FLAME CARBONS.

carbons where they pass through the base-plate just above the economiser, in which case the amount of carbon between the contacts and the arc is small and constant. This method can only be said to have been partially successful, and the most satisfactory results have been obtained by providing the carbon with a metal core, and coppering the outside of the carbon. Coppered carbons are now less used than formerly, and seem likely to be entirely superseded by metal-cored carbons.

In the metal-cored carbon the increased conductivity is obtained by threading a brass wire the length of the carbon and turning its upper end down the side of the carbon so that there may be direct electrical contact between the lamp-holder and the wire. At first this wire was simply threaded into the core canal, but it is now standard practice to run the wire in a separate channel (fig. 1); the formation of this small hole increases the cost of tools and the difficulty of pressing the carbons, and thus raises their cost; but the advantages gained are considerable. It is most important to be sure, with metal-cored carbons, that direct contact is made in the carbon holder to the flattened end of the wire which is turned down the side of the carbon, as if the circuit—carbon holder to carbon and carbon to wire—is relied upon the contact may be very poor and the benefit of the metal core largely lost. It is also most desirable that the wire should make good contact with the carbon throughout its length, so that the end of the wire nearest the arc is always in electrical contact with the carbon at or very near the actual tip of the carbon. This is obtained by various makers in various ways.

The cores of the carbons manufactured by the writer's company, and those of other manufacturers which he has analysed, contain about 50 per cent. of fluoride, the exact percentage varying slightly. The golden-yellow arc—which is in most general use, and which alone is dealt with in this paper—is obtained from calcium fluoride, the white arc from cerium fluoride and the red arc from strontium fluoride. Neither the white nor the red arc is nearly so efficient as the yellow. The core is made by mixing finely ground carbon and fluoride with a solution of potassium silicate and pressing this mixture into the core canal of the carbon, and drying at a suitable temperature. The secret of successful coring lies more in the composition of the silicate solution used than in anything else, as potassium silicate is a very indefinite compound, the alkalinity of which may vary over wide limits.

With approximately 50 per cent. of fluoride in the core, there will be 12½ per cent. of fluoride in a large-core carbon, and only 5½ per cent. in a small-core carbon.



The additional efficiency due to the flame-producing material in the negative carbon is but slight and is accompanied by a decrease in the steadiness of the arc. Hence it has become common practice to use ordinary core in the negative carbon for direct-current arcs. Thus we get three groups:—

1. Large-core flame-cored carbons (L.C.F.).
2. Small-core flame-cored carbons (S.C.F.).
3. Small-core ordinary-cored carbons (S.C.O.).

The letters given in brackets will be used to indicate to which of these three groups the carbons used in the various tests belong. Further, any of the carbons in the above three classes may be either metal-cored (M.C.); coppered (Cop.); plain (P.).

The author's experience is that the nearest the majority of arc-lamp users can approach to the correct ordering of carbons is to specify the particular make of lamp for which they are required, or else the external dimensions of the carbons, from which the manufacturer is left to determine the correct carbons to supply. For alternating current the two carbons are nearly always the same

50 per cent. off list for plain carbons as fairly representative prices for the largest consumers, we arrive at the costs in Table II.

The flame arc is practically, if not quite, as steady as the open type arc.

Before giving some results of C.P. tests, some reference may be made to the photometric methods adopted.

In order to obtain a candle-power distribution curve, readings are taken every 10° throughout a vertical plane.

Each distribution curve represents the result of between 350 and 400 photometer readings; the curves may, therefore, be regarded as representing with considerable accuracy the typical distribution. To maintain the arc as steady as possible throughout the tests it is run in series with an enclosed lamp specially designed by Mr. Angold, of the General Electric Co., which keeps the current practically constant.

In fig. 2 are given the distribution curves for four different Excello lamps, 6, 8, 10, and 12-ampere respectively. The data from these tests are given in Table III. There is not any great

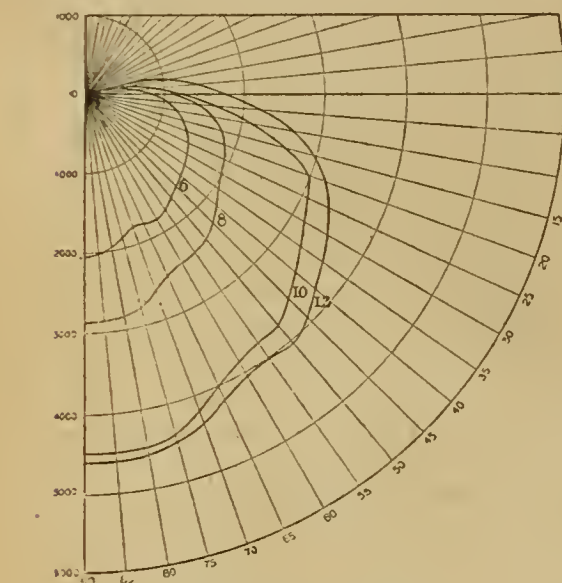


FIG. 2.—DISTRIBUTION CURVES FOR EXCELLO LAMPS, NO GLOBES.

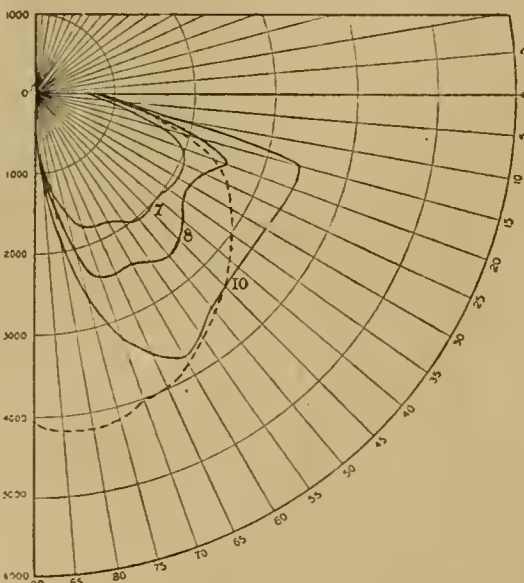


FIG. 3.—DISTRIBUTION CURVES FOR ANGOLD MAGAZINE LAMP, WITH INNER AND OUTER CLEAR GLOBES.

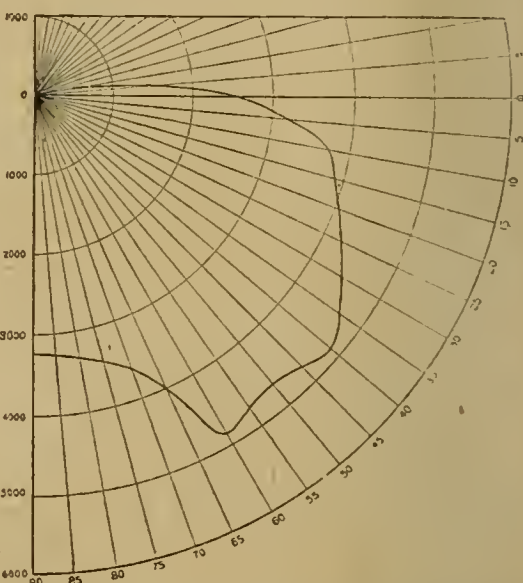


FIG. 4.—DISTRIBUTION CURVE FOR CROMPTON-BLONDEL 10-AMPERE ARC (NO GLOBE).

diameter and are both small-core flame-cored, and it only remains to decide whether metal-cored, coppered; or plain carbons are required. In direct-current lamps there is much greater variety: generally the positive carbon is 1 mm. larger in diameter than the negative, though exceptions exist to this rule. When the carbons are metal-cored the most general combination is a large-core flame-cored positive with a small-core ordinary-cored negative, but one also meets frequently the combination of two small-core flame-cored carbons, and occasionally even a large-core flame-core positive with a small-core flame-core negative, though this is probably the result of a mistake. When the carbons are either coppered or plain the most usual combination is two small-core flame-core carbons, though the use of a large-core flame-core positive and a small-core ordinary-core negative, as with metal-cored carbons, is frequent and on the whole to be preferred.

It is safe to say that only harm results from the variety of combinations in use. The real interests of the lamp-maker and the carbon-maker are alike. The former wants cheap carbons to help his lamp sales, and the latter wants standardisation to enable him to manufacture cheaply. Any lamp which requires special carbons and which cannot be used with the standard types is saddled with a permanent handicap.

In the Blondel carbon there is a very large central core with a very thin outer shell of pure carbon; in a 14-mm. carbon the core is 9 mm. in diameter, and occupies therefore nearly one-half of the area. The percentage of fluoride can be increased in the Blondel core to 60 per cent., or even more, when a distinct gain in efficiency is obtained.

The one test that seems to be of supreme interest to the English carbon user is the rate of carbon consumption. For the last 10 or 15 years it has been possible by the use of high-grade carbons in open type lamps to increase the efficiency of the arc by about 25 per cent. with a diminution of only about 15 per cent. in the burning hours, and an increase of about 4 per cent. in the carbon cost. Nowadays, thanks largely to the real competition of high-pressure gas, and to the imagined competition of high candle-power metal-filament lamps, engineers are paying more attention to the cost per candle-hour than simply to the carbon cost.

TABLE II.—CARBON COST IN PENCE PER HOUR FOR VARIOUS CURRENTS.

		Metal-cored carbons.		Plain carbons.	
6 amperes	...	...	0'181	...	0'126
8 "	...	...	0'206	...	0'144
10 "	...	...	0'228	...	0'160
12 "	...	...	0'256	...	0'181

For general practical purposes the carbons may be taken as burning at the rate of approximately 30 mm. per hour. That means that 600-mm. carbons, allowing for 75-mm. unburnt ends, will give a life of 17 to 18 hours with one trim. It is difficult to work out actual carbon costs, as the prices at which consumers buy vary so greatly according to the quantities purchased, but if we take discounts of 45 per cent. off list for metal-cored carbons and

difference between the efficiencies obtained at the various currents, except that there is a slight falling-off at 6 amperes.

TABLE III.—TEST RESULTS FOR EXCELLO LAMPS. NO GLOBES.

Carbons.		Amperes.	Arc volts.	Watts.	Mean spherical.		Lower hemispherical.	
Positive.	Negative.				C.P.	W./C.P.	C.P.	W./C.P.
L.C.F., M.C.	S.C.O., M.C.							
8 m.m.	7 m.m.	6	44'0	264	778	0'340	1,430	0'185
9 "	8 "	8	44'5	356	1,092	0'326	2,035	0'175
10 "	9 "	10	45'0	450	1,627	0'276	3,087	0'145
11 "	10 "	12	47'0	564	1,895	0'297	3,425	0'169

A series of tests was made with Angold magazine lamps, with the standard globes supplied with these lamps for street lighting. These are an inner and outer clear globe, the shape of the inner globe being specially designed so as to deviate the course of the rays into the angles most useful for outdoor lighting. The distribution curves obtained for 7, 8 and 10-ampere lamps are given in fig. 3, and the test results in Table IV. It will be noticed on comparing these curves with the dotted curve (10-ampere arc with no globe) that the globes reduce the light between the angles from 60° to 90° below the horizontal, part of this reduction being due to the shadow of the ashpan; the radiation between the angles 15° to 60° is relatively increased.

TABLE IV.—TEST RESULTS FOR ANGOLD MAGAZINE LAMPS. STANDARD INNER AND OUTER CLEAR GLOBES.

Carbons.		Amps.	Arc volts.	Watts.	Mean spherical.		Lower hemispherical.	
Positive.	Negative.				C.P.	W./C.P.	C.P.	W./C.P.
L.C.F., P.	S.C.O., P.							
8 mm.	7 mm.	7	42'0	294	896	0'328	1,710	0'172
8 mm.	7 mm.	8	43'5	348	1,114	0'312	2,112	0'165
9 mm.	8 mm.	10	43'0	430	1,471	0'292	2,825	0'152

An experiment was made to test the effect of current on candle-power using the same size carbons; an 8-ampere Excello lamp used with 9-mm. and 8-mm. carbons, i.e., the correct size carbons for the lamp, and was run with a 6, 8, and 10-ampere arc, the mechanism being shunted in the last and the arc is the first case, so that 8 amperes was always passing through the lamp series coils.

The efficiency increases with the current: the watts per candle (lower hemispherical) being for 6 amperes 0'257, 8 amperes 0'211, and 10 amperes 0'171.

The effect of arc voltage on the candle-power and efficiency was tested in a 10-ampere Angold magazine lamp, which was hand-fed to keep the voltage constant at 38, 42 and 47 volts respectively.



Although the candle-power rises with the voltage, the efficiency falls, though the differences are not very great, the figures being (lower hemisphere) 0.156, 0.166 and 0.176.

It would hardly be possible to obtain distribution curves for all the different flame arc lamps on the market; there are, however, certain groupings into which existing flame lamps fall, and it seemed worth while to test representative examples of these groups. There is first the simple single-carbon flame lamp, *i.e.*, a lamp with one pair of carbons only, of which group the Excello is the leading example. The distribution curve of the 10-ampere lamp is given in fig. 2.

Secondly, we have the magazine lamps, of which group the Angold magazine lamp may be taken as representative; the distribution curve for this lamp is dotted in fig. 3, and the test results given in Table V. It will be seen by a comparison of these results with those for the Excello lamp that both in distribution and efficiency there is not very much to choose between the two, and that the advantages for street lighting which the magazine type possesses can be obtained without any material sacrifice of either of these properties.

Thirdly, there is the group of special lamps which have certain unique features, and of these the only two of importance are the enclosed flame lamp and the Crompton-Blondel lamp, a distribution curve for the latter is given in fig. 4. The enclosed lamp was of necessity tested with the inner chimney, and the carbons used were those supplied by the makers and are altogether of

instead of long carbons, which must be either coppered or metal-cored. Trimming costs are saved by the long burning hours obtained with one filling of the magazine, and of late there has been a tendency to push this advantage to inordinate lengths. During the burning of the carbons deposit forms both on the economiser and the globe, and it is obvious that there is not much use in prolonging the interval between trims beyond the limits set by the falling off in candle-power due to the formation of this deposit. A test was carried out on an Angold magazine lamp to see how great this was, and test results are given in Table VI. Standard inner and outer globes were used, and neither the globes nor economiser were cleaned during the test, but the magazine was refilled when necessary. It would appear from this test that a life with one trim of more than about 50 to 75 hours would not be economical.

Care must be taken not to draw too hasty conclusions by comparing the results obtained in different sets of tests; they were carried out at different times, in some cases as much as 12 months apart, and under such circumstances variations were unavoidable.

In endeavouring to arrive at an average figure for candle-power and efficiency of the yellow flame arc from these tests, the best method is perhaps to take the average of the results obtained, Table VII. Combining the figures in the first four lines of this table with the carbon costs per hour already calculated, we arrive at the carbon costs per 1,000 candle-hours given in Table VIII.

TABLE V.—COMPARISON OF DIFFERENT TYPES OF LAMP.

Lamp.	Globe.	Carbons.		Amps.	Arc volts.	Watts.	Meanspherical.		Lower hemispherical.	
		Positive.	Negative.				C.P.	W./C.P.	C.P.	W./C.P.
Excello ...	None ...	10 mm. L.C.F., M.C.	9 mm. S.C.O., M.C.	10.0	45.0	450.0	1,627	0.276	3,087	0.145
Angold magazine ...	None ...	9 mm. L.C.F., P.	8 mm. S.C.O., P.	10.0	43.5	435.0	1,389	0.313	2,725	0.159
Regenerative ...	Chimney only ...	Special carbons		5.5	65.0	357.5	779	0.458	955	0.374
Crompton-Blondel ...	None ...	4 mm. Blondel	9 mm. cored, open type	10.0	39.6	396.0	2,231	0.178	4,177	0.095

special construction: the arc wanders considerably and the current varies from 5 to 6 amperes, the voltage varying from 60 to 70 volts. The carbons are vertically one above the other, and the arc is in the centre of the globe, so there is considerable radiation above the horizontal; consequently the comparison on the basis of lower hemispherical candle-power is unjust to this lamp, as in practice reflectors would be used to utilise

TABLE VI.—LONG-HOUR TEST OF ANGOLD MAGAZINE LAMP. CLEAR INNER AND OUTER GLOBES.

Carbons: Positive, 9 mm. L.C.F., P. Negative, 8 mm., s.c.o., P. 10 amps., 43 volts.

Hours run.	Mean spherical.		Lower hemispherical.	
	C.P.	W./C.P.	C.P.	W./C.P.
0	1,471	0.292	2,825	0.152
25	1,439	0.299	2,725	0.158
50	946	0.455	1,812	0.237
100	860	0.500	1,602	0.268
125	605	0.711	1,130	0.381

the light in the upper hemisphere. The comparison on the basis of mean spherical candle-power is a truer criterion of the value of this lamp; although the lamp does not stand high in this respect, the long carbon life must be remembered, and it is probable that in any enclosed flame lamp efficiency will have to be sacrificed to this end just as it has to be sacrificed in pure carbon lamps when

TABLE VII.—CANDLE-POWER AND EFFICIENCY OF YELLOW FLAME ARCS. BARE ARCS: EFFICIENCY OF ARC ALONE.

Current and lamp.	Mean spherical.		Lower hemispherical.	
	C.P.	W./C.P.	C.P.	W./C.P.
Inclined carbon, 6 amperes	740	0.36	1,370	0.19
Inclined carbon, 8 " "	1,050	0.34	1,910	0.19
Inclined carbon, 10 " "	1,520	0.29	2,920	0.15
Inclined carbon, 12 " "	1,960	0.29	3,490	0.16
Regenerative, 5.5 " "	780	0.46	960	0.37
Blondel, 10 " "	1,400	0.28	2,680	0.15

an enclosed arc is used. In the Crompton-Blondel lamp the carbons are also arranged vertically, the positive flame carbon being the lower one; but an economiser is used, the negative carbon just projecting into it, so the distribution is nearly all below the horizontal and the curve is similar to that of an inclined carbon lamp except where the shadow of the lower carbon cuts off the light between the angles of 60° to 90°. It is interesting to draw attention to the very high candle-power and efficiency obtainable with this type of carbon.

The object of the magazine lamp is to save carbon and trimming costs. Carbon costs are saved by the use of short plain carbons

It will be seen that the carbon costs are very low per 1,000 candle-hours, and if similar calculations are made for open type carbons they will be found to be almost exactly equal to the cost of metal-cored carbons. The actual running costs are obtained by adding these carbon costs to the cost of energy and trimming and depreciation allowances. Whatever the conditions may be, no other electrical light source will be found a possible competitor of the yellow flame arc where large light units can be used.

The majority of the results published apply to bare arcs, and, of course, in actual practice allowance must be made for loss in globes.

TABLE VIII.—CARBON COSTS IN PENCE PER 1,000 CANDLE-HOURS. BARE ARCS.

Current.	Metal cored carbons.		Plain carbons.	
	Mean spherical.	Lower hemispherical.	Mean spherical.	Lower hemispherical.
6 amps....	0.244	0.132	0.170	0.092
8 amps....	0.196	0.108	0.137	0.075
10 amps...	0.150	0.078	0.105	0.055
12 amps...	0.131	0.073	0.092	0.052

It is eminently desirable that some really comprehensive tests on this subject should be made, and, if possible, some system of grading arc lamp globes according to their absorption devised, so that when buying either lamps or new globes, one could be more or less certain that one was getting an article which did not destroy all the efforts after efficiency of the arc lamp and carbon makers.

DISCUSSION.

DR. W. E. SUMPNER drew attention to the fact that, owing to internal reflection, more light was actually absorbed by the globe than would otherwise be the case.

MR. W. E. MILNS said that the flame arc was the great weapon of electricity against high-pressure gas. It had, however, the following drawbacks: (1) Its first cost was much higher than that of the high-pressure gas lamp; (2) it was usually necessary to burn four or five lamps in series to secure the greatest economy; (3) the lamps became obsolete after two or three seasons' use. These drawbacks accounted for the growing use of high-pressure gas lamps. It should be emphasised that quality in the lamp was important. Not all flame arcs had satisfactory mechanism, nor was the mechanism always adequately protected. On the question of costs of illumination, the following figures were obtained from a local flame arc lamp experiment. Ten 7-ampere magazine flame lamps, five in series on 220 volts, were being run in competition with 10 twin mantle "Keith Blackman" high-pressure gas lamps. The approximate maximum candle-power from the arc lamps totalled 16,400, the current consumed by them amounted to 3.1 units per hour. The maximum candle-power obtained from the gas lamps totalled 6,600, the consumption being at the rate of 170 cb. ft. per hour. Taking electricity at 2d. per



unit, and gas at 1s. 10d. per 1,000 cb. ft., this showed a cost of approximately 0.38d. per 1,000 C.P.-hours for flame arc lamps, and 0.57d. per 1,000 C.P.-hours for high-pressure gas mantles. The candle-power from flame arc lamps was practically constant, whereas the candle-power from high-pressure gas fell off rapidly, and was affected to a very great extent if the mantle was torn or not properly hung. A 50 per cent. variation in candle-power could be accounted for by either of these causes. Dealing with the cost of maintenance, observation showed that the average life of a high-pressure gas mantle was 80 hours, while the arc lamps referred to burnt approximately 80 hours for one trim. The attendance charges were approximately the same. The cost of carbons per trim worked out at 1s. when bought in quantities; the cost of mantles bought in quantities was the same. The maintenance charges were therefore equal, excluding the labour of lighting and turning off. High-pressure gas was never debited with the cost of low-pressure gas on the by-pass, which amounted to approximately 3 cb. ft. per by-pass per hour. Actual tests proved that they need not fear the competition of high-pressure gas, but they should not allow their customers to be misled by the misstatements of candle-power usually given by the manufacturers of high-pressure gas lamps.

MR. A. T. BARTLETT said he found that the cost of high-candle-power metal-filament lamps per 1,000 C.P.-hours came out roughly the same as that for carbons for flame arcs, the advantage being slightly in favour of the former. In arriving at this result the lower hemispherical candle-power was taken, and an allowance of 25 per cent. due to loss in globes; also the working voltage of 50 volts per lamp was taken, instead of the 44 across the arc. The watts per candle-power worked out two or three times greater for the metal filament. Distribution of light must, however, be considered; the disadvantage of metal-filament lamps would be reduced in some cases by the adoption of a larger number of smaller units.

MR. A. E. BREWERTON could not agree that the burning hours of the magazine lamps were necessarily restricted to from 50 to 70 hours; that the amount of deposit depended upon the ventilation was exemplified by the "deposit-free globes," and, therefore, tests taken on one lamp could not be said to hold good for another. One maker of magazine lamps was placing a 120-hour lamp upon the market. Shopkeepers often preferred a red globe which absorbed a large proportion of the light, as it then appeared wholly incandescent from a distance, and this might be better for advertising purposes than an efficient illuminating medium. In designing any arc lamp globe where a dioptric was not employed, the starting point should be to make it as nearly hemispherical as possible with the arc at the centre. Any arc lamp globe would increase in density as time went on, owing to the attack of hydrofluoric acid, so that with any attempt to bring about the proper use of globes, it was not only necessary to see that the consumer bought the right grade, but that he discarded the old ones when they became too dense.

MR. LINDSAY FORSTER referred briefly to an enclosed long-burning arc with flame carbons which had recently come to his notice. Both carbons were coreless, and were placed concentrically and vertical, the volts across the arc being about 100. The lamp was constructed with an annular cooling chamber of thin copper, the idea being that there was sufficient circulation to carry the vapour given off by the arc into the cooling chamber, where the fluorides would be deposited.

MR. SOLOMON, in reply, said that if the candle-power was first measured with, and then without, the globe, the actual amount of light lost could be determined. Such measurements, in his opinion, could only be made satisfactorily with a spherical photometer. Mr. Milns's comparison being made on the basis of maximum candle-power seemed to lose some of its value. He agreed that the cost of carbons was approximately the same as the cost of renewals of metal-filament lamps. Comparing in each case an installation of 1,000 mean spherical candle-power, allowing for absorption by globes and for 50 volts per lamp in the case of the arc lamps, he found that the cost per year (4,000 burning hours) for carbons and depreciation came to £4 10s., and for new metal-filament lamps and depreciation to fittings, to £3 16s. As regards trimming and attendance costs, these might be estimated at £2 for the arc lamps and 10s. for the metal-filament lamps. These two items left a balance of £2 4s. per year in favour of the metal filaments. Against this the cost of energy at 1d. per unit would be slightly under £7 for the arc lamps, and slightly over £18 for the metal-filament lamps, leaving a balance of about £10 in favour of the arc lamps. It would thus be seen that the cost of using metal-filament lamps for street lighting, where 1,000 C.P. units might be required, was much dearer than using yellow flame arc lamps. The comparison was still less favourable to metal-filament lamps if it was made on the basis of lower hemispherical instead of mean spherical candle-power, as the metal-filament lamp would lose considerably by the use of a reflector. Where much smaller light units were required, metal-filament lamps might be satisfactory, but it would be found that arc lamps could be installed for the same maintenance cost, giving better illumination.

### The Brain as an Electrical Organ.

"THE pedagogue of the future will have to be something of an electrician," said DR. W. DEANE BUTCHER, in the course of a striking address at the RONTGEN SOCIETY, on May 7th, on the subject of the brain as an electrical organ. The analogy between a nervous and an electrical system has been remarked before, but seldom pressed home to such an extent as by Dr. Butcher. The ordinary physical forces which we called vital, the forces of

osmotic pressure, of diffusion, and the like, he said, were capable of producing electric tension or potential. An electrical current of action accompanied every contraction of the heart and every motion of the brain, and the shock of a brain that was angry would be felt, if our senses were keen enough, exactly as a shock of electricity. Even the picture of a nerve cell, as he pointed out by means of Prof. Ramon y Cajal's remarkable drawings, possessed a likeness to the ordinary galvanic cell. The nucleus was insulated from the surrounding protoplasm, and the protoplasm was itself enfolded in a second insulating sheath, which was continued along the nerve-trunk and gave it all the appearance of an electric cable. Just as in the early experiments on electricity, observers joined hands in order to conduct the electric shock from one to another, so did these cells join hands to conduct the currents of sensation and motion. And did not the diagram of a synapsis—the junction between two adjacent dendrons or afferent processes of a nerve cell—remind them of the coherer, with its varying resistance, as used in wireless telegraphy? Every thought, breath, muscular contraction and beat of the heart sent streams of electrons pulsing through the body by way of the branching electric cables. A living galvanic cell consisted essentially of a colloidal solution contained in a semi-permeable membrane, and in order that it might work properly it must be kept immersed in an electrolytic solution to a constant degree of concentration. The solution, in the shape of lymph and blood, was so constant in its composition and unvarying in its concentration that it might be called nature's electrolyte. Dr. Butcher proceeded to show how the hypothesis of the brain as an electrical organ would affect education, particularly in the direction of cultivating the power of attention and of acquiring habit? What was the mechanism of habit? A certain spot in the brain cortex was excited in some way, the excitation spreading along a devious and zigzag path to another spot in the brain cortex, and this passage of mental and nervous stimulus evidently diminished the electrical resistance from nerve-cell to nerve-cell of the intervening path. Therefore, a similar excitation made subsequently would be most likely to travel along the same course, just as in a lightning discharge from a cloud the ionisation of the intervening atmosphere caused the zigzags of the reverberating discharges to follow that path for preference.

### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"KIM" writes: "There are a number of electricity works such as ours that supply their customers with such incandescent lamps as they may from time to time need. The only other people in the town supplying similar lamps are the ironmongers. Now these traders have applied for a closing order under the new Shops' Act. Seeing that all other suppliers of electric lighting accessories are closing early on Thursday in each week, are we under this Act regarded as shopkeepers? Must we close our stores on that day? As two of the electricians on duty in the works (on separate shifts) are the ones who supply the lamps, how are they affected? If we give them a holiday, it would be necessary to shut down the supply of electricity. Also, all the other traders agree to close at 7 o'clock on other days; must we close our stores as well? Attending to the stores takes but a very small percentage of employes' time.

\* \* \* There is nothing in the Shops Act, 1911, to indicate that there is any procedure by which "Kim" can be exempted. It is expressly provided that "Every shop shall, save as otherwise provided by this Act, be closed for the serving of customers not later than 1 o'clock in the afternoon on one weekday in every week." This is the general rule. Sec. 2 (4) prescribes a procedure by which in certain events the majority of the shopkeepers of any particular class can secure a modification of the Act, or even an abandonment of the early closing altogether: but there would seem to be little hope of "Kim" effecting this. So far as closing before 7 o'clock is concerned, this seems to be optional. "Kim" can keep his shop open as long as he chooses, wholly irrespective of anything that may be done by his rivals in trade.

"OHMIC" writes:—"A small public electric supply undertaking, which has been in operation some 12 months decided to apply to the Board of Trade for a provisional order. The compulsory area is to be taken where the mains are already run. The whole of the mains and plant have been erected to the requirements of the Board of Trade. The company are working under the consents of the Board of Trade and the local authorities. Other outlying districts are to be included in the area.

"We should like to know if the undertakers would be under a penalty to give a supply to the outlying districts within any prescribed period of time, or would the said powers be revoked? Sec. 25 of the Electric Lighting Acts, 1909, seems to infer that the undertakers would be under an obligation to run mains and give the supply within those outlying areas within the prescribed time, or otherwise have the powers revoked."

\* \* \* It is clear from Sec. 25 of the Act of 1909 that "area of supply means any area within which any local authority, company, or person is authorised to supply electricity." This Act, however, does not confer upon the Board of Trade power to revoke



an order; but this power is given by Sec. 23 of the Schedule to the Electric Lighting Clauses Act, 1899, which is generally incorporated with every provisional order. It provides that "if the undertakers, not being a local authority, make default in laying down any distributing mains in accordance with the order within the periods prescribed in that behalf respectively, they shall be liable for each default to a penalty not exceeding £5 for each day during which the default continues; and if the Board of Trade are of opinion in any case that the default is wilful and unreasonably prolonged they may, after considering any representations of the local authority, deal with the special order in manner provided by this section." Unless there is something in the order to exempt "Ohmic" from this provision it would seem he must be liable to the penalty.

"B. M. R." writes:—"In the Bill obtained by a municipal authority for their electricity undertaking, the Northumberland Clause has been inserted, which states that there shall be a triennial consideration of the financial state of the undertaking, to revise if necessary the scale of prices charged for energy, so that, as far as possible, there will be no contribution from the rates of the town for the purpose of defraying the future expenses of the undertaking during the next three years. Clause 3 then goes on to state:—

"Nothing in this Section contained shall prevent the Corporation from entering into contracts for periods which may extend beyond the periods at which any revision may take place under the provisions of this Section, on special terms under special circumstances not applicable to ordinary consumers, but each such contract shall provide that the price to be charged for energy supplied under such contract shall either—

"(a) Be subject to revision at the next triennial revision provided for in this Section; or

"(b) Vary in the same proportion as the prices charged to ordinary consumers,

"Provided that the Corporation shall not, without their consent, be required to accept any price lower than the minimum price mentioned in such contract."

"Supposing the Corporation contract to supply a large consumer at, say, 1d. per unit, on a 10-years' agreement, the present price for electricity to ordinary consumers being 6d. per unit, and suppose in a year's time the municipal authority lower the price of current to 4d. a unit, without, however, giving the large consumer any reduction, then if, at the end of three years, owing to the undertaking not paying its way, it becomes necessary to increase this price of 4d., would the municipal authority be bound to increase the price charged to the large consumer in the same proportion, or need they not do this until the price is raised over the original figure in existence to ordinary consumers (6d.) when the contract was first entered into?"

\* \* It is clear that the contract to supply electricity to the large consumer must contain one of two alternative provisions for the protection of that consumer. Either the price must be revised at the next triennial revision, in which case the large consumer gets the benefit of a revision, or it must vary in the same proportion as the prices charged to ordinary consumers, and the variation will apparently be operative at any time when the charges to ordinary consumers are varied. Assuming that the first alternative is adopted, it would seem that the supply authority would have power to raise the price in the manner suggested, although the large consumer had not been given the benefit of the previous lowering. Nevertheless, it is probable that the authority which have a judicial discretion to arrange the terms of revision would regard such treatment as inequitable and deal with it accordingly. If the second alternative is adopted, no difficulty would arise, because then the price chargeable to the large consumer would vary automatically with the price charged to the small consumer.

**The "Gardener Electrician" Again.**—The simplification of machinery is proceeding to such an extent that skilled attention is popularly supposed to be almost eradicated, and hence the domination of the "gardener-electrician" type of individual in the case of small lighting installations is becoming painfully recurrent. It must not, however, be supposed that such individuals, even if they are destitute of a college education, are entirely deficient in the sense of originality, and it sometimes occurs that an opportunity arises for the display of the aforesaid ingenuity and resource. Gas and oil engines are usually supposed to be fairly simple to operate, but the following instance will show how, even in the most simple situations of life, there is an opportunity for going wrong. In this case an oil engine of about 10 H.P. was installed in order to drive a small lighting dynamo, and as the the lighting load only reached its maximum occasionally, the engine was usually under light load during most part of its useful and happy existence. The attendant, who fulfilled various functions, including that of engineer-in-charge of the installation, discovered that there was a certain amount of irregularity in governing the speed at light loads, and instead of searching for the true cause of the trouble, he conceived the happy idea of equalising the load on the engine throughout its run. This simply consisted of arranging a thick plank in the form of a brake upon the flywheel in order to take up about 8 H.P., and, needless to say, the arrangement was quite effective in keeping the speed of the engine within reasonable limits. The idea is recommended to those engineers in our midst who are wrestling with governing problems upon fluctuating loads, as being one which might with very great advantage be—avoided.

## EXPIRING PATENTS.

(Concluded from page 799.)

21,550. October 13th, 1898. (Date claimed under Sec. 103 of Patents Act of 1893, March 17th). "Controlling electrically-propelled trains." W. B. POTTER. Relates to master-controller arrangements for the motor and brake controllers on electrically-propelled trains, whereby the latter are synchronously actuated. For this purpose the subsidiary controllers are driven by electromotors, and their motion is limited by stops which are successively withdrawn as the master-controller is turned.

21,759. October 15th, 1898. (Date claimed under Sec. 103 of Act of 1893, March 31st). "Controlling electrically-propelled trains." W. B. POTTER. Relates to means for instantaneously interrupting the circuit on all the motor vehicles from a single point on the train, especially in those arrangements where the motor controllers are worked from a master controller. All the collectors are connected by a common wire to obviate temporary loss of current in any one of them, and provision on each car of a switch of the automatic type operated by an overload or by an underload.

22,545. October 26th, 1898. "Automatic telephone exchanges." W. P. THOMPSON. (Strowger Automatic Telephone Exchange, U.S.A.). Relates to an automatic exchange for telephonic working in which each subscriber is provided with a selecting apparatus consisting of grouped contacts divided into groups of 10 bars, each bar being curved and having 10 contacts. The contacts are acted upon by radial wipers rigidly mounted but insulated on a shaft which is operated by a circular feed-rack for longitudinal movement, and by an elongated pinion for rotary selection. The pinion carries an arm which engages with one of the pegs of the subsidiary switch of which the pegs agree in number with, and are connected by, wires to the wiper arms.

22,700. October 26th, 1898. "Tubes or conduits." H. EDMUNDS. Conduits for electric conductors are formed of Portland, &c., cement lined with bitumen, &c.

22,768. October 29th, 1898. "Sound magnifying apparatus." H. L. SHORT. Relates to methods of increasing the volume of sounds produced by electric or other instruments. The principle involved consists in operating some form of valve so as to vary the passage of compressed air, steam, etc., in accordance with the vibratory motion of a diaphragm, &c., acted upon by the voice or by a phonograph cylinder or disk, &c.

23,265. November 5th, 1898. "Electric lamps." E. J. PRESTON and J. STONE & Co. Relates to incandescent electric lamps. Parts of caps are pressed in to afford additional hold for the plaster filling. The depressions so made may have the form of bayonet slots to engage parts pressed in on the holders.

23,750. November 11th, 1898. "Electrodynamic relays." S. G. BROWN. Relays for telegraph and telephone working are constructed as generators in which the inductive effect is neutralised by dividing the magnet poles into pairs, and so crossing these that pairs of reversed poles are obtained and no current generated in the armature.

24,277. November 17th, 1898. "Looms." W. P. THOMPSON. (F. E. Kip, U.S.A.). Relates to warp stop motions controlled by electricity in which an electric circuit is closed by the falling of a drop normally supported by the warp thread, the object here being to free the shipper lever without disturbing the knock-off lever.

24,404. November 18th, 1898. "Electric conductors." L. HACKETHAL. Conductors are insulated with a woven fibrous coating impregnated with a mixture of red lead or litharge and linseed oil. The two wires of an overhead metallic circuit are attached to one insulator, and are arranged to cross.

26,420. December 14th, 1898. "Cut-outs." C. M. DORMAN and R. A. SMITH. Relates to the arrangement of the fusible wire in the support of removable fuses to prevent arcing, &c. The insulating support has an obstruction in the centre. The fuse wire is led past the obstruction through small holes which open externally, and is connected at its extremities to the terminals.

27,390. December 28th, 1898. "Coin-freed apparatus." C. D. ABEL. (Soc. Anon. Continentale pour la Fabrication des Compteurs a Gaz et Autres Appareils, Paris.) Relates to coin-freed electric meters. A horizontal fork joined to a crank on the rock shaft of a switch and resting upon a fixed pin is drawn so as to close the circuit when a disk having a recess to engage a pin on the lower arm of the fork is turned after prepayment. The disk is reversed at a rate depending on the operation of an escapement anchor by the electric meter. The disk is turned proportionately to the payment.

**The Present Position of the Copper Market.**—The writer of an article in the *Times* of April 22nd expresses the opinion that the general position of the copper market is at present stronger than it has been for the past four years. In 1907, he points out, the unusually high price of copper (£113) was due to the supply being unequal to the demand, resulting in customers outbidding one another, thus forcing up the prices and creating a generally unhealthy state of affairs, which disturbed conditions for four years, the price falling off badly till it reached £50.55, at which figure it remained for some time. Following on this, the consumption of copper increased steadily, even making inroads upon the stocks which had accumulated during the slack period.

The writer proceeds to note the state of stocks in June, 1910, when they were 75,172 tons in the United States and 103,957 tons in England or France (and afloat), while by March 31st of this year they were only 27,843 tons in America, and 50,175 tons in Europe. The production is at present increasing, and everything, in his opinion, points to a period of healthy copper industry.

The quotations for copper shares, especially Americans, have been rising, though somewhat unevenly. This, however, is not surprising, seeing that four out of the five leading copper producers are American, only the Rio Tinto being under European control. Owing, he observes, to the fact that information as to progress and profitability of the European-controlled companies is more easily obtainable than is the case with those under American control, the home investor prefers to deal with the former. The Rio Tinto holds the fourth position for production among the large copper mines of the world.

The article goes on to mention Mount Elliot, Great Cobar, Spassky, and Abbasir (Siberia), as promising concerns under British control, and especially speaks favourably of the Whim Well Mines in Western Australia, and the properties of the Messina Transvaal Development in the Northern Transvaal.



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 10,070. "Homopolar dynamo." P. HYNES. April 29th.  
 10,092. "Apparatus for winding incandescent electric lamp filaments on their supports." Soc. FRANCAISE D'INCANDESCENCE PAR LE GAZ. (Système Auer.) (Convention date, May 1st, 1911, France.) April 29th. (Complete.)  
 10,098. "Device for securing and locking together incandescent electric lamps and holders." G. BREKETON and P. BREWER. April 29th.  
 10,113. "Phase compensation of dynamo-electric induction machinery." AKT.-GES. BROWN, BOVERI ET CIE. (Convention date, April 29th, 1911, Germany.) April 29th. (Complete.)  
 10,116. "Cylindrical electric accumulator." P. KLIVER. April 29th. (Complete.)  
 10,120. "Electrical-impulse transmitters." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) April 29th. (Complete.)  
 10,137. "Flame arc lamps." G. E. TATE and F. O. MONKHOUSE. April 29th.  
 10,167. "Trolley head." F. C. LENTON. April 30th.  
 10,182. "Electric lamps." R. O'BRIEN. April 30th.  
 10,183. "Electric photographic printing or copying frames." J. B. HALDEN. April 30th.  
 10,208. "Automatic block-signalling systems for railways." A. E. WHITE. (H. Carson, United States.) April 30th. (Complete.)  
 10,209. "Magneto current generators." E. PODLESAK. April 30th. (Complete.)  
 10,243. "Electric arc lights." J. BILLITER and GENERAL COMPOSING CO., G.M.B.H. (Addition to 15,474, 1911.) April 30th. (Complete.)  
 10,294. "Electric signalling systems." R. HACKING. May 1st.  
 10,297. "Electrical heating and cooking apparatus." G. W. L. PATTERSON. May 1st.  
 10,338. "Electrical contacts and methods of making the same." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 1st.  
 10,346. "Bulbs for electric glow-lamps." H. GETHE and G. "HANSA," G.M.B.H. May 1st. (Complete.)  
 10,360. "Construction of electric bell push." A. BONELLA. May 1st.  
 10,361. "Operation of flash lamps for photography." H. E. HULL. May 1st.  
 10,364. "Combined intercommunication and exchange telephone systems." TELEPHONFABRIK. AKT. GES. VORM J. (Convention date, May 11th, 1911, Germany.) May 1st. (Complete.)  
 10,366. "Clutches and driving mechanisms particularly adapted as slow motion gears for the operation of starting devices for electric motors." J. H. WOOLLISCROFT and H. T. BOOTHROYD, LTD. May 1st. (Complete.)  
 10,372. "Electric signalling in mines." W. S. TOPPIS, W. J. H. PORTER and W. LLOYD. May 1st.  
 10,376. "Telephone systems." T. G. MARTIN. (Convention date, May 1st, 1911, United States.) May 1st. (Complete.)  
 10,383. "Adaptable transport trolley for electric light and power pendants and the like." A. RIDER. May 2nd.  
 10,409. "Fusible cut-outs." C. M. DORMAN, R. A. SMITH and H. G. BAGGS. May 2nd.  
 10,417. "Altering current generators." J. G. SHAW and C. R. SHAW (trading as Crypto Electrical Co. and H. G. Sharp). May 2nd.  
 10,431. "Automatic signalling arrangement for tramway lines or electric railways." D. SAMARA. May 2nd. (Complete.)  
 10,444. "Impulse transmitter for semi-automatic telephone systems." SIEMENS & HALSKE AKT.-GES. (Convention date, May 2nd, 1911, Germany.) May 2nd. (Complete.)  
 10,490. "Radio-action and arrangements therefor." G. J. EPSTEIN. May 3rd.  
 10,496. "Electric flame arc lamps." F. W. E. SCHUER. May 3rd.  
 10,501. "Wireless telegraphy apparatus." W. S. PEAKE. May 3rd.  
 10,507. "High speed rotors for electrical machinery." R. GOLDSCHMIDT. (Convention date, May 4th, 1911, Germany.) May 3rd. (Complete.)  
 10,528. "Oil break electric switches." R. H. BAROUR and T. G. TAVIS. May 3rd. (Complete.)  
 10,539. "Automatic telephone systems." SIEMENS BROS. & CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 3rd. (Complete.)  
 10,541. "Electrodes for primary or secondary batteries." A. HEIL. (Convention date, May 9th, 1911, Germany.) May 3rd. (Complete.)  
 10,545. "Protective devices for electric distribution systems." BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. May 3rd.  
 10,555. "Electric ignition devices for internal combustion engines." M. A. CODD. May 3rd.  
 10,558. "Controlling or actuation of clocks, or other indicating or recording mechanism by electric, wireless, or other waves." E. V. GRATZ. May 3rd.  
 10,559. "Compound electric switch." C. S. SYER. May 3rd.  
 10,599. "Gear for automatically reversing electric-motors employed for driving machines and the like." J. P. HALL. May 4th.  
 10,616. "Telephone receivers." J. PARR. May 4th. (Complete.)  
 10,619. "Electro-magnetic separator for the wet separation of ores." ELEKTROMAGNETISCHE GES.M.B.H. (Convention date, May 4th, 1911, Germany.) May 4th. (Complete.)  
 10,651. "Electric water heater." G. F. F. DAVIS. May 4th.  
 10,654. "Electric motors." S. & J. L. MOTORS, LTD., and T. L. R. COOPER. May 4th.  
 10,655. "Dynamo-electric machines." S. & J. L. MOTORS, LTD., and H. B. POYNTER. May 4th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1910.

REGISTERING OR TOTALLING MECHANISM OF INTEGRATING ELECTRICITY METERS AND OTHER INSTRUMENTS. W. H. JOHNSON and A. M. BILLINGTON. 19,075. August 13th. (March 11th, 1911.)

## 1911.

TELEPHONE EXCHANGE SYSTEM. P. JENSEN. (Clement International Engineering Corporation.) 9,142. April 12th.

DEVICES FOR STARTING AND PROTECTING ELECTRIC MOTORS. Wolseley Sheep Shearing Machine Co. and H. E. Brewerton. 9,176. April 18th. (Cognate application, No. 15,607 of 1911.)

ELECTRO-CAPILLARY CONTRIVANCES. Orling & Orlings Telegraph Instruments Syndicate. 9,725. April 21st.

ELECTRICAL MEASURING INSTRUMENTS OF THE INDUCTION TYPE. G. North. 9,819. April 22nd.

SILK EXTENSION SHADE FOR USE WITH ELECTRIC OR GAS OPAL SHADES. P. D. COLLINS. 12,017. May 18th.

OPERATING LEVERS APPLICABLE TO GEAR-CHANGING DEVICES, ELECTRICAL CONTACTS AND THE LIKE. R. ACCLES. 12,127. May 19th.

ELECTRICAL REVERSING APPARATUS FOR REMOTE CONTROL. Smith, Major and Stevens, Ltd., C. G. Major and G. Kennard. 12,828. May 29th.

## Wireless Telegraphy in Spain.—The following notes

describe briefly the equipment of the large Spanish stations at Cadiz, Teneriffe, Las Palmas and Barcelona, the inauguration of which was reported in the ELECTRICAL REVIEW of December 1st, 1911. These stations are equipped with the latest Marconi apparatus, and were only taken over after an exhaustive series of trials carried out between July and November last year: the Testing Commission is now engaged (according to *L'Industrie Electrique*) in tests on the smaller stations at Vigo, Aranjuez, Soller and Alicante. The station at Cadiz is situated  $2\frac{1}{2}$  miles from the town, on the sea coast. A large stone building (erected by a company which, some time ago, attempted but abandoned a wireless scheme), has now been equipped and round it have been built four lattice towers carrying the antennae. Fifteen wires are used in the antennae, and the towers, which are 70 m. high, are placed 90 m. apart. A petrol motor drives a dynamo and alternator through belting. The D.C. machine maintains a secondary battery at full charge and can, in case of need, be run as a motor from the latter, then driving the alternator, which, when running at 1,000 R.P.M., 150 cycles, delivers 25 kW. at 350-400 v. The Marconi type of rotary disk sparker is employed, the disk being motor-driven at 800 R.P.M. (then providing a note of 320 cycles per sec. and working with a 2,540 m. wave). A 3-kw. auxiliary equipment works with 300 and 600-m. waves, and is used for communication with ships. Vacuum valve detectors are used for the reception of long-distance messages, and the ordinary magnetic detector is used for reception from ships near by. The station contains living accommodation for the operating staff.

The station at Las Palmas is situated about 16 miles from the town of the same name, and comprises a very handsome stone and ferro-concrete building, erected on rocks. Of the two stories, the upper is reserved for the accommodation of the staff and the lower for the superintendent. Technically, the station is identical with that at Cadiz.

The Teneriffe station is at Santa Cruz, and when erecting it great difficulty was experienced in securing an adequate earth connection. The ground is practically volcanic lava and the climate is very dry, so that it was found necessary to dig a trench 150 m. long and 2 m. deep in which were buried sheets of galvanized iron. Electrical energy is drawn from the Santa Cruz supply station, a D.C. motor being connected to the public mains and direct coupled to an alternator. A petrol motor is installed as a stand-by in case of failure of the central station supply.

Under the terms of the original contract the Barcelona station was to have been erected in the town, but in default of a suitable city site at a reasonable price, the station had to be built  $7\frac{1}{2}$  miles away, on a triangular site enclosed by the village of Prat de Llobregat, the mountains and the sea. The climate is very humid and the locality agricultural and practically cut off from communication with the outside world (except, of course, by way of the new wireless station). Apart from the great loss which Barcelona has incurred by allowing the station to be built outside her boundaries, it does not appear that the actual site is very suitable, particularly as regards the neighbouring mountains, which must screen the station in certain directions. The station building is of stone and iron erected on arches: it is of one story only, and contains good living accommodation for the operators. Three distinct antennae are provided; the main aerial is of the Tee form with six wires in each branch, and there are also separate aeriels for the despatch and reception of messages to and from ships. The masts are of steel tubing, and rest on cement foundations carried by piles: the central mast is 84 m. high, and the four secondary structures are 40 m. in height. The generating equipment comprises a large petrol motor, direct coupled to a dynamo: a storage battery: and a motor-generator coupled to a disk sparker of the latest type. The alternator provides current at 150 cycles per second, and eight large condensers in galvanized iron tanks provide long wave lengths for long-distance work, while four other condensers yield the shorter wave lengths. Two types of detector are used, as before.

These four stations place Spain high in the scale of nations arranged according to wireless development. The guaranteed range of the four large stations is 1,800 km., and of the four smaller stations 800 km.: their geographical position is such that the stations must play an important part in the wireless traffic of the Mediterranean. The station in the Canaries will have much traffic with vessels bound for South Africa, Australia and Central America. The Barcelona station will regularly interchange messages with Marseilles, the Balearic Isles, Aranjuez and the new Coltano station (Gulf of Genoa). Within the range of the Cadiz station will be the stations at Las Palmas, Aranjuez (near Madrid) and Vigo, while the Teneriffe and Las Palmas stations will, for the present, be mainly engaged in forwarding messages between ships at sea and the other stations of the group.



# THE ELECTRICAL REVIEW.

Vol. LXX.

MAY 24, 1912.

No. 1,800.

## ELECTRICAL REVIEW.

## BRITISH v. FOREIGN PLANT.

Vol. LXX.]	CONTENTS: May 24, 1912.	[No. 1,800.
		Page
British v. Foreign Plant ...	...	825
London Street Traffic Obstruction ...	...	826
Employers and Tuberculosis ...	...	826
Edison Battery Cars for London ...	...	826
"Silvertown" and the Electrical Industry ( <i>illus.</i> ) ...	...	827
Legal ...	...	829
Business Notes ...	...	833
Notes ...	...	843
City Notes ...	...	844
Presentation of a Bust of Lord Kelvin to the I.E.E. ( <i>illus.</i> ) ...	...	845
The Dessau-Bitterfeld Single-Phase Railway ( <i>illus.</i> ) ...	...	846
Stocks and Shares ...	...	856
Market Quotations ...	...	856
Share List of Electrical Companies ...	...	857
An Electric Locomotive with the Auvert-Ferrand Rectifier ( <i>illus.</i> ) ...	...	859
Trade Statistics of Italy ...	...	860
Proceedings of Institutions:—		
The Faraday Society ...	...	860
High-Frequency Currents ...	...	862
The Corrugation of Rails ( <i>illus.</i> ) ...	...	862
The Institution of Electrical Engineers ...	...	864
Correspondence:—		
On Advertising Methods ...	...	865
The Domestic Uses of Electricity ...	...	865
The E.A.C. Automatic Solenoid Starter ...	...	865
Colonial References ...	...	865
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	867
Foreign and Colonial Tariffs on Electrical Goods ...	...	868
New Patents Applied For, 1912 ...	...	868
Abstracts of Published Specifications ...	...	868
Contractors' Column ...	Advertisement pages xxiv and xxvi	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAT, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASNER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly's).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill London, E.C.

We have often commented upon that curious phase of British thought which is revealed in the imposition of wages clauses and similar arbitrary conditions upon manufacturers in this country, followed by the acceptance of a foreign tender. This practice is, of course, confined to municipal transactions, as no business man would dream of forcing up prices against himself by such methods; he would not hesitate to go abroad for his plant, if he were satisfied that by so doing he made a better bargain, but he certainly would not delude himself with the idea that foreign plant was the cheaper, if he himself had been the cause of its *apparent* cheapness. The practice is inspired by the desire for popularity on the part of our municipal representatives—in plain English, the need to catch the votes of the working man, who looks only on the surface and does not realise that he is thus undermining his own position; cause and effect are easily identified in this case.

But another singular tendency has sometimes been observed—and has of late attained unpleasant prominence—a tendency to purchase plant from abroad, even when the prices are level, the quality of the British product above reproach, and the guarantees as good. For this phenomenon we are at a loss to find an adequate explanation. It is, as in the former case, met with only in connection with municipal contracts, and has recently been especially manifest in the repeated purchase of Diesel engines from Continental makers.

As our readers must be aware, the manufacture of this type of engine has been carried on in this country for a period of at least 14 years, during which, according to the inventor, only minor changes have been effected in its design. The business has been taken up by numerous British engine-building firms of the highest reputation—and British engines, as a class, are unexcelled throughout the world. Many British Diesel engines have been running since the beginning of this century, and have thus given proof of their reliability and durability, while there is no appreciable difference in point of efficiency.

Why is it, then, that in so many cases lately British Corporations have gone abroad for engines of this type? We may cite the following instances:—Barking, Leek, Kingston-on-Thames, Weymouth, Epsom, Pembroke, Aldershot, Swindon and Newcastle-under-Lyme. In the case last-named, the Council rejected the recommendation of the Committee, and the order will be placed at home. We do not say that in all of these cases the British offers were the better, or that in every instance the foreign tender should have been rejected; but it is a fact that in many instances the British prices were either lower for the same speed of revolution, or about equal to the prices of the foreign engines, though the latter ran at higher speeds. It cannot be



suggested that, *ceteris paribus*, a high-speed engine is as good an investment as one that runs at a lower speed.

In some instances, the transaction was carried out after the engineer had accompanied a deputation from the corporation to visit foreign works. The fatuous futility of this procedure is obvious: what is the use of sending non-technical men to see oil-engines at work? They return as wise as they went—but, no doubt, full of enthusiasm for the courtesy of their reception, the hospitality with which they have been treated, and the amenities of the scenes they have visited. We have seen the same phenomena in connection with many other matters—such as the railless trolley, steam turbines, street lighting, &c.—and we are disposed to think that the same influences are still at work.

Let us play the game. Our British Diesels are as good as can be got anywhere for the same price and under the same conditions: why, then, should we go abroad? We earnestly appeal to engineers charged with the duty of advising on the purchase of these—and other—items of plant to see that fair play is afforded to the British manufacturer: he will do the rest.

#### London Street Traffic Obstruction.

SOME few months ago public attention was drawn to the alleged congestion and obstruction of streets by L.C.C. cars, in a memorial presented by the Roads Improvement Association to the Board of Trade.

Tramway obstruction, real and imaginary, has provided much occasion for harmless inkspilling by the 'bus enthusiast during the past few years, but we are glad that the Highways Committee has on this occasion taken the opportunity of replying to and refuting—as regards the tramways in particular—the charges made by the Association.

We publish an abstract of the Committee's report in our "Tramway Notes," from which it will be seen that the conclusions arrived at as to the state of affairs on the roads, were the 'bus to replace the car, accord with those expressed by ourselves in our issue of March 17th, 1911.

Other aspects of the matter are also worth noting; the heavy cost of repairing road paving, of widening roads, and of carrying 42 million passengers per annum at workmen's fares—which do not cover capital charges—represents practically a subsidy to London ratepayers, for which one would think a little street car obstruction is a comparatively small price to pay, especially as it has not been shown that this can be avoided in any circumstances.

The Mansion House Station and Bank crossings provide typical instances of unavoidable traffic obstruction, in which the motor-'bus plays no small part, but apparently this aspect of the question did not interest the memorialists.

We commend to the Association the somewhat Utopian idea of the traffic circus for crowded street junctions, previously referred to in our columns. So far as we know, it has never been tried in this country, although there seems to be no reason why the experiment should not be made.

#### Employers and Tuberculosis.

AN unsuccessful attempt was made last week to show that employers can be made responsible for that terrible scourge which has properly been designated the "white man's plague." The Junior Army and Navy Stores in their office in Regent Street have a room known as "the deposit office," where a number of clerks are

employed. It measures 40 ft. by 16 ft., is 8 ft. high, and has but one window. Ventilation is provided by means of fans. A youth who entered the service of the firm in 1900 was transferred to the deposit office in 1905. He subsequently developed symptoms of phthisis, and eventually, owing to this complaint, was compelled to leave the employment in February, 1911. He brought an action for damages, alleging that it was the duty of the firm to provide reasonable accommodation, and that, as a result of his being compelled to work in an overcrowded office, he became a victim of consumption. The defence was that the plaintiff's serious condition was not brought about by the circumstances of his employment; and that even if it were so, he had voluntarily accepted those conditions. The jury found that while the conditions were injurious to health (but not to the knowledge of the employers) nevertheless they did not cause the plaintiff to suffer from phthisis, and that, in any event, the plaintiff had voluntarily undertaken the risk (if any). In the result, judgment was entered for the defendants. This is a favourable example of the application of a maxim which is frequently mentioned in cases relating to master and servant, namely, *Volenti non fit injuria*.

To render it in language more likely "to be understood of the people," it means that, at common law, every servant impliedly accepts the risks incidental to his employment. A wireman undertakes the risk of getting an occasional shock; and if such a trade as that of wireman had been known in the year 1881, he could have recovered nothing in any Court in respect of injury so caused. In the majority of trades, however, this old common-law rule has been abrogated by various statutes, commencing with the Employers' Liability Act, 1882, and ending with the famous Compensation Act of 1906.

At the present day, the rule has practically no application to persons engaged in manual labour, or even to clerks who do not earn £250 a year. Had the poor clerk who failed in the action above-mentioned taken proceedings under the Compensation Act, he would, of course, have been met with the further defence that consumption could not be described as injury from accident arising out of, and in the course of, his employment.

#### Edison Battery Cars for London.

THE possibilities of the electric vehicle in the large towns of Britain, and more particularly in London, have frequently been pointed out in these pages. It is, therefore, with some interest that we note a letter which appeared in the *Motor Car Journal* of May 15th, intimating that a new organisation is being formed to introduce all kinds of electric pleasure and commercial vehicles propelled by means of the Edison nickel-iron battery. We gather that the Edison people in London, who have made arrangements to represent the Anderson Electric Car Co., of Detroit, U.S.A., contemplate establishing a large dépôt for showing these vehicles, also that the London central-station authorities have been approached, and—what is more to the point—are prepared to give the necessary charging facilities, in most cases during both day and night.

We read that recently an electric van, with a loaded weight of 2 tons, made a 60-mile test journey from London on a battery charge of 20 units, the cost for the whole journey being 1s. 3d. for energy.

As it cannot be denied that the electric vehicle has a considerable field of usefulness in this country, given the necessary support of the electricity supply authorities in the matter of battery charging, and sound business organisation on the part of the electric vehicle people, it is to be hoped that this latest venture will not suffer from the lack of either.



## "SILVERTOWN" AND THE ELECTRICAL INDUSTRY.

THE India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E., manufacture such a great variety of goods that one is, at times, apt to overlook the prominent position they have for so long occupied, and still hold, as electrical engineers and contractors. For this

facture of submarine cable. In 1867 the company secured the contract for a cable to connect Key West—the southernmost point of the United States—with Havana, from the Western Union Telegraph Co., of America. This cable was the first to be made and laid by the company.

The first ship bought by the company was the s.s. *International*, which was purchased in 1870, and fitted with cable tanks and the necessary machinery, the first cable laid by her being that between the Channel Islands and the English Coast in that year. She also laid a cable between Gravelines and Bordeaux during the Franco-Prussian War.

In 1870-1871 the Silvertown Co. laid down the West India and Panama cables; in 1871 the Algiers and Marseilles cable; in 1872 the Lizard-Bilbao cable, and in 1875-1876 the West Coast of America cables, the latter

totalling 1,700 nautical miles. The company also received an order for over 3,000 knots of cable to be laid on the coasts of Senegal and West Africa. Many other important submarine cables have been laid by the company, and quite recently an order has been secured from the Pacific Cable Board to supply and lay about 1,500 miles of cable between Sydney (New South Wales) and Auckland (New Zealand).

The cable vessels now owned by the Silvertown Co.



BIRD'S-EYE VIEW OF THE SILVERTOWN WORKS.

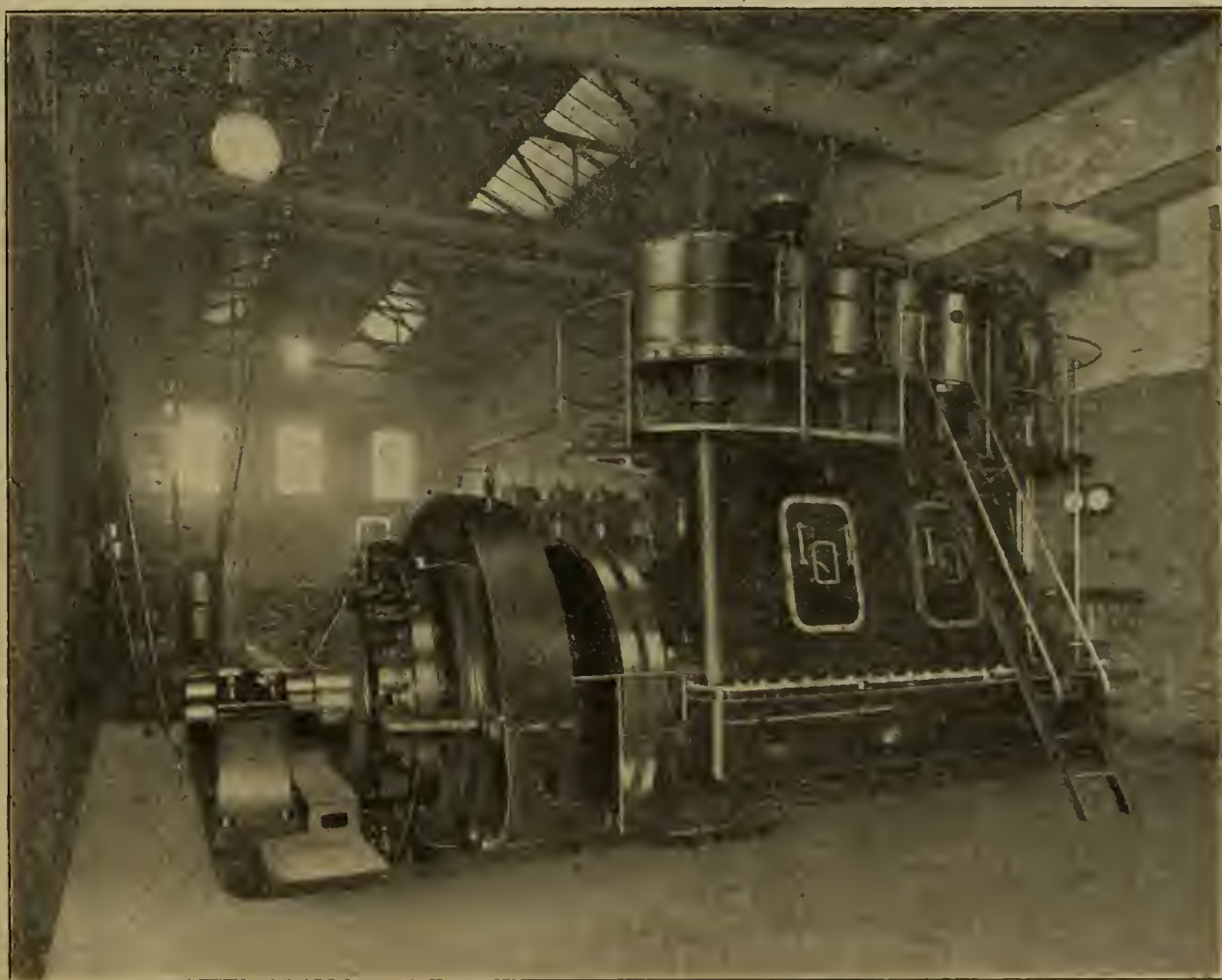
reason we believe that a brief survey of this side of the Silvertown business will be of interest to our readers.

The company's works at Silvertown occupy an area of rather more than 17 acres, and are situated close to the Silvertown Station on the Great Eastern Railway. The works possess exceptional facilities in the matter of communication. On the one hand a siding from the railway enters the factory, whilst on the river front there is a wharf with a frontage of 860 ft., furnished with cranes, derricks, winches, &c., offering all the accommodation and convenience necessary in such works, where large quantities of material can be delivered by water as well as by rail.

The boiler capacity required for power and heating in works of these dimensions is necessarily considerable, and there are in use at Silvertown 36 Lancashire boilers of an aggregate evaporative power of 225,000 lb. of steam per hour, the normal weekly consumption of coal exceeding 900 tons. There are seven steam engines, driving machinery of an aggregate horse-power of 700, seven steam dynamos supplying current for light and power, of an aggregate horse-power of 3,500, and over 300 motors for driving machinery of an aggregate horse-power of nearly 5,000.

At Persan (Seine et Oise) France, about 800 hands are engaged, while there are permanently employed at Silvertown from 3,500 to 4,000, a number exceeded when large contracts are on hand. The company possesses branches in Australia and New Zealand, India, South America and South Africa, and in 12 of the largest towns in the United Kingdom.

Quite a large portion of the works is devoted to the manu-



SILVERTOWN POWER STATION: 1,100-H.P. GENERATING SET IN FOREGROUND.

are three in number, the *Silvertown* (shown at the firm's moorings in fig. 1), the *Dacia* and the *Buccaneer*, the first and last-named being fitted with the Marconi system of wireless telegraphy. The *Silvertown* is remarkable for the enormous size of her cable tanks, which will receive nearly 5,000 tons of cable. The heaviest load she has carried, when on a cable expedition, was composed of 4,880 tons of cable, 1,660 tons of coal, 110 tons of buoys, chains, grappling rope, and cable gear, and 160 tons of provisions and fresh water, amounting in all to a cargo of 6,810 tons.



The total amount of submarine cable made at Silvertown to date is approximately 60,000 nautical miles: this length refers to sheathed cable only, including that used for torpedo work, and does not take into account unarmoured core.

Silvertown rubber insulated electric light cables are known wherever this method of illumination is employed, and have acquired a high reputation for efficiency. In addition to cables for telegraphy, telephony, lighting and power, the company manufacture bell wires, telephone cords and flexibles, India-rubber and gutta-percha insulated wires, shot-firing wires, motor-car leads, &c.

The Silvertown company was one of the first to manufacture Gramme machines in England. One of the earliest undertakings of the electric light department was the equipment of the works with an extensive electric light installation, which, when erected in 1882, was the largest private plant in the United Kingdom. Since that time many alterations and extensions have been made to the plant, the many small belt-driven dynamos having been replaced by larger direct-coupled medium-speed sets, and the isolated steam engines throughout the factory by electric motors. At the present time, in addition to two 250-H.P. marine type engines, each driving by ropes a continuous-current dynamo, the machinery put down includes one 1,100-H.P. engine and dynamo (shown in the foreground in fig. 2), and four 500-H.P. sets, working at 150 lb. pressure. The system of distribution is two-wire at 200 volts, supplying current to the equivalent of 14,000 8-C.P. incandescent lamps for lighting, and over 300 motors (already referred to) of from 1 to 150 H.P., driving the planes, drills, lathes, cable machinery, calenders, mixing mills, masticators, pumps, cranes, and capstans, &c., in the factory.

The manufacture of dynamos and motors is an important feature of the work executed in the electric light department, and a considerable business is carried on in supplying British and foreign Governments, and private firms, with these and other apparatus necessary in electric lighting and in the transmission of power—such as balancers, boosters, motor-generators, and rotary converters. Amongst others, we may instance the continuous-current plant delivered to the War Office and Admiralty and many British Corporations.

A great variety of instruments is made, including much special apparatus used in various departments of the factory. The submarine department, together with the cable ships connected therewith, employs a large number of instruments for experimental and research work, as well as for the testing of submarine cables at all stages of the manufacture and laying. The general business of the instrument department at Silvertown includes the manufacture of electrical apparatus and instruments for the Post Office, War Office and Admiralty, railways, cable and other companies, Colonial and foreign Governments, &c., and, in fact, Silvertown instruments are well known over the whole world. Among the numerous instruments devised at the works, are the Silvertown portable testing sets, which have been largely used for many years by telegraph, telephone and electric light engineers; the Silvertown water-level apparatus for electrically indicating or recording, at any required distance, the change of level of the water in tanks, reservoirs, rivers, &c.; the various high-class testing keys of Mr. Rymer-Jones, now universally used; the conductometer of Mr. Rollo Appleyard, and the ingenious two-tone vibrating transmitter of Mr. E. Raymond-Barker for conductive and inductive signalling.

Due to the great extension of telegraphy in recent years, there has resulted an increased adoption of various systems—such as duplex, quadruplex and automatic telegraphy—designed to augment the message-carrying capacity of the lines, and thus cope with the heavier traffic. In addition, the introduction of central-battery and secondary-cell working, together with improved switchboard methods, has contributed largely to the same end by providing quicker and more efficient methods of working. The construction of the various instruments and switchboards required for these improved systems forms an important portion of the work turned out by the instrument department. The heavier work demanded in the construction of switchboards for electric light and power installations is carried out elsewhere in the works.

Another branch of the work of the instrument department

is the manufacture of condensers of various kinds for wireless telegraphy, and for telephone, telegraph, and submarine cable work.

The manufacture of batteries for telegraphic and other purposes is an important industry, and at Silvertown no fewer than five shops are entirely occupied therewith. One shop deals with the preparation of carbon and manganese: another is employed in the pressing and shaping of carbon plates; a third is fitted with the necessary retorts and furnaces for the firing of carbon plates and electric light rods; a fourth is furnished with hydraulic presses for the forming of Leclanché battery blocks; while in the fifth shop the various parts of the battery are fitted together.

Besides Daniell, bichromate, Minotto, Grove, and Bunsen cells in all forms, the company makes a speciality of Leclanché cells. The last-mentioned type of battery was originally introduced into this country nearly 50 years ago by the Silvertown company.

The supply of material for telegraph and telephone overhead lines also forms a section of the company's electrical business, and large quantities of this class of goods have been supplied to railway and telegraph companies in China, South America, South Africa, India, &c.

A new train-lighting equipment was recently introduced by the company, and was fully described in our issue of December 1st last. It has been designed on the lines suggested by actual practical experience, special attention being given to ensuring a thoroughly reliable equipment that is easy to install, and cheap to maintain.

A very varied assortment of manufactures is produced in what is known as the india-rubber department, whose workshops are the chief, as well as the most extensive, in the factory. Rubber-insulating gloves form the principal product of this department for electrical work. All Silvertown rubber gloves are thoroughly tested, either at 5,000 or 10,000 volts, and each glove is sold with a label certifying this test.

The company make a feature also of special red quality insulating mats for switchboard platforms, india-rubber tiling for the front of switchboards, &c., and they are, of course, large makers of battery syringes, jointers' waterproof tents, valves, sheet, washers, engine packing and hose.

Ebonite, one of the manufactures in which the Silvertown company have obtained some celebrity, is, as many of our readers are aware, produced by hardening india-rubber through prolonging and intensifying the curing or vulcanising process. The use of ebonite in the electrical trade is largely increasing. Cells, fork separators, sheet separators, rod and channelling insulators, bobbins, handles, switch caps, plates for condensers, and other articles are, wholly or in part, made of ebonite.

Among the Silvertown company's other manufactures are numerous insulating tapes and jointing materials, &c.

#### Educational Notes.—IMPERIAL COLLEGE OF SCIENCE.—

Mr. Herbert Wright dealt with diseases of rubber plants in his fifth and last lecture at the Imperial College of Science. He complained that few people realised the gravity of the position: only one mycologist was provided for 220,000 acres of Hevea in Ceylon, and two for 400,000 acres in Malaya. He regarded the paucity of scientific officers on rubber estates as one of the gravest errors of our administration, and appealed to private companies and Government to tackle the problem now while diseases and pests were in their infancy.

In the tenth of the special series of lectures on rubber, Dr. Schidrowitz said it appeared to be the fact that the supplies of high-grade gutta-percha were gradually failing, and it did not seem to be practicable—on account of the slowness of growth and small yield of the trees—to plant gutta in the same way as rubber. He thought it extremely probable that in the future, not perhaps immediately, but within the next 15 or 20 years, the falling-off in the high-grade gutta supplies would force submarine cable makers seriously to consider the use of rubber, and he personally believed that the difficulties attending its use at present, were by no means insuperable.

The last of the special series of lectures was delivered by Dr. Schidrowitz, and dealt with the chemical and physical properties of vulcanised rubber, and the methods of applying mechanical and chemical tests to vulcanised rubber.



## LEGAL.

OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(Continued from page 790.)

MR. TERRELL having concluded his speech for the defence, evidence was then called.

MR. WILLIAM PAKENHAM said the defendant company commenced in June, 1907, as a syndicate formed to acquire the patents under which they were operating; he meant the predecessors of the defendant company. They acquired patents and processes for making lamps from Dr. Hollefreun & Co. and Zerning & Sander; they were the patents under which defendants were now working.

WITNESS, examined, said: In 1905 or 1906 there was an electrical exhibition, and there was no metal-filament lamp on the market then with the exception, he thought, of the osmium. In 1906 two lamps were imported from Germany, and there were no other tungsten lamps on the market made in this country before that date. Osram lamps were advertised in this country about 1907, but not made here until, he thought, the last two years. The "Z" Co. commenced right away in 1908, manufacturing high-voltage lamps, and were the only people doing so.

MR. FROST: What do you mean by high voltage?—Lamps of 200 volts and upwards in contradistinction to 110 and 100-volt lamps.

What was the power of the high-voltage lamps put on the market by them in 1908?—Somewhere about 60 C.P.

WITNESS, continuing, said they required what was known as black metal; it was an amorphous form of tungsten, and the only form of tungsten which could be used in practice in their process. Hollefreun and Zerning worked out the method of preparing the tungsten; these were the people in Germany from whom they bought the patent. The soft and hard-paste processes were absolutely different.

Questioned as to the hard-paste process, WITNESS said it consisted in taking a metal in a very fine powder. We take a binding material, which contains so much of this nitric radical and enough oxygen to burn itself out—the very thing that you are instructed to take out in this specification—we mix these together, and then we subject them to a very high pressure. If you mix material like our binding material with a very finely divided metal and attempt to put that under a high pressure, you will get no filament squirted. The binding material separates out under the press, the more fluid stuff comes out first, and you get a scaffolding in your die; the consequence is, beyond the mixing, you have to put in the calendering operation. Calendering includes mixing, but it is quite a separate process. You have to mix your metal and binding material into a thoroughly homogeneous mass; you then squirt it. It is put into dies and squeezed under enormous pressure. Our pressure is something like 25 tons to the square inch. The pressure in the soft-paste process is merely pounds. That makes the filament, and it then passes through the baking stage, when a very large proportion of the carbon is removed. The baking in the hard-paste process is not in any way comparable with the carbonising in the soft-paste process. The baking is done under a vacuum, because you want to take away as much of the carbon as you can.

Do you find in the specification of the plaintiffs any directions to do this?—No, you are not told to do that; you are told to carbonise.

HIS LORDSHIP: According to you, as a practical man, seeing the direction in the plaintiffs' specification that you are to carbonise, which of the two, the hard paste or the soft paste, would you take?—There is no question about it; this is a soft-paste process. He mentions coagulable binders, and he mentions a material which you could not use with a hard paste as one of his binders.

HIS LORDSHIP: You say it would lead you to the soft paste?—There can be no question about it to a lamp maker.

MR. FROST: Is there anything in the specification hostile to a hard-paste process?—Yes, he directs you to use a solution of cellulose and chloride of zinc which you cannot use in the hard-paste process. You cannot get rid of your chloride of zinc and your filament will never dry.

HIS LORDSHIP: For the hard paste, what solution do you use? I do not want you to tell any trade secrets, but perhaps it is not a secret?—It is not a secret in this Court, I think. We use a solution of collodion in amyl-acetate which is a vaporisable solution quite different to these coagulable solutions.

MR. FROST: What are the materials for making the binder?—Collodion and amyl-acetate and a small proportion of castor oil.

What, as a lamp maker, do you understand by the term sintering, which is the next stage?—Sintering is the operation of shrinking together to a solid coherent filament.

Will you shortly summarise the practical points which have been worked out and made your process a successful one, and the modern lamp a successful lamp?—The success is due to the particular form of metal used and required. Then there is the binder. The question with the binder is the quantity and the nature of the binder. Then there is the calendering, and then there is the high-pressure squirting, baking in the vacuum, and the sintering operation.

MR. FROST: Dealing shortly with the second specification sued on, 18,622, of 1906, reading that specification as a practical lamp-maker, what would you understand that you were directed to?—There is no question, this is a decarbonising process used on the filament.

We will go to the weights—the third patent. When the defendants bought their process, were the weights being used then by the people who sold the process to them?—Yes.

HIS LORDSHIP: I do not quite follow this.

MR. FROST: Defendants bought their patent under which they work, and the weight process was part and parcel of it. (To witness): What is the effect of putting the weights on first of all, as the plaintiffs contend they do, during the sintering operation?—Apparently that was a very old idea to put weights on filaments, at all events carbon filaments, and I think it was simply transferred to this metal-filament industry without any question. On the sizes of filaments on which we were working in the old days, there was no difficulty in using the weight, but when you come to thick filaments or very thin filaments, the weight is not an advantage. Using the weight on the fine filament during the sintering stage you get an extremely V-shaped filament.

Why?—In a high-voltage lamp you have to put 10 filaments in the lamp, and the filament is drawn down with a very narrow base. With the thin filaments, the slightest knock to the lamp starts the filaments vibrating, and if they are V-shaped, as I described, up at the top of the V the filament is not stretched apart wide enough to prevent the legs touching round the hook and they run together, and once they begin to run they run on till they get to the point where they break.

Could you by the defendants' process make a filament containing 5 to 10 per cent. of carbon?—Using our metal and our binding material without any added carbon, it would be absolutely impossible for us to get a filament which, at the baking stage, would contain 5 per cent. of carbon.

Cross-examined by MR. ASTBURY, WITNESS said his experience of lamp making was confined to the "Z" lamp. They made all thicknesses of filament substantially from 15 of an ampere up to five amperes.

MR. ASTBURY: You say that the first lamp was made subsequently to June, 1907, and I suppose the first filaments were made subsequently, too?—The first filaments were made as soon as we could get the plant working after June, 1907.

Do you know anything about the quantity of tungsten-filament lamps that were sold in this country in the latter half of 1906 and the first part of 1907?—No; but not many, I should think.

If Dr. Oberlander, in June, 1907, made tungsten-filament lamps at Hammersmith under this patent on which we are suing—that is, the Just and Hanaman steam and hydrogen patent—do you know anything about it? Were they sold?—Unless they were I should not know.

If some of those lamps were handed to Dr. Liebmann, and burnt successfully for two years, that you would not know?—No, I should not know.

Will you look at No. 1,535 of 1898, the Welsbach patent. Was it one of your points that you used an extremely small amount of binder?—It is not merely a question of quantity.

Do you know whether the osmium filaments were in fact all of them made of what you call a hard paste?—This does not refer to a hard-paste process at all.

We say it does?—But this is impregnating or coating—this has nothing to do with squirting.

What do you suggest is the purpose of your carbonising, which is not in the ordinary known form of carbonising?—Our carbonising is to get rid of the bulk of our binding material.

With regard to the question of the amorphous metal. You do not know, do you, to what extent that was known prior to 1904?—Personally I do not know that it was not known. I know that it began to be obtainable in 1908-9.

Questioned with regard to the weights, WITNESS said they began stopping the use of hooks in December, 1910, on the thick filaments, and it was a gradual process of giving up the hooks until about the summer of 1911.

You say that it is not an advantage to use a weight during the sintering in either the thick or the thin ones?—Quite so.

Do you happen to know that every Osram lamp which has ever been made in this country has always had a weight on during sintering?—I could not say anything about that.

MR. JAMES SWINBURNE then gave evidence as to the development of the carbon filament.

MR. TERRELL: What was the usual method of forming filaments in 1904?—The universal manner practically was the soft-paste or Swan process for making carbon filaments.

When you got the idea that you wanted to make a metal filament out of high-resistance metals, what was the difficulty?—The first difficulty was to realise that such a thing was possible at all. I found with tungsten and molybdenum that I could squirt by mixing them with gum tragacanth as a binder. I found that I could not squirt these metals through small holes, and I came to the conclusion that there was no hope at all of making practical lamps. The idea of making wire lamps of such brittle metals that would be of any commercial value at all seemed absurd, and I gave it up as hopeless. Then I heard of Welsbach, but even then I concluded that he would not succeed in making a lamp on the lines he was following. The success of the tungsten lamp is due not to any invention. Once Welsbach had pointed out that you had a possible line of working by making his osmium lamp, then everyone knew that you could try the same sort of thing with high-resistance metals. The first thing was to get the right metal. That was done by taking the Delepine process.

Asked about hard paste, WITNESS said if they were going to get a metal filament that had a lot of metal to begin with, they must have hard paste, because they must have as little binder as possible, otherwise they got the particles of metal far apart, separated by a lot of carbon. After the calendering came the squirting. One was apt to suppose the machinery was all ready, waiting for use, but all that machinery has been designed and worked out since. First of all it involved getting fine dies. As a matter of fact fine dies were used for drawing very



fine wire in wire works. They could have been got if lamp makers had known where to get them, but these hydraulic machines had to be worked out. They had to get the hydraulic machines which would allow them to squirt the thick hard paste. Then they must work out the details of handling these fine filaments and then baking them. Moissan showed about 1889 that tungsten was a very infusible metal. It was known that tungsten was reduced by hydrogen, and that at a high temperature tungsten would oxidise readily, and would decompose.

MR. TERRELL questioned WITNESS on the specifications, and continued:—After the baking process which has been described in this case such as is practised by the defendants, what is the condition of the carbon in that filament?—I think it is most probable that the carbon is entirely in the form of carbide.

MR. TERRELL: You see in the literature, and even in these specifications, it is frequently referred to as being in a state of carbide?—Yes.

Reading this specification, what do you understand by the terms "in an atmosphere of steam and hydrogen"?—I should say it was an atmosphere of steam diluted with hydrogen, but it has been assumed that because the apparatus that is now used is not an apparatus that can conveniently be kept at a temperature at which you could have steam, the patentee had somehow determined to use that particular apparatus and had meant not to use steam at all, but traces of vapour.

With regard to the issue of infringement, in what respects does what the defendants do differ from what the plaintiffs specify?—Leaving out whether the patent is limited to the use of hard paste or soft paste—then as regards the third process of equalising, it is obvious that it is not used. Coming to the second process of decarbonising with water, while it is quite true that at the beginning of our sintering process, when you begin to burn the filament up, and, indeed, right through, there must be some combination of carbon with traces of water in the jar, that is an entirely immaterial and accidental result, against which all reasonable precautions are taken. What happens really, is that the defendants are sintering in a reducing atmosphere. If you want to sinter a filament you must either do it in a complete vacuum, which is expensive, or you must take what was quite common practice in lamp making—a reducing or protecting atmosphere. What the defendants do is to take a protecting atmosphere of hydrogen and use that. Looking at it as a matter of substance, we say the defendants are sintering in a protecting gas and nothing else.

With regard to patent No. 2, will you tell my Lord what the invention is there?—The invention, as I, as a lamp maker, understand it, consists of changing from the steam and hydrogen, which had been modified in the meantime to hydrogen with a very little trace of moisture, to hydrogen with no moisture, and with nitrogen put in the place of moisture to remove the carbon; and, as an alternative, instead of putting nitrogen in you may use some ammonia.

At what stage of the operation do you consider that that is specified?—This would be a decarbonising process done after baking.

The defendants put phospham on to their stem, and then they make it hot. So that in the decomposition of phospham in these lamps you will have ammonia and moisture?—No doubt.

With respect to the third patent, in your experience as a manufacturer of lamps, do you know that hooks have been used?—I never used them myself in the earlier days, but I know the literature, and I know the sort of result you would get. I can tell you that incandescent carbon filaments are most delicate of all during the process of carbonisation, and they are, next, most delicate in the process of equalising before they get hot, so that the most delicate time of the existence of a carbon filament is during the baking, where weights have been disclaimed as being put on, and the next most delicate part is during what they call flashing, where weights also are shown as put on.

Was it a common practice to put weights on?—I do not know that of my own knowledge. Using weights on carbon filaments came in after I stopped making carbon lamps.

Do you yourself see any advantage in putting the weights on during the sintering process instead of in a subsequent process?—This is really a question of economy of manufacture. If the weights worked equally well, of course it would obviously be better to do it in one process.

Cross-examined by MR. ASTBURY: Witness agreed there were certain chemical actions of gases on bodies at certain temperatures which must operate if they were brought together at those temperatures. He also agreed that where a novel invention of difficulty started, as the years went on, the steps which were taken to effectuate the best results were always being improved upon. Witness was then taken through the 1904 patent specification.

You never heard or knew of a lamp being made by either the Lodyguine or the oxychloride process prior to 1904, the date of our patent, did you?—No, I don't think so.

In one of the documents there is the precise process used in the defendants' works, both as to the hardness of the paste, the minute amount of binder, the calendering and everything else absolutely set out and described?—It differs only in degree.

Collodion, unless it is used with acetic acid, cannot make a soft paste?—I should not think so.

You have formed a view at present that the man who published the document had his mind on soft paste?—Yes.

We do not accept that, but let me assume that it is right. A man at that date who read this document and assumed that it meant soft paste, and who made a lamp filament out of soft paste, could then carbonise it by the ordinary process then known or disclosed in these documents. And if he then put that filament into an atmosphere of steam and hydrogen he would decarbonise it

by oxidation. When he had done that he would have a filament which, in your view, would be one which could be improved by flashing?—Yes.

Will you look at Claim 1—he would then have produced an incandescing body for incandescent lamps consisting of tungsten, and which would be manufactured substantially as and in the manner described in the document?—I agree.

Will you now look at the second claim—supposing that he stopped at the decarbonising, and did not flash it after decarbonising. Claim 2 says: "Process for the manufacture of incandescing bodies in accordance with Claim 1." Now, I will ask you to assume from me that "in accordance with Claim 1" means repeating the language of Claim 1. That would be—"Process for manufacturing incandescing bodies," and then reading the actual words of Claim 1, "for incandescent electric lamps consisting of tungsten." If he stopped at the decarbonising and did not make it uniform, would he not then have put into practice a process for making an incandescing body for an incandescent lamp consisting of tungsten having these features, or characterised by the fact that tungsten had been mixed with an organic binding medium, that it had been formed and carbonised and the carbon removed chemically?—If your interpretation of Claim 1 is what his Lordship adopts, that would be so.

There is no prior document which discloses or suggests the building up and squirting of a tungsten filament in accordance with the osmium process and decarbonising it in steam and hydrogen, is there?—No.

Assume that your view is right that if you make it with a soft paste, you can improve it by flashing in the sense of uniformity?—Yes.

Assume that if you make it of hard paste, that is a process which is not necessary, because it is quite uniform after decarbonising?—I will assume so from you, although you must understand that I disagree entirely with that particular step.

You disagree with what?—That you can from a hard paste, by following this specification, make a filament that does not require equalising.

We know it is done every day in the defendants' works?—No, that is the whole point at issue.

His LORDSHIP: Mr. Swinburne says that it is done, but that it is done by sintering.

MR. ASTBURY: I am assuming that a man does this with hard paste, and he does it in Voelker's way. If he does that, we have it from Mr. Pakenham and from you that it is indistinguishable in every way from the process adopted by the defendants?—No, I think Mr. Pakenham put a great many other things.

What difference is there?—Our calendering is different, because we use different speeds. It is only a difference of degree.

How do you know that Voelker does not use different speeds?—Because he does not say so. He may do, but I cannot assume that he does.

His LORDSHIP: Voelker does not use the expression "calendering." All he says is, "Rolled for about an hour between hard and polished steel rolls." Nothing is said about the speed of the rolls.

The Court adjourned at this stage. On resuming, MR. ASTBURY asked whether they might have some of defendants' thicker filaments to enable them to carry out a certain experiment. They now knew that they were all made in the same way.

His LORDSHIP: That must be without prejudice to any objection you may make as to the thicker filaments.

MR. TERRELL agreed to supply the filaments.

MR. ASTBURY (further cross-examining): Please look at Welsbach, 1,535; it says:—"The function of the protective atmosphere is to oxidise the carbon of the filaments without oxidising the osmium or obtaining a deposit of carbon on the filament." The function of the hydrogen is to allow the other part of the gas which can oxidise the carbon to do that, the protective hydrogen protecting the osmium from oxidation at the same time?—Yes.

"Free oxygen must not be present, and in fact the atmosphere shall be such as will reduce any oxides of osmium that may be present. In such a reducing atmosphere the filament can without danger be raised to a temperature which consolidates the osmium." That means sintering of osmium?—No, I do not think it does, because you get some sort of consolidation in these filaments long before sintering temperature, which has been referred to by a witness as the coherer effect.

"And forms it into a useful coherent filament"—that is, a metal filament of osmium?—Yes; there were useful coherent filaments of tungsten which were not sintered, therefore not nearly as good as the present filaments, but they were commercial.

Do you know how many millions of osmium lamps had been made in 1904?—No; I had not seen any, as far as I know.

The Nernst lamp was also a known manufactured lamp at that date?—Yes.

The Nernst lamp filament was made of a hard paste, mixed in a Pfeiderer machine?—Yes.

Was there a single metal filament prior to 1904 that had ever been made with a soft paste?—Not to my knowledge. I can only refer you to the osmium patent.

Can you point out one single advantage that in 1904 anybody could possibly think they would get by using a soft paste if they wanted to get a metal filament?—I do not think you would get an advantage, and doubt whether anyone who had hard paste in his mind in 1904 would think soft paste better; but you had the earlier specification of Welsbach dealing with soft paste, and you have a specific instruction here to use soft paste. If you take an intelligent lampmaker, I say that he would not learn anything from this specification; but if you are going to take a man who knows little enough to take all this specification very seriously, then he would make a soft-paste filament.



Supposing that this specification was handed to Dr. Oberlander in 1897 without any directions at all, and that he took it, produced a hard paste, squirted it through a die with a screw pressure, manufactured his paste in the ordinary way, that he had non-metallic-filament lamps made before that, that he then carbonised and decarbonised, and found it did not require any further flashing, mounted that into lamps, and that two of those lamps burnt in Dr. Liebmann's laboratory for two years.

MR. TERRELL said he objected to such questions at this stage of the proceedings, and that Dr. Oberlander had not been called.

MR. ASTBURY said his friends had called a lot of evidence, of which no hint had been given. Plaintiffs could have called any number of lamp makers, but there was no point for them to be called upon.

MR. TERRELL: My friend says I did not put to his witness the difference between hard and soft paste. I put it that this was a soft paste patent, and upon that he did nothing.

MR. ASTBURY: I am told that it is not pleaded. I do not think the words hard or soft paste appear once.

HIS LORDSHIP: I am perfectly aware of that. My impression at present is that the patentee has not told the ordinary workman what process he is to adopt. If the patentee knew he ought to convert the mixture into that shiny sheet which is then rolled up and pressed through a die, he ought to have said so.

MR. ASTBURY: Have you ever since the date of this patent heard of a filament being sintered in a jacketed vessel?—No.

Did you ever hear of a Lodyguine filament being made?—Not before this case.

And there is, in fact, no direction in Lodyguine how to get rid of the fillet from the inside of a filament?—I do not remember any.

Prior to the patent of 1904 that we are suing on, there never had been any suggestion of any publication had there, that you should make a tungsten filament by the building-up process of Welsbach?—Not that I remember.

It is a fact that since 1904 the built-up tungsten filament has become the most successful filament in the world?—Yes.

COUNSEL then took witness through the various experiments that had been made with the view of comparing and ascertaining the difference between plaintiffs' and defendants' processes.

The phospham is put there for the purpose of removing the carbon?—The phospham is put there because they say it makes a lamp better—a better vacuum.

You believe that it does, in fact, remove carbon?—Yes, to some extent.

You know no purpose for which it can be there other than that?—No.

We have, therefore, got it that in the defendants' last process they do in fact eliminate carbon in an atmosphere of ammonia from a filament which has been built up of powdered metal with the addition of organic binding materials?—Yes.

You did find cyanogen as the result of this operation of the defendants?—No, I found cyanogen in other cases, from which I infer that it probably takes place in the defendants'.

HIS LORDSHIP: You do not deny that the process of the defendants may produce some cyanogen?—No, I think it does.

MR. ASTBURY: Some very strange documents have been put to you as anticipating this second patent. Is there a single suggestion in any of this literature of decarbonising a tungsten built-up filament with nitrogen and hydrogen, or ammonia, in lieu of doing it by an oxidising process?—I remember none.

Then we come to the prior grant. I want to ask you one question—that is, Specification 15,510, of 1907. My friend put a question to you which I do not agree with. You will see they are practically saying that you can decarbonise with less than 1 per cent. of oxygen with water vapour?—Yes.

Then it says:—"This process is of practical value when means are arranged to remove the last perceptible traces of oxygen—containing gases and vapours from the gas mixture. Traces of oxygen containing gases, still remain in the mixture on account of the inadequacy of the plant, and these traces will have the desired effect." Does that mean anything more than this—that if you use a plant with which you are going to try and get rid of all traces of oxygen, it may very well be, and is likely to be, that the plant will not be quite sufficient to do that very difficult work?—That is what it means.

But that you might still have traces of oxygen there, although you did not want them?—Yes.

HIS LORDSHIP: He says something more than "may." I think he says that you will get it.—Yes, he must have it for his patent.

In reply to questions about the use of weights, WITNESS said: You will find in one of the earlier specifications that Edison carbonised carbon filaments freely in a vessel with a weight on them, and my point is during that time the carbon went through a much tenderer state than it ever does in any other part of the carbon manufacture. It was therefore old to filament makers to hang a weight on at the tenderest part of the life of the filament.

It matters enormously however what the relative proportion of that tenderness to its strength is?—Yes.

If you are going to weight the metallic filament after sintering, it involves a separate heating up, a separate set of jars, a separate current, &c.?—Yes.

MR. CHARLES FRED. TOPHAM, general manager of Mr. Stearn's works, said he had occupied that position ever since he had been manufacturing lamps—that was about 1882. Mr. Stearn used to manufacture lamps at Kew under the name of the Zurich Incandescence Lamp Co. In the year 1898, Mr. Stearn started his present factory at Kew, and still carried on business there under the name

of the Stearn Electric Lamp Co. In that year Mr. Stearn commenced the manufacture of metal-filament lamps. Witness said the practice in those factories with regard to the weights was that they always used the weights when it was desired to make a straight filament of carbon. It was common knowledge to them. Witness recollected going with Mr. Stearn to Berlin in the year 1906, and certain notes were made by Mr. Stearn, which witness saw. It was the "Z" Co.'s factory which they went to, and there they saw metal-filament lamps made, and investigated the manufacture of same. Witness brought some powder from Berlin. It was given to them as metal powder, and also a binder. The powder was a mixture of tungsten and zirconium; the binder was made of gun-cotton dissolved in amyl-acetate.

WITNESS, asked to describe what he did, said he added about 10 per cent. of the binder to the powder and then rolled it with a pair of photograph rollers—steel rollers; the process was known as calendering. He then took the paste and placed it in a gun-metal cylinder and forced it through a die into filaments. After that, he dried the filaments at about 60° to 100° C. for the purpose of drying off the amyl-acetate. They were then put into a porcelain tube on an iron tray, and raised in a vacuum to a temperature of about 800°, with a very small quantity of hydrogen passing through. They were then allowed to cool down, taken out and put into forceps and placed in the ordinary glass vessel used for flashing carbon filaments. A small weight was then put on in order to keep the filaments perfectly straight, as they were liable to cockle and twist about. The filaments were very delicate, and it was very seldom witness could get a filament strong enough to bear a weight, although he sometimes succeeded. He always tried to succeed, and it was a long time before he found out how he failed. A lot of trouble was caused by the porcelain tubes, as they cracked, and the temperature had to be kept very low. He always put on the weights whenever possible. The weights were brought into use from the very commencement, and they were used to the present day. The weight was put on in the sintering process. If the filament was not strong enough to bear the weight before sintering, it was put on immediately afterwards.

Had you been doing the same thing with carbon lamps before that time?—Yes, whenever narrow or straight filaments were required for making tube lamps. I had to hold a filament perfectly straight while the hydro-carbon was being deposited on it.

What weight did you have on?—A piece of platinum about 16 mils in diameter with a length of, I should think, about  $\frac{1}{2}$  of an inch.

Witness first used pure tungsten very shortly after that; it was made of zinc and tungstic acid on the Delepine process. He first used tungsten about April 25th, 1906.

Cross-examined by MR. COLEFAX: After his visit to Germany, they commenced to put into practice the process they saw there. The putting on of the weight was done in Mr. Stearn's laboratory, but the subsequent process was carried out in the factory. It was about a month or six weeks after their return that they found out what the metal powder consisted of through Dr. Feilman, a chemist. The powder was analysed, because it decomposed in the lamp and zirconium came off and left the tungsten behind, in burning in the lamp after being evacuated. He was not prepared to say that any metal-filament lamps were sold in 1906. When those made by the Zurich Co. were first sold they were called Leuconium. They found it was very seldom they could use the weight beforehand during sintering. In separating them they could tell by the handling of the filaments whether they were tender.

About the dies, can you tell us the diameter of the filament?—I commenced by using a die five mils in diameter.

Re-examined by MR. TERRELL: What was done with the lamps, were they run in the factory?—They were run at Westminster.

HIS LORDSHIP: You are certain they were run at the factory?—Quite certain.

Between April and September, 1906?—Yes, because we had the lamps blacken so badly.

MR. A. C. HYDE, a practical lampmaker, said he was actually engaged in lamp making in the years 1901 to 1904 with the Edison-Swan Co. at their factory at Ponder's End. While there, he was the technical expert to the company, principally in connection with the lamp department. At that time they were making carbon lamps. The high-voltage carbon lamps had very fine carbon filaments. Previously to his commencing work on this particular form of lamp, great difficulty was experienced in getting uniformity in a filament. When he took the matter in hand, he found, what he had previously known to some extent, that filaments must be carbonised under strain to be made uniform. He found the greatest strain he could possibly employ was the best. The filaments were subjected first of all to a preliminary baking with the weights applied, at a temperature of about 600° or 700° C. in a large crucible through which gases passed. During that period these filaments passed through a stage in which they were plastic and very weak. After this preliminary baking to 600° or 700° C., the top portion was lifted off and put into a carbon trough which formed part of the electric furnace. The whole thing that carried the weights was lifted off, and put into a carbon trough. A great many were put in in one operation—about 50 or 60. The carbon trough formed the core of an electric furnace, the whole of the core was surrounded by some non-conducting material. When all was ready an electric current was passed through the core, and the temperature rose to 2,500° or 3,000° C. During the electric furnacing the carbon became again plastic, so it was necessary to keep the weights on the whole time, or the filament would cockle up. After the electric furnace operation, which took three or four hours, the furnace was cooled down and the filaments were cut away from the rod and were then ready for use. In the first furnacing



up to 600° or 700°, ordinary coal gas was passed through. In the second furnacing no gas at all, but simply hydro-carbon oil sprinkled on so as to burn up the air.

Cross-examined by MR. COLEFAX: Was the current passing through the filaments when they were in this furnace?—Yes, it was.

Was the temperature between 2,000° and 3,000°? Was the current passing through the filaments heating them up to that temperature?—Yes.

During that stage there is, in fact, no contraction taking place?—No. In the first furnacing you get about 40 per cent. contraction. When you carbonise any thread, it shrinks, but if you put a strain on it, it does not shrink so much. If you had no weight on you would have got a shrinking of 50 per cent. in the filament; with the weights you got 40 per cent.

With regard to the second temperature, there is no contraction?—Yes, there is about a further 5 per cent. With the weight on it was 5 per cent., without the weight on it was about 10 to 15.

MR. GEORGE LUEDECKE gave evidence through an interpreter, Dr. Otto Hehner. Witness said he was the manager of the Brims-down Lamp Works, Ponder's End, who carried on the business of metallic-filament lamp makers. He was also works manager and technical adviser. Witness had been engaged in the practical manufacture of lamps since 1883, and had worked with Siemens and others. Witness also manufactured lamps at Augsburg as George Luedecke & Co., and from 1906 under the name of the Wolfram Lamp Co. Witness came to this country to take up his present position in 1909. He also had experience in Germany for a considerable time with Just and Hanaman. His firm had bought all patents which were possessed by Just and Hanaman at that time concerning Germany as regards tungsten filaments. Witness had read the specification of Just and Hanaman that was the subject of this action.

MR. TERRELL: In your view as a lamp-maker, would this teach you that a soft or a hard paste was to be used, or both?—I understand from this specification that a soft paste is to be used.

Speaking of your own experience, when did you first become acquainted at all with a hard-paste process?—In August, 1908, we came to Buda-Pesth, and Hanaman showed us a hard-paste process with gum tragacanth and tungsten powder.

Is that the first you heard of a hard-paste process?—No, I had heard before that.

Did you at any time, and where, work the oxychloride process of Just and Hannaman?—We bought the patents in March, 1906, and I think we had the necessary apparatus in June or July of the same year, and we worked with the oxychloride process until 1908.

How many filaments did you make by the oxychloride process?—Up to 50,000 filaments daily.

Was that work carried out under the German Specification 154,262?—I do not remember the number of the German process, and I rather think the hexachloride and the oxychloride process are the same.

WITNESS: We prepared the hexachloride by passing chlorine over tungstic oxide. In a long furnace there was a tube 1 m. 50 cm. long in which the tungstic oxide was placed. At one side the chlorine entered, and from the other the chloride or oxychloride issued, and was condensed in a receiver. Having prepared the hexachloride, then came the process of the preparation of the filaments. In a bell jar holding 150 cb. cm., very thin carbon filaments were placed. In the bottom of the bell from 1 to 2 grammes of the hexachloride were placed. A flame was placed beneath the bell, in order to evaporate the chloride. When that had been done a current was passed through the thin carbon filaments, and at the same time a little hydrogen was passed through it. Upon the carbon filament thus a layer of metallic tungsten was precipitated. When there was sufficient the ampere-meter connected with the filaments showed when we had to stop. Afterwards the filaments were taken out of this apparatus, and were placed in a second vessel—this was called the decarbonising process. The filaments were then placed in series, current was sent through the filaments thus placed, and at the same time hydrogen was passed through. First, the carbon combined with the tungsten, produced tungsten carbide, and at the same moment was decomposed, and the pure Wolfram remained behind. The tungsten filaments were hollow, and during the removal of the carbon the filaments were weighted by small weights.

Were those filaments made up into lamps and sold?—Certainly they were.

Cross-examined by MR. COLEFAX: In the process described, was not a mixture of steam with reducing gases used to get rid of the carbon?—At first we had thick filaments containing much carbon, and we had to pass the hydrogen through the water. Later on, when we were capable of making very thin filaments, it not only was not necessary to pass it through the water, but, on the contrary, we had to dry hydrogen by passing it through sulphuric acid.

Did you acquire a licence under the German Just and Hanaman patent corresponding to the specification I am handing you now?—I cannot say exactly. I can only say we acquired all German patents, and if there is a German one corresponding to this, then we did buy it.

When did you commence to manufacture a filament using oxychloride of tungsten?—In July, 1906. We started with five girls and we finished off with 70 people working by day and 70 at night, all employed in making filaments by the oxychloride process.

At that date did you use steam and hydrogen?—I passed the hydrogen through a bottle containing water, so that the hydrogen became but very little moist.

When you abandoned it, you were using these very fine filaments that you have spoken of?—We found it out by accident. One day the water had been sucked out of the bottle, and I came to the workman who pointed out that on that day the manufacture went much better, and since that time we have given up using it. Then we went in the contrary direction and dried the hydrogen very much—we passed it over phosphorus pentoxide and sulphuric acid. When we used water vapour, the filament had light spots and burnt through, and afterwards when we had dry hydrogen, this no longer was the case. We made 50,000 filaments daily, placed them in lamps and sold the lamps.

Do you know the process that is being used there to-day?—Not the oxychloride process, but a paste process.

In 1904, for a built-up metal-filament the only process you knew of was the osmium process?—Yes.

As you used the term soft paste and said that this specification 23,899 of 1904, describes to you a soft-paste process, what is it in the specification that points to a soft-paste process?—I know that Just and Hanaman did not know a hard-paste process, but only used the ordinary soft collodion which was used for the preparation of carbon filaments.

Will you tell us what the collodion was that you used—what was its consistency?—I used a 15 per cent. collodion, and the differences consisted in this, that I tried for months to work by this patent, and I never succeeded.

Have you ever had experience of the manufacture of tungsten filaments from colloidal tungsten, made without a binding agent?—Yes.

MR. HORATIO BALLANTYNE said he had never been a lamp maker. For the last four years he had acted for the defendant company. At the date of the first patent sued on in this case, the only manner known to him in which filaments were made, was that of squirting a soft paste. He never heard of the hard-paste process until he met Voelker.

MR. TERRELL: You have heard Mr. Swinburne's evidence. Do you agree that carbon volatilises if a carbon filament is over run?—Yes. The carbon comes off and is deposited on the walls of the bulb.

Supposing a tungsten carbon filament is run up near to the melting point of tungsten, what happens to the carbon?—The carbon volatilises out. Whether it comes out as carbon *solus*, or whether it is in combination as carbide I cannot say, but that it does come out non-chemically I am satisfied.

Coming back to the specification, have you read it with a view to find out whether it was a soft-paste or a hard-paste process, or applicable to both?—Yes; as I understand it, it is applicable to soft paste only.

Have you ever seen in your life an artificial silk process, which you could describe as a hard-paste process?—No, and I have never heard of one either.

MR. TERRELL was asking witness further questions when MR. ASTBURY said:—Hardly one of these things has been suggested to our witnesses. We have not a conception that this was the sort of case alleged against us when our case was closed.

HIS LORDSHIP: This is all in the particulars. The sufficiency of the description is a matter, the onus of which lies on the plaintiffs.

MR. TERRELL (to WITNESS): Have you made filaments by the soft-paste method?—Yes, and leaving out for the moment the question of the cuprammonia method, one can make filaments by using the soft-paste process with carbon or chloride of zinc solution in cellulose. Then I have tried the hard-paste process, using chloride of zinc cellulose, and I must say that that has proved a difficulty. I have made a number of experiments, and I have not been able to get a filament by using the hard-paste process with chloride of zinc cellulose.

MR. ASTBURY: May I say that again has not been suggested to us. There has been no suggestion to any of our witnesses that there is any difficulty with chloride of zinc in a hard paste. When I sat down after I had finished my evidence I had no conception that many of these points which have been taken were even suggested or hinted at.

MR. TERRELL: What about the particulars of objections.

MR. ASTBURY: They are not in those particulars.

HIS LORDSHIP: Surely you must have known that one of the objections relied on was that there are not sufficient description of the invention. The difficulty I feel about it is this: Assuming the osmium process to be a hard-paste process, of which I am not quite sure, but if the patentee knew that a process similar to that used by the defendants was the way of making filaments he ought to have told you so; and if he did not know it, then he has made no invention.

MR. ASTBURY: Your Lordship seems to think that there is some difficulty about this soft-paste process. You can make it just as well by the soft-paste as you can with the other.

HIS LORDSHIP: That is not so. What I feel is that he has not told you what you are to do.

MR. ASTBURY: I am going to remove that difficulty. I am going to ask your Lordship to let me put certain witnesses into the box.

HIS LORDSHIP: I know you are. But I do not understand it to be their case that only the hard paste will work. The point of insufficiency is that he has not told the public with sufficient detail how to do it.

After further discussion, his LORDSHIP said: There will be an application on Mr. Astbury's part for leave to adduce further evidence. That I understand, and on that I shall have carefully to consider whether that leave ought to be given or not.

In further examination of witness, MR. TERRELL asked: Now, as to what the defendants do. First of all, do the defendants



use the hard-paste process?—They do. They bake the filaments under reduced pressure in a gentle stream of hydrogen, in which process the nitro-cellulose is decomposed and dispersed, and much of the oil is distilled over and a small residue of carbon amounting to about '4 to '8 per cent. is left.

In what condition is the carbon present, in your opinion? It is present in the form of carbide. It is very difficult to get any experimental evidence, one way or the other, as to the condition in which it exists. I may say that what appeals to me in coming to that conclusion is the strength of the thread. The quantity of carbon is so extremely small that I can hardly imagine its existing merely as a kind of mortar joining up the bricks. We know that a cementation process goes on and that tungsten is capable of combining with carbon at temperatures far below the fusion point. In these filaments during baking, we have this extremely finely divided tungsten in contact with extremely finely divided carbon, and it seems to me that the natural result will be that, at the high temperature, this transfusion of carbon with tungsten metal will occur.

When the defendants do their sintering, what, in your opinion, happens?—When the current is switched on, the temperature goes up extremely rapidly, and incipient fusion of the filament substance takes place. Whilst in this semi-fused condition, the particles are drawn together. The carbon, in my opinion, is an important element in that action, because, as we know, carbide of tungsten has a lower melting point than tungsten itself. As I picture the operation, the carbide fuses, the filament draws together and at the same time the carbon is expelled from the filament, leaving substantially pure tungsten, which has a very high melting point.

In your view is the carbon removed from the tungsten chemically?—Substantially not.

MR. TERRELL asked Witness, with regard to the second patent, what experiments he had tried with regard to the action of hydrogen and nitrogen. WITNESS said he found no difference whatever in the result, whether he used hydrogen alone or hydrogen plus 3 per cent. of nitrogen—the carbon was all substantially removed in half a second.

MR. TERRELL: The suggestion of my friend is that the ammonia means that the ammonia is to be a substitute for the nitrogen and the hydrogen. If that is so, did you try it in ammonia?—I tried the sintered filaments in ammonia, that is to say, treating the filaments in bulbs with ammonia instead of phospham. In the case of the phospham lamps made up with these filaments, there was no blackening, but in the case of those made up with ammonia, there was blackening.

(To be concluded.)

MR. JUSTICE WARRINGTON delivered his reserved judgment in this case on Tuesday, May 21st, deciding in the plaintiffs' favour as to the first claim, and for the defendants as to the other two. Notices of cross-appeals were given. The judgment will be reported in our next issue.

#### FERGUSON SUPERHEATERS, LTD., v. ASKERN COAL AND IRON Co., LTD.

THIS action, which was brought to restrain an alleged infringement by the defendants, of Askern, near Doncaster, of the plaintiffs' patent for steam superheaters No. 25,611 of 1905, granted to Charles Melville Ferguson, came before Mr. Justice Neville in the Chancery Division on Tuesday.

Mr. Walter, K.C., and Mr. Gray were counsel for the plaintiffs, and Mr. Bousfield, K.C., and Mr. Colefax represented the defendants.

In opening the case, MR. WALTER said that the usual defences were raised, but he did not think that any question would arise as to non-infringement, as the defendants had done the plaintiffs the honour to copy their invention exactly. The defence, he understood, would really be anticipation and want of subject matter.

After Counsel's opening speech, Mr Dugald Clerk gave evidence, and was cross-examined by Mr. Bousfield. Mr. Walter then announced that the parties had come to terms. The defendants had consented to pay an agreed sum for damages and costs, and the plaintiffs would grant them a licence to use the invention. His Lordship made an order in the terms agreed.

## BUSINESS NOTES.

**Russia.**—The St. Petersburg *Journal* reports that the Government intends to make amendments to some of the existing import duties, and amongst others, that on incandescent lamps will be increased. When the present tariff came into force in 1906, there was no import of metal-filament lamps, nor, of course, were they manufactured in Russia. Since then some metal-filament lamp works have been started, but they have not been very successful, and have had to fall back on the manufacture of carbon-filament lamps, as the insufficient protection afforded them by the tariff did not allow them to compete with the lamps of this kind imported. The duty fixed in 1906 was 7½ copecks per lamp, but it is now proposed to increase this figure up to 90 roubles the pood. Lamps will, of course, be much dearer to the consumer; carbon-filament lamps will be charged the same duty, but there is, of course, practically no import of them.

**Condensing Plant Contracts.**—Among the orders recently booked by the MIRLEES WATSON CO., LTD., of Glasgow, are the following:—

Surface Condensing Plants.—Leeds Corporation Electricity Department, condenser having 24,400 sq. ft. cooling surface; Frederick Smith & Co., Salford Wire Works, per the B.T.-H. Co., Ltd.; Midland Junction Railways, Australia; Devonport Corporation, per Jas. Howden & Co., Ltd.; Lanarkshire Steel Co.; Banquhar and Kirkconnell Collieries, per D. Selby Bigge & Co.

Condensing Plant of the "Mirlees-Leblanc" Type.—Weardale Steel, Coal and Coke Co., per D. Selby Bigge & Co.; the Fife Coal Co.; Falkirk Corporation, per Jas. Howden & Co., Ltd.; Maatschappij "De Laval," Amsterdam, for two cargo steamers; Ipswich Corporation, per Willans & Robinson.

Low-Level Jet Plant.—Rossington Colliery, per the B.T.-H. Co., Ltd.

Barometric Jet Plant.—Hornsey U.D.C.; McMurtrie, Guiler & Co., U.S.A.

In addition to the above there are a number of special air pumps for Sweden, South Africa, Borough of Hampstead, Greenock, &c.

**Dissolutions and Liquidations.**—S. BOTTONE & SON, LTD.—A meeting of creditors is called for May 29th at Temple Chambers, London, E.C. The company is winding up voluntarily. Mr. H. A. G. Lewis, liquidator.

SWITCHGEAR CO., LTD.—A meeting is called for June 14th, at 109, Colmore Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. H. Keeling.

ROWLAND & HULTON, LTD. (in voluntary liquidation), 109, Great Eastern Street, London, E.C., electrical engineers and contractors.—A meeting of creditors is called for May 22nd at 119, Finsbury Pavement, London, E.C. Mr. G. E. Corfield, liquidator. Mr. R. P. Hulton informs us that he has purchased from the liquidator of Rowland & Hulton, Ltd., the stock and goodwill of their business, and that he will carry on the business under the style of R. P. Hulton & Co., at 109, Great Eastern Street, E.C., as electrical engineers and contractors.

CHINNERY SIGNS (1909), LTD.—Creditors must send particulars of their debts, &c., by June 5th, to the liquidator, Mr. H. J. Sheldrake, 12, Duke Street, Chelmsford.

THE HELPTOPHONE CO., LTD.—A meeting is called for June 19th, to hear an account of the winding up from the liquidator, Mr. R. Evans Smith.

THE SUNBEAM LAMP CO., LTD.—A meeting of creditors is called for Monday, June 3rd, at 11 o'clock a.m., at the offices of Messrs. Watson Burton & Corder, Pilgrim House, Newcastle-upon-Tyne. Liquidator, Mr. T. Wallace, 42, Mosley Street, Newcastle-on-Tyne. The resolution for voluntary liquidation was passed on May 14th, Mr. J. T. Merz presiding.

**Electric Heating.**—THE BASTIAN ELECTRIC HEATING SYNDICATE, LTD., inform us that their agents, Messrs. Wheeler and Sons, of Victoria Gardens, Notting Hill Gate, W., have secured the order to heat and ventilate St. Michael's Church, Cornhill, E.C., and that Bastian electric heaters will be used throughout. Messrs. Drake & Gorham, Ltd., have recently fitted Bastian electric heaters in several dining halls and other rooms in the Holborn Restaurant, and amongst other important orders recently booked is one for 70 Bastian heaters for use on H.M. battleships, and in several dockyards.

**Consular Notes.**—URUGUAY.—A report of the machine-testing station of the Agricultural College at Monte Video gives certain details of the comparative running costs of various types of motors in Uruguay, and particularly in Monte Video. From these details it appears that electrical power in Monte Video is relatively cheap, and that it is particularly profitable for small industrial purposes. A much extended use of the Diesel engine is anticipated, particularly as for some little time now the importation of these engines for agricultural purposes has been allowed free of duty. It appears that the first motor plough was made only last year in Uruguay, and now there are more than 50 in use.

**India.**—The German Consul in Bombay reports that the installation of electric and gas lighting, and of other public works, is being rapidly extended not only in the largest towns, but also in the outlying districts. In Bombay, for instance, the new dwellings and offices are nearly all fitted with electric light and electric fans, and some also with electric lifts. Electric lamps are not separately specified in the Indian statistics, but it appears from the German export returns that the exports of German lamps to India were valued at 54,000 marks, 165,000 marks, and 110,000 marks, in 1908, 1909, and 1910. Hardly less important than lighting is the demand in the bungalows for electric fans. Where electric power is available, there is in every room an electric fan attached to the ceiling, and generally there are also small portable lamps. There is also a large demand for electric machinery and power plant; not the least important part of this demand is for the textile factories in Bombay, and it may be anticipated that in a few years, most, if not all, of the larger spinning and weaving mills, at least, will be run by electric power.

**Russia.**—The Austrian Consul in Rostov reports that, since the coming into force of the arrangement between the Schuckert Werke and the firm Siemens & Halske, the leading rôles in the trade in that district, in electro-technical goods, have been played by Siemens & Halske and the Allgemeine Elektrizitäts Gesellschaft. The former has secured important installation works, including the extension of electric control of the Novorossisk Cement Works, the erection of the electric station at Nowotcherkask, and the extension of the municipal electric light works at Nachitschewan. No new electric tramways were constructed in 1910, but projects for such tramways at Stawropol and Tagaurog were prepared. In the



trade in arc lamps, in which a Saxony firm was formerly actively engaged, the firm Siemens & Halske, and the Allgemeine Elektrizitäts Gesellschaft, have eliminated outside competition. In telephone apparatus, bells, &c., a St. Petersburg firm have taken the largest orders, and after it a Hungarian firm. As regards public telephones, the firm Siemens & Halske have succeeded in squeezing out competition, and the same has occurred in the trade in telegraph materials. A Swedish firm, through its St. Petersburg house, actively competes in the trade in house telephones. Carbon-filament lamps are supplied chiefly by a Berlin syndicate, a Dutch house, and a Warsaw firm; incandescent lamps of Hungarian origin are also to be found on the market. Metal-filament lamps have become increasingly popular in recent years, and in 1910 the demand in the Rostov district was very large. German firms are prepared for the supply of insulating tubes for electric installations.

**Spain.**—The Austrian Consul at Barcelona reports that the imports of dynamos, electric motors, induction coils, resistors, transformers, switchboards, &c., in 1910, amounted in value to 11,400,000 pesetas. There is a very good demand for this class of goods, and a large opportunity for sales. Especially for goods weighing not more than 400 kgs. each, and for small electrical installations, is there an increasing demand, and the imports of these goods increased from 2,700,000 pesetas in 1908, to 3,000,000 in 1909, and 4,700,000 in 1910. Germany rules the Spanish market, but France, Switzerland, Great Britain, Belgium and the United States also take an important share. Insulated cables and wires for the transmission of electricity were imported in 1910 to the value of 1,300,000 pesetas, as against 1,900,000 pesetas in the previous year. The demand for these wires, 1 cm. in diameter, is falling off, the cause being partly the increasing home production and partly the existing conditions. Germany takes the most important share of the trade. Telegraph apparatus and telephones, electric meters, &c., were imported in 1910 to the value of 1,500,000 pesetas. The importation is on the increase, and is chiefly from Germany, France, Sweden, Belgium and Great Britain. The opportunities for trade in these lines are very great. Electric arc lamps were imported to a value of 408,039 pesetas, chiefly from Germany; carbons for these lamps accounted for 130,000 pesetas, and the demand for them is on the increase. Electric incandescent lamps, mounted, are in strong demand and the demand is increasing. In 1908 the imports amounted to 900,000 pesetas, but by 1910 they had increased to 2,300,000 pesetas. Although a factory for the production of these lamps has been started in Spain, producing at cheap prices, it will be seen that the demand for foreign lamps is still large. Germany is still the largest participator, but France, Austria and Great Britain also supply certain quantities. The price for Spanish lamps is 50 pesetas per 100, and for foreign 90 pesetas per 100, payment in 90 days. The imports of fixed steam engines and gas motors in 1910 amounted to 2,900,000 pesetas, but they have fallen off considerably during the last three years. In 1908 they amounted to 4,200,000 pesetas, and in 1909 to 1,600,000 pesetas. Great Britain, France and Germany are the largest suppliers. The trade in cylindrical steam boilers has also declined over the same period, and in 1910 amounted to only 1,300,000 pesetas. The trade in tubular boilers and gas generators amounted to 2,800,000 pesetas in 1910, as against 1,900,000 in 1909, and the trade in hydraulic motors has also fallen off; as regards the former, Germany, Belgium and France are the largest suppliers, and as regards the latter Germany, France, Switzerland and Sweden.

**Turkey.**—The Austrian Consul at Salonica reports that the trade in electro-technical apparatus has greatly increased in recent years, as the telephone installations and the other electrical undertakings of the town have been extended considerably. The trade in Salonica is now chiefly confined to small articles for household use. The imports amounted to 30,000 fr. in 1910, chiefly from Austria, Germany and Belgium. The trade in larger goods for the electric stations, the railways and the other large undertakings with their own electrical plant, is chiefly carried on direct with firms in Austria, Germany and Belgium. Firms interested should note that if they hope to increase their trade in these larger goods it is necessary that they should be adequately represented on the spot.

**Brazilian Trade and Finance.**—It is of more than passing interest to note in the Presidential address of Hermes da Fonseca the continued progress of Brazil. For the financial year 1911 the foreign trade of the country amounted to more than £119 millions, representing an increase approaching £9 millions as compared with 1910, whilst the customs receipts for the same year exceeded those for 1910 by 16,328 contos. The total receipts from all sources, including credit operations, amounted to 139,948 contos of reis gold, and 424,581 contos paper, the expenditure totalling 89,088 contos gold and 511,874 contos paper. In respect of the revenue proper there was a gold surplus over expenditure of 33,266 contos, and a net deficit of 34,069 contos paper. The external debt of the country stands at nearly £83 millions, together with a sum of 300 millions in francs. It is important to observe also that the gold passing into the Conversion Fund in 1911 reached almost £8½ millions, and the withdrawals over £3¼ millions. The milreis in gold is equal to 26·93 pence at par, and the paper in currency milreis is fixed at 16d. per 1,000 reis, or one milreis, a conto being the equivalent of 1,000 milreis.

The Brazilian Conversion Law of 1906, it may be added, fixed the value of the currency milreis at 15d. (since increased comparatively recently by a law containing other alterations to 16d.), and anyone may change at the Conversion Caisse, or the Caixa de Conversao, their notes for gold, or *vice versa*, at the fixed rate. The notes issued by the Conversion Caisse are legal tender, and their acceptance is obligatory for all contracts and payments, except in cases in which payment is decreed, undertaken, or contracted to be effected

in gold, and must be realised as at present by the legal rate of 27d. per milreis, in notes of the Conversion Office at their gold value as established by law. That the Conversion Law of 1906 has given a much-needed stability to Brazilian currency is undoubted, its primary objects being stability and the accumulation of a gold reserve for the eventual conversion of the unconvertible paper in circulation and its supersession by a currency convertible or exchangeable on presentation.

It is easy to see that (prior to the fixation of the rate) a non-guaranteed currency is likely to favour the home producer when the exchange rate of the monetary unit is low, inasmuch as he pays his wages and other forms of trading expense in the depreciated standard, and ships his produce for payment in gold. *Per contra* the importer buys for payment in gold, and sells for payment in depreciated paper. Similarly with British tramway and other undertakings. They receive in such circumstances their revenue in paper of changing value, which, to a considerable extent, has to be converted into gold for the purpose of paying dividends and interests, machinery for equipment purposes, and other home requirements. A non-guaranteed currency with internal widely fluctuating exchange always acts as a detrimental clog upon the wheels of the machinery of real industry.

**Re-Establishment of the International Aluminium Syndicate.**—It is announced from Paris that the several months of negotiations have now resulted in the resuscitation of the International Aluminium Syndicate, which collapsed as far back as 1908. The combination, which has been brought into immediate operation, is composed of the producing works in France, Switzerland, Great Britain, the United States, and Canada, although the sales organisation of each individual constituent remains the same as hitherto. The capacity of production of the works has been estimated, and the division of the world's business is to be effected *pro rata* to the actual sales which have already been carried out by individual producers within a particular period. It is intended to fix prices after mutual discussion. The trade for the present year has already been substantially concluded. Nevertheless the basis price has been arranged at £70 per ton, but sales for next year are not to be undertaken for the present. It will be remembered that the former syndicate collapsed, owing to the price policy pursued in the direction of forcing up quotations to an exceptionally high level, thus stimulating the promotion of new undertakings which kept outside the combination, and which led to exceedingly keen competition and falls in prices, and eventually to the dissolution of the syndicate. The new syndicate, which was formed in Paris on April 29th, is said to have been constituted for a number of years, although its operations will scarcely commence before January 1st, 1913, seeing that nearly all business has already been transacted for the current year. It appears from a statement made by the chairman of the Neuhausen Aluminium Industry Co. on April 30th, that a few signatures to the agreement were then still lacking, although there is no doubt that they will be obtained. The details of the agreement are to be kept secret, as a result of an arrangement made at the Paris meeting. The conditions under which the Neuhausen company has joined the syndicate might have been better, but it was thought advisable to accept them in the interest of final peace, and in order not to allow the scheme to be abandoned. It is, however, considered to be a favourable circumstance that the syndicate has been revived, as the consumption of aluminium has enormously increased during the obstinate trade contest which has proceeded for several years past. The hope is expressed that the syndicate will render useful services, although it is admitted that the greatest caution will have to be exercised in the matter of price policy.

**Catalogues and Lists.**—THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, London, E.C.—16 page illustrated list (No. C. 1,137) of "Glob-o-lite" illuminated signs. The principle of construction of these signs is described and a number of night effects illustrations show the signs used effectively in advertising service for hotel, restaurant, and shop exteriors. The "Glob-o-lite" signs included in the list are for single lamp and reflector use, and for special reproductions, art metal shop window advertisements, and interchangeable letter signs for cinematograph and music halls, illuminated facias, etc. In the construction of the signs, between two plates of perforated sheet metal are placed moulded crystal glass balls, having a flange around their diameter. The back and front hemisphere of the glass sphere project through the perforation in the back and front plate respectively, and the flange of the ball, when the two sheets are bolted together, is tightly gripped between them, holding the ball securely in position.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 348 (eight pages) giving illustrated particulars and prices of B.T.-H. fan motors for bracket, desk and other service, also C.C. and A.C. exhaust fans, for the 1912 season.

MESSRS. JAMES KEITH & BLACKMAN CO., LTD., 27, Farringdon Avenue, London, E.C.—Leaflet relating to the advantages of the Blackman ventilating fans for summer service.

MESSRS. T. & T. VICARS, 20, Bucklersbury, London, E.C.—Two booklets just issued relating to the Vicars mechanical stoker. One is a catalogue of 66 pages, in the first section of which are a number of elevations and sectional drawings of the stoker; the second part containing matter relating to the combustion of fuel and giving a general description of the stoker, showing the saving as compared with hand firing and giving test information. Section 3 briefly covers elevating and conveying plant, and No. 4 contains a number of tables of combustion, saturated steam, boiler efficiencies, and other



data; the last section includes a series of tables giving the heat values of 146 British coals. The accompanying brochure contains many pages of illustrations of various installations of the Vicars stokers, among them being electric light and tramway stations and many industrial works.

THE WESTMINSTER TOOL AND ELECTRIC CO., Suffolk House, Laurence Pountney Hill, London, E.C.—Leaflet No. W18 containing illustrations, brief notes and prices of the "Westminster" motor-boat and yacht lighting system of several types and sizes, type "A" being for sailing yachts which have no engine, and "B" for auxiliary yachts and motor-boats. Motor-boat electrical fittings are shown.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—4-page detailed price list of various qualities of carbons for open and enclosed arc lamps.

MESSRS. W. E. MOULSDALE & CO., 24, Chapel Street, Liverpool.—Illustrated leaflet relating to a 240-KW. steam generating set that is offered for sale.

LANGDON-DAVIES MOTOR CO., 110, Cannon Street, E.C.—Booklet of useful tables of H.P. and KW. equivalents, &c., and data relating to the company's standard A.C. and D.C. motors.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109 and 111, New Oxford Street, London, W.C.—32-page catalogue (No. S 3) containing very fully illustrated particulars of a variety of fittings and accessories used in connection with street lighting. These include cast-iron water-tight reflector fittings for outside and exposed positions, multiple lamp fittings supplied for up to 2,400 C.P. for dock and street lighting, ornamental water-tight lantern fittings for metal-filament lighting, wall brackets and pendants, shop lighting and tramway standard fittings, lamp brackets and columns, contact gear and self-sustaining devices and parts for use in connection therewith, automatic safety winches, spring insulated suspenders for arc and metal-filament lamps, time switches and remote-control switches, automatic locking device for suspension fittings; various suspension methods are shown. Price information, code words and weights are given throughout the list.

THE ELECTRIC CONSTRUCTION CO., LTD., 9, New Broad Street, London, E.C.—Booklet (B/287) of eight pages containing illustrated descriptive information relating to the firm's E.C.C. removable panel ironclad switchboards.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, Kent.—New pamphlet (No. B 527) describing with diagrams the Baudot type-writing telegraph apparatus of the latest and most developed form, as used in the General Post Office.

MESSRS. T. & J. JACKSON, LTD., 14, Park Road, London, N.W.—16-page catalogue of electric cooking apparatus. Its illustrations include views of electric restaurants fitted entirely with Jackson apparatus, while prices and views of the following are also given:—Electric ranges, rapid water boiler, electric oven, grills, breakfast cookers, boiling pans, fish frier, boiling plates, hot cupboards, kettles, urns, glue pots, sterilisers, instantaneous water heaters, &c.

THE TELEGRAPH CONDENSER CO., LTD., Vauxhall Street, Kennington Oval, S.E.—Illustrated catalogue of their hermetically sealed condensers, artificial cables with negligible coefficient (Dearlove patent), various types of adjustable condensers for duplex working, &c., standard condensers, complete duplex balancing sets and instruments for use therewith. A completed box of artificial line with a ratio of 4.96, and a total resistance of 104 ohms, is stated to have given, over a range of 21° F., a rise in resistance of less than 0.01 per cent. per ° F. A number of useful tables and curves relating to the temperature corrections of condensers, expansion of paraffin, &c., is given at the end of the catalogue, which is admirably produced.

MESSRS. UNITED BRASSFOUNDERS AND ENGINEERS, LTD., Empress Foundry, Cornbrook, Manchester.—Useful bound catalogue of 170 pages containing full information, together with illustrations, of a great variety of valves, cocks, gauges, lubricators, unions, whistles, governors, and other fittings for steam, water, heating, and fire, in gun-metal, brass, cast-iron, &c. Prices are clearly tabulated, together with weights, reference numbers, &c. The catalogue should be of great use to the trade, and interested parties who have not yet received a copy should make application for one.

**Book Notices.**—"Heat Engines." By Herbert A. Garratt. 1912. London: Edward Arnold. Price 6s. net.

"The Art of Illumination." By Louis Bell. 1912. London: Hill Publishing Co., Ltd. Price 10s. 6d. net.

"Report of the Annual Meeting of the American Institute of Consulting Engineers, January 16th, 1912." New York: The Institute.

"Lord Kelvin." By Dr. Silvanus P. Thompson, F.R.S. Published in French and English. 1912. London: International Electrotechnical Commission. Price 1s. 2d.

"The Central." Vol. IX, No. 27; also "List of Members and Rules of The Old Centralians." 1912. Reading: The Secretary, 98, London Road. Price 1s. 6d.

"Soren Hjorth; Inventor of the Dynamo-Electric Principle." By Ligurd Smith. 1912. Kobenhavn: *Elektroteknisk Forening*.

"Annuaire International de l'Acétylène, 1912." By R. Granjon and P. Rosenberg. Paris: l'Office Central de l'Acétylène. Price 3 fr.

"Bulletin de la Société Internationale des Electriciens." Vol. II, No. 14. April, 1912. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"Transactions of the South African Institute of Electrical Engineers." Vol. III, part 2. March, 1912. Johannesburg: The Institute. Price 2s.

"Notes on Alternating Electric Current and Induction Motors." By T. Harding Churton. 1912. Leeds: T. Harding Churton & Co., Ltd.

"Journal of the American Society of Mechanical Engineers." May, 1912. New York: The Society. Price 35 cents.

"Bulletin Mensuel de la Société Belge d'Electriciens." March, 1912. Brussels: Emile Bruylant. Price 1 fr. 50.

"Proceedings of the Engineers' Club of Philadelphia." Vol. XXIX, No. 2. April, 1912. Philadelphia: The Club.

"Boletín de la Sociedad de Fomento Fabril." March, 1912. Santiago de Chile: The Society.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Speciales." March, 1912. Liège: The Association. Price 75 cents.

"Transactions of the Illuminating Engineering Society." Vol. VII, No. 4. April, 1912. New York: The Society. Price 75 cents.

"Telephony." By Samuel G. McMeen and K. B. Miller. 1912. London: Crosby Lockwood & Son. Price 17s. net.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 5. May, 1912. Philadelphia, Pa.: The Institute. Price 50 cents.

"Steam Boiler Construction." By Edward G. Hiller. 1912. Manchester: The National Boiler and General Insurance Co. Price 1s.

"Peru To-day." Vol. III, No. 12. March, 1912. Lima: The West Coast Publishing Co. Price 5d.

"The Physical Review." Vol. XXXIV, No. 4. April, 1912. Lancaster, Pa.: The Review Office.

"La Telegraphie Sans Fil." By E. Monier. 1912. Paris: Dunod et Pinat. Price 2 fr. 50.

"Engineering Directory." April, 1912. London: *Engineering*, Ltd. Gratis.

**Trade Announcements.**—We learn that the firm of T. HARDING CHURTON & CO., of Atlas Works, Water Lane, Leeds, electrical engineers, has been converted into a private limited company, and will in future carry on business under the style of T. Harding Churton & Co., Ltd. The conversion has been made for private reasons only, and no part of the capital has been offered to the public. The directors of the company are Thomas Harding Churton, who is the governing director and the chairman of the company, and Sidney Herbert Smith. All debts and liabilities of the firm are undertaken by the company, and all debts due to the firm are to be paid to the company. The conversion will not affect the general conduct of the business, which will be carried on as heretofore.

MR. SAMUEL ATKINSON, electrical goods dealer, of Castleford (Yorks.), has removed his business from Sagar Street to new premises in Vickers Street.

MR. L. F. BRUNNER, has removed to 222, Romford Road, Forest Gate, London, E.

The new works and offices of the LIVERPOOL ELECTRIC CABLE CO., LTD., being now ready, the business will be transferred thereto on May 31st, when all correspondence should be addressed to Linacre Lane, Bootle, Liverpool. The telegraphic address will be as before—"Concentric, Liverpool"; Telephone number—"147 Bootle."

On May 18th MESSRS. ISENTHAL & CO. changed the address for offices and works to Denzil Road, Neasden, N.W.—their only address in future.

THE FREDK. CRANE CHEMICAL CO. have recently found it necessary to migrate from their old home in Newhall Hill, to a new factory designed to meet the requirements of the business, in Armoury Close, Bordesley Green, Birmingham. Here they have ample room for expansion for some years to come.

MR. H. B. ARNOLD, who recently resigned his position with Messrs. G. & H. Grevener, London, as their Northern representative, has now joined the staff of MESSRS. CARNEY & PEARNS, LTD., and is taking charge of their supplies department, which he is re-organising and extending, so that the firm are now in a position to supply every class of electrical material for power and lighting. His new address is Nutsford Vale Works, Manchester, S.E.

MR. HARRY NANCE, electrical manufacturers' representative, 4, Church Street, Cardiff, is removing his offices and stores to larger and more convenient premises, and his address will henceforth be Dragon Buildings, Paradise Place, Cardiff.

**Stoker Contracts.**—Among orders recently booked by the UNDERFEED STOKER CO., LTD., of Coventry House, E.C., are the following:—

Portsmouth Dockyard generating station, six travelling grate stokers and air heaters; Swansea Corporation Electricity Works, four "E" type stokers; South Metropolitan Electric Light Co., four "E" type stokers; Corporation of Oldham, 16 "B" type stokers; Corporation of Sheffield, Sheaf Street, two "E" type stokers; Soc. Energia Electrica de Cataluna, Barcelona, 16 travelling grate stokers.

**Osram Lamps.**—THE GENERAL ELECTRIC CO., LTD., announce a reduction in the price of pear-shape Osram lamps of 20 to 30 volts, 5 to 16 C.P., to 2s. 1d. each. They now hold large stocks of low-candle-power Osrams, as follows:—100 to 135 volts, 11 watts, approximately 10 C.P.; 200 to 260 volts, 20 watts, approximately 16 C.P. The company can now supply from stock plain flame Osram lamps, candle-shape, 200-260 volts, 20 watts, 16 C.P., with drawn wire filaments. Hitherto the firm have only supplied these candle-lamps for low voltages, up to 130 volts.

**Bankruptcy Proceedings.**—H. JOHN WRIGHT, 69 Blackboy Lane, West Green, N.—At a sitting of the London Bankruptcy Court, held on Tuesday last week, before Mr. Registrar Linklater, this debtor attended for public examination upon accounts showing unsecured debts £305, contingent liabilities £180 (not expected to rank), and assets nil. Replying to Mr. Egerton S. Grey, Official Receiver, the debtor stated that he had been employed



in the electrical trade since January, 1911, by a firm of electrical accessory suppliers. Judgment for £37 odd was obtained against him in September, 1911, by a creditor, and, a committal order having been obtained, he filed his petition on March 28th last. Witness attributed his failure and insolvency to his liabilities in connection with the Ferabin Lamp and Electrical Accessories, Ltd. The examination was concluded.

C. H. STEEL, electrical engineer, Bradford (lately Cardiff). First meeting, May 30th; public examination, June 10th: both at Cardiff.

## LIGHTING and POWER NOTES.

**Accrington.**—In his annual report on the electricity undertaking, the borough treasurer states that the gross income for last year was £19,452, and gross expenditure £10,872, leaving a revenue surplus balance of £8,580, representing 9·29 per cent. on the capital outlay. The number of consumers was 848, compared with 731, and the units supplied were 3,315,512 against 2,860,722. Average prices per unit:—Lighting, 3·661d.; power, 9·53d.; public lighting, 3d.; tramways (for traction), 1·2d.; combined average, 1·349d.; working expenses per unit, 787d. The borrowing powers amounted to £95,560, compared with £87,560 in the previous year.

**Altrincham.**—The B. of T. has granted a provisional order authorising the Altrincham Electric Supply Co. to supply electrical energy for all public and private purposes within such parts of the townships of Hale, Timperley, and Dunham Massey, as were not included in previous orders, as well as to the township of Baguley. Important building developments in these districts in the near future are anticipated.

**Australia.**—The demand for electric light and power in country districts in Victoria continues to grow, the transition in very many cases being the pronounced one from kerosene to electric lighting. *The Australian Mining Standard* says, with respect to the State as a whole, an official return, prepared recently, showed that up till then 42 undertakings had been authorised by Order-in-Council under the Electric Light and Power Act, including four electric tramways, and sixteen of the orders are held by municipal councils. The approximate amount of capital invested was £1,700,000, and the gross annual revenue about £265,000. The amount of capital invested by consumers of electric light and power in installations and machinery was set down at £470,000. The number of electric motors was estimated at 3,500, and the number of lamps 408,000. "There are also," the official report added, "about 80 private electric installations at mines, etc." Since that date over a dozen additional Orders-in-Council have been granted, mainly for country supplies, and the amount of capital practically invested is, therefore, considerably higher than the figures given above.

**Ayrshire.**—According to a statement made to the County Council the electric lighting scheme for Skelmorlie has been completed and is giving much satisfaction. The village is now lit by 85 metal lamps of 50 candle power, and the cost per annum is £158.

**Ballybay (Co. Monaghan).**—At a meeting of the Monaghan County Council, last week, an application was made by the Ballybay Gas Light Co. for permission to erect poles in the streets for the purpose of electric lighting. At the previous meeting of the County Council, a similar application was granted subject to the approval of the County Solicitor. Both parties addressed the Council, and the solicitor stated that having carefully considered both applications, he found that neither of the applicants had obtained a B. of T. licence under the Electric Lighting Act, 1882, and it appeared to him that in a small town like Ballybay, it was not desirable there should be two electric lighting undertakings, as their poles and wires would be crossing one another. It was, however, entirely a question for the B. of T. and the Castleblaney R.D.C., and he thought it would be advisable to communicate a copy of his letter to that body. After discussion, the Council passed a resolution that the terms of Mr. M. Murray, the earlier applicant, be adhered to.

**Belfast.**—The accounts of electricity undertaking for the year ended March 31st, 1912, showed that for the period a working profit of £32,496 had been carried to net revenue account, which had also been credited with £442 for bank interest, making a total of £32,939. After providing for loan charges amounting to £19,521, income-tax £470, and stamp duty £28, there remained to credit of net revenue account a disposable balance of £12,919.

**Birmingham.**—It is anticipated that notwithstanding the high price of coal during the strike, there will be a profit of about £50,000 on the electric supply department.

**Blackpool.**—An inquiry on behalf of the L.G.B. was held on April 15th, relative to the T.C.'s application for sanction to a loan of £10,000 for extensions at the electricity works, rendered urgently necessary to meet the increasing demands for lighting and power purposes.

**Brazil.**—At Parahyba, in the Parahyba do Norte Province, a new company with a capital of 3,000,000 dollars and the title of the "Empresa de Traccao, Luce Força de Parahyba do Norte" has been founded to build power and lighting stations in

the aforementioned province. The directors of this new enterprise are:—Dr. Julio Bandeira, Dr. Alberto de S. Juan and Thiago V. Monteiro.

Large electrical works are to be erected near Pindamonhangaba, San Paulo. The Ribeirao waterfall will supply the power—about 4,000 H.P. The works will supply current to the towns of Taubaté and Tremembó.

**Broadstairs.**—The Isle of Thanet Tramway Co. is erecting a sub-station in St. Peter's Road, in order to cope with the increasing demand for current.

**Chester.**—A L.G.B. inquiry was held on May 16th respecting the proposed loan of the Corporation for providing hydro-electric works on the site of Old Dee Mills. The scheme proposes to develop 775 H.P. and be capable of supplying 1½ million units per annum, and will replace, for the present, extensions of the Crane Street station, with a prospect of greater profits than if that station were extended. The Electricity Committee proposes to recommend the T.C. to accept tenders for buildings, £4,639; turbines, Gordon & Co., £4,693; dynamos, Lanes. Dynamo Co., £2,006; and switchgear, Crompton & Co., £269. The Chester Waterworks Co., and others opposed with a view to raising the weir to its original height, and the Conservancy Board were also represented.

**Continental Notes.**—**SICILY.**—La Société d'Electricité de la Sicile Orientale has recently established two large power stations to utilise the water power of the Rivers Alcantara and Cassibile. The plants, which have a capacity of 11,500 kw., are supplying electrical energy to all the principal towns on the east coast of Sicily, including Messina, Acireale-Catania, and Syracuse.

**FRANCE.**—A Bill has been introduced into the French Chamber by the Minister of Agriculture and Public Works, for the establishment on the River Durance of hydraulic works for the irrigation of the low lands on the right bank of the Rhone, and the working of agricultural water undertakings in the Mediterranean region. The scheme provides for the erection of hydro-electric generating stations on the Durance, near the watermeet of the River Verdon and the bridge at Pertuis. The power produced at these stations will be used for all kinds of agricultural purposes in the Departments of the Bouches-du-Rhone, Vaucluse, Gard, and Hérault. The surplus, after the satisfaction of these requirements, may be sold and delivered either to generating stations or distribution networks. These and supplementary works are estimated to cost 65 million francs, and the Bill asks for the sanction of a first expenditure of 300,000 fr. on account of preliminary studies.—*Revue Electrique*.

**Coventry.**—The City Council on Tuesday received the annual report and accounts of the electricity department for the past year, showing a net profit of £16,173. The engineer (Mr. G. Tough) reported that the total units sold during the year amounted to 10,473,339, as compared with 7,943,937 last year, being an increase of 2,529,402, or 32 per cent., the increase in the power load accounting for 2,470,163 of this amount. The total revenue for the year amounted to £50,682, an increase of 9·2 per cent.; the revenue from the power load increased from £29,839 to £33,719, or 13 per cent.; and the revenue from the lighting load, which is only 10 per cent. of the total load, increased from £13,550 to £14,196 this year, an increase of 4·8 per cent. The average revenue received per unit was 1·16d., compared with 1·40d. last year, being a reduction of 24d., or 17 per cent. This was due to the revised scale of charges for meters, and reduced rates for power adopted by the Committee last year, but these reduced rates had been largely responsible for the heavy increase in the power load, which in turn had greatly reduced the capital charges per unit. The capital expenditure during the year amounted to £22,884, making a total capital expenditure to March 31st, 1912, of £294,085, which included a sum of £27,750 transferred at various times from the reserve fund, on account of superseded, or obsolete plant, &c. The total works cost per unit sold was reduced from 378d. to 325d., or 14 per cent. The coal per unit generated was 2·69 lb., as against 3·8 lb. in the previous year, being a reduction of not less than 6,100 tons on the year, and a saving of £2,440. The total coal cost per unit sold was reduced from 164d. to 135d., the very lowest coal costs ever recorded in the country. These low costs were brought about by the installation of the more efficient turbo-alternators (which are still the largest units in the Midlands), increased load, and a higher working efficiency. The total costs per unit, including capital charged amounted to 72d., being a reduction of 15 per cent., and was 703d. less than 75d., which was the lowest charge for energy. This total cost of 72d., deducted from the average revenue received, viz., 1·16d., left a net profit of 44d. per unit, or 62 per cent. of the total cost, compared with 56d. and 66 per cent. in the previous year. The cost of new meters, motors, &c., has no connection with the working costs and had to be deducted from the 44d. per unit, leaving the nett profit, as per cost sheet, viz., 37d. per unit. Plant has been scrapped and superseded during the year to make room for the third turbo-alternator now on order from the B.T.H. Co. The remaining value of this plant scrapped and superseded amounted to £5,779, which amount will require to be provided out of profits this year, and go towards the cost of the present extension. The H.T. mains had been extended by 11,473 yd., and the L.T. mains by 11,419 yd., making a total of 22,892 yd. laid during the year, and the total mains laid to March 31st, 1912, amounted to 172,976 yd., being equal to 93 miles 496 yd. The number of consumers had increased from 1,590 last year, to 1,962 this year—an increase of 372, as compared with 297 last year.

Councillor Pridmore, chairman of the Electric Light Committee, in moving the adoption of the report, paid a high tribute to the



engineer. As to the demand for a greater sum out of the profits toward the relief of the rates, he contended that the needs of the undertaking must be the most important consideration, and that its success was dependent upon selling current at the lowest price possible, and the provision for ample depreciation of plant, in view of the rapid development of electrical science. The report was adopted, and the following revision of charges sanctioned:—Total consumption exceeding 250,000 units per quarter (1,000,000 per annum), charge reduced from 75d. per unit to 7d.; exceeding 375,000 units per quarter (1,500,000 per annum), 65d. per unit; a further reduction of 5 per cent. to be allowed for every 10 per cent. increase of load factor above 40 per cent. Meter rentals to be abolished. The total estimated cost of these reductions was £1,000 per annum.

**Barnes.**—At the last meeting of the U.D.C. the electrical engineer suggested, owing to the development of the demand on the Lowther Estate during the past winter, the laying of a 25-sq. in. concentric feeder to a point in Kitson Road, at an estimated cost of £620, and recommended the invitation of tenders for supplying the cable. This was agreed to.

**Creswell.**—The ratepayers here have accepted the offer of the Bolsover Colliery Co. to supply current for private lighting at 3½d. per unit.

**Croydon.**—The report of the year's work of the Corporation electricity undertaking, presented to the B.C. on Monday evening, stated that the main increase of business was in general supply, the greater output having been brought about by reductions in charges to consumers and more active publicity and canvassing work. Of the increase of 536,203 units sold, 430,206 were for lighting, power, heating and cooking. There was a larger demand for heating and cooking supplies, the possibilities of which would be very great, says Mr. Cramb, if the department could work on advanced competitive lines. "Unfortunately," he adds, "restrictions of Parliamentary powers at the present moment result in 75 per cent. of the inquiries for electric supply being turned away owing to the fact that consumers' requirements cannot be met." Concessions to consumers reduced the revenue by £3,076, but the total receipts were £62,593, an increase of £1,104. Consumers increased by 367 to 4,316. Regarding finances, besides the concessions to consumers, the appropriation of £3,500 to relief of rates, and the fact that £5,986 on the revenue account was charged against profits (a considerable proportion of which, the auditors certified, might have been regarded as capital expenditure), there was a surplus of £3,742, which was carried to the appropriation account. The reserve fund stood at £39,031, subject to a sanctioned expenditure of £15,400 chargeable to it. Ald. D. B. Miller (chairman of the Lighting and Electricity Committee) said that if they could they would have vetoed the £3,500 taken for the rates. He held out no hope of further concessions to consumers this year. He had great hopes that the Committee would get powers on the lines of the Bill now before Parliament promoted by the Municipal Electrical Association. He did not think the Bill, if passed, would injure contractors in any way. The new machinery, it was hoped, would save £1,000 a year on the fuel bill. The report and accounts were passed; also an expenditure of £3,295 on various works in connection with distribution, of which £978 comes from revenue account.

**Douglas (Isle of Man).**—The T.C. has decided to issue circulars to possible consumers of electricity with a view to ascertaining what amount of current would be taken if an electrical undertaking is established. The circulars will contain the cost of wiring premises, the cost of lighting and other particulars.

**Dundee.**—The Electricity Committee of the T.C. has approved of the electrical engineer's proposal for the better lighting of the streets, and has sanctioned the replacement of 84 lamps of old design by a new form of arc lamp. The estimated cost of the proposal is £714.

**Highbridge.**—Dr. Purves, who is establishing electricity works at Burnham (Somerset), has approached the Council with respect to the extension of the supply to Highbridge, under an agreement. The Council has decided that the Lighting Committee shall confer with Dr. Purves.

**Horsham.**—By a large majority the U.D.C. has decided to proceed with the construction of a refuse destructor in connection with the electricity works on the lines suggested by the electrical engineer. It is estimated to cost £1,150, exclusive of alterations of buildings.

**Kenmare.**—The electric lighting works, after a somewhat chequered career, have we understand since being placed under the care of Mr. R. J. Campbell, been modernised and an up-to-date scheme of electric lighting adopted. An electrically operated mineral water works and the development of clay working in the vicinity are expected to provide a day load, while the growth of electric lighting has been most gratifying during recent months.

**Llandudno.**—The Council has decided, in order to encourage the consumption of electricity for heating purposes, to invite makers of the heating apparatus to give a demonstration in the autumn and will place the Town Hall at their disposal for the purpose, and give a free supply of electricity.

**London.**—HACKNEY.—It has been decided to borrow £3,468 from the L.C.C. for mains.

**FULHAM.**—The Electricity Committee reports the result of negotiations with the Surveyor of Taxes on the subject of income-tax and depreciation allowance in respect of the electricity undertaking, to the effect that the approval of Somerset House authorities

had been obtained to a statement showing that on April 5th last, the unexhausted depreciation may be regarded as £11,658. This statement the Committee states will have the effect of relieving the Council from payment of income-tax on the profits of the undertaking for several years to come. The Committee has decided to provide and fix a suitable 24-in. water strainer in connection with a condensing plant at the electricity works at an estimated cost of £185.

**MARYLEBONE.**—As it is found that a residence consumer on the "telephone" system who uses electricity for lighting only, consumes 1d. units amounting in value, in a year, to approximately 25 per cent. of the amount he paid in advance by way of annual charge, the E.L. Committee proposes as an alternative that, after the annual charge has been calculated in the ordinary way under the "telephone" system, 33½ % shall be added to such amount to be paid in advance, and that all units consumed shall be calculated at ½d., further, that the rate per unit for residence consumers preferring the present annual charge under the "telephone" system be as follows: Up to 25 per cent. in value of the annual charge 1d., then up to full value of annual charge ½d., and all beyond this ½d. There is practically no difference in results between the two proposals.

**LONDON (CITY).**—At the last meeting of the Court of Common Council, Mr. Deputy Millar Wilkinson asked the chairman of the Streets Committee if he could give any information with regard to the rumour of the purchase of the City of London Electric Lighting Co. by the Corporation. In reply, Mr. G. Stanham said that he could only state that the matter would come before his Committee at the next meeting.

**ISLINGTON.**—The Lighting Committee reports having had under consideration a report from the electrical engineer as to the necessity for at once providing additional plant. Particulars of the plant proposed to be laid down, with the estimated costs are as follows:—One 3,000-kw. steam turbo-alternator, exciter and condenser, together with auxiliary plant and other accessories; steam pipe connections, foundations, &c., cable, cable connections, switch-gear and accessories, and circulating pipes, valves, &c., £12,600; contingencies, £400. The Committee recommended that it be authorised to invite tenders for the carrying out of the work and for the supply of the plant and machinery referred to. Alderman Vorley, in moving the adoption of the report, said that it had been fully discussed, and carried by a large majority by the Finance Committee. It was not desired that the loan capital of the undertaking should be greatly increased, and it was proposed that the reserve fund should be used in paying for the new machinery. They had accumulated £21,000, but they did not propose that that sum should be depleted by £13,000, as it was proposed to pay for the plant by instalments; 40 per cent. on giving the order, another 40 per cent. 12 or 18 months afterwards, and 20 per cent. in three years' time. They expected that their surplus in the present year would almost pay for the first instalment, and that the surplus in the second would be more than sufficient to pay the second instalment. The third instalment would only be a trifle out of the surplus which accumulated in the third year, because having put down a more economical machine than they had ever done before, their works' cost would decrease considerably. After discussion, an amendment referring the matter back was carried.

**BERMONDSEY.**—At a meeting of the B.C. on Tuesday evening, a letter was received from the L.G.B., adverting to the refusal of the L.C.C. to sanction a loan for £18,872 for extending the electricity undertaking. The Board stated that it was unable to deal with the whole of the proposed loan of £18,872, as its power only extended to the determination of the appeal of the Borough Council against the decision of the L.C.C. not to sanction a loan of £18,563. It had arrived at this amount, and the Board stated it had deducted the sum of £162 in respect of debt outstanding on the foundations, which will be superseded, and that the loan was sanctioned on the condition that, whatever the actual cost of the proposed work be, it will be defrayed to the extent of £162 out of current income. The Town Clerk said that sanction to the loan bore out the contention he had always held, that the L.C.C. was not entitled to the information asked for. Discussion of the letter was adjourned.

**HAMMERSMITH.**—The Electricity Committee reports that several large establishments in the borough have intimated their willingness to take a supply of current for lighting purposes if the Council is prepared to supply upon the unlimited service system, adopted successfully by Marylebone B.C. The Committee considers that this proposal should be adopted experimentally, and has decided to offer the following fixed rates of charges: 25 watts, 7d. per week per lighting point; 50 watts, 10d.; 100, 1s. 6d.; 200, 2s. 10d.; 300, 4s. 2d. The above rates are to be limited to a consumption of 1,400 hours per annum, the Council supplying the current and undertaking the fixing and maintenance of the installation, and subject to an agreement being entered into for a period of not less than three years. The engineer estimates the total cost per week to the Council as follows: 25 watts, 4'75d.; 50, 6'75d.; 100, 11d.; 200, 19'75d.; 300, 27'75d. The Committee has further decided, as an experiment, to set aside the sum of £100 for hiring out to consumers small electrical apparatus.

**Lowestoft.**—Sanction has been received from the L.G.B. to the borrowing of £1,962 for condenser plant, pumps, &c.; £1,000 for street lighting; and £1,500 for meters.

**Manchester.**—The City Council has discussed the proposal of the Electricity Committee to give £12,000 to the rates, and as was the case when a similar proposal was made last year, the amount was raised, by amendment, to £24,500, the chairman of the Gas Committee, seizing the opportunity to inform the Council that electricity had reached the limit with regard to lighting, although apparently, he conceded that it was useful for power.



**Maldon.**—The T.C. has decided to enter into an agreement with Messrs. John Sadd & Sons, Ltd., for the firm to have the right to provide current for public and private purposes for a period of ten years, the Council to have the option of purchasing the undertaking on giving 12 months' notice. The Council will also assist the firm to obtain a prov. order if one is desired during the ten years.

**Mexborough.**—The U.D.C. has instructed the E.L. Committee to submit a scheme for the development of the electricity undertaking, at an estimated cost of £8,000.

**Nottingham.**—An interesting feature of the annual report of the Electricity Committee is the reference to the disastrous explosion which occurred in the cellars of the Albert Hotel, on November 26th. The Committee admitted that persons who had sustained damage had good claims against the Corporation, and eventually they compromised them for a total sum of £4,791, in addition to a life annuity of £52. The capital sums paid have been taken from the reserve fund of the electricity undertaking.

The electrical engineer states that during the past financial year 14,690 additional 32-watt lamps, or their equivalent, have been connected to the mains, making a total of 435,012. There has been an increased demand for electricity for power purposes. One hundred and sixty-six additional motors, aggregating 575 H.P., have also been connected to the mains, making a total of 1,349 motors and 5,210 H.P. This is the largest increase since the commencement of the supply. The number of units sold during the year was:—For lighting, 3,803,553; for power, 2,734,570; for traction, 6,039,203; total, 12,577,326 units; an increase of 632,799 units. 52.25 per cent. of the units used for private lighting were at the reduced rate of 1½d. per unit last year. The total working cost was 1'02d., compared with 1'04d. in the previous year. The sale of current yielded £94,863, and a balance of £44,061 was carried to the net revenue account, £28,380 going in interest, repayment of loans, &c., £14,850 in contribution to the rates, and £831 to the reserve fund.

**Oulton Broad.**—The U.D.C. having approached the Lowestoft T.C. for a supply of electricity for the district, the borough electrical engineer has been instructed to prepare a scheme, to undertake the supervision of it, and he is to be permitted to receive remuneration from the U.D.C. for his services.

**Rugely.**—An electricity scheme for the town, prepared by Mr. Chas. Balbiani, of Birmingham, has been submitted to the U.D.C., who will fully consider it at the June meeting. The scheme provides for the use of both underground and overhead cables, and the estimated capital cost is placed at £5,000. For the first year a loss of only £17 is anticipated, and afterwards a yearly profit.

**South Africa.**—The Robertson (Cape Province) Municipal Council proposes to obtain permission from the Administrator to enter into an undertaking for the purpose of lighting the town by electricity and to borrow a sum of £5,000 for that purpose. A meeting of ratepayers will be held on June 3rd to vote on the matter.

**Swinton and Pendlebury.**—A sub-committee of the Electricity Committee appointed to consider steps to be taken in connection with the forthcoming termination of the agreements with the Lancashire Electric Power Co. for a bulk supply and management of the undertaking, has considered Mr. Leach's report, and representatives have interviewed him. It was recommended that Mr. Leach be asked to prepare a statement setting forth the Council's proposals which will be forwarded to the Lancashire Electric Power Co.

**Twickenham.**—The U.D.C. has decided to invite alternative tenders for public lighting by electricity and gas, for one, three, or five years.

**Workshop.**—In connection with the application of the U.D.C. for sanction to borrow £6,670 for the extension of the electric lighting service of the town a public inquiry was held on Friday last, by Mr. H. S. Bidwell, inspector of the L.G.B. The electrical engineer (Mr. Crowther) explained the position of the undertaking from its commencement in 1902, and showed the rapid progress it had made, the total number of consumers at present being 996 compared with 84 in 1902, and the profit in 1911, £1,026 compared with a deficit in the first four years of its existence. The total expenditure to date on the electric lighting works is £31,244, and the authorised expenditure £31,073. The inspector at the conclusion of the inquiry proceeded to view the electric light works and the streets where overhead wires are proposed to be erected.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—At the meeting of the Tramways and Electrical Committee it was decided to leave the question of universal 1d. fares over for another year. The City Accountant submitted the estimate of revenue and expenditure for the year ending March 31st, 1913, as follows: Revenue, £257,000. Expenditure—working expenses, £138,500; interest, £46,000; sinking fund contributions, £27,000; general purposes fund, £9,000; sundry net revenue charges, £3,000; depreciation, £13,000—total, £236,700. Estimated surplus, £20,000. The audited account of the tramways under-

taking for the year ended March 31st, 1912, showed that the balance carried to net revenue account had been increased to £113,725. After providing for fixed charges and depreciation there was left to credit of appropriation account a balance of £23,871 transferable to the general purposes fund.

**Bexhill-on-Sea.**—The T.C., having been approached by the Commercial Association respecting a scheme of railless trolley cars for the town, has come to the conclusion that the time has not yet arrived when such a system can be adopted with advantage, as the system is to a very large degree still in its early and experimental stage.

**Bingley.**—Discussing the question of tramways in the area, the District Council said that the County Council had opposed the proposed scheme, apparently with a view to compelling the local authority to carry out road and bridge widenings at its own cost on county roads.

**Birtley.**—The P.C. has passed a resolution favouring the proposal of the Gateshead Tramway Co. to provide railless cars for the district.

**Bolton.**—The motormen, conductors and cleaners in the employ of the Corporation Tramways Department have asked for an increase in wages and reduction of hours. The Tramways Committee has made an offer, which has been refused.

**Bradford.**—A special meeting of the Tramways Committee has been held to consider the question of the Bingley extension, and it has been decided to approach the latter town with a view to ascertaining what inducement would be held out to the city.

**Continental Notes.**—FRANCE.—The Conseil Général of the Department of Haute Savoie has decided to electrify the tramway line from Annemasse to Samoëns, and the projected branch lines from the latter place to Sixt, and from the bridge at Fillinges to Habère-Poche. The estimated cost of these works is 4,500,000 fr. The Conseil has likewise decided to construct a tramway from Chapareillan to Bourget-du-Lac, thus affording through communication with Grenoble.—*Revue Pratique d'Electricité*.

**Croydon.**—The B.C., on Monday, resolved to spend £3,557 on track renewals in North and South-End, and High Street, adopting interlacing lines between certain loops. The cost is to come from the reserve and renewals fund.

**Doncaster.**—The Light Railway Commissioners have decided to issue an order, on the application for the Doncaster T.C., for the construction of electric tramways in the parishes of Balby-with-Hexthorpe, Warmsworth, Bentley-with-Arksey, and Ardwick-le-Street. Particulars of the scheme have been previously given in the ELECTRICAL REVIEW.

**Dundee.**—The tramways manager has been asked to prepare a report upon the practicability, and the probable expense of having hanging flower boxes placed on the tramway standards in the central parts of the city during the summer months.

**Farnborough.**—The U.D.C. has decided to lay before the B. of T. objections to the application from the Aldershot and Farnborough Light Railway Co. for an extension of time until June 4th, 1913, for commencing and completing the tramways in the district, on the grounds that sufficient time has elapsed for the company to have made a substantial commencement with the work; that the delay is causing a stagnation of commercial enterprise as it prevents other means of transit being afforded for which there is an increasing demand; and that as the matter has been under discussion by different companies for 14 years, the work should long since have been completed.

**Greenock.**—The Corporation Law and Finance Committee declines to agree to the proposal of the Greenock and Port Glasgow Tramways Co. to instal a system of railless traction in the upper part of the town on condition that the Council extend the present lease held by the company.

**Ilford.**—At the last meeting of the U.D.C., a resolution was moved to the effect that the Council appoint a tramways manager at a commencing salary of £400 per annum, rising to a maximum of £500 per annum. Councillor Bailey, in moving the resolution, said that the Council had about nine miles of track, and that the capital originally sunk in it was £180,000, of which about £30,000 had been paid off. An amendment was moved to refer the question to a meeting of the Joint Tramways and Electricity Committees, and Councillor Gullis, in supporting this amendment, said the undertaking could not stand another £400 or £500 a year. After further discussion, this amendment was carried.

**London.**—A correspondent of the *Financial News*, who has been investigating the progress of the East London Railway electrification, states that the Metropolitan Co. are to run this line, which will obtain power from the District Co.'s Lot's Road power station. The suggestion is that Metropolitan-Great Western joint trains are to be run *via* Aldgate to New Cross, and not District trains, as is generally understood.

**Hammersmith.**—The Law Committee of the B.C. reports the receipt of a letter from the Referee appointed to determine the differences between the Borough Council and the London United Tramway Co., Ltd., with regard to the condition of the tramway tracks in the borough, stating that his award was now ready, and



would be handed to either party on the payment of 170 guineas, the amount of the costs of the award. The Committee has decided to take up same.

**L.C.C. AND OMNIBUS TRAFFIC.**—Last January the Roads Improvements Association complained to the B. of T. alleging that the L.C.C. tramway cars were causing obstruction of the streets. The Highways Committee has recently reported on the matter to the B. of T. The Association furnished particulars of the passengers using tramcars at certain times when traffic was light; the Committee has made observations between 9 a.m. and 5 p.m. of motor-bus traffic on two typical days, and finds the average of the eight places observed to be 10'65 and 9'02 passengers per bus respectively. At three of these points the average number of tramcar passengers were 11'35 (first day) and 13'99 (second day); 4'36 and 8'30, and 4'27 and 7'94 higher than on the omnibuses. As there was ample accommodation on the cars for the bus passengers, and the cars were in operation before the buses on these routes, the report suggests that it is the omnibus companies which have placed unnecessary vehicles on the streets. To obtain further information as to bus traffic between 9 a.m. and 5 p.m. at busy centres, observations were made at Charing Cross, Piccadilly, and Oxford Street, when 5,480 buses were noted (average 685 an hour), and the average number of passengers per bus was 10'97. From this, the report suggests that the Association's charge as to running too many cars, applies equally to the bus companies. In practice, however, the Council between 10 a.m. and 4 p.m. only runs 63'9 per cent. of the cars running for the morning and evening traffic, and the receipts on the day cars are higher than on those run during busy morning and evening hours, although the cars are then filled to their full capacity.

The report states further that, if electric cars were entirely withdrawn and the same seating accommodation had to be provided by motor-omnibuses as is now provided by tramcars, 2,688 omnibuses, or an increase of 114 per cent. of vehicles over the number of tramcars would be required during fine weather, while during inclement weather, when only the inside seats of omnibuses are fit to be used, 5,712 omnibuses, or an increase of 354 per cent., would be required. The Walworth Road route may be taken as an instance of the addition which would be made to the congestion of the streets if omnibuses were entirely to take the place of tramcars. During the busy period of each week-day morning, 70 omnibuses and 100 tramcars pass any given point in Walworth Road in one hour. If the electric cars were withdrawn and the same accommodation were given by omnibuses, the result would be, on a dry morning, 284 omnibuses an hour, and, on a wet morning, 603 omnibuses an hour. At present there is a tramcar every 141 yards; with 284 omnibuses, there would be one of these vehicles every 50 yards; with 603, there would be an omnibus every 23 yards in each direction. This calculation is based on a speed of 8 miles an hour—a speed which could hardly be exceeded even if it were practically possible to run such a service of omnibuses.

As regards congestion at junctions, 462 cars an hour pass the Elephant and Castle junction, 988 buses an hour, in addition to the present service, would be required to give the same accommodation in fine weather, and 2,099 additional buses if wet. An observation at the junction of buses passing to and from New Kent Road between 10 a.m. and 4 p.m. showed that 303 buses passed, carrying an average of only 3'61 passengers per bus.

The report points out that heavy vehicles obstruct tramway traffic; that obstruction occurs at every street junction where there are no tramways; that the tramways pay £118,000 annually for keeping the track paving in the centre of the road in repair and relieve the ratepayers of expenditure on that portion of the road; that the tramways have contributed nearly half a million to the cost of road widenings, while other passenger traffic undertakings have contributed nothing; and that more than 42 million passengers are carried annually at workmen's fares, which only defray working costs, without regard to capital charges, and that no other form of street transport caters for this class of traffic.

**Manchester.**—The Tramways Committee is considering the question of underground tramways as a means of adequately relieving the congestion of traffic in the central area of the city. The committee is actively prosecuting inquiries of Continental and American municipal authorities who have underground systems relative to the question of cost and construction. The idea is to have a central station on the old infirmary site at Piccadilly, from which there should be a line tapping the railway stations at London Road, Victoria, Exchange, Central, Oxford Road, and finishing up a circular route at Piccadilly. At present the Corporation has about 600 trams, and the congestion is getting worse every year.

**Nottingham.**—The annual report of the Tramways Committee states that the receipts, exclusive of interest on investments, amounted to £162,597, an increase of £5,308. The average per mile was 11'22d., an increase of '09d. over the previous year. The working expenses amounted to £106,162, the average per mile being 7'32d., compared with 7'37d. during the previous year. The balance, amounting to £56,435, had been disposed of as follows:—To interest on stock and loans, £14,969; to repayment of capital, £19,302; to reserve and renewals fund, £4,163; in aid of general district rate, £18,000. In addition to the general overhaul and maintenance of cars, a further 10 were fitted with top covers, making a total of 110 so fitted, and a further 10 were equipped with electro-mechanical track brakes. A considerable reduction in the working hours, and increases in the rates of wages of motormen and conductors were made early in November at a cost of about £3,500 per annum, which also necessitated the employment of an additional 44 men. The cars ran 3,476,262 miles, or an increase of 87,552. The consumption of electrical energy for

traction, car and depot lighting, works machinery, and permanent way maintenance was 6,039,203 units, an average of 1'73 units, and 2'17d. per mile. The number of passengers carried was 36,026,471, an increase of 767,401.

**Southport.**—At a special meeting of the Traders' Association on Thursday last week, a recommendation was passed urging the appointment of a separate committee and manager for the Corporation tramways, and the taking of a plebiscite on Sunday running. The Corporation was also advised to consider the purchase of the tramway company's interest in Greater Southport. Alderman Griffiths said on the latter point the company still had a lease of 10 years to run. Councillor Hodson said the linking up of the undertaking would be an inestimable boon to the development of Ainsdale and Birkdale.

**Stalybridge.**—At the time of writing, efforts to settle the tramway strike on the Joint Board's system have proved futile.

## TELEGRAPH and TELEPHONE NOTES.

**Automatic Telephony.**—On Saturday last the automatic telephone exchange at Epsom was brought into operation, with satisfactory results; it is on the Strowger system, and is connected to 320 subscribers' stations.

**Chile.**—A concession of the duration of ten years has been granted for the telegraphic and telephonic connection of Valparaiso and Santiago. There will be a midway station at Curacavi. The work will be commenced in the coming autumn, and it is hoped to complete it within the year.

**Hull.**—At a meeting of the Hull Corporation Telephone Committee on Monday, it was stated that after all charges against the undertaking for the past year had been met, the profit was £1,684, against £1,168 a year ago.

**Marconi House.**—On Thursday last week the new premises of Marconi's Wireless Telegraph Co., Ltd., in the Strand, were formally opened for business. The area of the site is about 54,500 sq. ft., and the buildings comprise nine floors, with three lifts and five staircases. There is a telegraph office on the ground floor, open night and day, from which messages are forwarded by a private wire to the Clifden wireless station for dispatch to the United States and Canada, thus saving time. An intercommunication telephone system with a 100-line switchboard, and two P.O. exchange boards with five extra points and 50 extensions each, are provided on the ground floor, on which the transfer department and the postal room are situated; on other floors palatial accommodation is provided for the managing director, secretaries, accountants, engineering staff, Mr. Marconi himself, and the numerous departments into which the business of the company has been organised. Electricity is supplied by the Charing Cross Co. at 200 volts D.C. for lighting, driving the lifts and sewage pumps, &c. A pneumatic tube system with eight stations, operated by an electrically-driven blower, conveys letters from all parts of the building to the postal department, and small electric lifts carry baskets of letters and Dictaphone records to and from—the Dictaphone being largely used. The intercommunication telephones, bells and fire alarms were installed by Messrs. W. G. Hodgson & Co.; Messrs. F. Geere Howard carried out the electric light installation. Magneta clocks are installed throughout. A wireless equipment will be installed shortly, for demonstration purposes. The furnishing, decoration, and equipment of the new headquarters of the company have been carried out in first-class style, and the Marconi House forms a worthy home for the great undertaking with which it is associated.

It is interesting to note that since the loss of the *Titanic* there has been an urgent demand for wireless operators, in order to provide two on each ship, and a school has been established in the new premises for the purpose of completing the training of operators.

**Post Office Estimates.**—On Monday a statement was made by Mr. H. Samuel, on the vote for £13,880,960 for the postal service. The P.M.G. pointed out that this year a full year's expenditure on the telephone system was provided for, as compared with one quarter in the last estimates, and this accounted for an increase of £3,079,000. The increase in the revenue was estimated at £3,475,000. The department contemplates the construction of a tube railway from east to west in London, to carry mails and parcels. The night letter telegram system is to be extended to all towns where night staffs are employed, and telephone numbers will shortly be made available as telegraphic addresses. A system of urgent telegrams at three times the ordinary rates is under consideration, for continental messages only. The question whether wireless installations shall be made compulsory on board passenger ships is receiving the attention of the department and the Board of Trade. The P.M.G. is firmly opposed to the suggestion of a State-owned Atlantic cable. A new cable will be laid between Britain and Germany, and a new system of urgent telegrams is under contemplation. About 19,000 employes were taken over from the National Telephone Co., and these are receiving in wages alone £175,000 a year more than formerly, while the shortened hours of work and increased holidays involve an increase of £32,000 a year, and the pensions rates will eventually require an extra £20,000.



## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—June 4th. 1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

June 11th.—Electric incandescent lamps and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" April 26th.

June 11th.—(a) 1,237 electricity recording meters; (b) 3 tons 12 cwt. of bare hard-drawn aluminium cables, for the Melbourne City Council. See "Official Notices" to-day.

Melbourne.—June 18th. 50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—June 10th and 18th. Steam piping and fittings for Ultimo Power House.

June 17th.—Two coal elevators and conveyors, for White Bay Power House. July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

WESTERN AUSTRALIA.—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" May 10th.

NEW SOUTH WALES.—July 31st. Common battery and automatic switchboards, for Newton, Glebe & Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

**Bedlington.**—May 29th. Poles, cables, &c., for electric lighting of Stakeford district, and poles, cables, lamps, &c., for extensions at Cambois. Particulars from Mr. J. E. Johnston, surveyor to U.D.C., Bedlington.

**Belfast.**—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" May 17th.

**Belgium.**—June 12th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the construction of the overhead work in connection with the Roue-Zuen section of the Brussels-Hal light railway.

June 13th.—The Société de l'Exposition de Gand (Rue des Moineaux, Ghent), is inviting tenders for the supply and installation of the electric lighting plant for the Galerie des Machines, at the forthcoming Ghent Exhibition.

**Bettws-y-Coed.**—June 4th. Underground cables, transformer pillars and public lighting apparatus, two water-turbine alternators and pipework, high and low-pressure switchgear and connections, for the U.D.C. See "Official Notices" May 17th.

**Birkenhead.**—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" April 26th.

**Bolivar.**—The municipality of Bolivar will shortly call for tenders for an electric light station.—*Review of the River Plate.*

**Bristol.**—June 3rd. Arc lamp carbons (No. 122) and incandescent electric lamps (No. 123), for the Docks Committee of the T.C. W. W. Squire, engineer, Cumberland Basin.

June 10th.—Wiring and fittings for electric lighting at Stapleton Workhouse, for the B. of G. See "Official Notices" to-day.

**Buenos Aires.**—"The Department of Engineers of the Province of Buenos Aires have reported unfavourably on the four tenders received for the electric lighting of Florencio Varela, and recommend that fresh tenders be called for. The same result will be the outcome of their study of tenders for a station at Pilar."—*Review of the River Plate.*

**Cleckheaton.**—June 1st. Slack coal (1,600 tons), for the Electricity Department of the U.D.C. J. H. Linfield, clerk.

**Constantinople.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Devonport.**—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" May 17th.

June 13th.—Steam coal (5,000 tons), for the Corporation electricity works. J. W. Spark, borough electrical engineer, Newport Street, East Stonehouse.

**Dumfries.**—The County Council invites tenders for the electric lighting of the Sheriff Court House, Buccleuch Street. Mr. W. Arnot, 163, Hope Street, Glasgow.

**Epsom.**—May 28th. Maintenance of storage battery at the U.D.C. electricity works. See "Official Notices" May 17th.

**France.**—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

June 15th.—The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

**Glasgow.** May 27th. Erection of substation, Shawpark Street, Maryhill. W. W. Lackie, electrical engineer.

May 29th.—The T.C.'s Electricity Department invites offers for the supply and erection of overhead travelling cranes for the following sub-stations:—(1) Osborne, (2) Dennistoun, (3) Byres Road, (4) Maryhill. Specifications and forms from W. W. Lackie, electrical engineer.

**Gloucester.**—Forty-five street-lighting lanterns for high-candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

**Huddersfield.**—Electric lighting of proposed new banking premises in Westgate, for the West Yorkshire Bank, Ltd. Apply Messrs. J. C. Gibson, Skipworth & Gordon, architects, 5, Old Bond Street, London.

**Keighley.**—From 5,000 to 7,000 tons of steam coal, for the Corporation Electricity Department. Borough Electrical Engineer.

**Liverpool.**—June 4th. Electrical fittings, &c., for a year, for the Overhead Railway Co., Ltd. E. J. Neachell, general manager, 31, James Street.

**London.**—June 3rd. Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" May 10th.

POPLAR.—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" to-day.

HACKNEY.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, &c., pipework &c., travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

ISLINGTON.—May 30th. Electric lighting installation at the Receiving Homes for Children, for the St. Mary, Islington, Guardians. See "Official Notices" May 17th.

HORNSEY.—June 10th. One electrically-driven turbine feed pump, for the T.C. See "Official Notices" to-day.

**Manchester.**—June 3rd. Electricity department. For Stuart Street generating station; electrically-driven coal-conveying plant. Specification, &c., from the secretary, F. E. Hughes, Town Hall, Manchester. Deposit £1 1s. (returnable).

June 5th.—Electricity department. Tenders for annual stores. Particulars and forms of tender can be obtained up to May 25th (in writing only) from F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

**Margate.**—June 3rd. Two electrically-driven vertical spindle rotary sewage pumps, with one set of automatic starting and stopping gear, for the Corporation. See "Official Notices" to-day.

**New Zealand.**—July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

**Rochdale.**—June 5th. Extra-high-pressure three-phase switchboard, for the Corporation. See "Official Notices" May 17th.

**Sheffield.**—May 31st. Electricity department. Contract 84, three water-tube boilers, mechanical stokers, economisers, steam and feed piping, &c. Contract 85, coal shoots and supports and measuring chambers. Specifications, &c., £1 1s. each (returnable), from S. E. Fedden, engineer and manager, Commercial Street, Sheffield.

**South Africa.**—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

**Spain.**—June 1st. Tenders are being invited by the municipal authorities of Alosno (province of Huelva) for the electric lighting of the town during a period of twenty years.

**Stockport.**—June 11th. One or more 1,500-KW. mixed pressure turbine alternators, for the Corporation. See "Official Notices" to-day.



**Uruguay.**—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

**Walthamstow.**—May 31st. Stoneware conduits, for the U.D.C. Electricity Department. See "Official Notices" May 17th.

**West Ham.**—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

June 17th.—Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" to-day.

**Workshop.**—May 28th. Storage battery and surface condensing plant for the U.D.C. See "Official Notices" May 17th.

**York.**—May 31st. Telephones and fire alarms, for the B.G. Geo. Sykes, Clerk, Museum Street.

### CLOSED.

**Ashton-under-Lyne.**—The B. of G. on May 16th, decided to accept the tender of Mr. R. Butterworth, of St. Michael's Square, Ashton, for the electric lighting installation at the Workhouse, at £450. At a previous meeting the tender of Messrs. J. Swainson, of Manchester, was accepted, but this has been rescinded, so that a local trader may have the work.

**Australia.**—The *Australian Mining Standard* states that the tender (about £19,000) of the British Insulated and Helsby Cables, Ltd., has been accepted for the carrying out of the reticulation of Hobart (Tas.) and suburbs for the Hydro-Electric Power and Metallurgical Company. The work is to be put in hand as soon as possible, in order to prepare for the company's lighting contracts with the City Council and the suburban municipalities.

P.M.G., SYDNEY.—Various quantities of switchboard cable have been ordered from W. T. Henley's Telegraph Works Co., Ltd., and one wire-testing machine from Joshua Buckton & Co., £195.—*Australian Mining Standard*.

**Bedford.**—The T.C. has accepted the tender of Messrs. J. E. Page & Co. for 500 tons of Cotes Park coal for the electricity works at 14s. 3d. per ton.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government departments named:—

#### WAR OFFICE.

Travelling electric crane.—Herbert Morris, Ltd.  
Electric motors.—Lancashire Dynamo and Motor Co., Ltd.  
Installation of electric light and power, Military Hospital, York.—G. E. Taylor & Co.

#### INDIA OFFICE: STORE DEPARTMENT.

Conversion of cranes.—Lancs. Dynamo, &c., Co.  
Electric plant.—British Westinghouse Electric, &c., Co.  
Fans.—Veritys, Ltd.  
Transformers, &c.—British Westinghouse Electric, &c., Co.  
Wire.—W. T. Glover & Co.; Whitecross Co.

#### CROWN AGENTS FOR THE COLONIES.

Cables.—Callender's Cable and Construction Co., Ltd.  
Condensing plant.—Brush Electrical Engineering Co., Ltd.  
Tubular telegraph posts.—J. Russell & Sons, Ltd.; Siemens Bros. & Co., Ltd.

#### OFFICE OF WORKS.

Lamp standards in Mall.—W. T. Allen & Co.  
Two electric lifts, Courts of Justice extension.—Medway's Safety Lift Co.

#### GENERAL POST OFFICE.

Telegraphic apparatus.—Gell perforators, Gell Telegraphic Appliance Syndicate, Ltd.; receiver, trains, bases, &c., Siemens Bros. & Co., Ltd.  
Telephonic apparatus.—Loading coils, Western Electric Co., Ltd.  
Switchboards.—British L. M. Ericsson Manufacturing Co., Ltd.  
Cable.—I.R. and C.C.; British Insulated and Helsby Cables, Ltd.; Western Electric Co., Ltd.; W. T. Henley's Telegraph Works, Ltd.  
I.R.V. and C.—Johnson & Phillips, Ltd.  
Paper core.—Callender's Cable and Construction Co., Ltd.; Johnson and Phillips, Ltd.  
Submarine.—Siemens Bros. & Co., Ltd.  
Earthenware ducts.—Albion Clay Co., Ltd.  
Wire.—Copper, T. Bolton & Sons, Ltd.  
Flameproof.—C. Mackintosh & Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.  
Electric lighting, S.E. District P.O., Borough, S.E.—Pinching & Walton.  
Storage battery, G.P.O., Birmingham.—Premier Accumulator Co., Ltd.

**Hertford.**—The B. of G. has accepted the tender of the North Metropolitan Electrical Supply Co., Ltd., for a motor engine, &c., for the laundry, which is to be worked by electricity, at £70.

**Horsham.**—The Council School managers have accepted the tender of Messrs. Sendall & Co. for the electric lighting installation at Denne Road and Victory Road schools.

**India.**—The Walsall Electrical Co., Ltd., have received the contract for supplying the power distribution boards for the Jhansi workshops of the Great Indian Peninsula Railway Co., amounting to £239.

**London.**—L.C.C.—The Highways Committee received tenders as below for roadwork and platelaying for the Forest Hill to Rushley Green tramway:—

Kirk & Randall .. .. .	(recommended)	£19,418
G. Wimpey & Co. .. .. .		19,528
Dick, Kerr & Co., Ltd. .. .. .		20,248
J. Mowlem & Co., Ltd. .. .. .		20,307
A. N. Colles .. .. .		20,578

Several pyrometers for Greenwich generating station are to be ordered from the Cambridge Scientific Instrument Co., Ltd., for £250.

**SOUTHWARK.**—In our last issue we reported that the Council had accepted the tenders of Kabelfabrik-und-Drahtindustrie Joint Stock Co., of Vienna, for cable. We should, however, have stated that that company's tenders had been *recommended* for acceptance. As a matter of fact the Council accepted the tenders of the Western Electric Co., Ltd., at £112 and £69 respectively.

**River Plate.**—The *Review of the River Plate* states that the "Government has accepted the tender of Messrs. Lassout & Co. for the electric installation in the asylum at Oliva, at a cost of \$109,989.25 m/n., and in the asylum at Torres, at a cost of \$55,106.66 m/n."

The same exchange says that Messrs. C. H. Walker & Co., Ltd., have just placed an order for four 170-kw. three-wire 500-volt "Witton" dynamos, to be coupled direct to four Diesel engines, which will be used in connection with the construction of the Buenos Aires Port extension.

**Southampton.**—The B. of G. has accepted the tender of Messrs. W. G. Heath & Co. for the electric lighting installation at the Infirmary.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, May 27th.—Bank Holiday.  
Tuesday, May 28th.—"B" Company. Infantry drill, 7.30 to 9.30 p.m.  
Recruit instruction, 7 p.m. to 10 p.m.  
Wednesday, May 29th.—All Companies. Annual musketry at Purfleet.  
This is the last date on which members can fire to make themselves efficient in musketry.  
Thursday, May 30th.—"C" Company. Infantry drill, 7.30 to 9.30 p.m.  
Technical work, 8.45 to 10 p.m.  
Friday, May 31st.—"D" Company. Infantry drill, 7.30 to 9.30 p.m.  
Technical work, 8.45 to 10 p.m.  
Saturday, June 1st.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

**International Electrotechnical Commission.**—The Special Committee, appointed at Turin in 1911 to consider the rating of electrical machinery, held its first meeting in Paris from Monday, May 6th, to Thursday, May 9th, inclusive. Monsieur R. V. Picou (president of the French Committee) welcomed the delegates on behalf of his colleagues. M. Paul Boucherot was unanimously elected to preside over the meetings.

The discussions covered a very wide field. Probably the most interesting points discussed, and upon which definite suggestions have been made, were:—The question of the surrounding air temperature, temperature limits and the methods of measuring them, and the information to be carried on the name plates, and to be asked for when machines are bought and sold without any special specification.

The vexed question of "overloads" was discussed at very considerable length, and though at first it appeared as if the Special Committee would be unable to put forward any suggestions on this subject, a compromise was finally reached, which, it is hoped, will meet the views of those who desire that an overload be specified for the purposes of comparing different machines, and those who, on the other hand, are of opinion that an overload should be considered as entirely special.

The question of international agreement in reference to the resistivity of copper was submitted by Mr. C. O. Mailloux, delegate of the American Committee, and supported by M. Paul Janet, a member of the French Committee, and director of the Laboratoire Central d'Electricité. The Committee viewed the proposal most favourably, and expressed the hope that the figure recommended by the Bureau of Standards of Washington in consultation with the British, French, and German National Laboratories, would be adopted internationally.

As far as Great Britain is concerned the suggested figure, if adopted, will necessitate an alteration of only one-eighth of 1 per cent. in the present standard, which is practically an insignificant alteration from the commercial point of view.

The proposals of the Special Committee will be submitted, in French and English, to the various Electrotechnical Committees for their consideration, and the Committee will meet again in December in order to take into account any observations or modifications received.

It is hoped that the proposals of the Special Committee will be duly adopted by the I.E.C. at its plenary meeting, which will take place in Berlin in 1913, probably during the month of September.



## FORTHCOMING EVENTS.

**Royal Institution.**—Friday, May 24th. At 9 p.m. Discourse on "Recent Advances in Agricultural Science—The Fertility of the Soil," by Mr. A. D. Hall.

Friday, May 31st. At 9 p.m. Paper on "Icebergs and their Location in Navigation," by Prof. Howard T. Barnes, F.R.S.

**Royal Society of Arts.**—Monday, May 20th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture IV.)

**Physical Society.**—Friday, May 31st. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Calibration of Wave-meters for Radio-telegraphy," by Prof. G. W. O. Howe; and "On the Use of Heaviside's Resistance Operators in Air-Core Transformer Theory," by Dr. W. H. Eccles.

## NOTES.

**Institution and Lecture Notes.**—TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—On the occasion of the Mumbles Congress, of June 27th and 28th, the following are among the subjects to come under discussion:—

"The Respective Values of Tramways, Motor-Buses and Railless Traction as Means of Transport," by Mr. A. H. Pott, chief engineer of the Metropolitan Electric Tramways, Ltd.

"How to Secure the Best Results from Car Meters," by Mr. W. Clough, general manager, Bury Corporation Tramways.

"Track Maintenance," by Mr. W. Thom, general manager, Potteries Electric Traction Co., Ltd.

"Pay-as-you-Enter and its Advantages to Tramway Companies and the Travelling Public," by Mr. H. M. Howard.

There will be a banquet at Swansea, given by the Mayor and Corporation of Swansea, on June 27th, and one at Mumbles, by the British Electrical Federation, on June 28th.

**THE ELECTRICAL CONTRACTORS' ASSOCIATION (INCORPORATED).**—The annual dinner of this Association will be held on Monday, June 17th, at Frascati's Restaurant, Oxford Street, W., at 7 o'clock p.m. Tickets can be obtained from the hon. sec., Mr. L. G. Tate, 20, Bucklersbury, E.C., or any of the members of the London Section at 10s. 6d. each, exclusive of wines, &c.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).**—At a meeting in Glasgow, on Saturday, the discussion was resumed on the paper contributed by Mr. R. W. Peters, Lochgelly, on "Earthed v. Insulated Neutrals in Colliery Installations." Mr. H. A. McGuffie, Glasgow, said that the local conditions should be very carefully weighed before either method was adopted, especially the earthed system. He did not agree with the use of only one resistance in the neutral connection, but preferred a resistance to be inserted in each generator and transformer neutral. This gave many advantages which entirely outweighed the extra cost. Mr. S. A. Symon said that for medium-pressure plant above 200 volts, especially when used with portable or semi-portable apparatus, or in a position where accidental contact with live parts was not unlikely to occur, it was safer to work with the insulated neutral. In low-pressure systems an earthed neutral could be adopted without danger of shock.

**THE INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).**—The report of the session 1911-12 states that the average attendance at the meetings in London has been about 40, the highest recorded being 62. Five Students' Premiums were awarded by the Council at the end of last session to Messrs G. W. P. Page and G. J. Scott (£10); Hugh C. May, Allan Monkhouse, R. C. Plowman, E. F. Hetherington and A. R. Stelling (£5 each). An important matter under discussion is a proposal that the Committee should examine papers offered for reading at the general meetings, and should suggest modifications and rearrangements of the material, and generally assist the authors to make their papers more suitable for reading before the students. The Committee are also considering the question of the exchange of papers and ideas between themselves and the Local Section Students' Committees, in order to bring the several sections into closer relationship. A summer tour again took place, with the sanction of the Council, a party of students numbering 14 visiting works and other places of engineering interest in Sweden between July 21st and 29th, 1911. Mr. H. G. Jenkins conducted the tour, and the Committee record their appreciation of his work and of the assistance rendered by Mr. A. V. Clayton to the hon. secretary, Mr. D. Betts. There will be no tour this year.

**INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).**—The annual report of the Committee states that the Section has now completed the first session under its new designation, and with its area embracing the whole of Scotland. The Committee felt that the ordinary general meetings of the Section should be no longer confined to Glasgow, and decided to hold a certain number of these in Edinburgh, and, although the attendance has not been large, the meetings held in Edinburgh have been generally successful. The membership now amounts to 362, an increase of seven. The Council has accepted the Section's invitation to visit Glasgow during the summer. The meeting will take place in the middle of June, and will last for three days. The Committee took exception to the apparent intention of the Council to obtain ratification of its original draft of revised Articles at an extraordinary meeting which had been called for November 2nd. Subsequently the President explained to the Section the reasons which made revision necessary, and the Committee is of opinion that the final draft of the proposed revision, as now printed, is

generally in accord with the views of the membership of the Section. The office-bearers for the session 1912-13, besides past-chairmen, will be as follows:—

*Chairman.*—Mr. William M'Whirter.

*Vice-Chairmen.*—Mr. James Lowson; Mr. T. Blackwood Murray.

*Chairman of Students' Section.*—Mr. W. W. Lackie.

*Ordinary Members of Committee.*—Mr. J. A. Robertson; Mr. T. C. Parsons; Mr. David A. Starr; Mr. John Ferguson; Mr. M. B. Field; Mr. J. K. Stothert; Mr. Wilfrid L. Spence; Mr. J. F. Neilson; Mr. J. H. Bunting.

*Hon. Secretary and Treasurer.*—Mr. James E. Sayers.

At the annual business meeting in Glasgow on the 15th inst., the report was adopted and the officers declared elected. A paper was then read by Mr. D. A. Starr on "Power generation and distribution in the Clyde Valley."

**ILLUMINATING ENGINEERING SOCIETY.**—The Report of the Council states that the membership now exceeds 340—an increase of 70 during the year—and comprises electrical engineers (32 per cent.), gas engineers (20 per cent.), professors and experts (14 per cent.), representatives of oil, acetylene and petrol-air-gas lighting (6 per cent.), oculists (10 per cent.), architects (5 per cent.), and miscellaneous interests (13 per cent.). The Society claims to have been successful in stimulating interest in illumination and in organising friendly discussions between representatives of rival modes of lighting. The Joint Committee on Street Lighting is still pursuing its labours, and other committees have been appointed to deal with the lighting of libraries and schools. The Society was formally recognised by the International Electrical Congress at Turin, which authorised it to form an International Commission to study all systems of lighting. Good work has been done in many other directions, including the teaching of illuminating engineering. The use of the term "illuminating engineer" is deprecated by the Society, and membership of it is not regarded as entitling members so to describe themselves.

In a lecture to the MANCHESTER LIT. AND PHIL. SOCIETY, on May 7th, Dr. Henry Wilde described his early work in the evolution of the dynamo-electric machine; he employed it for the operation of searchlights, which were adopted by the British Navy without payment. Afterwards the Mercantile Marine adopted the system; had it been in use on the *Titanic*, he said, that vessel would not have been lost.

**Educational Notes.**—On Saturday last Lord Haldane opened the new Harrison-Hughes Engineering Laboratories at Liverpool University, which have been erected at a cost of £40,000, given by Messrs. T. F. Harrison, J. W. Hughes and H. Harrison, shipowners, of Liverpool.

At the annual meeting of the BRITISH SCIENCE GUILD, held at the Institution of Electrical Engineers on Friday last, Sir W. Ramsay presided. He drew attention to the danger involved in a failure to obtain supplies of nitrates from abroad, which would prevent us from maintaining a supply of explosives in time of war, and he urged that the manufacture of nitrates from the air should be established in our colliery districts.

**Appointments Vacant.**—Assistant electrical engineer, for the East Indian Railway Co. (Rs. 450 per month); lecturer in physics and electrical engineering at the Belfast Municipal Technical Institute (£180). See our advertisement pages in this issue.

**London Electricians' Trade Movement.**—We have received the following report:—

"On Saturday last a general meeting of the London members of the Electrical Trades Union was held at Chandos Hall to consider methods to secure an improvement in the conditions of the various grades employed in the electrical industry. After an exhaustive discussion of the various points raised, it was unanimously agreed that—'This general meeting of London members of E.T.U. instructs the District Committee to formulate proposals embodying an increase of wages to 1s. per hour for electrical wiremen, and corresponding increases in other grades employed in the electrical industry. The hours of labour to be 48 per week, or in conformity with those prevailing in the building industry, as the case may be. The proposals to be submitted to the London Electrical Contractors' Association, London County Council, public bodies, and all others concerned at a date to be decided hereafter.'"

**Recent Progress in the Manufacture of Incandescent Lamps.**—Innumerable methods have been tried to avoid the great liability of tungsten filaments to fracture at the terminal connecting points; one of the most successful devices consists in mounting the central column on a short length of piano wire, but even then vertical shocks remain disastrous. Last year was marked by the commercial perfecting of the drawn-wire tungsten filament. Early failures to obtain satisfactory drawn tungsten have been attributed to the presence of traces of carbon, but experience shows that tungsten containing 0.005 per cent. of carbon is no more ductile than that containing 0.1 per cent.—nevertheless, elimination of carbon should be carried as far as practicable. Ductile tungsten, as used in drawn-wire lamps, may be considered chemically pure. Its strength, elasticity and ductility are comparable with those of steel. The original structure of the metal is fibrous, and drawn tungsten lamps may safely be handled as carelessly as carbon lamps *before they have been used* for any appreciable time. It appears, however, that the drawn wires develop an irregular crystalline structure in use, and must, therefore—for the present—be handled with the same care as the older squirted filaments when in service. Great care has to be paid in manufacture to the support of the filament and its connection with the leading-in wires.

A valuable property of ductile tungsten is the ease with which



it can be drawn into filaments of various C.P.; thus a given length of wire can as well be made into a 6-ampere as into a 0.2 ampere filament—further, the filament may be arranged in a loop, spiral or zig-zag, so as to yield any desired distribution of light. The number of contacts between the filament and its supports, including the terminal attachments, and the length of the filament control the robustness of the finished lamp.

Data showing the influence of the number of contact points and the relative merits of copper and molybdenum supports are appended:—

Number of contacts	...	...	11	13	15
Relative resistance to shock—Cu	...	...	91.5	100	96.5
" " " —Mo	...	...	91.5	100	93.0
Performance at normal efficiency—Cu	...	...	99.4	100	96.1
Relative life at max. temperature—Cu	...	...	107.0	100	87.0
" " " —Mo	...	...	107.0	100	103.0

—*L'Industrie Electrique.*

**Scottish Tramway Managers' Association.**—Mr. C. W. Shepherd, of the Edinburgh and District Tramway Co., presided over a meeting of this Association, held in Leith Council Chambers, last Friday. Among the subjects discussed was the question of the providing of vestibules or protected fronts for drivers on cars. Later in the day the delegates were entertained to luncheon by the Corporation and inspected the Leith electric tramway system.

**Strike.**—On the 10th inst. 40 members of the Electrical Trades Union engaged in wiring and fitting work, struck work, making a claim for an increase of  $\frac{1}{2}$ d. per hour, to 9d. According to a Leicester paper, the strike was the result of a breakdown of negotiations which had been in progress for 18 months, conferences between the men and the Electrical Contractors' Association having been unsuccessful.

**Parliamentary.**—The Unopposed Bill Committee of the House of Commons has passed the preamble of the Penwortham Bridge Bill. The Bill authorises the abandonment of a portion of the authorised tramways of the Preston, Chorley and Horwich Tramways Co., and the construction of a new or substituted tramway over the bridge.

**THIRD READING.**—In the House of Commons on Monday, the London United Tramways Bill was read a third time.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—Mr. J. K. HOLDEN, of Bradford, has been appointed assistant in the Brighton Corporation meter department.

Mr. B. DRANE, late of the Sutton (Surrey) staff of the South Metropolitan Electric Tramways and Lighting Co., who has obtained a position in the Electricity Supply Department of Marylebone T.C., has been presented by his late colleagues with a demi-hunter watch bearing a monogram and inscription.

The Portsmouth T.C. has adopted a recommendation from the E.L. Committee forthwith to increase the salary of Mr. W. S. FOALE, engineer and manager of the E.L. station, from £500 to £550 per annum.

The Swindon T.C. has increased the salary of Mr. A. DIMMACK, the electrical and mechanical engineer, from £275 to £300 per annum.

On 16th inst., at the Wolverhampton Corporation electricity works, Mr. ERNEST STUBBS, chief assistant engineer, was presented with an oak writing table to mark the occasion of his marriage to Miss D. Watkins, of Wolverhampton. Mr. Shawfield, Borough electrical engineer, made the presentation on behalf of the officials and employes of the department, and referred to the rapid growth of the undertaking during the 11 years of Mr. Stubbs' service, and the consequent increase of the latter's responsibility. Messrs Forder, Rothwell, Dudley, and Smith, also made congratulatory speeches.

Mr. B. T. HAWKINS, late station superintendent at Wakefield electricity works, prior to his leaving to take up a similar position at St. Helens, was presented by the staff and workmen of the electricity and destructor department with a pewter flower épergne. Mr. Garside, commercial engineer, expressed the esteem of the employes for Mr. Hawkins. The presentation was made by Councillor England, chairman of the Electric Lighting Committee.

**Tramway Officials.**—The Swindon T.C. has increased the salary of Mr. T. MEDCALF, tramway manager, from £200 to £225 per annum.

The salary of Mr. A. WOOLSTENCROFT, tramways traffic superintendent to the Ilford U.D.C., is to be increased from £220 to £230 per annum.

**General.**—Mr. W. D. WEAVER has just retired from the position of editor of the *Electrical World* (U.S.A.) which he has held for the past 19 years. He will devote himself to literary and other private pursuits and will act as consulting editor to the

*Electrical World*. His journalistic and other friends gave a luncheon in his honour on April 29th at the Engineers' Club, New York.

The late staff of the National Telephone Co. at Brighton have presented a gold watch to Mr. P. F. HART, who has accepted an appointment at Buenos Ayres.

The King of Spain has conferred upon Mr. MARCONI the Grand Cross of the Order of Alfonso XII.

It is announced that the President of the Board of Trade has appointed Mr. C. HAMILTON WICKES, who, as our readers know, is at present His Majesty's Trade Commissioner for Australia, to be His Majesty's Trade Commissioner for Canada, in place of Mr. RICHARD GRIGG, who has received an important appointment under the Dominion Government. We have already made our readers familiar with the reports and views of both of these gentlemen respecting British trade prospects in the markets alluded to, and to both of them the ELECTRICAL REVIEW offers its congratulations. The British electrical and engineering industries will hope for still greater things at the hands of Mr. Grigg in the higher position which he will shortly occupy in Canada, while the experience and insight of Mr. Wickes brought to bear in the same country should assist us in our increasing efforts to substantially develop our trade connections in that more or less difficult market.

**Obituary.**—We regret to record the death, which occurred at his residence in London on May 16th, of MAJOR-GENERAL E. R. FESTING, C.B., F.R.S., late R.E., who was director of the Science Museum at the Victoria and Albert Museum from 1893 to 1904. Major-Gen. Festing was born in 1839. He became a lieutenant in the Royal Engineers in 1855, and served through the Central Indian Campaign between 1857 and 1859. In 1864 he joined the Department of Science and Art as Deputy-General Superintendent of South Kensington Museum.

The death recently occurred at Johannesburg of Mr. DAVID LOWSON, electrician, son of the late Mr. Peter Lowson, Bridge of Earn. Mr. Lowson, who went out to Johannesburg in 1895, had charge of the installation work for many of the largest buildings in the town and suburbs, and was widely known and universally respected. During the Boer War he served in Thorneycroft's Mounted Infantry.

## NEW COMPANIES REGISTERED.

**Sheffield Electrical Engineering Co., Ltd.** (121,834).—This company was registered on May 6th, with a capital of £1,000 in £1 shares, to take over the business of an electrical and mechanical engineer carried on by E. O. Burn, trading as the "Sheffield Electrical Engineering Co.," at 99, Rockingham Lane, Sheffield, and the business of general engineers carried on by W. Morton and E. Leadbeater Scott, as "E. L. Scott & Co.," at 109, Rockingham Lane, Sheffield. The subscribers (with one share each) are:—F. Kenyon, 47, Strathitay Road, Sheffield, gentleman; E. O. Burn, 136, Millhouses Lane, Sheffield, electrical engineer; Mrs. C. Kenyon, 47, Strathitay Road, Sheffield; R. B. Hodgson, 75, Riverdale Road, Sheffield, engineer; C. F. Bennett, 10, Figtrees Lane, Sheffield, solicitor. Private company. The number of directors is not to be less than two or more than three: the first are F. Kenyon and E. O. Burn; E. O. Burn is permanent managing director, with £2 per week in addition to remuneration as an ordinary director; qualification, 50 ordinary shares; remuneration of ordinary directors £10 each per annum. Registered by C. Double, 14, Serjeant's Inn, E.C.

**Standard Woodwork Co., Ltd.** (121,836).—This company was registered on May 6th, with a capital of £15,000 in £1 shares, to carry on the business of manufacturers of and dealers in all kinds of accessories to telephones and telegraphs (especially switchboards, telephone bell cases and telephone battery cases), cabinet and box makers, wood workers and turners, &c. The subscribers are:—R. S. Challands, 19, Gayton Road, Hampstead, N.V., chartered accountant, 2,000 shares; C. H. Walton, 55, Fore Street, E.C., solicitor, 2,000 shares; A. P. Johnson, The Wong, Marsfield Gardens, S.W., solicitor, 1,500 shares; F. McDougall, 99, Aldersgate Street, E.C., merchant, 1,500 shares. Private company. The number of directors is not to be less than three or more than seven; the first are R. M. Jones, R. S. Challands, C. H. Walton, F. McDougall and A. P. Johnson; qualification, £250; remuneration, £50 each per annum. Registered office, 55, Fore Street, E.C.

**Power Syndicate of South America, Ltd.** (121,823).—This company was registered on May 6th, with a capital of £33,000 in £1 shares, to employ and equip expeditions, commissions, experts, and agents, to carry on the business of a power company to acquire water rights, to construct and operate power supply and other works, to supply and utilise water and water power, to carry on the business of mechanical, hydraulic and electrical engineers, &c. The subscribers (with one share each) are:—G. L. Bevan, 1, Cornhill, E.C., stockbroker; F. E. O. Tootal, 1, Cornhill, E.C., stockbroker; T. J. Fleming, 1, 123, Taleahuan, Buenos Ayres, engineer. Private company. The first directors are G. L. Bevan, F. E. O. Tootal, and T. J. Fleming. Registered by Linklater, Addison & Brown, 2, Bond Court, Walbrook, E.C.]

**Anderson & Munro, Ltd.** (8,247).—This company was registered in Edinburgh on May 7th, with a capital of £3,000 in £1 shares (2,000 preference), to acquire and carry on the business of Anderson & Munro, electrical engineers, 136, Bothwell Street, Glasgow. The subscribers (each with one share) are:—T. B. Wright, 136, Bothwell Street, Glasgow, electrical engineer; A. S. Nairn, 136, Bothwell Street, Glasgow, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are T. B. Wright and A. S. Nairn. Registered office, 136, Bothwell Street, Glasgow.

**Rushmore Lamps, Ltd.** (121,973).—This company was registered on May 13th, with a capital of £20,000 in 7,500 6 per cent. cumulative preference and 12,500 ordinary shares of £1 each, to take over the business carried on by a company of the same name, to carry on the business of manufacturers of, and dealers in, searchlights, lamps and all kinds of electric, gas, acetylene and other illuminating apparatus, and to adopt an agreement with the said old company, and G. H. Cobley, the liquidator thereof. The subscribers (with one preference share each) are:—S. F. Tyler, St. Lawrence, Thames Ditton, merchant; E. S. Kemshead, 12, Glasslyn Road, Crouch End, N., secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Qualification, £100; remuneration, £100 each per annum (chairman, £150). Registered office, 46, Brewer Street, Piccadilly, W.



**T. Harding Churton & Co., Ltd., (121,792).**—This company was registered on May 3rd, with a capital of £10,000 in £10 shares (400 preference), to take over the business of an electrical engineer, carried on by T. H. Churton, at Atlas Works, Water Lane, Leeds, as T. Harding Churton and Co. The subscribers (with one share each) are:—T. H. Churton, 8, Hillary Place, Leeds, electrical engineer; S. H. Smith, Pengarn, Shaftesbury Avenue, Roundhay, Leeds, electrical engineer; Mrs. E. B. Churton, 8, Hillary Place, Leeds. Private company. The number of directors is not to be less than two or more than five; the first are T. H. Churton (permanent governing director: special qualification, £2,000 shares), S. H. Smith and one other to be nominated by the said T. H. Churton; qualification, £100; remuneration of T. H. Churton and S. H. Smith, £800 per annum divisible. Registered by Surr, Gribble, Nelson and Oliver, 6, Laurence Pountney Hill, E.C.

**X.L. Electric Co., Ltd. (121,696).**—This company was registered on April 23rd, with a capital of £20,000 in £1 shares, to carry on the business of electricians, electrical and mechanical engineers, manufacturers of and dealers in electrical and mechanical devices, &c., to acquire the benefit of certain inventions for improvements relating to electrically-operated clocks and time-indicating devices, &c., and to adopt an agreement with L. J. Aron. The subscribers (with one share each) are:—R. C. E. Poulter, 71A, Queen Victoria Street, E.C., solicitor; C. T. Taylor, 71A, Queen Victoria Street, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. Weiner (chairman and managing director) and L. J. Aron. Registered by Bristows, Cooke & Carpmal, 1, Copthall Buildings, E.C.

**Institute of Wireless Telegraphy, Ltd. (121,782).**—This company was registered on May 3rd, with a capital of £2,000 in £1 shares, to take over the business of wireless telegraphy instructors carried on by the Manchester Institute of Wireless Telegraphy at 15, Market Street, Manchester, to carry on the business of contractors for wireless telegraph installations, &c. The subscribers (with one share each) are:—E. A. Mayne, 15, Market Street, Manchester, wireless expert; C. G. Marston, National Liberal Club, Whitehall Place, S.W., gentleman; G. A. Blount, 7, Ormond Road, Richmond, Surrey, gentleman. Private company. The number of directors is not to be less than three or more than seven; the first are E. A. Mayne, C. G. Marston and G. A. Blount; qualification, £100. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

## CITY NOTES.

### German Electrical Companies.

THE Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, after making provision for depreciation, reports net profits and balance forward amounting to £49,000 in 1911, as compared with £43,000 in the previous year. The sum of £2,100 has been placed to the reserve fund, £7,500 to the contingency fund and £2,500 to the pension fund. Out of the balance it is intended to pay a dividend of 6 per cent. on a share capital of £350,000, being the same rate as in 1910, and at the rate of 6 per cent. on a share capital of £150,000 for a period of nine months. The cable maintenance fund received an allocation of £7,500 in the year 1910.

The first report of the Hochfrequenz-Maschinen A.G., of Berlin, which was formed some time ago for the working of the Goldschmidt patents for wireless telegraphy, states that two experimental generators were tested at the Lorenz Co.'s testing station at Eberswalde during 1911, and the favourable results had given occasion to trials on a large scale. It was intended for this purpose to erect a large station in Germany, and a second in the United States, which were to be carried out this year, and the unpaid capital was being called up to provide the necessary funds. The accounts show a debit balance of £7,800 on a share capital of £105,000, of which £45,000 was paid in 1911.

The Elektrizitäts Lieferungs Gesellschaft, of Berlin, which carried on 28 electric supply works in 1911, realised gross profits of £207,000, as compared with £165,000 in the preceding year. After meeting general expenses and interest charges on loans, the decline in the value of securities has rendered it necessary to make provision for their depreciation to the amount of £37,000, this contrasting with £31,000 in 1910. The net profits and balance forward are returned at £124,000 as against £97,000, and it is proposed to pay a dividend of 11 per cent. on the old capital of £750,000 as compared with 10 per cent. in 1910, and 5½ per cent. on the new share capital of £250,000. It is now intended to make a fresh increase of £500,000 in the share capital to defray the expense of extending existing works and participating in new transactions.

The directors of Hartmann & Braun, A.G., of Frankfurt-on-Main, state that the course of business in 1911 was good, all departments were fully occupied and the turnover showed a notable increase over the previous year. Nevertheless the severe competition in the whole of the electrical industry, which was emphasised in the report for 1910, had an unfavourable influence on sale prices last year. The gross profits amounted to £81,000, as against £74,000 in 1910, and the net profits, after setting aside £7,500 for depreciation as compared with £7,100, are £24,000, as contrasted with £21,000 in the previous year. A dividend of 10 per cent. is in contemplation on the share capital of £85,000, being the same rate as in 1910. The special reserve fund receives £2,000, the officials a bonus of £6,400, and other profit-sharing absorbs £5,600. It is proposed to raise a further loan of £25,000 for the purpose of providing additional working capital.

### Manufacturing in Belgium.

THE directors of the Ateliers de Constructions Electriques, of Charleroi, announce in their annual report that the orders received in 1911 represented a value of £576,000, as compared with £480,000 in the preceding year. A constant increase took place in

the number of regular customers, and most of the companies which had given initial orders continued to entrust the company with work notwithstanding the prevalence of keen competition. On the other hand, the efforts put forward by the technical staff in the examination of schemes submitted to the company had opened up new and important markets. The department for turbo-alternators constructed machines ranging from 2,000 H.P. to 12,000 H.P. whilst the lifting branch carried out special apparatus for foundries, blast furnaces, steel works and rolling mills, including casting cranes, furnace chargers, &c. As a result of various installations completed in previous years in the electrical driving of rolling mills, the company had obtained orders for apparatus of large power for delivery to different works, and several winding engines ordered in 1910 were put in operation last year. The cable factory was started at the beginning of 1911, the contracts booked exceeded expectations, and complete satisfaction was given by the high-tension cables which had been supplied for pressures up to 15,000 volts. The accounts show net profits of £35,000 on a share capital of £400,000, and a dividend of £1 8s. per share has been declared on the priority shares and 8s. per share on the ordinary shares.

The report of the A.E.G.-Union Electrique for 1911 states that there was an abundance of business in the Belgian market, both in regard to industrial transactions and to central stations and tramways. Under normal circumstances this situation of affairs should have caused an increase in prices, which had fallen to a low level, but, contrary to expectation, the advance did not take place. It was possible to secure a larger turnover in 1911, whilst at the same time the amount of orders brought over into the new year was greater than at the beginning of 1911. The profits realised were also as satisfactory as in the preceding year. Including the balance forward, the accounts exhibit net profits of £15,800 on a share capital of £140,000, and a dividend is proposed at the rate of 13s. 7d. per share.

### Shanghai Electric Construction Co., Ltd.

THE sixth annual general meeting of the shareholders of the above company was held on Thursday last week at Basildon House, Moorgate Street, Sir Alfred Dent, K.C., M.G., in the chair.

In proposing the adoption of the report (see ELECTRICAL REVIEW, page 806), the CHAIRMAN said there had been a considerable improvement in net receipts during the year under review. The accounts showed a profit of £14,139, as compared with £7,584 for 1910, and, including the balance brought forward of £6,635, the balance of profit and loss account amounted to £20,774. This balance had been dealt with by placing £10,000 to a reserve for renewals, by writing off £7,473, the item which had appeared in their last two balance-sheets under the heading of general expenditure during construction to June 30th, 1908, and carrying forward the balance of £3,301. The expense ratio, which was 78½ per cent. in 1910, and 71½ per cent. in 1911, had been further reduced from the returns so far received for 1912 to 68 per cent. The result for the first four months of this year showed a continuous expansion, the receipts being £22,635, against £17,370 for the first four months of 1911, or an increase of £5,265. Their operating profit for the same period, as nearly as they could estimate it, was £7,200, as against £4,200. If this improvement was maintained as expected, their net receipts for the year would show a large advance on the £14,000. There had been a large increase in passengers carried, the number being 27,257,250, as against 18,751,215 in 1910, and 11,772,715 in 1909. There was a 12 per cent. increase this year in the car-miles run, which amounted to 2,241,112, over their track of 25½ miles, and the number of passengers per car-mile worked out at 12'16, against 9'39 for 1910, and 5'95 for 1909. The expansion which had been going on for some time, would necessitate further capital expenditure, principally on additional motors, trailers, and feeder cables. This was now being taken in hand, and might cost them about £20,000, but as their revenue was largely increasing, they anticipated no difficulty in providing the money, and hoped to replace it later on by a further issue of capital sufficient to repay the bank loan and refund to the company's treasury the large sums spent on capital account, which under present circumstances had to be met out of revenue. Such an issue should release their profits for the payment of a dividend. They continued to suffer severely from the loss in exchange on converting the native coins, in which their fares were paid into Mexican dollars. This cost them £15,477 (equivalent to 4½ per cent. on the capital) last year, against £13,578 in 1910, and constituted a feature which did not exist when the concession was originally granted them by the Municipal Council. Power expenses had gone up £1,000, and amounted to £11,270, owing to their increased consumption. The charge per unit to general consumers had lately been reduced, but the tramway was again excluded from similar benefit. The 5 per cent. royalty on gross receipts had yielded the ratepayers £2,913 in 1911, as against £2,389 in 1910, and they were still unable to get this royalty reduced to the same basis as Hong-Kong and Singapore, where only 5 per cent. on net receipts was payable to the local authorities. No charge for road maintenance was included by the council in their budget estimates for 1912, but an amendment to the estimates was carried at the meeting held on March 21 last re-imposing the charge from January 1st, 1912. They had lately been carrying passengers at the rate of over 35,000,000 per annum, and this number would be again increased when the new cars and trailers were put into commission.

MR. J. S. HASKELL seconded the motion, and the report was adopted.

(Continued on page 849.)



## PRESENTATION OF A BUST OF LORD KELVIN TO THE I.E.E.

On Thursday last week, in fulfilment of a promise made by Lady Kelvin, a marble bust of the late Lord Kelvin was formally presented to the Institution of Electrical Engineers. The ceremony took place in the course of the annual general meeting of the Institution, in the presence of a number of relatives of Lord and Lady Kelvin, amongst whom were included Mr. James Thomson, M.Inst.C.E. (nephew), Mr. F. Bottomley (nephew), Lady Hargreaves Brown (sister of Lady Kelvin), and Sir A. Hargreaves Brown. Dr. J. T. Bottomley, nephew and former colleague of Lord Kelvin, was unfortunately unable to attend, being absent from England.

The presentation was performed on behalf of Lady Kelvin by Sir W. H. Preece, F.R.S., with whom was associated Dr. S. P. Thompson, F.R.S. Sir William Preece remarked that that was the first occasion on which he had publicly visited the beautiful lecture hall of the Institution; he was probably the oldest living friend of the late past-president, as he knew him in 1861. He paid an eloquent tribute to the great scientific achievements and many excellent qualities of Lord Kelvin, who, he reminded the audience, had been President of the Institution on three different occasions (a triple honour which has been conferred upon no other, and which he bore at the time of his death), and he hoped they would treasure the almost living representation of him whom they had loved so well.

His mind, said the speaker, would ever be with us; his works were classic, and his memory immortal. He added that he would not rest content until he saw that bust accompanied by one of his earlier master—Faraday—and announced that he hoped to be able to present such a bust to the Institution at some future time. He then presented the bust to the Institution, in the name of Lady Kelvin.

Prof. S. P. Thompson said he had been asked by Lady Kelvin to express her regret at being unable to be present on that occasion. The bust, the work of Mr. A. M'Fadyean Shannan, A.R.S.A., of Glasgow, was a faithful representation of Lord Kelvin, executed by an artist who knew him personally and had already produced two other busts of him; in Dr. Thompson's opinion the third was an exceptionally fine one. Great as was Lord Kelvin as a mathematical physicist, he was, nevertheless, in the closest touch with the commercial applications of science; he had left it on record that the very life and soul of science depended upon the practical

applications to which it could be put for the benefit of mankind. The Institution now possessed, in addition to that of Lord Kelvin, busts of Volta, Benjamin Franklin, Dr. John Hopkinson, Sir Francis Ronalds and Sir Charles Bright, as well as a medallion of Major-General Webber.

At the invitation of the President, Mr. James Thomson said a few words, and Mr. Ferranti then expressed his pleasure in accepting the bust on behalf of the Institution, with profound gratitude to Lady Kelvin.

We reproduce a photograph of the bust, which forms a most welcome addition to the art treasures of the Institution.

A short biography of Lord Kelvin, specially written for the International Electrotechnical Commission (of which he

was the first president) by Dr. S. P. Thompson, has recently been published by that body in English and French, at a very low price, it having been felt that a great many people would be glad to possess a biography of one of the greatest men of modern times. The frontispiece is an excellent photogravure of Lord Kelvin, from a photograph which has not been previously published. That the biography is a masterpiece in its way need not be said to those who are familiar with previous works of Dr. Thompson, who, it will be remembered, was the author of the official biography of Lord Kelvin. Necessarily the matter is severely compressed, in order to bring so enormous a subject within the prescribed limits; but the result is to make the multiplicity and diversity of the great philosopher's labours even more strikingly apparent, by grouping them more closely together in a highly concentrated form.

We need not here recapitulate the many branches of science and industry of which the foundations were laid, or the practice revolutionised, by Lord Kelvin's inventions and discoveries; we will only quote one passage in his own words:—"There cannot be a greater mistake than that of looking superciliously upon practical applications of science. The life and soul of science is its practical application . . . many of the greatest advances that have been made from the beginning of the world to the present time have been made in the earnest desire to turn the knowledge of the properties of matter to some purpose useful to mankind." This was the great principle of which he was so distinguished an exponent—the principle which for a century has been regarded as the fundamental law of engineering.





## THE DESSAU-BITTERFELD SINGLE-PHASE RAILWAY.

IN the early part of 1911 there was opened one of the most important European railway electrifications so far under-



FIG. 1.—A.E.G. EXPRESS LOCOMOTIVE AND TRAIN.

taken—the Dessau-Bitterfeld section of the German main line railways between Magdeburg, Leipzig and Halle.

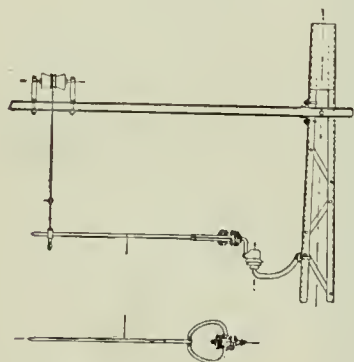
The work was, to some extent, experimental, as it was

this high pressure. The transmission distance is only about five miles, and the three transmissions were installed with a view to investigating the conditions which will arise when 60,000-volt pressures are a necessity.

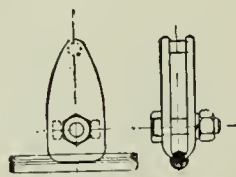
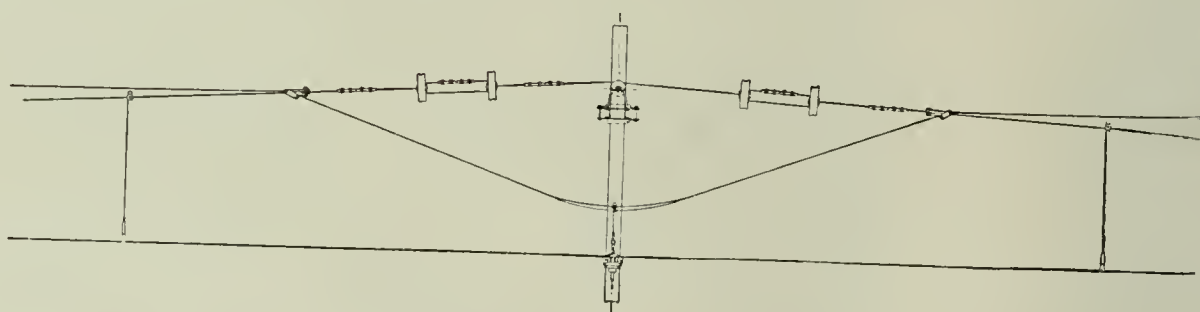
The cables were supplied by the Felten-Guilleaume and Siemens-Schuckert companies, the former with copper and the latter aluminium cores, paper insulated and lead covered. Although delivering at 60,000 volts, the cable is only subjected to 30,000 volts, as two distinct single-conductor lead-covered grounded cables are used for the two conductors of each 60,000-volt single-phase circuit.

At the Bitterfeld sub-station the pressure is stepped down to contact-line voltage, 10,000, by two A.E.G. air-cooled transformers, each of 1,800 K.V.A.

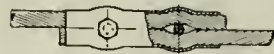
The section of line between Dessau-Bitterfeld is about 27 km. long, and has six intermediate stations; it is double tracked throughout, and provided with a contact line constructed with ordinary catenary suspension, the vertical suspension points being at 6-m. intervals. The overhead work is carried on gantries spaced at 75-m. intervals, and the contact line is divided into 1,000-m. lengths, which are fixed at the centre and automatically stretched at the ends by hanging weights. This tightening applies to both the contact and messenger or suspending wires, and in order to ensure uniform tension of the messenger cable in all sections, a third so-called span-wire of similar material is stretched tightly between the supports



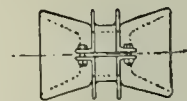
DISC INSULATOR.



CONTACT WIRE CLAMP.



MESSENGER CABLE CONNECTING CLAMP.



DIABOLO INSULATOR.

FIG. 2.—SHOWING METHOD OF SUSPENSION OF CONTACT LINE.

necessary to prove the adaptability of electric traction on this section, which deals with all classes of railway traffic, and the Magdeburg-Leipzig-Halle lines were selected for electrification first of all, with a view to utilising the brown coal-fields in the Bitterfeld district, where a power station has been erected. The results of the operation up to now have demonstrated the usual advantages of electrification, such as higher speeds, quicker acceleration and ability to draw the heaviest trains.

The electrification is on the single-phase system with 10,000-volt 15-cycle current on the contact lines; the power station supplying the railway contains four Stirling and Garbe water-tube boilers, under which the brown coal is burnt on step grates.

The steam is superheated, and supplies a 3,750-K.V.A. 15-cycle turbo-alternator, by the A.E.G., generating single-phase energy at 3,000 volts pressure. Current is fed to two oil-cooled transformers, where the pressure is stepped up to 60,000 volts, and led to a sub-station at Bitterfeld over one overhead transmission and through two underground cables, the latter being the first examples of underground cables for

of the latter, and in case of a rise in temperature, causing the messenger cable to expand, the span wire correspondingly expands and allows the suspension points of the messenger



FIG. 3.—SINGLE-PHASE PASSENGER LOCOMOTIVE, DESSAU-BITTERFELD.



cable to move further apart, thus taking up the sag in the latter, and keeping the contact line nearly horizontal.

Fig. 2 shows the suspension of the contact line on a support. A "diabolo" insulator is mounted on the gantry so that it can rotate, and while the messenger cable and span wire are carried under the gantry without break, they are carried by a stranded wire support which runs freely over the diabolo insulator mentioned. Our view shows the system of clamping the messenger cable to the supporting wire on which disk insulators are fitted.

Stays of steel tubing are used for fixing the contact wires at the sides; the arrangement, which is shown in fig. 2, includes two insulators in series and provides a certain amount of play vertically and lengthways for the contact wire.

For ensuring uniform wear of the bow current collectors, the contact line is slightly zig-zagged across the centre line of the track. The contact wire is of hard drawn copper, of circular section with side grooves for the clamps; its sectional area is 110 sq. mm. for main lines, and 70 sq. mm. for sidings.

The messenger cable is seven stranded, of galvanised steel, and 42 sq. mm. in section; the span wire is a similar cable, but of only 20 sq. mm. section; the suspension wires are of galvanised steel, 3 mm. diameter, with a small loop at the bottom, allowing 5 cm. vertical movement of the contact wire, and the clamps for the latter are of pressed brass.

As regards the automatic tightening device, mention may be made of the method of proportioning the pull of the

allow of independent movement of the two sections. The track is sectioned in various places, the contact wires overlapping in the same way between two gantries, but not being joined. The arrangement of the contact line at a section division is shown in fig. 6; in such a case the two contact wires are connected to horn switches, which can be opened



FIG. 4.—OVERHEAD WORK; ENTRANCE TO BITTERFELD STATION.

by a winch at the foot of the mast. Contact lines at small stations are connected to the main contact lines, except the loading track contact lines which are specially isolated and earthed for ordinary working, but switched in on request, in which case warning is given by a bell signal, and lamps which remain alight during the time pressure is on.

The rails are used as the return circuit, and are copper bonded in the usual way, and connected up at the sub-station by two heavily galvanised stranded copper cables: each main contact line is independently connected in the



FIG. 5.—AUTOMATIC TIGHTENING DEVICE.

weight between the contact wire, messenger cable, and span wire, which consists in attaching them to a lever with unequal arms, the lever being held by the weight acting through a pulley system.

It will be noticed in fig. 5 that the last sections in each direction of contact wire, &c., overlap, and are, in fact, connected at the centre of the span, but in such a way as to



FIG. 6.—SECTION DIVISION, SHOWING HORN SWITCHES.

sub-station through an oil switch, and protected by roller-type lightning arresters arranged to operate at 15,000 volts. The contact line insulation has been perfectly satisfactory up to the present.

A service of express, ordinary, and a large number of freight trains, all for through traffic and drawn by locomotives, has been regularly conducted over the line, which,



in addition, as was mentioned on page 122 of this volume, has been extensively used for trying the capabilities of various types of electric locomotives intended for single-phase working.

One passenger and one freight locomotive were provided by the A.E.G. in the first instance, and these have been in regular service for a year.

The passenger type of locomotive, intended for express and ordinary service, shown in fig. 3, was built for a speed of 110 km. per hour.

The axle arrangement follows the well-known Atlantic steam locomotive 4-4-2 arrangement—a leading 4-wheel bogie, two pairs of driving wheels worked by a parallel crank drive from a motor mounted high in the frame, and one trailing axle. The locomotive is 12,500 mm. long, with a fixed wheel base of 3,000 mm.

The 1,600-mm. driving wheels run at about 400 R.P.M. as a maximum, the speed being a safe one owing to the absence of reciprocating masses.

The motor—an A.C. commutator motor having an hourly rating of 1,000 H.P., and shown in fig. 9 in position in the locomotive—drives through vertical connecting rods on to a stiff intermediate crank-shaft midway between the two driving axles, the intermediate crankshaft driving on either side the usual coupling rods.

The vertical connecting rods are always at a dead centre when the coupling rods on the same side have to exert the maximum tractive effort, and the full driving power has to be transmitted by the intermediate crankshaft from one side to the other in these positions; this arrangement, however, facilitates the placing of the motor.

The intermediate shaft bearings are of special type, in view of the heavy strains, each being constructed in four parts, with all-round adjustments, and provided with a fusible plug, which, if melted by a warm bearing, blows an alarm whistle.

The rotor of the main motor has an axial play of  $2\frac{1}{2}$  mm. each side, and the motor is of the open type, to allow inspec-

tion of all parts. Ordinary contactor control is used; the current is taken from the overhead lines by means of two pantograph collectors, fitted with ball bearings. These collectors have removed earlier difficulties encountered with



FIG. 7.—CONTACTOR CHAMBER.

is provided with tapplings, switched in by contactors, fig. 7, for varying the motor voltage as required for train working, and the circuit includes a reversing controller for reversing the main motor, also the armature and compensating windings. A static balancer is provided to adjust the voltage of the armature winding.

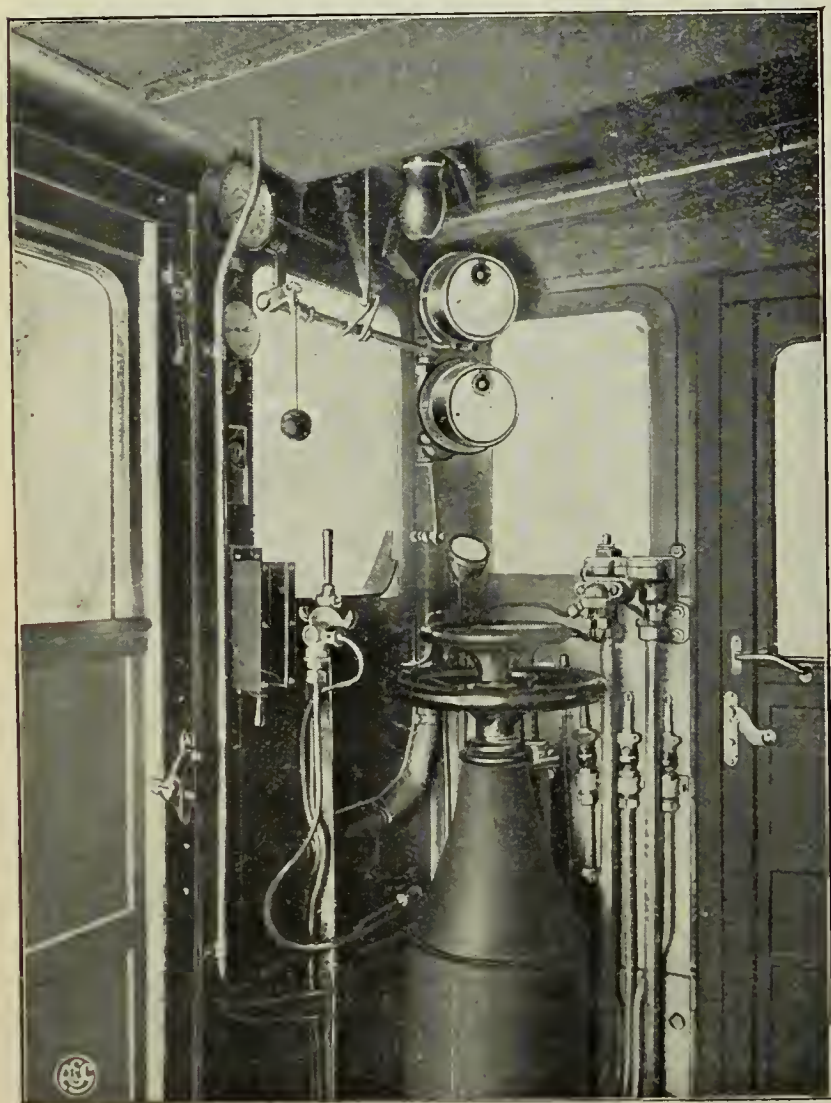


FIG. 8.—CONTROL GEAR, DRIVER'S CABIN.

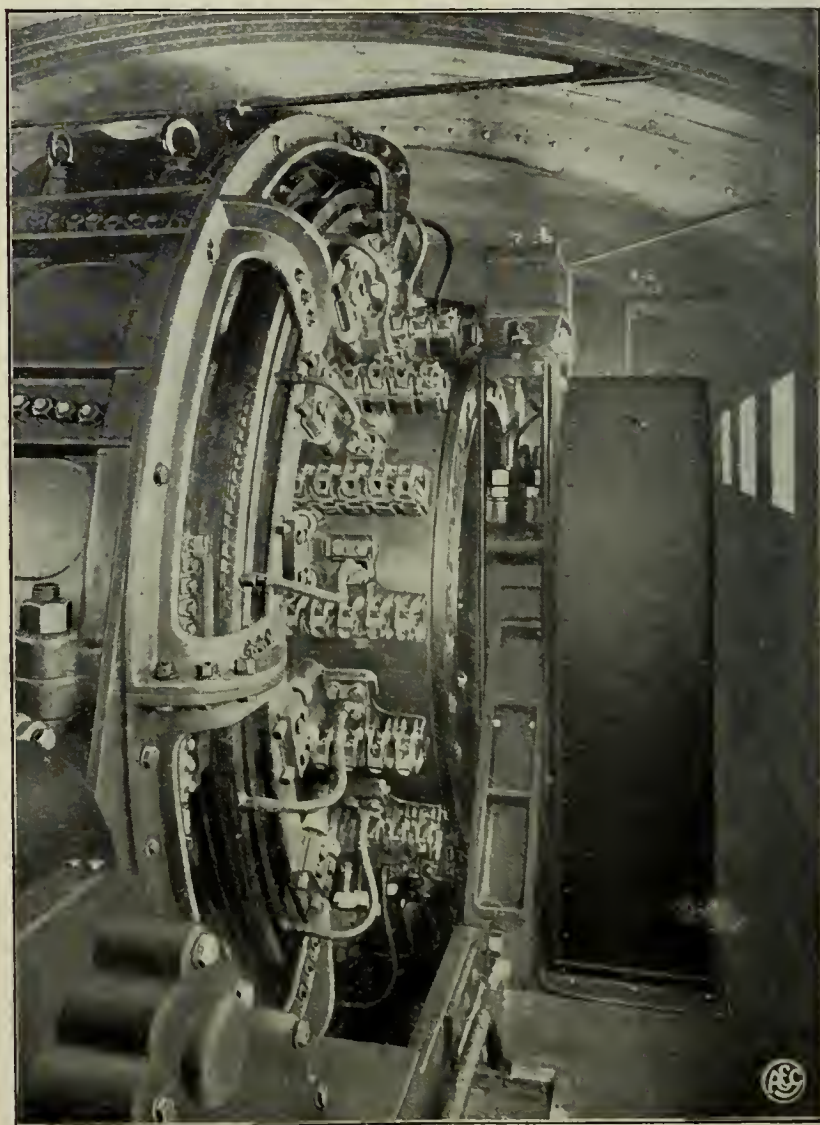


FIG. 9.—MOTOR COMPARTMENT, A.E.G. LOCOMOTIVE.

tion of all parts. Ordinary contactor control is used; the current is taken from the overhead lines by means of two pantograph collectors, fitted with ball bearings. These collectors have removed earlier difficulties encountered with

The transformer, erected in a compartment adjoining one of the driver's cabins, is specially ventilated; the main oil switch is mounted over it, with handles projecting into the cabin.



The contactor chamber adjoins the motor, and contains the master controller, while the reversing controller and a throw-over switch for short-circuiting the armature at starting (operated by a compressed-air cock in the driver's cabin) are placed under the contactor chamber.

The master-controller consists of two independent drums, the upper one operating the contactors by means of current from an auxiliary coil of the main transformer, and the lower one adjusting commutation. Both controller drums are worked mechanically by two hand wheels in either driver's cabin, fig. 8, the lower one having speeds marked on it.

Below the lower hand-wheel the lever of the reversing controller is shown, while over the wheel pillar are a small speed indicator, ammeter, voltmeter, air-brake pressure gauges, &c. The other apparatus controls the brakes, sanding, air pump, whistle, &c.

Fig. 1 shows one of the locomotives hauling an express train. Tests show a maximum tractive effort at starting of 9,500 kg., and the average starting acceleration with a train of 280 tons was 19 m. per sec. per sec.; the maximum temperature of the motor on a lengthy test was found to be 70° C., with 20° C. external temperature.

The freight locomotive was constructed for a maximum speed of 70 km. per hour; it is mounted on four coupled driving axles with a motor drive through a central intermediate crankshaft very similar to the other locomotive. A maximum tractive effort of 10,000 kg. at driving wheel periphery is obtained. The main motor in this case is of 800 H.P. (hourly rating), and so placed with regard to the intermediate crankshaft that the driving rods are at 45° to the horizontal—this arrangement giving a more favourable distribution of strains on the intermediate shaft, which has cranks set at 90°.

The two locomotives are similar, electrically, in many points, but in this case a trial was made of the regulation of motor starting by shifting the brushes to one side or other of the zero position, according to the desired direction of travelling. This brush movement is by a screw and hand-wheel in the driver's cabin. Further regulation of the motor voltage is by means of a step transformer switched through a mechanically-operated controller.

In view of shunting work two similar hand-wheel pillars are provided, one at each side of each of the driver's cabins.

It may be interesting to refer to one or two other locomotives which have been tried on this route. One of these is intended either for express passenger or slow freight trains on the Lauban-Konigszelt line, and is carried on four coupled driving axles, with leading and trailing axles: two 900-H.P. motors (with the transformer between) are fitted, driving through connecting rods at 45° to the horizontal on to the usual intermediate crank-shaft.

The hourly rating is 1,600 H.P. at 50 km. per hour, the highest speed 110 km., the maximum tractive effort 12,000 kg., and the total weight 99 tons. In view of experience gained during trials, air passages 500 mm. wide are provided on either side of the locomotive from end to end, and pass a strong current of air to the electrical apparatus. As the trains will be through ones and steam-heated, an electrical water-heater is also provided.

Another locomotive built for service on the French railways near the Pyrenees was subjected to an extended test. Two 800-H.P. motors are fitted, which in this case drive through inclined connecting rods on to two intermediate crank shafts, one at either end of the three driving axles, the coupling rods being extended: a trailing axle is also provided at either end, of the radial type.

Provision was made in the control of the locomotive, for the return of energy to the line on steep gradients which exist on the electrified sections of the French railway, and trials on the Dessau-Bitterfeld line made by drawing one locomotive by another, showed the success of this arrangement at medium speeds.

The locomotive drew 1,500 ton freight trains with ease at speeds of 40 km. per hour on 4 per cent. grades, and has proved very suitable for passenger service owing to its high accelerating qualities.

Another type of freight locomotive, one of 12 similar machines ordered from the A.E.G. for other railways has been tested, also other locomotives by Siemens-Schuckert,

Bergmann, the Maffei Co., and Brown-Boveri as mentioned in our issue of January 26th last.

As a result of the experience gained on the Dessau-Bitterfeld line, the Prussian Railway authorities have since commenced the electrification of the Magdeburg-Leipzig-Halle line, 170 km. and the Lauban-Konigszelt lines, 240 km. The former is expected to be working this year, and a pressure of 15,000 volts on the contact line will be adopted.

In conclusion, we are indebted to the A.E.G. for our illustrations; the various publications of the company have also been freely drawn on for information.

## CITY NOTES.

(Continued from page 844.)

### Eastern Telegraph Co., Ltd.

SIR JOHN WOLFE BARRY, K.C.B., chairman, presided over the meeting of this company at Electra House, E.C., on May 15th.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 764), the CHAIRMAN said that the gross revenue for the half-year amounted to £729,400, against £670,100, an increase of £59,300. Message and other receipts were £53,600 more than for the corresponding half-year of 1910, and the increased receipts were spread over practically the whole of the system with the exception of South Africa. Although the visit of the King to India, and also the war in Tripoli, had no doubt contributed to some extent to the improved revenue, the major portion of the increase in the traffic receipts appeared to be due to a general improvement in trade. The revenue for the whole year 1911 exceeded the revenue of any year since the inception of the company, and the improvement had been so far well maintained in the year now current. Turning to the expenditure side of the revenue account, the total expenses amounted to £282,800, while the expenses for the half-year to December, 1910, were £264,700. With an increase in the volume of traffic to be handled, they must look to a consequent general increase in their expenses all round. Expenses at stations were £24,000 more this half-year than for the corresponding period of 1910. Here, also, most of the items of expenditure show an increase when comparing the two half-years, as, in addition to the annual increments to the staff, they must expect some increase of expenses in view of the growth in the volume of work to be carried out consequent upon their growing revenue, especially when combined with their reductions in tariffs. In addition to this factor, they had found it necessary to improve substantially the conditions prevailing for the payment of overtime and Sunday duty throughout the system, and this revised scale had necessitated an increased expenditure of about £8,000 under the heading of salaries and wages. Maintenance of instruments showed an increase of £6,600, due to the introduction of new and improved apparatus for accelerating the speed, increasing the accuracy, and generally improving the working of the cables. The balance of the increase was spread over practically the whole of the items of expenditure comprised in this abstract. As a set-off against the increased expenditure referred to, the expenses attending maintenance of cables showed a reduction of £7,500 when comparing the two half-years. Although the actual expenses on this account were heavier this half-year, the amount received for the charter of their ships by foreign Governments and other telegraph companies was in excess of that credited for the half-year to December, 1910, so that the net total of the abstract showed a satisfactory reduction. As a result of the half-year's working, they had been able to make a contribution of £210,000 to the general reserve fund, while maintaining the payment of the usual dividend and bonus. The general reserve fund had been debited with £165,780 in respect of the new cable between Gibraltar and Alexandria, touching at Malta, which was successfully completed on April 12th. He referred to this matter at the last meeting, when he stated that the probable cost of this cable would be about £400,000. The above-mentioned figure of £165,780 represented the actual expenditure to December 31st last, and the balance of the cost would appear in the current half-year's accounts. The general reserve fund had also been debited with about £63,000 in respect of the partial renewal of some of their cables, and other special expenditure. It was, therefore, fortunate that they had been able to carry a substantial amount to the general reserve fund this half-year, and they looked forward to being able to contribute at least an equal sum next half-year so as to meet the balance of cost of these new sections, and at the same time maintain this fund as a provision against further expenditure for new cables, which would, no doubt, be necessary in the near future. From January 1st this year the company had been carrying deferred messages in plain language at half the ordinary tariffs. As the acceptance of this class of message had only been in operation for a few months, it was too early to form any definite opinion as to the effect this reduced rate would have upon the company's revenue.



but their experience up to the present showed that apparently it had not adversely affected the ordinary fully paid traffic. They had also reduced the Press rates between Great Britain, South Africa, Egypt and the Straits Settlements to the low figure of 3½d. and 4½d. per word, and negotiations were in progress for reducing the Press rates for telegrams exchanged with India and other places in the Far East. Messages charged at these reduced rates were not subject to special deferment, it being the opinion of the company that it would be inadvisable to introduce any special deferment on Press messages beyond the ordinary regulation, which had always been in operation, that this class of traffic was transmitted when the line was clear. As regarded Australasia, the British Pacific Cable Board agreed to a deferred Press rate over their cable, but the Eastern and Associated Companies did not see their way to reduce their Press rate, as the Government cable was fully equal to carrying this description of traffic. They, however, agreed in case of interruption of the Pacific cable to carry this traffic as a temporary measure, so as to avoid the Press having to pay higher charges for their deferred news during such interruption. He thought they might congratulate themselves upon the continued prosperity of the Company. This feeling should also be shared by those who relied upon submarine cables for their important correspondence, because, as he had frequently stated at these meetings, their policy had always been to give the telegraphing public a fair share of the benefits which were derived from the success of their business. They fully recognised that, as public servants, they had a duty to perform to the public who supported them and the higher interests of the State must also be considered in all their dealings. Although their interests were to a great extent international, they could not forget that they were a British Company, and their efforts should always be directed towards endeavouring to maintain the good reputation which submarine cable enterprise in this country had deservedly acquired. They believed that the only way to keep in the forefront was to continue to improve the efficiency of their service. By this means, and by the granting of additional facilities whenever it was possible, they encouraged the desire to make greater use of their cables, which ultimately tended to increase their revenue and enabled them to reduce their rates whenever they saw a favourable opportunity of so doing. It must be borne in mind that, when important reductions in rates were contemplated, additional cables might be required to cope with the increased volume of traffic which might be created. Unless this important factor was carefully considered, they might find themselves incurring a serious liability for the cost of new cables which might be out of all proportion to the benefits to be derived from the increased volume of traffic at the lowered rates. This was a point which some people who were constantly agitating for further reductions in the rates could not, or would not, appreciate. It might be useful and interesting to compare some of the principal rates now ruling with those in vogue in 1876, when the introduction of the word-rate first took place :—

	Per word.			Per word.		
	1876.			1912.		
	£	s.	d.	£	s.	d.
Australia .. .. .	0	10	6½			0
China .. .. .	0	8	4			5
Japan .. .. .	0	11	3			10
Straits Settlements .. .. .	0	6	3			3 6
India .. .. .	0	4	6			2 0
Egypt .. .. .	0	1	7			1 0
South Africa (1879) .. .. .	0	9	3			2 6
Gibraltar (1880) .. .. .	0	0	6½			0 3
Peru (1875) .. .. .	13	4				2 9
Chile (1875) .. .. .	1	4				2 9
Argentina (1874) .. .. .	16	4				2 9
Brazil (1874) .. .. .	13	7				2 7

The Press and telegraphing public might rest assured that whenever they felt justified in reducing their rates, it would be their policy to do so ; but naturally the interests of the stockholders and the interests of the public—which were really in common—must be safeguarded by taking into account the important points to which he had referred. They were convinced that by so doing the best interests of all concerned would thereby be protected.

SIR J. DENISON PENDER seconded the motion. MR. STACEY said that six months ago he called the attention of the board to the question of co-partnership, and he hoped the board were giving the matter sympathetic consideration.

The CHAIRMAN said this matter of co-partnership was one which was being considered by a good many commercial firms, and personally he was sympathetic to the principle. It must be remembered, however, that cable companies were under rather special conditions in that the business was scattered all over the world. When, however, some of the great commercial firms had formulated something tangible, he thought the board would sympathetically consider it. At present they were not ready for it.

The report was adopted.

### Hong-Kong Tramway Co., Ltd.

THE report of the directors states that the accounts to Dec. 31st show a profit of £14,361, which, with £8,557 brought forward, makes a total of £22,918 at the credit of the profit and loss account. The board have disposed of this amount as follows : Allocated to the reserve for depreciation and renewals, £9,000 ; charged to profit and loss account, to comply with the arrangement approved by the debenture-holders on July 11th, 1910, £10,000 ; carried forward, £3,918. The large increase in the net traffic receipts is caused partly through expansion of traffic (consequent on the revolution in

China driving many refugees into Hong-Kong), but is principally accounted for by the fall in the discount in the copper subsidiary coinage. In this connection the directors notice with satisfaction that the Government of Hong-Kong introduced into the Legislative Council upon March 7th, 1912, a Bill to prohibit the importation and circulation of foreign copper and bronze coins, which, it is hoped, will further ameliorate the position. The working expenses for the year have been increased by £1,233, of which the greater portion was incurred under the heading of maintenance and repairs.

MR. E. C. MORGAN (chairman) presided on Thursday last week at the offices, 19, St. Swithin's Lane, over the ordinary general meeting of the above company.

In moving the adoption of the report, the CHAIRMAN said he would explain the wide difference in the figures of the accounts as shown compared with last year's accounts. The very great increase in the net receipts during 1911 was due mainly to the smaller sum which it had been necessary to provide for the loss on subsidiary coinage, viz., £5,000. This, as he had frequently had occasion to tell them, was a matter beyond the control of the directors. Apart from that, however, the gross receipts during 1911 had exceeded those in 1910 by over £2,000, and this was the best evidence that the popularity of the company continued to grow, which he was glad to say was the case to even a greater extent during the present year. They would also be pleased to notice that the Government were now seriously taking up the vexed question of the standard of the coinage, and it was to be hoped would arrive at a scheme which would render further reference to this disagreeable question unnecessary in the future. It would also be a subject for congratulation for the shareholders to observe from the accounts that the conditions imposed by the debenture-holders two years ago had now been fully complied with, and, in addition, that the substantial sum of £9,000 had been placed to reserve for depreciation and renewals, bringing that up to £30,000. The expenses of the year showed an increase of about £1,233, but this was largely due to the heavy amount expended on maintenance and repairs, and in a measure to the increase in the number of passengers carried and the miles run, which resulted in an increased rate of earning per car-mile, far in excess of the additional expenses, while the condition of the plant and track had been maintained in a high state of efficiency. They could notice an increase under the heading of salaries in Hong-Kong, which was due to the necessary changes in the staff, involving additional expenditure, but that was not likely to be recurrent. He thought he might safely say that the position of the company was thoroughly sound, and gave good promise of future improvement, as they were now in a position to meet the demands of the public for further developments as they arose, and they had an excellent staff, whose hearts were in their work. Before concluding, he would like to record a vote of thanks to Mr. Kennedy and his staff, to whose unstinted efforts the present favourable position was due.

MR. R. MILLER seconded the motion, which was carried. The retiring directors having been re-elected, MR. MILLER moved the addition of Mr. A. C. Morgan to the board, and this was seconded by MR. CUTBILL.

MR. W. T. SHAW objected to an addition to the board, as the company was not paying any dividend, and there was no need to incur additional expense. He pointed out that the proportion of London expenses was not so great in the Calcutta Tramways Co., of which their chairman was also the chairman, as was the case in the Hong-Kong Co.

The CHAIRMAN said that the addition to the board would entail no additional expense, at least until a dividend was paid. The work of the company was increasing, and he would remind shareholders that the directors were not immortal. He had lately received a rather sharp reminder that he might be necessarily removed from the board, and it would be to the advantage of the company to have three directors left who were acquainted with all the business.

MR. SHAW withdrew his opposition, and the motion was carried. A hearty vote of thanks to the staff concluded the meeting.

**The Horsfall Destructor Co., Ltd.**—The following notice has been issued to creditor debenture-holders, signed by Messrs. A. Barrett, H. C. Brodie and C. H. Cumberland :—

"The trustees have for some time been engaged in assisting the directors to bring the company into a more prosperous condition. At the moment when this had been accomplished, their efforts have been rendered futile by a decision in the Law Courts against the company in regard to materials supplied, and which is of so serious a nature that it has been found necessary to protect the various interests involved by applying for the appointment of a receiver and manager. The trustees greatly regret that the hope held out originally, that a reconstruction made possible the ultimate redemption of the creditor debentures, has not been realised, and that at present there is no prospect of any dividend."

**Submarine Cables Trust.**—The revenue for the year to April 15th amounted to £25,377, and the expenses to £1,315, leaving £24,061, plus £46 brought forward. After providing £17,235 to meet payment of the coupons, £6,798 has been transferred to the redemption fund, leaving £75 to be carried forward.



## Urban Electric Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1911, says that the gross profits amount to £50,876, as compared with £47,269 a year ago, and after deducting the expenses shown in the profit and loss account, a balance of £47,649 is carried down to net profit and loss account. In the latter account the amount required for interest and debenture redemption fund absorb £32,211, leaving an available balance of £15,438, which the directors recommend should be applied as follows:—To reserve for depreciation, £10,000; to dividend of 2 per cent. for the year on the preference shares, £5,000; balance to be carried forward £438. The balance of the 5 per cent. dividend on the preference shares will be satisfied by funded dividend certificates in accordance with the terms of the resolution passed and confirmed at the extraordinary general meetings of the company held on February 2nd and 17th, 1912. The usual comparative statement, showing the profits earned at the various works, and a table showing the equivalent in 33-watt lamps connected for three years is appended:—

	33-watt lamps connected.			Comparative statement of profit.		
	1909.	1910.	1911.	1909.	1910.	1911.
Hawick .. ..	44,725	57,681	65,599	£3,976	£4,771	£4,840
Stamford .. ..	32,573	33,563	32,411	1,532	1,626	1,467
Weybridge & Walton..	56,423	61,861	66,136	6,056	6,124	6,040
Godalming .. ..	27,549	29,612	32,271	3,406	2,982	3,396
Twickenham Co. ..	92,954	103,971	113,068	8,339	10,150	10,959
Dartmouth .. ..	23,478	23,734	24,543	2,586	2,607	2,637
Camborne and Redruth and Cornwall ..	69,698	75,041	105,178	7,920	7,620	8,727
Newton Abbot .. ..	16,509	18,570	20,719	1,452	1,467	1,695
Grantham .. ..	36,032	37,286	39,209	2,526	2,498	2,648
Glossop .. ..	26,141	27,538	28,732	2,999	2,641	2,933
Berwick .. ..	18,463	19,821	21,683	1,297	1,466	1,565
Caterham .. ..	12,665	14,813	16,563	950	1,142	1,635
Newbury .. ..	19,386	22,269	23,575	1,811	2,158	2,259
Totals .. ..	476,596	525,160	589,737	£44,850	£47,254	£50,850

## Brisbane Electric Tramways Investment Co., Ltd.

ON May 21st Mr. H. R. Beeton presided at Winchester House, E.C. over an extraordinary general meeting of the above company, when the resolution passed on May 6th, with regard to paying a bonus to the shareholders in the form of new shares, was confirmed.

MR. BEETON subsequently presided at the eleventh annual meeting, and in moving the adoption of the report (see ELECTRICAL REVIEW, page 765), said it would be seen from the abstract of the Tramways Co.'s working for last year, that the total receipts for 1911 were £253,970, being an increase of £31,390, or 14 per cent., whilst the expenses showed an increase of £13,590, or 11.74 per cent. The net profit amounted to £124,686, being an increase of £17,800, and adding £2,908, the amount brought forward from 1910, the available balance amounted to £127,594, which had been appropriated in the following manner, namely: By payment of a dividend, free of income-tax, on the shares—all of which were owned by the Investment Co.—which absorbed £110,000; by placing £15,000 to renewals, raising that fund to £90,000; and by carrying forward £2,595. The passengers carried in 1911 were 36,443,222, being an increase on the previous year of 4,023,946, which was an advance of nearly 13 per cent. on the previous year, whilst the increase in car-miles run during the year was 147,902, or an advance of only 4.19 per cent. over the previous year. The business in the sale of power amounted to £7,355, an increase of £1,590, as against an increase of £950 in the previous year. Turning to the accounts of the Investment Co., the net proceeds of the dividend paid by the Tramways Co. amounted to £109,927; adding sundry receipts and the amount carried over from 1910, £3,589, and deducting therefrom London expenses and certain expenditure in Brisbane, £2,716, for which the Investment Co. was liable, they had an available balance of £110,800. The interest on the debenture stock, the dividends on the preference shares, and the usual 8 per cent. dividend, free of income-tax, on the ordinary shares, which was now recommended, absorbed £66,725, and there remained a balance amounting to £44,075. They proposed to appropriate £37,500 of this surplus in payment of a bonus of 10s. per ordinary share payable in shares, and to carry forward a balance of £6,575. They further recommended the payment of another 10s. per ordinary share out of the reserve fund. When these suggestions were carried into effect the Tramways Co. would have a renewal reserve fund of £90,000, and a balance carried forward of £2,595; whilst the Investment Co. would have a reserve fund of £4,500, an accident reserve fund of £3,000, premiums on debenture stock issued £500, and a balance carried forward of £6,575; so that the combined total of undivided profits amounted to £107,170, which, with some confidence, they regarded as ample for all contingencies. For some years past various sums had been expended on capital account without any fresh issue of debenture or share capital, the surplus funds being temporarily used for capital purposes. Thus, whilst the Investment Co.'s total debenture and share capital, including the £75,000 share capital about to be issued, would amount to £1,275,000, the outlay on capital account on December 31st last totalled £1,326,000, and this item would be increased by the cost of upwards of 6 miles of extensions now under construction, all of which, they believed, would become remunerative when open for traffic, and also by the corresponding new equipments now in progress. It was true that the Tramways Co. had investments valued at £47,000, but as this amount and more would be required to meet the expenditure for heavy renewals when it became necessary, they would in the near

future have to issue further capital, which would probably take the form of the issue of ordinary shares at par. The various local authorities through whose districts the tramways ran had had several joint meetings with a view of coming to an arrangement for the purchase of the undertaking, culminating in their promoting a Bill in the Queensland Legislature seeking powers for the appointment of a joint board to negotiate with the Tramways Co. He was unable to say if these powers had been granted, but he rather thought that the Legislature was dissolved before the Act was passed, and they did not know exactly how the matter stood at the moment. The authorities had no power under the concession to purchase before 1921 except by agreement, and the fact was now generally recognised in Queensland that the basis of purchase must be the payment of the commercial value of the tramways as a going concern. Such negotiations as had occurred had been directed to enabling the authorities to acquire the undertaking now, or at any time prior to the expiry of the concession, at an agreed price and conceding a share of profits on the working in the meantime. Last year he predicted that under ordinary conditions a long period of prosperity might be looked forward to, and the operations of the past year had justified that anticipation. But he ventured also to say that the industrial position was not entirely free from anxiety, and he was sorry to say that since the opening of the current year they had suffered from a strike which had seriously affected them, which had vitally concerned the Commonwealth of Australia, and which had interested the world at large. The chairman proceeded to explain the working of the Wages Board in Queensland, under which, he said, their employes were as contented as any body of tramway men in Australia. In pursuance, however, of the policy of the Federal Government, against which there has since been a marked revulsion, a law had been passed, entitled "The Commonwealth Conciliation and Arbitration Act," which constituted a Court, for the same purpose as the State Wages Board, but consisting of one judge, who was bound by no rules of evidence, who was entitled to refuse legal assistance to either party on the objection of the other, who had jurisdiction in all industrial disputes extending beyond the limits of a State, and against whose award there was no appeal. The ground being thus prepared, it was not long before industrial war broke out. Agitators were sent up from Melbourne, who seduced a certain number of their men into registering themselves in a Federal Labour Union as contemplated by the Act, and in conjunction with similar Unions in other States, engineered in the same way, extraordinary demands were embodied in a "plaint" which was forthwith presented for determination. Without, however, waiting for a decision of the Court, the agitators resolved to provoke a strike. To this end they resolved, on January 18th, that the members of the Federal Union in the company's employment should wear Union badges, in violation of a regulation of the company which had been promulgated in the previous May in order to avoid the intimidation and coercion of its employes. The recalcitrants were interviewed by Mr. Badger, and as they insisted on their right to wear the badge, they were not allowed to board their cars. By availing themselves of the services of students who were under instruction for drivers, and of absent and retired employes who returned to work, they were able to continue a reduced service. Mr. Badger, who had acted throughout with the utmost moderation and firmness, won for the company the approval and confidence of the public from the first. The storm gathered in intensity and burst on January 30th, when a general strike of all trades was declared by a Junta, representing 43 Unions. The industrial crisis which followed this action was the worst in the history of Brisbane, if not in that of Australia. The Tramways Co. was the storm centre, and was the object of virulent attack. In these circumstances it redounded greatly to the credit of their general manager that, in spite of three futile attempts to blow up cars, no depredations on the company's property were committed, no injury to workmen ensued, no accidents occurred which were attributable to inexperience in driving, and what was even more gratifying, there were no defections on the part of their non-union employes, and they were now entirely free of the Federal Union. The history of the strike read like the account of a siege. Their depôt at Countess Street was surrounded with barbed wire entanglements and the live current turned on: they had a large number of men on guard well armed; the fire hose and the hot-water hose were both ready: and all the windows of the power station were protected with iron inside. Most of the men were quartered at the different depôts, and they established a provisioning department. Notwithstanding the fact that all the engineers except the chief, as well as most of the stokers, left suddenly, they were able to keep the power station running, which was of public importance for the reason that all the city and suburban railway stations and many other important institutions got their light from the company, and four times every day their whistle sounded its note of defiance. Thanks to the energy of the Queensland Government on February 2nd a sufficient force of special constables was organised to cope with the situation, and on February 5th they started some cars with a posse of police on each, amidst popular acclamation. Unfortunately the action of the Federal Judge in granting jurisdiction to the strikers and in summoning Mr. Badger to a compulsory conference in Melbourne on February 13th greatly protracted the strike. After three days' session, the conference came to nothing, and the judge immediately remitted the issue to his Court, where he affirmed the right to wear the badge, but was unable to compel the re-instatement of the discharged employees. In the meantime, all the vacancies having been filled, the men who went on strike while they received permission to wear their badges found themselves without work, and the company was accordingly placed in a position to plead in the "plaint" that it had no dispute, for the reason that no members of the claimant Association were in its employment, and that as they had a full staff, from engineers to



point boys, it was not necessary to employ any of them. The company had since obtained from the High Court a prohibitive injunction against the award pending the hearing of the principal suit, which they were hoping to defeat on the ground of jurisdiction. The company had, of course, suffered severely in traffic and in expenses caused by the strike, but they had been sustained by the approval of the entire community, excepting the Labour Unions, and with the resumption of normal conditions, which already obtained, they had hopes of recovering in the course of the year a large part of the loss. At any rate, they were encouraged in this anticipation by the traffic for April, which was a record return for that month. He regretted to say, however, that the health of Mr. Badger had suffered from the severe strain imposed upon him, and they had accorded him, on the advice of his physicians, a long leave of absence, upon which he hoped to enter in a few days. Mr. Badger was the pilot who weathered the storm, and it was the intention of the board before the close of the proceedings to propose a resolution of gratitude to him for his signal services. They had despatched their colleague, Mr. Hamilton, and the secretary (Mr. Woodrow), to Brisbane to take stock of the situation, and to make the best arrangements possible for filling his place until such time as he might be restored to health and the service of the company.

MR. CONCANNON seconded the motion, which was carried.

Subsequently, on the motion of the CHAIRMAN, seconded by SIR THOMAS ROBINSON (Agent-General of Queensland), a most cordial vote of thanks was passed to Mr. Badger for his devotion to the service of the company, and this was ordered to be cabled to him.

MR. WICKSTEAD also proposed a vote of thanks to the staff who remained loyal, and this was agreed to.

### Delhi Electric Tramways and Lighting Co., Ltd.

THE sixth ordinary general meeting of the shareholders of the above company was held on Thursday last week at Basildon House, Moorgate Street, E.C., Col. Sir Buchanan Scott, K.C.I.E., presiding.

The CHAIRMAN, in moving the adoption of the report, said he was sure the shareholders would have been gratified to learn the announcement regarding the change of the capital of India from Calcutta to Delhi. This change would, no doubt, result in a great increase of business to the company, even so far as the existing area of its operations was concerned, and with a view to being prepared for future developments, the company had made a formal application to the Government for the extension of its area of operations. They would appreciate that the negotiations would inevitably occupy some time, so that, while the change had materially improved their prospects, they were not likely to derive much immediate benefit from the change. Turning to the figures in the report, he said he thought the shareholders would agree that the net result of the 14 months' operations might be considered satisfactory. The net revenue from the combined sections was £7,832, as compared with £3,232 for the 12 months ended October 31st, 1910. This increase was, of course, largely due to the additional revenue earned during the period of the Delhi Durbar. He was glad that the hope expressed at the last meeting with regard to the disappearance of the debit balance on the profit and loss account had been realised. After making good the whole of the accumulated loss, amounting to £1,912, they had an available balance of £1,401, which had been placed to the credit of renewals reserve account. The directors considered that necessary in order that the plant and equipment might be made more efficient, and they would now be able to carry out several alterations which had unfortunately to be left over in the past, owing to the company's financial position. The wiring and fittings department showed a profit of £272. On the debit side of the profit and loss account all the items showed an increase over the figures shown in the 1910 accounts. The increase under all heads was, of course, very largely explained by the fact that the accounts covered an additional period of two months. The net profit had amounted to £3,313, as compared with £457 in 1910. The passengers carried during the 14 months ending December 31st last numbered 2,957,456, as against 2,416,763 for the corresponding period. The receipts per passenger had amounted to '86d., as compared with '83d. The car-miles run totalled 437,429, as against 436,928, and the receipts per car-mile had risen from 4'59d. to 5'79d. The electricity portion of the business showed that for the period under review the units generated had amounted to 1,153,495, against 824,777, and the units sold to 498,657, as compared with 289,064. The average revenue per unit sold from all sources had been 5'4d., as compared with 5'1d. The consumers connected numbered 173, as compared with 203 in 1910, but the equivalent in 8-c.p. lamps had increased from 2,169 to 5,528. The total consumers connected at the end of last year was 685, and the total number of fans 865. The gross receipts from the tramway section since December, 1911, had been rather disappointing, but this was partly explained by reason of the fact that owing to certain alterations in the station a smaller number of cars had to be sent out. He was also inclined to think that they were suffering from an inevitable set-back following upon a period of prosperity. The receipts from the lighting section continued to increase, and they were constantly receiving further inquiries for supply of current for motive power, chiefly for small mills. They hoped to be able to expand that field of their operations very considerably in view of the expansion of local industry consequent upon the change of capitals. He hoped the shareholders would agree with him that the accounts showed that the company was now in a much more favourable position. They could not, unfortunately, have another Durbar this year, and he would ask the shareholders to bear that in mind when considering the figures for the later months of the present year, but with the additional growth of the lighting section, and the increased demands for

power to which he had already referred, he felt sure that a considerable extension of the company's business was assured.

MR. T. W. STRATFORD-ANDREWS seconded the motion.

The CHAIRMAN, in reply to questions, said the attention of the board had been directed to the proposed Jumna power scheme, and they had been in negotiation with the promoters, who were very anxious that they should combine with them. They had told them that if they could give them a supply of power cheaper than they could generate for themselves, they would take it from them, but further than that they could not go. They could come in against them as competitors eventually if the Government gave them permission, but he did not think that a very likely contingency.

The report was adopted.

### Rio de Janeiro Tramway, Light, and Power Co., Ltd.

THE report for 1911 records most satisfactory progress in all departments. The net revenue, after deducting all operating, maintenance, and other expenses in Rio de Janeiro, amounted to \$6,781,006. The fixed and other charges of the subsidiary companies, and the fixed charges, interest, and general expenses of this company amounted to \$3,072,411, leaving a surplus of \$3,708,595. Four quarterly dividends of 1½ per cent. each, amounting to \$1,960,912, were declared and paid by the directors, and after providing for the sinking fund for the year on the first mortgage bonds—namely, \$250,000—and transferring \$300,000 to the general reserve fund, there remains \$1,197,682, which has been added to the profit and loss account. The amount at the credit of profit and loss account now stands at \$3,230,323. As an extension to its tramway system the company has acquired the Jacarepagua Tramway lines, a suburban tramway of 11 miles in length, extending from the terminus of the Cascadura line of the company. The line, which was formerly operated by animal traction, is being electrically equipped, and should prove a profitable undertaking, in addition to becoming a valuable feeder to the company's lines. In the past year there were built in the company's shops and added to the equipment of the tramway system 54 13-bench cars and 12 large freight cars, in addition to trailer cars, street sprinklers, and other miscellaneous equipment. The electric light and power service shows a steady growth. There are now installed transformers connected to the overhead and underground systems of 44,232-kw. capacity. Owing to the increase in the consumption of power, and in order to be in a position to cope with future requirements, it was deemed advisable to commence work at once on the tunnel and canal necessary for diverting the flood waters of the River Pirahy into the basin of the Rio das Lages. The diversion of this river will provide additional water capable of developing 50,000 H.P., and will enable the capacity of the power station at Rio das Lages to be increased to 100,000 H.P. when the growth of the business requires it. This work will be pushed to completion as rapidly as possible. The telephone business has shown satisfactory progress. On December 31st, 1911, 6,275 telephones were connected, as compared with 4,859 at 1910. These figures do not include the telephones of the Interurban Telephone Co., of Brazil, of which there were 721 on December 31st, 1911. The Interurban Telephone Co., of Brazil, was acquired by this company early in 1911, and its net revenue is included in the earnings of the telephone department. The Interurban is operating in the City of Nictheroy with long-distance lines to Petropolis and Rio de Janeiro, the latter by means of a submarine cable across the bay, connecting with the company's system. Other extensions are being made to important centres in the State, and this telephone system should prove a valuable acquisition to the company, and should add materially to the earnings of the telephone department. The telephone system in the city has also been extended considerably, and it is the intention to increase the switchboard capacity to 10,000 lines, in order to care for the growing demand for telephone service. During the year the company issued \$2,375,000 par value of its capital stock, being the balance of the \$40,000,000 authorised capital, and on December 8th, 1911, the shareholders in general meeting sanctioned the increase of the capital stock from \$40,000,000 to \$50,000,000. The company also issued during the year a further \$1,000,000 of the English issue and Fs.12,580,000 (equivalent to £500,000) of the French issue of its 50-year mortgage bonds, bringing the combined English and French issues outstanding to £5,000,000. In the past year a subsidiary company, the Companhia Ferro-Carril do Jardim Botânico, successfully disposed of an issue of 5 per cent. bonds amounting to £1,200,000. This issue was mainly for the purpose of retiring an outstanding bond issue bearing 7 per cent. interest. A reduction of the subsidiary company's fixed charges for interest has therefore been accomplished, and at the same time additional capital of about £200,000 was provided for the development of its undertakings.

**Stewarts & Lloyds, Ltd.**—According to the *Financier*, the directors have decided to issue 212,500 deferred shares of £1 each. It has been decided to pay an interim dividend of 6d. per share (free of income-tax) on the existing deferred shares in respect of the half-year to June 30th, in order that the existing deferred shares may receive dividend to the date when the new shares begin to rank.

**Mirrlees, Bickerton & Day, Ltd.**—The directors have declared a dividend of 7½ per cent. on the ordinary shares for the year ended March. £337 is carried forward.

**Castner-Kellner Alkali Co., Ltd.**—The directors have declared an interim dividend at the rate of 15 per cent. per annum for the half-year ended March 31st.



### Chiswick Electricity Supply Corporation, Ltd.

THE directors' report for 1911 stated that the returns from the undertakings owned by the Corporation at Chiswick and Aberystwyth showed fair progress, and the number of consumers added during the year indicated a satisfactory increase. During the year £2,472 had been expended on capital account for machinery, mains, services, &c. An amount of £313 has been written off for depreciation, and it is proposed to place a further sum of £620 to depreciation reserve fund account, making a total contribution for the year in respect of depreciation of £933.

The figures below show the Corporation's liabilities on share and loan account at the end of four years:—

Year .. .. .	1908.	1909.	1910.	1911.
On Shares .. ..	£62,800	£62,800	£62,800	£62,800
On Loans .. ..	£63,000	£80,000	£80,000	£80,000
Total .. .. .	£125,800	£142,800	£142,800	£142,800

The following table shows the increase from year to year in the number of consumers, the revenue yielded and the profits distributed:—

	Consumers.	Revenue.	Profits.
1908 ..	1,692	£11,867	£6,834
1909 ..	1,875	£15,129	£7,592
1910 ..	2,081	£15,404	£7,584
1911 ..	2,237	£16,338	£7,363

The profits made by the Corporation for the year after paying sinking fund premium and trustees' fees were £7,363. Out of this sum interest on first mortgage debenture stock amounting to £3,600 had been paid, leaving a balance of £3,763 to the credit of the net revenue account. The increase in the revenue for the year amounted to £934, but the profits had not benefited by the increase, for several reasons. As in the previous year, the account for repairs had been heavy and included several exceptional items consequent on alterations to buildings and exchange of land at Aberystwyth, also an item in respect of reconstructing the chimney stack there. The item of rents, rates and taxes had increased by over £350, mainly due to an increase in the rates at Chiswick. Outlays incidental to opening the new showrooms at Chiswick, and certain other expenses, together with the increase in the amount written off for depreciation, disposed of the remainder of the £934 increase in the revenue, with the result that there was carried to the net revenue account £37 less than in the previous year. The results of the year's working, after placing to depreciation reserve fund account the sum above mentioned, would enable a dividend of 5 per cent. for the year to be paid on the shares of the company. The directors proposed that this dividend be paid to the West London and Provincial Electric Supply Co., Ltd., on May 15th.

### West India and Panama Telegraph Co., Ltd.

THE directors' report for the six months ended December 31st, 1911, states that the amount to credit of revenue is £40,604, against £40,306, and the expenses have been £26,920, against £24,319. The result is, therefore, a balance of £13,683, plus £1,695 interest on investments, and £2,825 brought forward, making an available total of £18,204. The directors recommend, after paying first and second preference dividend, a dividend on the ordinary shares of 1s. per share (free of income-tax), requiring £4,416, carrying forward £2,018. The traffic receipts showed an increase of £1,833. The expenses of repairing cables (after deducting the amount mentioned in the next paragraph) amount to £9,103, as compared with £7,620. During the half-year the company's repairing steamer, *Henry Holmes*, was thoroughly overhauled in accordance with Lloyds' requirements for her No. 2 survey. The cost, £1,361, has been charged to reserve for depreciation. In January a contract was entered into with the Telegraph Construction and Maintenance Co. for the manufacture of 109 knots of cable for stock, which have since been delivered in the West Indies. The exclusive rights conferred under the Spanish concession for landing cables in Porto Rico expired on February 15th, and the United States Government has not acceded to the company's application for an extension of those exclusive rights. The company will, however, continue to carry on its business in that island.

MR. W. B. KINGSFORD (chairman) presided on Wednesday, May 15th, at Winchester House, E.C., over the meeting of the company. He said that the total revenue for the half-year was slightly more than it was for the same period last year. Their expenses were £2,600 more, mainly owing to maintenance of cables and landlines. The traffic receipts for the half-year were £1,833 more than they were in the corresponding period; but as against that, they had to spend in new cable £1,100 more than they did a year ago. The half-year's profit was £13,683, which, with the balance brought forward from last year and other items, made up an available total of £18,203, which the board proposed to deal with in the manner stated in the report. During the half-year they had increased their investments from £80,867 to £87,672. They would have seen by the report that their exclusive rights in the Spanish concession for landlines in Porto Rico expired on February 15th. The concession was granted them by the Spanish Government for a period of 40 years, and it was stipulated that during that period no other concession could be granted for the establishment of cables between Porto Rico and Cuba, and it was also stipulated that when the concession expired the company should still have the right to carry on business as before. After the Spanish-American war came to an end, and Porto Rico was taken over by the Americans in 1899, the company continued to carry on their business under the terms of the concession, and the United States Government had always

most scrupulously respected their exclusive rights. With the view of obtaining an extension of their concession he went to Washington last June to submit the matter to the United States Government for its favourable consideration. Amongst those with whom he had interviews on the subject was the Secretary for War, whose department had charge of Porto Rico affairs. He told him that another company was in negotiation for landing cables in Porto Rico, and at his request he (the chairman) sent him for his information a long statement of their case, setting out fully the grounds on which they asked for an extension of their exclusive concession. As they were well aware, for some years the tendency of American policy had been to discourage strongly the grant of any kind of monopoly, and, as stated in the report, the United States Government had not acceded to their application. The question therefore of competition remained in their hands. He might mention that in connection with their negotiations they reduced the rate for the handling of a certain class of traffic. Recently, from time to time, statements had appeared in the newspapers, to the effect that Americans were purchasing their ordinary shares, and that to this cause chiefly was attributable the rise in the price of those shares. The board had repeatedly officially denied the truth of those statements, and he took that opportunity of emphatically confirming those denials. They had on the register 2,200 shareholders, of whom four only resided in America; those four had been on their books for periods varying from 22 to 35 years, and they held between them 635 ordinary shares all told. So far from large blocks of ordinary shares having been purchased with the view of obtaining the control of the company, of late there had been a noticeable increase in the number of their shareholders whose holdings were small. There were, therefore, no indications whatever in support of the statements to which he had referred. The traffic receipts for the current half-year showed a slight decrease. He thought, however, it was generally agreed that business in the West Indies was doing well, and that it showed a steady tendency to do better.

MR. H. HOLMES, in seconding the motion, said the statements which had gone about had done a great deal of injury, and had induced people to buy shares who had no knowledge of the past history of the company. People had bought shares at inflated prices.

MR. BIRKS said that amongst the statements which had been made was that the company would greatly benefit by the opening of the Panama Canal in respect of the land they held there. whilst another paper, commenting on the question of control, said that the balance of voting power had been vested for many years past in one of the organisations formed to finance the cable industry.

The CHAIRMAN said the company held no land in Panama, and knew nothing of anyone holding any control of the company. Such a statement was absolutely devoid of fact.

The report was adopted, and the meeting closed with a vote of thanks to the board and staff, on the motion of MR. BIRKS.

### Western Telegraph Co., Ltd.

THE meeting of this company was held on Wednesday last week at Electra House, Sir J. Wolfe Barry presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 764), said that no exceptional political or commercial circumstances had occurred in any of the South American countries which were served by the company. The recent history of those States was one of steady development of the vast resources with which most of those lands were endowed, resulting in much progress in business, which was reflected in increased demands on their cable system. The company thus transmitted an increased number of messages in the six months under consideration, but the revenue therefrom was practically the same as for the corresponding six months of 1910. The explanation of this was that a lower tariff was in force during the latter half of 1911. With regard to this year, during the four months ended April 30th there was a satisfactory increase in revenue, but on 1st inst. the board decided that it was time that the international tariffs with South America should be further reduced by 10d. per word, and, of course, they could not yet see the outcome of this reduction. It was one which must be a great boon to all concerned in the future of the great countries which they served. The total reductions of tariff made since the first half of 1910 would amount to 1s. 5d. per word. With reference to the expenses for the half-year ended December last, those in London showed a net increase of £258, and at the stations and agencies an increase of £13,234. The principal item in this latter amount was an increase of over £6,000 in salaries and wages, due to annual promotions, and an increase of 40 in the number of the staff—viz., four Europeans and 36 Brazilians and Argentines. The cost of agencies was more by £740. Rent, taxes, &c., showed an increase of £1,078, principally in respect of Buenos Ayres and the Azores. The maintenance of landlines, electrical instruments, &c., was more by £915. Under the head of repairs and renewal of furniture were included some exceptional items, viz., refrigerating apparatus for St. Vincent, outside drum clocks for six stations, and pneumatic tubes for two stations. These accounted for the increase of £840. The advertising account was increased by £347. Legal expenses were higher by £2,573 in consequence of the lawsuit to which he referred at the last meeting. Expenses of training the staff were decreased by £655. Amongst the other expenses, staff assurance and pension funds showed an increase of £133, electrical and other technical departments an increase of £518, and cost of landlines occasioned by the removal of the landing place of their seven cables at Pernambuco was increased during the half-year by £4,490. The work being only recently completed, there would be a further additional charge for this



alteration of the cables in the current half-year. This expenditure was necessitated by harbour improvements which were being carried out by the State, and they hoped to obtain compensation for the expense which the company had had to incur. Interest on loans during the corresponding period of 1910 amounted to £1,269, but there was no charge under this head in the half-year under review. The ships and expenses attending the maintenance of cables showed a net decrease of £21,930, as compared with 1910, when a repairing ship was chartered at a cost of £18,000 to relieve the *Norseman*, which had to come home for survey and repairs. After providing £16,373 for debenture stock interest, and £7,874 for income-tax, there remained a balance of £248,302; to this was added £4,390, brought forward from June 30th last, making a total of £252,691. First and second interim dividends, amounting to £62,379, had been paid, and after transferring £150,000 to the reserve fund, and £10,000 to the land and buildings depreciation fund, there remained a balance of £30,312, which was carried forward.

SIR J. DENISON PENDER (deputy chairman) seconded the motion, and the report was adopted.

### West London and Provincial Electric Supply Co., Ltd.

SIR T. BROOKE HITCHING presided at the offices, 14, Ironmonger Lane, E.C., on May 15th, over the twelfth ordinary general meeting of the above company.

In moving the adoption of the report, the CHAIRMAN said all the shareholders had received the reports of both the West London and Provincial Electric Supply Co. and of the Chiswick Electricity Supply Corporation. All the shares of the latter company were held by the West London and Provincial Co. By a reference to the Chiswick accounts (see p. 853) they would see a tabulated statement showing the profits, the number of consumers, and the revenue for the past 12 years. They would see that so far as the consumers were concerned every year had shown an increase, and the same thing applied to revenue. With regard to profits, that was the first year in which the profits were slightly smaller than in the preceding year. The diminution was less than £200, and was accounted for by the fact that there had been several exceptional items of expenditure consequent on alterations to buildings, exchange of land at Aberystwyth and the construction of a chimney stack there. He was sorry to inform them that the item of rates and taxes had increased by about £350 at Chiswick. There were certain other expenses they did not have in the preceding year, and had it not been for these there would have been a fair increase in the profits. This year the directors felt it incumbent upon them to make provision for a larger sum for depreciation, although he believed the machinery and works were kept up to the highest point of perfection. On that account the Chiswick Co. had allocated a smaller sum to the West London Co. This would permit of them paying the cumulative preference dividend of 6 per cent., but they were not able this year to pay the interest on the  $4\frac{1}{2}$  per cent. funding certificates. As these certificates were, however, cumulative, the shareholders must look upon that as a pleasure deferred.

MR. W. B. ESSON, managing director, seconded the motion.

A SHAREHOLDER asked whether the National Welsh Museum at Aberystwyth would not tend to increase the revenue of the company?

The CHAIRMAN said the returns from Aberystwyth were a little up that year, and they hoped to find them increase. It would, of course, be some time before the Museum was completed. The Government and other people were spending a good deal of money in Aberystwyth, which he hoped would result in their undertaking there showing an improved profit in future. There had been some negotiations for the sale of the undertaking at Aberystwyth, but he was not in a position to say yet whether they were likely to come to anything. He thought Aberystwyth was a place of considerable promise.

The report was adopted.

### West African Telegraph Co., Ltd.

SIR JOHN DENISON PENDER, K.C.M.G., presided on May 15th, at Electric House, E.C., at the meeting of this company. In moving the adoption of the report (see ELEC. REV., page 765), he said that the total revenue was £54,932, compared with £61,797 in 1910, but this difference was accounted for by the Portuguese guarantee having come to an end in September last. The loss of traffic had to a certain extent been modified by an item of £1,539 to the credit of the loss on exchange account, for £1,539 interest and dividend on the reserve fund, so the actual loss on revenue account was £6,875. As regarded the expenditure in 1911, it was £26,051, against £20,923 in 1910, an increase of £5,128, but this was chiefly owing to repairs to cables. During the year there were light repairs which entailed an average of about 10 knots of new cable being put in at each repair. There was also the bonus to the staff in commemoration of King George's accession, which cost something like £500. The only item of interest with regard to traffic, was that they had instituted a half-rate plain-language traffic. It was not brought in really for the merchants, or for commercial work, because their codes were so good that they could get a much greater benefit than by a half-rate plain-language rate. It was felt, however, that there might be what he might term a class of social traffic—people wishing to send plain-language messages to their relatives, and so on. He thought the Portuguese subsidy wanted some explanation.

tion. Ever since the institution of the company the Portuguese Government had given them a subsidy, but this came to an end in September last, and now the company received nothing from Portugal. Of course the directors had been looking forward to this for a considerable time, and they had put a substantial amount to reserve. The subsidy amounted in 1910 to £21,121, and in 1911, when it only ran for part of the year, it came to £11,545. He thought the provision they had made for the future would not only prevent any diminution of dividend, but they would also be able to put a considerable amount to reserve fund, although not so much as in the past. Therefore, he did not think there was any possibility whatever of the dividend being reduced. The reserve fund now stood at the big figure of £284,392, as they had added about £16,000 since 1910. They proposed to pay the usual dividend of 4 per cent.

SIR H. C. MANCE seconded the motion, and the report was adopted.

### Swiss Electrical Companies.

*The Société Financière pour Entreprises Electriques aux Etats-Unis*, of Geneva, realised net profits of £15,200 on its investments in electrical undertakings in the United States in 1911, this sum comparing with £6,000 in the previous year. A dividend of 6 per cent. has been declared as against no distribution in 1910.

*The Société Franco-Suisse pour l'Industrie Electrique*, of Geneva, which is interested in many tramway and lighting and power stations, reports net profits and balance forward amounting to £52,000 for 1911, as contrasted with £43,000 in the preceding year. After placing £4,700 to the reserve fund a dividend of  $4\frac{1}{2}$  per cent. has been declared as against 4 per cent. in 1910. The value of the securities in portfolio and of other investments is returned at £1,670,000, whilst advances and other debtors represent a further sum of £560,000.

The directors of the *Société Métallurgique des Procédés Paul Girod*, of Neuenburg, intend to recommend at the forthcoming meeting that the ordinary share capital should be reduced by one half and then increased by a corresponding amount by the issue of preference shares. Since 1905, when a dividend of  $7\frac{1}{2}$  per cent. was paid, no distribution has been made on the share capital, which was fixed at £72,000 on the formation of the company in 1903, and has been gradually increased to £480,000. It is stated that the technical results obtained by the undertaking are favourable.

*The Schweizerische Gesellschaft für Elektrische Industrie*, of Basle, which is an investment and trust company closely associated with the Siemens & Halske Co., states that all the undertakings under its control experienced a satisfactory development in 1911. As net profits the accounts, after deducting interest on the loan capital of £1,200,000, show the sum of £51,000, as compared with £48,000 in 1910. A dividend at the rate of 7 per cent. has been approved on the ordinary share capital of £400,000, this being the same rate as in 1910, whilst the new shares of £400,000 participate in the distribution at the same rate for six months.

### French and Italian Thomson-Houston Companies.

—The report of the Compagnie Francaise Thomson-Houston states that the yield from investments and technical working and subsidiary receipts amounted to £274,000 in 1911, as contrasted with £273,000 in the previous year. After making provision for general expenses and interest on loans, the accounts exhibit a net surplus of £153,000, as against £154,000 in 1910. It is proposed to pay a dividend of £1 5s. per share, as compared with £1 4s. in 1910 on a share capital of £2,400,000, the slight increase being rendered possible owing to the legal reserve fund having already reached the maximum of 10 per cent. of the capital. The directors of the A.E.G.-Thomson-Houston, of Milan, report an advance in the turnover of 1911, notwithstanding the unfavourable situation of the industry. The new works in Milan were in full operation, and produced a considerable portion of the machinery sold. The traction department completed the single-phase railway between Naples and Piedimonte, which, at a working pressure of 11,000 volts, represents the highest tension of a contact railway in Italy. After writing off £6,000 for depreciation, as in the preceding year, the accounts indicate net profits of £23,000, as against £19,000, and a dividend is in contemplation at the rate of 6 per cent. on share capital of £360,000, being the same as in 1910. It appears that the company, in addition to having become associated with the Berlin A.E.G. some time ago, has now acquired the shares of the Italian Lahmeyer Co., which has gone into liquidation, and has taken over that company's business.

**Continental.**—GERMANY.—The German-South American Telegraph Co., of Cologne, reports a net profit of £49,359 for the last financial year, as compared with only £43,808 in the preceding 12 months. The dividend is being maintained at 6 per cent.

The balance-sheet of the Felten & Guillaume Carlswerk Gesellschaft, of Mulheim, for the last financial year, shows a net profit of £212,276, as compared with £142,055 in the preceding 12 months. The dividend is being increased from 4 per cent. to 6 per cent.

FRANCE.—La Compagnie Continentale Edison, of Paris, reports a net profit of £152,455 for the last financial year, as compared with £134,708 in the preceding 12 months.

BELGIUM.—The Société des Accumulateurs Tudor, of Brussels, reports a profit of £8,026 for the last financial year.

**Hobart Electric Tramway Co., Ltd.**—A further dividend is announced of 5 per cent. on the shares, making  $7\frac{1}{2}$  per cent. for the year.



**Prospectuses.**—*The Nagpur Electric Light and Power Co., Ltd.*—We have received a copy of the prospectus of this company, which was circulated in India in March, offering for subscription 20,000 shares of Rs. 25 each, with 4 per cent. per annum dividend guaranteed by the Municipal Committee of Nagpur for seven years from the completion of the installation by the contractors. It is stipulated, however, that if during that period profits are earned sufficient to justify the declaration of a dividend in excess of 6 per cent. per annum, one-half of the excess profits shall be paid to the municipality. The chairman of the directors is Divan Bahadur Sir Kasturchand Daga, K.C.I.E., and the whole of the eight other directors are natives of India. Messrs Crompton and Co., Ltd., of Chelmsford and Bombay, are engineers and contractors for the construction. Arrangements have been made for the lighting of 17½ miles of streets with 600 lamps, each of 30 to 40 C.P., for the annual sum of Rs. 11,000. Messrs. Crompton have contracted to erect the generating station, complete with mains, &c., for Rs. 315,875, and, if required, they will run the station on terms to be arranged.

*The Rose Automatic Target Co., Ltd.*—We have received a copy of the prospectus in which this company offers for subscription 19,000 shares of £1 each. The nominal capital is £35,000. The inventor and vendor is to take as his purchase price £4,000 in cash and £16,000 in fully-paid shares, and he will pay the preliminary expenses (about £1,000). The object of the company is to purchase the British and Colonial patent rights of S. A. M. Rose in the Rose electric recording target, with which our readers are already familiar. The British patent is No. 2,708, of 1908. A suitable factory building near London is under consideration, and it is proposed that Mr. Rose shall be technical adviser to the company and manager of its factory for two years. It is stated that estimates have been prepared of manufacturing cost, and, judging from inquiries received, it is anticipated that the demand will be such as to enable the earnings during the first year to reach a total sufficient to pay a dividend of not less than 10 per cent. on the capital, and, in addition, provide for depreciation and reserve. There is no information vouchsafed to guide the would-be investor as to whether this is a modest or an extravagant estimate. A dividend of 10 per cent. in the first year, however, strikes us as being a little optimistic, if we bear in mind that the factory is only being considered, and that only "inquiries" have been received. The only information given bearing on the probable future earnings, is a statement of the number of rifle clubs, ranges, &c., in England with which business may be done, but the company retains for six months the right to purchase all the foreign patents, and can extend the option over another six months by paying £250.

*Callender's Share and Investment Trust, Ltd.*—This company has been offering for subscription an issue of £115,000 5 per cent. first mortgage debenture stock, the issue being guaranteed as to principal, interest, premium and sinking fund by Callender's Cable Co. The company will deal with the shares, debentures and debenture stock of other companies (mentioned in the prospectus) which the company acquired, on its formation, from Callender's Co. The matter was referred to at the recent annual meeting of the latter company.

*British Columbia Telephone Co., Ltd.*—Messrs. Brown, Shipley and Co., recently offered £400,000 4½ per cent. first mortgage debenture stock in this company at £94 10s. per cent., and 5,000 6 per cent. cumulative preference shares of \$100 each, at 98½ per cent.

**Stock Exchange Notices.**—Applications have been made to the Stock Exchange Committee to appoint a special settling day in and grant a quotation to:—

Alby United Carbide-Factories, Ltd.—Further issue of 150,000 5½ per cent. cumulative preference shares (convertible until June 30th, 1915) of £1 each, 10s. paid, (Nos. 400,001 to 550,000).

And to appoint a special settling day in:—

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—250,000 shares of £4 each, fully paid (Nos. 1 to 250,000) (share warrants to bearer).

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co., of Baltimore.—\$700,000 additional common stock, in shares of \$100 each.

United Electric Tramways of Monte Video, Ltd.—£100,000 additional 5 per cent. first debenture stock.

**The S. and H. Co. in Russia.**—The report for 1911 of the Russian Electrotechnical Works of Siemens & Halske, St. Petersburg, states that increasing business had rendered it necessary to extend the workshops, which had now been completed. The new shops were mainly devoted to the construction of dynamos, motors and transformers, whilst the production of apparatus for heavy currents for all branches of light currents was continued in the old works. During 1911 the trade development made further progress and favourably influenced the working results, which showed an increase. Including the balance forward the accounts show a surplus of £52,000, as compared with £42,000 in 1910. After allocating £10,000 to depreciation, and placing £2,500 to the reserve fund, it is proposed to pay a dividend of 6 per cent. on the share capital of £560,000, this contrasting with 5 per cent. in 1910. A fresh increase in orders is reported to have taken place in the new financial year.

**Spanish and General Wireless Trust, Ltd.**—The statutory meeting of this company was held on May 9th at the Hotel Metropole, London, Mr. G. C. Isaacs, presiding. The chairman said that, of the 249,007 shares allotted, 247,000 had been allotted in payment of 12,350 bearer shares of 500 pesetas each in La Compania Nacional de Telegrafia sin Hilos. That was the extent of the company's business transactions to that date. The company mentioned was formed in December 1910 in Spain, under Spanish

laws, to secure the Marconi rights for Spain and Spanish Colonies, and to erect a number of high-power and ship stations under a concession from the Spanish Government. A contract was entered into between the Spanish company and the Marconi Wireless Telegraph Co. for the erection of these stations. The first were erected in Tenerife and Las Palmas, in the Canary Islands, Cadiz, Vigo, Barcelona and Soller, on the Island of Majorca. The last was completed at Aranjuez (Madrid). All these stations were now at work communicating between the shore and ships at sea, and were ready for the conduct of an international telegraph service. A considerable business was being done between Spain and the Canary Islands. When the war in Tripoli ended, arrangements would be made to open up the service between Spain and Italy, and it was contemplated that, before long, a service would be conducted between England, Spain, and the Canary Islands. This would involve a service from the Canary Islands and Spain to the U.S.A. and Canada through England.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Cape Town-Cairo Railway and Telegraph Combination Syndicate, Ltd.  
Chorley and District Tramways, Ltd.  
De Martis Electric Storage Syndicate, Ltd.  
Electrical Trolley Head Co., Ltd.  
Electrical Entertainment Syndicate, Ltd.  
Electrical Ordnance Co., Ltd.  
Electro-Metallurgical Syndicate, Ltd.  
Electro Scrip Sign Co., Ltd.  
Gravity Flame Arc Lamps, Ltd.  
Hart-Durtnall Syndicate, Ltd.  
Holmquist Electrical Co., Ltd.  
Ljungstrom Engine, Boiler, and Condenser Co., Ltd.  
Mersea Motor and Electric Co., Ltd.  
Mountain & Gibson & Thornewill, Ltd.  
National Radium Trust, Ltd.  
Palmer & Co. (Electricians), Ltd.  
Perth Traction and Development Co., Ltd.  
Pollak-Virag Telegraph Co., Ltd.  
Premier Electric Institute, Ltd.  
Steel Wings Wind Turbine Co., Ltd.  
Technical Press Bureau, Ltd.  
Wireless Syndicate, Ltd.

**Austrian Manufacturing Works.**—The directors of Felten & Guillaume, A.G., of Vienna, report that remunerative employment was provided for the company's works in 1911, by the extension of the telephone network in Vienna, whilst the ironworks in Styria derived advantage from the increasing demand in the iron and steel industry. The net profits are returned at £102,000, or £17,000 more than in 1910. The provision made for depreciation absorbs £17,000, and the balance permits of the payment of a dividend of 16¼ per cent., as against 15 per cent. in 1910. A favourable opinion is entertained of the prospects for the current year, as the development of the Vienna telephone system is being continued, and the company has secured large orders. Large extensions of the telephone networks are also proceeding in provincial towns, and progress is being made in connection with light and power supply works and in the erection of new works.

The report of the A.E.G. Union Elektrizitäts Gesellschaft, of Vienna, states that the general industrial revival in 1911 exercised a favourable influence on the company's business. The volume of orders was the highest during the existence of the company, and the orders brought over into 1912 were substantially larger than was the case a year ago. As gross profits the accounts indicate the sum of £110,000, as contrasted with £93,000 in 1910. After meeting general expenses and apportioning £14,000 to depreciation, the net profits amount to £44,000, as against £33,000 in the previous year. It is intended to pay a dividend of 7 per cent., being the same rate, although on less capital, as in 1910.

**Shanghai Electric Construction Co., Ltd.**—The directors' report states that the accounts for the year to December 31st show a profit of £14,139, as compared with £7,583 for 1910. The total standing to credit of profit and loss account at the end of the year, including the balance brought forward, was £20,773, which has been disposed of as follows:—Amount written off general expenditure during construction, £7,472; transfer to reserve for renewals, £10,000; carried forward, £3,301. Substantial progress has again been made in the number of passengers carried, the traffic receipts per car-mile, the gross earnings and the net operating receipts. This improvement has been obtained by continuing the policy of popularising the cars by means of more attractive short-distance fares. The percentage of loss by exchange on subsidiary coinage was, on the average, somewhat lower in 1911 than in 1910, but has recently shown a tendency to increase. The loss under this head for the year was £15,477, equivalent to over 4½ per cent. on the capital of the company. The 30 trailers referred to in the last report were in use for a considerable portion of the year, with satisfactory results. The capital expenditure for the year, amounting to £11,526, which was mainly in respect of the additional rolling stock and the wayside car-shed required for its accommodation, has been met out of revenue. The further augmentation of the rolling stock by the addition of motor-cars, as well as trailers, is now called for in order to accommodate the growing traffic, and the system of feeder cables is being strengthened for the same reason.—*Financier*.

**Hindhead and District Electric Light Co., Ltd.**—Mr. John Grover presided at the annual meeting held last week. The report referred to the fire at the generating station, and stated that the new buildings had been made practically fire-proof. The net profit amounted to £1,781. The directors recommended a final dividend of 3 per cent., making a total of 5½ per cent. for the year, absorbing £533, and leaving £288 to be carried forward.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 22nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. per lb.	22/-	..
a " Oxalic .. .. per cwt.	23d.	..
a " Sulphuric .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. per ton	42/-	..
a Ammonia, Muriate (large crystal) .. ..	£29 10	..
a Bleaching powder .. ..	£5 10	..
a Bisulphide of Carbon .. ..	£18	..
a Borax .. ..	£16 10	..
a Copper Sulphate .. ..	£24 15	..
a Lead, Nitrate .. ..	£26 10	..
a " White Sugar .. ..	£25 10	..
a " Peroxide .. ..	£32	..
c Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks .. .. per lb.	33d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. per lb.	33d.	..
a " Perchlorate .. ..	43d.	..
a Potassium, Cyanide (98/100 %) .. ..	73d.	..
(for mining purposes only)		
a Shellac .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ..	£6 10	..
a " Recovered .. ..	£5 10	..
a " Lump .. ..	£5 5	..
a Soda, Caustic (white 70/72 %) .. ..	£10 5	..
a " Chlorate .. .. per lb.	35d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. .. per ton	£70	£3 inc.
b " Wire, in ton lots .. ..	£102	..
b " Sheet, in ton lots .. ..	£120	..
p Babbitt's metal ingots .. ..	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) .. .. per lb.	83d.	1d. inc.
c " Tube (brazed) .. ..	114d.	3d. inc.
c " (solid drawn) .. ..	93d.	3d. inc.
c " Wire, basis .. ..	83d.	1d. dec.
c Copper Tubes (brazed) .. ..	114d.	1d. inc.
c " (solid drawn) .. ..	113d.	1d. inc.
g " Bars (best selected) .. .. per ton	£90	£4 inc.
g " Sheet .. ..	£90	£4 inc.
g " Rod .. ..	£90	£4 inc.
d " (Electrolytic) Bars .. ..	£76 10	£2 inc.
d " Sheets .. ..	£93 10	£2 inc.
d " Rods .. ..	£81 10	£2 inc.
d " H.C. Wire .. .. per lb.	93d.	1d. inc.
f Ebonite Rod .. ..	5/3	..
f " Sheet .. ..	4/9	..
n German Silver Wire .. ..	1/11	..
h Gutta-percha, fine .. ..	4/7 1/2	1d. dec.
h India-rubber, Para fine .. ..	53/11 1/2	10d. inc.
i Iron Pig (Cleveland warrants) .. .. per ton	£14	..
i " Wire, galv. No. 8, P.O. qual. .. ..	£15 15s.	..
g Lead, English Pig .. ..	6/6	..
m Manganin Wire No. 28 .. .. per lb.	£8 5	..
g Mercury .. .. per bot.	6d. to 3s.	1/- inc.
e Mica (in original cases) small .. .. per lb.	3/6 to 6/-	1/- to 2/- inc.
e " " " medium .. ..	7/6 to 11/-	3/- inc.
e " " " large .. ..	11d.	..
p Phosphor Bronze, plain castings .. ..	1/0 1/2	..
p " " rolled bars & rods .. ..	1/1	..
p " " rolled strip & sheet .. ..	185/-	..
o Platinum .. .. per oz.	10 1/2	..
d Silicon Bronze Wire .. .. per lb.	£55	..
r Steel Magnet, in bars .. .. per ton	£209 to £211	£3 dec.
g Tin, Block (English) .. ..	2/5	1d. inc.
n " Wire, Nos. 1 to 16 .. .. per lb.	£45 to £150	..
p White Anti-friction Metals .. .. per ton	£29 15	..
k Zinc, Sh't (Vieille Montagne bnd.) .. ..		..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Shakspeare.	r W. F. Dennis & Co.
h Edward Till & Co.	

## STOCKS AND SHARES.

Tuesday Evening.

STOCK Exchange markets began the week in a frame of mind the reverse of cheerful, and although a general fall tempted purchases, the net result has been to reduce values substantially in a good many directions. Searching for reasons to explain a decline due mainly to financial indigestion, the Stock Exchange authorities threw out dark hints as to possible political complications abroad, while they professed to scent danger in the various naval manœuvres in home and foreign waters, none of which reasons, however, deceived those who are acquainted with the true state of the stale bull account in many markets, added to which is the fresh outbreak of strike fever on the Thames and elsewhere.

The steady and substantial fall in Consols adds extra bitterness to the Home Railway market, already oppressed and weak. Gambling in Home Rails too often ends in discomfiture for the

buyers, and many prices fell sharply. Central Londons have given way, the Deferred and Ordinary being down 2 and 1 respectively. Great Northern and City Preferred Ordinary are rapidly sliding back, and show a fall of 5s. City and South London dropped 1 1/2. East Londons fell to 7 1/2, after being 10, and then recovered to 8. The Fourth stock is down to 17 1/2. Districts, after keeping comparatively steady, went back 2 points, and Metropolitans show a loss of 1 1/2. Underground Electric Railways shares eased off to 4 1/2, the income bonds going back a point. A new stock of this undertaking has recently been introduced in the shape of a 6 per cent. First Cumulative Income Debenture, the price of which is 117 middle. The "A" shares, of 1s. each, rose to 17s. 3d., and reverted to 16s., the firmness of these being due to optimistic estimates of what the company is likely to earn in respect of the current year. Brighton Railway stocks have been very flat, the Deferred falling to 100 1/2 as compared with 105 1/2 quite lately. It is perfectly evident that buyers over-calculated their resources; or, to use an American vulgarism, that they have "bitten off more than they can chew," but the severe liquidation has brought in a few buyers, and prices look as though they had gruelled for the time being.

Electric Tramway issues are not much changed. British Electric Traction 6 per cent. Preference is down a point, but the company's two debenture stocks are higher. Isle of Thanet Preference eased off to 2 1/2. London United Trams Preference went off 1/4. There is not much going on in Metropolitan Electric Tramways descriptions.

The list of English Electricity Supply stocks and shares is monotonously firm. There are few changes worth mentioning. Advances of 1/2 took place in St. James' Preference, Metropolitan Preference, and London Electric Ordinary. The market in City of London shares has quieted down to some extent, and there has been a certain amount of selling, which caused falls of 10s. in the Ordinary and Preference. Counties fell 1/2. The improvements in Bournemouth and Poole failed to bring any shares to market.

The Telegraph department has been affected somewhat as the result of sales by speculators, and the gamble in Marconi brought about several Stock Exchange failures. Clients who had been plunging heavily in the shares omitted to pay their differences, and innocent people had to suffer. On the week, Marconi Ordinary are 1/2 down, and the Preference 12s. 6d. There is a huge account open in American Marconi shares, the price of which fell at one time to 2, or just half that to which the shares were run up some few weeks back. They have recovered to 2 1/2, but the special settlement in the shares—the date of which has not yet been fixed—is awaited with considerable nervousness in the Stock Exchange. Canadian Marconis and Spanish and General Trusts weakened in sympathy. Moralising would, of course, be out of place in this column, but it is difficult to refrain from the observation that the Marconi affair adds one more to the long and melancholy list of speculative manias indulged in by people with more optimism than money.

West India and Panama Telegraphs have again been scaled down on fresh selling by weak holders. At 2 1/2 the price shows a fall of 8s. 9d., following upon a drop of 7s. 6d. last week. Anglo-American Deferred is also 3/4 down, but the Eastern group continues very steady. Reuters lost the 5s. which they picked up a week ago, and the price has receded to 11 1/4. Callenders are marked ex the dividend of 10s., and this amount has been taken off the price of the shares. The issue of the new Callender's Share and Investment Trust Debenture stock has not affected the market in Callender's shares. A nominal premium of 1 per cent. is quoted on the stock, which appears to be a good investment, although the price of par is perhaps a little high. Underwriters received 3 per cent. in cash and £5,600 stock, which seems to be quite sufficient, considering the nature of the security. British Insulated and Helsby's Preference are 5s. better at 6 1/2 middle. National Telephone Deferred fell back 6 points, but the Preferred have hardened up to 101 1/2, the stock changing hands pretty freely on this basis.

The news from Mexico is judged satisfactory, and one feature of the week in the market with which we deal has been a rise of 5 1/2 points in Mexican Light and Power Common shares. The buying of these has been coming from abroad as well as at home, and rumours are in the air of an increase in the 4 per cent. dividend at present distributed quarterly. Possibly the substantial rise which has taken place recently in Rio Trams may have some indirect connection with the jump in Mexican Light and Power, and it is a little curious to note that the Company's Preferred shares are a point down. Mexico Trams are 1/2 lower, but the 6 per cent. bonds hardened to 104 1/2. The rest of the Canadian-Latin issues are very steady. Sao Paulo Trams are marked up 13. Shawinigan Water at 144 is 5 points better. West Kootenay bonds continue to improve. Montreal Light and Power shares are 2 up. On the other hand, Canadian General Electrics receded a little after their sharp rise. River Plate Ordinary is quoted 5 down, but this is twice covered by the dividend of £10 deducted last week. Rio Trams have been keeping steady, and the Second bonds are better. Of the other issues, Anglo-Argentines are firmer, British Columbia Electric Deferred rose 1, and Victoria Falls Preference are 1/2 down. Business in this section, however, has dwindled considerably, and the dealers admit that they now have time to get away for 10 minutes to lunch, which they aver is quite a change for them.

Manufacturing shares are quiet and somewhat neglected. The noticeable feature was a rise of 1 1/2 in Babcock & Wilcox, but of this 1/2 was lost later. There was a little rise in Rubber shares, in consequence of several excellent reports which came out a day or two ago. The market for the commodity is steady, and so long as it keeps about the present figure of 4s. 8d. per lb., the producing companies can, of course, earn splendid profits.



## SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 21st.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 21st.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9½—10½	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 9	7½—7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½ 4½	8½—9½	..	4 12 2	Do. 4 % Deb. ..	Stock	4 4	92—95	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½—11	..	5 9 1	Kent Eleo. Power, 4½ % Deb. ..	Stock	4½ 4½	80—84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100—102	..	4 8 8	London Electric, Ord. ..	8	2 2½	13—2½	+ ½	3 10 5
Brompton & Kensington, Ord. ..	5	10 10½	8½—8½	..	5 14 3	Do. 6 % Pref. ..	5	6 6	4½—5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7 7	7½—8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	92—95	..	4 4 3
Central Electric Supply, 4 %	100	4 4	98—101	..	8 19 8	Metropolitan ..	5	5 4½	8½—4½	..	8 1 3
Guar. Deb. ..	5	5 5	4½—5	..	5 0 0	Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½—4½	+ ½	4 1½ 9
Charing Cross, West End & City	5	4½ 4½	4½—4½	..	4 14 9	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	101—104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½ 4½	8½—4½	..	5 2 10	Do. 8½ % Mort. Deb. ..	Stock	8½ 8½	85—88	..	3 19 7
Do. "City Undertaking"	5	4½ 4½	8½—4½	..	4 1 8	Midland Electric Corporation	100	4½ 4½	96—98	..	4 11 10
4½ % Cum. Pref. ..	100	4 4	95—98	..	5 2 7	4½ % First Mort. Deb. ..	5	5 5	3½—4½	..	5 14 3
Do. Do. 4 % Deb. ..	5	5 5	4½—4½	..	4 9 1	Newcastle-on-Tyne 5 % Pref.,	5	5 5	3½—4½	..	5 14 3
Chelsea, Ord. ..	Stock	4½ 4½	98—101	..	3 11 1	Non-Cum. ..	100	5 5	97—100 xd	..	5 0 0
Do. 4½ % Deb. ..	10	7 8	20½—22½	— ½	3 3 2	North Metropolitan Power Sup-	10	6 6	10½—11½	..	5 6 8
City of London, Ord. ..	10	6 6	17—19	— ½	4 1 4	ply, 5 % Mortgages (Red.)	5	7½ 7½	5½—6½	..	5 13 9
Do. 6 % Cum. Pref. ..	Stock	5 5	119—123	..	5 2 7	Do. 7 % Pref. ..	5	10 10	8—8½	..	5 14 3
Do. 5 % Deb. ..	100	4½ 4½	101—104	..	4 1 10	Do. 8½ % Deb. ..	100	8½ 8½	85—87	+ ½	4 15 0
Do. 4½ % Second Deb. ..	Stock	4½ 4½	99—102 xd	..	4 8 3	Smithfield Markets, Ord. ..	5	Nil 2	1½—1½	..	6 8 0
County of London, Ord. ..	10	5 6	10½—11½	— ½	5 7 10	South London, Ord. ..	4	5 5	2½—3½	..	4 18 0
Do. 6 % Pref. ..	10	6 6	11½—11½	..	5 2 7	Do. 5 % First Mort. Deb. ..	100	5 5	99—102	..	6 1 0
Do. 4½ % Deb. ..	Stock	4½ 4½	108—110	..	4 1 10	South Metropolitan, 7 % Pref. ..	1	7 7	1½—1½	..	4 11 0
Do. 4½ % Second Deb. ..	Stock	4½ 4½	99—102 xd	..	4 8 3	Do. 4½ % First Deb. Stock ..	100	4½ 4½	96—99	..	5 2 3
Edmundson's, Ord. ..	5	Nil Nil	3—3½	..	Nil	Urban, Ord. ..	5	5 5	2½—3½	..	5 11 1
Do. 6 % Cum. Pref. ..	5	Nil Nil	3—3½	..	Nil	Do. 5 % Cum. Pref. ..	5	5 5	2½—3½	..	4 4 8
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86—89	..	5 1 2	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86—88	..	5 11 1
Folkestone ..	5	6 6	4½—4½	..	5 3 1	Westminster, Ord. ..	5	10 10	8½—9	..	4 4 8
Do. 5 % Cum. Pref. ..	5	6 6	4½—4½	..	5 3 1	Do. 4½ % Cum. Pref. ..	5	4½ 4½	5½—5½	..	4 4 8
Do. 4½ % First Deb. ..	100	4½ 4½	93—96	..	4 13 9						
Hove ..	5	9 9	6½—7	..	6 8 7						

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½—5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	87½—89½	..	5 11 9
Calcutta, Ord. ..	5	8½ 8½	7½—7½ xd	— ½	5 9 8	5 % 1st Mort. Deb. ..	\$100	7 8	209—213	+1	8 15 1
Do. 5 % Pref. ..	5	5 5	5—5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$500	5 ..	39—41	..	12 3 10
Calgary Power, 1st Mort. Bds.	100	5 5	94½—96½	..	5 3 8	Northern, Lt., Power and Coal, }	5	..	103—105	..	4 15 3
Canadian Gen. El. Com. ..	\$100	7 7½	112—116	—2	6 0 8	5 % 1st Mort. Bonds ..	Stock	10 10	240—250 xd	—5	4 0 0
Do. 7 % Pref. ..	\$100	7 7	118—122	..	5 14 9	River Plate, Ord. ..	Do.	6 6	109—114 xd	..	5 5 3
Cordoba Lt., Power and T., Ord.	1	3 3½	1½—1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	5 5	103—105	..	4 15 3
Do. 5 % Deb. ..	100	5 ..	94—97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5 5	99—101	..	4 9 1
Eleo. Lt. and P. of Cochabamba, }	100	6 6	95½—97½	+2½	6 3 1	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	99—101	..	4 9 1
6 % Bonds ..	100	5 5	83—86	..	5 16 3	1st Mort. Deb. ..	\$100	4 5½	142—146	+5	3 8 6
Eleo. Supply Victoria, 6 % 1st	100	5 5	83—86	..	5 16 3	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108½—110½	..	4 10 6
Mort. Deb. ..	\$500	5 5	92—94	..	5 6 5	Do. 4½ % Per. Deb. ..	Stock	4½ 4½	102½—104½ xd	..	4 6 2
Eleo. Dev. Ontario, 5 % 1st	10/-	Nil ..	7½—7½	..	Nil	Toronto Power, 4½ % Deb. ..	Do.	4½ 4½	100½—102½	..	4 7 10
Mort. Bonds ..	1	6 6	103—106	..	4 15 3	Vera Cruz Lt., P. and T., 5 %	100	5 5	92½—94½	..	5 5 10
Kalgoorlie Eleo. P. and L., Ord.	5	.. ..	2½—2½	..	8 6 0	1st Mort. Deb. ..	1	Nil 11½d.	7—7½	— ½	..
Do. 6 % Pref. ..	\$500	5 5	103—106	..	4 15 3	Victoria Falls Power, Pref. ..	100	6 6	105½—107½	+ ½	5 11 7
Kaministiquia Power, 5 % G. Bs.	5	.. ..	2½—2½	..	4 14 9	West Kootenay Power and Lt., }					
Madras, Ord. ..	100	5 5	102½—105½	..	5 11 9	1st Mort. 6 % Gold ..					
Melbourne, 5 % 1st Mort. Deb.	\$100	4 4	91—93	+5½	4 6 0						
Mexican El. Lt., 5 % 1st M. Bds.	\$100	7 7	104—106	—1	5 12 1						
Mexican Lt. & Power, Common	..	5 5	96—98	..	5 2 0						
Do. 7 % Cum. Pref. ..	..	5 5	96—98	..	5 2 0						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	96—98	..	5 2 0						

## TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil 4½	7½—7½	..	5 0 6	Monte Video Telephone, Ord. ..	1	6 6	1—1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5 5	97½—99½	..	5 6 4	Do. 5 % Pref. ..	1	5 5	8½—8½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8 8½	148½—150½	..	4 2 6	National Telephone, Pref. ..	Stock	6 6½	99½—102½	..	..
Do. Collat. Trust ..	\$1000	4 4	95—97	..	5 10 4	Do. Def. ..	Do.	6 6½	153—155	—6	..
Anglo-American Telegraph ..	Stock	8½ 8	65—67	..	5 16 0	Do. 5 % Non-cum. 3rd Pref.	5	5 5	6½—6½	..	..
Do. 6 % Pref. ..	Do.	6 6	107½—108½	+ ½	4 10 8	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	100—101	..	4 7 2
Do. Def. ..	Do.	30/- 80/-	25½—25½	— ½	4 16 2	Oriental Telep. and Eleo. ..	1	8 8	11½—11½	..	4 13 0
Anglo-Portuguese Tel., 5 %	100	5 5	102—104	..	4 10 8	Do. 6 % Cum. Pref. ..	1	6 6	1½—1½	..	4 16 0
Mort. Deb. ..	5	7 7	7½—8	..	4 14 4	Do. 4 % Red. Deb. ..	Stock	4 4	89—91	..	4 8 0
Chili Telephone ..	Stock	4 4	82½—84½	..	5 14 3	Pacific and European Tel., 4 %	Do.	4 4	99½—101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb.	10	6 6½	9½—10½ xd	..	5 14 3	Guar. Debs. ..	8	5 5½	11—11½	— ½	3 9 7
Cuba Telegraph ..	10	10 10	16½—17½ xd	..	5 14 3	Reuter's ..	Cert.	6 6	127—130	..	4 12 4
Do. 10 % Pref. ..	5	4 4½	8½—8½	..	6 5 0	Submarine Cables Trust ..	Stock	4½ 4½	99—101	..	4 9 1
Direct Spanish Telegraph, Ord.	5	10 10	7½—8	— ½	6 5 0	Telephone Co. of Egypt, 4½ %	5	8 8	7½—7½	..	5 1
Do. 10 % Cum. Pref. ..	10	4½ 5	7½—8	..	6 5 0	Deb. Red. ..	5	5 5	5½—5½	..	4 8 11
Direct United States Cable	100	4½ 4½	99½—101½	+ ½	4 8 8	United River Plate Telephone	2½	2½ 2½	1½—1½ xd	— ½	3 11 5
Direct W. India Cable, 4½ %	Stock	7 7½	135½—138½	..	5 1 1	Do. 5 % Cum. Pref. ..	100	4 4	94½—97½	..	4 2 1
Reg. Deb. ..	Do.	8½ 8½	80½—82½	..	4 4 10	Do. 4 % Debs., 1 to 1,500	10	1½ 1½	21½—3½	— ½	3 11 5
Eastern Telegraph, Ord. Stock	Do.	4 4	99½—101½	..	8 18 10	guar. by Braz. Sub. Tel. }	10	6 6	10½—11	..	5 9 1
Do. 8½ % Pref. Stock ..	Do.	7 7½	12½—13½ xd	..	5 5 8	Do. 6 % Cum. 1st Pref. ..	10	6 6	9½—10½	..	5 17 1
Do. 4 % Mort. Deb. ..	Stock	4 4	99—101	..	8 19 3	Do. 6 % Cum. 2nd Pref. ..	100	5 5	102½—104½	..	4 15 8
Eastern Extension ..	10	7 7½	12½—13½ xd	..	5 5 8	Do. 5 % Debs. ..	10	7 7½	13½—13½	..	5 2 9
Do. 4 % Deb. ..	Stock	4 4	99—101	..	4 0 0	Western Telegraph, Ltd. ..	Stock	4 4	98—100	..	4 0 0
East and S. Africa Tel. 4 %	25	4 4	97—100	..	4 0 0	Do. 4 % Deb. ..	\$1000	4½ 4½	100—103	..	4 7 5
Mt. Db. Mauritius Sub. }	10	5½ 6½	10½—11½	..	5 5 6						
Globe Telegraph and Trust ..	10	6 6	13—13½	..	4 9 0						
Do. 6 % Pref. ..	10	18 18	30—31	— ½	5 13 6						
Great Northern Telegraph ..	25	18 18	56—58	—2	5 12 1						
Indo-European Telegraph ..	\$100	5 5½	87—90	..	5 11 1						
Mackay Companies Common ..	\$100	4 4	69—72	..	5 11 1						
Do. 4 % Cum. Pref. ..	1	5 ..	6½—6½	— ½	..						
Marconi's Wireless Telegraph	1	16 ..	5½—5½	— ½	..						
Do. 7 % Cum. Partic. Pref.	1	..	..	..	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Continued on next page



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 21st.	Rise + or Fall	Present Yield p.e.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 21st.	Rise + or Fall	Present Yield p.e.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. . .	1	Nil Nil	7 — 13	..	Nil	Metropolitan Railway Consol. . .	100	13 17	68 — 69	—1 3	2 14 9
Do. 5 % Pref. . .	1	6 6	13 — 13	..	6 3 1	Do. Surplus Lands . .	100	2 2	67 — 69	..	4 3 4
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	78 — 83	..	5 8 5	Do. 8 1/2 % Deb. . .	100	3 3	81 — 91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. . .	100	.. ..	11 — 13	—1	..	Do. 8 1/2 % Pref. . .	100	3 3	86 — 88	..	3 19 7
Do. Do. Deferred . .	100	.. ..	6 1/2 — 8 1/2	..	..	Do. 3 1/2 % Con. Pref. . .	100	3 1/2 3 1/2	87 — 89	..	3 18 8
Do. Do. 6 % Cum. Pr'f. . .	100	.. 6	92 — 94	..	6 7 8	Metropolitan District Ord. . .	100	Nil ..	43 — 43 1/2	—2	Nil
Do. 7 % Non-Cum. Pr'f. . .	100	.. ..	44 — 48	..	..	Do. 6 % Deb. . .	100	6 6	144 — 146	..	4 2 2
Do. 5 % Perp. Deb. . .	100	5 6	94 — 97	+1 1/2	5 3 1	Do. 4 % Deb. . .	100	4 4	96 — 98	..	4 1 8
Do. 4 1/2 % 2nd Deb. . .	100	4 1/2 4 1/2	79 — 83	..	5 8 5	Do. 4 % Prior Lien . .	100	4 4	98 — 100 xd	..	4 0 0
Central London Railway, Ord.	100	8 8	81 — 83	—1	3 12 3	Do. 4 1/2 % First Pref. . .	100	3 1/2 4 1/2	90 — 92	..	4 17 10
Do. Pref. . .	100	4 4	86 — 88	..	4 11 0	Do. 3 1/2 % Gtd. . .	100	3 1/2 3 1/2	76 — 78	..	4 9 9
Do. Def. . .	100	2 2	81 — 83	—2	2 8 2	Metropolitan Elec. Trams, Ord.	1	5 6	1 1/2 — 1	..	6 0 0
Do. 4 % Deb. . .	100	4 4	101 — 103	..	3 17 8	Do. Def. . .	1	Nil ..	1 1/2 — 1 1/2	..	Nil
City & South London, Ord.	100	1 1/2 1 1/2	37 — 38	—1 1/2	4 5 6	Do. 5 % Pref. . .	1	5 5	2 1/2 — 2 1/2	..	5 10 6
Do. 5 % Pref., 1891 . .	100	5 6	108 — 110	..	4 11 0	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	98 — 100	..	4 10 0
Do. Do. 1896 . .	100	5 5	104 — 106	..	4 15 3	Do. 5 % Deb. . .	100	5 5	98 — 100	..	5 0 0
Do. Do. 1901 . .	100	5 5	104 — 106	..	4 14 4	Potteries, Ord. . .	1	2 ..	3 — 3	..	..
Do. Do. 1903 . .	100	5 5	103 — 105	..	4 15 3	Do. 5 % Pref. . .	1	5 5	4 1/2 — 4 1/2	..	6 19 3
Do. 4 % Deb. . .	100	4 4	99 — 101	..	3 19 3	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	87 — 90 xd	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6 6	103 — 113	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6 6	72 — 77	..	5 4 0
Great Northern & City, Pr'f. Ord	10	Nil ..	1 1/2 — 1 1/2	—1 1/2	Nil	Do. 4 % Deb. . .	100	4 4	72 — 77	..	5 4 0
Hastings Trams, 6 % Pref. . .	5	Nil 6	1 — 1	..	8 0 0	Underground Elec. Railways	10	.. ..	4 1/2 — 4 1/2	—1 1/2	Nil
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	71 — 76	..	5 18 5	Do. 4 1/2 % Bonds . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2 2 1/2	2 1/2 — 2 1/2	—1 1/2	4 11 0	Do. 6 % Income . .	100	1 1 1/2	90 — 92	—1	..
Do. 4 % Deb. . .	100	4 4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil ..	1 — 1	..	Nil
Lancashire United, 5 % Deb. . .	100	5 5	83 — 85	..	5 17 8	Do. 6 % Pref. . .	5	Nil ..	2 1/2 — 3 1/2	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4 4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	80 — 84	..	5 7
London United Trams, 5 % Pref.	10	Nil ..	5 1/2 — 5 1/2	—1 1/2	..						
Do. 4 % Deb. . .	100	4 4	78 — 81	..	4 18 9						

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . .	5	5 5 1/2	5 1/2 — 5 1/2	+1 1/2	5 0 0	La Plata Elec. Trms, Ord. . .	1	.. ..	1 — 1	..	..
Do. 2nd Pref. . .	5	5 5 1/2	4 1/2 — 5 1/2	+1 1/2	5 6 0	Do. Pref. . .	1	6 6	2 1/2 — 1	..	6 0 0
Do. 4 % Deb. . .	100	4 4	95 — 96 1/2	+1	4 2 11	Lisbon Elec. Trams, Ord. . .	1	5 1/2 6	1 — 1 1/2 xd	..	4 8 0
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	102 — 104	..	4 6 7	Do. 6 % Pref. . .	1	6 6	1 — 1 1/2	..	4 16 0
Do. 5 % Deb. . .	100	5 5	103 — 105	..	4 15 3	Do. 5 % Deb. . .	100	5 5	95 — 99	..	5 1 0
Auckland Trams, 5 % Deb. . .	100	5 5	104 — 106	..	4 14 4	Madras Elec. Tr. (1904), Deb. . .	100	5 5	99 — 101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6 6	11 — 11 1/2	..	5 4 4	Manaos Trams & Lt., 1st Deb. . .	100	5 5	93 — 96	..	5 4 2
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	98 — 100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5 5	102 — 104	..	4 16 2
Do. 5 % 2nd Deb. . .	100	5 5	99 — 101	..	4 19 0	Mexico Trams Com. . .	\$100	7 7	121 1/2 — 123 1/2	—1 1/2	5 13 4
Brisbane Trams Invt., Ord. . .	5	8 8	9 — 9 1/2	—1 1/2	4 4 3	Do. Gen. Con. 5 % Bonds . .	..	5 5	96 — 98	..	5 2 0
Do. 5 % Pref. . .	5	5 5	4 1/2 — 5 1/2	..	4 15 3	Do. 6 % Bonds . .	100	6 6	103 1/2 — 105 1/2	+1 1/2	5 13 9
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	100 — 103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. . .	5	10 10	7 — 7 1/2	..	6 15 7
B. Columbia Elec. Rly., Def. . .	100	8 8 1/2	140 — 144	+1	5 11 1	Do. 6 % Pref. . .	5	6 6	5 — 5 1/2	..	7 0 4
Do. Pref. Ord. . .	100	6 6	126 1/2 — 128 1/2	+1 1/2	4 13 5	Do. 5 % 1st Deb. . .	100	5 5	100 — 102 xd	..	4 18 0
Do. 5 % Pref. . .	100	5 5	111 — 114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord. . .	1	2 1/2 ..	1 1/2 — 1 1/2	..	1 18 4
Do. 4 1/2 % 1st Mort. Deb. . .	40	4 1/2 4 1/2	98 1/2 — 101 1/2	..	4 8 8	Do. 5 % 1st Deb. . .	100	5 5	101 — 104	..	4 16 2
Do. 4 1/2 % Vancouver Deb. . .	100	4 1/2 4 1/2	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. . .	5	6 6	5 1/2 — 5 1/2	..	5 6 8
Do. 4 1/2 % Con. Deb. . .	100	4 1/2 4 1/2	104 — 106	..	4 5 0	Do. 4 1/2 % 1st Deb. . .	100	4 1/2 4 1/2	99 — 101	..	4 9 1
Calcutta Trams, Ord. . .	5	6 7	6 1/2 — 6 1/2	..	5 5 8	Rio de Janeiro Trams . .	\$100	4 1/2 5 1/2	133 — 134	—1	3 14 8
Do. 5 % Pref. . .	5	5 5	4 1/2 — 5 1/2	..	4 16 5	Do. 1st Mort. 5 % Bonds . .	..	5 5	104 — 105	..	4 15 3
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	100 — 103	..	4 7 5	Do. 5 % Mort. Bonds . .	100	5 5	98 1/2 — 99 1/2	+1	5 0 3
Cape Electric Trams . .	1	Nil 2 1/2	1 — 1	..	..	Sao Paulo Tram, Lt. and P. . .	\$100	10 10 1/2	235 — 240	+13	4 3 4
City Buenos Aires Trams (1904)	5	5 5	5 1/2 — 5 1/2	—1 1/2	4 10 6	Do. 5 % 1st Deb. . .	\$500	5 5	105 — 107	+1 1/2	4 13 6
Do. 4 % Deb. . .	100	5 5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb. . .	100	5 5	79 — 82	..	5 19 1
Colombo Elec. Tr. & Lt., 6 % Deb.	100	5 5	94 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5 5	93 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5 5	101 — 104	..	4 16 2	Un. Elec. Trams Monte Video . .	5	6 7	5 1/2 — 6	..	6 1 11
Kalgoorlie Elec. Trams . .	1	Nil ..	3 1/2 — 3 1/2	..	Nil	Do. 6 % Pref. . .	5	6 6	5 — 5 1/2	..	5 14 3
Do. 5 % A Deb. . .	100	5 5	91 — 94	..	5 6 5	Do. 5 % 1st Deb. . .	100	5 5	100 — 103 xd	..	4 17 1
Do. 6 % B Deb. . .	100	5 6 1/2	56 — 60	..	10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2 4 1/2	103 — 105	+1 1/2	4 5 9

MANUFACTURING COMPANIES.

Aron, Ord. . .	1	Nil 6	1 1/2 — 1 1/2	..	7 7 8	Dick, Kerr . .	1	5 ..	27 — 3 1/2	..	5 9 1
Do. 6 % Pref. . .	1	9 6	1 1/2 — 1 1/2	..	7 2 2	Do. Pref. . .	1	6 6	1 1/2 — 1 1/2	..	5 12 11
Babcock & Wilcox . .	1	26 28	6 1/2 — 6 1/2	+1 1/2	4 4 7	Do. Deb. . .	100	4 1/2 4 1/2	97 — 100	..	4 10 0
Do. Pref. . .	1	6 6	1 1/2 — 1 1/2	..	3 16 10	Edison & Swan, A, £3 paid	5	Nil ..	1 — 1	..	Nil
B.I. & Helsby Cables . .	5	10 10	6 1/2 — 7 1/2	..	6 18 0	Do. fully paid . .	5	Nil ..	17 — 2 1/2	..	Nil
Do. Pref. . .	5	6 6	6 — 6 1/2	+1 1/2	4 12 4	Do. 4 % Deb. . .	100	4 4	68 — 72	..	5 11 1
Do. Deb. . .	100	4 1/2 4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb. . .	100	5 5	75 — 73	..	6 8 2
British Thomson-Houston, Deb.	100	4 1/2 4 1/2	91 1/2 — 94 1/2	..	4 15 3	Electric Construction . .	2	Nil 2 1/2	3 — 1	..	..
British Westinghouse, Pref. . .	8	Nil ..	1 — 1	..	Nil	Do. Pref. . .	2	7 7	1 — 2	..	7 0 0
Do. Deb. . .	100	4 4	63 — 66	..	6 1 3	Greenwood & Batley, Pref.	10	7 7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien . .	100	6 6	99 — 102	..	5 17 8	Do. Deb. . .	100	5 5	94 — 96	..	5 4 2
Browett, Lindley, Ord. . .	1	Nil ..	1/6 — 2/6	..	Nil	General Electric, Pref. . .	10	5 5	9 — 9 1/2	..	5 5 3
Do. Pref. . .	1	Nil ..	5/6 — 6/6	..	Nil	Do. Deb. . .	100	4 4	85 — 90	..	4 8 11
Brush, 7 % Pref. . .	2	Nil ..	0 — 1	..	Nil	Henley's, Ord. . .	5	15 10 1/2	11 1/2 — 12 1/2	..	6 0 0
Do. 5 % Prior Lien Deb. . .	100	5 5	77 1/2 — 82 1/2	..	6 1 3	Do. Pref. . .	5	4 1/2 4 1/2	4 1/2 — 5 1/2	..	4 6 9
Do. 4 1/2 % Deb. . .	100	4 1/2 4 1/2	54 — 59	..	7 10 6	Do. Deb. . .	100	4 1/2 4 1/2	103 — 105	..	4 5 9
Do. 4 1/2 % Second Deb. . .	100	4 1/2 4 1/2	87 — 42	..	10 14 4	India-Rubber, G. & T. . .	10	10 ..	8 1/2 — 9 1/2	..	4 17 7
Callender's Cable . .	5	15 10 1/2	10 1/2 — 11 1/2 xd	..	6 10 5	Do. Pref. . .	12	20 10 1/2	34 — 36	..	6 13 4
Do. Pref. . .	5	5 5	5 — 5 1/2	..	4 15 3	Do. Deb. . .	100	4 4	99 1/2 — 101 1/2	..	4 9 0
Do. Deb. . .	100	4 1/2 4 1/2	99 1/2 — 101 1/2	..	4 8 8	Willans & Robinson . .	1	Nil ..	3 — 1 1/2	..	Nil
Castner-Kellner . .	1	17 1/2 20	3 1/2 — 3 1/2	..	5 6 8	Do. Pref. . .	5	Nil ..	3 — 1	..	Nil
Do. Deb. . .	100	4 1/2 4 1/2	105 — 109	..	4 10 7	Do. Deb. . .	100	4 4	59 — 61	..	6 11 2
Crompton & Co. . .	8	Nil Nil	1 — 1	..	Nil						
Do. Deb. . .	100	5 5	58 — 68	..	7 7 1						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## AN ELECTRIC LOCOMOTIVE WITH THE AUVERT-FERRAND RECTIFIER.

*Le Génie Civil* of February 17th gives an interesting account of the application of the special rectifier, designed by MM. Auvert and Ferrand, of the P.L.M. Railway, to an electric locomotive built by the Société Alioth, of Basle. Since the Compagnie des Chemins de fer du Midi intend to make comparative tests this year of six different types of electric locomotives, the particular type described here will no doubt be included.

Single-phase current is taken from an overhead line at 12,000 volts pressure with a periodicity of 25, and the pressure is reduced by transformers on the locomotive to that necessary to supply the rectifiers. The principle of the latter is as follows:—

On a built-up ring A (fig. 1) there are two windings as shown. These windings, fed at the points B and C by a single-phase current, produce a closed magnetic field in the ring. The latter, with the collector K, to which the sections of the windings are connected, is rotated by a synchronous motor on the same shaft, operated from

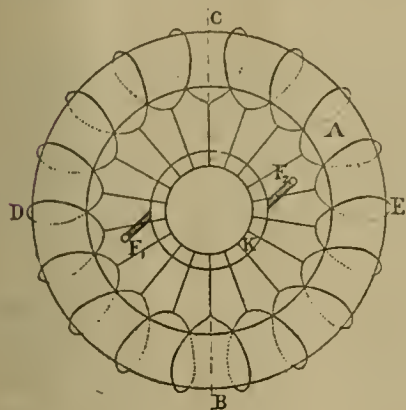


FIG. 1.

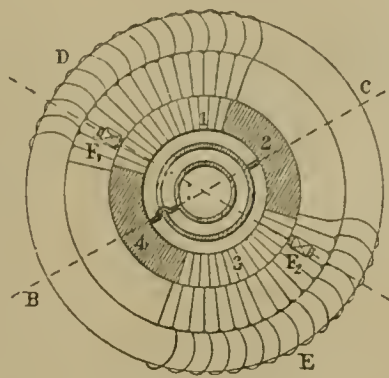


FIG. 2.

the single-phase secondary circuit, the points B and C being also connected to this circuit through collector rings. Two brushes,  $F_1$  and  $F_2$ , are placed opposite one another. When the position of the brushes is such that they reach the points B and C at the moment of maximum pressure, the potential difference between the brushes will always be in the same direction, and will be represented by a curve of wave form. To improve the efficiency of the rectifier, the arrangement of the collector and the windings is different from the simple one shown in fig. 1. In practice that shown in fig. 2 is adopted:—

Here the collector K, instead of being divided up into equal insulated sections, is made with four groups of sections. The separate sections of the Groups 1 and 3 are insulated from one another, and connected to the windings of the ring. The sections of Groups 2 and 4, however, are connected in a body to the points C and B respectively. The brushes  $F_1$  and  $F_2$  are then in direct communication with the single-phase circuit all the time they are in contact with the Groups 2 and 4, and the windings are only effective while the brushes are passing over the Groups 1 and 3. If the four groups divide the collector into equal parts, then during half the time of each rotation the brushes are in direct communication with the circuit. If the brushes are so placed that they are at the middle of Groups 2 and 4 at the instant of maximum pressure, the difference of potential between the brushes will always be in the same direction. The machine may be built up of several similar sets of windings placed symmetrically on the ring, with a separate collector to each set, and presents no particular difficulty of construction in this respect. By merely moving round the brush carrier representing one of the sets of windings, the pressure of the rectified current can be regulated without the necessity of changing the single-phase circuit.

The rectified current supplied by the machine is an undulating one if the circuit which it feeds is without self-induction, but by interposing a choking coil in this circuit the undulations are reduced to the practical limits of continuous-current working.

Fig. 3 gives the form of the curves of pressure and intensity for both the single-phase and rectified currents:— $U_a$  represents the curve of single-phase voltage at the terminals of the rectifier;  $U_c$  represents the variation of voltage of the rectified current without self-induction in the rectified circuit;  $U'_c$  represents the variation of this pressure with a choking coil in the rectified circuit;  $i_a$  is the current curve for the single-phase current supplied to the rectifier;  $i_c$  is the current curve for the rectified current with a choking coil in this circuit.

It is not explained here, but appears from the drawing of the rectifier that the curves relate to a machine with two sets of windings. The positions of the two sets of brushes, corresponding to these curves, is such that there is an angular distance between the two sets of one quarter of the maximum distance used in working. The altering of this angle is equivalent to the changing of the number of coils in the secondary windings of a static transformer. Reducing the angle is equivalent to reducing the number of secondary coils.

The synchronous motors driving the rectifiers have only to overcome the friction of the moving parts. In order to avoid current surgings in these motors when variations of frequency and pressure occur in the line current, it is found necessary to have two rectifiers to each locomotive, with two separate driving motors. The two machines turn in opposite directions, and the two con-

tinuous current collectors are connected in series. Three equidistant points in one synchronous motor armature are connected to three corresponding points on the other armature, so as to ensure that the effect of any line variation will be the same on both motors. As

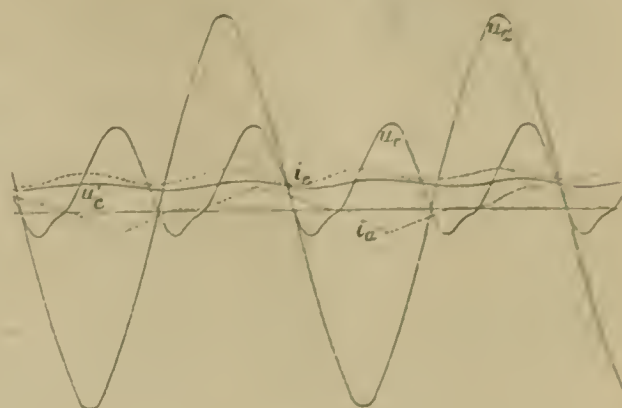


FIG. 3.

the latter turn in opposite directions, while the brushes of both rectifiers move in the same direction during a variation of pressure or frequency, the net result is to eliminate the effect of any current surging in the two motors.

An important part of the apparatus is the small controlling motor which adjusts the brush carriers of the rectifiers in accordance with the requirements of the load, and forms the whole means of control. This small motor has its armature traversed by a continuous current of low amperage supplied by a small motor-generator set on the locomotive.

The field magnets have two windings, one of fine wire carrying continuous current from the same source as the armature current, and of which both the amperage and the direction can be controlled by the driver; the other winding consists of four turns of the main wire carrying the rectified current for the main motors. By the interaction of these two windings the controlling motor turns in either direction or stops, and as it has a mechanical connection with the brush carriers of the rectifiers, the effect of altering the continuous current in its field windings is to control the rectified current taken from the main machines. The mechanical arrangement is such that when the brushes are in a position corresponding to minimum pressure in the rectified circuit, the high-tension current is automatically cut off from the main transformer. As soon as the controlling motor begins to move the brushes so as to augment the pressure in the rectified circuit, the high-tension circuit is again established by a special form of circuit-breaker.

The rectified current is supplied normally at 600 volts pressure to the two motors of each half of the locomotive, the latter consisting of two similar truck frames and bodies connected by a single central coupling. The two motors of each half are of 400 H.P. each, and are connected in series.

From results obtained it appears that the starting up of this locomotive is rapid and very regular. It ought certainly to have the latter qualification from its method of control. The power factor even at the commencement of movement of the train was maintained at above .50. The efficiency of the whole locomotive, that is of the combined apparatus, was 78 to 80 per cent. It is interesting to note that in the tests which were made of this locomotive on the line from Cannes to Grasse (P.L.M. Railway) it was found possible to exert a high tractive effort on the draw-bar with the locomotive standing still for some minutes, without damaging the electrical apparatus in any way.

The chief points claimed for this system of rectified current electric drive are flexibility of control and working, and high efficiency. Comparisons are made with the disadvantages attending the use of single-phase driving motors, but as only synchronous motors are considered, the comparison is not a fair one. The commutator motors at present in use on single-phase systems are not subject to several of the inconveniences brought into the comparison. Besides this it would evidently not be practicable to apply any system of rectified or converted current drive to the multiple unit system of train propulsion, which has great advantages at any rate for suburban lines and short runs. The necessity for having two rectifiers to each locomotive also appears to be a disadvantage of the system.

However, the final test is efficiency in ordinary working and low cost of maintenance and repairs, and it will be interesting to have later the results of the trials of this form of locomotive compared with those of the other types shortly to be experimented with.

**National Insurance.**—The Board of Trade has issued from its Central Office for Labour Exchanges and Unemployment Insurance, Queen Anne's Chambers, Westminster, S.W., a "Provisional List of Workmen in the Insured Trades (Sixth Schedule)." It relates to the following sub-sections: Building; Construction of Works; Shipbuilding; Mechanical Engineering; Ironfounding; Construction of Vehicles; Sawmilling (including machine wood-work). Electrical wiremen, electrical winders, engine-men, stokers, boilermakers, crane-men, bladers (rotors and turbines), erectors, fitters, and commutator-makers are specifically mentioned in a number of these sections. Those interested in the matter should secure a copy of this document.



TRADE STATISTICS OF ITALY.

THE following figures, showing the imports of electrical and similar goods into Italy during the year 1910, have been taken from the recently issued official trade statistics; the figures for 1909 have been added for purposes of comparison, and notes of increases or decreases are given :—

	1909.	1910.	Increase or decrease.
	Lire.	Lire.	Lire.
<i>Copper, brass or bronze wire more than ½ mm. diameter.—</i>			
From France ...	2,774,000	1,372,000	— 1,402,000
„ Germany ...	1,267,000	1,517,000	+ 250,000
„ Great Britain ...	20,000	125,000	+ 105,000
„ Other countries ...	101,000	112,000	+ 11,000
Total ...	4,162,000	3,126,000	— 1,036,000

<i>Copper, brass or bronze wire of ½ mm. diameter or less.—</i>			
From Germany ...	430,000	338,000	— 92,000
„ France ...	19,000	34,000	+ 15,000
„ Other countries ...	13,000	4,000	— 9,000
Total ...	462,000	376,000	— 86,000

<i>Boilers.—</i>			
From France ...	143,000	155,000	+ 12,000
„ Germany ...	552,000	717,000	+ 165,000
„ Great Britain ...	2,469,000	1,715,000	— 754,000
„ Switzerland ...	275,000	139,000	— 136,000
„ Other countries ...	428,000	306,000	— 122,000
Total ...	3,867,000	3,032,000	— 835,000

<i>Steam engines, fixed without boilers.—</i>			
From Belgium ...	160,000	7,000	— 153,000
„ Germany ...	540,000	306,000	— 234,000
„ Great Britain ...	739,000	1,100,000	+ 361,000
„ Switzerland ...	279,000	262,000	— 17,000
„ United States ...	132,000	169,000	+ 37,000
„ Other countries ...	230,000	137,000	— 93,000
Total ...	2,080,000	1,981,000	— 99,000

<i>Steam engines, semi-fixed (with boilers), hot-air motors, compressed air, gas, petrol, &amp;c.—</i>			
From France ...	196,000	110,000	— 86,000
„ Germany ...	1,888,000	1,505,000	— 383,000
„ Great Britain ...	1,554,000	1,590,000	+ 36,000
„ Switzerland ...	366,000	599,000	+ 233,000
„ United States ...	323,000	231,000	— 92,000
„ Other countries ...	152,000	376,000	+ 224,000
Total ...	4,479,000	4,411,000	— 68,000

<i>Hydraulic machines and water or wind motors.—</i>			
From France ...	299,000	102,000	— 197,000
„ Germany ...	633,000	1,035,000	+ 402,000
„ Great Britain ...	116,000	962,000	+ 846,000
„ Switzerland ...	369,000	360,000	— 9,000
„ Other countries ...	172,000	158,000	— 14,000
Total ...	1,589,000	2,617,000	+ 1,028,000

<i>Dynamo-electric machines weighing more than 1,000 kg.—</i>			
From Austria ...	110,000	159,000	+ 49,000
„ France ...	587,000	236,000	— 351,000
„ Germany ...	5,603,000	4,911,000	— 692,000
„ Great Britain ...	663,000	945,000	+ 282,000
„ Switzerland ...	1,670,000	1,458,000	— 212,000
„ United States ...	358,000	64,000	— 294,000
„ Other countries ...	27,000	236,000	+ 209,000
Total ...	9,018,000	8,009,000	— 1,009,000

<i>Ditto, weighing 1,000 kg. or less.—</i>			
From Austria ...	162,000	106,000	— 56,000
„ France ...	194,000	160,000	— 34,000
„ Germany ...	4,670,000	4,685,000	+ 15,000
„ Great Britain ...	200,000	401,000	+ 201,000
„ Switzerland ...	760,000	630,000	— 130,000
„ United States ...	431,000	489,000	+ 58,000
„ Other countries ...	64,000	138,000	+ 74,000
Total ...	6,481,000	6,609,000	+ 128,000

<i>Accumulators and metal parts.—</i>			
From Germany ...	42,000	15,000	— 27,000
„ Great Britain ...	20,000	12,000	— 8,000
„ Other countries ...	39,000	136,000*	+ 97,000
Total ...	101,000	163,000	+ 62,000

\* Holland, 120,000.

	1909.	1910.	Increase or decrease.
	Lire.	Lire.	Lire.
<i>Electric transformers.—</i>			
From Austria ...	752,000	640,000	— 112,000
„ France ...	207,000	30,000	— 177,000
„ Germany ...	2,226,000	2,586,000	+ 360,000
„ Great Britain ...	59,000	12,000	— 47,000
„ Switzerland ...	539,000	827,000	+ 288,000
„ United States ...	800,000	—	— 800,000
„ Other countries ...	—	16,000	+ 16,000
Total ...	4,583,000	4,111,000	— 472,000

<i>Parts of dynamo-electric machines and of transformers.—</i>			
From France ...	202,000	78,000	— 124,000
„ Germany ...	606,000	632,000	+ 26,000
„ Great Britain ...	100,000	60,000	— 40,000
„ United States ...	344,000	122,000	— 222,000
„ Other countries ...	80,000	161,000	+ 81,000
Total ...	1,332,000	1,053,000	— 279,000

<i>Electrical apparatus.—</i>			
From Germany ...	1,752,000	2,563,000	+ 811,000
„ Great Britain ...	22,000	138,000	+ 116,000
„ Switzerland ...	248,000	213,000	— 35,000
„ United States ...	292,000	362,000	+ 70,000
„ Other countries ...	171,000	309,000	+ 138,000
Total ...	2,485,000	3,585,000	+ 1,100,000

<i>Are lamps.—</i>			
From Germany ...	459,000	400,000	— 59,000
„ Great Britain ...	2,000	—	— 2,000
„ United States ...	45,000	11,000	— 34,000
„ Other countries ...	47,000	34,000	— 13,000
Total ...	553,000	445,000	— 108,000

<i>Electric lamps, incandescent.—</i>			
From Austria ...	559,000	615,000	+ 56,000
„ France ...	130,000	201,000	+ 71,000
„ Germany ...	1,394,000	1,938,000	+ 544,000
„ Great Britain ...	5,000	7,000	+ 2,000
„ Switzerland ...	64,000	108,000	+ 44,000
„ Other countries ...	71,000	208,000	+ 137,000
Total ...	2,223,000	3,077,000	+ 854,000

<i>Carbons of all kinds for electro-technical purposes.—</i>			
From Austria ...	223,000	321,000	+ 98,000
„ Germany ...	611,000	590,000	— 21,000
„ Switzerland ...	35,000	27,000	— 8,000
„ Other countries ...	5,000	10,000	+ 5,000
Total ...	874,000	948,000	+ 74,000

N.B.—25 lire = £1.

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

THE MAGNETIC PROPERTIES OF ALLOYS.

THE April meeting of the Faraday Society took the form of a general discussion on "The Magnetic Properties of Alloys." Quite a unique collection of papers—some 10 in all—was presented, and among the authors who gave their papers in person, were Dr. E. Gumlich, Director of the Magnetic Department of the Reichsanstalt, Charlottenburg; Dr. E. Wedekind, of Strassburg; and Dr. S. Hilpert, of Berlin. Prof. H. Du Bois, the Kelvin Lecturer for this year, also took part in the discussion, which was presided over by Sir Robert Hadfield, F.R.S., himself a pioneer in this branch of magnetism.

The subject divides itself into two branches, one dealing with the effects of composition and heat treatment on the magnetic qualities of steels and other ferro-alloys, and the other dealing with the properties of the remarkable magnetic non-ferro-alloy of manganese discovered in 1903 by Hensler, who also contributed a paper to the discussion.

The papers on ferro-alloys covered a very wide range of aspects, and only a very brief reference to the scope of the work described will be possible in the limited amount of space here available. Dr. Gumlich's paper dealt with the effects of carbon and silicon on the magnetic properties of irons, and it embodied the preliminary results of a very important series of investigations being carried out at the Reichsanstalt, which will be of considerable interest to the builder of dynamos and transformers. It has been found that the carbon which is dissolved in the iron, in solid solution, has the strongest influence upon its magnetic properties, the coercive force increasing proportionally with the dissolved carbon, while the remanence



decreases—an important point as regards permanent magnets. The carbon present as impurity decreases the permeability and increases the hysteresis loss, and hence the maker of dynamo steel and transformer iron, who wants to have his material soft magnetically, has to render the effect of carbon innocuous. This can be done, according to Dr. Gumlich's experiments, by a considerable addition of silicon. Long ago it was discovered by Barrett, Brown, and Hadfield that the addition of silicon to iron diminished its electric conductivity without impairing its magnetic qualities, and it was this work which suggested the experiments made in the Reichsanstalt. Although the part played by the silicon is by no means clear, its effect would appear to be indirect; it seems merely to counteract and eliminate the detrimental effect of the carbon.

The amount of silicon which must be present in order to influence the decomposition of the pearlite, in annealing, into ferrite and temper carbon is from 3 to 4 per cent. Dr. Gumlich thinks that there must be other reasons for the good magnetic qualities of thin iron sheets containing a smaller amount of silicon.

The magnetic properties of a series of nickel and manganese steels, 5 to 33 per cent. nickel, and 5 to 10 per cent. manganese, were dealt with in a paper by Dr. S. Hilpert and Dr. E. Colver-Glavert. The paper considers principally the question of heat treatment, and it should here be remarked that the dependence of magnetic qualities of metals and alloys in heat treatment is quite as great as in the effect of composition. The chairman showed the meeting a piece of manganese steel of uniform composition, which had been treated thermally so as to be magnetic at one end, and non-magnetic at the other. Explanations of the effects of heat treatment largely turn on the validity of the allotropic theory of iron. This theory, which, although generally accepted, is disputed by many eminent metallurgists—including Sir Robert Hadfield—assumes that iron at  $750^{\circ}\text{C}$ . changes into a non-magnetic  $\beta$  form, and at  $900^{\circ}$  into another non-magnetic allotropic modification, denoted  $\gamma$  iron. It is supposed that all magnetic steels derive their magnetic properties from their content of  $\alpha$  iron, but the present experiments of Hilpert and Colver-Glavert, show this cannot be the case, since specimens quenched from  $1,240^{\circ}\text{C}$ ., which ought to contain only  $\gamma$  iron were found to be more strongly magnetic than the slowly-cooled specimen which should consist entirely of  $\alpha$  iron.

Again, nearly all the steel tested (the only exception was the 33 per cent. nickel steel, which must be regarded as a special compound), showed a remarkable maximum in magnetic properties by quenching from  $900^{\circ}\text{C}$ . The interesting 25 per cent. nickel steel, which is usually employed when a non-magnetic steel is required, was subjected to very close investigation. In this steel an unmagnetic product is obtained in quenching from about  $750^{\circ}\text{C}$ ., and as the temperature rises, a maximum of magnetisability is reached at  $900^{\circ}$ . The quenched specimens were also cooled as low as  $-100^{\circ}\text{C}$ ., and at each step measured magnetically at even temperatures; it was found that, with falling temperatures, a gradual increase in magnetisability occurred. The authors were not able to define any connection between magnetic properties and metallographic structure, since steels similar in structure had entirely different magnetic properties, depending on their previous thermal history.

DR. ALEXANDER D. ROSS and DR. JAMES G. GRAY spoke on the magnetic properties of certain special steels at low temperatures. The steels—carbon, nickel, chrome, silicon, tungsten, phosphor, &c.—were tested at some temperature, and when immersed in boiling liquid air, in the conditions brought about by normalising, annealing and quenching the metals at various temperatures. In general, the effect of cooling was to diminish the permeability for low field strengths and to increase it for high fields; a typical magnetisation curve at  $-190^{\circ}\text{C}$ . lies initially below and finally above one corresponding to  $15^{\circ}\text{C}$ . The effect is thus the reverse of what takes place when the test piece is heated and is in harmony with Hopkinson's theory of elementary magnets, which regards the iron or steel as made up of permanently magnetic molecules, which become more or less paralleled by magnetic force and whose intensity of magnetisation and polar length vary with the temperature.

PROF. PIERRE WEISS, of Zürich, sent in a study of the magnetic properties of the iron-nickel, iron-cobalt, and nickel-cobalt alloys. Prof. Weiss, from the standpoint of his kinetic theory of ferro-magnetism, regards all metals as homogeneous solid solutions. The saturation intensity is the resultant of the magnetic moments of the molecular magnets, and its value at absolute zero gives the true moment of the molecule, because at that point the disturbing effect of thermal agitation has ceased to exist. In the case of feebly magnetic substances, such as oxygen and the salts of metals, the coefficient of magnetisation is inversely proportional to the absolute temperature. Multiplied by the absolute temperature therefore, this coefficient yields a constant,  $C$ , termed the Curie constant, and from this the molecular moment, which cannot be obtained directly in these cases, can be deduced. The feeble magnetisation of ferro-magnetic bodies above the Curie point—at which they lose their strong magnetism—can be deduced from the same constant. Prof. Weiss has found that the varying molecular moments obtained in the case of the same atom under all conditions of temperature and combination have a common measure (1123'5), and, further, this common measure is the same for the atoms of cobalt, manganese, chromium, vanadium, copper, and other elements, so that it appears to be associated with the common elementary magnets. This common moment the author calls the *magneton*, and he has found the conception very useful in studying the alloys of iron, nickel, and cobalt. The results of these researches of Weiss and his students must be given quite briefly. In the case of iron and nickel, the existence of a compound,  $\text{Fe}_2\text{Ni}$ , is indicated. Two uninterrupted series of solid solutions are formed between this compound and iron and nickel respectively. The molecular

magnetic moment is additive in the solid solutions, but it ceases to be so in chemical compounds, so that we may have compounds whose magnetism is greater than that of their separate constituents. Measurements made on  $\beta$  iron show that its molecule is  $\text{Fe}_8$ , that of  $\gamma$  iron  $\text{Fe}_2$ , and that of  $\delta$  iron probably  $\text{Fe}$ . One curious result is that nickel in its reversible ferro alloys is in a state which the pure metal only assumes at a much higher temperature, suggesting a "repercussion" of the neighbouring atoms in the interior magnetic state of the nickel atom. The nickel-cobalt alloys form one uninterrupted series of solid solutions. Cobalt behaves similarly to nickel with respect to its alloys with iron, but the compound  $\text{Fe}_2\text{Co}$  is of special interest, in that at ordinary temperatures it possesses a saturation intensity exceeding that of pure iron by about 10 per cent. Technical applications of this remarkable alloy are under consideration.

Papers on the Hensler alloys were read by Dr. Alexander Ross and Dr. Hilpert, and communicated by Prof. A. A. Knowlton and Dr. O. C. Clifford, of Utah, U.S.A., Dr. E. Take, of Masbury, and by Dr. Hensler himself. The Hensler alloys, which were discovered in 1903, are ferro-magnetic materials built up of constituents which themselves show only the feeblest magnetic qualities, namely, copper, manganese, and aluminium. Binary alloys of manganese with aluminium, tin, antimony, bismuth, boron, and arsenic, are also ferro-magnetic—to a less degree—but they have not been studied in detail, as have the ternary Hensler alloys. Dr. Ross has also studied the copper-manganese with tin, antimony, and bismuth ternary series, and several binary combinations of the above metals. He appears to have taken very special precautions to ensure the purity of the materials employed in making his alloys, a consideration which has been neglected by some workers in this field, and which renders their results more or less untrustworthy. For the methods of making and annealing the alloys and for details of the specially sensitive magnetometer employed, reference must be made to the original papers. The primary object of Dr. Ross's tests was to determine the magnetic quality of the alloys in the condition as cast, to find the best thermal treatment for rendering the metal of good magnetic quality, to test the variation of permeability with temperature, and finally to investigate the effects of annealing and quenching the alloys at various temperatures. The effect on the magnetic quality brought about by cooling the alloys to the temperature of liquid air was found to be in marked opposition to what is found in iron alloys. For example, a typical ternary alloy containing 62 per cent. copper, 25 per cent. manganese and 8 per cent. aluminium, when cooled from  $15^{\circ}\text{C}$ . to  $-190^{\circ}\text{C}$ . showed a considerable increase in permeability for all strengths of field, while a 43'4 per cent. copper, 18'1 per cent. manganese, and 40 per cent. tin alloy had a permeability almost independent of temperature. As already stated, ferro-alloys show enhanced permeability at liquid-air temperature only for high voltages of the applied field. Annealing the alloys at  $180^{\circ}\text{C}$ . improves their magnetic qualities, the best duration of annealing depending on the composition. Quenching the ternary alloys results in diminished permeability and coercive force, except in the bismuth alloys, where the very opposite effect is observed. The quenched alloys after the lapse of some time (accelerated at higher temperatures) undergo a slow transformation by which the permeability returns to its original value, but the hysteresis remains almost at zero.

In the opinion of Dr. Ross, the magnetic experiments, combined with the thermal and microscopic tests, which he described in detail, have proved that the Cu-Mn-Al Hensler alloys are solid solutions of varying concentration, probably consisting  $\text{Cu}_3\text{Al}$  and  $\text{Mn}_3\text{Al}$ , these compounds being the most magnetic members of their respective binary series. Hensler's own theory that ternary magnetic compounds exist, and the alternative theory that the magnetic properties of the alloys are to be ascribed to the occurrence of manganese in a peculiar crystalline form when dissolved in copper and aluminium, are stated by Dr. Ross to be in conflict with his own experimental results. But *why* the feebly magnetic copper, aluminium, and manganese should form magnetic solid solutions of  $\text{Cu}_3\text{Al}$  and  $\text{Mn}_3\text{Al}$  is a problem that still remains to be solved.

The paper on the Hensler alloys, communicated by PROF. A. A. KNOWLTON and DR. O. C. CLIFFORD, of Utah, U.S.A., showed that the percentage composition of these alloys is relatively unimportant as compared with their heat treatment. Thoroughness of mixing in making the alloys, is also an important factor in determining their magnetic qualities, a factor that has been overlooked by many investigators. Of all the alloys made, only some seven, containing from about 60-65 per cent. copper, 25 to 30 per cent. manganese, and 4 to 14 per cent. aluminium, were experimented with, as the mechanical or magnetic properties of the remainder rendered them useless for this purpose. It would appear that under the best conditions of mixing and chilling, the maximum possible induction for a given manganese content, increases with increasing percentage of aluminium. Sensitiveness to heat treatment and magnetic hardness are closely dependent upon the proportion of aluminium present, while the transformation temperatures—at which the alloys lose their magnetic properties—depend largely upon the percentage of copper. On the whole it will be impossible to decide what composition will give the best magnetic alloy until the effects of thermal treatment have been worked out over a wide range of composition. Messrs. Knowlton and Clifford do not accept the assumption of Hensler and Starck that the best results are given by alloys built up of atomic proportion. On the question of the nature of the magnetic units in the Hensler alloys, Knowlton and Clifford seem to incline—not very positively—to the view that these are complex groups, which form the structural elements of a certain type of mixed crystal, and contain at least two different kinds of chemical molecules. This



hypothesis, while broader than that put forward by Dr. Ross, is not in contradiction to Dr. Ross's views.

DR. E. TATE and DR. F. HENSLEY, in their communications, also discussed the various hypotheses regarding the magnetic units in the Hensler alloys. The allotropic theory, first put forward by Faraday and applied in the present connection by Guillaume, is refuted as not being based on experimental facts. The theory discovers that manganese exists in a magnetic form at a very low temperature in its pure state, but that the transformation temperature is raised by the addition of such metals as aluminium and tin. Hensler's opinion is that complex compounds of the general form  $Al_x(Mn, Cu)_{8x}$  exist, and that the molecules of these compounds are the carriers of the strong ferro-magnetism of the aluminium-manganese bronzes. Dr. Ross's hypothesis is substantially the same, but Dr. Hensler's is the more general, and he claims priority, a question which need not be here discussed.

DR. TATE further considers the very interesting phenomena connected with the "ageing" of the Hensler bronzes. These are in general not magnetic when freshly cast, but they acquire their maximum magnetic intensity by a more or less prolonged heating at high temperatures. Two structural transformations appear to take place, (1) a development of strongly ferro-magnetic elementary magnets, (2) a further rearrangement by virtue of which the free dirigibility of the elementary magnets is more or less impeded in the course of the ageing. It is supposed that the magnetism only becomes manifest when the separate  $Al_x(Mn, Cu)_{8x}$  molecules, having been re-formed from desiccated fragments, are further united by segregation from the solid solution with other constituents of the alloy. The intensity of the magnetism will depend on the extent to which these complexes are formed.

DR. S. HILPERT and DR. T. DIECKMANN spoke on the magnetic properties of the compounds of manganese with phosphorus, arsenic, antimony, and bismuth. The transformation points of these alloys are closely connected with the atomic weights of the elements associated with the manganese. In the case of the phosphide MnP the transformation point is so low (18-25°) that if the compound be warmed with the hand it no longer reacts with a magnet, but immediately does so if placed in cold water. This was experimentally demonstrated.

The last contribution to the discussion which we have to notice is that of PROF. E. WEDEKIND, who spoke on the relations between the magnetism and the constitution of chemical compounds. The elements which form ferro-magnetic substances in their compounds may be divided into two classes, the ferro-magnetic metals themselves—iron, nickel and cobalt—and the metals which are themselves feebly paramagnetic, and which form compounds more or less ferro-magnetic. These elements—manganese, chromium, vanadium, titanium, among others—may be said to possess "latent magnetism." The magnetism of compounds of the ferro-magnetic metals is essentially feebler than that of the metal. On the other hand, in the case of the metals possessing "latent" magnetism, their simple compounds are, as a rule, more strongly magnetic than the metals, the susceptibility of the various compounds depending on the *valency* of the metal in the particular compound in question. On the whole, the magnetic susceptibility decreases with decreasing atomic weight of the chief metal. Thus several manganese compounds are ferro-magnetic; in the case of chromium, only the two mixed oxides are ferro-magnetic, while none of the vanadium compounds are very decidedly magnetic. An interesting group of magnetic compounds, which have hardly at present been investigated, are the oxides of the rare earths, neodymium, europium, gadolinium, terbium, and dysprosium. These show extraordinarily high magnetic values, which appear to depend not, as in the above cases on the valency, but on the atomic weights of the metallic constituents.

### High-Frequency Currents.

HIGH-FREQUENCY currents formed the subject of the Friday evening lecture at the Royal Institution on May 17th, the lecturer being MR. W. DUDDELL, F.R.S. After an elementary description of the meaning of electrical frequencies, which was graphically illustrated by the writing of a pendulum on a piece of smoked glass as it passed through the lantern, Mr. Duddell devoted the greater part of his hour to considering the three main groups of methods for generating high frequencies. The first of these was the alternator method; the second depended on the discharge of the Leyden jar; the third, on the properties of the electric arc. In his opinion the alternator method was the one most likely to develop in importance in the near future. He had himself lately constructed a little machine to give 2,000 frequencies. It had 15 magnets, and the circumference of the disk when rotating covered something like three miles per minute. This machine was not brought on view, but a telephone in the lecture theatre was connected with the basement in which it was installed, and with this it was possible to realise the increasing frequency by the shrillness of the note, the telephone failing to respond when the machine reached the higher frequencies of which it was capable. For high frequencies proper, that is to say, periodicities of 10,000 cycles per second and upwards, he drew attention by means of photographs to one American and one German construction, the former a recent 100,000-cycle alternator, with a 400 and 600-slot winding, with which a frequency of 200,000 was possible; and the latter, the machine of Dr. Goldschmidt, with a method of stepping-up the frequency, electrically or magnetically, by short-circuitings of the rotating part. He was confident that there was a great future before the high-frequency alternator. Only a brief description was given of the method of generating high-frequency current by means of a Leyden jar, and Mr. Duddell

then passed on to describe the arc method, in which advantage was taken of the instability of the arc to produce rapidly alternating current. He demonstrated in this connection the use of the Tesla coil with an arc burning in air between two carbon electrodes, and also showed Poulsen's method of immersing the arc in coal-gas, and, in order to make it still more unstable, using a very powerful magnetic field. With an apparatus of this sort Mr. Poulsen had succeeded in transmitting 100 words a minute in wireless telegraphy over a thousand miles. A number of beautiful experiments, such as the lighting-up of vacuum tubes when brought into this field, were shown, and a remarkable phenomenon, which he had not himself noted until his attention was called to it the same afternoon by Sir James Dewar, was the gradual luminosity and ultimate red-heat of a carbon filament lamp when placed at the top of the coil. With a metal-filament the effect was not obtained, and the formation of carbon dioxide in the lamp appeared to play an essential part in its production. In conclusion, Mr. Duddell showed the simple high-frequency method of Mr. S. G. Brown, in which an oscillating current was in parallel with a constant current circuit, the current flowing to a rotating disk of aluminium from a small copper block, which was lightly pressed against the edge of the disk. He added that the choice between the different methods would depend upon their respective reliability in practice, and upon the cost of generating the high-frequency current.

### The Corrugation of Rails.

By PROF. ALFRED SCHWARTZ, M.I.E.E., and R. G. CUNLIFFE, M.Sc.Tech., A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, March 26th, 1912.)

EXPERIMENTS were carried out with a view to affording some indication of the extent to which "slip" and "skid" take place with trailed wheels under various conditions of load and track. A model Brill truck to a scale of  $\frac{1}{20}$  was employed, with a recording device. It was found that on curves from 2 to 15 ft. radius, the increment of slip or skid per revolution was practically constant for a given curve.

Wheels of equal diameters passing round curves of 2 to 15 ft. radius, and wheels of unequal diameters were employed on straight track and on curves of radius of 2 to 15 ft.

In every case the skid of a wheel on the outer rail of a curve is greater than the slip on its mate wheel; this is due to the additional skid produced by the action of the flange.

Experiments were made on the cold flow of metals due to rubbing and hammering. A cast lead disk 9 in. in diameter and 1 in. thick was turned true on the sides and edges. A brass cylinder 1 in. in diameter and 2 in. long was pinned to one end of a steel arm 6 in. long, in such a way that the cylinder could not rotate. The cylinder rested upon the edge of the lead disk with the centre of the cylinder vertically above the centre of the disk, the cylinder being free to rise and fall. The disk was then rotated in the lathe at a peripheral speed of 10 miles per hour. After running in this way for a short time, it was found that the cylinder appeared to be "floating" above the edge of the disk, the gap between the cylinder and the disk being marked by a persistent line of light. This effect was produced by the rapid rise and fall of the cylinder in its passage over the minute irregularities on the surface of the disk. Its amplitude rapidly increased as the experiment progressed, and finally resulted in the cylinder movement resolving itself into a series of jumps, the average height of these jumps at the conclusion of the experiments being about 3 to 4 in. above the surface of the disk.

After running for a few minutes, the edge of the disk was found to be covered with a number of abrasions of somewhat irregular pitch. These abrasions were formed by the surface of the metal being pushed forward in certain places, thus forming slight elevations or ridges which were perceptible to sight and touch. In consequence of these ridges the jumping of the cylinder now became considerable, and the surface of the metal was rapidly displaced owing to the hammering produced by the successive blows of the cylinder. This action was continued until the edge of the disk was strongly marked with corrugation of somewhat irregular pitch.

The fixed rubbing cylinder was now replaced by a cylinder of the same diameter, which was capable of rotating freely on an axle. The time occupied in obtaining corrugation of a given size was very much longer with the rotating cylinder than with the fixed one.

It was decided to cause the rubbing cylinder to jump once in each revolution by placing an artificial obstacle on the edge of the disk.

A deep indentation was caused by the rubbing cylinder striking the disk immediately after its jump, and smaller indentations due to the vibrations set up in the arm on which the rubbing cylinder was carried.

A straight bar of cast lead carefully machined on the sides and edges was employed, and arrangements were made whereby the bar was rubbed in one direction only by a steel cylinder which did not rotate.

After three minutes' rubbing with the fixed cylinder, the surface of the lead bar was covered with corrugation of short pitch, and as the rubbing proceeded, the pitch and depth of the corrugation progressively increased; when the rubbing cylinder and the lead bar were well lubricated with oil throughout the experiment, the effect was extremely small compared with the results obtained without lubrication.

A steel cylinder capable of rotating freely on a steel axle was substituted for the fixed rubbing cylinder, and results were obtained identical in their main features with those obtained with the fixed



rubbing cylinder under similar conditions. The time required to produce corrugation of a given size was, however, very much longer in the case of the cylinder that was free to rotate than that required with the fixed cylinder.

In the case of lead, the metal is pushed forward, and piled up in front of the point of impact, and the tops of the crests thus formed are higher than the original surface of the bar. The hollows are lower than the original surface of the bar owing to metal having been pushed forward from them to form the crests, and to fins of metal being extended at the sides of the bar due to the hammering of the cylinder.

With lead, it was found that there was a limit to the height to which the crests were raised above the original surface of the rail, since, after a certain point was reached, there was not sufficient cohesion between the various layers of metal which had been pushed forward, to hold them in position, and large and small flakes were removed at frequent intervals by the rubbing cylinder.

A bar of yellow pine was substituted for the lead with a view to trying the effect on a material, the surface of which did not lend itself readily to horizontal displacement, and yet would be sufficiently soft to show the effect of hammering.

In this case the hollows of the corrugations were beaten out within the limits set by the transverse vibrations of the connecting rod, the crests remaining at the level of the original surface of the bar. The rubbing cylinder was, to begin with, only bearing on one edge of the wood bar, and as the hollows increased in depth the bearing of the cylinder was increased until it extended right across the bar at the deepest parts of the hollows. This same formation is frequently found in corrugation on the track.

In the previous experiments the average speed of the rubbing cylinder was 200 ft. per minute; this was now reduced to 80 ft. per minute, with the result that the corrugation developed more slowly, and was very much altered in character. The pitch increased with time, but the amplitude of the corrugation did not increase proportionately, and remained extremely small.

For the purpose of experiment and observation on the tramway track a portable apparatus was constructed for obtaining longitudinal profiles of corrugations with a vertical magnification of 10 to 40 times and a natural horizontal scale. By this means it was found that the corrugation was, in general, irregular both as to pitch and amplitude, and that the crests of the corrugations were at the general level of the rail head, while the hollows were below this level. Plaster casts of corrugation were obtained from the rails *in situ*; from a consideration of these casts, and a comparison with the original sections of the new rails, it was found that metal was extruded both on the inner and outer side of the rail head, and that in many places the outer side of the rail head was much worn by the vehicular traffic.

To obtain graphical records of the pitch and shape of the corrugations in plan, a strip of thin tough paper was laid along the rail tread and drawn tight; it was then rubbed on its upper surface with a wooden rubber coated with blacklead. Preparatory to taking a record, the rail head was first carefully cleaned by means of a metal scraper, followed by a stiff wire brush, and was finally polished with a dry cloth. Graphic records were obtained in this way from a large number of typical portions of electric tramway tracks, from main line steam tracks, and from the running rails and conductor rails (third rails) of electric railways. In making these rubbings care must be taken to keep the paper strip stretched taut; if it is at all loose it is liable to cockle under the rubber, and to give rise to alternate light and dark patches of short pitch, which might be mistaken for corrugations.

Experiments were also made on the track designed to record the variation in pressure between the wheels and the rails under service conditions. A length of rail tread was coated with graphite, and polished bright; a paper strip was placed over this length, which was pressed upon the blacklead rail surface by the wheel in its passage over it. In taking a record a paper strip about 4 in. wide was pinned lengthwise along one edge of a thin wood board, so that the paper projected about 3 in. beyond the edge of the board throughout its length. The projecting portion of the paper was laid over the tread of the rail with its outer edge coincident with the gauge edge of the rail. It was found quite easy to obtain a record from the leading wheel of a car by pulling back the board before the second wheel reached the paper.

In general, corrugation appears on the running rails of cable, steam, and electric traction systems. We have found pronounced corrugation on the rails of each of the five steam railway systems which we have examined in this country, but it is not present on steam or cable lines to nearly so serious an extent as it is on electric lines. The third rails of electric railways with sliding collector shoes are frequently extensively corrugated. The trolley wire of tramway systems is often corrugated for short lengths at bridge, bracket arm, or span supports, and for considerable lengths of the suspended wire between the supports.

Parts of machines making sliding or rolling contacts are frequently corrugated when there is some freedom of motion of one or other of the parts concerned at right angles to the surface rubbed. We have noticed corrugation on the collector rings of alternators, and while, no doubt, the burning due to sparking when the contact is broken affects the result, we regard this as an effect rather than as the cause of the corrugation.

Corrugation in trolley wires frequently shows "pitting," due to arcing in the hollows caused by the jumping of the trolley wheel on the crests.

Fig. 2 shows rubbings taken from the track of the Manchester Corporation tramways, as follows:—

A, 40-ft. curve, outer rail; B, 40-ft. curve, inner rail.

The rails of sharp curves such as these are generally free from corrugation. The wheels of cars passing round sharp curves are

continually binding in rail grooves, with the result that the car body, truck, and driving elements are locked together, and the vertical movements of the wheels are damped.

C. Outer rail of flat curve of very large radius. D. Inner rail, opposite to C.

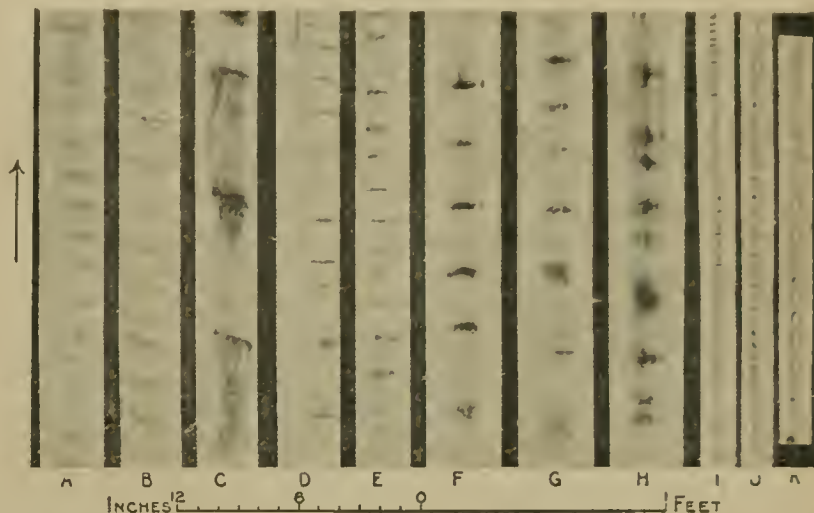
The radius of curvature is not uniform, the track following the curvature of the road, but in no place being less than 1,000 ft. The record D shows long corrugations on the inner rail.

E. Outer rail of flat curve. F. Inner rail, opposite to E.

The record F shows both long and short corrugations on the inner rail.

G. Straight track, cars in one direction only as is usual practice.

In this case the coned wheels run on a horizontal rail tread and bear at first on the gauge end of the rail.



City and South London Railway—A, B, C, collector rails; A, running dead slow just before stop, current about 5 amperes; B, running slow, accelerating, current about 280 amperes; C, running fast, coasting, current about 5 amperes; D and E, C. & S.L. Railway, running rails; F, G and H, running rails, main-line steam track, Manchester; I, trolley wire, Manchester Corporation tramways, between supports; J, trolley wire under the ear at a span support, flexible in a vertical plane; K, trolley wire under the ear at a support used in passing under bridges.

FIG. 1.

H. Similar rail on the same route with contact between wheels and rail and at middle of rail tread.

I. Straight track, traffic in both directions equally. Gauge edge contact between wheels and rail.

J. Rail opposite to I, at the same place, showing approximate agreement between corrugations. Complete wheel contact.

A consideration of the experiments appears to show that the corrugation is initiated by the action of one or more of the following forces:—

(a) Jumping of the moving system on its passage over minute irregularities of the surface, or over an obstacle of some magnitude, when the critical speed is exceeded.

(b) Abrasion and displacement of the surface due to the difference between the static and dynamic coefficients of friction of the surfaces in contact.

(c) The longitudinal vibrations of the moving system.

(d) The transverse vibrations of the moving system.

In the case of a metal like lead the surface material is easily pushed forward, and the principal factor in initiating the corrugation would appear to be the abrasion of the surface and the progressive longitudinal displacement of metal, due to the great

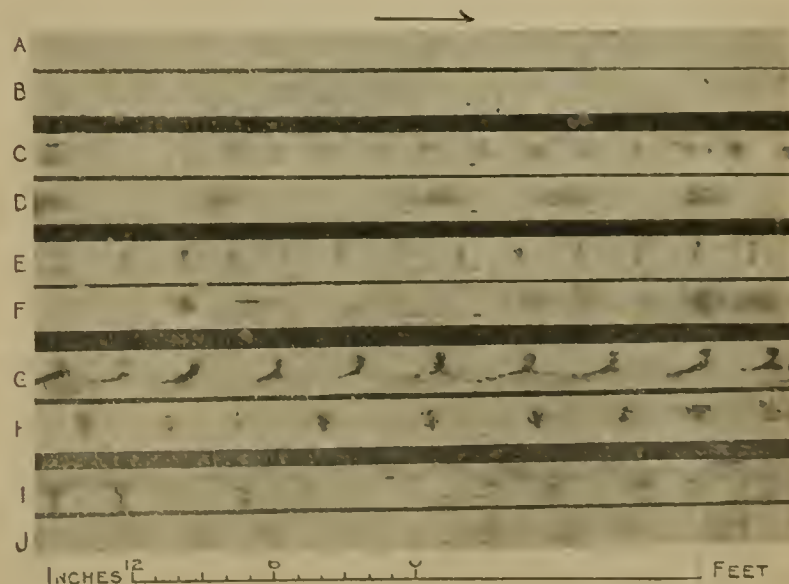


FIG. 2.

difference existing between the static and the dynamic coefficients of friction.

The main factor influencing the growth and also the spread of the corrugation is the hammering due to the jumping of the rubbing cylinder; in general the other factors may be regarded as



being subordinate to this, and as affecting the form of the corrugation produced, and its degree of regularity.

The authors distinguish two classes of corrugation on the tramway track which they term "visible" and "invisible" respectively, according as the corrugations are visible to the naked eye or not. The presence of the invisible corrugation may be determined by means of graphite rubbings.

Invisible corrugation does not appear to give rise to annoyance or trouble in practice to any extent; it increases very slowly, and may even reach a condition of equilibrium with respect to the general wear of the rail.

The main facts relating to visible corrugation are well known. The inner rails of flat curves are generally less strongly corrugated than the outer rails, and the pitch in many cases is longer than that on the outer rails, but in some cases the pitch on both rails is equal, and the crests and hollows occupy corresponding positions on the two rails.

Visible corrugation on the track appears to be due to a combination of forces similar to those operating in the formation of corrugation on the lead bars, in which progressive longitudinal displacement of the metal is brought about by the joint action of the forces concerned.

The specific pressure on the area of contact will be a maximum when the flange of a given wheel is against the rail head, and with coned wheels on a flat rail tread the bearing surface will be close to the gauge edge of the rail where, as pointed out by Beaumont, the metal is not held *encastrée*. The result will be that the wheels of the car travelling on the outside rail of a curve will have the maximum value for the specific pressure on the area of contact, and the tendency to jump will be increased by the climbing action of the flange.

With regard to corrugation on the inner rails of curves, it appears to the authors that where this agrees in pitch and position with that on the outer rails, it is a case of transference of the impulses derived from the outer rail to the inner rail by means of the axle. In this connection it may be observed that, although the wheels on the outer rails frequently break contact with the rails when "jumping," we have not yet observed this to be the case with the inside wheels, the results showing variation in pressure on the contact only. As already stated, the presence or absence of continuity of contact between the wheel and rail profoundly modifies the character of the corrugation produced and its rate of growth.

The characteristics of corrugation on the straight are precisely the same as those of the visible corrugation on the outer rails of flat curves. Our conclusions with regard to visible corrugation on the straight are as follows:—The visible corrugation is probably an augmentation of the invisible corrugation of short pitch present at almost all parts of the track. This augmentation may be due to variation in the specific pressure on the contact area between wheels and rail due to the position of the wheel flange relative to the rail. The position of the flange in the groove will vary with the following conditions:—

1. A constant contact of the flange of one wheel with the check or gauge edge may be caused by unequal diameters of the wheels. Owing to the prevalence of curves in one direction on a given route, and the use of particular cars on given routes, it is not infrequent to find the wheel diameters on one side of a car persistently greater or less than those on the other side.

2. An intermittent contact of the flange of one wheel with the check or gauge edge may be caused by differences between the coefficient of friction of the two rails. The wheel on which the friction is greatest will tend to lead and will throw the flange of its mate wheel against the gauge edge of the rail; this will increase the friction on the mate wheel, which will then lead, and these alternations in lead will continue possibly with high frequency.

In the event of the tire or groove wear allowing the flange of either wheel to come in contact with the check, the above-mentioned alternations will be set up and corrugation of the check may result.

The flange action referred to may set up skid and a tendency in the wheel to climb the rail, thus giving rise to corrugation.

#### DISCUSSION.

MR. J. PRESCOTT said he could not come to any definite conclusion as to whether corrugations were caused by vibration or not. Calculations on a Brill truck showed that the oscillations due to the spring system could not produce the well-known corrugations of 2 and 3 in. pitch on tramrails. It did not follow, however, that oscillations were not the cause, as many parts of a truck could vibrate besides the springs, and it would need an accurate knowledge of the rigidity of the parts in order to decide whether oscillations of the right period were possible.

DR. E. W. MARCHANT referred to the question of how far corrugation was caused by the flexibility of the wheels and axles. Corrugation appeared to be due mainly to driving wheels. The corrugation due to steam trains was not so large as on electric tramways because the number of driving wheels compared with the number of trailers was very small. The effect might be got rid of by making the wheels and axles stiffer than at present.

MR. D. HARROP said that amongst the many variable factors causing corrugations were the actual circumstances peculiar to local conditions, such as the nature of substructure of track, concrete foundations, &c. This might not be a fundamental but a contributory cause.

MR. J. FRITH said that one of the valuable points about the paper was to disprove almost every theory that had hitherto been put forward regarding rail corrugation. For example, the theory of the teeth of the gearing and the theory of high axle pressure

had weak points when the matter in the paper was applied. One conclusion seemed evident, viz.: That there must always be a tendency to corrugate when there was relative motion.

MR. W. CRAMP (chairman) said the corrugations shown were, to some extent, similar to those found in the work which had been done with fluids on sand. These experiments were sufficient to account for the fact that initial bumps on a rail would produce continuous corrugation. The most important deduction from the paper had already been mentioned by Mr. Frith, viz.:—That any single explanation put forward seemed to fail in some particular, therefore the cause was probably complex, each suggestion being a partial truth. It should be possible to free the rail from bumps, and then observe whether corrugation appeared more slowly, in a different manner, or not at all. If corrugations were set up by the pushing over of metal, or even by hammering such as would occur by the oscillation of a car, it would seem that the rails when examined by a microscope would appear in the hollows to be harder and closer grained than at the crests.

MR. R. G. PARROTT said there seemed to be some critical relative speed between the wheel and rail at which corrugation began to form rapidly. It would be of interest to know if the pitch of the corrugations remained constant under varying conditions. He had observed on a straight tramway track a series of corrugations alternately on the left and right-hand rail.

MR. C. F. ELLWOOD said he had noticed on a straight stretch of Manchester tramway track, a series of longitudinal scratches nearly parallel with the rail edge. These scratches or abrasions were due to either slip or skid, and were in his opinion incipient corrugations. The scratches were two to three inches long and in patches. The action of a jumping wheel alighting is to produce skid or slip, perhaps both, and the foregoing observations seemed to bear out the authors' contentions regarding causes of corrugations. The marks referred to by Mr. Prescott might be observed on short-radius curves transversely across the track, but the wheel records given by the authors were actually due to corrugation.

#### The Institution of Electrical Engineers.

THE Report of the Council and statement of accounts for 1911 were presented and adopted at the annual general meeting on Thursday last week. The membership now consists of seven Hon. Members, 1,388 Members, 3,089 Associate Members, 806 Associates, and 1,247 Students—total, 6,537; the gross increase amounts to 685, and the net increase to 304, compared with an average annual increase of 105 during the last five years. A Salomons Scholarship has been awarded to Mr. R. J. Webb, of King's College, and a David Hughes Scholarship to Mr. D. Dunham, of the City and Guilds (Engineering) College, South Kensington. The Institution Premium has been awarded to Dr. J. A. Fleming and Mr. G. B. Dyke; the Ayrton Premium to Mr. J. Lustgarten; the Fahie Premium to Mr. W. Aitken; the John Hopkinson Premium to Messrs. H. D. Symons and Miles Walker; the Kelvin Premium to Mr. E. H. Rayner; the Paris Electrical Exhibition Premium to Mr. R. J. Roberts; and an extra premium to Messrs. S. W. Melsom and H. C. Booth, for papers read before the Institution. Students' Premiums have been awarded to Messrs. E. W. Moss and J. Mould, E. T. Pannell, E. T. Caparn, R. G. Parrott, and P. R. Coursey and G. G. Dawson.

The International Radio-Telegraphic Conference will be held at the Institution Buildings in June and July.

A sum of £500 has been allocated to the provision of apparatus to enable authors to illustrate their papers by experiments. The Wiring Rules have been adopted by some 50 Fire Offices and 232 supply authorities; more than 8,000 copies have been sold, and they have been reprinted in many hand-books. A scheme is under consideration for the examination and certification of wiremen. An "Industrial Committee" is to be appointed to report on all industrial matters in respect of which the Institution might usefully take action, besides taking over the work of the Parliamentary Committee; the Committee will also on occasion arrange for special meetings of various branches of the electrical industry. The Benevolent Fund shows a satisfactory increase, the capital account on December 31st, 1911, standing at £4,000.

The report of the hon. treasurer, Mr. Robert Hammond, shows that the margin to the good on the revenue account is £1,274, as compared with £3,053 in the previous year, a decrease of £1,779; the current expenditure was £13,763, and the year's revenue £15,037. Books and furniture have further absorbed £357, and repayment of mortgage on the Institution building, £626. The assets amount to £101,739, against liabilities £39,335, leaving a margin to the good of £62,404, an improvement of £2,569; of this increase, entrance fees account for £929—a record in the history of the Institution—and life compositions for £223. The Life Compositions Fund stands at £5,866, and under the revised Articles this sum will be freed for transfer to the general fund.

**Hornchurch and Upminster.**—Mr. W. Ivey, of London, has informed the Romford R.D.C. that he proposes to apply for powers to supply electricity for all purposes in the parishes of Hornchurch and Upminster, and has asked for the consent and support of the Council. Mr. Ivey has been requested to furnish more definite particulars of the scheme prior to interviewing the Council.



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## On Advertising Methods.

May I avail myself of the columns of your journal to suggest to certain electrical manufacturers that it would be much to their interest if they refrained from endorsing envelopes "Private," which contain nothing more important than circular letters and pamphlets describing certain of their manufactures?

It often happens that certain of these letters are forwarded on to one, after no little time has been wasted in judging whether they are really of a private nature or otherwise.

I think this is a practice more worthy of some quack medicine or money-lending concern than of a firm carrying on the sober business of electrical manufacturers. Any literature received by me under such conditions is very quickly relegated to the waste-paper basket.

I enclose my card, and subscribe myself,

Disgusted.

## The Domestic Uses of Electricity.

The recent discussions at the Institution have emphasised, after unsuitable tariffs, chiefly three main factors as acting against the efficient development of the electrical industry, these being inefficient and insufficient advertisement, mutual recrimination instead of co-operation between the supply people and electrical contractors, and the harm that has been and is being done by the sale of apparatus not properly designed or made for everyday use.

It is to be hoped that matters do not end with the discussion or its utility will be doubtful.

Dealing with the last point first, Mr. Vesey Brown's suggestion that no apparatus should be allowed till it had passed what one is tempted to call "the committee for the suppression of electrical development," obviously overshoots the mark, but it contains, I think, the germ of a good suggestion. Without going so far as Mr. Brown suggests, I think it is an opportune time for the Institution to take a leaf out of the book of the R.A.C., and issue certificates of performance of apparatus submitted to them that satisfies them as to its usefulness.

Features it would be advisable to embody would be a description of the apparatus for the purpose of identification, claims made for it, and the results of the Institution tests.

Makers or vendors should not be allowed to advertise the obtaining of the Institution certificate with any claims, other than those tested by the Institution, added. These certificates, therefore, would form a sort of hall mark, rendering the introduction of new satisfactory apparatus easy, and at the same time protecting users from apparatus that will not fulfil its claims.

The case of the contractors and a good part of the advertising problems, it seems to me, might be solved together. The contractors have long been called "unpaid canvassers" to the supply people, and to this I would like to repeat the substance of some remarks made by Mr. Seabrook during the discussion of Messrs. Macfarlane and Burge's paper, which were much appreciated at the time. Referring to the cost of developing and marketing new applications, he remarked that the supply companies might well do more than they did towards this, since they had most to gain—the makers and vendors made only one profit, whilst the supply people obtained a continuous revenue.

Taking the case of the contractor, this means that for every shilling profit he puts in his own pocket, he puts several (say, five) shillings into the pocket of the supply people. To balance this, when the supply people make a shilling profit, do they put five shillings into the pockets of the contractors?

Personally, I think they wish to go at any rate part of the way, but there is the Committee to think of, which bars out most arrangements.

The suggestion I have to make is this:—The electric supply authority to equip and maintain commodious central premises, containing a permanent exhibition of, as far as practicable, every electrical appliance suitable for use on their circuit, with facilities to demonstrate their use.

Essential features it appears desirable to have in the scheme would be, (1) prominently displayed the name and address of every electrical contractor in their area, except any known to be incompetent or to do bad work; (2) no goods to be sold in the Exhibition; (3) when the supply people have a contracting department, this to be kept clear away from the premises, and their officials only allowed in during public hours when with a client, and to have no precedence over outside contractors.

A centre like this could have a much bigger range of appliances than any single contractor could accommodate, and manufacturers would in many cases loan goods which they would not do to individual contractors, and the scheme generally would promote co-operation between the contractors and supply people, which, in turn, would go a long way to removing present differences, which are four-fifths misunderstanding and only one-fifth based on realities, only needing the parties to get together, with a determination to settle the differences, to disappear.

W. E. Burnand.

Sheffield, May 14th, 1912.

## E.A.C. Automatic Solenoid Starter.

I was much interested in reading the description and seeing the illustrations in your issue of the 10th inst., of the new automatic solenoid starter brought out by the Electrical Apparatus Co., Ltd., as for some time past it has been one of my hobbies to attempt to improve this class of apparatus. It is, however, very difficult to hit upon anything which is really novel, because it is inevitable that people working on the same problems should hit upon similar methods of solving them, and I have frequently found that little improvements which I thought were novel have been devised and patented years before. I think that this applies also to the new automatic solenoid starter described, as a precisely similar arrangement is shown in my Patent No. 20,369 of the year 1906, namely, a single solenoid starter in which the main switch is pulled in by a short core at the top of the solenoid, and the rheostat lever is drawn up against the dash-pot by a core at the bottom of the solenoid. This is only one of many arrangements shown in the patent referred to, which you will see is almost six years old.

Frank Broadbent.

London, E.C., May 21st, 1912.

P.S.—The sole manufacturing rights in connection with the above patent were assigned to the Adams Manufacturing Co. some few years ago.

## Colonial References.

May we be allowed the use of your valuable space to corroborate the views put forward with reference to South Africa by "Colonial," in your issue of March 29th.

The trouble, we think, may be said to have started during the time of, or shortly after the close of, the Boer War.

Employers and mine managers were thirsting for electrical men, and anyone who knew, or professed to know, the difference between a voltmeter and a switch was received with open arms, and the choice of many jobs at a minimum wage of £1 per day.

The consequence is that these men have gradually, by dint of perseverance and, incidentally, much damage to their employers' plant, picked up a certain amount of knowledge, and in the majority of cases they occupy good positions with excellent salaries. During the past year or two many trained engineers have been imported from "home" to large power schemes on the Rand.

Dazzled by promises of salaries magnificent compared with the home standard, and the assurance that their lives out here would be made a little "Heaven on earth," they are bitterly disappointed when they learn the real truth of the matter. In some cases the men discover, too



late, that they are being paid less than the standard rate of pay of the mines with very little prospect of any increase. Apart from this they are so hedged about with petty rules and regulations that the vision of South Africa as the "Promised land" quickly fades, and their one object resolves itself into saving a little money and getting away somewhere else as soon as possible. Again, is it fair that men should be signed on for a period of three years, and, after working for some months, should be forced to sign an entirely new agreement rendering them liable to be sacked at a month's notice, with the prospect of being stranded in Africa? Until some change is made in the method of bringing men out here, and in the manner of treating them when they arrive, there will always be a scarcity of trained power station engineers on the Rand.

#### Ex-Contract Men.

The article under the above title in your March 29th number was so evidently written by a young, very young, engineer, that your footnote was quite unnecessary.

It reminds one of the young man who, when he left school, thought his father completely ignorant. As he grew older he acknowledged that his father did know something, and when at last he came to years of discretion he was obliged to admit that the "old man" knew considerably more than he did himself!

Referring to the article by "Colonial," he says: "Many Colonial engineers do not know their work—merely self-taught, and not entitled to be called professional men at all, &c." All pioneers are self-taught.

Who taught Edison, Sir William Preece, F.R.S., Sir John Gavey, in fact all the original leaders in our profession? It is just these self-taught men who teach the younger generation what they themselves, by study and experience, have learnt.

Sir William Preece used to say that the principal object of schools and colleges was to teach their pupils how to instruct themselves, for in all professions one must be continually learning, or otherwise be shortly out of date.

Who were the original chiefs of the electrical world in South Africa? Presidents of the South African Section of the Institution of Electrical Engineers? Men of the writer's time who went out long before telephones or electric light (and possibly "Colonial") were ever thought of. These were the men who introduced the electric light, &c., who were, and are, no doubt, quite up to date.

"Colonial" apparently has a very high opinion of "Home Engineers." We are sure that no one wishes to destroy this good opinion, but to insinuate that they are the *only* engineers, is a little too sweeping.

Conditions in England, a thickly-populated country, are very different from those abroad in new and sparsely-populated countries.

What at first sight appears to a "Home Engineer" to be a very untidy and badly-arranged installation, may be just what is required to meet the case.

Why did the electric light, telephones, and electric tramways go ahead so fast in the United States? Simply because there, as in most new countries, they were not hampered by "Home Engineers," who either would do the work "just so," as they had been taught, or would do nothing at all.

The writer well remembers how horrified he was when he first saw the original arc lighting wires in New York. Telephone wires of the then unusual small gauge, with abnormally long spans, and not a joint soldered, also shocked him, who was accustomed to the high-class English Post Office standard; but this rough work was cheap, and allowed installations to be made and experience gained.

Railways, again, in nearly all new countries, are simply astounding to "Home Engineers." Many times on a narrow-gauge railway here, after running at 30 miles an hour or more round curves of 150 metres radius, over rails merely spiked down, "Home Engineer" friends of the writer have refused to continue the journey beyond the first station, alleging danger. Yet the American bogie engine with a bar frame, which twists about like a basket, continues to run safely over this kind of track. Nowadays English engines are to be obtained built on these lines, but the "Home Engineer" learnt his lesson from the "Colonial."

Where did the three-phase high-tension come from? It was employed and brought to perfection long before "home engineers" appreciated it. In fact, many years ago the present writer recommended it for an installation in which he was interested. His opinion was squashed by some well-known consulting engineers, but at the present day the three-phase, then tabooed, is employed.

"Colonial" recommends examinations as a panacea for his imagined evils. This is a very vexed question, and the writer, from his experience, does not concur with the efficiency of this system. It is well known that many, if not most, famous men would have made a poor figure in examinations. Any man with a good memory can cram and pass with the greatest ease any examination, and yet he may be quite worthless for anything else.

When electric tramways were in their infancy the writer saw all there was to be seen in England, where the best engineers of the day (probably most of whom had passed excellent examinations) were occupied in the work. Everyone knows what troubles arose. Returning to this country (which shall be nameless, as it is of no consequence), the writer saw the installation of a very large tramway system by an American company.

There were specialists for each section of the work, for pole-setting, wiring, rail-laying, &c. Never was work better done according to the knowledge of that time. Everything went like clockwork, no burnt motors, no derailments, no breakdown. The men who did this work were classed by their American compatriots as cowboys! and an examination, as desired by "Colonial," would not only have "weeded out scores," but the whole lot of these excellent men.

The writer has made joints with his own hands over and over again, has cleaned batteries, repaired apparatus of every description, and although consulting engineer to important companies, does not consider that he has "lowered his status" by so doing.

In a new country an engineer should be prepared not only to order work, but also to show how it must be done. The above is not one tithe of what could be written in connection with the sweeping condemnation by "Colonial" of all that is Colonial or foreign, but your space has already been too much trespassed upon.

After a little more experience our friend "Colonial" will, no doubt, give justice where it is due, and will find that in spite of his home experience, he will be able to learn quite a good deal from the self-educated Colonial whose Bible has probably been the ELECTRICAL REVIEW, as it has been since No. 1 to

M.I.E.E.

"Nickel Chrome" has omitted to send his address.

**Co-partnership.**—At the annual meeting of the Labour Co-partnership Association last week, Lord Grey said the events of the last year had forced the nation to realise that it was necessary to set its industrial house in order. The objects of the Association were to secure industrial peace, to promote industrial efficiency to raise wages to the highest point which the industry could afford, and to ennoble and dignify the *status* of the manual worker. He did not claim that co-partnership principles could be at present universally applied, but he did contend that, wherever co-partnership principles were applied under right conditions, the cost of production would be lessened and the possibilities of profit increased to the benefit of the capitalist, the worker, and the consumer.—*Times*.

**Galloways, Ltd.**—According to the *Financial Times*, the affairs of this Manchester firm of boilermakers and engineers have, with the consent of the Deputy Chancellor of the Duchy of Lancaster, been placed in the hands of Mr. Alfred H. Pownall, chartered accountant, of Manchester, who will act as receiver and manager, and carry on the business. "The motion was made, on the application of Sir Frederick Cawley and Mr. Charles Leonard Agnew, on behalf of themselves and all other debenture holders who opposed the prospective issue of £50,000 prior lien debentures. The deficiency on last year's trading is stated to be heavy."

**The Whitsun Holidays.**—THE WALSALL ELECTRICAL CO., LTD., of Walsall, announce that their works will be closed from to-night, 24th inst., until Thursday morning, May 30th, for the holidays.



## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### The "Flotteur" Sight-feed Lubricator.

THE STERN SONNEBORN OIL CO., LTD., of Finsbury Square, E.C., have recently introduced a new sight-feed oil lubricator, which, as regards accuracy of adjustment and precision of lubrication, is claimed to be considerably in advance of anything hitherto obtainable.

The "Flotteur" lubricator depends for its action on the suction of the syphon, which takes its supply from the surface of the oil,

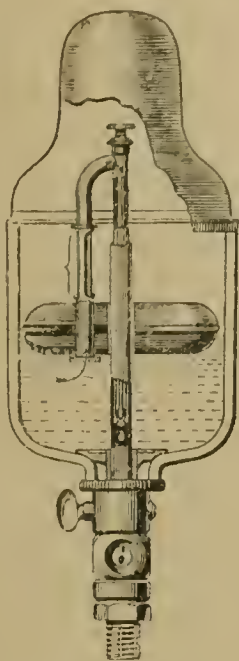


FIG. 1.—"FLOTTEUR" LUBRICATOR.

and is therefore efficient, entirely independent of the height at which the oil may be standing in the container.

The oil flow is regulated by adjusting the suction pipe and size of outflow opening, and a thermoscopic arrangement is provided to make this free of temperature change.

This lubricator will automatically supply a somewhat larger amount of oil when required by the bearings of a machine just starting up; it is absolutely dustproof when closed, and feeds only the clear surface oil, any sediment falling to the bottom of the container.

### "Metallic" Fuseboards.

The distributing board here illustrated is made by the METALLIC SEAMLESS TUBE CO., LTD., of Birmingham; as shown, it is enclosed in an iron case, fitted with independent doors for fuses and

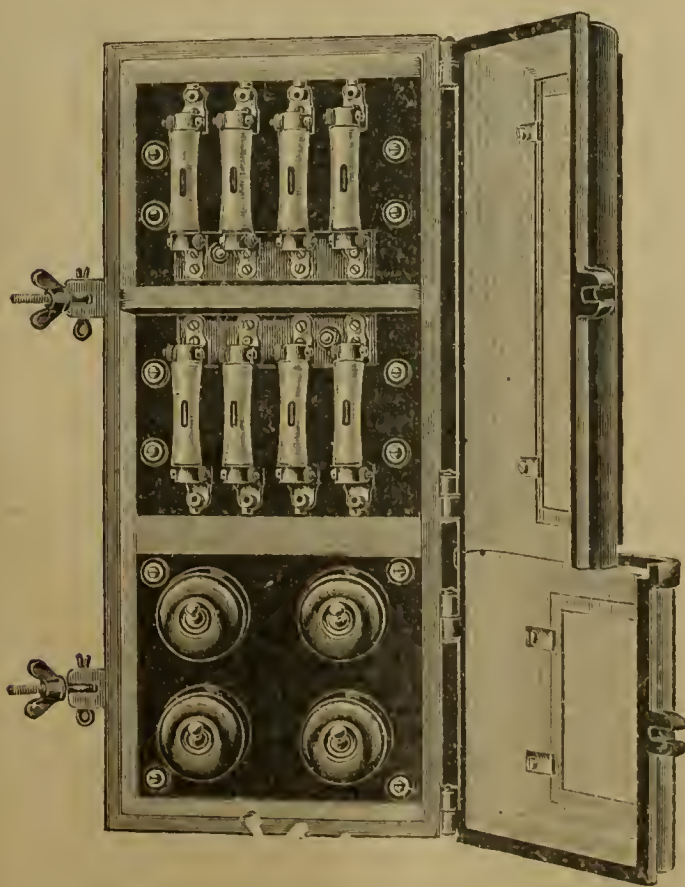


FIG. 2.—"METALLIC" IRONCLAD DISTRIBUTING BOARD.

switches, and is made for two to seven ways, 5 or 10 amperes. Other "Metallic" fuseboards are made in teak cases, with swing-back frames, which allow of ready access to the back of the board for wiring or inspection.

### Solid (Keyless) Muff Coupling.

A new type of detachable coupling has just been introduced by MESSRS. JOHN JARDINE, of Deering Street, Nottingham, and is shown in fig. 3. This coupling is turned bright all over, and has

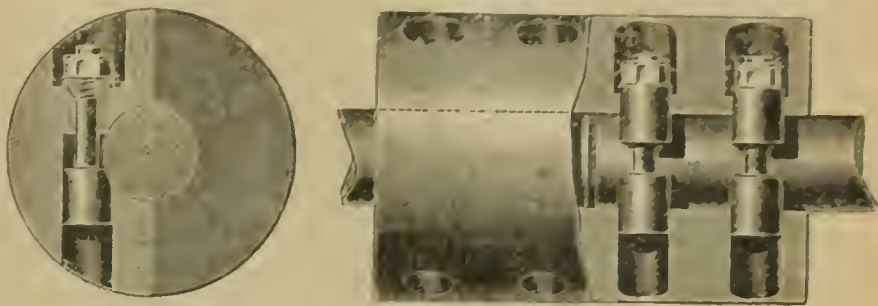


FIG. 3.—SOLID MUFF COUPLING.

no projecting parts, being tightened on to the shaft ends by means of wedge bolts in recessed holes.

Keys and key-ways are not required, and for export purposes particularly, these couplings offer many advantages over the ordinary flange couplings.

### Benjamin Reflector Fittings.

THE BENJAMIN ELECTRIC, LTD., of 117, Victoria Street, S.W., are supplying their patent reflector fittings in two types, giving either concentrated or distributed illumination, and suitable for metal-filament lamps of 50 to 1,000 watts; each reflector is designed for a single lamp which needs no outer globe, as the fittings are



FIG. 4.—BENJAMIN DISTRIBUTING REFLECTOR FITTING.

weatherproof. They are made for outdoor or indoor use, and consist of vitreous enamelled steel. The "Benco" shockproof lamp-holder, consisting of two pieces of vitreous porcelain, with all conducting parts completely enclosed, is used in all the fittings. We illustrate the distributing type, which, with other matters, is described in Section List No. 44, just issued.

**The I.M.E.A. Convention.**—The annual meeting of the Municipal Electrical Association takes place this year at Harrogate, on June 18th, 19th, 20th and 21st inclusive.

Following the civic welcome in the Kursaal on the first day come the presidential address by Mr. George Wilkinson, the borough electrical engineer, and a discussion on "Means for Securing Reliability and Maintaining Continuity of Electricity Supply," introduced by Mr. Frank Ayton, Ipswich. In the afternoon similar discussions on "A Cooking Load from the Supply Station Point of View," introduced by Mr. F. M. Long, Norwich, and "Electrical Cooking Apparatus," introduced by Mr. H. H. Holmes, Marylebone, will take place, this time at the Hotel Majestic, which, we may add, is the headquarters of the Association during its stay. In the evening a reception takes place by the Mayor and Mayoress of Harrogate, followed by a special concert in the Kursaal.

The second day's proceedings take place in Leeds, which will be reached by special train, and include in the morning, at the Albert Hall, the discussion of papers on "The Limitation of Rate Relief from Profits," by Mr. S. L. Pearce, Manchester, and on "Organisation in Electrical Supply Undertakings," by Mr. C. M. Shaw, Worcester, and in the afternoon visits to the Corporation power stations, &c. Later in the evening, the annual dinner takes place at the Hotel Majestic. The third day is given up to visiting Middlesbrough, a special train being provided. The morning will be occupied with discussion on "Automatic Pressure Regulation," a subject to be introduced by Mr. S. J. Watson, Bury, while visits to the works of Messrs. Samuelson, Messrs. Dorman, Long & Co., and the Cargo Fleet Iron Co., a trip on the Tees and an inspection of the local transporter bridge, should more than occupy the remaining daylight hours. An alternative, and much less strenuous, visit is also provided to York, on this day, principally for the benefit of the ladies of the party.

The last day of the Conference is, as usual, given over to the annual general meeting in the morning, and to what should prove weather permitting a delightful trip by road to Ripon, Studley Royal and Fountains Abbey, in the afternoon.



## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**HOLLAND.**—The Dutch Customs Authorities have decided that ignition dynamos or magnetos for explosion motors, imported separately are to be dutiable as instruments at the rate of 5 per cent. *ad valorem*.

**BULGARIA.**—A treaty has recently been entered into between the Governments of Bulgaria and Austria-Hungary, by which the duties on certain Austrian goods entering Bulgaria are to be reduced. As a result of most-favoured-nation treaties these rates will also be applicable to British goods. The following are the reductions on goods of interest to readers of the ELECTRICAL REVIEW:—

	Old rate.	New rate.
	Francs per 100 kg.	
Bowls for lamps, of glass, with metal burners and reflectors, vases and other articles of hollow glass, with ground edges or with single-etched rings	50	30
Lamp glasses, ordinary or crystal bearing marks or not	20	15
Articles of aluminium, nickel, German silver and other metal alloys, even combined with other common materials	300	250

The above duties will come into force as soon as the treaty is ratified.

**RUSSIA.**—A Bill has recently been introduced into the Russian Duma, which proposes to increase the duties on incandescent electric lamps with metallic filaments to 65 roubles per pound (3s. 9½d. per lb.) if mounted, and to 90 roubles per pound (5s. 3d. per lb.) if unmounted. The duties at present levied under Sec. 169 (3) of the Russian Customs Tariff on incandescent electric lamps (30 roubles per pound if mounted, and 60 roubles if without mounting) are to be retained in the case of incandescent electric lamps with carbon filaments.

**FRANCE.**—The French Customs authorities have decided that articles formed of a combination of asbestos and india-rubber are to be dutiable as "other manufactures of india-rubber" or as "manufactures of asbestos," according to kind, whichever classification yields the higher rate of duty. Thus paper, pasteboard, threads and cords of asbestos combined with india-rubber are to pay 70 fr. per 100 kg. as "other manufactures of india-rubber"; whilst plaits, tissues and other wares composed of the same materials are to be dutiable under paragraph 4 of Tariff No. 620 *bis* at the rate of 75 fr. per 100 kg. India-rubber representing not more than 5 per cent. of the total weight of the articles is, however, to be left out of account for the purpose of tariff classification.

**AUSTRALIAN COMMONWEALTH.**—The Customs Authorities have issued the following decisions as to the duties to be levied on certain imported goods:

Slide rails, adjustable foundations accompanying small motor engines	25 % ad val.
Slide rails imported with dynamos	20% or 12½%, according to the power of the dynamo
Machinery or engine couplings	20 % ad val.
Ferodo bonded asbestos (containing wire)	Free

With regard to the certificate (form A) required to be produced for the entry of goods under the British Preferential Tariff, it has been decided that the ordinary signatures of declarants and witnesses are sufficient at the foot of the certificate, the full name of the declarant being shown at the head of the form.

**NOTE.**—The duties quoted above are in all cases those leviable under the British Preferential Tariff.

The Australian Customs authorities have issued a notice providing that parts of any article, machine or appliance shall, although specifically or generically provided for in the tariff as parts, if imported with any such article in a complete or substantially complete state, be classifiable under the tariff heading applicable to such article. Articles shipped in an unassembled condition ready, or practically ready, for assembling, shall be treated as though actually assembled.

**NORWAY.**—Notification has been received at the Foreign Office to the effect that, until further notice, circuit breakers, lamp-holders and plug sockets, are not liable to customs duty on importation into Norway. This exemption is granted by virtue of the provisions of the note to paragraph 393 of the Norwegian Tariff, which empowers the Customs Department to admit free of duty, under certain conditions, machines and apparatus of a kind not manufactured in Norway.

**Colombia.**—The municipal authorities of the town of Santo Domingo have leased a concession to a group of capitalists for the erection and exploitation of a power station and electric lighting plant in that town.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 10,685. "Electrical radiators and the like." C. R. BELLING. May 6th.  
 10,701. "Means for establishing electrical communication between ships and other vessels and the shore." A. G. POSSOLO. May 6th.  
 10,704. "Switches." H. G. C. FAIRWEATHER. (Hart Mfg. Co., United States.) May 6th. (Complete.)  
 10,737. "Arc lamps." C. WEBER. May 6th. (Convention date, May 5th, 1911, Germany.) (Complete.)  
 10,749. "Means for electrically transmitting and receiving messages." A. T. M. JOHNSON, F. H. VARLEY, W. F. C. MICHAELIS, J. POWER and JOHNSON SECRET WIRELESS TELEGRAPH AND TELEPHONE TESTING SYNDICATE, LTD. May 6th.  
 10,753. "Shade carrier and locking device for electric lamps and holders." J. N. MOLLETT and E. E. EDWARDS. May 6th.  
 10,765. "Electric heating elements." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD, J. D. MORRISON and L. H. DAVIES. May 7th.  
 10,766. "Corrugated secondary battery box." E. J. CLARK. May 7th.  
 10,784. "Electric dynamos and motors." W. D. BELL. May 7th.  
 10,791. "Electric light fitting for sewing machines and machines of a similar nature." A. F. FRANCIS. May 7th.  
 10,802. "Electric locking apparatus." W. MITCHELL. May 7th.  
 10,805. "Supporting insulators for electric conductors." E. C. R. MARKS. (H. Reinert and K. Petersen, Norway.) May 7th. (Complete.)  
 10,838. "Switches." H. G. C. FAIRWEATHER. (Hart Manufacturing Co., United States.) May 7th. (Complete.)  
 10,860. "Apparatus for tilting the shade of a pendant electric lamp." L. C. INGRAM and C. E. HUNT. May 7th.  
 10,861. "Sparking plug." L. C. INGRAM and C. E. HUNT. May 7th.  
 10,863. "Transmission of electric energy at a distance without connecting wires and a new system of wireless signalling." R. C. GALLETTI. May 7th. (Complete.)  
 10,869. "Trolleys for electric cars." S. J. VEACOCK. May 7th.  
 10,889. "Electric wire couplings or connections." D. BYROM. May 8th.  
 10,911. "Apparatus by means of which an electric circuit will be automatically closed at any particular telegraphic station by the reception there only of a specially arranged number of and sequence of telegraphic signals sent by wireless or other method and capable of working a relay." W. J. LYONS. May 8th.  
 10,927. "Form of electric fire-alarm apparatus." H. NEAL and E. E. MOORE. May 8th.  
 10,959. "Electric incandescent lamps and lampholders." J. STONE & Co., LTD., and A. C. T. MYERS. May 8th.  
 10,989. "Electric cables." METAL JOINTING Co., LTD., and T. HARDEN. May 8th.  
 10,994. "Sparking plugs." G. E. FORSTER. May 8th.  
 11,051. "Electric switches." A. H. F. PERL. May 9th.  
 11,079. "Electric arc welding." A. P. STROHMENGER. (Addition to 1,274, 1912) May 9th.  
 11,085. "Hoisting and lowering ships' boats from the navigating bridge by electricity." J. GUTHRIE and T. ANGEL. May 9th.  
 11,091. "Apparatus for producing electric oscillations adapted for wireless communication and other purposes." W. DUBILIER. May 9th. (Complete.)  
 11,109. "Means for securing electrotypes and the like upon the cylinders of rotary printing machines." G. M. BROWN and J. MURRAY. May 10th.  
 11,126. "Electrical switches." J. H. WOOLLISCROFT and H. T. BOOTHROYD, LTD. May 10th.  
 11,155. "Electrical incandescent lamp-holders, ceiling roses, or like articles to which flexible conductors are connected." H. E. EVANS. May 10th.  
 11,175. "Apparatus for the control of electric circuits." H. LEITNER. May 10th.  
 11,240. "Mounting electric generators upon the head frame of windmills." A. P. TURNBULL. May 11th. (Complete.)  
 11,252. "Machines for forming filaments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States) May 11th.  
 11,259. "Apparatus for preventing the fraudulent use or theft of electrical energy." M. G. DIAZ and A. A. Y GRESILLON. (Addition to 11,259, of 1908.) May 11th.  
 11,260. "Electric circuit closing devices." NALDER BROS. & THOMPSON, LTD., and A. F. HARRIS. May 11th.  
 11,261. "Graded service automatic telephone system." H. BARON. (G. Heinmann, Germany.) May 11th. (Complete.)  
 11,271. "Process relating to galvanising in a cold state." E. BALLEGEER. May 11th. (Complete.)  
 11,272. "Wireless telegraphy and telephony." J. T. SIBLEY. May 11th.  
 11,279. "Electrical measuring apparatus." W. H. APTHORPE and CAMBRIDGE SCIENTIFIC INSTRUMENT Co., LTD. May 11th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- ELECTRICALLY-OPERATED SIGNALS FOR RAILWAYS. Automatic Electric Block Signalling Co. and R. P. Brousson. 14,148. June 14th.  
 GAS CONTROLLERS, ELECTRIC TIME SWITCHES AND OTHER TIMING DEVICES. G. O. H. HORTSMANN, E. H. HORTSMANN, W. T. EDGAR. 14,825. June 26th.  
 ELECTRIC ARC LAMPS. J. WETTER. (Ges. für Maschinen und Metall-Industrie.) 17,778. August 4th.  
 ELECTRIC SPARKING APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Unterberg and Helme (Firm of). 21,785. October 3rd. (October 11th, 1910.)  
 TELEPHONIC APPARATUS. E. A. GRAHAM. 22,558. October 12th.  
 PERFORATING APPARATUS FOR TELEGRAPHIC STRIPS. F. BELIN. 25,157. November 11th. (Divided application on No. 9,556 of 1911. April 19th.)  
 MEANS FOR COOLING THE ROTOR OF ELECTRIC MACHINES, ESPECIALLY TURBO-GENERATORS. K. J. KORNER. 26,756. November 19th. (January 4th, 1911.)  
 HOLDERS FOR ARTICLES TO BE TREATED BY ELECTRO-DEPOSITION. C. BOIRIC. 28,506. December 18th.  
 ELECTRIC MOTOR CONTROLLERS. T. BARNARD and G. C. EDWARDS. 4,190. February 18th.  
 TELEGRAPH TRANSMITTERS. J. W. MACKENZIE. (American Transmitter and Manufacturing Co.) 10,044. April 25th.



# THE ELECTRICAL REVIEW.

Vol. LXX. MAY 31, 1912. No. 1,801.

## ELECTRICAL REVIEW.

## NE SUTOR ULTRA CREPIDAM.

Vol. LXX.]	CONTENTS: May 31, 1912.	[No. 1,801.
		Page
Ne Sutor Ultra Crepidam ...	...	869
The Diesel Engine ...	...	870
Electrical Engineers in India ...	...	870
Copper ...	...	870
Competition in Germany ...	...	870
A Royal Visit ( <i>illus.</i> ) ...	...	871
Correspondence:—		
Strikes in Australia ...	...	871
Street Lighting and Pole Construction ...	...	872
Proceedings of Institutions:—		
Illumination: Production, Calculation, Measurement ...	...	873
The Illumination of Printing Works by Electricity ...	...	874
Highland Water-Power ( <i>illus.</i> ) ...	...	874
Physical Society ...	...	875
The Diesel Engine from the User's Standpoint ...	...	876
New Electrical Devices, Fittings and Plant ( <i>illus.</i> ) ...	...	877
Legal ...	...	879
In Darkest Africa ...	...	881
Figures Indispensable to Municipal Electricity Supply Works	...	883
Copper Buying and Drawing: The Economy of the Draw-		
Bench ...	...	884
Business Notes ...	...	885
Notes ...	...	891
City Notes ...	...	893
Electric Tramway and Railway Traffic Returns ...	...	896
Stocks and Shares ...	...	896
Share List of Electrical Companies ...	...	897
Exports and Imports of Electrical Goods during April, 1912	...	899
Reviews ...	...	900
Melbourne Suburban Railway Electrification ( <i>illus.</i> ) ...	...	902
Combined Irrigation and Hydro-Electric Power Schemes ...	...	903
Improving the Light Distribution from Metallic-Filament		
Lamps ( <i>illus.</i> ) ...	...	904
The Engineer and the Clerk—A Study in Relative Values ...	...	905
Notes from India ...	...	905
Australian Tramway Companies and their Employés.—IV ...	...	906
Trade Statistics of Egypt, 1911 ...	...	907
New Patents Applied For, 1912 ...	...	908
Abstracts of Published Specifications ...	...	908
Contractors' Column ...	Advertisement page xxiv	

In all departments of business there are certain items of information which are jealously withheld from public knowledge by those whose interests are affected, so far as they are able to do so: in some cases, however, especially in connection with tenders called for by municipal and other public bodies, the facts are recorded on the minutes of proceedings, and are thereby made known to all who care to investigate such matters. Thus the purity of municipal transactions is safeguarded. The questions whether, and to what extent, such information should be scattered broadcast by the organs of the various trades have often been discussed, but with no definite result, as it is usually found that opinion is divided on these points.

The attitude of the technical Press in dealing with the subject is naturally determined in this, as in other matters, by the requirements of its readers and the public welfare; it is obvious that no journal professing to serve the interests of any particular trade would consciously and wilfully publish information detrimental to those interests—such a proceeding would be akin to cutting its own throat—but it is not always easy to discriminate between what is, and what is not, conducive to the welfare of an industry.

When doubt arises in such cases, an Editor naturally turns for guidance to those whose interests are immediately concerned, and adopts that policy which appears to be most fully in accordance with the common good: expressions of opinion, therefore, on the part of those who have a right to speak, are always welcome. Sometimes, however, suggestions are received from others—those who are in no way affected by the issue at stake, and whose intrusion into matters with which they have no concern savours merely of over-assurance.

For example, we recently published the detailed results of tendering for a turbo-alternator—a practice which we have followed from the beginning, and to which no objection has ever hitherto been raised by anyone; we were surprised, therefore, to receive an intimation from a manufacturer of a certain class of *instruments*, that he considered this proceeding “detrimental to trade!” Surely, if any objection is to be taken to an old-established custom, it should come from those who are familiar with the subject, and not from one whose interests lie in a totally different direction—who, in fact, knows nothing about the matter.

As regards the merits of the case referred to, apart from the mode of its introduction, all who are interested in turbo-alternators—makers and users alike—are well aware that the mere statement of the price and output of such a machine by no means affords material for appraising its value: without a knowledge of the details of the specification to which it has been built—of the speed, the power factor, the temperature limit, the guaranteed efficiencies, &c.—it is impossible to form more than a rough comparison between

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: “AGEEKAY, LONDON.” Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The “Electrical Review” is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION  
of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers’ numbers bound, including case, for 4s. each volume. Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY  
(J. A. Berly’s).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill London, E.C.



that machine and one of nominally similar size. In other words, the information is of value mainly, though not solely, to those who took part in the competition for the contract. The same applies to any machine or apparatus specially built according to a detailed specification.

In the case of such things, however, as are made to stock by the thousand and sold "off the shelf," the conditions are different. Everyone then knows precisely what is being sold and can compare the prices to a penny. When this is the case, it may be argued that such knowledge may be misapplied, but even amongst those most intimately concerned with such matters, there will be found to be considerable diversity of opinion.

### The Diesel Engine.

Now that the oil engine is so much in the minds of laymen and of engineers alike, the paper which is printed in abstract in another column may not come amiss, although it contains little which has not been recorded previously by users of the Diesel engine. Mr. Sowter's testimony is that of an unbiased station engineer, who has had personal experience of the various types of plant with which he deals, and it is evident that he has been impressed favourably by the Diesel engine for central-station work, as he is backing his opinion by installing another, and a larger set. Nevertheless, we are not prepared to follow him quite so far as he would take us, as his comparison of the Diesel engine with the gas engine is not sufficiently convincing. The paper would have been more valuable to the prospective purchasers of a prime mover if the author had confined his comparisons entirely to gas and Diesel engines, or had compared steam, gas, and Diesel engines under every heading. As it is, he compares the Diesel engine with a steam engine only here, and with a gas engine only there, with the result that the gas engine, perhaps, does not receive quite fair treatment.

Rightly enough, Mr. Sowter emphasises the necessity for highly skilled and even specialised attendance, as the Diesel engine, although so simple in appearance, depends so entirely upon internal cleanliness and the accuracy of delicate adjustments and clearances, that the type of man who can be trusted with the sole management of a small suction-gas producer and engine, might be a source of catastrophe if put in charge of a Diesel plant of equal power.

The enormous expansion of the Diesel business proves that the popularity and usefulness of this system is not the result of mere interested boosting; and, although the casualties during development are said to have been frequent and serious, there is no reason to suppose that the engine is not now as reliable as the gas engine, which, in its own childhood, had to endure many calamities.

### Electrical Engineers in India.

FOLLOWING upon our recent references to the need for a local section of the Institution of Electrical Engineers in Canada, comes an appeal from a member away in India who keenly feels the lack of facilities for conferring with fellow members in that part of the world. There is, of course, a Calcutta branch, but seemingly the difficulties in the way of holding sufficiently large gatherings have been great, for, reading between the lines of our correspondent's letter, we assume that there has been no effort made to hold a meeting for a long while. Yet it is thought that there are quite 25 or 30 members in Calcutta and many more in other parts of India who ought occasionally to gladly respond to an invitation to confer together. The present outlook has not much of encouragement in it for those who desire to so foregather, for the local honorary secretary, a Government official, who was formerly located in Calcutta, has now, it is said, been permanently transferred to Delhi, the new capital, whence it is hardly likely that he will be able to convene Calcutta meetings.

We recall at least one very useful paper that was read some years ago before a Calcutta I.E.E. meeting, on the

packing of electrical instruments for export to India, and in another part of this issue, our Indian correspondent mentions a subject of considerable local interest (in regard to the effect of extremes of temperature upon batteries), such as might advantageously be discussed together by men who are frequently confronted with the problem on the spot. Perhaps the Institution may be able to do something more than it has hitherto succeeded in doing on behalf of the member abroad—though, if there is not sufficient enthusiasm in Calcutta to continue meetings when once they have been started, we do not know that much can be done from the headquarters in London.

### Copper.

MESSRS. MERTON'S circular shows an unusually large withdrawal from stock for the fortnight ending May 15th. The visible supplies at that date stood at 46,163 tons (for Europe), a reduction of 3,608 tons on the return for the end of April. This is made up of a reduction in English stocks of 1,934 tons, a reduction in quantity afloat from Chile of 675 tons, and a reduction in the quantity afloat from Australia of 600 tons. Rotterdam stocks are less by 250 tons, Hamburg by 492, and French stocks by 399 tons. The supplies from North America were below average, Spain and Portugal distinctly low, shipments from Chile very low, but Australia rather above average (half-monthly returns). The deliveries were low at 18,842 tons. The situation thus tends to higher prices, which, it is rumoured (says the *Financier* of May 18th), are assisted by large forward sales induced by fresh American advices. From the same source we note that the total consumption in Europe has advanced from 393,052 tons in 1909-10 to 497,602 tons in 1910-11, and to 510,597 tons in the past 12 months. The increase on consumption is, therefore, 117,000 tons. The increase in European supplies has, however, only amounted to 23,000 tons in the two years.

The large increase in consumption is attributed to active trade, especially in the electrical industries and ship-building. While this conclusion would appear a perfectly fair one, it will be interesting to see if the activity is maintained in the face of continuous "hold-ups" of national industry.

Turning to countries where the commercial conditions, if a little less modern, are, at any rate, not constantly changing for the worse, we find that Russia, while largely increasing her output of copper, is absorbing practically as much as she mines. The result of the equalisation of the two factors (as noted in an article in the *Financier* for May 21st), is that the market for copper from other sources becomes more limited.

### Competition in Germany.

THE recent meeting of the Bergmann Electricity Works Co., in which the Siemens-Schuckert Works Co. has acquired a large financial interest, was enlightened by Herr von Gwinner, general director of the Deutsche Bank, as to the events leading up to this transaction and the relations existing between the two companies. The director stated that there had been several possibilities of overcoming the ruinous trade competition which had prevailed in the electrical industry through the fault of the Bergmann Co. Either a kind of syndicate could have been formed by the large firms, or the Bergmann Co. could have become associated with one of the leading concerns. The transaction was finally concluded with the Siemens-Schuckert Co., because the latter had demanded the least. The present relations between the two were a kind of syndicate relationship for the prevention of mutual competition of a ruinous character, but it could only be lasting if the other electrical undertakings would join it. Herr Gwinner added that the electrical industry need not be ashamed of forming a syndicate in an age when the Prussian State belongs both to the Potash Syndicate and the Rhenish-Westphalian Coal Syndicate. If, then, these statements represent the opinions of the banking world, it is considered that the question of a syndicate or electrical trust will assume definite shape sooner or later.



## A ROYAL VISIT.

A VISIT was paid by their Majesties, the King and Queen, on May 17th, to the Aldershot power station, which was described and illustrated in the ELECTRICAL REVIEW of May 29th, 1903.

The visitors, who were accompanied by General Sir John French and Lient.-General Sir Douglas Haig, were received by the officer in charge of the electricity department, and Mr. A. J. Mayne, the chief electrical engineer, who explained to his Majesty the technical features of interest in the installation. A complete tour was made of the power station, which since we described it has been extended in order to supply the more distant parts of the camp.

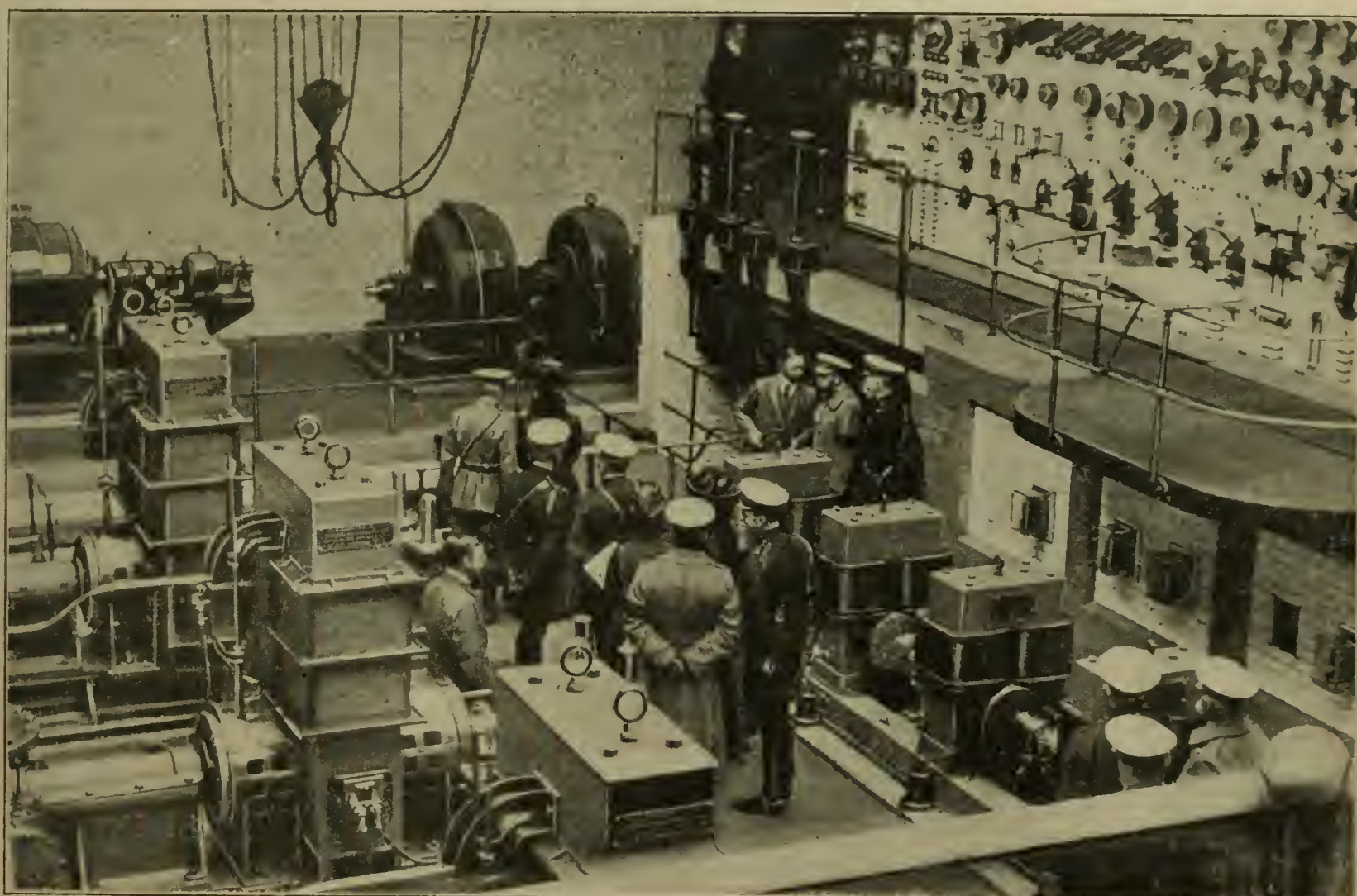
The generating plant consists of three 250-KW. direct-current sets, one 100-KW. set, and one 319 K.V.A. extra-H.T. alternator (turbo-generators), with two motor-generators of 150 KW. The direct-current plant supplies light and power

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## Strikes in Australia.

Your leaders in your issues of March 8th and 15th with reference to the coal strike and compulsory arbitration, are of special interest to us here in Australia, inasmuch as we live in a perpetual atmosphere of strikes, in spite of Arbitration Acts, Wages Boards and similar enactments, and especially are we subject to coal strikes of varying dimensions. Coal miners in N.S.W. are paid by piecework at so much per ton of coal hewn, the hewing rate being on a sliding scale based on the selling price. The selling price is controlled, or was until lately, by a combine known as "The Vend," and has not varied very much for some years. Local



KING GEORGE INSPECTING ALDERSHOT ELECTRIC POWER STATION.

to Aldershot proper, that is Stanhope and Marlborough Lines, and a portion of Wellington Lines, while the alternating plant supplies light and power to Ewshott, Deepcut, Blackdown, the Royal Pavilion, and the Royal Aircraft Factory; the last-named takes power in bulk, being a large consumer. Since its installation the station has supplied electrical power to a very large number of places in the garrison which formerly employed steam. The Mechanical Transport Depot is a big consumer, running all its machinery by electrical power, as also do the Field Stores and Ordnance Workshops, the R.E. Lands yard, with their big sawing and other plant, the R.E. workshops, the Headquarters' Printing Office, &c. The extent of the supply can be gauged from the fact that last year something like two and a quarter million units were generated, a remarkable figure for a station of its size. It is run on a thorough business basis, and affords an eloquent testimony to the up-to-date methods of the present-day military administration.

**Walsall Electric Lighting.**—The T.C. has applied to the L.G.B. for a loan of £10,000 for meters, services, mains, and additions to plant.

strikes, that is to say, strikes confined to one mine, are frequently attributable to causes which in themselves border on the ludicrous. For instance, quite recently a mine was held up for some days because the wheelers objected to work with a certain horse; on another occasion a wheeler getting extra annoyed with his horse, seized a pick and drove it some inches into the horse's rump; the wheeler was promptly sacked by the manager, and his mates equally promptly refused to go to work until the offender was reinstated. The manager retorted by prosecuting the offending wheeler, and secured his detention in H.M. gaol for a month, and the strike only lasted 10 days. We have elaborate Arbitration and Conciliation Acts, Wages Boards, Industrial Courts, and all sorts of legal paraphernalia with the avowed object of preventing strikes, and all are abortive, largely for the reason that they are very one-sided in operation. The Trade Unions, collectively and individually, have no idea of keeping their side of a bargain. There is, perhaps, a trade dispute on a question of wages: a Wages Board is appointed, and duly delivers an award, which award is theoretically binding equally on both parties to the dispute, but actually it is only binding on the employers, as being few in number, and being men of substance, they can be prosecuted and fined for a breach of the award, but the Unions simply flout the



award unless it gives them exactly the terms they originally demanded.

The most trivial matter seems sufficient cause for a strike, as was seen in the recent strike in Brisbane. It commenced with a dispute as to whether the tramcar drivers and conductors should be allowed, when in uniform, to wear openly a badge indicating that they belonged to a Trade Union; the general manager of the tramway company naturally objected to having invidious distinctions made, but agreed that, as several other matters were to be submitted to the Arbitration Court, this question should also be included. The tramway men not being satisfied with this decided to go on strike. Finding themselves being beaten they induced the Trades Hall officials to declare a general strike, forcing everyone in Brisbane, and virtually in Queensland, to participate in a dispute over such a trifling matter as to whether a certain small number of men should or should not be allowed to display an enamelled button. On finding that employers did not, as they had anticipated, immediately capitulate, the strikers, as usual, resorted to violence. But Brisbane, fortunately, had a strong man as Police Commissioner, and a Government with a backbone behind him, and the strikers were met in a determined manner by a strong body of police and special constables.

Processions were absolutely forbidden, and public meetings and inflammatory speeches stopped, and the strike immediately began to fizzle out. The employers' executive assisted materially in making the general strike abortive by refusing to meet the strike leaders in conference. They said truthfully that they were not aware of any trade dispute in which they were concerned, and, consequently, there was nothing to confer about. In the meantime, the tramcar service, though decreased, had never actually ceased, and it continued to improve. Finally, the trade unions by contriving to get a similar dispute as to badges raised on the Adelaide tramway system managed to get the whole matter taken out of the State jurisdiction and brought before the Federal Arbitration Court, the Judge of which has been particularly kindly disposed to the labour side of the question, so much so, in fact, that the trade union officials strain every nerve to make any dispute extend over more than one State, so that the matter can be brought before the Federal Court. The result was as anticipated, and an award was promulgated permitting the tramway men to wear the much discussed badge, and the general strike was declared off (some time after it had been actually dead as mutton). Unfortunately for the tramway men it proved a very barren victory, as, though the Court had given permission for them to wear badges during their hours of labour, they found that they no longer had any hours of labour, as their places had mostly been filled by others who were indifferent on the subject of badges. On a recent visit to Brisbane I travelled a good deal on the cars, but though I looked carefully I did not see a badge.

A strike at Lithgow Ironworks, which has been going on for many months, arose over the dismissal of a man for absenting himself from duty without permission or giving notice; this strike involved directly some 4,000 to 5,000 men, and indirectly many others. The Mount Zeehan strike, which also extended over a long period, was due also to the dismissal of two men; and the Australian Gas Co.'s strike arose from a similar cause. A strike involving the whole of the southern collieries and lasting many weeks was caused primarily by two union men refusing to pay fines which they considered had been unjustly levied by their union. The union demanded their dismissal, and because the mine manager refused to be a party to the dispute, the mine in question closed down, and eventually the whole of the southern mines followed suit, and the northern and western mines were also drawn into the matter. Usually when strikes of such magnitude occur, the primary cause becomes lost in obscurity, as the occasion is seized to make further demands.

The Sydney tramway strike was caused by the dismissal of a conductor found guilty of diverting fares into his own pocket.

One can sympathise with a body of underpaid men striking with the object of getting a fair remuneration for their labour, or to get better working conditions or shorter hours of labour, but such pitiful excuses for striking as we have

had experience of lately in Australia, amount to prostitution of an otherwise worthy organisation and a tyrannical misuse of power.

The minimum wage has been adopted here to the limit, and though the principle appears reasonable, the practice works out badly, mainly due to the fact that the minimum is placed too high. A good tradesman can always command good wages, irrespective of the minimum, but the trouble arises from the fact that the poor or indifferent workman wants the minimum put at such a rate that he also can earn as good wages as a skilled man; further, the minimum is constantly on the increase, with a levelling-down in the amount of work executed per man. If the minimum wage is put at such a rate that an employer has to pay more for an indifferent workman than he should do, he has to balance things by paying less to the good man, that is to say, the minimum becomes the standard wage. If, for example, the standard rate is 10s. per day, then the minimum should be placed at not higher than 7s. 6d. per day, giving an employer a chance to grade men according to their worth. There are plenty of men who know that they are not worth the standard wage, and are quite content to work for less, but under the high minimum standards adopted here, such men find it extremely difficult to get any work at all, as whoever employs them is compelled by law to pay them more than they are worth. In some instances it is permissible to class a man as a "slow worker," and pay him lower wages than the minimum, but the power of granting such permits is placed in the hands of the secretaries or other officials of the unions, and the permit is very very rarely granted, with the result that many men have been forced into the asylums.

Australia, with its Labour Governments, controlled and directed by the Trades Hall, short hours of labour, minimum wages, courts which continually grant preference to Unionists, compulsory Arbitration Courts which are only compulsory on the employers, and shortage of labour, is the Paradise of the *Unionist working man*. The non-unionist is hardly recognised as a human being, and he is not considered as having a right to live.

Arthur C. F. Webb.

Sydney, April 17th, 1912.

#### Street Lighting, and Pole Construction.

I saw in your paper some few months ago that Aberdeen were experimenting with metallic-filament lamps suspended from tramway span wires. At the time of reading the information, we had already had some four months with this, which, I believe, is a new form of suspension. All the side streets and less important streets in Ballarat are gas lit. Owing to the exceptional width of our streets here, and the fact that the majority of the roads have avenues of trees down them, lighting by gas lamps positioned on the pathway is a difficult problem, and the results far from satisfactory (our main streets are 200 ft. wide, and our side streets 99 ft.). By positioning the lamps centrally over the road, and also at street intersections a very satisfactory form of street lighting has been obtained. We use 50 and 100-c.p. Pope lamps with enamelled white shades of parabolic shape for throwing out the rays to a far distance. In the case of tramway span-wire construction, the lamp fitting is clamped on to the span-wire about 18 in. from the trolley wire, and at intersections special span wires are run for the suspension of same. I anticipated we might be troubled with the lamps fracturing owing to the amount of vibration and movement on the lamps. This has not been our experience. The first experimental section have been up some eight months, and the fractured lamps have been remarkably few. The Pope lamp is a mechanically strong one, and I have every reason to believe we shall obtain a life similar to that in lamps burning under normal conditions.

*Pole Construction.*—I was interested in reading the articles in your paper entitled "Wood and Concrete Poles in Electric Service," by Mr. W. Manktelow, on February 2nd last. It may interest your readers to hear of a combined wood and concrete pole, the invention of a local resident in this town. We have a number of these poles in use for arc lighting purposes, which have been up some five years, and



the Postal and Telegraph Department have been experimenting with these as well. We are at the present time erecting some more of them. I can, perhaps, describe these best by sending you the enclosed pamphlet, which gives an illustrated description of these poles and copies of tests that have been made on them.

P. J. Pringle,  
Engineer and General Manager.  
THE ELECTRIC SUPPLY CO. OF VICTORIA, LTD.

Ballarat, April 23rd, 1912.

[The suspension referred to by Mr. Pringle has given very satisfactory results at Barrow-in-Furness, where it was introduced by Mr. H. B. Burnett (see ELECTRICAL REVIEW, May 3rd, 1912). A description of the composite pole appears elsewhere in this issue.—EDS. E.R.]

## PROCEEDINGS OF INSTITUTIONS.

### Illumination: Production, Calculation, Measurement.

By J. D. MACKENZIE.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Glasgow, March 19th, 1912.)

THE function of all light is to make visible; to illuminate surrounding objects so as to excite the visual faculties of the onlooker. The advent of the metallic-filament lamp has caused the general use of larger units and more brilliant illumination. Whether this is or is not a matter for unalloyed satisfaction, the intensely brilliant light sources now at our disposal should only be applied where there is a knowledge of illuminating engineering to arrange them properly and offset the obvious disadvantages attending their use. There is no doubt that the alarming increase in ophthalmic complaints is to a certain extent due to improper lighting arrangements.

We come far short of the possible efficiency in light production. When it only requires 0.05 to 0.1 watt per candle-power to produce light, the tungsten lamp giving 1 C.P. per 1.25 watts, has only a possible efficiency of 4 to 8 per cent. The attainment of very much higher efficiencies from incandescent solids is scarcely to be expected owing to the long range of invisible heat vibrations at the one end and invisible ultraviolet vibrations at the other end of the spectrum. Tests of the light efficiencies for the mercury arc give values from 5.8 to 17.6 per cent. The fire-fly and glow-worm have a lighting efficiency of practically 100 per cent., and the production of light with an efficiency approaching this figure is the problem still awaiting solution.

For interior lighting, the maximum candle-power should be obtained at an angle of about 45° on each side of the vertical. For lighting of streets and open spaces, the maximum should be at about 10° to 20° from the horizontal. To direct the maximum light rays in the desired direction is the purpose of reflecting shades and refracting globes, such as the Holophane globes, and it is possible, by the correct use of these devices, to obtain any required result, and to modify an unsuitable polar curve into a useful and effective one. One point essentially necessary is that all light sources should be screened from direct vision. This should preferably be done by enclosing globes or white backing reflectors which do not unduly absorb the light. The eye adjusts itself to the brightest spot in the field of view, and if this bears a great disproportion to the minimum illumination (that is, if the diversity factor is very large) the iris opening may not be great enough to permit of proper vision. An apparent gain in illumination is obtained by substituting an obscured lamp of the same candle-power for a clear one. One-third of the light flux may be absorbed in passing through the glass in the obscured lamp, and still the increased pupil area enables one to obtain a better visual effect than with the clear one. An important point is that all such articles as the Holophane globes and reflecting shades should be readily accessible for cleaning purposes; a very little dust will make a very great difference to the resulting illumination.

There is still much necessity for a properly designed inner globe for arc lamps. A reduction in the luminous intensity at angles up to 20° from the vertical, and throwing the maximum intensity at an angle of about 80° from the vertical, would result in a decreased height of lamp with a more uniform illumination. At the same time, intense light sources, such as arc lamps, should not be placed too low. With an arc lamp placed at a height of 20 ft. from the ground, the direct rays reaching the eye of the man about average height would be from 5 to 16 times the horizontal illumination at the same place. Hence it follows that high-power sources should be placed well up out of the range of ordinary vision. This is where the advocates of low-power sources, placed at moderate heights and spaced more closely, score.

The table gives a series of values obtained in gas and electrically-lighted streets in Glasgow, from which you will notice that some of the values obtained are very low, and indicate what is the usual standard obtained in ordinary gas-lighted thoroughfares. The readings were taken with the Trotter standard photometer made by

Messrs. Everett, Edgecumbe & Co. It is a matter for surprise that there are so very few thoroughfares lighted by lamps placed centrally. Lamps suspended from steel cables stretched across the streets are quite common in Continental cities, and give a very fine lighting effect. There is a good deal to be said in favour of this method of lighting; the footpaths are left quite unhampered, and the roadway is also quite clear of any objectionable posts with the accompanying islands of concrete surrounding them. And the roadway is nowadays the part most requiring illumination. The large increase in fast vehicular traffic on main thoroughfares in our cities demands more and better illumination, and therefore, instead of having values of the order 0.01 ft.-candle at the centre

Illuminant.	Distance.	Hor. illumination.	Direct illumination.	Calculated equiv.
Single vertical gas mantle on post approximately 10 feet high (street without much traffic).	39 ft.	—	.01	16 C.P.
	19½ ft.	—	.06	25 C.P.
	10 ft.	.05	.14	20 C.P.
Double vertical gas mantle (busy main thoroughfare).	40 ft.	.005	.03	48 C.P.
	30 ft.	.01	—	—
	20 ft.	.05	—	—
	10 ft.	.21	.425	63 C.P.
Single 100-C.P. M.F. lamps with reflectors (as above).	33 ft.	.01	.07	78 C.P.
	26½ ft.	.1	.28	89 C.P.
	9 ft.	.39	.625	80 C.P.

of a roadway, it ought to be at least 10 times that amount. The principal objection probably to suspended lamps is the difficulty of cleaning and trimming, but this can easily be overcome.

There is one point affecting street lighting which ought to come within the statutory powers of municipal and burgh authorities; that is the right to regulate the intensity of outside illumination provided by shopkeepers for their business purposes. The author would suggest that a limit should be placed on the maximum illumination.

A very simple method of suspending street-lighting fittings over the roadway has been developed by Mr. H. B. Burnett, the electrical engineer for the County Borough of Barrow-in-Furness, and is peculiarly applicable in the case of lighting required along tramway routes.\*

While the calculation of illumination is generally a very tedious operation, the measurement has been made a very simple matter. A great deal of ingenuity has been expended on the design and construction of portable instruments, and the uses of such are obvious. If a complaint is received by the electricity department that a consumer cannot read his evening paper owing to the poor supply given in the evening, it is quite a simple matter for the illumination expert of the department to set himself down for the time being on the complainer's chair and take an illumination reading. If he is wise, and has provided himself with a new lamp to substitute in the electric fitting he may be able, by taking a second reading, to prove that the lamps are old and ready to perish, and that the supply is all in order. To the canvasser and the contractor such an instrument should be a valuable aid. A reading taken with the existing lighting compared with a value likely to be obtained with the suggested improvement would go far towards convincing a wavering client. As to the measurement of illumination on streets and open spaces, it is evident that if a screen is placed horizontally it will receive illumination from all the sources in the neighbourhood, and hence it gives a measure of the total illumination. The "Westminster" method of measuring street lighting is by taking two readings with the screen pointing directly to the source of light and at angles of 20° and 50° from the horizontal.

The human eye takes in a very wide field, and the visual effect is not measured by either of those methods. I think that a visual effect photometer could be constructed having a lens of approximately equal field to the human eye, receiving light from all the sources in the field of vision and illuminating a screen which could be balanced against a known illumination. This would give, I think, a more accurate idea of street illumination than any photometer at present on the market.

#### DISCUSSION.

MR. S. Z. DE FERRANTI said Mr. Mackenzie had shown them the wonderful possibilities there still were in the way of improving the efficiency of a light-giving source, especially in lamps. Notwithstanding this, it was a very doubtful question how far it was desirable to improve the efficiency of illumination. They might be paying too dearly for this increased efficiency. At present the price of electrical energy was nothing like a reasonable value. What they wanted was something as nearly approaching sunlight as possible, and if that was less costly, as it probably would be in time, that was the form of lighting that the public would want because it suited them best. They might have to look for the equivalent, the higher equivalent of efficiency, in the cheaper supply of energy, and he thought that would be brought about in a much greater degree as time passed. It was very different with gas, which had very much settled down upon what might be termed bed-rock prices, while with electricity this was not so. The cost might not drop to any great extent, but nothing had yet been done with by-

\* The author's description of this system was reproduced in our issue of May 3rd, page 734.—EDS. E.R.



products recovery. That went to show that without any increase in the efficiency of the light source itself, they might have electric light at an immensely lower price than it stood at to-day.

MR. W. W. LACKIE thought Mr. Mackenzie was wrong in what he said about the increasing amount of ophthalmic cases. This increase was only apparent because it was shown as the result of medical examination of school children and others. He did not agree that they should object to people putting arc lamps along the outside of their premises. They would never get a glare from arc lamps that would be greater than the glare of the sun. There had been great advances in street lighting recently.

MR. ROBERTSON (Greenock) said that the subject was one which had not received anything like the attention it ought to, and that was largely owing to the fact that most electrical contractors fell into the practice set by gas before their time. In Glasgow they found naked metal-filament lamps in a row in shop windows. With gas they concealed the lamps in a window behind a screen and saw the goods to the best advantage and without any strain to the sight. In house lighting the same thing prevailed. It was thought the proper thing to hang the light in the centre of the room, with the light 8 or 10 ft. from the floor; the right way was to illuminate the ceiling with lamps concealed in glass bowls or reflectors. They often found that the architect knew little about the fitting-up of a building with electric light; he was more concerned with the appearance of the place than with the lighting effect. The whole principle upon which architects proceeded in illuminating buildings was erroneous. Now they were up against keener competition in street lighting through high-pressure gas lighting, which was no doubt a very strong competitor. With ordinary pressures they had not much to fear with the latest metal-filament lamps. He was quite at one with Mr. Mackenzie in desiring some regulation in the shop-lighting by shopkeepers outside their premises. This was becoming something of an evil, and the authorities would have to deal with it.

MR. MCWHIRTER said he was forced to the conclusion that the question of proper installation and distribution of illumination was one of the most exacting sciences they had to deal with.

MR. J. S. NICHOLSON agreed that it was a most important thing to isolate as much light as possible in shop windows from the eyes.

MR. MACKENZIE, in reply, said the President spoke about the ideal light as one which would approach nearest to sunlight, but suggested that it would be more costly; he thought, however, it would be cheaper in the end, for the human eye was more accustomed to sunlight, and there was a factor acting upon the visual nerves at the point where the yellow waves at their maximum approached to sunlight. That was the very light which, if they could get it, and get rid of the reds above and below it, would give them the best and cheapest form of lighting. He agreed with Mr. Robertson's remarks about concealed lighting for shops and houses, with the remarks made about the planning of lighting schemes by architects.

### The Illumination of Printing Works by Electricity.

By JUSTUS ECK, M.A., M.I.E.E.

(Abstract of paper read before the ILLUMINATING ENGINEERING SOCIETY, on March 19th, 1912).

The object of this paper is to give some indication of the requirements of the industry and to endeavour to find the most economical method of dealing with them.

The measurements given in the paper are mostly taken in newspaper printing works where the work is mostly done at night, and where time is the very essence of the business. Other important factors have to be considered, such as safety both to the person and against fire, absence of heat and moisture, non-contamination of the air, freedom from glare, ease of supervision of machines and operatives, correctness of colour-discrimination, and absence of eye-strain, but in many cases other factors have militated against proper consideration being given to them. In the hand-composing room, increased illumination without glare or perceptible increase in the air temperature had not only resulted in more rapid output, but also in improvement in the eyesight of the compositors. One important printing firm stated that they had not only decreased their lighting bill this year by over £500, but they had contemporaneously increased their output by nearly 40 per cent. Linotype machines require a good illumination on the copy, less on the keyboard, and a very powerful illumination on the matrices just before they reach the casting-box, for which purpose an adjustable lamp is brought to within a few inches of the matrix receptacle, a method of lighting which seems to me to be capable of improvement by means of a suitably-designed reflector. Average values were: matrix box, 25 foot-candles; copy, 8.3; keyboard, 4.3.

For Monotype machines a considerably lower illumination is usually provided: copy, 5.4; keyboard, 3.7; instructions, 4.2.

On the Monotype casting machines the averages were: type-face, 2.75; reel-face, 3.9; galley bench, 5.0 ft. candles.

With the skilled compositor the selecting of the type is largely automatic, the operation requiring most light being the reading of partially illegible matter and the checking of the set-up work. The cases of type in use are generally placed: One, more distant, on the slant, and one horizontal, or at a less angle, close to the compositor; when glow lamps were used, one lamp per man was usually the allowance. On slanting cases the average with glow lamps was 7.4 ft. candles; with inverted arc lamps 6.8, and with mercury vapour lamps 4.7, while on the horizontal case the figures were 5.3, 10.5 and 7.3 respectively.

In the composing room many other operations besides typesetting are conducted, such as the assembly of advertisements and miscellaneous matter on horizontal tables called random benches, and the finished work is assembled in formes ready for passing to the press or casting room.

On random benches the average illumination was about 7 ft. candles, and on imposing benches 6½.

For the purpose of comparing the efficiency of illumination over an area, the number of watts per foot-candle measured at a standard height on a horizontal surface per sq. ft. has been taken. Values found were for glow lamps 35, for inverted arcs 24, and for mercury vapour lamps 3 watts per foot-candle per sq. ft. It is only necessary to multiply this by the area in square feet and the average number of foot-candles required, to obtain as a product the watt consumption.

To arrive at the actual cost per hour, the figure must be multiplied by the cost per watt-hour, to which must be added the depreciation and repair cost per hour, together with, in the case of arc lamps, the cost of carbons and trimming, and in the case of metal-filament lamps, the cost of renewals and cleaning. These figures cannot be stated except for individual cases, but they may be taken to be in proportion to the watt consumption.

In some composing-rooms using metal-filament lamps improvements were in hand in the direction of using Holophane or similar prismatic directive glass shades.

Actual measurements of the improvements effected by the prismatic glass reflectors were made:—

	Ord shade.	Holophane.
1. Make-up table ... Average ft.-candles, 4'8	4'8	8'0

These measurements are the mean result obtained upon the same table with the same lamps fixed at the same heights.

	Between Lamps 1.	Between Lamps 2.	Between Lamps 3.
2. Random table.			
(a) Ordinary shade	17	3'4	11
(b) Holophane ...	7'0	6'0	7'0

In case (a) there were three lamps in the row, while in case (b) there were only two lamps, so that, with a far more even and quite sufficient illumination, slightly more than half the number of lamps in a long row would be required; in this case there was an actual saving of 33½ per cent. in the energy consumption.

	Ord. shade.	Holophane.
3. Examining tables.		
Max. ft.-candles ...	8'0	9'2
Average „ ...	5'2	8'0
Minimum „ ...	2'1	6'8

In this case the energy consumption was the same, but the mean illumination was raised by the prismatic shades to the maximum before obtained, whilst the minimum was improved over threefold. Similar improvements were in another case obtained by the employment of the Benjamin steel reflectors.

For high-speed rotary presses powerful lamps giving good diffused general illumination are preferred, aided in the interior of the press by additional lighting, usually obtained from one or two carbon-filament lamps.

It may be taken that not less than 2½-ft. candles is anywhere satisfactory for a high-speed rotary press.

Flat-bed presses require an average illumination of about 5-ft. candles on the working plane.

Presses for two and three-colour work need not only a good illumination of not less than 5-ft. candles, but attention must be paid to the spectrum of light resulting from the source used, in order to obtain the best results.

In large despatching rooms the efficiency was 0.3 watt per ft.-candle per sq. ft., with an average illumination on floor of 2.1 ft.-candles.

In most places I have visited and measured there is room for improvement, which would in some cases take the aspect of a saving of current, and in other cases of rendering the illumination more even and in accordance with the requirements of the average user, thus producing better and greater output in a shorter time. Many operatives working with an ample supply of indirect lighting, approximately white, have found their eyesight improve to such an extent as to enable them to discard their spectacles.

### Highland Water Power.

IN a paper recently read before the INVERNESS FIELD CLUB, by MR. A. NEWLANDS, M.Inst. C.E., on our sources of power, attention is drawn to the resources of the Highlands of the North and West of Scotland. No other part of the country, says the author, can offer equal possibilities.

This part of Scotland has the greatest extent of elevated area and the greatest rainfall, with the possible exception of Cumberland, in England. In many parts of Scotland the rainfall amounts to 60 in. per annum, and it has the further advantage that the rainfall is fairly uniform throughout the year. This maximum rainfall coincides as a rule with the areas of greatest elevation, and in these areas there are many fine natural reservoirs in the form of Highland lochs, with a rapid and short fall to the sea. A further advantage is that, particularly in the North and West Highlands, these drainage areas are all near the seaboard, which again is so indented and sheltered as to afford peculiar advantages for access by shipping, and the country generally is well served by railways and roads.

Already works have been installed at Foyers and Kinlochleven, the former developing 7,000 H.P. and the latter 30,000 H.P. Many smaller installations are scattered over the north and west.



To utilise the water power possibilities in the Highlands to the best advantage it is necessary that each entire drainage area should be developed up to its maximum output as one complete unit, for it is in the large installations that the maximum efficiency and economy is got.

The Kinlochleven installation shows what can be done by the application of this principle of generating in large units. The drainage area is the relatively small one of 55 sq. miles, but it had no natural reservoir within it, so that the expense of constructing a dam of a maximum height of 86 ft. and of a length of 1,037 yd. had to be faced. The reservoir, probably the largest artificial one in Europe, has a length of  $7\frac{1}{2}$  miles and an average width of about  $\frac{1}{2}$  mile. It impounds about 20,000 million gallons of water, sufficient to give an output of 30,000 H.P. for about 100 days. The cost of the work was £600,000, or equal to £20 per H.P.

With the exception of its high elevation (1,065 ft.) and heavy rainfall (70 in. per annum), the Kinlochleven area is not more favoured than many areas of greater extent throughout the West and North of Scotland, and in many of these the expense of a dam would be unnecessary, owing to the presence of natural reservoirs or lochs in most of them.

These power possibilities ought to be looked upon as a national asset, and as such should be developed by Government assistance, and probably this could best be done by the appointment of a Royal Commission to examine and report on them.



SOME UNDEVELOPED SCOTTISH WATER-POWERS.

Electric power from water has been publicly advertised for sale as low as 30s. per horse-power per annum. Probably the following figures from the ELECTRICAL REVIEW of a few years ago may be a fair comparison of the minimum cost of power from various sources:—

Electrical horse-power-year from water in				
Switzerland	...	...	...	£1 19 0
Steam in England	...	...	...	4 11 8
Blast-furnace gas in Germany	...	...	...	4 1 7
Producer gas in England	...	...	...	5 0 0

A comparatively recent estimate showed that the quantity of power obtainable from water in Great Britain amounted to about 1,000,000 H.P.

If the rainfall from its 700 square miles of drainage area were retained in Loch-Ness by controlling the overflow into the river, it would be possible, by utilising the Caledonian Canal as a flume or conduit, to convey the stored water to Inverness, to utilise it there for the development of 3,000 H.P. during the working days of the year, and yet supply sufficient water to the river to maintain its normal summer flow.

The Loch-Luichart drainage area is a very attractive one for power purposes. Its area is 149 square miles, and the loch has an area of 176 square miles, say, 1,150 acres. The river flows out of the loch in a series of cascades, and falls 125 ft. in a length of 850 yards. On a 75 per cent. efficiency, and dealing with half of a 42-in. rainfall as available for power, 1,580 H.P. on a 24-hour power day could be developed. This will be fully 3,000 H.P. for a working day, and even if no water flowed into the loch for six months a sufficient quantity of water could be stored to give this quantity of power for six months by raising the level of the loch 36 ft., and the water would all be returned to the river again within

half-a-mile of the loch. The raising of the loch could be very easily done, as the outlet is through a narrow rocky gorge. The power could be taken to Inverness by a high-voltage transmission line. The cost of the necessary pipe lines, generating plant, buildings, and transmission line to Inverness, but excluding water rights and way-leave, would probably amount to £40,000. Even 1,000 H.P. used industrially would provide employment for 3,000 workers in Inverness, representing an increase in the population of probably 15,000 people, and with the fine facilities for shipping, and the abundance of open ground on both sides of the river mouth suitable for factory sites, and readily accessible by railway, the town is in an eminent degree suitable for such an industrial development.

The accompanying map may be found useful as indicating a number of localities where power is available, and the approximate amount of such power; it is in no sense a complete list.

The horse-power figures noted on the plan represent what is available for 12 hours' daily continuous working, it being assumed that it is possible to impound or store  $\frac{2}{3}$  of a 42-in. rainfall, the remaining  $\frac{1}{3}$  being reckoned as lost by evaporation and absorption in the ground, and any rainfall above 42 in. per annum being reckoned as lost in flooding or in compensation water to the rivers.

Scotland is estimated to possess 1,000,000 H.P. obtainable from water, and even if the figures be put at one-half that amount, this would represent an amount of power on a 10-hour working day basis throughout the year equal to that obtained from  $3\frac{1}{2}$  million tons of coal, which is about one-twelfth of the total quantity raised in Scotland for 1911, and of this quantity only a small proportion is converted into power.

### Physical Society.

At the meeting held on May 10th, a paper on "The Generation of Electricity by Carbon at High Temperatures," by DR. J. A. HARKER, F.R.S., and DR. G. W. C. KAYE, was read by Dr. Harker.

The experiments described owe their origin to some contamination phenomena which were encountered when tubes of refractory rare earths were baked in carbon-tube resistance furnaces at temperatures from 1,500° C. upwards. It was found that the tubes often had their outer surfaces carbonised to an appreciable depth, while the inner surfaces, though freely exposed, were much less attacked. The blackening was presumably caused by particles shot from the carbon walls of the furnace with velocity high enough to penetrate the refractory material after crossing a few millimetres of air at atmospheric pressure.

The preliminary experiments on the nature of these particles were carried out by the use of two insulated exploring electrodes of carbon inserted into an alternating-current furnace. They were connected externally to a battery of cells, and the potential-current curves were determined for the electrode gap in the furnace at a number of temperatures. No appreciable current could be detected at temperatures below about 1,400° C., but as the temperature rose it was found that quite small E.M.F.s gave rise to steady currents of relatively enormous magnitude. For example, with 8 volts, currents up to 10 amperes have been obtained at a temperature of about 2,500° C. The relation between current and temperature was found to be of an exponential character.

The magnitude of the currents made it evident that the atmosphere of the furnace was ionised to an unusual degree at high temperatures, and the authors were led to try the effect of temperature alone in the absence of any applied potential. Accordingly the battery was cut out, and while one of the electrodes remained stationary within the furnace the other could be suddenly displaced to a colder or hotter part of the furnace. The resulting difference of temperature manifested itself as a transient current in the circuit, which in some cases amounted to 2 amperes. The current died away when the two electrodes attained the same temperature.

In the apparatus shown the movable electrode was moved in and out of the hot region of the furnace by means of a clockwork mechanism. The pulsating electric current thus produced was large enough at high furnace temperatures to light up a nest of small glow lamps, the illumination waxing and waning as the movable electrode moved in and out. The experiment has been modified in later work by keeping both electrodes stationary and water cooling one of them. The cold electrode was made of a brass tube, which in some cases was provided with a carbon sleeve. A continuous current can thus be generated. Its direction is such as would be produced by a discharge of negative particles from the hot electrode. As before, no potential is applied. At the lower temperatures small positive currents have also been detected; at high temperatures negative currents up to nearly an ampere have been measured. The whole of the experiments were conducted at atmospheric pressure and almost entirely with low-voltage alternating current furnaces.

In reply to the discussion, DR. HARKER stated that the effect was not chiefly a chemical effect, as it was the same whether the gas in the furnace was H<sub>2</sub> or N<sub>2</sub>, nor did it matter what the carbons were made of. Specially pure carbons gave phenomena of just the same order of magnitude.

DR. KAYE, in reply, stated that the feature which differentiated their experiments from others was that the effect occurred at atmospheric pressure and not *in vacuo*. It was hardly likely at this pressure that the effect could be confined to electrons, as the mean free path of such would be very small. The effect might be due to the transference of carbon itself, probably in ultra-microscopic particles and not molecules. When a cold tube was used for one of the electrodes it was found in half an hour to be coated with a deposit of carbon. There was no likelihood that the effect would



decay with the time, as it had been kept constant for over three hours. It was also not necessary to use electric heating in the furnace. Heating by Thermit and Méker gas furnaces gave the same results.

A paper by MR. S. BUTTERWORTH on "A Method of Measuring Small Inductances" was read by Mr. A. Campbell.

The author shows how Anderson's method may be modified so that, while still retaining the usual standards of capacity, very small inductances may be measured. The conditions of maximum sensibility are indicated and experimental results are quoted in which an inductance of 20 microhenries is compared with a capacity of 0.1 mfd.

A paper on "The Conversion of Starch into Dextrin by X-Rays," by H. A. COLWELL, M.B., and S. RUSS, D.Sc., was read by Dr. Russ.

### The Diesel Engine from the User's Standpoint.

By WM. J. U. SOWTER, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Dublin, April 18th, 1912.)

It is the intention of the author to discuss the matter from the user's standpoint, quoting as far as possible results obtained in actual practice.

The quantity of cooling water required is considerably less than that required by suction-gas or steam plants. With an inlet temperature of 50° F. and an outlet temperature of 140° F., about three gallons per B.H.P. are required. Taking the case of a 250-B.H.P. engine, and assuming the loss due to evaporation and leakage to be 10 per cent., the cost of water at 6d. per 1,000 gallons will amount to 0.45d. per hour. It is apparent, therefore, that generating stations using Diesel engines can be located in populous districts, removed from rivers or canals, if a town water supply is available, and the cost of cooling water will be a negligible item. This may result in a considerable reduction of the cost of the distributing system.

The standard fuel is crude Texas or Roumanian oil, which may be purchased at prices ranging between 35s. and 70s. per ton, the price being lower near large ports. The oil can be purchased in London at about 40s. per ton, while in Bray (Co. Wicklow) the present price delivered into our tanks is 58s. 6d. per ton.

The following is a specification of a suitable oil which the author has adopted with satisfactory results:—

1. The oil shall be crude, refined, or a residue of petroleum.
2. It shall be free from tar, bitumen, or solid hydrocarbons, sand, fibrous matter, or foreign solid impurities.
3. The oil shall not contain more than one-half of 1 per cent. of water, nor 1½ per cent. of sulphur, and shall be free from acid.
4. The viscosity shall be such that the oil will flow in a continuous stream with 1-ft. head through a ½-in. copper pipe 6 ft. long without being heated.
5. The calorific value shall not be less than 18,000 B.T.H.U. per lb.

Many other liquid fuels may be used, such as residue shale oil, gasworks tar oil, or creosote oil. There seems every probability that the market for oil is now fairly settled.

There is but little difference in fuel consumption per B.H.P.-hour between large and small Diesel engines, nor does the fuel consumption increase largely per unit of energy as the load is decreased on the engine. It is well known that a large steam engine running at light load is grossly inefficient, the fuel required to maintain steam pressure in the boilers and to run the engine light, together with the necessary auxiliaries, being out of all proportion to the work done; also, a small steam engine requires many more pounds of steam per H.P. to run it fully loaded than does a large one. Stand-by losses, which are very great with steam plants, are absolutely non-existent where the Diesel engine is used.

The following figures, for which the author vouches personally, show the cost of fuel in pence, per unit generated, with oil at the prices mentioned, and at various loads, for a 50-B.H.P. engine coupled to a 33-KW. generator:—

Load.	Dynamo efficiency.	Price of fuel per ton.			
		40s.	50s.	60s.	70s.
Full ...	88 %	0.161	0.201	0.242	0.281
Three-quarter	86 %	0.178	0.210	0.252	0.295
Half ...	83 %	0.208	0.261	0.314	0.365
Quarter	78 %	0.307	0.384	0.462	0.538

On larger plants the costs would be some 10 to 20 per cent. better, depending upon the size of the plant.

Steam plant, if not properly maintained, becomes more and more uneconomical as time goes on; still, the plant continues to run as though all were in order, but with an increased fuel consumption; on the other hand, internal combustion engines—and particularly the Diesel engine—must be maintained in thorough good order, otherwise there will be great difficulty in getting them to run at all; therefore, those in charge of such plants are bound to see that they are carefully attended to. This characteristic of the Diesel engine is a valuable one. In small steam-driven stations it requires constant supervision and a certain amount of labour to keep a strictly accurate record of the fuel consumption day by day. With a properly arranged station where Diesel engines are employed the fuel consumption may be ascertained with absolute accuracy hourly if desired, and thus it may be said that the plant is always under test.

The capital cost of a Diesel engine direct-coupled to a generator is considerably greater than a gas or steam-driven generator of similar capacity, but when the cost of complete plants, comprising

either gas or steam, are compared, there is but little difference in the price per kilowatt. A Diesel station, however, requires less land and buildings than similar stations employing steam or gas plant, so that the difference, if any, is in favour of the Diesel plant.

The following are approximate prices for small plants, delivered and erected on purchaser's foundations complete with oil storage tanks, piping, &c., and may be taken as fairly representative:—

Size in kw.	Price.	Price per kw.
100 ...	£1,950	£19.5
150 ...	2,600	17.3
200 ...	3,260	16.3
300 ...	4,380	14.6
400 ...	5,300	13.3

The author is of opinion that the life of the Diesel engine should be as long as that of a well-built steam engine. The only expensive part likely to require replacement is the cylinder liner. It is essential that the compression should be maintained. The author has had an engine running for over two years, and no appreciable wear of either the liner or piston rings has yet occurred. It appears, therefore, that the life of the liner may be computed at at least 10 years. The valves are fitted into removable casings, which can be renewed at quite a small cost.

As most of the other parts are quite light, cheap, and easy to replace, it appears that the cost of maintenance of this type of engine must be very much less than a complete steam plant.

Although the Diesel engine possesses considerable advantages, it is undoubtedly true that in order to secure reliability first-class attention is necessary. It may safely be said that 90 per cent. of the trouble experienced in running is due to the neglect of attendants. As the running and maintenance of internal-combustion engines is essentially different to that of steam plant, it is always better to secure the services of men who are accustomed to similar plant than to employ men who have spent their lives among steam plant. In spite of statements to the contrary Diesel engines require considerable supervision, and it is advisable to employ men of skill and experience rather than mere labourers. Even taking this matter into consideration, the cost of labour on moderate-sized plants is substantially less than that necessary with steam plant.

It is of importance that a suitable grade of lubricating oil should be chosen; the oil must be a pure mineral one with a high flash-point. The author is using ordinary crank-chamber oil, costing 1s. 5d. per gallon, with perfectly satisfactory results. The cost of lubrication is about 50 per cent. greater than that of a steam engine.

The use of an excessive quantity of oil should be avoided. Oil after collection from the crank pit contains a certain amount of carbon, and should be placed in a settling tank, preferably heated. After a sufficient time has elapsed for settling, the oil should be drawn off from the top and passed through a good filter before use. The author has found that it is practically impossible to remove the whole of the carbon from the oil, and consequently if the oil is used repeatedly, more and more carbon will be fed into the cylinders and other parts until there is a sufficient accumulation of carbon to cause a stoppage of the lubricating passages. As a seizure of the piston might cause serious damage to the engine, and as it is necessary to economise in lubricating oil as much as possible by using filtered oil, the author recommends that the piston should be drawn every six months, and the lubricating passages cleaned.

The carbonisation of oil may also cause trouble in the air-compressor cylinders. Before the author realised this possibility, filtered oil was always used in the compressor, and probably to excess. In course of time the high-pressure air-pipe leading from the compressor to the intercooler blew off at the joint, when it was discovered that the pipe was completely blocked with solid carbon.

Owing to the high compression, which must be maintained, it is necessary to keep the valves quite tight. The author has found that under the conditions in which he is working, the valves will run without any attention for the following periods:—Exhaust, 600 hours; air, 2,000 hours; fuel, 600 hours; starting, one year.

The needle or fuel valve is so adjusted that the fuel spray is blown into the cylinder two or three degrees before the crank reaches the top centre on the compression stroke. It is very important that this valve should be properly set and quite tight; if there is any leakage fuel will be admitted at the wrong time, resulting in irregular running of the engine.

The pulveriser is liable to become choked if the fuel is dirty and insufficiently filtered; it should, therefore, be examined and cleaned at the same time as the needle valve.

A considerable quantity of vapour is carried into the compressor, the quantity depending upon the humidity of the atmosphere, and is condensed in the intercooler; it causes rusting of the interior surfaces, and the rust is carried along to the starting valve where it will accumulate, eventually causing the starting valve to stick. If this occurs, the contents of the bottle may be lost before the valve can be shut. The only precaution necessary to avoid this annoying experience is to see that the intercooler drain is blown down at regular intervals, say, every half-hour, particularly in damp weather. The air-storage receivers are provided with siphons and drains, and should be drained every day.

It is well to draw the compressor pistons every six months and clean off the accumulation of carbonised oil which is deposited on the top. It is also advisable to clean the air inlet and passages to the low-pressure valves at the same time.



Where only one engine is installed in an isolated position, the loss of the air in the storage cylinders would be a serious contingency, as without such a supply it would be a difficult matter to start the engine. If the engine is driving a dynamo, and there is a storage battery on the premises, the dynamo may be run as a motor

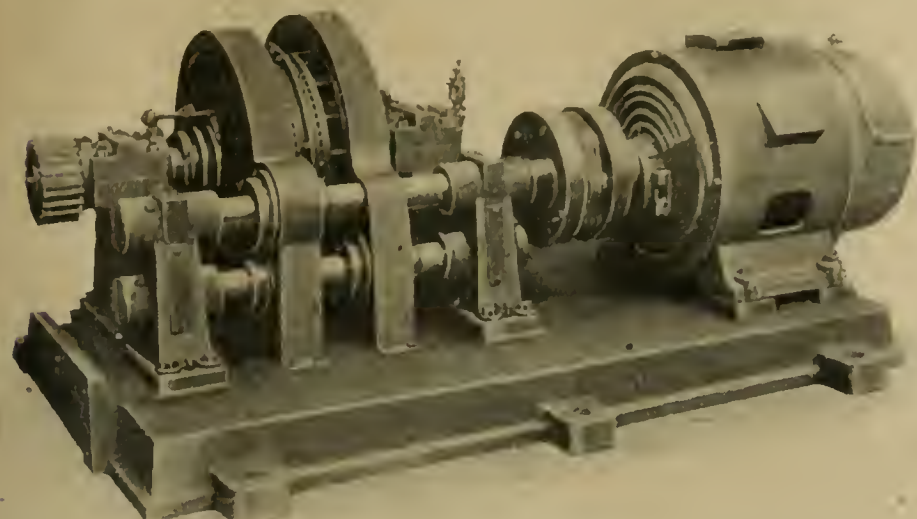


FIG. 1.—VULKAN REVERSING DRIVE FOR PLANING MACHINES, &amp; CO.

to drive the engine and compressor. Alternatively the storage bottles may be charged from cylinders of oxygen or carbonic acid gas. If the latter is used, the cylinders and pipes should be warmed in order to prevent solidification of the gas in the pipes. If the engine is erected in a locality where it is unlikely that either of the above facilities will be available, it is desirable that a small independent compressor, coupled to an ordinary oil engine, should be put down as a safeguard.

Defective starting is generally due to low compression, defect in oil pump or oil supply, or incorrect adjustment of fuel, air or exhaust valves.

Black smoke may be emitted if the blast pressure is too low, or if the engine is overloaded. If all is in order the exhaust should be colourless, indicating perfect combustion of the fuel. The exhaust gases escape from the engine at a pressure of about 40 lb. per sq. in., and adequate measures should be taken to allow the escaping gases to expand gradually, or nuisance may be caused to the surrounding neighbourhood. The author had some trouble, due to the fact that private residences are in close proximity to the works. The exhaust, therefore, was led to a large concrete pit, which removed all cause for complaint. It is the intention of the author to lead the exhaust from a 150-B.H.P. engine, shortly to be installed, to the base of an existing chimney stack 120 ft. high, which should deal with the difficulty in an effectual manner.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Magnetic Clutches on Plate Edge Planers.

We illustrate in fig. 3 some plate-edge planers, equipped with the Vulkan drive, which have just been delivered to an Austrian dockyard.

Each machine measures 38 ft. 3 in. between the housings, and is capable of planing a plate 33 ft. long, 1½ in. thick, at 40 ft. per minute.

A cut of .07 sq. in. can be taken in steel of 41-ton tensile strength, or at the rate of 9½ lb. of metal removed per minute.

The tool turns over automatically on reversal, the turnover being done while the saddle travels 4 in. It can also be dropped so as to scarf a plate up to 15°.

The motor, fig. 1, is of 30 B.H.P., three-phase, 42 cycles, running at 1,200 R.P.M. in one direction only, the reversals being obtained by a Vulkan electro-magnetic clutch through the ordinary five-wheel change spur gearing.

The clutch shaft runs at 330 R.P.M., and is connected to the main screw through a steel pinion of 23 teeth and a spur wheel of 60 teeth (1-in. pitch). The main screw is 5 in.

diameter, and has a 3-in. pitch double thread, running at 126½ R.P.M. The planer will work on a stroke of 5½ in., if necessary.

On test, driven by a 220-volt D.C. motor, the motor and clutch gearing only running, took 7 amperes, and when the clutch was excited so that the main screw and saddle were running light, the current was 15 amperes, with a maximum kick on reverse of 36 amperes, which included 17 amperes taken by the clutch.

As regards the striking gear, the saddle is fitted with a



FIG. 2.—SIMPLEX OVEN ON HOT-PLATE.

finger which strikes the dogs, which are carried on a rod running the length of the machine, and operates the automatic reversing switch. A switch is also fixed on each housing to stop the clutch, if necessary. The clutches are supplied in this country by MESSRS. C. E. LUGARD AND CO., of St. John's House, Chester.

### Simplex Combination Cooking Outfit.

The "Combination Cooking Outfit" made by MESSRS. SIMPLEX CONDUITS, LTD., in its preliminary form has already been described in our pages; it has proved so successful in actual practice under working conditions, that improvements in the design in several directions have been made, and at the same time its sphere of usefulness has been considerably extended. It is now capable of carrying out all the necessary cooking operations for a small household, and in large establishments it is a most useful adjunct to the main cooking installation. It provides a ready means of testing electric cooking and the cost, even if the apparatus be purchased outright, is extremely small, and well within the reach of the great majority of consumers.

Two larger size plates have now been produced of 8 in. and 10 in. diameter, with loadings of 800 and 1,000 watts each respectively. These hot plates are intended for use with correspondingly larger ovens. In the case of the small set the oven is capable of cooking chops, steaks, a bird, or a small joint, say of 3 lb. weight. The largest pattern will take a 9 or 10 lb. joint.

The oven is made of polished metal, to prevent radiation of heat, and has an aperture in the bottom, which fits on the hot plate, as shown in the accompanying illustration. The 8-in. and 10-in. boiling plates are arranged for temperature regulation by means of the standard three-pin terminals, giving four variations of temperature. A more convenient method is supplied at a small extra cost, and incorporates the use of a special heat regulation switch. This is suitably attached to the boiling plate, and is arranged with an indicator showing the exact heat—one-third, two-thirds, or full—which is being used. The clear indication of the condition of the heat regulation assists economy in current consumption in actual practice. The makers will supply descriptive leaflets to applicants, for distribution, gratis.

### The "Ezyfix" Two-Part Lampholder.

Another ingenious patent lampholder which has recently been brought to our notice, is the "Ezyfix," which is being placed on the market by the EASTERN ELECTRIC CO., of 11, Queen Victoria Street, E.C.

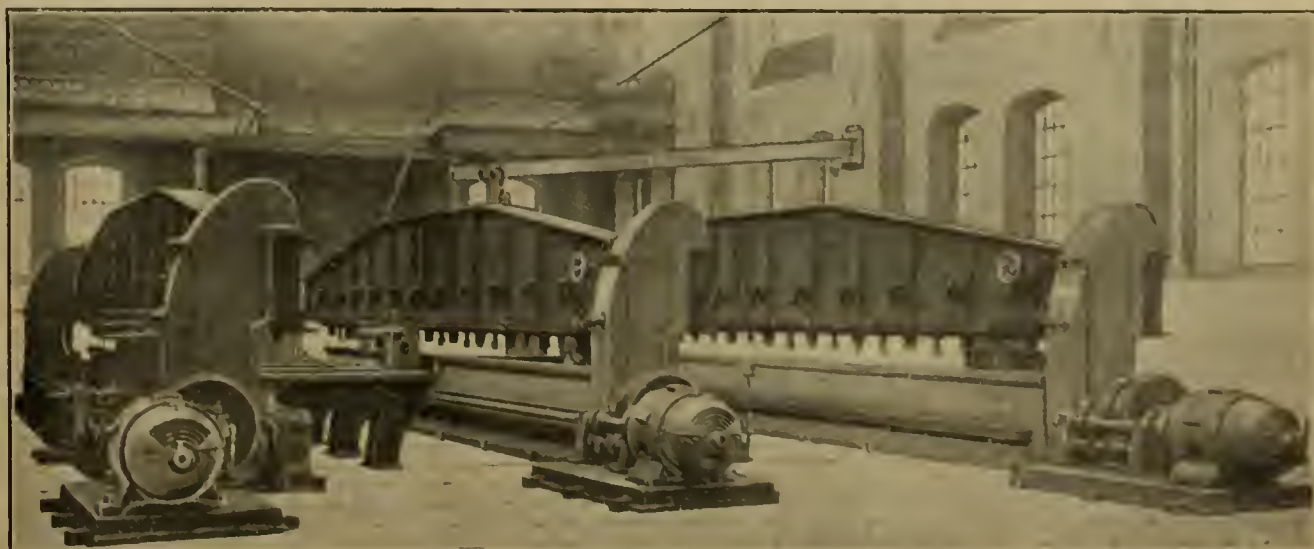


FIG. 3.—PLATE-EDGE PLANERS, WITH VULKAN ELECTRIC DRIVE.



For all practical purposes this is a two-part lampholder: that is to say the porcelain interior is in one piece, and is permanently attached to the lower or socketed end of the barrel, which carries the shade ring and another ring for locking the upper detachable portion of the barrel in position. This upper portion is removed for wiring the holder. For the latter operation, the flex is divided, one wire being passed down each of the two holes in the upper end of the porcelain interior, looped over a projecting side lug, and inserted in the plunger terminal, the arrangement being shown in fig. 4.

It will be seen that the entering wires are separated throughout their run by porcelain, no wood plugs being required; the grip obtained by looping is such as will hold the lamp, &c., even if the

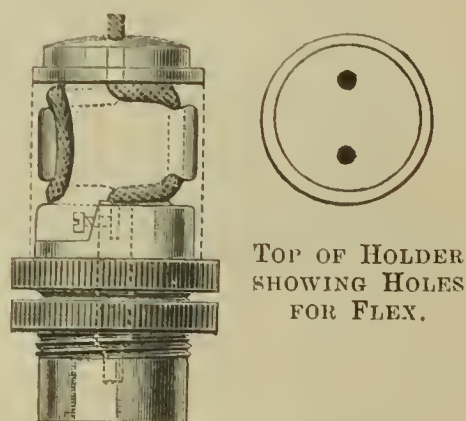


FIG. 4.—“EZYFIX” LAMPHOLDER, SHOWING WIRING ARRANGEMENT.

wires are withdrawn from the plunger terminals. The permanent attachment of the socketed end of the barrel to the interior, obviates the possibility of the lamp falling off owing to the slacking-off of a loose locking ring.

The arrangement is extremely ingenious, and appears not only fully to meet the claims of the inventors, but also to be a substantial move in the right direction, namely, that of simplicity.

#### Composite Telegraph Poles.

In our “Correspondence” columns, Mr. P. J. Pringle draws attention to a type of pole which has been in use in Australia for some 10 years past, but which apparently has not hitherto been adopted in this country. The idea is to avoid the decay which inevitably occurs at the ground-line of wooden poles set in the

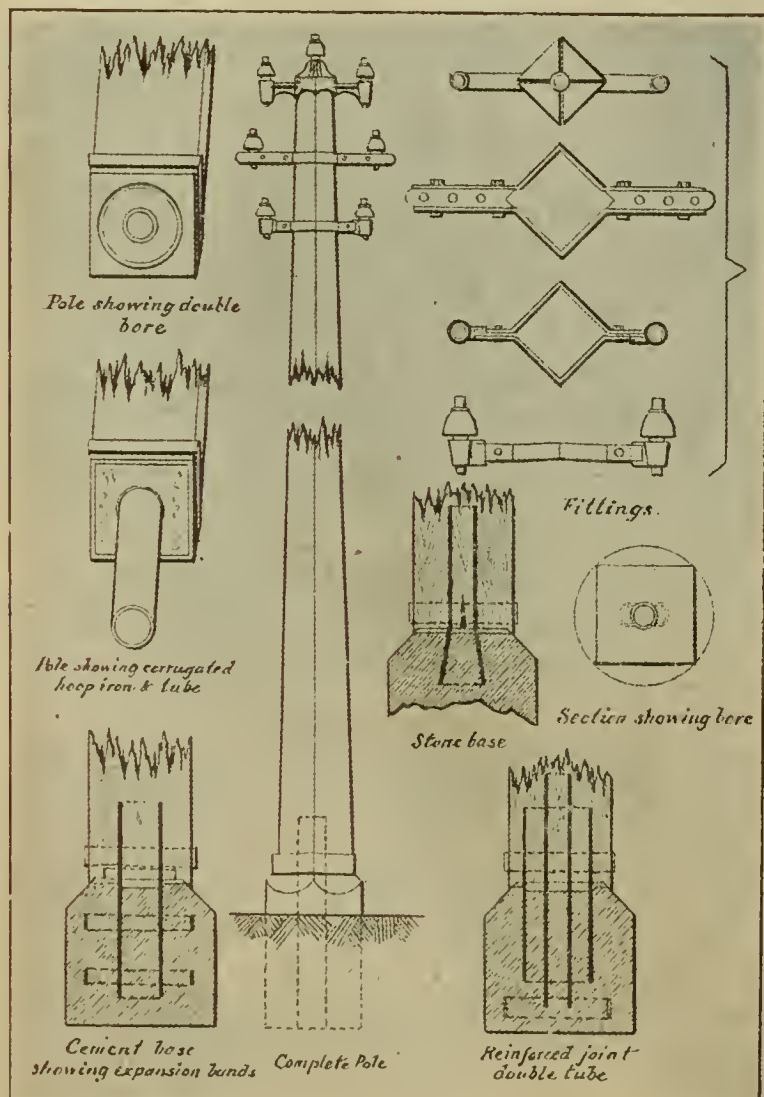


FIG. 5.—DETAILS OF COMMONS'S PATENT COMPOSITE POLE.

ground, and to improve the appearance of the pole, which consists of a straight timber shaft joined to a concrete base. The joint is effected by means of a steel tube, one end of which is inserted into the butt of the pole, and firmly cemented in place with bitumen, while the projecting part of the tube is shod with concrete, as shown in the illustration, fig. 5. An iron band shrunk on the end

of the wood prevents the pole from splitting. The strength of this simple joint is surprising. According to some tests made at the Melbourne University, a pull of  $7\frac{1}{2}$  tons was required to draw a  $2\frac{3}{4}$ -in. tube out of the end of an Oregon pole  $4\frac{1}{2}$  in. square, and the strength of the joint against bending is 70 to 80 per cent. of that of continuous timber of the same cross section. Moreover, the failure of the joint, when it occurs, is gradual—bending, not fracture.

The pole being squared, iron fittings are used which fit any standard pole, and they are applied in the direction of the diagonal, so as to utilise the greatest resistance to bending either along or across the line of wires. The complete pole weighs less than an equivalent ordinary hard-wood pole, but slightly more than an iron pole. The manufacturers are the TUBULAR JOINT COMPOSITE TELEGRAPH POLE CO. OF AUSTRALIA, LTD., Ballarat, Victoria.

#### Drum-Type Starters for Induction Motors.

THE ELECTRICAL APPARATUS CO., LTD., of South Lambeth Road, S.E., has recently developed a line of drum-type switches for starting squirrel cage motors; these are arranged to give star-delta connections for three-phase motors and series-parallel for two-phase motors, or they can be arranged to switch the motors



FIG. 6.—E.A.C. STARTER FOR SQUIRREL-CAGE MOTORS.

direct on the mains, cutting the fuses out of circuit in the starting position.

Among the points emphasised by the makers are the use of coil compression springs of tested strength, easy of adjustment; substantial copper finger tips, self-aligning contacts, renewable wearing parts, &c.

As the motor is disconnected from the line with the switch in the “off” position, no main switch is required; the “full on” position cannot be reached without a pause in the starting position, but the handle will not remain in the latter position when released.



FIG. 7.—INTERIOR MECHANISM, E.A.C. STARTER.

The totally-enclosed type (shown in fig. 6) is recommended for textile mills, &c., while an oil-immersed type is suitable for mining work and can be made flame proof. Various automatic features and the E.A.C. interlock can be fitted.

The switches are designed for up to 200 amperes and 3,500 volts; our second figure shows the interior mechanism—contact fingers, coil compression springs and drums.

**Cascade Motors.**—MESSRS. SIEMENS-SCHUCKERTWERKE, of Berlin, have taken a licence for the manufacture of “Sandycroft-Hunt” cascade motors in Germany.



## LEGAL.

OSRAM LAMP WORKS, LTD., v. THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(Concluded from page 833.)

MR. H. BALLANTYNE was then cross-examined by MR. ASTBURY: On the patent of 1904 it is perfectly plain, is it not, that what he means there is that if you take a carbon core and merely coat it with metal and then run it, that metal coating will not suffice to prevent that carbon core doing what all carbon-filaments would do if they were run at a sufficient temperature and for a sufficient time, viz., disintegrate?—Yes, but I think it is a little more than that, because a tungsten-coated carbon-filament would be intended to run at a higher temperature than ordinary carbon, so that the tendency for this carbon to volatilise would be still greater.

Whether that disintegration is the mere effect of temperature, or whether it is the combined effect of temperature plus electrical current, you cannot say?—No.

You have said that if you take one of these tungsten filaments and run it up near to the melting point of tungsten, your view is that the carbon comes out non-chemically?—Yes.

Are you going to pledge yourself as a chemist that because carbon somehow or other comes out of a filament in a non-oxidising atmosphere at a certain temperature, if you have a totally different atmosphere which is chemically known to take it out in another way, it takes one course rather than the other?—That is my clear opinion. You have to have regard to the conditions under which this chemical atmosphere is operating or under which it is capable of operating. In my opinion, as a chemist, I do not consider that that chemical action can come into play in the time to any substantial extent.

The reason of that is that you think there is this little filament in a big atmosphere. You think the atmosphere cannot get to the filament?—Yes. If I am correct in the view that the carbon is eliminated physically and not chemically, then it is quite immaterial what the nature of the circumambient gas is; it will come out in exactly the same way.

You have expressed an opinion that this patent points to a direction or an intention to use soft paste?—Yes.

His LORDSHIP: And to use a paste which is not used by the defendants?—Certainly.

You have already told me that in your view a soft paste does not necessitate squirting into a liquid at all?—I say that if you take a soft-paste filament, you must coagulate that filament.

Have you ever made any experiments to ascertain how much of the carbon contents of the defendants' baked filaments are in the form of carbon and how much are in the form of carbide?—No.

Do you disagree with what I am told, that the instant effect of putting the current through the filament is to make a tremendously strong convection of the gas towards and through the length of the filament?—That is one of the results which, in my opinion, is far outweighed by the fact that you have the sudden expansion away from the filament.

You made soft filaments and sintered them, and found them quite good?—Yes, they sintered quite well.

With regard to the Lodyguine filament which you say you had made. You made one with a platinum fillet, and ran it for five minutes at a lower temperature—lower than sintering?—Yes.

When you took it to the blinding white heat it broke?—After 30 seconds it broke at the clip.

And when you examined it you found it was in tubular form and the platinum had come out?—Yes.

MR. ASTBURY then took witness through other experiments which had been made, with a view to showing how witness got rid of the carbon out of the filaments.

At the conclusion of a very short re-examination by Mr. Terrell, Mr. Astbury said to his Lordship: I am really in a difficulty here. I do not make any complaint, but I must tell you honestly I think the case which has been made, and is weighing on your Lordship, has not been put to our witnesses at all. I have been through, as well as I could, every line of cross-examination of our witnesses, and I have made a list of the matters that have been put in evidence-in-chief which I am absolutely satisfied have not been put to my witnesses. Counsel then referred to many passages in evidence given in support of his contention.

His LORDSHIP said the important point seemed to him to be whether or not to use a hard paste—that was to say, to use such a paste that one must use tons of weight to put it through a diamond die to make the finer filaments—was or was not the best process. If the patentee had discovered that that was the best process, then he ought to have said so.

MR. ASTBURY then went through the list of points which he said had been raised by Mr. Terrell since the case was opened.

His LORDSHIP said the further evidence he would allow Mr. Astbury to call must be confined to the points which had been mentioned.

Evidence was thereupon called by MR. ASTBURY on the points in question.

DR. OTTO OBERLANDER said he had been a consulting chemist in England since 1906. Prior to that he was assistant to Prof. Noelting in Germany, and also a works chemist in that country.

How did you first come into contact with this patent?—I met Hanaman of 1904, which is being sued upon in this action?—I met the manager of the General Electric Co., Ltd., who told me that it was essential for his concern to have a metal-filament lamp, and asked me whether I could take this matter up. That was about September, 1906.

At that time had the General Electric Co. who were instructing you an interest in the patent at all?—No.

When you came to it in its turn what did you do?—I repeated the process and I made filaments.

In making filaments under it what paste did you use?—The first was a fairly tough paste of tungsten metal and gum arabic.

Why did you use a stiff paste?—I wanted to squirt it through fine orifices, and I gave it such a consistency as would give a good thread.

Did you squirt your own stuff into a liquid or not?—No. I squirted it in air simply on a card and collected the thread as soon as it was made.

When WITNESS had got these threads squirted and made, they were carbonised in a current of hydrogen in a combustion furnace. They were then mounted in clips and decarbonised in steam and hydrogen.

What did you understand the patent to mean by steam and hydrogen?—It meant to have so much water vapour as will remove the carbon, and to have so much hydrogen as will protect the tungsten.

WITNESS passed hydrogen through water, and it was, therefore, charged with something like 2 per cent. of water vapour. He passed the current through the filament and saw almost instantly a sintering operation taking place. The filaments were raised to a good red heat. The sintering took from a minute to two minutes, or less.

In those early days did you know of any pointed distinction between decarbonising and sintering as such?—No.

The filaments were mounted in bulbs by the men who were accustomed to do that particular work. All the filaments appeared uniform to such a degree that he did not consider it necessary to render them uniform. When these filaments were mounted in lamps they were satisfactory. He had made filaments, and what was called stiff paste of many varying degrees of stiffness, and had never found any difficulty in making any of the filaments so obtained into lamps.

It has been suggested by the other side in this case that if you make a soft paste, or if you do not make this excessively hard paste of the defendants, the uniformity or flashing process is a necessity?—That is not my experience.

In some of the softest pastes which you have used, whether you squirt into air or whether you squirt into liquid, have you found that they do or do not require to be rendered uniform by this subsequent process?—In my opinion, they do not require to be rendered uniform, except a very few of the filaments. When you make a filament, the fact whether or not it shows any bright spots indicates whether or not it is necessary to render it uniform, and in such cases I did render them uniform.

As a result of your early experiments and what you did under this 1904 patent, I think Mr. Hirst bought the patent?—Yes. I advised him to, as I did not know of any anticipation or any other reason why the patent should not be good.

Are you familiar with the way in which the weights have always been used in the Osram lamp works?—Yes.

There were two alleged disadvantages mentioned by Mr. Pakenham. First, it is suggested that, if you put the weight on during sintering, you get a cooling or some other action of that character at the apex and an insufficient sintering, and, at all events, a weakening there?—It is not my experience, neither is it the experience of the people at the works.

I think the Osram Co. make something like 5½ millions a year, do they not?—Yes, I am told so.

That is to say 5½ million lamps, and the lamps I think contain about 10 filaments each?—Yes.

So that it would be about 50 million filaments a year?—Some of the filaments break in manufacture, therefore it would be nearer 75 millions.

If this weighting during sintering had any such disadvantage as is alleged, is it possible that you could not have found it out, or heard of it?—I do not think so.

His LORDSHIP: All your filaments are made in this way, are they?—Every one, of all kinds, and of all types and thicknesses.

Going back to 1904, from your knowledge of the literature, what, in fact, was carbonising of a filament, and what did it mean?—Carbonising in 1904 or 1912 does not mean anything else but destructive distillation of the hydrocarbon.

Does the reduction of the pressure at which the defendants bake their filaments in any way prevent them obtaining the necessary result of carbonisation?—No.

Taking the defendants' paste and baking filaments made of it in carefully dried hydrogen at ordinary pressure, do you get any difference in result between the filaments so baked and the filaments baked by them?—No, the result I got is 776 per cent. of carbon at atmospheric pressure in carefully dried hydrogen free from oxygen.

In Welsbach's Specification 1,535 of 1898, he says:—"The function of the protective atmosphere is to oxidise the carbon of the filaments without oxidising the osmium or obtaining a deposit of carbon on the filament. Free oxygen must not be present, and, in fact, the atmosphere should be such as will reduce any oxides of osmium that may be present. In such a reducing atmosphere the filament can without danger be raised to a temperature which consolidates the osmium and forms it into a useful coherent filament." Is there, in your opinion, any difference between that and sintering the metal which forms it into a coherent metal filament?—None.

It is suggested that our patent intended you to decarbonise, and not to sinter?—Yes.

Supposing you knew nothing about this discussion, and that you simply took your baked filament and put it in an atmosphere of steam and hydrogen, as the patentee tells you, and subjected it to the passage of a current; if you do absolutely nothing else, will



nature itself gradually get more and more current going through it until you get to constancy?—Yes. I do not know of any way to prevent it.

If it goes on in that way until it gets to constancy, is it physically possible to stop the sintering?—No.

There is another suggestion, that if you have enough water-vapour to oxidise the carbon, you cannot help oxidising the tungsten if the temperature goes up to that at which the metal will sinter?—That is not my experience.

DR. ADOLF LIEBMANN was also recalled and examined on similar points, at the conclusion of which COUNSEL addressed the Court on behalf of their respective clients.

In reply to his LORDSHIP with regard to the counterclaim, MR. TERRELL said that, after consideration, he had decided to withdraw it.

#### JUDGMENT.

MR. JUSTICE WARRINGTON, in giving judgment, said this was an action for infringement of three patents, all relating to the manufacture of metallic filaments for incandescent electric lamps. The first was a patent for the manufacture of such filaments from the metal tungsten. The second related to a particular mode of effecting one of the steps in the process of manufacture. The third was for a small practical detail in producing a metal filament of the now common shape of a more or less pointed loop. The date of the first patent was November 4th, 1904, that of the second August 20th, 1906, and that of the third August 30th, 1906, being the date of the first foreign application. In the case of all three patents the defendants attack their validity, and in the case of the first two they deny infringement. As to the third, they admitted that they had infringed, but said that they were not now infringing, and did not intend to do so in future. The general subject-matter of the inventions, or alleged inventions, was the manufacture of metallic filaments suitable for use as the incandescent bodies in electric lamps of the incandescent type. The particular kind of metallic filament with which they were concerned was that which was manufactured by a process often referred to in the course of the case as a building-up process. His Lordship then went through in great detail the building-up process, as well as the specification in question, which had been amended, and which, of course, had to be considered in its amended form. The first question was, what was the true construction of the specification. What was it the patentees described and claimed? They mentioned the application of tungsten as a coating material for carbon and plainly did not claim that: they expressly disclaimed their own oxychloride process—Kellner's proposal to form the filaments by pressing and the drawn-wire process of Siemens. Bearing that in mind there was no difficulty of construction. The first claim was limited to a tungsten filament made in the way described. The second claim was for the process for the manufacture of the bodies mentioned in the first claim, the process being characterised by the special feature particularly referred to. He thought the words: "In accordance with Claim 1" were a qualification of the word "bodies" and meant in substance, "such bodies as accord with the description given in Claim 1." It was, he thought, the essence of the claim, the second claim, that the carbon should be removed chemically. The principal objection to the validity of this patent was want of subject matter. In the general description of the process itself there was nothing new. It was merely the building-up process already referred to. The first paragraph on page 3 described the process of mixing and the carbonising process long used for making carbon filaments. The second paragraph described, first, the decarbonisation by oxidation already described by Welsbach, and, secondly, a process of rendering the filament uniform by means admittedly already employed in connection with carbon filaments. The invention, if there was any, consisted first in the application of the known process to the particular metal tungsten, and, secondly, in the selection of the atmosphere of steam and hydrogen as a suitable atmosphere for the purpose of oxidising out the carbon from a substance consisting of tungsten and carbon. It was said that the relevant qualities of tungsten were so well known that any person acquainted with the subject, if reminded of the existence of tungsten, would know at once that this metal would be suitable for the purpose. He thought it was impossible to reconcile that view with the facts. In the first place, he was satisfied that though it was known that tungsten was highly refractory, and that it was reducible from the oxide by the action of hydrogen, it was impossible to say without actual experiment whether a filament could be made of it in the mode described. In fact, the patentees' process of decarbonising in steam and hydrogen was actually tried by Dr. Liebmann upon a number of the highly refractory metals, including uranium, which was in the same group with tungsten, without success. It seemed to him (his Lordship), further, on the evidence, that the selection by the patentees of steam and hydrogen as the atmosphere in which decarbonisation was to be effected, also required experiment. But there were other considerations which, in his opinion, led inevitably to the same conclusion. Tungsten was a very common and cheap metal. Osmium and the other metals mentioned by Welsbach were scarce and dear. Tungsten had now practically superseded all other metals in the manufacture of filaments. It was recognised as a suitable metal to employ for electric lighting, as shown by the various suggestions for its use, to which reference had already been made. He could not believe that if its suitability for the purpose of making a filament by the process described in the specification had been so obvious as was pretended, its use would not have been suggested by Welsbach or one of the other inventors who were searching for a practicable mode of making a metal filament. He found that there was sufficient invention to support a patent, and that the

objections on the ground of want of subject matter failed. A further objection which he had one time thought might be of importance, was that of insufficiency of description. The point was that no details were given as to the proportions of metal to binding material, of steam to hydrogen, and the temperature, and so forth. In his opinion, the furnishing of such details was in the particular case unnecessary, for that a lampmaker of ordinary skill and knowledge reading the specification would have had no difficulty in putting it into operation. The first paragraph on page 3 obviously required no detailed description, as it was the ordinary process of making a carbon filament applied to one of carbon and tungsten. The decarbonising process required no further description, for he found on the evidence, and in particular on that of Dr. Oberlander, that anyone having a reasonable knowledge of the subject would be able without difficulty to decide on the proper proportions of steam and hydrogen—the appropriate degree of temperature was indicated by the direction to raise the filaments to a high temperature by subjecting them to the passage of current. In his opinion that objection also failed. No other objection to validity had been pressed, and he must, therefore, hold that the patent was valid. Then there remained the question as to whether defendants had infringed the patent. First, what had been rejected? They did not make use of the process of rendering the filament uniform described in the specification, not finding it necessary to resort to that process. It was said that this was an essential part of the plaintiffs' process, and that as it was not taken, the patent was not infringed, even if the defendants did the other things described. It was settled by law, and what was the real substance of the invention, whether it be a combination or a process must be decided on the evidence—in other words, it was a question of fact. He found, as to that, that the process in question was not an essential part of the invention; good filaments could be made in the manner described, and the substance of the invention taken, though that step was omitted. He had now to consider whether the substance of the invention had, in fact, been taken.

The process adopted by the defendants was then read by his LORDSHIP, who said that he found that the atmosphere used was an atmosphere of steam and hydrogen within the meaning of the specification in question. It was said that the claim was limited to the removal of the carbon chemically, and that the process adopted by the defendants removed it by physical or mechanical means. As to that, it was admitted that carbon monoxide was formed. That showed that there was in the process a chemical reaction resulting in the oxidation of carbon. But the defendants maintained that, bearing in mind the very short space of time and the very high temperature, the proper conclusion to draw was that the carbon was removed by volatilisation or by the mechanical effect of the current, and that the oxidation, such as there was, took place after such removal. In his opinion, that was not proved. The steps directed by the patentee were taken, the result indicated by him was obtained, there was certainly some such chemical reaction as he suggested, and it would in his (his Lordship's) opinion require much stronger evidence than any before him to justify the conclusion that the real action of the means adopted by the defendants was so different from the patentees' method as not to be infringement.

As to the first patent, he was of opinion that it was valid, and that the defendants had infringed, and the plaintiffs were entitled to the usual relief.

The second patent (18,622 of 1906) was for an improved method of producing metallic incandescence bodies for electric glow lamps. The point of this invention was to substitute in the decarbonising process gases containing no oxygen for the oxidising gases previously employed, and he thought the absence of oxygen was its essential characteristic.

The validity of this patent was seriously attacked on one ground only—that a patent for the same invention had been previously granted to the same patentees. This last patent was No. 15,510 of 1907, but protection dated from July 11th, 1906, the date of the first application in Germany, and was therefore prior to the plaintiffs' patent. This patent (15,510) was entitled again—"Improved process for the manufacture of illuminating bodies for electric incandescence lamps." The patentees begin by referring to the British specification No. 23,899 of 1904, and they refer to it in these terms. They say that in that specification is described a method of making tungsten and molybdenum filaments for incandescent lamps. It was, in fact, of course the specification of the first patent in the present case. It was referred to there as a method of making tungsten and molybdenum filaments, but molybdenum was afterwards struck out by amendment. The reference laid stress on the fact that the carbon was to be removed by oxidation. Another specification was then referred to of 1905, by which it was pointed out that the oxidising agent must bear but a small proportion to the quantity of hydrogen present, and so far as one was aware, it had heretofore always been assumed that it must be at least from 1 to 2 per cent. as set out in the prior Specification 19,379 of 1905. He was of opinion that the second claim was merely what it said, that the hydrogen was diluted with nitrogen, but that in that atmosphere so diluted there were still traces of oxidising means. In his opinion, that was not the same invention as the plaintiffs'. In the claim he had just referred to, oxygen, however small, was regarded as essential. In the plaintiffs' patent the essential feature was the absence of oxygen. The defence of prior grant failed, and he must hold the patent to be valid.

The really important defence in this case was non-infringement. From what he had already said, it would be seen that for the substantial decarbonisation of the filaments, the defendants used the oxidising process and not that which was the subject of the patent now under discussion, but the plaintiffs insisted that the



defendants used the latter in the subsequent stages of the manufacture. (Here his Lordship described the process.) In his opinion, there was here no infringement of the patent rightly understood. The patent was for a method of producing a filament from the metals mentioned in the specification. In substance it was the substitution of the process described for the process of decarbonisation by the action of oxygen-bearing gases. It did not, in his opinion, cover such a process as the final process of the defendants, which was not a method of producing a metal filament at all—that had already been in substance produced—but was merely a device for improving the filament so produced. To say that the defendants were not at liberty to adopt such a device because, incidentally, a little carbon was eliminated by the action of ammonia, would, in his opinion, give an extravagant effect to the patent. On that ground the action on the second patent failed and must be dismissed.

The third patent, 8,563 of 1907, was for an improvement in one of the mechanical details of the manufacture. The point was this—Before the date of this patent, filaments made in the mode described assumed, after the sintering process, the shape of a more or less irregular loop. To obtain a more suitable shape a small weight was hung at the bottom of the loop, and the filaments were again subjected to the action of current under somewhat similar conditions to those of sintering. It occurred to the patentee that instead of doing that as a separate step in the manufacture, the weight might be applied during the sintering process itself. The alleged invention was nothing more or less than this. It was unnecessary to read the specification. The defendants admitted that for some time they used weights during the decarbonisation and sintering, but they said they gave up the practice for reasons of their own, and were not now pursuing it and did not intend to do so. If the patent was valid they had certainly infringed. The validity of the patent was disputed on two grounds, first, on the ground want of subject matter, and, secondly, on that of prior user. As to subject matter the plaintiffs claimed, and the patentee's suggestion was a very bold one, viz., the application of a strain to a thread still containing some binding matter at a moment when that was being removed, and before the sintering or cohesive process had been completed. Plaintiffs' scientific witnesses strongly supported that view. To men of the scientific eminence of the plaintiffs' witnesses who realised what was actually occurring to the structure of the filament, the difficulty of applying a weight at the moment in question might well appear to be a serious one, whereas the practical man of ordinary but sufficient knowledge being aware as was the case, that a slight strain of the nature of that in question had been used in the making of carbon filaments, might without further thought apply such strain during the decarbonisation and sintering. So far as the result was concerned, the filaments made in the two ways seemed to him to be substantially identical in form. Plaintiffs' plan no doubt avoided a second operation, and he thought that fewer filaments were spoilt in the sintering, as they were kept steadier by the weights. For all that he thought the change so unimportant and the amount of invention required to effect it was so minute that he must hold the patent to be invalid for want of subject matter. He need not consider with any minuteness the alleged prior user. He had, however, come to the conclusion that the objection ought to fail for the reason that the alleged user was experimental only, and not a user of the invention within the authorities.

So far as regarded the first patent, then plaintiffs were entitled to an injunction and to damages, or an account of profits and the other usual relief. As regarded the second and third patents, there must be judgment for the defendants. The action was really three separate patent actions in one, and the costs, therefore, must be apportioned. So far as they related to the first patent, they must be paid by the defendants, but so far as they related to the second and third, by the plaintiffs, and there must be a set off.

MR. WALTER: As regards the first patent, I ask your Lordship for a certificate of validity, and we will take an inquiry as to damages, reserving the costs.

HIS LORDSHIP: Very well.

MR. TERRELL: With regard to the first patent, I am going to ask for a stay of the injunction, because this is stopping a great industry. We will proceed with the appeal as fast as we can.

MR. WALTER said that might be reasonable on certain terms.

After some discussion, his LORDSHIP said I do not think I ought as a term of staying the injunction to require any security whatever. The defendants undertake to pay into Court a certain proportion of the moneys which they will realise by the sale of the lamps during suspension of the injunction, and I think if the undertaking is given in this form it ought to be sufficient.—An undertaking without prejudice to the inquiry as to damages, to pay into Court by monthly payments, on the 21st of each month, 1d. per lamp manufactured during the past month, and an undertaking forthwith to give notice of appeal, and to prosecute the appeal diligently, and then stay the injunction pending the appeal.

COUNSEL assented, MR. WALTER intimating that there would be a cross appeal.

#### PILKINGTON v. EDINBURGH SCHOOL BOARD.

A SETTLEMENT has been intimated to Lord Dewar, in the Court of Session, in the action by Basil A. Pilkington, electrical engineer, 13, Melville Place, Edinburgh, against Edinburgh School Board, for payment of £73, the amount found to be due to pursuer by an arbiter after a reference on questions between the parties in regard to work which the pursuer had done for the defenders at Tower Bank School, Portobello. The School Board maintained that they were due the pursuer only £19. They paid him for items in his

account not in dispute £321. To this they added £73 allowed by the arbiter, a total of £394. They had already paid the pursuer £375, leaving the balance of £19, which they admitted was due. Intimation was made that the pursuer was not to proceed further with the case, and Lord Dewar accordingly granted absolvitor, with expenses.

#### IN DARKEST AFRICA.

WE are indebted to an esteemed correspondent for the opportunity of whiling away our Whitsuntide holidays by the perusal of a collection of documents, as to the contents of which we now propose to enlighten our readers.

It will probably be remembered that as far back as March, 1907, the Corporation of Johannesburg was placed in a serious position owing to the failure of the gas engines which had been laid down, and it became necessary to install a steam plant. Two 500-kw. sets were put in, and in July of the same year a 1,000-kw. set was erected. In January, 1908, two further sets of 1,000-kw. and 500-kw. respectively, were called for, and again in July, 1908, yet another 1,000-kw. set. All these were reciprocating plants, and before proceeding further, we will look into the question of what these plants were and the circumstances attending their purchase.

The first two sets were ordered from Messrs. Reunert and Lenz, the General Manager of the Tramways Department being assisted in the consideration of the tenders by an advisory committee of four consulting engineers. This committee consisted of Mr. A. M. Robeson, consulting mechanical engineer to Messrs. H. Eckstein & Co.; Mr. H. C. Behr, who acts in that capacity for the Consolidated Goldfields of South Africa, Ltd.; Mr. D. Gilmour, who occupies a similar position with the Johannesburg Consolidated Investment Co.; and Mr. A. C. Holtby, of Messrs. Neumann & Co., who was afterwards added to the Committee.

As very quick delivery was required, the order was secured, as stated above, by Messrs. Reunert & Lenz, although their price—over £10,000—was some £2,000 in excess of the ordinary market price for such machines.

The second case, when in July, 1908, a 1,000-kw. set was asked for, shows the beginning of differences of opinion. The municipality invited tenders for either a turbine or a reciprocating engine. The general manager recommended two Allen-Siemens sets of 500 kw. each, but the Advisory Committee, constituted as above, unanimously recommended the installation of a 1,000-kw. Parsons turbo-generator. The Council, with a lofty disregard of the advice of the technical experts, placed the order with Messrs. Reunert and Lenz for a 1,000-kw. Belliss plant. The tender accepted by the Council was £12,387 without condensing plant; that for the Parsons plant was under £6,000.

The third contract, for one 1,000-kw. and one 500-kw., was again placed with Messrs. Reunert & Lenz. Alternators were involved on this occasion, and the price was, again, some thousands of pounds greater than the prices asked for turbine-driven sets.

In the fourth case, the final tenders left for consideration were a 1,000-kw. Belliss-A.E.G. plant and a Parsons plant of 1,800 kw. then running at the Franco-British Exhibition. The prices were £12,683 for the first, and for the second—nearly double the size—£10,470. The general manager and the Electric Light and Tramways Committee, recommended, as one would expect, the Parsons tender, and the Advisory Committee's recommendation on the same lines, mentioned above, still held good. Moreover, in this case, the Corporation's consulting engineers in London inspected and tested the actual plant, and, of course, the plant being at work already, no question of delivery could arise. After protracted discussion, the Council gave the tender to Messrs. Reunert & Lenz for the Belliss plant. The Labour members of the Council voted for the Committee's recommendation.

We are not surprised that, on the publication of the facts, strong comments were made on the tactics employed to get the recommendations defeated.

Thus we see four contracts given away to one firm, at prices far in excess of what need have been paid, and in face



of the best engineering advice procurable, which advice was not offered in an officious manner, but was solicited, and, we presume, paid for, by the Council.

This much is written in order to prepare our readers for what follows. The feeling of surprise at the Corporation's methods will, we think, give way to feelings of dismay.

Last year the municipality asked for a third turbine, two having been laid down already by Messrs. Reunert & Lenz, manufactured by Messrs. Belliss & Morcom.

Tenders were received from practically all the British and foreign manufacturers, and the engineer, Prof. Dobson, reported that Messrs. Reunert & Lenz should be awarded the contract for another Belliss turbine. When the report was published in the Press, it was found that the tenders were not reported upon in their original form, but after the figures had been so manoeuvred that Messrs. Reunert and Lenz's tender, though high in price, became equal to the lowest tender.

All the other tenderers seem, then, to have held an indignation meeting, and the Johannesburg Chamber of Commerce decided to protest officially against the treatment that the unsuccessful tenderers had received. They wrote to the Corporation, who requested that the Chamber would send a deputation to meet the Council. This was done, but with no result, and finally the Council, after further representations and protests, and in view of the strong opposition now manifested as to the way in which the tenders had been handled, agreed to call in two experts to report on Prof. Dobson's recommendation, and to advise the Council which tender to accept.

On March 27th a letter was written by the town clerk of Johannesburg, from which the following is a quotation:—

"1. To report to the Council as to which is the most advantageous tender for the Council to accept, bearing in mind the present condition of affairs at the power station.

"2. To report further on Prof. Dobson's three reports referred to in the criticisms made by the members of the electrical section of the Chamber of Commerce, and on those criticisms as contained in the two memoranda dated May 13th and March 15th, 1912, respectively, and on Prof. Dobson's reply to those criticisms, and (3) to report generally on any matters at the Council's power station which, in your opinion, affect the questions submitted to you." These were the requirements set before the experts.

Now, our readers will have no difficulty whatever in selecting, in their own minds, the most capable man in the whole of the South African dominions to report on such a matter as this. We refer, of course, to Mr. John H. Rider. Well, he was one of the experts, and the other was Mr. A. M. Tippet, the chief engineer of the South African railways—a man well known for strict impartiality and straight dealing in all matters, especially those relating to contracts.

These gentlemen constituted what was called the Board of Inquiry, and, for the sake of brevity, we shall refer to them as the board.

The board considered all the tenders and the communications between the tenderers and Prof. Dobson; they visited the power station and saw the first turbine at work and the second opened up; they asked for and received information on all the details of the matter; and they gave a careful, thoughtful, and strictly impartial report on the whole question.

The specification was for one 3,000-kw. alternator with condenser plant, &c., and was issued in October, 1911, by Prof. Dobson. The Board criticises this document, and says that there is no close detail given as to the type required, so that the tenderers are able to submit their standard designs. The specification does not say how much condensing water is available, nor does it give any information as to cable connections, foundations, or switchgear. The chief point seems to be that the symmetrical appearance of the engine room should be regarded, and "that the turbine should be approximately the same height and length as those installed."

Tenderers were allowed 45 weeks for the completion and setting to work of the plant. On the ground that the period asked for was 60 weeks, Prof. Dobson struck out the British Westinghouse Co., but left in the British General Electric Co., who asked for 52 weeks, and the South African General

Electric Co., who asked for 48 weeks. The board remarks, in effect, that sauce for the goose should have been sauce for the gander.

Therefore, the board ruled these tenders out, and also all which were incomplete. They were left with three offers, viz., Messrs. Blane & Co.; Messrs. Reunert & Lenz; and Messrs. Sykes & Co.; and they included only for the delivery and erection of the complete turbo-alternator and condenser. They did not investigate questions of switchgear, because Prof. Dobson did not remark on it in his report, and they assumed that he was equally satisfied with all of the offers.

Further, some firms quoted for cable connections, while others endorsed their tenders "Not specified," or "Supplied by Municipality." Hence the board struck this item out of their considerations, recommending that the Corporation should do this work with its own staff.

Spare parts are not detailed, and we have prices varying from £220 to £754 for this item in the tenders of the three remaining firms above-mentioned. This item could not be considered in the circumstances, and was ruled out. Similar considerations applied in the case of the foundations.

On the remaining matters the board wrote a report consisting of 17 pages of type-written matter, with tables and full data for arriving at conclusions, and recommended that the offer of Messrs. Sykes & Co., at the price of £11,812, be accepted.

So much, then, for the report of the board. We do not think it necessary, in a technical journal, to go at great length into this document, although it may seem to interested parties that we are refraining from giving publicity to the board's views. We have not the space to give the report in full, or we would do so. Our readers will know, however, that such men as Messrs. Rider and Tippet will only have given a frank, fearless, and reliable report.

The town clerk of Johannesburg, to whom, as the executive head of the Corporation's staff, the report was sent, took it upon himself to criticise it. His criticism extends over 35 pages of type-written matter, and for a thoroughly bumptious, consequential, and extravagantly absurd concoction we have never seen its equal. We regret more than ever that we cannot give the whole of it in our pages.

It should here be noted that the second turbine broke down in August last, and a claim is still open against Messrs. Reunert & Lenz in respect of liability for this occurrence. The board referred very properly to this circumstance in its report, and this is what the town clerk says, in remarking upon it: "It has to be allowed that the papers and information available to Messrs. Rider and Tippet are of such a nature as would lead them to conclude that Messrs. Reunert & Lenz were entirely responsible for the breakdown. I submit, however, that it is incompetent of them to judge in this matter without knowing what Messrs. Reunert & Lenz have to say on the subject. That information is not yet available to the Council. Until it be established that the accident to No. 2 turbine was caused by mechanical defects, it is improper for the engineers to assume that the Belliss turbine is defective mechanically." We hope these words, which we presume express the considered opinion of the town clerk as the legal adviser of the Corporation, will be duly noted by the manufacturers.

Next, we find this choplogic genius arguing over the meaning of the word "dismantled." They saw No. 2 turbine "dismantled," said Messrs. Rider and Tippet. The town clerk pretends to think that this might lead people to suppose that it was being taken down as useless, and condemns the board's report on this account.

He then goes on to prate of "professional conduct," and the fact that Prof. Dobson's reputation was in their hands. Now the board treated him with quite as much consideration as he deserved, and quite as much as, to judge from our prefatory remarks on the other contracts, he was accustomed to obtain.

Then the town clerk deals with technical matters! Words fail us to deal satisfactorily with such crass stupidity. Rushing in "where angels fear to tread," he discusses vacuum, steam consumption, and other engineering details, and remarks, "I am more than astonished that Messrs. Rider and Tippet have fallen into these blunders."







and will be found to save many hours at times when details are wanted for estimates, reports, &c. Once the figures are collected and set out in the form described, little trouble will be found in keeping them up to date from time to time, and a true statement of capital expenditure is always at hand.

Another very necessary item in the working of a station is a correct detailed statement of coal delivered and on order. I have previously referred to this question in the *ELECTRICAL REVIEW*, but think the two forms now illustrated will be found original, and will prove useful to those who prefer keeping their particulars on cards rather than in books. No further explanation is needed than the forms themselves, which clearly set out all that is desired. (See cards Nos. 3 and 4.)

## COPPER BUYING AND DRAWING: THE ECONOMY OF THE DRAW-BENCH.

By C. V. RAPIER.

THE question whether it pays a firm to put in a draw-bench for drawing copper from rough rolled bar into rounds, flats, commutator bars, tubular connections (from tubes), &c., is often negatived through a too narrow-sighted policy. Firms building turbines will find such a bench capable of drawing the smaller sections of steel turbine blading after they have been run through stamp dies.

The argument invariably used against the draw-bench is that, as very often the machine cannot be kept running, the machine rate of the idle tool and accessories has to be placed to burden account, involving considerable loss.

An explanation of reasons for not keeping the draw-bench constantly employed in a certain works was that, according to the buyer, it seldom paid to draw down existing sections thrown on stock through change of design or other reasons. When the bench was first installed it was used for drawing down some stock sizes which did not seem likely to be utilised for some little time, but this old copper had been bought when prices were high, and as the original price on the stock-card was not in any way reduced, the addition of factory cost of drawing to the same produced a rather high final cost. This figure was entered in the material cost of the machines for which the copper was used, raising the total factory cost of machine; and this gave rise to criticism resulting in the condemning of the draw-bench, as an uneconomical part of the shop equipment. The fact was that if the original price of the stock copper used had been written down to the existing basis price prevailing, there would have been at least equality of cost and certainly a distinct gain in date of delivery; this latter item in particular escaped notice at the time.

The advantages of redrawing copper in stock, and likely to remain there for any reason, are: (1) Decreasing amount of capital tied up to a minimum; (2) quicker delivery to factory than could be obtained from outside. And these advantages are to be reckoned even when the basis price at the time of drawing plus the factory cost (labour plus burden charge) of drawing is greater than the price of similar bars from supplier.

The whole question is one for a "live" purchasing agent to keep after and decide whether it would be advantageous to pay and get delivery or pay less and wait longer. With the aid of the system made possible by the existence of a "Copper Difference Account," his task would be a very light one. In one modern concern, the draw-bench exists:—

1. To obtain quicker delivery of standard sizes to shops than could otherwise be obtained in certain cases. Such copper would be rarely cheaper and often slightly dearer in final price than if it were bought outside.

2. To draw special sizes and lengths, which can thus be supplied to shops very much quicker and considerably cheaper than could be done outside.

3. To reduce stock carried in stores of sections out of use through change in design, errors, or other causes; such sections would be drawn down to standard sizes.

4. By virtue of the existence of a "Copper Difference Account" described hereinafter.

With regard to the general situation in an up-to-date firm, copper is bought systematically and supplied to the shops in a methodical manner permitting the economical employment of a draw-bench. This firm belongs to the H.C.A. (High Conductivity Association) which is, of course, a combine of firms in the copper trade with reference to the sale of rough-rolled and finished drawn copper. The membership is limited, confidential and conditional to an agreement of secrecy. The advantages of this membership are:—

1. Copper can be bought at a reduction of the H.C.A. (not market price) basis price of  $\frac{1}{8}$  of a penny per lb. (in England.)

2. Special rebates on "extras" are allowed to members, the amount of similar sizes and kinds of copper bought regularly being the main determining factor in the granting of such rebates. A typical case would be (a) an all-round reduction on "extras" to  $1\frac{1}{2}$ d. per lb. on commutator sections instead of the quoted list price of 8d., 6d., 4d., 3d., or 2d., as the case might be; (b) a reduction of £3 per ton ( $\frac{3}{8}$ d. per lb.) less basis, for hot-rolled soft bars.

By "extras" is meant the extra price per pound to be added to the basis price for the manufacture of "basis" copper into the finished article—rod, wire, strip or bar, as the case may be.

The difference in prices for a firm in the H.C.A. from what any other concern outside the "ring" would be charged, may be best illustrated by taking some actual figures: (1) Ingots (metal market prices); (2) soft hot-rolled bars (H.C.A. and other bases); (3) drawn (finished price—"basis" plus the "extra").

(1) Ingots	...	...	...	£64	5	0	per ton.
Add for rolling per ton	...	...	...	10	0	0	
				£74	5	0	per ton price (basis)
							for hot-rolled bars,
							or $7\frac{1}{8}$ d. per lb.
(2) Add for drawing to bars	...	14	0	0	per ton, or	$1\frac{1}{2}$ d. per lb.	
(3) Subtract $\frac{1}{8}$ d. per lb. (basis reduction H.C.A.)			1	3	4	per ton.	
			£87	1	8	to H.C.A. member.	

To an outside firm, even with the "extras" taken at 2d. the price would be £92 18s. 4d.—a difference of £5 16s. 8d. The above figures represent the prices as on January 3rd, 1910.

It would pay very few firms to lay down plant for the commercial rolling of soft bars from ingots, so we can dismiss this matter from consideration and confine ourselves to operations subsequent to the purchase of soft hot-rolled bars, etc. These could be bought as seen above at a rebate of £3 per ton (given above as £74 5s.); therefore, a firm in the H.C.A. on January 3rd, 1910, could have purchased soft hot-rolled copper for draw-bench use for £71 5s. per ton or  $7\frac{1}{8}$ d. per lb., whilst the price to outsiders would have been  $7\frac{1}{2}$ d. per lb.

Now, taking the most difficult case for the draw-bench to make itself pay, viz., commutator bars—if a firm has a rebate on "extras" it is evident that as the soft hot-rolled bars can be bought at  $7\frac{1}{8}$ d. per lb. and as finished drawn commutator bars can also be bought at  $9\frac{1}{2}$ d. per lb. the difference of  $2\frac{1}{2}$ d. per lb. is the drawing cost; this the draw-bench factory cost must not exceed, in order to compete.

It is, therefore, a comparatively simple matter to see right away by trial whether the draw-bench pays or not, apart from its value in giving quick delivery. It is only necessary to see if the factory cost of drawing per lb. can be made equal to, or less than, the extras on suppliers' lists if the rebate on soft hot-rolled copper is allowed to the firm.

Results of such trials should be carefully recorded, where drawing was cheaper, and where dearer, and after the "shop" or tool side of the question had been carefully sifted, data could be accumulated which would be exceedingly valuable to the buyer.

If it so happens that special sizes or other reasons determine the policy of using a draw-bench, then to permit of buying hot-rolled bars in quantities it will probably be found necessary to install a small, simple type of roll for the rough reduction or breaking down of large sections; this would also greatly facilitate the use of old stock sections.



**Copper Difference Account.**—Even if the matter of purchasing and drawing copper be settled as described above, there still remains a disconcerting item to account for, viz., the daily fluctuation of price of copper.

This problem is satisfactorily solved at some works by the institution of a system of book-keeping known as the "copper difference account," which is based on the fact that there is a standard works basis (conventional price) known sometimes as the "shop basis."

This basis when copper was high, say, in 1908, might have been fixed at 1s. per lb. The figure would have probably been reduced to 8d. by 1910. This basis is treated absolutely like the regular H.C.A. basis and "extras," &c., are added thereto.

The account has a substantial reserve fund to be distributed monthly to the various sections of the works to cover discrepancies, and which would be diminished *pro rata* by a rise in copper or increased by a fall. Being run in parallel with the burden accounts, it is conceivable that too great a surplus might be diminished by crediting a portion to some burden account and *vice versa*.

It would be absolutely necessary to introduce such a scheme before using a draw-bench, otherwise the trouble outlined at the commencement of this article would be sure to ensue.

With regard to the figure to be chosen as the commencing basis, a minimum would appear to be 6½d., and a maximum 14½d.; the mean between these figures, or about 10½d., would appear a logical figure to adopt at the outset.

To this basis the "extras" for sizes would, of course, be added, and the figure would be treated in all respects as a regular basis. It will be readily appreciated how convenient such an arrangement would be, and what a help to the purchasing and accounts departments.

## BUSINESS NOTES.

**Consular Notes.—Palestine.**—In a Consular report just issued, the British Consul at Jerusalem states that in the course of 1911 the concession for the establishment of a water supply and for electric tramways and lighting, was put up to competition, and according to the best information locally available at the time of writing, was awarded to a certain Monsieur Fouquian, of Constantinople, said to have been the only applicant. Some doubt is now felt as to whether the matter has after all really been definitely settled. In any case nothing has, as yet, been done locally.

**Russia.**—The British Consul at Batoum reports that telephonic communication was established during 1911 between Tiflis and Baku, and is expected to bring in a handsome revenue to the State. The standing telegraph poles were used for the purpose, and should this State enterprise prove a financial success, the system, it is reported, will be extended to other towns of the Caucasus. Wireless telegraph communication between Batoum and Sebastopol and a radio-telegraph station at Petrovsk for wireless telegraphy with Fort Alexandrovsk in Trans-Caspia were installed during the year.

The British Vice-Consul at Baku reports that a concession for electrifying the tramways of the town has been taken up by a Belgian firm, but requires confirmation before any work in connection with its realisation can be proceeded with. Dealing with the general trade of the district the Vice-Consul states that it is noticeable that imports from abroad are generally on the decline. At one time Russia depended to a great extent upon other countries for her machinery and general manufactured supplies. She has now many excellent works and factories of her own, and is able to manufacture goods for use in the country with excellent results; hence the reason for the decline referred to. Each year makes this more apparent, but, despite it, many imported commodities still find a profitable market in the country. A great demand exists for engines working on crude oil as fuel. Most of the oil producers of Baku are now dismantling their boiler installations and erecting electric plants for power purposes. Keen competition between electric and other power is the result. Oil motors are holding their own at present, but it is difficult to say what the ultimate issue is likely to be. The best internal combustion engines at present sold in the Baku market are undoubtedly those of British makes. Their only disadvantage is in price, which is comparatively high, and often disproportionately in excess of the advantages to be derived from their use. Foreign competitors, by having the heavier and coarser parts manufactured in Russia (payment of freight and duty on which are consequently avoided), and only importing the more intricate and complex parts of their machinery, are able to furnish

this class of machinery to the Baku market at lower prices than British manufacturers ask. It would be advisable for British manufacturers intending to do business with Baku in motors of the description referred to, to make several practical trials and tests with crude oil actually received from the Baku fields. Internal combustion engines and motors would also sell well in Trans-Caspia and the agricultural districts of the Caucasus, where they are much used for driving cotton machinery, mills and irrigation plant. Excellent motors are now made entirely in Russia. They are cheaper than the foreign-made article, and have met with certain success in the Baku market.

**Holland.**—The British Consul at Rotterdam reports that a private firm has entered into a contract with the town authorities for the lease of a plot of waste ground in close proximity to the Maashaven to the extent of 17,940 sq. yards, for the storage and handling of bulky articles. Electric loading and discharging cranes will be erected on the shore, and will be so constructed as to enable goods to be discharged from the ocean steamers into barges alongside. The construction of the quays for the support of the necessary heavy machinery will involve an outlay of £33,000.

**Nicaragua.**—The British Consul in Nicaragua reports that American trade there has been making great and rapid progress during the last few years. Its success may be attributed, in the first place, to the proximity of the United States, and consequent cheaper freight and quicker communication. Besides this, American manufacturers are ready to supply at moderate prices certain lines of machinery and tools, which, although not of very lasting or solid construction, are well fitted for their purpose, and consequently find a ready market. It is frequently urged by American manufacturers that in many classes of machinery, especially agricultural implements and labour-saving devices, improvements in construction are of such frequent occurrence that it is better policy to turn out a cheaper though, perhaps, not so durable article that can later on be replaced by a new model. The superiority of British machinery is very generally recognised, but, for reasons of expediency and cheapness, inferior goods get the preference. The longer and easier terms of payment generally granted by foreign houses, and greater enterprise in sending out commercial representatives, may also largely account for the existing state of things. Nicaragua does not seem to have attracted British enterprise to any considerable extent. A large amount of foreign capital is invested directly or indirectly in the coffee industry, whereas British capital appears to be more largely represented in mining concerns. The imports of machinery in 1910 were as follows:—

From United States	...	...	...	...	£10,953
" United Kingdom	...	...	...	...	8,037
" Germany	...	...	...	...	1,052
" France	...	...	...	...	28
" Italy	...	...	...	...	159
Total	...	...	...	...	£20,230

**Canary Islands.**—The British Consul reports that the wireless telegraphy stations lately erected at Santa Cruz de Tenerife, and Gando, Grand Canary, were opened to the public on November 27th, 1911. They are under the management of the Marconi Co. The station at Melenara was completed about the middle of 1911, and has proved of great use to the port and shipping, but it is to be regretted that its advantages are not more generally appreciated, and its use thereby extended. However, it is anticipated that general business will increase in the near future.

**Spain.**—The British Vice-Consul at Vigo reports that the city electrical tramway scheme, which was considered to be a failure, has now been revived. A new company, with a capital of 2,000,000 pesetas, has purchased the Government concession, and there is every probability that this enterprise will now be pushed forward. A new company has started with works for the supply of electric light to the towns of Corcubion, Cea, Noya, Muros, and Santiago. The water power to produce the energy is obtained from the waterfalls of the River Ezaro.

**Price Increase in Germany.**—Circulars have been issued by a number of firms engaged in the light electrical engineering branches (telephony and telegraphy) in Germany announcing an increase of 10 per cent. in prices from May 15th, in consequence of the advance in the cost of raw materials. Among the firms concerned are the Siemens & Halske Co., the Felten and Guillaume-Carlswerk, Mix & Genest, J. Berliner, and the Lorenz Co. An improvement in the sale prices of heavy electrical engineering manufactures is also reported to have taken place in Saxony in the course of the present year.

**A Bombay Electrical Trade Association.**—We read in the April *Indian Textile Journal* that a movement was recently commenced amongst leading firms interested in electrical trades in Bombay to form an Electrical Trades Association. A preliminary meeting was held and a Committee appointed to draw up a scheme for the conduct of such an Association. When what are considered to be suitable rules have been formulated, a meeting of representatives of all firms concerned will be called to discuss the scheme, and it is fully anticipated that an Association will be formed.

**Trade Announcements.**—MESSRS. ELLIOTT BROS. have moved their London office to Central Buildings, Tothill Street, Westminster, London, S.W. The works address will remain as heretofore—Century Works, Lewisham, S.E.

MESSRS. W. CHRISTIE & CO. have removed to more commodious and central offices at 105, St. Vincent Street, Glasgow. New telephone number; "Central 1066."



**Private Meeting.**—FREDERICK LEWIS MITCHELL (trading as F. L. Mitchell & Co.), ironmonger and electrical engineer, 58, Peckham Rye, and 188, Rye Lane, Peckham, S.E. The creditors interested herein were called together on May 22nd, when a statement of affairs was presented showing the position as at May 14th last. The ranking liabilities amounted to £1,285, of which £1,012 13s. 5d. was due to trade creditors, and £96 13s. 4d. to cash creditors. There were fully secured creditors for £52 and partly secured creditors for £282. The assets were estimated to realise £715 from which had to be deducted £122 for preference claims, leaving net assets of £593, or a deficiency of £692. The deficiency was chiefly accounted for by losses on trading. The debtor started in business for himself about nine years ago with a capital of £460. He then took an unexpired lease of premises at Peckham Rye at a rental of £70 per annum. The business in Rye Lane was purchased about two years ago. On behalf of the debtor an offer was made of a composition of 6s. 8d. in the £, but it was decided that a Deed of Assignment should be executed, and a committee of five of the principals was also elected. The following are creditors:—

Armorduct Co. . . . .	£35	Smith, J. & W. B. . . . .	£63
Evered & Co. . . . .	34	Schoen Bros. . . . .	26
Jagon, W. H. . . . .	24	Baker & Crockett . . . . .	63
General Electric Co. . . . .	20	Carron Co. . . . .	34
Needham, Veall & Tyack . . . . .	50	Currie, Thompson & Co. . . . .	16
Hoofs & Rowland . . . . .	21	Faulkner, Herbert & Co. . . . .	34
Krupka & Jacoby . . . . .	18	Farniloe, T. & W. . . . .	22
London & Continental Electric . . . . .	16	Falk, Stadelmann & Co. . . . .	37
Stores . . . . .	16	Nettlefolds, Ltd. . . . .	19
Phillips, J. . . . .	25		

**The Horticultural Exhibition.**—The lighting of the large tents erected in the Chelsea Hospital Gardens for the recent Royal International Horticultural Exhibition, also that of the grounds themselves, was done by a large number of electric lamps. Current was provided by means of a 300 to 400-H.P. engine and dynamo.

**Book Notice.**—In the quarterly magazine *Advertising* (101, Fleet Street, E.C.) there is an article by Edmund Olander entitled "The Great White Way," in which some pictures and notes are given relating to the use of large electric signs for advertising purposes in New York City, and the possibilities of London in the same connection.

**Holidays.**—The London and South-Western Railway Co. have published their fourteenth annual official illustrated guide, containing a list of hotels and other establishments which provide accommodation for visitors. More than eighty of the most attractive places on the company's system are mentioned in the descriptive matter, which the editor, Mr. W. T. Perkins, has again brought up-to-date. The list of golf links approached by the L. and S.W. train and steamship services has now reached the large total of 120. Copies may be obtained from the department of Mr. Henry Holmes, superintendent of the line, Waterloo Station, or at any booking office.

**Meter Contracts.**—The Edinburgh Corporation has accepted the tender of the BASTIAN METER Co., LTD., for five ampere meters, and Govan Corporation that of the same company for three ampere meters.

**Liquidations.**—HORSFALL DESTRUCTOR Co., LTD.—Mr. Justice Joyce, in the Chancery Division on May 22nd, appointed a Receiver and manager of this company. The appointment was made on the application of Mr. H. E. Wright on behalf of Parr's Bank, who were holders of debentures for £10,000, and he stated that the company was not a losing concern, and last year made a profit of £4,500. It had several contracts in hand, but heavy judgments had recently gone against them, and they were consequently in financial difficulties. No opposition was offered, and his Lordship made the appointment.

CANADIAN BRITISH ENGINEERING Co., LTD.—This company is winding up voluntarily, with Mr. P. J. Hellis, 3, Merthyr Terrace, Castlenau, Barnes, as liquidator.

HARPER ELECTRIC PIANO Co., LTD.—A meeting is to be held on June 25th at 23, Devereux Court, Strand, W.C., to hear an account of the winding up from the liquidator (Mr. H. Wilson).

**Catalogues and Lists.**—THE BRITISH PROMETHEUS Co., LTD., Salop Street Works, Highgate, Birmingham.—The company have issued a pamphlet containing a full illustrated account of the electric kitchen in Marylebone, of which a description has already appeared in our pages. The brochure is really a reprint (by permission) of part of the pamphlet prepared by the Marylebone electricity department a few months ago, but it contains a number of additional pictures of the Prometheus equipment. We believe that the contents are calculated to be useful to the prospective cooking consumer, and copies can be obtained by those interested on application.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS Co., LTD., Silvertown, E.—Small illustrated folding list, relating to "Silvertown" petrol-electric plant for country house lighting, and giving prices of same.

THE CROSBY STEAM GAGE AND VALVE Co., 147, Queen Victoria Street, London, E.C.—A 12-page pamphlet has been issued illustrating and describing a new method of obtaining reduced steam pressure. A separate regulator, actuated by a relay, is coupled to a balanced valve fitted in the steam main. The same system is being successfully used for surplus and excess pressure valves, and the relay regulator can also be used for actuating dampers, blast gates, electric speed regulators, and other similar devices. The

pamphlet further illustrates the firm's differential reducing valve for obtaining very low pressure, in which the diameter of the outlet is twice that of the inlet, the valve being the size of the inlet. By the use of this valve it is possible to obtain reduced pressures right down to vacuum. Fan engine regulators for induced draught plants, and a horizontal controller working on the relay principle, are also included in the list.

MESSRS. UNION ELECTRIC Co., LTD., Park Street, Southwark, London, S.E.—20-page booklet entitled "The Artificial Lighting of Low-roofed Factories," containing a brief description of the Union "Eye-Comfort" electric system for interior lighting, and a number of photographic reproductions of factory and other premises lighted on this system.

MR. C. SCHNIEWINDT, Neuenrade.—Leaflet showing, and giving prices of, a number of electric flat-irons.

THE ELECTRIC CONSTRUCTION Co., LTD., 9, New Broad Street, London, E.C.—Eight-page pamphlet containing illustrated information respecting the "N.P.M." self-starting two or three-phase motor, parts being shown, also views of applications of the motor to the driving of sand mills and grinding machines. Diagrams appear relating to various classes of application, ordinary and special.

THE ARMORDUCT MANUFACTURING Co., LTD., Farringdon Avenue, London, E.C.—We have received advance copies of a new electric ventilating fan leaflet, which is being issued. Illustrations, brief information, and tabulated price particulars, are given for D.C. and A.C. desk and bracket fans, porthole type exhaust fans, ship and railway fans, &c.

THE SUN ELECTRICAL Co., LTD., 118-120, Charing Cross Road, London, W.C.—Several leaflets relating to D.C. and A.C. oscillating fans, lampholder fans, H.V. distributing fuseboards ("Savetime," and "Competition" types), also "Sun" electric ovens.

THE BRITISH THOMSON-HOUSTON Co., LTD., Mazda House, Upper Thames Street, London, E.C.—A new folder has been issued, entitled "The Necessity for Scientific Reflectors." It covers the Holophane (glass) and Mazdalux (metal) reflectors supplied by the company, giving the usual data and prices of the reflectors, and some notes on the need for, and value of, a scientific reflector. Copies of this folder (No. 2,278), overprinted with name and address, may be obtained on application.

**Mesopotamia.**—An American Consul says that the Turkish Imperial Government has approved the concession granted by Bagdad Municipality to Mr. Shabunder to build a tramway from Moazzem to Garara, and that Mr. Shabunder left for Europe recently to contract for material and engineers. The same Consul reports that Bagdad municipality has also opened bids for installing an electric lighting plant, and the army post has been considering introducing a telephone system all over the city.

## LIGHTING and POWER NOTES.

**Aberystwyth.**—The T.C. has invited the Chiswick Electricity Supply Corporation to tender for public lighting, either for the whole of the town or specified streets, for three or five years.

**Argentina.**—At an extraordinary general meeting of shareholders of the Cia. Franco-Argentina de Electricidad, held on April 30th, the sale of the company to the Cia. Anglo-Argentina de Electricidad was approved.

Negotiations are on foot for installing electric light in the town of Tornquist, Province of Buenos Ayres.

**Blackburn.**—The Corporation electricity works have obtained their first large customer for electric driving at the new mill in Whalley New Road, of the Great Harwood Commercial Co. The individual drive having been decided upon, each of the 1,040 looms to be installed in the shed will be fitted with a small motor for that purpose.

**Broadstairs.**—The U.D.C. has accepted the tender of the Isle of Thanet Electric Tramways and Lighting Co., Ltd., for lighting the sea front by flame arc lamps, at £10 per lamp per annum.

**Burnham (Somerset).**—The U.D.C. proposes to have the Esplanade lighted by means of 12 200-c.p. electric lamps, and other parts of the town with lamps of various candle-power through the supply of Dr. Purves.

**Chester.**—At a meeting of the T.C., the Special Sub-Committee appointed to decide the question of the electricity undertaking charges, reported that it had decided to recommend the Council to adopt the previous recommendation of the Finance Committee, viz., "That Mr. J. F. C. Snell, consulting engineer, London, be engaged to report upon (1) the mode of charging the tramways undertaking for current supplied, and (2) the mode of charging for the public lighting in the city, at an inclusive fee of 50 guineas." An amendment, however, was moved and carried, that the matter be deferred until the next meeting of the Council.

**Continental Notes.**—BAVARIA.—An electricity generating station is being established in connection with the Gustav Lignite Mines at Dettingen for the supply of electrical energy for lighting and power purposes in the Hanau district.



**HUNGARY.**—The municipal authorities of Agram are interested in a scheme to establish a large electricity generating station at Sveto-Nedelja to utilise certain available water-power for lighting and power purposes. The installation is estimated to cost £32,000.

**Darwen.**—The Corporation electricity works are to be extended by the installation of a turbo-generating set and motor-generator at an estimated cost of £4,850, and mechanical stokers at a cost of £400.

**Erith.**—The U.D.C. has decided to supply current to the L.C.C. for the sewage outfall works at Crossness, for three years at the following rates:—Lighting, 1½d. per unit between one hour before sunrise and one hour after sunset; 4½d. per unit for other periods. Power, on a sliding scale, with a minimum annual payment of £110.

**Festiniog.**—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for permission to utilise overhead lines for the transmission of current at a pressure of 9,500 volts in the parish of Festiniog (Merionethshire), for the purposes of supply under the Act.

**Fifeshire.**—The Fife Electric Power Co. has again made application to Kirkcaldy District Committee of the County Council, to be allowed to erect overhead wires on four level crossings on the new line which they intend to open between Red House and Freuchie, a distance of nine miles. At a recent meeting the Committee had refused the request. Mr. Thomson, the manager of the Power Co., pointed out that it was purely for an electrical reason that they wished to keep the wires overhead. He also stated that the wires would be carried double across all public roads, and would be well protected, while the company would take the responsibility for any accident. On the understanding that the company would enter into an obligation to repair all damage, the Committee decided to accept a notice of motion for next meeting, suspending its standing orders so as to rescind its previous decision.

**India.**—The *Indian Textile Journal* says that the result of the investigation which has been undertaken with a view to determining the feasibility of securing in Mysore a supply of electric power at sufficiently low cost to render possible a future smelting industry, is awaited with interest. There is little doubt of the ample resources of the State in regard to supplies of ore, flux and charcoal, and all that seems needed for the utilisation of these materials in the manufacture of steel is cheap power. Pending a satisfactory report concerning the latter, the State geologist and other officials are watching the development of electric smelting in other countries.

The Lahore electric supply scheme is making good progress, and when the mail left the machinery obtained from the Delhi Durbar installation had been placed in position. House connections will be made during the summer months, and it is probable that the works will be formally opened in the coming month by Sir Louis Dane.

**Keighley.**—The T.C. has decided to apply to the L.G.B. for a loan of £1,660 for a new water-tube boiler for the electric light works.

**Lancaster.**—The Corporation Electricity Department reports an income of £9,708, compared with £9,231 in the previous year, and a decreased expenditure of £383. Although lighting current produced £33 less, motive power was more by £444, notwithstanding a reduction of £67 on tramway supply. The net profits were £1,348, against £488 last year, and £161 more than anticipated. £800 was voted to the relief of the rates, and the balance, £548, to the credit of the reserve fund, now £2,865. The capital expenditure is £63,252, and the outstanding debt £51,531, with £3,622 set aside for depreciation.

**Linthwaite.**—The U.D.C. has consented to the Huddersfield T.C. erecting an overhead line in the town for the supply of current to residences and a place of worship in the district.

**London.**—A large electrically-driven pumping plant, which is being installed by the Port of London authority for raising the level of the water in the Royal Victoria and Albert Docks, consists of three Allen 70-in. centrifugal pumps, with a capacity of 280,000 gallons of water per minute, driven by Westinghouse motors. The suction culvert to the pumps is 14 ft. sq., and six 50-in. delivery pipes are provided.

**Oldham.**—The profit on the electricity department for the year ended March 25th last was £2,047, against £1,300 in the previous year. There had been increased receipts from lighting of £1,579, and £998 from power, but there was a decrease of £1,128 on traction supply. It has been decided by the Committee that the balance of £1,300 on the year ended March 25th, 1911, should be placed to reserve fund. The suggested extension of the electric lighting cables to Moorside, at a cost of £2,585, is under consideration.

**Peterborough.**—The working of the Corporation electricity department shows a gross surplus of £4,289, and of £629 after providing for interest on, and repayment of loans. This compares with £369 net surplus last year, and a considerable deficit (largely owing to an expensive arbitration) the year before. The total capital expenditure on the undertaking has amounted to £58,402.

**Perthshire.**—In regard to the projected Loch Ericht Water and Electric Power Bill for Perthshire, it is now stated that the promoters have cancelled all the clauses giving them power to

dam or interfere in any way with Loch Ericht. Therefore, the water power will now be developed from the River Ericht, which is wholly on the Menzies estate. The Bill will not be likely to meet with any opposition in Parliament, and is to be taken up immediately.

**Port Glasgow.**—Further correspondence between Port Glasgow T.C. and the Greenock Corporation, relative to the latter supplying certain power users in Port Glasgow with electricity, has been considered by the T.C. It was agreed that the proposal for the supply of electricity must be considered as a whole, and the necessary agreement for consent submitted. The Council objected to the inclusion in the B. of T. order of premises proposed to be supplied for lighting purposes in John Wood Street, as it understood the supply to be given under the order was to the power users in the burgh only.

**Portrush.**—At a special meeting of the Council a report was made on the proposal of Messrs. Miller, Wilson & Pegg, electrical engineers, Belfast, to do the engineers' duties in connection with the lighting scheme, at 5 per cent. on the contract prices. A proposition to this effect was defeated, however, and the majority decided to advertise for other tenders, those in favour of this course explaining that they were not against the firm mentioned, but wished to have a larger field of choice.

**Rugby.**—At the last meeting of this Council, the electricity accounts for the year ending March 31st last were presented. These showed an apparent loss of £250 on the year's working, but Mr. Dewar, the chairman of the Committee, explained that about £800 had been paid towards capital expenditure, but for which and other outgoings there would have been a balance to revenue account of nearly £1,200. Mr. Dewar added that during last year 82 new connections were made, bringing up the total number to 514.

**Southport.**—Following the amalgamation of Birkdale with Southport, the Traders' Association recommended the Southport T.C. to consider the purchase of the Birkdale Electric Lighting Co.'s interest in Greater Southport, and also the Southport and Birkdale Tramway Co.'s interest in the amalgamated area. The matter has been referred to a Special Committee, consisting of the members of the Parliamentary and the Finance Committees.

**Stourbridge.**—The Midland Electric Corporation for Power Distribution, Ltd., announces its intention to lay cables in Heath Street and Norton Road, Stourbridge, for the supply of current for lighting, power, heating and cooking.

**Swindon.**—The T.C. has applied to the L.G.B. for a loan of £6,050 for mains, feeders, and services, for five years.

**Taunton.**—The T.C. has decided to offer the National Electric Construction Co., Ltd., £500 in full settlement of all claims under the free wiring agreement. The company had asked one-half of the original cost for the installations, viz., £793.

**West Hartlepool.**—The L.G.B. has sanctioned a loan of £38,000, applied for by the T.C. in connection with the proposed power development at the Seaton Carew Iron Works.

## TRAMWAY and RAILWAY NOTES.

**Asiatic Turkey.**—The representatives of the British European Trust, Ltd., have concluded a convention by which they have obtained from the Imperial Ottoman Government a concession to construct a system of tramways in and about the city of Smyrna. Negotiations are also taking place for the acquisition of telephone and power concessions for the same city.—*Financier*.

**Bradford.**—The Tramways Committee has under consideration a proposal to extend the tramways from Allerton to Wilsden.

**Chile.**—The Government has requested Congress to give preferential attention to the question of the electrification of the railway from Valparaiso to Santiago, as also other lines.—*Review of the River Plate*.

**Continental Notes.**—FRANCE.—A concession has lately been granted for the construction and working of a system of electric tramways in the town and district of Montlucon (Department of Allier).

A scheme for the conversion of the local steam railway between Bordeaux and Camarsan to electric traction is at present under consideration.

**Halifax.**—The Tramways Committee has decided to purchase six new cars and to carry out further doubling of the track on the Skircoat Green and Sellon sections. It was also agreed to open negotiations with Bradford with a view to instituting a through tramway service between the two towns.

**Japan.**—We learn from Tokio that a scheme is under consideration to establish a garden city about five miles from Kodzu, with which town it would be connected by an electric tramway.

**Lancaster.**—Alterations have been agreed upon to the track at King Street Corner, amounting to £85. The traffic



revenue last year was £5,566—an increase of £315. Traffic and general expenses were similar to last year; power, £67 less; and repairs, £101 more. The total expenditure was £8,181. The income on revenue account exceeded the expenditure by £305, making the net deficit, after paying interest and redemption, £2,379, the smallest yet experienced. The capital expenditure is £43,412, and the debt redeemed, £12,371.

**Maidstone.**—Councillor Green, deputy chairman of the Tramways Committee, on Wednesday last week appeared on a car with tickets and punch, serving as a volunteer conductor, and had to submit to a good deal of chaff. The conductors had ceased work as a protest against the dismissal of one of their number, who had been their spokesman in an agitation for increased wages. The Corporation was willing to grant the increase, but not to reinstate the conductor, and his comrades refused to go back without him.

**Middlesex.**—An arrangement has been made between the County Council and the Finchley District Council, it is stated, for the removal of the electric tramway standards in the centre of the Great North Road between Highgate and Whetstone.

**New Zealand.**—The report of Mr. F. Black, the consulting engineer, on the Timaru tramway scheme, has now been presented. The estimated capital expenditure for track, overhead equipment, rolling stock and car-shed is £57,000, the estimated revenue in three years' time is £11,812, and the working expenses £10,417, leaving a balance for depreciation, &c., of £1,395. The report also compares the alternative sources of supply, *i.e.*, whether the borough should purchase energy from the Government Hydro-Electric Supply, to be generated at Lake Coleridge, or install its own generating plant. The Government department offers to supply in bulk at 11,000 volts at a charge of £6 10s. per H.P. per annum based on the average demand ascertained from the maximum half-hourly consumption. The engineer estimates that, unless the above rate is reduced to £5 10s. per H.P., it will be more economical for the borough to run its own generating plant, with the prime movers either suction-gas engines or Diesel engines. The estimated costs of the three alternatives, based on the present growth of the town and population, and assuming that the equipment will be completed in three years' time, this also being the time that will elapse before the Government supply is available, are as follows:—Sub-station reducing H.T. supply to direct current, £10,900; producer gas plant, £20,560; Diesel engine plant, £24,200. The report is very favourable to the Council's proceeding with the scheme, and it is also probable that the borough will buy over the present lighting plant, which is owned by a private company.

The poll of the Napier ratepayers has resulted in sanction being given to the raising of an additional £10,000 loan for the tramway and lighting scheme; this increased expenditure is the extra cost of material and labour since the first estimates were presented.

The town of Inglewood is about to raise a loan of £8,500 for electric lighting work.

**Perth.**—According to a report submitted to the Corporation Tramways Committee, the receipts for the year ended May 15th amounted to £9,394, which constitutes a record, being £499 better than last year. The expenditure has been kept below the estimate by £140.

**Rhondda.**—The employees of the Rhondda Electric Tramways Co., numbering over 200, struck work on Friday last week. The company, apparently, does not intend to attempt to run cars while the strike lasts, and a long stoppage is expected.

**South Shields.**—The annual report on the Corporation tramway undertaking by Mr. L. E. Harvey, the manager, showed a gross profit of £14,505, which was the largest amount yet received. After paying interest on capital, sinking fund charges, &c., the net profit balance was £5,663. This is an increase of £3,319 over the previous year, and is the largest net balance yet realised by the undertaking. The traffic receipts showed an increase of £3,113 over the previous year. The receipts per car-mile were 9'71d., an increase of '871d. The working expenses showed a decrease of £56. The consumption of energy per car-mile was 1'11 units. The Committee recommended that £500 should be handed to the insurance fund, and the remainder (£5,163) be placed to the credit of the reserve fund, making it £14,633.

**Southend-on-Sea.**—The T.C. has applied to the L.G.B. for a loan of £3,800 for the provision of additional loops and sidings on the Pier tramways.

**U.S.A.**—By its agreement with the Interborough and Brooklyn Rapid Transit Companies for new subways, New York City has committed itself to an expenditure of £24,800,000 during the next five years, the two subway companies finding £54,000,000.

			White population.	Number of telephones.
Durban	...	...	32 000	1,928
Johannesburg	...	...	122,000	3,450
Cape Town	...	...	30,000	1,400
Pietermaritzburg	...	...	14,000	874

Durban is also the only city of the Union of South Africa which uses American telephones. All other cities use the Ericsson, a Swedish telephone. Durban's revenue from telephones in the fiscal year 1911 was \$38,162, of which \$21,384 was surplus over expenditures.

**Glass Poles for Telegraph Work.**—It is stated that glass poles are now being manufactured for telephone and telegraph service. The glass is strengthened by interlacing and intertwining it with strong wire threads. It is claimed that poles of this kind show their superiority over wooden poles in their resistance to the ravages of insects in tropical climates and to the effects of rain, snow and sleet in other climates.—*Electrical Review and Western Electrician*.

**Imperial Wireless Telegraphy.**—In reply to questions regarding the confusion and lack of secrecy observed in the transmission of wireless messages at the time of the disaster to the *Titanic*, Mr. H. Samuel recently stated that there was no reason to suppose that confusion would occur in the transmission of long-distance wireless telegrams with a wave-length specially reserved for them under a properly regulated system. At present, he said, the secrecy of wireless telegrams was mainly dependent on the use of cipher or code.

**International Radio-Telegraphic Conference.**—The British representatives at the forthcoming International Radio-Telegraphic Conference are to be Sir H. Babington Smith, Mr. E. W. Farnall, Mr. R. J. Mackay, Mr. F. W. Home, Commander F. G. Loring, Capt. E. F. B. Charlton, Commander W. R. W. Kettlewell, Lieut. John A. Slee, Lieut.-Col. J. M. W. Macdonogh, and Major R. H. H. Boys. Australia, Canada, India, New Zealand and South Africa are sending special representatives. The interests of other British Possessions will be looked after by the British delegates. Mr. Charles Bright, F.R.S.E., will represent the Commonwealth Government.

**Japan.**—It is stated that the number of applicants waiting for telephones on the books of the Japanese Government Department exceeds 100,000. Parliament is to be invited in its next session to consider a Bill to effect the necessary expansion of the telephonic system at a cost of approximately £600,000.

**Night Telegraph Letters.**—The Postmaster-General announces that from to-morrow a service of night telegraph letters at a charge of 6d. for 36 words, and 1d. for every three words beyond 36, will be inaugurated between all towns where the head telegraph offices are open all night. They can be handed in up to midnight, or telephoned to the head offices, and will be delivered by the first post next morning.

**Portugal.**—In addition to an agreement for the erection of high-power stations in various parts of Portugal, the Azores, the Madeira Islands, and the Cape Verde Islands, the Government has arranged with Mr. Marconi for the building of Marconi stations in all the Portuguese Colonies—Mozambique, Angola, Macan, Timor and Novagao.

**U.S.A.**—The American Marconi Co. is about to equip stations at New Orleans, at Swan Island, in the Caribbean Sea, and at Santa Marta, Colombia, providing direct wireless communication between the two American Continents.

**Wireless Installations on Board Ship.**—In reply to a question in Parliament, Mr. Buxton stated that the question of compulsorily installing wireless telegraphy on merchant ships was one of the points which had been referred to the Merchant Shipping Advisory Committee. Certain points in connection with it were at the same time being considered by the Board of Trade in conjunction with the Post Office.

The Dover Harbour Board's flotilla of tugs are to be fitted with wireless telegraph installations, with a range of 100 miles.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—June 11th. (a) 1,237 electricity recording meters; (b) 3 tons 12 cwt. of bare hard-drawn aluminium cables, for the Melbourne City Council. See "Official Notices" May 24th.

Melbourne.—June 18th. 50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

## TELEGRAPH and TELEPHONE NOTES.

**Durban.**—Durban, says an American Consular Report, has the only municipal telephone system in the Union of South Africa. All others are owned and operated by the Union Government. The number of telephones in use is greater here in proportion to population than in any other town in the Union from which figures are available, the following being a comparison of several of the larger towns on July 31st, 1911:—



**N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.**—June 10th and 18th. Steam piping and fittings for Ultimo Power House. June 17th.—Two coal elevators and conveyors, for White Bay Power House. July 1st.—200-kw. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

**WESTERN AUSTRALIA.**—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" May 10th.

**NEW SOUTH WALES.**—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

**SOUTH AUSTRALIA.**—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

**Barnes.**—June 11th. Concentric paper-insulated and lead-sheathed cable for the U.D.C. See "Official Notices" to-day.

**Belfast.**—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" May 17th.

June 10th.—35,000 tons of coal for the Corporation generating station. Mr. T. W. Bloxam, city electrical engineer.

**Bettws-y-Coed.**—June 4th. Underground cables, transformer pillars and public lighting apparatus, two water turbines with alternators and pipework, high and low-pressure switchgear and connections, for the U.D.C. See "Official Notices" May 17th.

**Bristol.**—June 3rd. Arc lamp carbons (No. 122) and incandescent electric lamps (No. 123), for the Docks Committee of the T.C. W. W. Squire, engineer, Cumberland Basin.

June 10th.—Wiring and fittings for electric lighting at Stapleton Workhouse, for the B. of G. See "Official Notices" May 24th.

**Buenos Ayres.**—The *Review of the River Plate* states that the Government has authorised the Hydraulic Department to call for tenders for the electric installations in the new warehouses, port of Buenos Ayres, group H; also that the Municipality of General Alvear (prov. of Buenos Ayres) will shortly call for tenders for the installation of electric light.

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Devonport.**—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" May 17th.

June 13th.—Steam coal (5,000 tons), for the Corporation electricity works. Mr. J. W. Spark, borough electrical engineer, Newport Street, East Stonehouse.

**Dewsbury.**—June 5th. Steam coal (about 4,500 tons), for the Corporation electricity works. Mr. R. H. Champion, borough electrical engineer, Bradford Road.

**France.**—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

June 15th.—The French Post and Telegraph authorities in Paris are also inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

**Germany.**—June 4th. The Baden State Railway authorities at Karlsruhe are inviting tenders for the supply of 100 kilometres of electric cables.

**Gloucester.**—Forty-five street-lighting lanterns for high-candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

**Hoylake and West Kirkby.**—June 3rd. Coal, for the U.D.C. electricity works, for a year. Mr. Chas. J. Turner, electrical engineer.

**Italy.**—ISCHIA DI CASTRO.—Tenders will shortly be invited for the supply of public electric lamps. Particulars from the Concilio Municipale.

**Liverpool.**—June 4th. Electrical fittings, &c., for a year, for the Overhead Railway Co., Ltd. Mr. E. J. Neachell, general manager, 31, James Street.

**London.**—June 3rd. Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" May 10th.

**POPULAR.**—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

June 8th.—Steam-driven boiler feed pump for the B.C. electricity works. See "Official Notices" to-day.

**HACKNEY.**—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, &c., pipework &c., travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

**HORNSEY.**—June 10th. One electrically-driven turbine feed pump, for the T.C. See "Official Notices" May 24th.

**Manchester.**—June 3rd. Electricity department. For Stuart Street generating station; electrically-driven coal-conveying plant. Specification, &c., from the secretary, F. E. Hughes, Town Hall, Manchester. Deposit £1 1s. (returnable).

June 5th.—Electricity department. Tenders for annual stores. Particulars and forms of tender can be obtained up to May 25th (in writing only) from F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

June 5th.—Washed coal slack, for the Corporation electricity works, for a year. Mr. F. E. Hughes, secretary, Town Hall.

**Margate.**—June 3rd. Two electrically-driven vertical spindle rotary sewage pumps, with one set of automatic starting and stopping gear, for the Corporation. See "Official Notices" May 24th.

**Middleton (Lancs.).**—June 12th. Coal, for a year, for the borough electricity works. Mr. S. Pauls, electrical engineer.

**Oldham.**—June 10th. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" to-day.

**Penrhiwceiber (Glam.).**—June 5th. Electrical fittings for a year, for the Penrhyber Navigation Colliery Co., Ltd. The Secretary, Penrhiwceiber.

**Pontypridd.**—June 10th. Washed nuts for a year, for the U.D.C. electricity works. Mr. J. E. Teasdale, engineer, Treforest Works.

**River Plate.**—The *Review of the River Plate* states that the Municipality of San Antonio Oeste, Rio Negro Territory, will shortly call for tenders for an electric light station.

**Rochdale.**—June 5th. Extra-high-pressure three-phase switchboard, for the Corporation. See "Official Notices" May 17th.

**Russia.**—RIGA.—The Duma delegates are about to bring in a Bill for the construction of the Riga-Cherson Canal (Baltic to Black Sea), the cost of which will be included in the Budget for 1913. The scheme, when completed, will tend to develop the coal and naphtha regions around the Black Sea, and also render Russia independent of the passage through the Dardanelles. It will also afford a favourable opening for manufacturers of electrotechnical and other machinery.—*Zeitschrift für Elektrische und Maschinenbau.*

**Salford.**—June 10th. Electric wiring of Nashville Street Council school. See "Official Notices" to-day.

**South Africa.**—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

**Spain.**—June 6th. The municipal authorities of Caballo (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

**CADIZ.**—June 6th. Tenders are invited by the Ministerio del Marina at Madrid for the supply and erection of a revolving bridge in the port of Cadiz. Plans, details of construction and system of working proposed, to be submitted for the approval of the Ministerio.

July 2nd.—Electric lighting of City of Oviedo and its municipal buildings for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

**Stockport.**—June 11th. One or more 1,500-kw. mixed-pressure turbine alternators, for the Corporation. See "Official Notices" May 24th.

**Sweden.**—June 22nd. Swedish Royal Board of Waterworks. (1) 11,250-H.P. three-phase generator, 10,000 volts, 150 R.P.M.; transformers for raising to 70,000 volts. For State power station at Alfkärleby. Specification, for 15 kr. (16s. 8d.), deposit from, and tenders, to Forestandaren för Kungl. Vattenfallsstyrelsens Elektrotekniska Byrå, Stockholm.—*Board of Trade Journal.*

**Turkey.**—CONSTANTINOPLE.—Supply of telegraph instruments also the needful materials for the erection of telegraph lines. Particulars from, and tenders to, Department of Fortifications, War Ministry. Deposit £T400.

June 15th.—Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**HAIFAH.**—The Administration of the Hedschas Railway at Haifah having been called upon to extend their line from Medina to Mecca, tenders will shortly be called for for the rails and fittings, telegraph equipment, &c. Tenders must be submitted through local agents to the Railway Administration either at Constantinople or at Haifah.

**Uruguay.**—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

**Walthamstow.**—May 31st. Stoneware conduits, for the U.D.C. Electricity Department. See "Official Notices" May 17th.

June 14th.—Low-tension switchboard, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**West Ham.**—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

June 17th.—Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 24th.



## CLOSED.

**Chester.**—In connection with the hydro-electric works scheme, the Corporation has provisionally accepted the following tenders:—

J. Gordon & Co.—Erection of buildings and construction of turbines, £9,960.  
(Bentley & Co., sub-contractors for buildings.)  
Lancashire Dynamo Co., Ltd.—Dynamoes, £2,008.  
Crompton & Co., Ltd.—Switchboard, £269.

**Coventry.**—The T.C. has accepted the tender of Messrs. Stewarts & Lloyds, Ltd., for pipework for the electric light works, at £3,055.

**Leek.**—The U.D.C. has accepted the tender of Messrs. H. & T. Danks, of Netherton, for a Cornish boiler, with fittings, at £123 10s.; and that of Messrs. Goodrich & Hamlyn, of London, for a forced-draught furnace, at £30.

**London.**—**POPLAR.**—The B.C. Electricity Committee has placed an order with the Western Electric Co., Ltd., amounting to £1,035, for 1,917 yd. of three-core 6,600-volt '15 paper-insulated lead-covered and jute served E.H.T. cable.

**Mansfield.**—The T.C. has accepted the tender of the Western Electric Co., Ltd., for mains, &c., for the extension to Mansfield Woodhouse, at £3,624.

**River Plate.**—The contract for the extension of the electric installation in the National lunatic asylum has been given to Messrs. Duhnkrack, Nellen & Co. The cost of the contract is \$93,976 paper.—*Review of the River Plate.*

**Southampton.**—The T.C. has accepted the offer of Messrs. Ferranti, Ltd., at £57 10s. for the supply of a panel for extending the H.T. switchboard at the generating station.

**Southend-on-Sea.**—The T.C. has accepted the following tenders:—

General Electric Co., Ltd.—50 Aron current limiters, 8s. 9d. each.  
Lucy & Co., Ltd.—Joint, tee and tapping boxes (two years), 2s. 11d. to 9s. 9d. each.  
Chas. Mackintosh & Co., Ltd. (two years).—062 cable, £51 10s. per 1,000 yd.; 1½ cable, £96 per 1,000 yd.  
Dussek Bitumen Co., Ltd. (two years).—Bitumen, £5 15s. per ton.  
Limmer Asphalt Co., Ltd. (two years).—Insulating compound, 2d. per lb.

**Stoker Contracts.**—Messrs. E. Bennis & Co., Ltd., have received during the last few weeks, orders for about 100 stokers, which include their three types—sprinklers, cokers and chain grates; also orders for complete sets of coal-handling plant from three important undertakings. "Bennis" stokers are being supplied to the electricity works of Northampton, Stoke-on-Trent, Rotherham and Stalybridge.

**Taunton.**—The T.C. has decided to purchase from the Tudor Accumulator Co., Ltd., a battery, at £652, and to apply for a loan for this sum. For maintenance the following terms have been arranged with the company:—First and second years, £10 per annum; third and fourth years, £20 per annum; fifth and sixth years, £40 per annum; seventh, eighth, ninth and tenth years, £97 per annum.

**Walthamstow.**—The U.D.C. has accepted quotations from the Tudor Accumulator Co., amounting to £552, for replating the lighting battery at the generating station to half its normal capacity, and £80 per annum for maintenance for a period of ten years.

**Wolverhampton.**—The Education Committee has accepted the tender of the District Electric Lighting Co., Ltd., at £302, for the lighting of the new school and centre at Hordern Road

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, May 31st. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Calibration of Wave-meters for Radio-telegraphy," by Prof. G. W. O. Howe; and "On the Use of Heaviside's Resistance Operators in Air-Core Transformer Theory," by Dr. W. H. Eccles.

**Royal Institution.**—Friday, May 31st. At 9 p.m. Paper on "Icebergs and their Location in Navigation," by Prof. Howard T. Barnes, F.R.S.

Thursday, June 6th.—At 8 p.m. Lecture on "X-Rays and Matter," by Prof. C. G. Barkla. (Lecture II.)

**North-East Coast Institution of Engineers and Shipbuilders.**—Saturday, June 1st. At 2 p.m. At the Wood Memorial Hall, Newcastle. Paper on "The Use of X-Rays in the Examination of Coal," by Messrs. F. C. Garrett and R. C. Burton.

**Institution of Mining Engineers.**—Thursday, June 6th. At 11 a.m. At the Rooms of the Geological Society, Burlington House, W. Paper on "Safety Devices in connection with Electrical Machinery and Appliances for Coal Mines," by Messrs. D. Bowen and W. E. French; discussion on paper on "Reduction, Control and Collection of Coal-dust," by Mr. S. Mavor; and other papers and discussions.

At 7.30 p.m. At the Waldorf Hotel, W.C. Dinner.

Friday, June 7th.—At 9.40 a.m. (from Fenchurch Street). Visit to the works of the Western Electric Co., Ltd., North Woolwich.

THE ELECTRICAL ENGINEERS  
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, June 3rd.—"A" Company. Infantry drill, 7.30 to 9.30 p.m.

Tuesday, June 4th.—"B" Company. Infantry drill, 7.30 to 9.30 p.m.

Thursday, June 6th.—"C" Company. Infantry drill, 7.30 to 9.30 p.m.

Friday, June 7th.—"D" Company. Infantry drill, 7.30 to 9.30 p.m.

Saturday, June 8th.—Officers' Drill Cup Competition (Wimbledon Common). All Companies parade at headquarters at 2.30 p.m. Dress.—Service dress, drill order, with waterbottles and haversacks.

The headquarters will be closed for instructional work from June 10th until further orders.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

## NOTES.

**Inquiries.**—Makers of "Hiko" commutator compound and "Nichrome" resistance wire are asked for.

**Test Results on Zoelly Steam Turbines.**—The Zoelly steam turbine, manufactured by Messrs. Escher Wyss & Co., of Zürich, and a large number of their licensees in all countries, is one which has a high reputation for low steam consumption and consequently small running cost, combined with a high degree of reliability. The following test results obtained with typical standard machines may prove of interest to our readers; they concern sets of 1,250, 5,000 and 10,000 kW. respectively, coupled in each case to three-phase alternators. The outputs are in the proportion of 1:4:8.

1. Test result on two 1,250-KW. Zoelly turbines, 3,000 R.P.M., erected in 1911 at the Drammen Electricity Works, near Christiania, Norway; tested February 21st, 1912:—

	Turbine 1.		Turbine 2.	
Load ... ..	4/4	2/4	3/4	4/4
Output of turbine in kW. including excitation, excluding output for condenser ...	1,275	656	981	1,271
Steam pressure before turbine in lb. per sq. in. ...	182.4	174.1	174.4	174.1
Temperature before turbine in °F. ... ..	588.2	471.2	493.7	523.4
Vacuum at exhaust branch in % (barometer 735 mm.) ...	96.8	98.0	97.3	96.6
Steam consumption in lb. per KW.-hour ... ..	12.59	14.79	13.80	13.16

2. Test results on one 5,000-KW. Zoelly turbine, 1,500 R.P.M., erected 1911 at the Electricity Works, Escaut, near Antwerp; January 22nd and 23rd, 1912:—

	1/4	2/4	3/4	4/4
Load ... ..	1/4	2/4	3/4	4/4
Output in kW. including excitation, excluding output for condenser ...	1,184	3,160	4,305	5,418
Steam pressure before turbine in lb. per square inch ...	169.5	173.8	168.1	166.7
Temperature before turbine in °F. ... ..	519.8	558.3	555.8	588.2
Vacuum at turbine exhaust branch in % (barometer 735 mm.) ...	98.5	97.5	96.9	96.2
Steam consumption in lb. per KW.-hour ... ..	14.70	12.65	12.35	11.95

3. Test result on one 10,000-KW. Zoelly turbine, 1,250 R.P.M., erected in 1911 in the power station of La Société le Triphase, at Asnières, France: February 12th, 1912:—

	1/3	4/4
Load ... ..	1/3	4/4
Output in kW., including excitation, excluding output for condenser ...	3,678	10,006
Steam pressure before turbine in lb. per sq. in. ... ..	162.6	154
Temperature before turbine in °F. ... ..	566.6	566.3
Vacuum at turbine exhaust branch in per cent. (barometer 735 mm.) ...	97.2	95.6
Steam consumption in lb. per KW.-hour ...	14.55	11.01

The turbines under 1 and 2 were supplied by Messrs. Escher Wyss & Co., Zürich; that under turbine 3 by the Elsassische Maschinenbau Gesellschaft, Belfort. The 1,250-KW. turbine has 8 stages; the 5,000 and 10,000-KW. turbines have 12 single stages each.



**Parliamentary.—Tramway Provisional Orders.**—The first Tramway Provisional Order came before the Examiner on May 16th. It confirms orders in respect of four districts. The Bingley Urban District Council is authorised to construct a tramway, 3 miles 1 furlong in length, from Bingley to Shipley. The Dewsbury Corporation gets authority to construct a tramway in the borough 1 mile 5 furlongs in length. The Portsmouth Corporation is empowered to construct three lines of tramway of 6, 3 and 4 furlongs respectively, and the West Hartlepool Corporation is given power to construct a number of short lengths of line.

**Bradford Corporation Trolley Vehicles.**—The first Provisional Order Bill ever promoted in regard to trolley vehicles is that of the Bradford Corporation, which was before the Examiner on May 16th. There are five routes scheduled in the order over which it is proposed to run trolley vehicles, and the lengths are as follows:—2 miles 1 furlong 1 chain; 1 mile 5 furlongs 7 chains; 3 miles 2 furlongs 7 chains; 2 miles 1 furlong 7 chains; 4 furlongs 7 chains; and 1 mile 5 furlongs 1 chain.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).—The report of the Committee to the annual general meeting, held on May 22nd, for the session 1911-12, shows that the average attendance at meetings has been 88, as compared with 77 last year, and the membership has increased from 418 to 436. The officers for the session 1912-13, besides past chairmen are:—

Chairman—Mr. A. M. Taylor.

Vice-Chairmen—Mr. C. E. C. Shawfield, Dr. W. E. Sumpner.

Ordinary Members of Committee—Messrs. G. Barnard, W. C. Goodchild, M. L. Kahn, W. J. Larke, F. M. Lea, J. F. Lister, D. K. Morris, A. H. Railing, F. W. Schiller, M. Solomon, R. Threlfall and T. F. Wall.

Hon. Secretary—Mr. H. B. Matthews.

**ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.**—The sixth annual conference of the Association was held this week at the Polytechnic, Regent Street, under the presidency of Dr. James Clark, Rector of the Kilmarnock Academy and Technical School.

**THE SOCIETY OF ENGINEERS (INC.)**—The third annual dinner of the Society was held at the Criterion Restaurant on May 11th, Mr. John Kennedy, the President, being in the chair. The loyal toasts having been honoured, Sir David Gill proposed "The Society" in a felicitous speech, to which the Vice-President responded. The toast of "The Ladies" was proposed by Mr. J. W. Wilson, and acknowledged by Miss Siemens in a very creditable maiden speech. Coffee was served at small tables in an adjoining room during the performance of an excellent programme of music directed by Mr. Charles Capper, which formed a fitting conclusion to a very enjoyable evening.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—As the result of the ballot for an Associate Member of Council, Mr. A. Bruce Anderson, the Council's nominee, was declared elected.

**INSTITUTE OF MARINE ENGINEERS.**—On Saturday, May 18th, the Institute paid a visit to the works of the Western Electric Co., Ltd., Woolwich.

**Engineers' Prospects in Canada.**—Our esteemed contemporary, the *Surveyor*, quotes some very interesting remarks from a letter by Mr. R. O. Wynne-Roberts on the possibilities for engineers in Canada. He has received a number of letters from engineers and others at home regarding appointments on the Regina water scheme, for which he is the engineer; to all he has answered that, under Canadian conditions, it is quite impossible to offer anyone any appointment worth securing, because it cannot be assured that the engineer will adapt himself to the new conditions or be satisfied with the prospects. Canadian authorities are "quite willing to pay for goods if they can be delivered," so if engineers are willing to risk crossing the Atlantic, and to take the rough and the smooth of life, their merits or demerits will be rewarded accordingly. There are plenty of works to be carried out this summer. The railway companies are laying hundreds of miles of new railways, more especially in the West, and the amount of work that will in the near future be carried out between the Atlantic and the Pacific will be immense. But to any aspirant who proposes to visit Canada it should be made plain that the only royal road to success is to be energetic and persevering, and to mind his own business. The tendency of newcomers into any new country is to criticise. Let them take Punch's advice—"Don't." It irritates, it is useless and inane. Hard work is a vastly superior emollient. "Take on," Mr. Wynne-Roberts concludes, "the first offer that fits with your engineering experience. Never mind the pay at the commencement; that will adjust itself as soon as the newcomer proves himself to be capable, reliable and resourceful, for opportunities are plentiful to such men."

**A Flame Lamp Celebration Supper.**—The purchase of the patents and business of the Beck Flame Lamp, Ltd., by Mr. Billington, was celebrated at a supper given by him to the employés and their wives on Saturday last. The picturesque village inn attached to the works at Hayes was tastefully decorated with an abundance of crimson and white peonies, and the staff specially illuminated it electrically for the occasion. "May we all thrive like bees in a hive, and never sting one another," was the toast given by the landlord, a typical old English innkeeper. The musical programme arranged by the manager, Mr. Elmslie, was greatly appreciated. At the close of the evening, Mr. Billington thanked the staff, men and boys for their unswerving loyalty to him, and paid special tribute to his "friend and manager," Mr. Elmslie. He referred to the licence granted to the Foster Engineering Co. to manufacture Beck lamps, which he was convinced would

prove an admirable arrangement; it necessitated the drafting of some of the men to Wimbledon. Those who remained, he felt sure, would, under their capable and popular foreman, Mr. Bloomfield, cheerfully engage in every fresh enterprise. He would continue to be keenly interested in their welfare, and wished them all every success and happiness. The evening ended with the singing of "He's a Jolly Good Fellow" and "Auld Lang Syne."

**Electrical Engineers' Sports.**—On Friday last the London Electrical Engineers (Territorial Force) held their fourth annual athletic sports at Stamford Bridge grounds. The programme included seven events, and all the first prizes were won by four men:—

100 Yards Race.—Final heat: Spr. R. J. Wimberley, 11½ sec.

Long Jump.—Spr. R. J. Wimberley, 17 ft. 7 in.

880 Yards Race.—Second-Corpl. J. Mitchell, 2 min. 15 sec.

120 Yards Hurdle Race.—Spr. E. R. Hutt, 21 sec.

440 Yards Race.—Spr. G. M. Drake (holder), 60 sec.

High Jump.—Spr. E. R. Hutt, 4 ft. 11 in.

One Mile Race.—Second-Corpl. J. Mitchell, 5 min. 10 sec.

The programme also included inter-company tug-of-war pulling.

The officials were: Referee, Major A. E. Le Rossignol; judges, Major J. H. S. Phillips, Capt. K. W. E. Edgcumb, Capt. T. Rich, Capt. W. H. Merrett, and Lieuts. H. M. Edmunds, W. E. Hammerton, F. H. Masters, H. C. Tufnell, and E. T. Busk; timekeeper, Capt. T. H. Campbell, R.E.

**Detection of Icebergs.**—Experiments have been carried out by Prof. H. T. Barnes, F.R.S., director of the Physics Department of McGill University, Montreal, on the detection of the presence of icebergs with the aid of a micro-thermometer capable of automatically recording a change of temperature of 0.001°. The instrument is towed in the water, and its indications are recorded on a chart. The characteristic sign of the neighbourhood of ice is first a rise in temperature followed by a sharp and steady fall. It is stated that icebergs were thus detected at a distance of two or three miles during a voyage from Halifax to Bristol recently. Prof. Barnes will lecture on the subject at the Royal Institution to-night.

**Electric Light for the House of Commons.**—Reporting on the proposal to substitute electric light for gas in the House of Commons, Dr. Collins says:—"The proposed electric lighting is to be effected by groups of three metal-filament incandescent lamps. The rays from the lamps will be filtered by passage through three layers of glass, that covering the lamp itself, a Holophane globe, and an ornamental pane of glass. The ultra-violet rays will be cut off by the amber colour of the ornamental pane. There is, therefore, no fear that the eyesight of members of Parliament will be affected by ultra-violet rays." Even clear glass is opaque to ultra-violet rays, so there need be no apprehension on this point.

**Engineering Bequest.**—The Superannuation Funds of the Institutions of Civil and Mechanical Engineers stand to gain £2,500 each under the will of the late Mr. T. P. Reay (Kitson and Co., Ltd., Leeds). Under the same will, the income on £10,000 will go to the establishment of "Reay Scholarships" for engineering students at Leeds University.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. A. F. WILSON, the deputy city electrical engineer, of Bristol, was the recipient last week of a handsome silver cigar box, which was presented to him by the members of the staff of the electricity department on the occasion of his marriage. The presentation was made by the general manager, Mr. H. Faraday Proctor.

MR. G. C. MILNES, electrical engineer, Lancaster, has had his salary increased by £25, with a further similar advance to follow next year.

The Leek U.D.C. has increased the salary of the electrical engineer by £25 a year.

**General.**—MR. H. B. RENWICK, formerly secretary of the Bournemouth and Poole Electricity Supply Co., Ltd., has been elected to a seat on the board, and appointed managing director. MR. W. D. BRIGHTMAN has been appointed secretary and MR. F. C. MCQUOWN has been appointed London secretary. We are also informed that Mr. Renwick, who was formerly general manager and secretary of the Richmond (Surrey) Electric Light and Power Co., Ltd., has now been elected to a seat on the board of that company and appointed managing director. Mr. F. C. McQuown has been appointed secretary.

The "Marriages" column of the *Times* on May 28th contained the following announcement:—"Cooke—Bonnievie.—On May 24th, 1912, at the English Church, Christiania, by the Rev. G. E. Mooney, CONRAD WILLIAM COOKE, M.I.E.E., to Sophie Augusta, elder daughter of the late Chief Advocate August Bonnievie, of Christiania, and of Wilhelmina Bonnievie (née Ingstad), his wife."



A River Plate exchange says that MR. A. SAL, chief engineer to the Post and Telegraph Department, has been appointed technical adviser to the Argentine Legation at the Wireless Telegraphy Convention in London.

We are informed that MR. LEON GASTER is now making a tour on the Continent to further the progress of the illuminating engineering movement. Mr. Gaster is acting as delegate of the Illuminating Engineering Society to the International Congress for the Prevention of Industrial Accidents, which closes to-day at Milan, and at which he is contributing a paper on "The Value of Good Illumination as Regards Health and as a Means of Preventing Accidents."

**Obituary.**—SIR EDWARD ALBERT SASSOON, who died on May 24th, will best be remembered, says the *Times*, for his great interest in the means of telegraphic communication between India and this country. "His efforts led to the appointment of Lord Balfour's Departmental Committee in 1901. The report only accepted some of his proposals, but he persevered with his campaign, and many letters of his on the subject appeared in our columns. Sir Edward saw successive and substantial reductions in cable rates and improved facilities, and, though he was modest in his estimates of himself, he was gratified with the public tributes he received for his substantial share in securing them. Wireless telegraphy was another of his subjects. Its advantages so much impressed him that he introduced a Bill, which, however, shared the usual fate of private members' Bills, to make a wireless equipment compulsory in the case of passenger vessels."

MR. S. M. JONES.—The death occurred on May 23rd, at Cardiff, of Mr. S. Mansel Jones, electrical engineer, who was in business at Castle Street, Cardiff, and Wind Street, Swansea.

## GERMAN ENTERPRISE IN SOUTH AMERICA.

THE report of the German South American Telegraph Co., of Cologne, states that at the company's suggestion a banking group closely associated with the undertaking acquired about 80 per cent. of the share capital in the Compania Telefonica-Telefonica del Plata, of Buenos Ayres, about the end of 1911, and thus secured control of this enterprise. The latter owns telephone and telegraph cables between Buenos Ayres and Monte Video, and is also interested to the extent of one-half of the share capital in the Compania Telefonica-Telefonica Nacional, of Buenos Ayres, which maintains connections between Buenos Ayres and Rosario. It has been arranged that the German South American Telegraph Co. shall take over the shares from the banking group at cost price by the year 1914 at the latest, and until the time for acquisition has arrived the former has guaranteed to the latter that the dividends on the shares shall yield interest of a minimum of 6 per cent. per annum on the monetary outlay incurred, although the Argentine company has distributed an average of 13 per cent. in the past five years. The transaction has assured the German South American Co. of a connection between Uruguay and Argentina, so that the necessity for acquiring a cable concession in Argentina and Uruguay for communication between these two countries has been avoided. It is estimated that the total expenditure on taking over the shares and effecting technical improvements in contemplation will amount to £125,000.

## NEW COMPANIES REGISTERED.

**Talgarth Electric Supply Co., Ltd.** (122,131).—This company was registered on May 21st, with a capital of £1,500 in £1 shares (500 cumulative preference, 500 preferred ordinary and 500 ordinary), to carry on the business indicated by the title. The subscribers are:—J. H. Edwards, Springfield, Saltford, Somerset, electrical engineer, 50 shares; A. A. Douglas, Brendon, Colwyn Bay, manufacturer, 50 preference shares. Private company. Table "A" mainly applies. Registered office, Electricity Works, Talgarth.

**Cirencester Electric Supply Co., Ltd.** (122,004).—This company has been registered with a capital of £6,000 in 500 cumulative preference shares of £5 each and 1,500 preferred ordinary and 2,000 ordinary shares of £1 each, to carry on the business of an electric lighting and power company in all its branches. The subscribers (with 50 shares each) are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; S. Williams, All Saints' House, Bristol, solicitor. Private company. J. H. Edwards is first managing director; qualification, 50 shares. Registered by Seymour, Williams and Co., 38, Parliament Street, S.W.

**Intenso Patentees and Manufacturers, Ltd.** (122,037).—This company was registered on May 16th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of appliances connected with artificial light, burners, lamps, brackets, globes, films, shades, glasses, meters, galvanometers, ammeters, voltmeters, carbons, cut-outs, switches, batteries, &c., and to adopt an agreement with C. Stephens and T. Clayton. The subscribers (with one share each) are:—A. W. West, 124, Strathyre Avenue, Norbury, S.W., clerk; A. J. Button, 2, Edwin Street, Gravesend, clerk. Private company. The number of directors is not to be more than five; the first are not named. Registered office, Mill Works, Roden Street, Ilford, Essex.

**Yorkshire Waste Heat Co., Ltd.** (122,107).—This company was registered on May 20th with a capital of £100 in £1 shares, to carry on in Yorkshire or elsewhere the business of an electric light, electric power, and power gas supply company in all its branches, and to adopt agreements (1) with the Old Silkstone Collieries, Ltd., for the *(inter alia)* acquisition of a freehold plot of land in Barugh, York; and (2) with the Yorkshire Electric Power Co. for *(inter alia)* the erection of a generating station at Barugh aforesaid; and (3) an indenture of lease with the said Power Co. The subscribers (with one share each) as:—A. C. Lupton, Springwood, Roundhay, near Leeds, cloth manufacturer; H. Barran, Shadwall Grange, Moortown, Leeds, clothier; R. Armitage, Farnley Hall, Leeds, ironmaster; W. G. Jackson, Bramham Hall, Boston Spa, colliery proprietor; A. H. M. Thompson, Roundhay, Leeds, engineer; W. B. Woodhouse, Greenhow, Moortown, Leeds, engineer; J. J. H. Stansfield, Lee Lane, Horsforth, near Leeds, chartered secretary. Minimum cash subscription, seven shares; the number of directors is not to be less than three; the first are A. G. Lupton, H. Barran, R. Armitage, W. G. Jackson and A. H. M. Thompson. Registered offices, Calder Road, Thornhill, Dewsbury, Yorks.

**British Economical Lamp Co., Ltd.** (122,110).—This company was registered on May 21st, with a capital of £10,000 in £1 shares, to carry on the business of suppliers of electricity, electrical engineers, manufacturers of electric lamps and fittings, &c., and to adopt an agreement with J. Kohler. The subscriber (with one share each) are:—J. Kohler, 9, Old Bailey, E.C., merchant; R. Niepel, 9, Old Bailey, E.C., merchant. Private company. The number of directors is not to be less than two or more than four; the first are R. Niepel (managing director and chairman), and J. Kohler; remuneration of R. Niepel, as managing director, £500 per annum. Registered office, 9, Old Bailey, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Johnson & Phillips, Ltd.** (84,968).—Issue on April 29th, 1912, of £4,000 debentures, part of a series of which particulars have already been filed.

**Electromobile Co., Ltd.** (75,139).—Issue on April 29th, 1912, of £160 10s. debentures, part of a series of which particulars have already been filed.

**Royce, Ltd.** (68,871).—Memoranda of satisfaction (a) in full on or before March 23rd, 1911, of debentures issued between May 4th, 1903—October 7th, 1904, securing £25,000, and (b) in full on or before March 31st, 1912, of debentures dated March 23rd, 1911, for securing £13,000, created and issued in discharge *pro tanto* of the said debentures securing £25,000, have been filed.

**Bryant Trading Syndicate, Ltd.** (67,051).—Debenture dated April 15th, 1912, to secure £24,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. B. James, 8-9, Broad Street Avenue, E.C.

**"Z" Electric Lamp Manufacturing Co., Ltd.** (96,594).—Issue on May 3rd, 1912, of £3,000 debentures, part of a series of which particulars have already been filed.

**Minehead Electric Supply Co., Ltd.** (74,382).—Deed dated April 20th, 1912 (supplemental to trust deed dated Dec. 22nd, 1909, securing £500 debenture stock), charged on freehold property in Quay Lane, Minehead, forming part of North Hill Building Estate, leasehold property in Marsh Lane, near Alcombe, Somerset, with electric generating station and offices thereon, and company's other assets, present and future, including uncalled capital (subject to mortgage dated November 28th, 1907). Trustees: T. Joyce and F. Risdon, Williton, Somerset.

**Samuel Hartford & Co., Ltd.** (116,148).—Debentures dated May 4th, 1912, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. E. B. Woolbright, Holly Bank, 15, Hargreaves Road, Liverpool.

**Hill, Harding & Co., Ltd.** (108,926).—Issue on April 13th, 1912, of £150 debentures, part of a series of which particulars have already been filed.

**Oriental Telephone and Electric Co., Ltd.** (40,691).—A memorandum of satisfaction to the extent of £2,400 on April 24th, 1912, of trust deed dated June 28th, 1905, and deed of acknowledgement dated June 12th, 1907, securing £200,000 debenture stock, has been filed.

**Corona Lampworks, Ltd.** (116,527).—Issue on May 8th, 1912, of £3,500 debentures, part of a series of which particulars have already been filed.

**British Mica Co., Ltd.** (72,187).—Return dated March 18th, filed March 21st, 1912. Capital £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each; 629 preference and 2,000 ordinary shares taken up; £629 paid on the preference; £2,000 considered as paid on the ordinary. Mortgages and charges: Nil.

**W. J. Furse & Co., Ltd.** (121,420).—Particulars of £5,000 debentures, created April 26th, 1912, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Altrincham Electric Supply Ltd.** (40,795).—Particulars of £30,000 debentures, created by resolutions June 7th, 1898, and April 18th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future. No trustees.



**Anglo-Norwegian Aluminium Co., Ltd.**—Mortgage on 1,089 shares of a Norwegian company called Aktieselskabet Nigeland Brug, and mortgage to which the company is entitled on the property (land) of the said company, dated May 10th, 1912, to secure advances not exceeding £15,000, interest at 6 per cent., and bonus of £1,000. Holders: Vivian Younger & Bond, 27, Leadenhall Street, E.C.

**Newcastle and District Electric Lighting Co., Ltd.** (28,022).—Return dated April 11th, filed April 18th, 1912. Capital, £20,000 in £10 shares. All shares taken up. £297,200 paid, leaving £2,700 in arrears. Mortgages and charges: £250,000.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.** (27,997).—Return dated April 10th, filed April 18th, 1912. Capital, £1,500,000 in 150,000 ordinary and 150,000 preferred shares of £5 each. 137,500 ordinary and 137,500 preferred shares taken up. £5 per share called up on 129,529 ordinary and 126,741 preference. £1,281,950 paid. £93,150 considered as paid on 7,971 ordinary and 10,759 preferred. Mortgages and charges: £687,500.

**Mather & Platt, Ltd.** (60,387).—Return dated March 13th, filed April 4th, 1912. Capital £1,000,000 in 40,000 preference shares of £10 each and £600,000 ordinary shares of £1 each. All shares taken up. £10 per share called up on 29,200 preference and £1 per share on 25,000 ordinary. £317,000 paid. £683,000 considered as paid on the remainder. Mortgages and charges: Nil.

**County of Durham Electrical Power Distribution Co., Ltd.** (61,591).—Return dated April 10th, 1912. Capital £500,000 in £5 shares (50,000 preferred). All shares taken up. £500,000 paid. Mortgages and charges: £250,000.

**I. Frankenburg & Sons, Ltd.** (67,889).—Return dated February 20th, filed March 12th, 1912. Capital £250,000 in £10 shares (12,500 ordinary and 12,500 preference); 10,093 ordinary and 10,010 preference shares taken up. £10 per share called up on 593 ordinary and 10 preference: £6,030 paid; £195,000 considered as paid on 9,500 ordinary and 10,000 preference. Mortgages and charges: £15,000.

**Hove Electric Lighting Co., Ltd.** (36,942).—Return dated March 20th, 1912, capital £100,000 in £5 shares (15,000 ordinary and 5,000 preference). All shares taken up; £100,000 paid. Mortgages and charges: £14,600.

**Folkestone Electricity Supply Co., Ltd.** (51,825).—Return dated April 13th, filed May 1st, 1912. Capital, £100,000 in £5 shares. All shares taken up. £100,000 paid. Mortgages and charges: £100,000.

**Crystal Palace Kearney High-Speed Railway Syndicate, Ltd.** (113,126).—Return dated January 13th, filed March 22nd, 1912. Capital £30,000 in £1 shares (29,000 preference and 1,000 deferred). 1,447 preference and 100 deferred shares taken up. £1,340 paid on 1,347 preference, leaving £7 in arrears. £200 considered as paid on 100 preference and 100 deferred. Mortgages and charges: Nil. List of allotments made up to April 1st, 1912, shows a further 340 preference shares allotted, payable in cash.

**Ellis & Ward, Ltd.** (107,215).—Return dated March 18th, 1912, filed March 2nd, 1912; capital, £10,000 in £1 shares; 6,003 shares taken up; £8 paid; £6,000 considered as paid. Mortgages and charges: Nil.

**Madras Electric Tramways (1904), Ltd.** (80,361).—Return dated March 28th, 1912; capital, £200,000 in 25,000 preference and 15,000 ordinary shares of £5 each; 11,500 preference and 11,452 ordinary shares taken up; £5 per share called up on 5,000 preference; £25,000 paid; £89,760 considered as paid on 6,500 preference and 11,452 ordinary. Mortgages and charges: £62,730.

**Incandescent Heat Co., Ltd.** (81,371).—Return dated December 1st, 1911, filed April 13th, 1912. Capital £120,000 in £1 shares; 116,436 shares taken up; £1 per share called up on 21,436; £21,448 10s. paid, including £12 10s. on 250 forfeited shares; £95,000 considered as paid on 95,000 shares. Mortgages and charges: Nil.

**Acton Lamp Co., Ltd.** (110,486).—Particulars of £3,000 debenture stock, created by resolutions of March 19th and April 1st, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future. No trustees.

**Everett, Edgecombe & Co., Ltd.** (84,764).—A memorandum of satisfaction to the extent of £1,000 on May 15th, 1912, of debentures dated June 9th, 1905, securing £10,000, has been filed.

**Foots Cray Electricity Supply Corporation, Ltd.** (86,863).—Issue on May 13th, 1912, of £450 debentures, part of a series of which particulars have already been filed.

**Pritchetts & Gold, Ltd.** (69,517).—Return dated March 20th, filed March 21st, 1912. Capital £45,000 in £1 shares (25,000 preference); original capital, £40,000 in 20,000 preference and 20,000 ordinary shares of £1 each (increased to present amount in January, 1911); 24,907 preference and 20,000 ordinary shares taken up; £1 per share called up on 20,997 preference, 6d. per share on 4,000 preference, and £1 per share on 3,000 ordinary; £24,004 paid, leaving £9 in arrears, £17,000 considered as paid on 17,000 ordinary shares; mortgages and charges: Nil.

## CITY NOTES.

### Hindhead and District Electric Light Co., Ltd.

THE directors' report, to which we made brief reference last week, showed that cables had been laid to Shottermill Ponds, and to the "Seven Thorns" in Portsmouth Road. A cable is to be laid as far as the Fernden Estate, and within the next few months the supply will be run through this estate to Marley Heights. Applications from Frensham have not come in sufficient numbers to justify making the extension this year. The report refers to the fire at the generating station at Hindhead and the engineer's house in May, 1911. Thanks to the efforts of the consulting engineers and the staff, with the generous assistance of other companies, the company were able to resume the lighting of Hindhead after two days, and Haslemere after five days. So far as can be ascertained, the fire was due to the ignition of celluloid batteries, which were being

charged during the night. It was at once decided that in future no battery should be charged at the station. The generating station had been restored and enlarged and made practically fire-proof, and increased dwelling accommodation had been provided, so that two engineers now live upon the premises. There had been installed new up-to-date switchboards, a battery double the capacity of the old one, and the engines and dynamos had been thoroughly overhauled and restored. It was proposed to write off the whole of the loss caused by the fire. Under these circumstances the directors had not set anything aside this year for depreciation. Owing to the fire and temporary loss of day load, the income for 1911 was only £116 more than in 1910, although they supplied 39 new consumers. During the year £1,250 had been received on account of share capital, and further debentures amounting to £200 had also been issued. The net profit, after deducting all expenses, amounted to £1,781. The final dividend for last year had been paid. An interim dividend of 2½ per cent., debenture interest and income-tax had been paid, the fire loss written off, and £10 put to bad debt account. After bringing in the balance from last year there remained a balance of £821. The directors recommended a final dividend of 3 per cent. (making a total of 5½ per cent. for the year), absorbing £533, and leaving a balance of £288 to carry forward. (The dividend for 1910 was 6 per cent., and £282 was carried forward.)

### Urban Electric Supply Co., Ltd.

MR. P. D. TUCKETT (chairman) presided on Wednesday at Salisbury House, E.C., over the annual general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 851), said the accounts showed steady progress, the profits earned at the various works being increased by £3,597. This was not as large an increase as the results for the first quarter of the year led them to hope they might have realised, but it was not unsatisfactory, being an increase of over 7½ per cent. As against this, the administration expenses were increased by £870, owing to the expiry of the guarantee and the new arrangement with Edmundson's, under which they paid them a fixed sum of £2,000 a year. Also, owing to the expiry of the guarantee, the net profit and loss account had assumed a new form; instead of showing the guaranteed dividends on the one side with the corresponding guaranteed deficit on the other, they now showed the item "interest on outstanding accounts due to the contractors," with a balance of net profit carried down to the balance-sheet. The former depreciation provision under the contract also disappeared, whilst the provision for redemption of debenture stock appeared for the first time. Deducting this and the interest charges, there was an available net profit of £15,438, out of which, after appropriation of £10,000 to reserve for depreciation, they recommended the payment of a 2 per cent. dividend for the year on the preference shares, leaving a balance of £438 to be carried forward. As they knew, a scheme of capital reduction was approved in the early part of this year, and under its terms the balance of the 5 per cent. dividend on preference shares would be satisfied by the issue of funded dividend certificates. Turning to the balance-sheet, the capital expenditure had increased by £68,606, the bulk of the expenditure having been incurred in connection with the Cornwall and Twickenham undertakings. To meet this expenditure, the debenture debt had been increased by £52,658, and the debt due to the contractors by £14,887. The items "Preliminary Expenses," "Discount and Stamp Duty on Debenture Stock issued" and "Suspense account for loss on wiring and motors on hire and plant dismantled" appeared for the last time, as they would be written off next year against the £160,000 by which their capital had been reduced. From this time forward the balance-sheet should disclose a steadily improving position. In addition to the very much more ample reserve for depreciation which they were now making, there would be a growing debenture stock redemption fund, whilst the two items of "instalments received in redemption of capital expenditure on wiring and motors on hire," which was partly a reserve provision, and "Amount received from consumers remains," would increase from year to year. Moreover, as long as they were able to apply the annual provision for the redemption of debenture stock in purchasing such stock on the market at a discount, the profit resulting from the transaction would constitute a further reserve provision. This year the profit so realised amounted to £733, and it had been applied in reducing the item of "Discount on debenture stock issued." The only item which appeared superficially to be somewhat unsatisfactory, and was likely to remain, was the debt due to contractors, but, as they knew, the liquidation of that debt was provided for by contract, and it could at any time be satisfied by the allotment of debenture stock, principally in the form of second debenture stock. Their lamp connections still continued to show a progressive increase. During the year they connected the equivalent of 64,577 33-watt lamps—a 12 per cent. increase as compared with increases of 8 per cent., 9 per cent. and 10 per cent. for the three previous years. A large part of this increase was attributable to Cornwall, and 69 per cent. of it represented power. The lighting connections, however, also represented an increase of 13 per cent. on those for the previous year, which was most satisfactory, considering that with metal-filament lamps they required to connect three times the candle-power to give them an equivalent connection in watts compared with carbon lamps. The proportion of the power to the lighting business was steadily rising. Four years ago 65 per cent. of their connections for the year represented lighting, and only 35 per cent. power, whereas last year the propor-



tions were reversed, power representing 69 per cent., as against 31 per cent. only for lighting. The output for the past year increased by 2,410,425 units, from 8,785,732 to 11,196,157, a 27 per cent. increase, for which, as in the case of the lamp connections, Cornwall was principally responsible, the power and heating units representing an increase of 40 per cent., as against an increase of less than 5 per cent. in the lighting units. For some years now the lighting output had shown a comparatively small increase owing to the influence of the metal-filament lamp, and there was no doubt that they still continued to feel the effect of the change from carbon to metal-filament lamps, although it was difficult to say how far last year's results were affected by this cause, and how far by the exceptionally fine weather which they experienced throughout the summer. The fine weather unquestionably exerted a marked influence on the output, and it was, therefore, fortunate that they were able to counteract this feature by so substantial an increase in the power output. Every year the innumerable advantages of electric driving were coming to be increasingly appreciated, and as long as trade remained good, they were likely to continue to benefit by this development. In particular, their Cornish power business was developing most satisfactorily, although, as he told them a year ago would be the case, its beneficial results were reflected in last year's accounts to a comparatively small extent. The demand for power was, however, altogether exceeding their expectations, and was, indeed, increasing with such inconvenient rapidity that their difficulty was to provide the plant to deal with it. He did not know that he could yet say anything very definite as to the possibilities of a cooking load, but during the past year every effort had been made to stimulate interest in the subject of electric cooking, and, so far as kettles, toasters, and other small apparatus was concerned, with some considerable success. Anything like a general adoption of electricity for cooking purposes must necessarily be a matter of gradual growth, since there was naturally a great deal of prejudice and innate conservatism to be overcome, but those of their consumers who had adopted it as their regular and normal method of cooking, and quite a few had done so, were, he believed, entirely satisfied with the results, so that he felt pretty sure it was only a question of time for this to become an important feature of their business. He did not propose to analyse the results realised at the various towns set out in the table in the report, but it might be well for him to say a few words with reference to their experiences during the past year, as they afforded a very good illustration of the impossibility, owing to the influence of extraneous circumstances, over which they had no control, of forecasting or ensuring the results of any particular year. Thus, they began last year with one of the best quarters they had had for some time, and consequently with the promise of a bumper year. No sooner had they entered on the June quarter than they began to feel the effect of last year's phenomenal summer, with the result that their combined profits for the three latter quarters of the year were considerably below those for the single March quarter. Their profits for the September quarter, partly owing to the dislocation of business due to the railway strike, actually showed a small decrease on those for the corresponding quarter of the previous year. When fine weather kept people out of doors in the evening or delayed their lighting up by perhaps half an hour, its influence on the output was most marked, and this, combined with the influence of the metal lamp economy which they undoubtedly still continued to feel, was only partly offset by the comparatively small annual percentage of new business. If, for instance, new connections represented 10 per cent., which was a fair increase, a corresponding increase in the output was entirely swamped by a reduction of anything over 1 per cent. in the general output. This showed how narrow was the margin between increase and decrease, and he, therefore, thought they had no reason to be dissatisfied with the results for the past year. For the first quarter of the current year they had connected the equivalent of 21,804 33-watt lamps, as against 10,864 for the corresponding period of last year, an increase of over 100 per cent. 84 per cent. of these connections represented power. They had sold an additional 1,034,761 units, a 38 per cent. increase, the lighting output having increased 4.6 per cent., and the power 59 per cent. The profit increase, though substantial, was not in proportion, partly because it compared with an exceptionally favourable March quarter last year, and partly because this year they had suffered from the effects of the coal strike. Not only had they had to pay more for their coal, but its quality had been inferior. They would, however, be glad to know that in spite of the difficulties which the strike entailed, they were able to maintain an uninterrupted supply at all their stations. For the remaining quarters of the year it was more than usually difficult to forecast their prospects. Unless they had a repetition of last year's weather conditions, the two summer quarters should compare favourably with last year's, whilst their Cornish power load was bound to bring in a substantial increase of profit. On the other hand, the prevailing industrial unrest was bad for their business equally with others. They were faced with the certainty of dearer coal, the burden of the Insurance Act would fall on them during the latter half of the year, and the general tendency was for all expenses to increase. Whilst less confident, therefore, that their growth of profits this year was likely to attain the handsome proportions which, but for these untoward features, he thought they might have expected, he had no reason to doubt that their profits would show a substantial and healthy increase. Owing to the many disturbing factors which might at any time upset their most careful calculations, he felt it increasingly difficult to promise them a particular result for a particular year, but that the business was a stable and progressive one, and that the trend of profits would be steadily upwards he had no doubt whatever.

Mr. F. E. GRIPPER seconded the motion.

Mr. CHASSERAN asked whether the renewals and repairs were charged to revenue; and if it would not be possible to print in the report a statement of the expenses of the different concerns in which they were interested. He also pointed out that the capital expenditure during the past year had earned very little, and suggested that the board should be very careful in regard to further capital expenditure.

The CHAIRMAN said the shareholders need have no anxiety as to the renewals and repairs being charged to revenue. In addition to the £10,000 put to depreciation they had also placed aside £4,846 for the redemption of debentures which was a far more substantial provision compared with the past, and was a substantial provision on its merits quite apart from any question of the past. He did not think they needed more tables in the report, as the figures already given were very full, and to add to them would be to unduly burden the report. Any shareholders could, however, on application, have the accounts of the concerns in which they were interested. It was quite true that the capital expended had not earned what they would like, but they would get the benefit of that expenditure in future. He remembered some time ago when Mr. O'Brien pointed out that the expenditure on the Caterham undertaking only earned 1½ per cent., but now it was earning close on 5 per cent. They were making a slow but steady forward movement. The electric lighting industry was one of the safest and most stable businesses when once built up, but in the small towns the progress must necessarily be slow.

The report was adopted.

The retiring director and auditors having been re-elected,

The CHAIRMAN moved, and Mr. CHARRINGTON seconded, a hearty vote of thanks to the staff.

Mr. W. J. FINNES, as a shareholder, expressed his pleasure at hearing such a resolution moved by the board, because it was really the officials on whom the success of a company depended, although they did not always get the credit acknowledged from the directors' side of the table. Personally, he would include the directors in the vote, for they had had a straightforward speech from the chairman, and, he believed, straightforward dealings by the whole board.

The motion was carried.

**Kalgoorlie Electric Power and Lighting Corporation, Ltd.**—The directors' report for the past year (according to the *Times*) states that the profits show a satisfactory increase over those of 1910, the amount brought to the credit of profit and loss account from Kalgoorlie being £24,290, compared with £18,106 in the previous year. The sum of £7,500 has been added to reserve for depreciation and renewals, bringing that account up to £30,500. Provision has also been made for the 2 per cent. premium payable on the redemption of the 6 per cent. first mortgage debentures. In February a violent cyclone did considerable damage to the plant and transmission lines, completely stopping operations, and entailing much loss to revenue. The cost of restoring the plant to its former state of efficiency is estimated at £2,280. In view of the serious loss resulting from this misfortune the directors are unable to recommend the payment of a dividend on the ordinary shares.

**Cape Asbestos Co., Ltd.**—The report for 1911 states that the trade of the company during the year under review, notwithstanding the bad tendency still prevailing in the asbestos industry, has been satisfactory. The directors have registered a separate Italian company, under the style of Capamianto Società Anonima Italiana, at Turin, which company has taken over the assets and liabilities of the Italian branch. The accounts show a net profit of £5,005, which, added to the credit balance brought forward, £1,855, leaves available for appropriation £6,861. The directors recommend the *pro rata* dividend of 5 per cent. per annum on the preference shares, amounting to £1,562, placing to reserve fund £3,000, and carrying forward £2,299.

**Penarth Electric Lighting Co., Ltd.**—The directors report that the accounts for the year 1911 show that the total expenditure on capital account was £41,798. The gross revenue was £4,254, an increase of £380, and the expenditure £3,111, leaving a balance of £1,143. After allowing for interest on loans and debenture stock the profit is £285. Deducting the debit balance of £49 brought forward, the amount at the credit of net revenue account is £236, and the directors recommend that £200 be placed to depreciation and £36 carried forward.

**Prospectus.**—The *New York Telephone Co.*—Messrs. Baring Bros. & Co., Ltd., have been inviting applications for the London part (£1,750,000) of an issue of £4,000,000 (20 million dollars) 4½ per cent. first and general mortgage bonds in this company at 97½ per cent., £250,000 is reserved for Amsterdam, and the remaining \$10,000,000 for the U.S.A. The proceeds are to be applied to repayment of advances obtained for improvements and to the acquisition of additional property.

**Continental.**—SWITZERLAND.—La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, reports a net profit of £47,310 for the last financial year; a dividend of 4½ per cent. is being declared.

**Victoria Falls and Transvaal Power Co., Ltd.**—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the period from October 15th to December 31st, 1910.—*Financier*.



**Felten & Guilleaume Co.**

THE report for 1911 of the Felten & Guilleaume, Carlswerk, A.G. of Mulheim, states that the transfer of the Frankfort dynamo works to the A.E.G. was completed by the beginning of that year. The settlement of this business and the collection of debts owing to the former Frankfort department and its foreign subsidiary companies were still in progress, although depreciation had been made to an extent corresponding with the sacrifices involved. It was intended to devote the funds thereby rendered available, in addition to extending and improving the equipment of the Carlswerk, to the acquisition of the mining and ironworks undertaking of J. Collart & Co., of Steinfurt, which was to be developed into a steel-producing enterprise capable of supplying the company's requirements in the matter of semi-finished steel. The accounts show the following figures for the two years, although the results are not directly comparable owing to the disposal of the dynamo works:—

	1911.	1910.
Share capital ... ..	£2,750,000	£2,750,000
Loan capital ... ..	1,241,000	1,264,000
Gross profits (manufacturing and investments) ...	509,000	570,000
General expenses ... ..	108,000	202,000
Depreciation ... ..	92,000	113,000
Interest on loans ... ..	55,000	56,000
Net profits ... ..	192,000	122,000
Dividend ... ..	165,000	110,000
Dividend, per cent. ...	6	4

The report states that the turnover of the Carlswerk was larger in 1911 than in the previous year, and prices were somewhat better. During the year the wire rolling works were well employed, and all departments in the cable factory were uniformly and well occupied, whilst the rubber factory was favourable in general. The number of employes and workmen at the end of 1911 was 7,073, as compared with 6,883 at the close of 1910; and a satisfactory development of business has, so far, proceeded in the new financial year.

**South Metropolitan Electric Tramways and Lighting Co., Ltd.**

THE directors' report for 1911 states that there was expended on capital account £4,206, making the total £505,743. The total revenue from all sources amounted to £59,223, compared with £55,579 for 1910; the expenses were £35,054, compared with £34,105 for 1910, and the net revenue was therefore £2,694 more than in 1910. After deducting all expenses chargeable to revenue, including payment to local authorities under agreements and interest upon the debenture stock of the company, and after charging profit and loss account with the sum of £3,000 provision for renewals, there remains a surplus of £13,939 plus £339 brought forward, making £14,278. Out of this the directors recommend a dividend at the rate of 6 per cent. per annum on the preference shares for the year requiring £10,174, depreciation and reserve fund £3,500, carrying forward £604.

The gross receipts derived from the working of the tramways and light railways amounted to £45,530, being an increase of £2,171, and the working expenses amounted to £24,097, being an increase of £305. The gross receipts from the electricity supply section of the undertaking (including the amount represented by the sale of energy to the tramways), amounted to £12,783, and the working expenses to £6,433. The receipts for 1911 exceeded the receipts for 1910 by £1,349, whilst the working expenses were £381 in excess of those for 1910.

The total number of units sold, including 194,797 supplied to the tramways, was 836,122, as compared with 748,710 in 1910. The units sold for lighting and power purposes were 641,325, an increase of 84,677 units, or 15 per cent., compared with 1910. The number of consumers was 1,355, as compared with 1,172, an increase of over 15 per cent.

The meeting was held on Tuesday, May 28th, at Electrical Federation offices, Kingsway, Mr. C. G. Tegetmeier presiding.

The CHAIRMAN, in moving the adoption of the above report, said the year's operations showed an improvement upon those of the previous year. The surplus upon the working of the combined undertaking had amounted to £22,939 as compared with £20,245. In 1909 the working surplus was £16,113, and, in 1908, £13,777. Although the progress of the company was not so rapid as they had hoped and anticipated, and they had a long way to go before they got an adequate return upon the capital they had expended yet they could find encouragement in the fact that the growth of the company's earning power was steady and continuous, and clearly indicated that they had a property of a distinctly improving character. Dealing first with the tramway undertaking, the traffic receipts showed an increase of £2,102, and they carried 7,478,000 passengers, as compared with 6,982,000 in the previous year. The greater portion of that increase was on the Penge section of the lines. The development of the district served by the Croydon and Sutton section made but comparatively slow progress. A considerable portion of the district was still open country and furnished very little intermediate traffic, and it was somewhat surprising that with the many natural advantages and attractions it possessed the district had not more rapidly developed for residential purposes. That development, however, would certainly come sooner or later and in the natural course of things they expected it to be facilitated by the efficient transit facilities that their tramways provided. They could feel fairly sure that any growth of the population of the district would be reflected in an increase in their traffic receipts. The working expenditure for the tramways showed an increase of £304, and it was satisfactory to

find that the increase in receipts of £2,102 had been earned at this comparatively slight increase in expenses. On repairs and maintenance they had spent the considerable sum of £5,516 and in addition they had spent £1,249 on actual renewals, which had been charged to the renewals account. The whole of the undertaking had been maintained in a thoroughly efficient state. With regard to the electricity supply portion of the business they had again to record fair progress. They had a net increase of 183 in the number of consumers and an increase of £1,216 in the sale of current for private lighting. A large portion of that increase was from the supply to new houses, and as in the case of the tramways the growth of the revenue was dependent to a large extent upon the residential development of the districts they served. The promising feature of the company's future was that a considerable proportion of their extensive area of supply was almost untouched and furnished the possibility of very large expansion in the lighting business. The capital expenditure during the year amounted to £4,206, practically the whole of which was spent on the electricity supply section. The larger proportion of that expenditure, £2,763, was for the cost of laying new mains to serve newly built houses. Expenditure of that kind was in most cases immediately remunerative, and every fresh consumer on the line of mains made it increasingly so. Their experience was that, if electric light was available, it was exceptional for any other form of illuminant to be adopted in new houses, but although the economy and other advantages of the electric light were generally recognised, it was a more gradual process to secure consumers from houses where gas had already been installed. The working balance of the two sections amounted to £27,782, or £2,814 more than the preceding year. The sundry receipts and interest amounted to £909, an increase of £143. On the other side, administrative and general expenses showed an increase of £260, accounted for by increased insurance premiums. They had set aside £1,000 more than last year to the renewals fund. They proposed to place £1,000 more than last year to the reserve and depreciation fund. After paying a year's dividend on the 6 per cent. preference shares, they would carry forward £603, as compared with £338 last year. Practically the whole of the increased profit for the year was placed to their two reserve funds, which, with this year's additions, would amount to £17,030. He felt sure the shareholders would endorse the policy of the directors in strengthening the company's position and looking to the future instead of making a larger dividend distribution.

MR. EMILE GARCKE seconded the motion, and the report was adopted.

**Paris Metropolitan Railway.**

THE report for 1911 of the Compagnie du Chemin de Fer Métropolitain de Paris deals at some length with the works executed by the City of Paris, and by the company during the year, and also sets forth the works in preparation. A slight increase took place in the mileage in operation, and the average for the whole of the year was 43.77 miles. Including various receipts, the total revenue in 1911 amounted to £2,170,000, as compared with £1,798,000 in the preceding year, whilst the working expenses reached £911,000 as against £772,000. The ratio of working expenses to the receipts was 42.01 per cent., as contrasted with 42.11 per cent. in 1910 and 42.83 per cent. in 1909. After deducting the share of the City of Paris—£712,000, as against £580,000 in 1910—and providing for the payment of interest on loans and other charges, the accounts exhibit net profits of £342,000, as compared with £296,000 in the previous year. A dividend has been declared at the rate of 16s. 9d. per share on an ordinary share capital of £3,000,000, this rate contrasting with 16s. per share in 1910. It appears that the average receipts per mile showed an increase over the previous year, when the traffic was seriously interrupted for a short time in consequence of the inundations in January, but the average was less than in the year 1909. The company's claim against the City of Paris in respect of the damage caused by the floods has not yet been settled. The number of employes and agents of all grades was 5,262 on December 31st, 1911, as compared with 5,023 at the close of 1910, whilst the amount of the bonuses paid in order to induce the men to take an interest in the good working of the railway, rose from £25,000 in 1910, to £33,000 last year. The passenger tickets issued during the year totalled 305,311,995.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Consolidated Gas, Electric Light and Power Co., of Baltimore—\$700,000 additional common stock, in shares of \$100 each.  
Shawinigan Water and Power Co.—Further issue of \$1,000,000 capital stock in shares of \$100 each

And to allow the following securities to be quoted in the Official List—

Arbon Electricity Meter, Ltd.—£100,000 5 per cent. first mortgage convertible debentures of £100 each, Nos. 1 to 1,000.  
Cuban Telephone Co.—£155,000 additional 5 per cent. first mortgage convertible bonds.  
Shawinigan Water and Power Co.—Further issue of £205,480 4½ per cent. perpetual consolidated mortgage debenture stock.

**Doulton & Co., Ltd.**—A financial daily states that the accounts for 1911, after providing for debenture interest, and £706 for depreciation of investments, and writing £500 off goodwill, show a debit balance at revenue account of \$9,782.



ELECTRIC TRAMWAY AND RAILWAY  
TRAFFIC RETURNS.

## STOCKS AND SHARES.

Tuesday Evening.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen ..	May 22	2,955	+ 158	51	74,293	+ 3,495	14.4	..
Ayr ..	" 25	426	+ 60	2	426	+ 70	8	..
Bath ..	" 15	881	+ 286	20	14,751	+ 164	14.75	..
Birkenhead ..	" 26	2,205	+ 49	8	8,669	+ 535	13.6	..
Birmingham Corp.	" 18	20,814	+ 6,585	7	71,822	+ 19,721	57.17	..
Blackburn ..	" 22	2,857	+ 16	8	9,629	+ 156	14.62	..
Blackpool Corp.	" 23	1,293	+ 6	..	6,535	+ 49	11.87	..
Blackpool-Fleetw'd	" 25	885	+ 19	20	7,543	+ 149	8	..
Bournemouth ..	" 22	8,399	+ 116	7	13,385	+ 587	21.95	..
Bradford ..	" 19	10,875	+ 101	7	38,549	+ 574	56	1.2
Brighton ..	" 26	1,974	+ 106	8	7,758	+ 281	9.5	..
Bristol ..	" 24	13,785	+ 1,101	..	192,474	+ 11,881	30.5	..
Brit. Elec. Trac. Co.								
Airdrie ..	" 17	580	+ 141	20	5,605	+ 1,406	3.65	..
Barnsley ..	" 17	388	+ 25	..	3,157	+ 330	..	..
Barrow ..	" 17	731	+ 187	..	6,542	+ 1,664	5.37	..
Devonport ..	" 17	1,060	+ 121	..	10,293	+ 1,587	8.85	..
Gateshead ..	" 17	2,061	+ 18	..	19,822	+ 147	11.25	..
Gravesend ..	" 17	412	+ 4	..	3,933	+ 224	6.5	..
Greenock ..	" 17	1,670	+ 123	..	14,816	+ 2,098	7.25	..
Hartlepool ..	" 17	542	+ 39	..	4,759	+ 354	6.72	..
Kidderminster ..	" 17	191	+ 17	..	1,834	+ 83	..	..
Leamington ..	" 17	233	+ 28	..	2,920	+ 183	..	..
Merthyr ..	" 17	331	+ 52	..	3,492	+ 352	2.9	..
Metropolitan ..	" 17	17,852	+ 183	..	168,676	+ 9,198	22	..
Middleton ..	" 17	706	+ 24	..	6,013	+ 43	8.5	..
Mid. Joint Com'tee	" 17	6,217	+ 142	..	60,224	+ 2,092	..	..
Oldham—Ashton	" 17	1,243	+ 93	..	11,516	+ 784	9.13	..
Peterborough ..	" 17	253	+ 25	..	2,306	+ 205	5.31	..
Potteries ..	" 17	3,899	+ 37	..	35,155	+ 2,442	29	..
Rothsay ..	" 17	235	+ 17	..	1,619	+ 91	2.75	..
Southport ..	" 17	585	+ 48	..	6,078	+ 77	8.17	..
S. Metropolitan ..	" 17	1,712	+ 153	..	15,529	+ 680	..	..
Swansea ..	" 17	2,140	+ 19	..	21,213	+ 206	12.5	..
Tynemouth ..	" 17	404	+ 6	..	3,275	+ 2	3.75	..
Weston-s-Mare ..	" 17	173	+ 43	..	876	+ 32	3	..
Worcester ..	" 17	576	+ 27	..	5,070	+ 28	5.75	..
Wrexham ..	" 17	216	+ 20	..	2,069	+ 226	..	..
Yorks. Wool. Dist.	" 17	2,157	+ 30	..	20,446	+ 598	17	..
Miscellaneous ..	" 17	452	+ 12	..	4,140	+ 141	..	..
Burnley ..	" 25	2,875	+ 191	..	..	..	11.73	..
Burton-on-Trent ..	" 26	548	+ 22	..	1,941	+ 14	6.6	..
Bury ..	" 26	2,595	+ 39	8	10,706	+ 122	22.5	..
Cardiff ..	" 18	4,580	+ 121	7	14,267	+ 2,421	17.35	..
Chatham and Dist.	" 23	1,686	+ 29	21	16,548	+ 290	14.98	..
Cork ..	" 23	1,021	+ 118	21	9,496	+ 39	9.89	..
Croydon ..	" 17	3,635	+ 6	7	13,616	+ 40	11.6	75
Darlington ..	" 18	225	+ 21	..	1,449	+ 6	4.87	..
Darwen ..	" 17	227	+ 6	7	1,897	+ 45	4.36	..
Dover ..	" 18	214	+ 7	7	1,548	+ 69	4.75	..
Dublin ..	" 24	11,907	+ 391	..	115,275	+ 7,548	54.75	..
East Ham ..	" 25	2,333	+ 48	8	8,480	+ 245	7.87	..
Exeter ..	" 24	67	+ 49	8	2,436	+ 171	5.6	..
Glasgow ..	" 25	39,259	+ 1,712	..	971,386	+ 43,453	98	25
Hastings ..	" 28	1,777	+ 120	..	..	+ 572	19.3	..
Huddersfield ..	" 18	2,024	+ 209	7	13,348	+ 263	29.5	1
Hull ..	" 25	5,699	+ 293	8	22,335	+ 67	13.5	1
Ilkeston ..	" 9	191	+ 58	6	855	+ 427	..	..
Ipswich ..	" 18	394	+ 22	7	2,878	+ 73	10.5	..
Kilmarnock ..	" 18	364	+ 4	..	..	..	4.25	..
Lancashire United	" 21	2,795	+ 44	21	25,766	+ 441	39	..
Leeds ..	" 18	7,850	+ 595	7	52,065	+ 1,509	112.7	..
Leicester ..	" 25	1,389	+ 75	12	1,007	+ 83	8.72	..
Leith ..	" 18	11,926	+ 402	19	230,911	+ 11,080	116	..
Liverpool ..	" 15	88,151	+ 856	..	281,558	+ 1,281	140.5	2
L.C.C. ..	" 25	13,309	+ 454	21	123,678	+ 370	..	..
London United	" 25	277	+ 42	84	5,190	+ 129	8.5	..
Lowestoft ..	" 25	33,788	+ 1,042	7	115,378	+ 5,599	105	..
Manchester ..	" 18	4,290	+ 322	..	28,760	+ 850	31.3	..
Newcastle ..	" 18	1,244	+ 61	7	4,468	+ 632	7.25	..
Newport ..	" 19	2,049	+ 31	8	16,406	+ 233	23	..
Oldham ..	" 18	383	+ 23	7	2,359	+ 703	5.5	..
Pontypidd ..	" 11	1,977	+ 136	6	12,425	+ 124	15.75	..
Portsmouth ..	" 22	1,552	+ 38	8	6,194	+ 184	10	..
Preston ..	" 20	1,414	+ 76	7	4,908	+ 176	12	..
Rotherham ..	" 22	10,031	+ 441	7	35,486	+ 983	41	..
Salford ..	" 21	6,783	+ 373	8	49,469	+ 143	40	..
Sheffield ..	" 22	2,362	+ 134	7	8,980	+ 605	11	..
Southampton ..	" 15	1,298	+ 199	7	4,599	+ 707	7	..
Southend-on-Sea ..	" 18	615	+ 40	7	3,978	+ 121	10.25	..
South Shields ..	" 22	967	+ 36	21	9,253	+ 503	11	..
Tyneside ..	" 25	2,100	+ 79	7	8,416	+ 362	8.72	..
Wallasey ..	" 25	1,559	+ 86	8	6,152	+ 257	9	..
Walthamstow ..	" 16	5,484	+ 103	6	17,939	+ 299	16.4	..
West Ham ..	" 22	974	+ 84	8	7,233	+ 65	13.75	1
Wolverhampton ..	" 22	..	..	..	..	..	..	..
Gen. London Rly...								
City & S. Lon. Rly.	" 26	5,908	+ 210	21	66,688	+ 4,897	7.26	..
Dublin-Lucan Rly.	" 24	303	+ 12	21	2,569	+ 67	7	..
G.N. and City Rly.	" 25	3,145	+ 266	21	34,595	+ 2,064	8.5	..
L'pool Overh'd Rly.	" 19	1,609	+ 126	..	30,036	+ 1,876	6.6	..
Llandudno-Col. Bay	" 17	209	+ 10	24	3,915	+ 220	6.5	..
Lon. Elec. Ry. Co.	" 25	26,910	+ 185	21	297,870	+ 8,625	21.25	..
Mersey Railway ..	" 25	4,181	+ 164	21	43,402	+ 6	4.5	..
Metropolitan Rly...	" 26	83,670	+ 217	21	845,496	+ 9,977	25.75	..
Met. District Rly...	" 25	24,347	+ 1,091	21	262,588	+ 10,699	25	..
Anglo-Argentine ..	" 20	50,335	+ 2,342	..	1,031,003	+ 89,678	..	..
Auckland ..	April 5	17,472	+ 1,038	..	172,044	+ 13,495	28.8	..
Bombay (B.E.T.) ..	" 25	6,235	+ 594	17	51,425	+ 8,197	..	..
Brisbane ..	" 25	..	..	..	..	..	..	..
Brit. Columbia Rly.	" 25	..	..	..	..	..	..	..
Calcutta ..	May 25	7,264	+ 12	..	..	..	..	..
Cape Electric T.Ld.	" 25	..	..	..	..	..	..	..
Kaloorlie, W.A. ...	April	8,084	..	4	12,036	..	20.5	..
Lisbon ..	" 25	..	..	..	..	..	..	..
Madras ..	April 80	1,708	+ 144	..	18,067	+ 1,157	13.5	75
Montevideo ..	April	28,074	+ 2,778	6	185,361	+ 19,183	..	..
Perth (W.A.) ..	May 17	1,985	+ 391	..	87,802	+ 5,867	29	..

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.

THE Stock Exchange returned from its holiday without much bullish enthusiasm. Markets had gone against holders so badly last week that apprehension of a difficult settlement on Friday next, May 31st, was rife. The strike of transport workers aroused alarm lest the trouble should spread to the railways, and Home Railway stocks have been extremely flat.

Severe liquidation in Metropolitan Consolidated caused the price to drop abruptly to 62 at one time, from which there was a smart rally, though the recovery was not fully maintained, and on the week the price is 5½ lower at 62½. A statement is in circulation to the effect that the Speyer group will take over the Metropolitan Company on the basis of a 3½ per cent. dividend on the Consolidated stock, and if this should be correct, Metropolitans ought to stand in the neighbourhood of 70—that is to say, yielding a return of 5 per cent. on the money. Nothing, however, has been announced officially, and it will be remembered that quite recently a denial was forthcoming from the Speyer group as to certain negotiations being in course whereby 4 per cent. would be guaranteed to the Ordinary stockholders. City and South London has been extremely flat, and the stock, after its drop to 33½, begins to look somewhat attractive. Districts are down 3. Central Londons broke away, and East Londons crumbled to 7½: while, amongst the steam electricity stocks, Brighton Deferred has been hammered down below par.

Underground Electric Ordinary fell back 7s. 6d., the 1s. "A" shares maintaining a certain amount of steadiness at 15s. middle. The company's Income Bonds shed 2. Market nervousness, aroused at first by the magnitude of the bull account, was naturally accentuated by the threatening outlook in the labour world, but there are shrewd observers who think the slump in prices has gone far enough already.

Electricity Supply shares are easier as regards City of Londons, where the Ordinary and Preference both fell ½ upon further realisations by some of the staler bulls. London Electrics are also down, the price falling 1½ to 1½ middle. This may be due to a possible line of shares hanging over the market, and in spite of the greater demand that has recently arisen for most of the Supply Companies' shares, to deal in a thousand or so is not always easy. Counties are steady at 10½ middle, and there is no movement in Charing Cross.

Of the Latin-Canadian varieties, the big jump in Sao Paulo Trams of 13 points last week has been followed by a fresh rise of 7, which has brought the price up to 24½, with anticipation making certain of an increase in the dividend before long. Rio Trams, after showing a certain amount of weakness, spurted to-day (Tuesday), and buyers gave up to 138 for the shares. On balance, the quotation shows an advance of 3 to 137. The very substantial advance in Mexican Light and Power Common brought in a few profit-takers, with the result that the price has slipped back a couple of points. But Mexican things as a whole are steady, and the market is firm enough. Bonds in this section are still in considerable demand. An issue which will be made in the course of possibly the next few days, is one of \$1,000,000 first mortgage 5 per cent. gold bonds at 90 in the Consolidated Cities Light, Power and Traction Company. With the bonds, \$800,000 Common stock is offered at \$30. Advance subscriptions are being secured now, preparatory to a public issue very soon, the early birds of course getting a cash consideration as well as a little extra through the issue of Common shares. Shawinigan Water went back 2 after its substantial improvement, but the other Latin-Canadian issues have held their rises well.

The Telegraph market finds its chief excitement in the mercurial movements of Marconis. This time last week the price was 6½: it has been down to 4½, and is now up again to 5½. American Marconis have kept an eighth or so under 2, and are not likely to make much headway on this side of the special settlement. Canadian Marconis at 24s. are a couple of shillings above the lowest, the market in all these shares being very timid, and responsive to comparatively small lines of shares purchased or sold.

West India and Panama shares are still dull. Great Northerns fell 25s. Anglo-American Telegraph Preferred gained a further ½. West Coast of Americas have fallen a similar amount. Dealings in National Telephone Deferred stock have been mainly on account of speculators who wanted to get out, though when these sales were absorbed, the market rallied, and the price is 2½ down on the week.

The Manufacturing group is so steady as to be almost negligible. British Insulated Ordinary rose 5s., and Babcock Preference are a trifle better. Except for these, there are no quotable changes to record.

**Ruston, Proctor & Co., Ltd.**—After paying preference dividend, and 8 per cent. per annum on the ordinary shares. £25,000 is transferred to reserve and equalisation of dividends account, and £14,930 is carried forward.

**Lima Light, Power and Tramways Co., Ltd.**—The directors announce a dividend of 1½ per cent. for the quarter ended March 31st.

**Mackay Companies.**—The directors have declared the regular quarterly dividend of 1½ per cent. on the common shares.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 28th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 28th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9½-10½	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 9	7½-7½	..	5 16 2
Do. 4½ % Pref. ..	10	4½ 4½	8½-9½	..	4 12 2	Do. 4 % Deb. ..	Stock	4 4	92-95	..	4 4 3
Do. Second 6 % Pref. ..	10	6 6	10½-11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80-84	..	6 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100-102	..	4 8 8	London Electric, Ord. ..	8	2 2½	1½-2	-½	3 15 0
Brompton & Kensington, Ord...	5	10 10½	8½-8½	..	5 14 8	Do. 6 % Pref. ..	5	6 6	4½-5½	..	5 14 3
Do. 7 % Cum. Pref. ..	5	7 7	7½-8½	..	4 8 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	92-95	..	4 4 3
Central Electric Supply, 4 %	100	4 4	99-102	+1	8 18 5	Metropolitan ..	5	5 4½	8½-4½	..	5 1 3
Guar. Deb. }						Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½-4½	..	4 14 9
Charing Cross, West End & City	5	5 5	4½-5	..	5 0 0	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	101-104	..	4 6 7
Do. 4½ % Cum. Pref. ..	5	4½ 4½	4½-4½	..	4 14 9	Do. 8½ % Mort. Deb. ..	Stock	8½ 8½	85-88	..	3 19 7
Do. "City Undertaking"	5	4½ 4½	8½-4½	..	5 2 10	Midland Electric Corporation }					
Do. 4½ % Cum. Pref. }						4½ % First Mort. Deb. }	100	4½ 4½	96-98	..	4 11 10
Do. Do. % Deb. ..	100	4 4	95-98	..	4 1 8	Newcastle-on-Tyne 5 % Pref., }					
Chelsea, Ord. ..	5	5 5	4½-4½	..	5 2 7	Non-Cum. }	5	5 5	4½-5	..	5 0 0
Do. 4½ % Deb. ..	Stock	4½ 4½	98-101	..	4 9 1	North Metropolitan Power Sup-	100	5 5	97-100	..	5 0 0
City of London, Ord. ..	10	7 8	20-22	-½	3 12 9	ply, 5 % Mortgages (Red.) }					
Do. 8 % Cum. Pref. ..	10	6 6	16½-18½	-½	3 4 10	Notting Hill, 6 % Non-Cum. }	10	.. 8	10½-11½	..	5 6 8
Do. 5 % Deb. ..	Stock	5 5	119-123	..	4 1 4	Pref. }					
Do. 4½ % Second Deb. ..	100	4½ 4½	101-104	..	4 6 7	Oxford ..	5	7½ 7½	5½-6½	..	5 13 9
County of London, Ord...	10	5 6	10½-11½	..	5 7 10	St. James' and Pall Mall, Ord.	5	10 10	8-8½	..	5 14 3
Do. 8 % Pref. ..	10	8 8	11½-11½	..	5 2 7	Do. 7 % Pref. ..	5	7 7	6½-7½	..	4 15 0
Do. 4½ % Deb. ..	Stock	4½ 4½	108-110	..	4 1 10	Do. 8½ % Deb. ..	100	8½ 8½	85-87	..	4 0 6
Do. 4½ % Second Deb. ..	Stock	4½ 4½	99-102	..	4 8 3	Smithfield Markets, Ord. ..	5	Nil 2	1½-1½	..	..
Edmundson's, Ord. ..	5	Nil Nil	..	..	Nil	South London, Ord. ..	4	5 5	2½-3½	..	6 8 0
Do. 8 % Cum. Pref. ..	5	Nil Nil	3-3½	..	Nil	Do. 5 % First Mort. Deb. ..	100	5 5	92-102	..	4 13 0
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86-89	..	5 1 2	South Metropolitan, 7 % Pref. ..	1	7 7	1½-1½	..	6 1 0
Folkestone ..	5	6 6	4½-4½	..	6 3 1	Do. 4½ % First Mort. Deb. Stock ..	100	4½ 4½	96-99	..	4 11 0
Do. 5 % Cum. Pref. ..	5	5 5	4½-4½	..	5 5 3	Urban, Ord...	5	5 ..	2½-3½	..	..
Do. 4½ % First Deb. ..	100	4½ 4½	93-96	..	4 13 9	Do. 5 % Cum. Pref. ..	5	5 ..	2½-3½	..	..
Hove ..	5	9 9	8½-7	..	6 8 7	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86-88	..	5 2 3
						Westminster, Ord. ..	5	10 10	8½-9	..	5 11 1
						Do. 4½ % Cum. Pref. ..	5	4½ 4½	5½-5½	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½-5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	88-90	+½	5 11 1
Calcutta, Ord. ..	5	8½ 8½	7½-7½ xd	..	5 9 8	5 % 1st Mort. Deb. }					
Do. 5 % Pref. ..	5	5 5	5-5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	211-215	+2	3 14 5
Calgary Power, 1st Mort. Bds.	100	5 5	95½-97½	+1	5 2 7	Northern, Lt., Power and Coal, }	\$500	5 ..	39-41	..	12 3 10
Canadian Gen. El. Com. ..	\$100	7 7½	112-116	..	6 0 8	5 % 1st Mort. Bonds }					
Do. 7 % Pref. ..	\$100	7 7	118-122	..	5 14 9	River Plate, Ord. ..	Stock	10 10	240-250 xd	..	4 0 0
Cordoba Lt., Power and T., Ord.	1	8 8½	1½-1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ..	Do.	6 6	109-114 xd	..	5 5 3
Do. 5 % Deb. ..	100	5 ..	94-97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5 5	103-105	..	4 15 3
Eleo. Lt. and P. of Cochabamba, }	100	6 6	95½-97½	..	6 3 1	Roy. Eleo. Co., Montreal, 4½ % }	100	4½ 4½	99-101	..	4 9 1
8 % Bonds }						1st Mort. Deb. }					
Eleo. Supply Victoria, 5 % 1st }	100	5 5	83-86	..	5 16 8	Shawinigan Water, Capital ..	\$100	4 5½	140-144	-2	3 9 5
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	108½-110½	..	4 10 6
Elec. Dev. Ontario, 5 % 1st }	\$500	5 5	92-94	..	5 6 5	Do. 4½ % Per. Deb. ..	Stock	4½ 4½	102½-104½ xd	..	4 6 2
Mort. Bonds }						Toronto Power, 4½ % Deb. ..	Do.	4½ 4½	100½-102½	..	4 7 10
Kalgoorlie Eleo. P. and L., Ord.	10½	Nil ..	7-7½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5 5	92½-94½	..	5 5 10
Do. 8 % Pref. ..	1	6 6	3½-3½	..	8 6 0	1st Mort. Deb. }					
Raministiquia Power, 5 % G. Bs.	\$500	5 5	103-105	..	4 15 3	Victoria Falls Power, Pref. ..	1	Nil 11½ d.	7-7½	..	..
Madras, Ord. ..	5	.. ..	2½-2½	..	..	West Kootenay Power and Lt., }	100	8 6	105½-107½	..	5 11 7
Meibourne, 5 % 1st Mort. Deb.	100	5 5	104-107	+1½	4 13 6	1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	87½-89½	..	5 11 9						
Mexican Lt. & Power, Common	\$100	4 4	89-91	-2	4 8 0						
Do. 7 % Cum. Pref. ..	\$100	7 7	104-106	..	5 12 1						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	96-98	..	5 2 0						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil 4½	7½-7½	..	..	Monte Video Telephone, Ord. ..	1	6 6	1-1½	..	5 6 3
Do. 5 % Deb. Red. ..	Stock	5 5	97½-99½	..	5 0 6	Do. 5 % Pref. ..	1	5 5	8½-8½	..	5 10 6
American Telep. & Teleg., Cap.	\$100	8 8½	148-150	-½	6 6 8	National Telephone, Pref. ..	Stock	6 6	100-103	+½	..
Do. Collat. Trust ..	\$1000	4 4	95-97	..	4 2 6	Do. Def. ..	Do.	6 6	150½-152½	-2½	..
Anglo-American Telegraph ..	Stock	8½ 8	65-67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ..	5	5 5	6½-6½	-½	..
Do. 6 % Pref. ..	Do.	6 6	108-109	+½	5 10 1	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	100-101	..	4 7 2
Do. Def. ..	Do.	80½ 30½	25½-25½	..	5 16 0	Oriental Telep. and Elec. ..	1	8 8	1½-1½	..	4 13 0
Anglo-Portuguese Tel., 5 % }	100	5 5	102-104	..	4 16 2	Do. 6 % Cum. Pref. ..	1	6 6	1½-1½	..	4 16 0
Mort. Deb. }						Do. 4 % Red. Deb. ..	Stock	4 4	89-91	..	4 8 0
Chili Telephone ..	5	7 ..	7½-8	..	4 10 4	Pacific and European Tel., 4 % }	Do.	4 4	99½-101½	..	3 13 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	82½-84½	..	4 14 8	Guar. Debs. }					
Cuba Telegraph ..	10	6 6½	9½-10½ xd	..	5 14 3	Reuter's ..	8	5 5½	11-11½	..	3 9 7
Do. 10 % Pref. ..	10	10 10	16½-17½ xd	..	5 14 8	Submarine Cables Trust ..	Cert.	6 6	127-130	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4 4½	8½-9½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½ 4½	99-101	..	4 9 1
Do. 10 % Cum. Pref. ..	5	10 10	7½-7½	-½	6 9 0	Deb. Red. }					
Direct United States Cable	10	4½ 5	7½-8	..	6 6 0	United River Plate Telephone	5	8 8	7½-7½	..	5 1 7
Direct W. India Cable, 4½ % }	100	4½ 4½	99-101	-½	4 9 1	Do. 5 % Cum. Pref. ..	5	5 5	5½-5½	..	4 8 11
Reg. Deb. }						West Coast of America ..	2½	2½ 2½	1½-1½	-½	4 5 4
Eastern Telegraph, Ord. Stock	7	5½ 5½	135-138	..	5 1 1	Do. 4 % Debs., 1 to 1,500 }	100	4 4	94½-97½	..	4 2 1
Do. 8½ % Pref. Stock ..	Do.	8½ 8½	80-82	..	4 4 10	guar. by Bras. Sub. Tel. }					
Do. 4 % Mort. Deb. ..	Do.	4 4	99½-101½	..	3 18 10	West India and Panama Teleg.	10	1½ 1½	2½-2½	-½	4 7 0
Eastern Extension ..	10	7 5½	12½-13½	..	5 5 8	Do. 6 % Cum. 1st Pref. ..	10	6 6	10½-11	..	5 9 1
Do. 4 % Deb. ..	Stock	4 4	99-101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ..	10	6 6	9½-10½	..	5 17 1
East and S. Africa Tel. 4 % }	25	4 4	97-100	..	4 0 0	Do. 5 % Debs. ..	100	5 5	102½-104½	..	4 15 8
Mt. Db. Mauritius Sub. }						Western Telegraph, Ltd. ..	10	7 6½	13½-13½	..	5 2 9
Globe Telegraph and Trust ..	10	5½ 6½	10½-11½	..	5 5 6	Do. 4 % Deb. ..	Stock	4 4	98-100	..	4 0 0
Do. 8 % Pref. ..	10	6 6	13-13½	..	4 9 0	Western Union 4½ % Fdg. Bonds	\$1000	4½ 4½	100-103	..	4 7 5
Great Northern Telegraph ..	10	18 18	28½-29½	-1½	6 1 0						
Indo-European Telegraph	25	18 5½	56-58	..	5 12 1						
MacKay Companies Common ..	\$100	5 5½	87-90	..	5 11 1						
Do. 4 % Cum. Pref. ..	\$100	4 4	69-72	..	5 11 1						
Marconi's Wireless Telegraph	1	5 ..	5½-5½	-½	..						
Do. 7 % Cum. Partic. Pref.	1	18 ..	4½-5	-½	..						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 23th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 23th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	78—83	..	Nil	Metropolitan Railway Consol. ..	100	18	62½—62½	—5½	2 19 9
Do. 5 % Pref. ..	1	5	78—83	..	6 8 1	Do. Surplus Lands ..	100	2½	66—68	—1	4 4 7
Do. 4½ % Deb. ..	100	4½	78—83	..	5 8 5	Do. 8½ % Deb. ..	100	8½	89—91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	102½—12½	—½	..	Do. 8½ % Pref. ..	100	8½	86—88	..	3 19 7
Do. Do. Deferred ..	100	..	6½—8½	..	..	Do. 8½ % Con. Pref. ..	100	3½	87—89	..	3 18 8
Do. Do. 6 % Cum. Pr'l. ..	100	6	92—94	..	6 7 8	Metropolitan District Ord. ..	100	Nil	40—40½	—3	Nil
Do. Do. 7 % Non-Cum. Pr'l. ..	100	..	44—48	..	..	Do. 6 % Deb. ..	100	6	144—146	..	4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5	94—97	..	5 3 1	Do. 4 % Deb. ..	100	4	96—98	..	4 1 8
Do. Do. 4½ % 2nd Deb. ..	100	4½	79—83	..	5 8 5	Do. 4 % Prior Lien ..	100	4	99—101	+1	3 19 3
Central London Railway, Ord.	100	8	77—79	—4	3 16 0	Do. 4½ % First Pref. ..	100	8½	90—92	..	4 17 10
Do. Pref. ..	100	4	84—86	—2	4 13 0	Do. 8½ % Gtd. ..	100	3½	76—78	..	4 9 9
Do. Def. ..	100	2	77—79	—4	2 10 8	Metropolitan Elec. Trams, Ord.	1	5½	1—1	..	6 0 0
Do. 4 % Deb. ..	100	4	101—103	..	3 17 8	Do. Def. ..	1	Nil	..	..	Nil
City & South London, Ord.	100	1½	33—34	—4	4 15 7	Do. 5 % Pref. ..	1	5	..	..	5 10 6
Do. 5 % Pref., 1891 ..	100	5	108—110	..	4 11 0	Do. 4½ % Deb. ..	100	4½	98—100	..	4 10 0
Do. Do. 1896 ..	100	5	104—106	..	4 15 3	Do. 5 % Deb. ..	100	5	98—100	..	5 0 0
Do. Do. 1901 ..	100	5	104—106	..	4 14 4	Potteries, Ord. ..	1	2	..	..	..
Do. Do. 1903 ..	100	5	103—105	..	4 15 3	Do. 5 % Pref. ..	1	5	..	..	6 13 4
Do. 4 % Deb. ..	100	4	99—101	..	3 19 3	Do. 4½ % Deb. ..	100	4½	87—90	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6	102½—11½	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6	..	..	6 17 2
Great Northern & City, Pr'l. Ord	10	Nil	15—17	..	Nil	Do. 4 % Deb. ..	100	4	72—77	..	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	..	..	8 0 0	Underground Elec. Railways	10	..	93—4	..	Nil
Do. 4½ % Deb. ..	100	4½	71—76	..	5 18 5	Do. 4½ % Bonds ..	100	4½	99—101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2½	21—23	..	4 11 0	Do. 6 % Income ..	100	1	88—90	—2	..
Do. 4 % Deb. ..	100	4	75—80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil	..	..	Nil
Lancashire United, 5 % Deb. ..	100	5	83—85	..	5 17 8	Do. 6 % Pref. ..	5	Nil	..	..	Nil
London Elec. Railwys, 4 % Deb.	100	4	97—99	..	4 0 10	Do. 4½ % Deb. ..	100	4½	80—84	..	5 7 2
London United Trams, 5 % Pref.	10	Nil	45—5½	—½	..						
Do. 4 % Deb. ..	100	4	78—81	..	4 18 9						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	51—5½	..	5 0 0	La Plata Elec. Trms, Ord.	1	..	..	..	..	..
Do. 2nd Pref. ..	5	5	5½	41½—5½	..	5 6 0	Do. Pref. ..	1	6	6	..	..	6 0 0
Do. 4 % Deb. ..	100	4	4	95—96½	..	4 2 11	Lisbon Elec. Trams, Ord.	1	5½	6	1—1½	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	102—104	..	4 6 7	Do. 6 % Pref. ..	1	6	6	1—1½	..	4 18 0
Do. 5 % Deb. ..	100	5	5	104—106	+1	4 14 4	Do. 5 % Deb. ..	100	5	5	95—99	..	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	104—106	..	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	100—102	+1	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11½—11½	+½	5 3 3	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93—96	..	5 4 2
Do. 4½ % Deb. ..	100	4½	4½	98—100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	102½—104½	+½	4 15 8
Do. 5 % 2nd Deb. ..	100	5	5	99—101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	121—123	—½	5 13 10
Brisbane Trams Invt., Ord.	5	8	8	9—9½	..	4 4 3	Do. Gen. Con. 5 % Bonds ..	..	5	5	96—98	..	5 2 0
Do. 5 % Pref. ..	5	5	5	47—5½	..	4 15 3	Do. 6 % Bonds ..	100	6	6	103½—105½	..	5 13 9
Do. 4½ % Deb. ..	100	4½	4½	100—103	..	4 7 5	Para Elec. Rlys. & Lt., Ord.	5	10	10	7—7½	..	6 15 7
B. Columbia Elec. Rly., Def.	100	8	8½	140—144	..	5 11 1	Do. 6 % Pref. ..	5	6	6	5—5½	..	7 0 4
Do. Pref. Ord. ..	100	6	6	125—128	—½	4 13 9	Do. 5 % 1st Deb. ..	100	5	5	100—102	..	4 18 0
Do. 5 % Pref. ..	100	5	5	111—114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1½—1½	..	1 18 4
Do. 4½ % 1st Mort. Deb. ..	49	4½	4½	98½—101½	..	4 8 8	Do. 5 % 1st Deb. ..	100	5	5	101—104	..	4 16 2
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103—105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½—5½	..	5 6 8
Do. 4½ % Con. Deb. ..	100	4½	4½	104—106	..	4 5 0	Do. 4½ % 1st Deb. ..	100	4½	4½	99—101	..	4 9 1
Calcutta Trams, Ord.	5	6	7	61—65	..	5 5 8	Rio de Janeiro Trams ..	\$100	4½	5½	136—138	+3	3 12 6
Do. 5 % Pref. ..	5	5	5	41½—5½	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	103½—104½	—½	4 15 6
Do. 4½ % Deb. ..	100	4½	4½	100—103	..	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	99—100	+½	5 0 0
Cape Electric Trams ..	1	Nil	2½	..	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10½	242—247	+7	4 1 0
City Buenos Aires Trams (1904)	5	5	5	5½—5½	..	4 10 6	Do. 5 % 1st Deb. ..	\$500	5	5	105½—107½	+½	4 13 0
Do. 4 % Deb. ..	100	5	5	101—103	..	4 17 3	Singapore Trams, 5 % Deb.	100	5	5	79—82	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94—98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	93—95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101—104	..	4 16 2	Un. Elec. Trams Monte Video ..	5	6	7	5½—6	..	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil	..	..	..	Nil	Do. 6 % Pref. ..	5	6	6	5—5½	..	5 14 3
Do. 5 % A Deb. ..	100	5	5	91—94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	100—103	..	4 17 1
Do. 6 % B Deb. ..	100	5	6½	56—60	..	10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103—105	..	4 5 9

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	11—11½	..	7 7 8	Dick, Kerr ..	1	5	..	27—31	..	5 8 1
Do. 6 % Pref. ..	1	9	6	11—11½	..	7 2 2	Do. Pref. ..	1	6	6	1½—1½	..	5 12 11
Babcock & Wilcox ..	1	26	28	6½—6½	..	4 4 7	Do. Deb. ..	100	4½	4½	97—100	..	4 10 0
Do. Pref. ..	1	6	6	11—11½	+½	3 13 10	Edison & Swan, A, £8 paid	5	Nil	..	..	..	Nil
B.I. & Helsby Cables ..	5	10	10	7—7½	+½	6 13 4	Do. fully paid ..	5	Nil	..	..	..	Nil
Do. Pref. ..	5	6	6	6—6½	..	4 12 4	Do. 4 % Deb. ..	100	4	4	68—72	..	5 11 1
Do. Deb. ..	100	4½	4½	101—103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	75—78	..	6 8 2
British Thomson-Houston, Deb.	100	4½	4½	91½—94½	..	4 15 3	Electric Construction ..	2	Nil	2½	..	..	..
British Westinghouse, Pref.	3	Nil	..	..	..	Nil	Do. Pref. ..	2	7	7	1—2	..	7 0 0
Do. Deb. ..	100	4	4	63—66	..	6 1 3	Greenwood & Batley, Pref.	10	7	7	7½—8½	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	100—103	+1	5 16 6	Do. Deb. ..	100	5	5	94—96	..	5 4 2
Browett, Lindley, Ord.	1	Nil	..	16—2½	..	Nil	General Electric, Pref. ..	10	5	5	9—9½	..	5 5 3
Do. Pref. ..	1	Nil	..	5½—6½	..	Nil	Do. Deb. ..	100	4	4	85—90	..	4 8 11
Brush, 7 % Pref. ..	2	Nil	..	0—1	..	Nil	Henley's, Ord.	5	15	10½	11½—12½	..	6 0 0
Do. 5 % Prior Lien Deb.	100	5	5	77½—82½	..	6 1 3	Do. Pref. ..	5	4½	4½	41½—51½	..	4 6 9
Do. 4½ % Deb. ..	100	4½	4½	54—59	..	7 10 6	Do. Deb. ..	100	4½	4½	103—105	..	4 5 9
Do. 4½ % Second Deb.	100	4½	4½	87—92	..	10 14 4	India-Rubber, G. & T. ..	13	10	..	8½—9½	..	..
Callender's Cable ..	5	15	10½	103—11½	..	6 10 5	Do. Pref. ..	10	5	5	9½—10½	..	4 17 7
Do. Pref. ..	5	5	5	5—5½	..	4 15 3	Telegraph Construction ..	12	20	10½	34—36	..	6 13 4
Do. Deb. ..	100	4½	4½	99½—101½	..	4 8 3	Do. Deb. ..	100	4	4	99½—101½	..	4 9 0
Castner-Kellner ..	1	17½	20	9½—9½	..	5 6 8	Willans & Robinson ..	1	Nil	..	..	..	Nil
Do. Deb. ..	100	4½	4½	105—109	..	4 10 7	Do. Pref. ..	5	Nil	..	..	..	Nil
Crompton & Co. ..	8	Nil	Nil	1—1	..	Nil	Do. Deb. ..	100	4	4	59—61	..	6 11 2
Do. Deb. ..	100	5	5	58—68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1912.

ALTHOUGH not so imposing at first sight as the previous month's figures, the April exports of electrical material reached the satisfactory level of £403,328, or excluding telegraphic business, £374,765, which was somewhat better than the figure for March, when the total of the exports reached £821,976, but included practically £450,000 worth of telegraphic business.

The feature of the export section is the £93,000 worth of cable exported, a third of the amount going to Japan, but the machinery

sections, which reached approximately £150,000, were also at a satisfactory level.

The imports for the month amounted to £198,038, showing a considerable falling off as compared with March, when the total was £248,651. The re-exports at £28,504 were an improvement on the £23,374 recorded in the previous month.

Our best customer during the month was Japan, while attention may also be drawn to India, Canada and our Australian markets.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	700	948	35	200	186	300	14,550	3,730	83	...	...	607	21,339
Germany ...	781	1,418	15	115	660	2	1,220	...	8	29	13	151	4,410
Netherlands, Java and Dutch Indies ...	404	734	125	25	12	304	304	56	25	...	21	296	2,306
Belgium ...	411	454	95	...	394	22	3,724	667	7	313	786	4	6,877
France ...	1,256	270	1,173	...	40	6	6,336	1,386	22	150	242	657	11,538
Portugal ...	63	140	11	30	...	...	95	...	11	...	174	...	524
Spain, Canary Isles and Spanish N. Africa...	1,001	718	66	...	53	709	5,976	842	16	...	27	69	9,477
Switzerland, Italy and Austria-Hungary ...	581	99	3	30	377	933	1,531	1,712	20	...	119	686	6,091
Greece, Roumania and Turkey ...	103	...	55	10	...	25	271	13	24	...	3	220	724
Channel Isles, Gibraltar, Malta and Cyprus...	26	140	27	56	...	27	92	...	17	...	46	817	1,248
U.S.A., Philippines and Cuba ...	228	...	91	598	...	...	1,281	171	...	8	...	4,694	7,071
Canada and Newfoundland ...	154	304	517	3,220	...	2,568	9,403	690	266	46	299	12,282	29,749
British West Indies and British Guiana ...	349	...	14	223	...	105	137	...	49	...	...	...	877
Mexico and Central America ...	287	511	...	56	...	...	100	...	11	...	...	...	965
Peru and Uruguay ...	123	499	10	121	...	...	749	...	...	5	...	35	1,542
Chile ...	212	901	158	77	...	112	1,907	349	55	...	250	18	4,039
Brazil ...	964	733	60	280	48	215	5,885	2,287	88	23	115	395	11,093
Argentina ...	1,120	6,870	648	1,264	1,395	572	4,494	2,619	426	505	990	1,117	22,020
Colombia, Venezuela and Bolivia ...	35	59	36	14	...	...	611	...	61	...	51	...	867
Egypt, N. Africa and Persia...	432	...	105	127	25	20	725	...	212	...	296	1,048	2,990
British West Africa ...	52	855	147	35	...	23	2,417	5	169	...	38	84	3,825
Rhodesia, O.R.C. and Transvaal ...	7,788	552	1,776	2,133	15	120	6,716	458	1,599	...	94	357	21,608
Cape of Good Hope ...	1,383	1,537	113	698	45	851	3,059	119	3,169	103	94	915	12,086
Natal ...	1,672	2,617	1,744	315	10	65	1,772	...	164	137	18	...	8,514
Zanzibar, Brit. E. Africa, Mauritius & Aden	77	107	6	229	14	...	198	6	...	...	38	82	757
Azores, Madeira and Portuguese Africa ...	108	250	178	94	...	41	1,369	137	27	...	...	...	2,204
French African Colonies and Madagascar ...	...	...	...	...	...	...	...	10	...	...	...	22	32
China and Siam ...	224	539	188	149	10	262	713	39	46	44	50	157	2,421
Japan and Korea ...	1,281	31,913	290	...	37	2,799	15,048	215	51	...	12,469	...	64,103
India ...	3,362	19,545	1,781	2,106	197	593	6,958	1,732	2,264	277	1,657	254	40,726
Ceylon ...	143	313	303	95	109	31	530	67	765	...	34	54	2,444
Straits Settlements and Fed. Malay States	102	679	382	...	...	339	469	392	4,158	...	107	231	6,859
Hong Kong ...	140	239	118	...	...	23	152	56	30	...	82	318	1,158
West Australia ...	297	220	4	94	...	128	197	69	19	...	29	210	1,267
South Australia ...	301	208	313	365	...	...	1,249	444	45	...	3,995	25	6,945
Victoria ...	2,602	7,617	792	1,726	...	265	3,107	292	4,875	...	3,178	385	24,839
New South Wales ...	3,380	8,154	546	884	...	350	12,278	2,191	298	16	3,532	819	32,451
Queensland ...	649	...	30	22	...	247	2,859	56	5	51	684	...	4,603
Tasmania ...	...	...	8	...	...	...	32	...	...	...	...	967	1,007
New Zealand and Fiji Islands ...	940	3,426	378	1,044	44	239	11,324	283	674	...	2,793	587	21,732
Total, £	33,731	93,569	12,339	16,435	3,671	12,296	129,838	21,096	19,759	1,707	32,324	28,563	403,328

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	488	8	...	102	...	30	2,965	...	644	...	6,693	10,930
Germany ...	2,575	23,972	810	27,736	7,273	794	36,956	15,728	3,486	5,133	3,425	127,888
Holland ...	...	96	...	1,468	384	20	4	200	...	39	...	2,211
Belgium ...	399	1,735	202	...	16	274	2,783	...	191	1,130	5,978	12,708
France ...	...	...	766	1,814	327	547	815	222	1,693	3,558	2,278	12,020
Switzerland ...	58	419	114	44	36	41	22	1,822	...	19	22	2,597
Italy ...	34	4,713	...	...	...	...	551	...	...	...	4	5,302
Austria-Hungary ...	22	1,103	...	641	315	...	43	...	35	577	...	2,736
United States ...	2,103	141	1,553	414	2,021	...	7,362	6,360	320	399	548	21,221
Total, £	5,679	32,187	3,445	32,219	10,372	1,706	51,501	24,332	6,369	10,855	18,948	197,613

Additional imports : Spain, carbons, £230 ; Canada, goods, £185, electrical machinery, £10.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	2,846	705	...	2,014	1,104	...	4,207	...	190	701	16,737
----------------------------------------	-------	-----	-----	-------	-------	-----	-------	-----	-----	-----	--------

TOTAL EXPORTS : £403,328.

TOTAL RE-EXPORTS : £28,504.

TOTAL IMPORTS : £198,038.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.



## REVIEWS.

*Electric Railway Engineering.* By C. F. HARDING. 1911.  
London: Hill Publishing Co., Ltd. Price 12s. 6d. net.

This volume, which the preface states is planned primarily for a senior elective course in a technical university, is written by Prof. Harding, of Purdue University, and covers the whole range of electric railway engineering in an elementary way. It makes no pretence of describing in detail any of the various sections falling naturally under its title; in fact, certain sections are so superficially treated that one wonders if it would not have been better to have left them out entirely. The volume is divided into four main sections: Part No. I is designated "Principles of Train Operation"; Part No. II, "Power Generation and Distribution"; Part No. III, "Equipment"; and, finally, Part No. IV, "Types of Systems." The two chapters on Traffic Studies, "predetermined" and "existing," are interesting, and the methods described of estimating the number of passengers likely to be carried over each route are worthy of a careful study. The fallacy of predicting the population for any considerable term of years by any rate of growth which has existed in the past, if the law of "yearly decrease in the rate of increase" be neglected, is pointed out, and diagrams based on the law for the Cities of Philadelphia, London, Paris, and New York, are given.

Chapter V confines itself to "Motor Characteristics," the superiority of the series motor for traction purposes being indicated in a clear manner. Why should the "Hopkinson" method of testing motors be called the "Pumping-back method?" It is almost universally known under the former name, and surely the profession's debt of gratitude to the founder of dynamo design demands its continuance.

Speed-time curves are lucidly explained in Chapters VI and VII, the method of calculating the rotative inertia of wheels and armatures being set forth at some length. Concrete examples of speed and distance, current and power curves are given in Chapter IX, this chapter being one of the best in the volume.

Dealing now with Part II and Chapter II—why call a "section insulator" a "circuit-breaker?" The former name clearly indicates its use, viz., an insulator between sections of the line; moreover, the latter is just as explicit, viz., an apparatus for interrupting the circuit where it is required. These are the generally accepted interpretations of the terms, and any alteration will, it is more than likely, lead to confusion. The statement that the two trolley wires are electrically connected at every hanger surely is incorrect; in this country they are only connected at each end of the section, so that to isolate one line, or cut it out in case of a ground, it is only necessary to pull out the switches in feeder or section boxes, the service then being maintained over the second wire. The system of feeding a single-phase railway from a three-phase machine, by connecting each phase to separate insulated sections of the line, does not appear to be good practice. If three-phase machines are already installed, the Scott three-phase two-phase connections are preferable, assuming the use of transformers, and if not, it is better to use only two phases of the alternator with reduced output.

In Chapter III "Sub-station Location and Design" is discussed at some length. Although it is perhaps true to a certain extent, that of late years the motor-generator has proved somewhat of a rival to a rotary converter, practice appears to be reverting to the rotary converter. This is as it should be, since no anxiety need be felt regarding hunting and commutation with turbine-driven generators and six-phase 25 or 50-cycle converters, provided the drop between synchronous machines is kept to moderate proportions. The statement that in *both* methods of starting rotaries—referring to starting from the D.C. side and with transformer taps—it is necessary to open the field in several places is, of course, incorrect. It should be pointed out that it is no longer necessary to couple two 600-volt converters in series for a 1,200-volt line, as 1,200-volt 25-cycle converters are now built with satisfactory operating characteristics.

"Power House Location and Design" is the title of

Chapter V, and several of the remarks therein are reminiscent of earlier days; for instance, "the question of vibration and foundation construction should be given careful attention, especially where high-speed reciprocating plant is employed." Again, with regard to "diversity factor," this, it appears, has only recently been given proper attention by operating companies. Table XV, taken from Kent's "Mechanical Engineers' Handbook," and showing the comparative steam economy of turbines and compound engines, compares a 600-H.P. turbine with an 850-H.P. engine using saturated steam. Such a table is quite useless, and is liable to give a reader not familiar with the subject entirely erroneous ideas. Complete exception must be taken to the paragraph, "As a considerable amount of 125-volt direct-current power is used about the station for auxiliary control circuits, &c., the excitors should be considerably larger than the combined demand of all alternator fields which they are called upon to supply." It is absolutely essential that the excitation circuits should be free from interruption; in fact, it is now common practice to tie the excitors to the bars without circuit-breakers or fuses. To run auxiliary circuits from the exciter bars is simply inviting trouble, and cannot be too severely condemned. Under the heading "Switchboards" it is stated that "No protective device is installed between the generators and the bus-bars, although the outgoing transmission lines are protected with time-limit relays." This is pleasant reading, as a few years ago, after a plethora of papers on relays of all sorts and descriptions, the fashion was to install this apparatus at every available opportunity. It was quickly found, however, that the majority of the instruments were unreliable, and they were soon discarded.

In Chapter VII on "Electrolysis," the system of bonding in use in Chicago is shown. This consists of a double track with cross bonds and the inner rails connected by a 00 wire to a 500,000 circ. mil (say 0.4 sq. in.) bare copper longitudinal negative return cable. Provided the rail joints are efficiently bonded, it is difficult to see the use of this bare 500,000 circ. mil cable. Assuming that the rails weigh 100 lb. per yard, then four rails in parallel have an area of approximately 40 sq. in., and taking the ratio of resistivity of steel to copper as 10 to 1, the equivalent area equals 4 sq. in. of copper, so that the negative cable would carry back about 10 per cent. of the total current; hence, unless this cable is for some purpose other than stated, it appears to be of little use. No wonder Chicago is suffering from the effects of electrolysis when the city authorities allow a maximum rail drop of 25 volts.

Chapter VIII describes "Signal and Dispatching Systems" in a very clear way, but one is somewhat surprised to read that "the more complete systems have not been cast aside by the interurban railroads because of their unsatisfactory design and operating qualities, but rather because of their high first cost and maintenance charges."

In Chapter II, Part III, it is stated that steel-tired wheels are being superseded by cast steel on interurban roads, as difficulties were encountered due to the tires working loose in service. Unquestionably, one has heard of this trouble, but only in very rare cases, and then the cause is easily explained. All tires are usually bored out to a standard gauge, and should it happen that the centre has been re-tired several times previously, it will be found that its diameter has actually been reduced, so that the tire has too large a diameter, and, consequently, the tire becoming hot from the friction of the brake shoes works loose. It is good, sound practice to bore out each tire for the centre it is to be shrunk on.

Surely it is an error to state that the field coils are wound with *rubber* or asbestos-covered wire. While commutating poles delete commutation as a limit to the output, it is doubtful if the maintenance costs are reduced in tramway motors. Many engineers who have had experience with both classes of motors for tramway service are not at all enamoured with the commutating-pole machine, on account of its inaccessibility and consequent increase of time required for examination, and the multiplication of coils liable to breakdown.

Part III, Chapter I, covers alternating *versus* direct-current traction, the bulk of the chapter being taken up by the discussion between Mr. Sprague and Mr. Storer before



the American Institute of Electrical Engineers, while the final chapter is devoted to "Electric Traction on Trunk Lines," and includes Mr. B. F. Wood's tables for cost of electrification and power-house operation and maintenance costs for the West Jersey and Seashore Railroad, complete details of which have been published in the *Proceedings* of the A.I.E.E.

Viewed from the standpoint of the technical student who wishes to gain a preliminary insight into electric railway engineering, the volume must be classed as a success. It will, however, only whet the student's appetite, for he will quickly discover that the subject has only been touched upon in a very superficial manner. Contrary to the usual rule in works of this description there are few errors, the more important being the following:—In fig. 13 the curve showing the higher efficiency should be named "Efficiency without gears," and the lower curve "Efficiency with gears." The numerator in the expression under Equation 19 should be 5,280. On page 70 a reference is made to fig. 99; it should be fig. 98. In fig. 48 the three-phase lines would be better named "Incoming A.C. lines." On page 140 an error is made in referring to Table XI in place of Table XIII. In the formula for finding the amount of injection water required per lb. of steam,  $w$  is given as equal to 1,150;  $w$  is the total amount of water required, and  $H$  equals the B.T.H.U.'s per lb. of steam at exhaust. Fig. 78 has the generator marked "D.C. Railway Generator"; it should be "A.C. Railway Generator." In discussing permanent way, it is stated that "a liberal use of concrete, steel, and sand, &c."—the word "steel" should read "stone." Under control systems, the New York Central locomotives are given as having three running steps on their controllers, the first with all motors in series, the second consisting of two groups in parallel-series, and finally all motors in series; this, of course, is an error for all motors in parallel. The gear ratio in the concrete example on the rotative inertia of wheels and armatures is reversed. There are a few cases of mis-spelling, such as "man" for "main," "condensing" for "condensing," &c.

The book has a good index, is well illustrated, and is printed in clear type, and, what is most important, it is of a size easy to hold in the hand.—S.W.

*The Application of Hyperbolic Functions to Electrical Engineering Problems.* By A. E. KENNELLY, M.A., D.Sc. London: The University of London Press. Price 6s. net.

In May and June last year, Dr. Kennelly delivered a series of lectures on this subject for the University of London, at the Institution of Electrical Engineers. These lectures were very well attended, but there was a generally-felt want, during their progress, of a text-book where further information concerning the remarkably powerful mathematical processes, so ably expounded by Dr. Kennelly, could be found. It will, therefore, be understood with what gratification the announcement, made at the conclusion of the course, was received, that Dr. Kennelly had generously decided to devote the portion of the fee he had received for coming to this country to deliver these lectures, which was not taken up in travelling expenses, to producing the lectures in book form. This book has now been published, and in our opinion is one of the most useful contributions to the more theoretical side of electrical engineering literature which has appeared in recent years.

The first chapter deals with hyperbolic angles and hyperbolic trigonometrical functions, and discusses the relationship which these functions bear to the ordinary circular functions.

In the second chapter the problems which arise in connection with the flow of steady currents in lines, having uniformly distributed conductor resistance and insulation conductance, are discussed. The simplicity of the hyperbolic method of treating these questions will appeal with special force to those readers who are acquainted with the other methods of arriving at the same results.

In the third chapter the method is discussed by which a uniform line conveying continuous current can be replaced, as far as those portions of the circuit external to itself are

concerned, by three resistances arranged in the form of either a  $\pi$  or a  $T$ , where the resistances forming the arms of the  $T$ , or those forming the legs or "pillars" of the  $\pi$ , are equal to one another. The solution of the converse problem is also investigated. That is, having given three resistances arranged in either of these two ways, it is shown how to deduce the data of the uniform line to which these combinations of resistances would be equivalent.

The next chapter deals with "loaded" steady current lines, that is, lines of which the uniformity is broken by the introduction either of a number of resistances in series in the line, or of a number of leaks to earth along the line. It is shown how, having given such a circuit, to deduce the data of a uniform unloaded line which shall be equivalent to the loaded line under consideration.

So far the author has been dealing with continuous-current flow, and has only required to introduce real or uni-dimensional quantities into his mathematical expressions. The study of the flow of alternating currents, however, necessitates the consideration of complex quantities, and, accordingly, the fifth chapter is devoted to a discussion of such quantities. The author points out that all the results which he has obtained for the flow of continuous currents are immediately applicable to the alternating-current case, if for the uni-dimensional quantities used in the former investigations we substitute the appropriate two-dimensional quantities. The geometry of complex quantities, and their mathematical manipulation, are dealt with very fully.

In the sixth chapter the phenomena which are met with in a uniform line carrying alternating currents are discussed. The seventh chapter is devoted to a consideration of the transmission of alternating-current power, and the eighth chapter deals with the theory of telephone transmission.

In the ninth chapter the application of hyperbolic functions to telegraph problems is discussed, and in the final chapter the discharge of a condenser through an inductive circuit is briefly considered.

The book concludes with a series of appendices, in which are given various data and demonstrations which have been omitted from the text, a list of the symbols used in the book with their definitions, and a bibliography of the subject of hyperbolic functions. It is a great convenience to the reader to have the symbols thus collected for reference, and the bibliography is exceedingly useful to anyone wishing to pursue the matter further.

We have little criticism to offer on the book. We think, however, that many readers will experience some difficulty in reading it, owing to the omission of intermediate steps in much of the work. It is not very difficult for the reader with some small acquaintance with the subject to fill in the gaps, but as the book is certain to be used to a large extent by beginners in this branch of applied mathematics, we feel that the subject matter would be more easily assimilated if these steps were given. We also think it would be better if much of the matter in the appendices were inserted at the corresponding places in the text, instead of being relegated to the end of the book. In subsequent editions some alterations and amplifications may be made. The book as it stands is, however, of great use to all who take an interest in the higher branches of electrical engineering, and the thanks of the electrical profession are due to Dr. Kennelly for enabling his lectures to reach, in this manner, a wider, and doubtless no less appreciative audience, than that which listened to them last year at the Institution of Electrical Engineers.

*Die Konstruktionen Elektrischer Maschinen.* By W. PEINEKE. (Vol. 16 of *Elektrotechnik in Einzel-Darstellungen*). Brunswick: Fried. Vieweg & Sohn. Price M. 3 60 pf.

This volume deals with the details of the mechanical construction of D.C. and A.C. rotating machinery, and is intended to give students and young designers an insight into modern methods of design and the reasons for their adoption.

The book is of a descriptive character, with a certain amount of critical comparison of one design with another, but its chief value lies in the numerous clear diagrams, which, in many cases, successfully take the place of pages of print.



Want of room has led to the omission of practically all calculations connected with the mechanical strength of the various parts, so that very few data as to actual dimensions are included. This is much to be regretted, because it is just in this direction that inexperienced designers find most difficulty in obtaining reliable information, and so are often constrained to follow existing conventional designs blindly.

The various chapters are devoted to: Iron stampings, the stationary members of D.C. and A.C. generators and motors, including windings, the rotating parts of the same, collector rings, commutators and brush gear, bearings, spindles, bed-plates, the cooling of machines, and foundations.

High-speed machinery is not dealt with. The book gives some useful information on a subject which is only cursorily dealt with in the ordinary text-books, and in this way should form a valuable adjunct to the latter.

## MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION.

THE conversion of the Melbourne suburban railways to electric working will be one of the largest single projects of the kind yet carried out. In other great capitals, like

In Melbourne, however, the lines being all in the hands of the State, practically speaking, only the consent of one authority is necessary; for although the State Railway Commissioners have very important powers, they are still the servants of the State, and cannot permanently resist public opinion, when sufficiently strongly expressed. This being so, a uniform and complete scheme is being prepared for Melbourne, involving the conversion of some 300 miles of track as a commencement. It will probably be extended to other lines as time goes on.

We publish herewith a map showing the lines to be converted, which also indicates the very complete nature of the Melbourne railways. As a matter of fact, even with steam, Melbourne possesses one of the best suburban services in the world. The absence of electric tramways (the tramways are cable operated) has made the suburban railway services the leading transportation agency in the Melbourne district, and the scattered nature of the suburbs has given the railways a further advantage as compared with the tramways.

Although the matter has been under consideration for many years, from one cause and another, political and economical, it has been deferred. Public opinion, however, has been steadily growing in favour of electric working, and the Government have decided that it is no longer necessary to allow the question of the choice of system to deter them from proceeding to carry out the work. They have adopted the wise course, however, of inviting tenders for both the direct and alternating-current systems, thus placing themselves in a position to decide on the best possible scheme put



THE MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION SCHEME, SHOWING THE PROPOSED ROUTES.

London, New York, Buenos Ayres or Berlin, although a great mileage of steam lines has been, or is being, converted to electric working, the work has in all these cities been done more or less piecemeal. This is due, of course, to the fact that such a large number of different companies and authorities own the various transport systems, that there is no particular incentive towards electrifying at the same time, except in so far as mutual running powers might make it desirable.

forward by the exponents of the two systems. Since the Melbourne situation was first reported on by Messrs. Merz and McLellan some five years ago, the direct-current system has been considerably developed, more especially in the direction of increase of pressure, and the economical radius to which it can now be extended is, of course, very much higher than formerly. On the other hand, the single-phase system since that day has been put into practical operation on a number of lines, and although no complete



data of working costs of any of the single-phase systems are yet available, the motor equipments are certainly better than they were, and the repairs and maintenance of them and the number of breakdowns have been considerably reduced. The overhead equipment and train equipment costs are still, however, higher than is desirable.

The magnitude of the present scheme will doubtless induce the big contracting firms to put forward their very best efforts in preparing proposals, and the decision of the Victorian Government is one that will be of first-class importance to the whole future of railway electrification. Moreover, the Government have very fully in mind the question of the extension of electrification in future to long-distance lines outside the suburban system, and they will not forget the fact in making their decision. The initial expenditure on the scheme is expected to reach between £2,000,000 and £3,000,000.

Mr. Charles Merz, M.Inst.C.E., sails for Melbourne shortly after the receipt of the tenders, in order to confer with the Government regarding the placing of contracts.

## COMBINED IRRIGATION AND HYDRO-ELECTRIC POWER SCHEMES.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

COMBINED hydro-electric power and irrigation developments are becoming a very marked feature of electric enterprise in the United States. With the help of electric power whole areas of country have been and are being changed from almost arid deserts, to blossom forth with fruit farms and as wheat lands. About ten years ago, the writer drew the attention of readers of this paper to an experiment which had been made in California. Water was being pumped up from deep gravel beds by three-phase vertical spindle motors coupled to centrifugal pumps; the electric power for these was obtained from the hydro-electric power houses dotted about on the streams coming down from the mountains many miles inland. The experiment was a huge success, and large areas of Californian fruit land are now irrigated in this way. The writer has it from the geological experts that the stratification where deep water-bearing gravel beds underlie apparently waterless country is not peculiar to California. For example, it is met with in Australia and India, and some day this ingenious method of irrigation may be given a trial in those countries.

Another development which promises to be a much bigger thing, is the combination of hydro-electric power supply with an irrigation dam and pumping stations. In many parts of the British Empire, and particularly in Australia, it is possible to back up huge volumes of water by comparatively small dams. We have all seen what a tremendous change for the better has been brought about by the building of the Assouan dam, and that dam it should be noted is a large one, that is to say, it is not high, but it is very long and consequently expensive.

Now, wherever water is backed up to a considerable height, especially to say 100 ft. or more, for the purpose of conserving flood waters for irrigation, there also it is possible to develop electric power; not a great deal of power, as compared with some of the great natural water powers of the world, but still sufficient to make it worth while to build an electric power house as part of the dam structure.

In some cases the water thus backed up, can all be merely gravitated to the land which it is proposed to irrigate. In other cases the water is made to develop electric power, and this is transmitted to places on the river at a lower level, where pumping stations are placed to lift the water on to the adjoining land.

The Burren-Juck dam proposition in New South Wales is an example of the water being led to where it is wanted by gravitation; the main canals now being cut are nearly 100 miles long. But this dam is over 160 ft. high, and although no provision has as yet been made to harness its water-

power, something will have to be done eventually. The thing is so obvious.

In the Argentine there is a combined irrigation and electric power proposition at work, and revenue is earned from both these sources. Irrigation is, of course, the primary function, and so the full water-power cannot be developed, but the engineer (an Englishman) has informed the writer that it amounts to about half the total power.

The amount of power which can be obtained from any given dam will, of course, depend on what provision is made for balance reservoirs lower down, into which the water can be passed when it is not wanted for irrigation.

Again, the question depends on the purposes for which the electric power is used. It is so easy to transmit electricity by overhead high-tension wires that the inexpert always think of electricity generated at a hydro-electric power house as being something to transmit a long way. But it does not follow at all. There are many electro-metallurgical operations which can be carried on just as well near the dam as 20 or more miles away. The manufacture of nitrogenous manure is an example, and in making this manure with irrigation water the former is being helped in two ways. It is commercially wise to use electric power as near to where it is generated as possible, also for any operations which can be temporarily suspended if need be. The supply of light and power to a city 50 or 100 miles away sounds well, but it is not necessarily wise or commercially advisable.

From time to time the writer receives information from the United States and elsewhere regarding hydro-electric and irrigation schemes. One such communication has just come to hand from Mr. Albert F. Cooke,\* general manager of the Crane Falls Power and Irrigation Co., of Idaho. The consulting engineers are Messrs. Smith, Kerry & Chace, well known in the States for hydro-electric work:—

"This is the fourth hydro-electric power and irrigation development I have been on for my present firm. They seem to have a reputation that is hard to beat. My position here is that of general manager. We have a contract for five years to operate the irrigative system. The power plant is a low-head proposition, about 27 ft. effective head and the maximum water flow is about 10,000 cb. ft. per second. We are building the dam across the Snake River, at a place known as Crane Falls, Idaho. At present we will install three 3,000-K.V.A. units of plant, but the power house structure on the intake side is to be completed up to 18,000-K.V.A. capacity. The transmission lines will work at 66,000 volts.

"We have a considerable market for industrial power and lighting and some traction load, in addition to our irrigative load. The latter consists at present of two stations. The larger one has three lifts of 180 ft., 108 ft. and 70 ft. Worthington centrifugal pumps are being used, and the high-head pumps deliver 1,000,000 gallons per hour to the canals, and are driven by three 1,050-H.P. three-phase motors operated at 2,200 volts. There are seven pumps in all at this station, the other four being in proportion to the two lower lifts.

"The smaller station, some 15 miles further from the power plant, is fed by a 22,000-volt line from step-up transformers in the first plant. It has a capacity of 8,000,000 gallons per day, with 104-ft. lift."

In Australia it is of paramount importance to develop combined irrigation and electric power schemes. Along with a firm of civil engineers in Melbourne, the writer spent some considerable time working out the details and financial particulars of what came to be known as the Trawool scheme. Trawool is about 70 miles from Melbourne, and it was proposed to build a dam 180 ft. high and about half a mile long at the top, which would have impounded more water than there is in Sydney Harbour, or more water than is impounded by the present Assouan dam in Egypt.

At the present time much of the land which that water would have made to blossom as the rose, is either bush, or, where it is used, is only carrying about one sheep to the

\* Brush men of about 17 years ago and others will remember Mr. A. F. Cooke. He went to Canada about 12 years ago, and passed from there to the United States, where his work has been mostly on hydro-electric installations.



acre. Naturally there is no population worth speaking of ; in fact, although Australia is as big as Europe, there are fewer people in it than in London.

Every year floods of water pass over the site, and if the dam had been built, the water in passing from Trawool to a balance reservoir some miles lower down could have been made to develop quite a respectable amount of electric power. Some of it might have been transmitted to various mining and industrial centres such as Bendigo, Ballarat, and Melbourne, &c., but the chances are that most of it could have been profitably used in other ways. For example, in irrigating, by pumping, further areas that the gravitation canals could not reach.

The manufacture of nitrogenous manures by electric power naturally suggests itself, for although Australian soil can be very fruitful when it does receive water, much of it, as compared with soils in other places, carries little natural store of nitrogen. To intensely cultivate it, therefore, manure is required as well as water, and this is a point which some do not seem to appreciate.

When Mr. Merz prepared his report on the electrification of the Melbourne Railway system he was shown the figures, &c., and viewed the site. He was sufficiently impressed with the feasibility to mention it favourably in his report.

The scheme looked so promising that a syndicate was formed in 1906 to forward the proposal, but directly Trawool was mentioned in Parliament the party who always want Government to do everything said, "Why shouldn't we carry this out ourselves"? Their idea is that the Public Works Department should do everything.

To such an extent is it carried on, that the Architect's Department of the New South Wales Government has even prepared designs and quantities, &c., for such things as bathing sheds on the beaches, and shops for back streets.

Government employes seldom initiate any new scheme, but they are adepts at slightly altering schemes put forward by others and serving them up, years later, as their own.

One would naturally expect that the Government intended to do something, but they have not done it. The land that the Trawool dam could have irrigated still feeds a few sheep, and the floods still come down at intervals. Tweedledum and Tweedledee, paid politicians, still come and go and play the ridiculous old party game, spouting platitudes to the gallery.

There may be faults in the system of allowing private enterprise too free scope, but at any rate, things do get carried out ; professional engineers and others, with brains, do get their chance ; arid land is turned into fruit farms and wheat lands ; the electrical manufacturers have plenty of orders ; many openings are presented in construction work and management for engineers, and, incidentally, as we have seen in the Argentine and the United States, some of these are Englishmen.

### IMPROVING THE LIGHT DISTRIBUTION FROM METALLIC-FILAMENT LAMPS.

USUALLY the filaments of metal lamps are arranged parallel to the vertical axis of the lamp, and, in lamps of medium or high C.P., in such manner as to form a cylindrical cage-work. As thus arranged, the lamp gives its maximum candle-power in a horizontal direction, and the illumination on a horizontal surface is approximately that given by the incident intensity  $c = c_h \cdot \cos \theta$ , where  $\theta$  = angle to horizontal made by the incident beam.

This distribution of light is seldom suitable or efficient, so that various shades and reflectors are employed. The latter result in a more or less serious loss of light, and, with a view to obtaining a better natural downward distribution of light, M. Vodovosow has constructed lamps in which the filaments form the envelope of an inverted cone (see fig. 1). The bulb of the lamp is preferably ovoidal, but in all other respects the construction is quite normal.

The results of a comparison, by the Laboratoire Central d'Electricité, between the new type of lamp and one in which the filaments were arranged in the ordinary cylindrical manner, were as follows :—

		Lamp with filaments enveloping a cone.	Lamp with filaments enveloping a cylinder.
Terminal lamp voltage	...	102	110.5
Watts consumption	...	21.4	20.9
Horizontal intensity (bougies)	...	16	16
Mean spherical intensity "	...	13.4	12.2
Lower M.H.-S. intensity (bougies)	...	15.4	12.6
Total luminous flux (lumens)	...	168	153
Ditto in lower hemisphere (lumens)...	...	97	79.2
Watts per horizontal bougie	...	1.34	1.31

These figures, and curves I and II respectively in fig. 2, clearly demonstrate the characteristic advantages of the conical lamp. The specific consumption per (lower) mean H.S. C.P. is 1.38 watts in the latter, as against 1.65 watts in the case of the ordinary drum-wound lamp. The 20 per

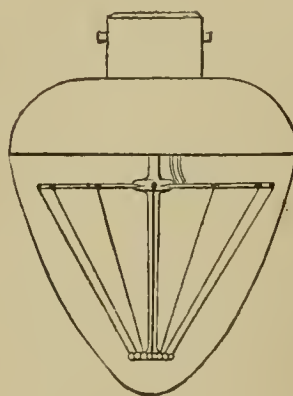
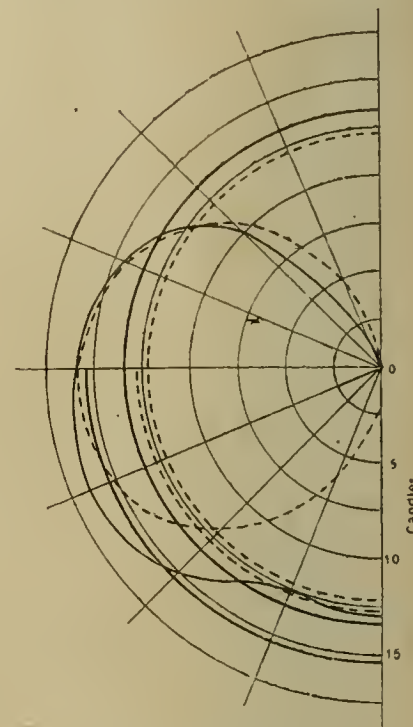


FIG. 1.



Conical — ; cylindrical - - - .

FIG. 2.

cent. superiority of the conical lamp, on this basis, is of great practical importance. Apart from the disposition of the filaments, the downward concentration of light is materially aided by the large cap (fig. 1), which acts as a reflector.

**Parliament and the Insurance Act.**—Mr. Arthur Henderson asked the Secretary of the Treasury last week whether he was aware that the manager of the Belfast Corporation tramways had issued a notice to the employes with regard to the National Insurance Act, in which he stated that he was very clearly of the opinion that the men should not select any society, no matter how first-rate it may be, which had anything whatever to do with politics or trade unionism ; and if so, whether he proposed to take any steps to secure to the employes their right of selection to an approved society. Mr. Masterman replied that it was both the clear intention of the Act, and in itself very desirable, that insured persons should have absolute freedom in the choice of their approved society. He had no legal power, however, to prevent such circulars being issued as those described in the question.

A further batch of documents relating to the Act have been issued. They give a summary of the "unemployment" part of the scheme, which comes into operation on July 15th, and directions to employers in respect thereto. By the date named every workman in the scheduled trades must obtain an unemployment book issued by the Board of Trade, and every employer must obtain an unemployment book from every such workman in his employ on that date, and from every such workman whom he may afterwards employ. Applications for these books may be made on and after June 1st at a Labour Exchange or other local office of the Unemployment Fund, where information as to rates of benefits and contributions may be obtained.

**Petrol-Electric Sets for Wireless Telegraphy.**—In consequence of the recent *Titanic* disaster, the ASTER ENGINEERING CO., LTD., are receiving a large number of inquiries for their petrol engines directly coupled to alternators, for supplying the necessary current to enable the wireless telegraph apparatus on board ships to work, in the event of a mishap, up to the very last moment, in spite of the main engines and other machinery having been stopped. These sets can be started up at a moment's notice, and are very similar to a large number which they have already supplied to the Marconi Co. for land work.

**Meters Approved.**—It is notified in the *London Gazette* that the Board of Trade has approved of the Ferranti A.C. and C.C. prepayment electricity meters, deposited by FERRANTI, LTD., in August, 1909.



## THE ENGINEER AND THE CLERK—A STUDY IN RELATIVE VALUES.

By H. E. GOODY.

WE are in the twentieth century, and every class of business is supposed to be conducted on a strictly utilitarian basis. Nothing that is not absolutely immoral (and sometimes even that exception is not made) is, one might have imagined, permitted to stand in the way of profit and general efficiency. It is, indeed, true that we have scrapped every decent form of business sentiment, and parted with nearly every courteous tradition in our modern hurry and bustle.

But, as a matter of fact, we still retain an absurd and humiliating tradition that is at once a bar to efficiency, and a source of irritation to competent and self-respecting employes. I refer to the ridiculous distinction which is made between the engineer and the mechanic on the one hand, and the clerk on the other.

This distinction, which, it is almost unnecessary to say, is in favour of the clerk, is a common feature of the administration of all engineering undertakings; but it will, perhaps, give more point to the argument if we confine ourselves to the consideration of this matter in relation to the supply of electricity.

In central stations this clerical domination is more pronounced than anywhere else; and especially so in those stations which are under municipal management. In any engineering business the office should be quite a subordinate department; but, in some curiously illogical way, the clerical staff, while still receiving pitifully small salaries, as compared with the engineer and the skilled mechanic, have got themselves raised to a status where, without money, wit, or skill, they impertinently rule the more intelligent workers. How this state of things originated it is hard to say; and how in the world such a blatantly idiotic piece of inconsistency gained almost universal recognition and acquiescence is impossible even to surmise.

Thus it comes about that at a certain generating station the list of staff members includes a junior clerk, at a salary—*salary*, mark you!—of £40 per annum, but totally ignores the existence of the meter superintendent, who draws a *wage* of £2 10s. per week.

The junior clerk is always referred to as Mr. Harvey, the meter superintendent is always known as Brown. Three committee meetings and a full council meeting had to be held, before the clerk could be appointed to his onerous and important post. Brown was engaged directly by the chief engineer as a weekly servant; and, so far as the committee is concerned, he is only one amongst a hundred workmen who are not on the *staff*.

Now, Brown is a well-educated man; he has received a good mechanical training at works and college, and, moreover, he is a trifle sensitive. He feels that he is a more important worker and more essential to the efficient conduct of the station than the gentleman who spends his time licking stamps and copying letters. As a proof, our meter expert will point out that he is paid nearly twice as much as any clerk in the place; and very naturally he resents the implied slight which is contained in his exclusion from the roll of the established staff.

This is merely one instance of clerical predominance. Hundreds of others might be adduced.

In another central station, for example, until quite recently, the charge engineers and the assistant mains superintendent were “unestablished,” and the office boy took precedence over them. It was only after years of quiet agitation that these men were able to get their positions officially recognised; and even now their names come last (the office, of course, being first) in the staff list published in the Borough Council's official handbook.

One may say that these things are empty honours, and that such trifling points of dignity are not worth making a fuss about; but you can't get over an obvious injustice by telling the victim that he is worrying himself over nothing, for he will naturally retort, if the honour is really empty, and the

dignity truly inconsiderable, why not relieve the clerical staff of such embarrassing superfluities?

Not only does this condition bear hardly upon the technical side of supply undertakings, but it also spoils clerks, who would otherwise be quite tolerable persons. It gives them an exaggerated idea of their own importance, and encourages them in a brusquely impertinent manner towards men who, although only engineers, are earning treble their own salary.

It is my experience that where there is any friction and unpleasantness in the working of a central station, it is, in nearly every case, due to clerical presumption. The relative positions of clerk and engineer, as they exist in central stations to-day, are so manifestly absurd that one can only wonder at their persistence. One would think that in a commercial undertaking, where the size of a man's salary is the only criterion of worth, the 25s.-a-week clerk would be taught to look with respect upon the skilled mechanic earning £2 10s., or the assistant engineer with £3 or £4 per week. But the contrary theory seems to prevail; and in default of a decent salary, the genteel scribe is (by way of compensation) called “Sir,” and paid monthly.

Of course, one cannot blame the clerks for these conditions; they have naturally taken advantage of the tendency to exalt their own class. But in their lust for power, it would be well for them to reflect that, after all, in a generating station, the men who actually generate and distribute electricity are of first importance, and the clerical function is the subsidiary and somewhat menial one of keeping records of work done and money spent.

If there is any blame, it must be borne by the chief engineer and committee who permit this incongruity. It is in the power of these high authorities to lower the status of the clerk and to raise that of the engineer and mechanic. Such a reversal of positions would be merely an act of justice; and if it be denied on the ground that there is no general demand therefor on the part of the men affected, one can only say that the reason for this apparent acquiescence is simply that the average Englishman is so mortally afraid of making himself ridiculous, that he would often rather go without something he greatly desired, and which he could have for the asking, than run the smallest risk of being laughed at.

The matter, if it is to be set right at all, must be set right from the outside; and it must be done as a voluntary act of grace, for it will never be demanded.

## NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

*Hyderabad, Deccan.*—There is considerable engineering activity in this native State since the young Nizam succeeded his father. The electrical engineer to the State has recently been home, and has, it is said, ordered a complete equipment for a large extension of the old lighting station. Messrs. Callenders, Siemens and Osler's have got a fair share of the orders for cables, plant and palace wiring respectively.

*Indian and Eastern Engineering* says that the Indian Government has granted a concession for the utilisation of the Upper Jumna for the generating of electricity for lighting New Delhi. The site proposed for the new power station is 180 miles above Delhi on the river. The first installation is to be of 5,300 KW., and the transmission line to be 140 miles long.

*Simla.*—This hydro-electric scheme is gradually approaching a finish, and the end of this year should see its completion. Tenders may be called for street lighting, and house wiring work will be brisk.

*Shillong.*—The provincial Government has again begun to move in the matter of an electrical installation for this hill station. House owners and occupiers are being canvassed to find out what load can be guaranteed. There is



plenty of water power available in the vicinity. Shillong being close to Cherapoonjee, said to be the rainiest district in the world, Government would probably grant a lighting and power concession to any person or body willing and enterprising enough to come forward.

*Accumulators in India.*—A point which often puzzles engineers in charge of batteries in India is, what influence extremes of temperature have on the life of a set of accumulators. The regulation instruction card comes out with each set imported, and the particulars given therein are obviously intended for cool climates only. Acid is seldom or never imported from home on account of freight and certain shipping prohibitions. It is usual, therefore, to order acid locally giving the specific gravity suitable to the particular type of accumulator to be used. Now, of course, a specific gravity of, say, 1.215° at 60° F. becomes very much reduced when the temperature is, say, 110° F., and an engineer is frequently puzzled as to how to act. In extremes of temperature, say at Delhi, a battery room may be 60° F., or less in cold weather, and in hot weather it may be 120° F. or more. The point which wants clearing up is, with these extremes in view, at what specific gravity should acid be put into cells. The life of a battery in India and on the plains is notoriously short, and whether this is due to (1) extremes of temperature and consequently varying specific gravities; (2) impure acid; (3) impure water; (4) native carelessness, or a combination of all four, remains yet to be discovered. Perhaps someone experienced in battery manufacture might write his views for the good of his exiled electrical brethren in India.

#### AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉES.—IV.

DURING an interval in the hearing of the case brought by the Australian Tramway Employés Association against the various tramway companies for improved conditions referred to in our issue of May 3rd, judgment was given by the same Judge, Mr. Justice Higgins, in another case bearing on the question. It seems that an application had been made in the Third Civil Court by four workmen to have the registration of the men's Trade Union—the Australian Tramway Employés Association—cancelled. This application was dismissed by the Judge, who first of all expressed his doubts as to whether the nominal applicants were really the real agents in the matter. *Primâ facie* they had sufficient interest in the matter to make the application. They had all been members of the Association, though most of them had resigned. They were bound, however, by the rules that no resignation could take effect for six months, so that, while disagreeing with the policy of the Union, they were unable for that period to free themselves of responsibility and liability. The Judge pointed out that while some of the rules appeared drastic, such as the apparently unlimited power to fine members—no stipulation being directly made that the fines must be reasonable in amount—the obligation to continue in membership for six months after giving notice of resignation, and the power of the Executive to prevent any member making copies from the Association's books, yet they did not in themselves render the registration of the Association invalid, though he did not think all of them quite reasonable.

On the resumption of the Arbitration Court case on April 1st, the conditions of service in Perth, Western Australia, were inquired into. Mr. Dewsnap, the President of the men's Union, stated that for 18 months he had been paid 10½d. per hour, then for a further 18 months 11½d. per hour, and he was now receiving 1s. per hour. The amount claimed was 11s. per day plus 15 per cent. This addition was asked for owing to the high cost of food as compared with other States. They had had a number of disputes with the Tramway Co., and in 1910 struck from July 20th till September 10th. Previous to this an appeal had been made to the Arbitration Court of Western Australia, who had issued an award giving minimum rates, which the men resented owing to the company reducing all wages to the minimum standard. At the present time 130 out of 142 employés were members of the Union. While they did not make any general charge against their employers, there were several things they wanted altered. They asked for time taken in paying in money to be included in the time worked, the right to travel free on the cars, and the other points included in the claim under discussion. Mr. Keating then gave evidence on behalf of the Freemantle employés. Considerable discussion took place as to the disappearance from the branch minute-book of the pages recording the adoption of the claim. Mr. Keating, although secretary, could not explain the mutilation of the book. He could only remember the acceptance of the claim as sent to them from Melbourne. When asked if he was aware that under one clause of the claim men would be entitled to 7s. 11d. per hour, he said the branch did not want that.

He knew that under another clause men could get 38s. for a day's work, but thought the company would find means to prevent it being done. He did not consider £2 13s. 4d. per week a living wage in Western Australia. He considered the work of both motormen and conductors very tiring. Asked as to whether the Association expected the company to dismiss any of their members whom they turned out of their ranks, the witness admitted that if a man tried to injure their Union they would refuse to work with him, and in this way bring pressure to bear on the company to dismiss him, too.

The position at Brisbane was then inquired into. To some extent this evidence repeated that given in another Court in connection with the case brought to compel the Tramway Co. to allow their employés to wear the Union badge.

Mr. Brandon, an ex-motorman, described the efforts made at various times to form a Trade Union, and the steps taken by the company to defeat this.

Mr. Jessop, another ex-employé, stated that special efforts were now being made that new employés should not be members of the Association. In fact, Mr. Badger, the manager, was altogether opposed to their Association. After giving a case where an employé, who was purchasing a house, was advised by the company to leave the Union—a course the man declined to do without any dismissal following—the witness stated that if a member of the Association broke any of the company's rules and regulations, he was more severely dealt with than if he were a non-member.

The discussion then turned to the paragraph in the claim demanding "That preference shall be given to members of this organisation, other things being equal." Mr. Jessop was asked what he understood by the phrase, but beyond admitting that character ought to have something to do with it, he was unable to give any information.

Mr. Prendergast, the men's leader, stated that they wanted a judicial finding as to the meaning of the term, and that until they got it they could hardly argue it. He would say, however, that "If the company want to have the wheels run smoothly, they should have inspectors who are pleasing to the men."

The claim that all cars should be fitted with air brakes was mentioned, and, referring to Adelaide, it was stated that it would cost £30,000 to fit them to the cars.

Mr. Ovenden, of the Adelaide tram service, was then recalled, and to test the statements made as to the demands made upon motormen, the judge was invited to personally inspect the cars and examine the appliances provided. As one ground on which the demand for high wages was made, Mr. Ovenden stated that a motorman was held to be responsible for his car, and, if damage was done to it, he had to pay. He ought, therefore, to be paid a sufficiently high salary to permit him to provide a sinking or an insurance fund for this purpose. Asked what proportion of the 11s. a day asked for would be devoted to that purpose, witness could not say. Mr. Goodman, the manager of the Tramway Co., said that at Adelaide in three years they had paid £166,144 in wages, and deducted £5 11s. 6d. for damage to cars.

The further hearing of the case was adjourned.

*Wotans and Tantalums.*—We understand that the Central London Railway have replaced the whole of their arc lamp installation for station lighting with SIEMENS "Wotan" drawn tungsten wire lamps in Holophane fittings specially designed for the purpose. We gave an illustration of one of the stations so lighted a few months ago. Altogether there are some 500 light points. We learn that at a recent discussion on railway lighting at the Society of Illuminating Engineers, this system came out very efficiently for station lighting, the illumination curve being almost a straight line. Tantalum traction lamps are about to be installed on another well-known East London tramway. These lamps are now installed on nine-tenths of the London tramway systems, and 20,000 are actually in use on the L.C.C. cars alone. We are also informed that Siemens tantalum traction lamps and "Wotan" lamps in Holophane fittings are to be installed on a London electric railway station which is to be open shortly. The new Liverpool Street Arcade is illuminated with Siemens "Wotan" lamps. This arcade is considered one of the finest in England, and special attention has been paid to the illumination scheme.

*Trade with Belgium.*—We have received from Brussels a copy of the second annual report of the British Chamber of Commerce in Belgium, for the year 1911. It refers to a number of matters of general interest to traders, and gives a list of members and their addresses. In the appendix there is a note for British firms seeking to do business with Belgium, based upon the observation by the Chamber of the defects of English ways of doing business, as compared with those of Continental rivals. The following advice is given to British firms:—(a) Appoint British representatives or agents who speak the language (French) fluently, and who are in sympathy with the inhabitants. (b) Send out all catalogues and other printed matter in the language of the country, with quotations, measurements and weights in French. Many foreign firms quote *à domicile*, a great advantage when dealing with the Continent. (c) Find out what goods are most wanted before sending out travellers with samples not adapted to the requirements of the country. "If more attention were paid to these points we are sure that a large part of the import trade of Belgium which now gets into the hands of our more watchful neighbours might be obtained by British firms. The present is no time for lethargic indifference."



## TRADE STATISTICS OF EGYPT, 1911.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1911, is taken from the recently issued trade statistics. The figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given:

	1910.	1911.	Increase or decrease.
	£E.	£E.	£E.
<i>Steam engines, including boilers, &amp;c.—</i>			
From Great Britain ...	70,000	91,000	+ 21,000
" Germany ...	8,000	15,000	+ 7,000
" Belgium ...	1,000	1,000	—
" France ...	2,000	5,000	+ 3,000
" Greece ...	1,000	—	— 1,000
" Holland ...	3,000	5,000	+ 2,000
" Italy ...	6,000	8,000	+ 2,000
" Switzerland ...	3,000	4,000	+ 1,000
" Austria-Hungary...	2,000	3,000	+ 1,000
Total ...	96,000	132,000	+ 36,000
<i>Electric machinery (including gas engines and petrol engines).—</i>			
From Great Britain ...	52,000	62,000	+ 10,000
" Germany ...	23,000	32,000	+ 9,000
" Austria ...	1,000	2,000	+ 1,000
" Belgium ...	7,000	3,000	— 4,000
" United States ...	1,000	2,000	+ 1,000
" France ...	14,000	8,000	— 6,000
" Italy ...	4,000	13,000	+ 9,000
" Switzerland ...	11,000	28,000	+ 17,000
Total ...	113,000	150,000	+ 37,000
<i>Other machinery (except agricultural).—</i>			
From Great Britain ...	71,000	116,000	+ 45,000
" Germany ...	23,000	41,000	+ 18,000
" Austria ...	2,000	3,000	+ 1,000
" Belgium ...	3,000	3,000	—
" United States ...	26,000	48,000	+ 22,000
" France ...	24,000	37,000	+ 13,000
" Italy ...	4,000	4,000	—
" Switzerland ...	3,000	10,000	+ 7,000
" Turkey ...	1,000	2,000	+ 1,000
" Other countries ...	1,000	1,000	—
Total ...	158,000	265,000	+ 107,000
<i>Railway and tramway carriages.—</i>			
From Great Britain ...	55,000	1,000	— 54,000
" Austria ...	—	19,000	+ 19,000
" Belgium ...	34,000	11,000	— 23,000
" France ...	5,000	—	— 5,000
Total ...	94,000	31,000	— 63,000
<i>Lamps of all kinds.—</i>			
From Great Britain ...	8,000	8,000	—
" Germany ...	20,000	24,000	+ 4,000
" Austria ...	28,000	36,000	+ 8,000
" Belgium ...	3,000	—	— 3,000
" France ...	7,000	7,000	—
" Italy ...	—	1,000	+ 1,000
" Sweden ...	11,000	10,000	— 1,000
" Turkey ...	1,000	—	— 1,000
" Other countries ...	3,000	3,000	—
Total ...	81,000	89,000	+ 8,000
<i>India-rubber and gutta-percha, raw or manufactured.—</i>			
From Great Britain ...	7,000	7,000	—
" Germany ...	13,000	15,000	+ 2,000
" Austria ...	4,000	7,000	+ 3,000
" France ...	13,000	13,000	—
" Italy ...	5,000	4,000	— 1,000
" Switzerland ...	1,000	—	— 1,000
" Belgium ...	1,000	1,000	—
" Other countries ...	—	2,000	+ 2,000
Total ...	44,000	49,000	+ 5,000
<i>Electric, telegraphic and telephonic apparatus.—</i>			
From Great Britain ...	52,000	50,000	— 2,000
" Germany ...	19,000	22,000	+ 3,000
" Austria ...	20,000	19,000	— 1,000
" Belgium ...	12,000	11,000	— 1,000
" United States ...	1,000	1,000	—
" France ...	19,000	20,000	+ 1,000
" Italy ...	3,000	2,000	— 1,000
" Sweden ...	5,000	7,000	+ 2,000
" Switzerland ...	3,000	6,000	+ 3,000
Total ...	134,000	138,000	+ 4,000

	1910.	1911.	Increase or decrease.
	£E.	£E.	£E.
<i>Scientific instruments.</i>			
From Great Britain ...	19,000	19,000	—
" Germany ...	17,000	20,000	+ 3,000
" Austria ...	2,000	2,000	—
" United States ...	1,000	2,000	+ 1,000
" France ...	14,000	14,000	—
" Italy ...	1,000	2,000	+ 1,000
" Switzerland ...	1,000	1,000	—
Total ...	55,000	60,000	+ 5,000
£E — £1 0s. 6½d.			

## A New Method of Testing High-Pressure Cables

**when Laid.**—It is very important that high-pressure cables should be tested after laying, but to test 1 or 2 km. or more of cable at 10,000 volts requires a large and heavy apparatus, if the old transformer method is adopted; further, a given transformer is only suitable for a comparatively narrow range of testing pressures. Methods have recently been advanced by Messrs. Delou and Picou whereby cables may be tested by direct current. The great loss of power in continually reversing the charge of the cable is thus avoided, but it is extremely difficult to determine what D.C. pressure is equivalent, for testing purposes, to a certain A.C. pressure. Experience shows that the ratio between the pressures depends on many factors, including the nature and thickness of the dielectric, the supply frequency, and so on. The D.C. "equivalent" of a given A.C. pressure cannot be determined with sufficient accuracy to be fair to the conflicting interests of manufacturer and client.

At the last meeting of the Soc. Int. des Electriciens, M. A. Léauté described a new means whereby cables can be conveniently tested under the conditions in which they are subsequently to be used. The principle employed is the interposition of an inductance between the cable and an alternating pressure of constant value. The value of the inductance is such as to make the test circuit resonate at the fundamental frequency of supply. A sectional inductance coil is easily adjusted to suit a very wide range of cable capacity, and it is easy to show that the number of turns required is less than the number of secondary turns in a transformer giving the same testing pressure (say, twice working pressure), assuming the same core flux density in each case. Actually, the transformer will usually work at a lower flux density, and, allowing for this fact, and the weight of the primary winding of the transformer, the advantage is very considerably in favour of the new resonance method.

The magnetic circuit of the inductance coil described by M. Léauté consists of two cylindrical uprights, 9 cm. diameter, 557 cm. high, built of enamelled iron wire, and weighing 40 kg. each. Two rectangular yoke bars, 10 cm. × 10 cm. × 81 cm. long, are built of insulated laminations, and weigh 55 kg. each. The four core sections can be transported separately: when in use, the lower yoke piece rests on an oak platform, and the upper yoke is bridged by a recessed oak cross-beam held down by long bolts (covered with ebonite tubes), between it and the platform.

Each vertical core receives 10 winding-sections, each 60 cm. in diameter, and carrying 500 layers of one turn each. Each turn is insulated from its neighbours by mica, held in place by shellac, and the whole is mounted in ebonite. The conductor consists of a strip of foil, 4 mm. wide and 0.1 mm. thick—a form which provides a strong coil with a large cooling surface and allows of a high current density. In the latest models the sections are regulable, to ascertain the resonance point without switchgear, and all the necessary measuring instruments are self-contained, so that only four connections have to be made—two to the supply and two to the cable. At present three sizes are built, viz., 0.50, 50-200, and over 200 kw.; all are capable of handling in transport and use by one man.

Among the advantages of the new method may be enumerated:—(1) The test is made by A.C. and under working conditions. (2) By distributing the coil sections in the outgoing and incoming leads, there is avoided all the inconvenience of earthing one terminal of the secondary, as is necessary when using a transformer to test between the cores and sheathing of the cable. (3) In case of breakdown during the test, the high inductance of the testing coil prevents the propagation of high-frequency oscillations. Also, the breakdown removes part of the capacity from the circuit, and thus destroys the resonance hitherto existing; the voltage on the cable then falls to normal, and the current, while remaining high enough to burn out the fault, is not sufficiently strong to injure the sound portions of the cable.

The method has already been applied to the testing of lengths of cable from 250 to 2,800 m. at pressures from 12,000 to 23,000 volts, and more elaborate and severe tests are in progress.

**Standards for Lighting.**—In the Parliamentary Papers, in reply to questions on the subject of standards of illumination, Mr. McKenna said that the matter had been under the consideration of his department for some time past, with reference both to the recommendation of the Accidents Committee and also to the work which was being done on the Continent in the matter, and preliminary investigations had already been made. The questions involved were very complex and technical, and he proposed in the near future to appoint a Departmental Committee of an expert character to report on the subject.



## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co.,  
Electrical Patent Agents, 285, High Holborn, London, W.C., and at  
Liverpool and Bradford, to whom all inquiries should be addressed.

- 11,302. "Starting mechanism for petrol motors or other internal combustion engines." W. MYCOCK. May 13th.  
11,306. "Switchboard connection cords and the like." P. P. CRAVEN. May 13th.  
11,311. "Sparking plugs." C. E. JOHNSON. May 13th.  
11,359. "Portable electric battery lamps." B. PORDES. May 13th.  
11,366. "Electrolytic valves or polarisation cells." G. LIEBE. (Convention date, May 31st, 1911, Germany.) May 13th. (Complete.)  
11,372. "Portable electric battery lamps." B. PORDES. May 13th. (Complete.)  
11,380. "Manufacture of electric resistance bodies." G. COOPER. May 13th.  
11,388. "Means for starting internal combustion engines (more especially those of motor-cars or the like), and for generating electricity for lighting or other purposes." W. H. SCOTT. May 13th.  
11,406. "Electrical insulating compound." F. B. ELLIS, E. REEVE and J. P. O'NEILL. May 14th.  
11,415. "Electric imitation candles." G. H. ROBERTS and E. GAWKROGER. May 14th.  
11,420. "Reflecting camera lucida for use with X-ray photographs." W. COTTON. May 14th.  
11,434. "Repulsion motor with divided stator winding." M. OERLIKON. (Convention date, May 26th, 1911, Germany.) May 14th. (Complete.)  
11,455. "Manufacture of metallic filaments for incandescent electric lamps." J. A. SCOLAR. May 14th.  
11,464. "Impulse transmitters for semi-automatic telephone systems." SIEMENS & HALSKE-AKT. GES. (Addition to 10,444/1912. Convention date, May 16th, 1911, Germany.) May 14th. (Complete.)  
11,466. "Electric control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 14th.  
11,476. "Electric signals." A. C. BROWN. May 14th.  
11,479. "Alarm devices for use with wireless telegraph systems." W. H. SHEPARD and A. E. McKECHNIE. May 14th.  
11,482. "Construction of electrical resistance devices." H. S. MARTIN. May 14th.  
11,486. "Method of and means for controlling electric circuits." G. C. PILLINGER and L. SUNDERLAND. May 14th.  
11,488. "Electric furnaces." C. DELLWIK. May 14th.  
11,501. "Compartment gas or electric cooking apparatus." S. A. WIELAND. May 14th.  
11,537. "Remote control for electrically-operated apparatus." W. P. THOMPSON. (Ateliers de Construction Electriques de Charleroi, Belgium.) May 15th. (Complete.)  
11,557. "Electric starting apparatus for internal combustion engines." C. A. VANDERVELL and A. H. MINGLEY. May 15th.  
11,559. "Distribution of electric energy." E. G. WATERS. May 15th.  
11,560. "Means for and methods of clearing faults on alternating-current systems." A. M. TAYLOR. May 15th.  
11,578. "Telephones." R. LAGUS. May 15th. (Complete.)  
11,581. "Method for opening and shutting alternatively several contacts in a very rapid manner." L. E. GABRILOVITCH and W. S. DSCHANPOLADOFF. May 15th.  
11,582. "Method of wireless multiplex telegraphy including the independent tuning of each of several receivers connected with one antenna." L. E. GABRILOVITCH and W. S. DSCHANPOLADOFF. May 15th.  
11,584. "Electric-current distribution system." E. BLOUSTEIN. May 15th. (Complete.)  
11,586. "Electric switches." P. V. HUNTER and W. L. SHAND. May 15th.  
11,597. "Systems of electrical distribution wherein direct-current motors are employed." S. ECKMANN. May 15th.  
11,604. "Telegraph systems." E. POPE. May 15th. (Complete.)  
11,605. "Telegraph apparatus." E. POPE. May 15th. (Complete.)  
11,635. "Electrical generators." R. J. LEWIS. May 16th.  
11,668. "Electric furnaces employed in the manufacture of calcium carbide and products of a like character." C. BINGHAM. May 16th. (Complete.)  
11,671. "Method of simultaneous transmission and reception of several wireless dispatches from one antenna." L. E. GABRILOVITCH and W. S. DSCHANPOLADOFF. May 16th.  
11,701. "Electric bells, indicators and domestic telephones." S. A. BHISEY. May 16th.  
11,702. "Starting apparatus for induction motors." A. B. STRATFORD. May 16th.  
11,703. "Method of indirect excitation for oscillatory circuits." E. GIRARDEAU. (Convention date, May 17th, 1911, Germany.) May 16th. (Complete.)  
11,714. "Wireless telegraphy or telephony." H. MERTON. May 16th.  
11,779. "Junction boxes and the like for electric cables." J. W. HOGG. May 17th.  
11,792. "Electrodes for arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 17th.  
11,824. "Homopolar dynamo-electric machines." P. HYNES. May 18th.  
11,842. "Economisers or shields for multiple arc lamps." GES. FÜR MASCHINEN UND METALL-INDUSTRIE M.B.H. (Convention date, May 19th, 1911, Germany.) May 18th. (Complete.)  
11,849. "Electric flash boiler-water heater." J. MANN. May 18th.  
11,868. "Receiving and transmitting apparatus for wireless signalling." LONDROME SYNDICATE, LTD. (L. Gallotti, France.) May 18th.  
11,869. "Telephone transmitters." LONDROME SYNDICATE LTD. (L. Gallotti, France.) May 18th. (Complete.)  
11,870. "Vapour electric apparatus." E. E. DARMOIS and M. A. E. LEBLANC. May 18th.  
11,871. "Regulation of electric installations." H. D. EARL. May 18th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

- CARBON ELECTRODE FOR GALVANIC BATTERIES, IN WHICH THE ELECTROLYTIC FLUID OR THE DEPOLARISING GAS OR THE MIXTURE THEREOF IS CONVEYED THROUGH THE PORES OF THE NEGATIVE ELECTRODE. S. Benko. 9,649. April 20th.  
RELAY DEVICE. A. Orling and Orling's Telegraph Instruments Syndicate. 10,105. April 26th. (Cognate application No. 13,984 of 1911.)

- METHOD OF CONNECTION OF LINES IN AUTOMATIC TELEPHONE EXCHANGES. Welles & Zwietsch. 10,238. April 27th. (April 27th, 1910.)  
CONTROLLERS FOR ELECTRIC MOTORS. J. E. Brown. 10,364. April 28th.  
INCANDESCENT ELECTRIC LAMPS AND THE MOUNTING OF SAME FOR ILLUMINATION, ADVERTISEMENT AND THE LIKE PURPOSES. J. Hubers. Berliner-Sirius-lampen-Vertriebs Ges.) 10,433. April 29th.  
ELECTRIC LAMP SHADES, SCREENS OR THE LIKE. J. H. Winter. 10,575. April 29th.  
MEANS FOR FASTENING INCANDESCENT ELECTRIC LAMPS TO SHEET-METAL DISKS. J. Hubers. (Berliner-Siriuslampen-Vertriebs Ges.) 10,434. April 29th.  
HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. J. Hubers. (Berliner-Siriuslampen-Vertriebs Ges.) 10,435. April 29th.  
MILITARY SEARCHLIGHTS. Sir A. T. Dawson and G. T. Buckham. 10,539. May 1st.  
MEANS FOR SUSPENDING ELECTRIC LAMP FITTINGS. J. Salmon. 10,728. May 4th.  
APPARATUS FOR OPERATING ELECTRIC MOTOR CONTROLLERS AND THE LIKE FROM A DISTANCE. J. A. Hirst and P. S. Brook. 11,045. May 8th.  
SHIPS' TELEGRAPHS. P. R. Keppie. 14,108. June 14th.  
CONTACT CONDUCTORS OF ELECTRIC TRACTION SYSTEMS. W. D. B. Duddell and G. W. Partridge. 15,597. July 6th. (December 23rd, 1911.)  
AUTOMATIC CONTROL OF DYNAMO-ELECTRIC MACHINES IN DIRECT-CURRENT DISTRIBUTING AND CONSUMPTION SYSTEMS. W. F. Grafton and E. P. Prior. 16,007. July 10th.  
SPARK PLUGS. J. W. Mackenzie. (Champion Ignition Co.) 16,437. July 17th.  
TELEPHONES. B. Gwozdz. 19,011. August 24th. (June 17th, 1911.) Addition to 11,234/11.  
MACHINES FOR GENERATING ELECTRICITY AND MACHINES DRIVEN BY ELECTRICITY. R. Boyd. 19,160. August 26th.  
METHOD AND APPARATUS FOR ELECTRICALLY PRODUCING HOLLOW BODIES FROM ARENACEOUS QUARTZ AND OTHER NOT EASILY-FUSIBLE MATERIALS. A. Vcelker and V. Meurer. 19,643. September 4th.  
VEHICLE LAMP FOR THE SIMULTANEOUS USE OF AN ELECTRIC LIGHT AND AN OIL OR OTHER BURNER. C. Hurford. 26,011. November 21st.  
ELECTRIC CLOCKS. H. W. Lakc. (Electric Clock Co.) 26,168. November 22nd.  
INCANDESCENT ELECTRIC LAMPS. R. Jahoda and Elektrische Glühlampen Fabrik "Watt" Scharf Loti & Latzko. 27,388. December 6th.  
MEANS FOR GUIDING THE ELECTRODES OF ELECTRIC ARC LAMPS. Siemens Schuckertwerke. 27,699. December 9th. (December 10th, 1910.)  
METHOD AND DEVICE FOR POLARISING MAGNETO-ELECTRICAL MACHINES. E. Volkers. 28,715. December 20th. (January 3rd, 1911.)  
ELECTRIC FURNACE. A. Helfenstein. 29,126. December 27th. Addition to 17,650/11.  
CONTROLLING MEANS FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co.) 11,850. May 10th.  
MACHINES FOR PASTING STORAGE BATTERY ELECTRODES AND OTHER ARTICLES. H. C. Lake. (United States Lighting and Heating Co.) 11,516. May 11th.  
ELECTRICAL COUPLING DEVICES. R. Day. 14,179. June 23rd.  
SECONDARY STORAGE BATTERIES OR ELECTRICAL ACCUMULATORS. O. Oldham. 15,453. July 3rd.  
METHOD OF MANUFACTURING METALLIC FILAMENTS OR BANDS TO BE USED PARTICULARLY IN CONNECTION WITH THERMIC TELEPHONES. B. Gwozdz. 15,544. July 4th.  
SPARK PLUGS FOR USE IN INTERNAL-COMBUSTION ENGINES. G. C. Davis. 17,463. August 1st.  
ELECTRICAL CONDUCTORS. B. A. Pilkington. 18,908. August 23rd.  
SPARK PLUGS. G. Wright. 19,685. September 4th.  
METHOD AND MEANS FOR TRANSMITTING HUMAN SPEECH AND OTHER SOUNDS THROUGH SPACE. H. Manders. 21,116. September 25th.  
APPARATUS FOR STARTING MULTICYLINDER INTERNAL-COMBUSTION ENGINES. Robert Bosch (Firm of). 21,169. September 25th. (November 8th, 1910. Addition to No. 13,691 of 1910.)  
APPARATUS FOR PERFORMING WORK OF SHORT DURATION AT PREDETERMINED TIMES FOR AUTOMATICALLY OPERATING GAS VALVES, ELECTRIC SWITCHES AND THE LIKE. "Novitas" Fabrik Elektrischer Apparate Akt.-Ges. 24,034. October 30th. (October 29th, 1910.)  
ELECTRO-MAGNETIC APPARATUS FOR ACTUATING ELECTRIC SWITCHES, VALVES AND THE LIKE. J. P. Coleman. 24,154. October 31st. (November 2nd, 1910.)  
METHOD FOR SECURING THE DIAPHRAGM IN THE CASES OF MICROPHONES, TELEPHONES, GRAMOPHONES AND LIKE SOUND-REPRODUCING APPARATUS. W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon- & Telegraphenwerke) 25,491. November 15th.  
ELECTROSTATIC SEPARATORS FOR USE IN PURIFYING FLOUR, GRAIN, RICE AND OTHER SUBSTANCES. J. L. Lawson. 28,782. December 21st.

## 1912.

- WIRELESS TELEGRAPHY INSTALLATIONS. W. P. Thompson, (Ges. für Drahtlose Telegraphie.) 2,769. February 2nd.  
TELEPHONE EXCHANGE SYSTEM. P. Jensen. (Clement International Engineering Corporation.) 4,983. February 28th. (Divided application on No. 9,142 of 1911. April 12th.)  
COUPLINGS OR JOINTS FOR ELECTRICAL CABLES AND THE LIKE. C. J. Beaver and E. A. Claremont. 5,071. February 29th.  
TELEPHONE EXCHANGE SYSTEM. J. Jensen. (Clement International Engineering Corporation.) 5,876. March 8th. (Divided application on No. 9,142 of 1911. April 12th.)  
PROCESS FOR THE MANUFACTURE OF OILS CONTAINING COLLOIDAL MERCURY. A. Dering. 1,219. January 16th. (February 11th, 1911.)  
VAPOUR ALTERNATING-CURRENT RECTIFIERS AND SIMILAR APPARATUS. Hartmann and Braun Akt.-Ges. 2,471. January 30th. (February 3rd, 1911.)  
DEVICE FOR SECURING ELECTRIC CONDUCTORS AND THE LIKE TO WALLS OR OTHER SUPPORTS. W. T. Henley's Telegraph Works Co. and A. J. Hedgecock. 2,649. February 1st.  
ALTERNATING-CURRENT ELECTRIC MOTORS. A. C. Bell. 910. January 11th.  
ROTARY APPARATUS FOR ELECTRO-PLATING SMALL ARTICLES. M. Hüttig. 4,127. February 19th.  
ELECTRIC ARC LAMPS. A. G. Way and C. E. G. Thorkelin. 4,365. February 21st.  
RECTIFIER FOR HIGH-TENSION ALTERNATING CURRENTS. Siemens & Halske Akt.-Ges. 7,467. March 27th. (March 27th, 1911.)

**International Congress of Applied Chemistry.**—No fewer than 683 papers have been definitely promised to the 24 sections of this Congress, which is to be held at Washington and New York on September 4th to 13th, 1912. Papers must be in the hands of the American Committee before June 30th, 1912, and membership in the Congress should be completed by all prior to July 1st, 1912, in order to receive the printed proceedings.



THE

ELECTRICAL REVIEW.

Vol. LXX.

JUNE 7, 1912.

No. 1,802.

ELECTRICAL REVIEW.

Vol. LXX.]	CONTENTS: June 7, 1912.	[No. 1,802.	Page
The Radio-telegraphic Convention	...	...	909
Advance in German Prices	...	...	910
Indian Railway Administration	...	...	911
Summer Meetings	...	...	911
Electrical Signs as Advertising Media	...	...	911
A Radio-Telegraphic Compass (illus.)	...	...	912
A New Electric Lift (illus.)	...	...	913
Our Legal Query Column	...	...	914
Proceedings of Institutions:—			
The Behaviour of Direct-Current Watt-hour Meters (illus.)	...	...	914
Electrical Meters on Variable Loads	...	...	916
Location of Icebergs by a Recording Microthermometer	...	...	917
Private House Lighting by Electricity	...	...	917
New Electrical Devices, Fittings and Plant (illus.)	...	...	918
Legal	...	...	919
Correspondence:—			
An Objectionable Clause	...	...	920
A Minimum Wage for Electrical Engineers	...	...	920
The Engineer and the Clerk	...	...	920
Rating of Cables	...	...	921
Business Notes	...	...	923
Notes	...	...	930
City Notes	...	...	934
Market Quotations	...	...	936
Stocks and Shares	...	...	936
Share List of Electrical Companies	...	...	937
Metal Market.—Fluctuations in May	...	...	939
The Australasian Tramway Officers' Association	...	...	939
The Uses of Copper-Clad Iron Wire	...	...	940
Reviews	...	...	941
Birds and High-Tension Lines	...	...	943
Completion of Works in Time	...	...	944
Trade with Mexico	...	...	944
A Direct Reading Wave Meter (illus.)	...	...	945
Trade Statistics of South Africa	...	...	946
The Sunbeam Lamp Co., Ltd.	...	...	947
Foreign and Colonial Tariffs on Electrical Goods	...	...	947
New Patents Applied For, 1912	...	...	948
Abstracts of Published Specifications	...	...	948
Contractors' Column	...	Advertisement pages xxii and xxiv	

THE RADIO-TELEGRAPHIC CONVENTION.

It is appropriate that London should be the venue of the International Radio-telegraphic Conference for the first time that the gathering takes place outside Berlin. The only right which the latter city could claim for this important gathering was that its inception was due to the German Government. The history of the Convention is now sufficiently known to need no recapitulation, but in order to obtain some idea of the significance of the meetings now being held in London, it is essential to bear in mind some of the salient features in connection therewith. For some reason or other, the meetings are being held behind closed doors. No official statement has been made as to the points which are likely to be discussed, and we suppose that the public will only gain access to the proceedings long after interest in them has waned. While there is something to be said for the meetings being held in secret, there is still more reason for making known without any undue delay the opinions of the assembly on the subject of the compulsory installation of wireless telegraphy on ships, and the means for rendering the service more efficient in preventing disasters, and aiding in the work of rescue. Although the question of compulsory equipment does not figure on the agenda published some months ago, there is no doubt that the question will loom very largely before the delegates, and in view of the facts that some important maritime powers have already insisted upon compulsory equipment, and that the matter is under the consideration of the authorities in this country, we may assume that the opinion expressed by the Conference will carry considerable weight with the authorities here.

The first Conference met in Berlin in August, 1903, when the powers represented, with the exception of Great Britain and Italy, agreed to certain proposals to be considered at a subsequent Conference for the international regulation of wireless telegraphy. The attitude of the British delegates was governed by the fact that the Government had not that control over wireless telegraphy which would have enabled them to enforce the provisions of the Convention. Accordingly, the Wireless Telegraph Act was passed in the following year, and this prohibited the installation or working of wireless apparatus in the United Kingdom or on British ships without a licence from the Postmaster-General. In 1906 the second Conference was held, also in Berlin, and the Convention has been ratified by nearly all the countries represented. That Conference adopted a principal list of 23 Statutes for proposed ratification, a secondary list of three Articles, a final protocol of six Articles, and an Appendix of Service Regulations consisting of 42 Articles. The Appendix is the most important part of the existing Convention, and it is upon this section of the Convention that the most important discussions will centre.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill London, E.C.



Strong efforts will be made to amend Articles 2 and 3 of the Service Regulations, which specify two wave lengths of 300 and 600 metres for the service of general public correspondence. The normal wave length on board ship was fixed at 300 metres. Wave lengths between 600 and 1,600 metres were excluded from commercial use, and entirely reserved for Government purposes. Experience has shown that a wave length of 600 metres is more generally adopted by ship stations, because it has a wider range and is more generally suitable than a wave length of 300 metres for correspondence, and an attempt will be made to fix the normal wave length for ship stations at 600 metres instead of 300 metres, which is the present normal wave length for ship stations. Provision would then have to be made, so that each station would be equipped in such a way as to be capable of using this wave length, as well as one of 300 metres. In the opinion of some, the restriction to the present wave lengths is altogether unnecessary, and there is a feeling in certain quarters that the efficiency of the service would be improved, and interference considerably lessened, by allowing the use of any wave length which each administration might think suitable. In this case, however, it would be essential to provide for a uniform wave length for calling. Another view which will doubtless be presented, is that inter-communication between a ship station and a shore station must be conducted on both sides on the same wave length. If in any particular case there is interference, the two stations may agree to change this wave length, and at the close of the message or messages interchanged, the stations would return to their normal wave lengths. The extended use of wireless telegraphy is principally dependent upon the ease with which a number of stations can be worked efficiently in the vicinity of each other. Such interference as does take place between ships is largely in consequence of the fact that the wave lengths adopted in accordance with the rules laid down by the Berlin Convention are not sufficient, and a considerable advantage would be obtained by the utilisation of a third and longer wave.

The Conference will not deal with shore-to-shore work, which is rather surprising, considering how rapidly wireless telegraphy has developed as a means of communication between country and country. The main questions to come before the delegates will deal with communication between ship and ship, and ship and shore, and also the question of charging. The Convention stipulates that the coast charge for wireless telegrams shall not exceed 60 centimes per word, nor the ship charge be more than 40 centimes per word. A number of countries have already fixed several rates for every station, and it seems clear that a single coast or ship station charge is not elastic enough to meet all requirements. For ships on short passages, reduced rates seem essential. On the other hand, the improvement of the means of transmission has necessitated more powerful, and consequently more costly, stations, to which it is reasonable to grant a fair remuneration for their work. Under the circumstances, it seems reasonable to make the charges proportionate to the distance, as is usually the case with ordinary telegraphy. The highly complex matter of accounts will doubtless be the subject of a great deal of discussion. When a message is communicated through a number of different stations, the fee for transmission has to be divided amongst them, and with the growth of the system this has been found to give rise to a considerable amount of difficulty. It is hoped that some simpler system may be devised.

Questions in which the French Government are particularly interested are the organisation of a time service, by which the shore time would be communicated to ships at sea, and the definition of aerial radio-telegraphic stations.

Opinion in this country has now become reconciled to the Convention. Six years ago, the opposition to ratification by Great Britain was so strong that Parliament was com-

pelled to appoint a Select Committee to investigate the question, and the decision of the Committee in favour of ratification was only arrived at by a majority of one vote. The arguments used against ratification were that the effect of the regulations of the Convention would be to cramp and restrict invention, and make it more difficult to try or to introduce improvements, and that the adoption of the regulations would remove that proper stimulus to making great improvements which arises from the pressure of necessity by creating an artificial condition of affairs in which difficulties were covered up rather than removed. How groundless was this fear is proved by the enormous development of the system throughout the entire world. The Convention has facilitated and promoted the use of wireless telegraphy, especially for maritime purposes. It has provided international arrangements for rules of working, control, licensing of operators, efficiency of apparatus, collection of charges, transmission of messages, and publication of information. Moreover, it has provided the means of preventing confusion, and of avoiding interference between neighbouring ship and shore stations, a result impossible of attainment except by international agreement. General freedom of communication between ships and coast stations has been secured, and the protection from interference thus afforded has given free play to all systems, and has tended to the encouragement and progress of invention in connection with wireless telegraphy.

#### Advance in German Prices.

THE increased cost of the principal raw materials in recent months on the one hand, and the discontinuance of excessively keen competition by the Bergmann Electricity Works Co. on the other, are now affecting the inland sale prices of electrical engineering manufactures in Germany, where a general upward movement appears to be in progress. A week ago we recorded an advance of 10 per cent. in the quotations charged by the makers of telephone and telegraph apparatus, and now further developments are reported. In the first place, the A.E.G. has notified its customers of a general advance of 10 per cent. on prices of machinery and apparatus, although it might perhaps have been expected that the initiative in the matter would have been taken by the Siemens-Schuckert Works, owing to the firm's recent conclusion of friendly relations on a financial basis with the Bergmann Co. Nevertheless it is understood that, although a definite decision has not yet been arrived at, the question of a general advance in selling prices is also under the consideration of the Siemens-Schuckert Works; and the action already taken by the A.E.G. will doubtless expedite that of the other leading firms in the heavy electrical engineering trade, especially as the Bergmann Co. has now also notified a 10 per cent. rise in machinery prices. In the second place, the Syndicate of Electrical Installation Firms announces that the Copper Wire Syndicate, which raised the prices of wire in April, has now resolved on a further advance of 2s. 6d. per cwt. In addition, the Syndicate of Makers of Insulated Wires, which introduced a general increase of 15 per cent. early this year and made a further addition in April, has just made a fresh advance. The Syndicate of Installation Firms states that the higher quotations existing for some months past for electrical apparatus and installation materials have been raised, so that a general advance of 10 per cent. is now in operation. Owing to these circumstances, and the improvement in the wages paid in recent years, the allied branches are said to have been seriously affected, particularly the installation branch, which is consequently compelled to make corresponding increases in its selling prices. The syndicate adds that judging from the present position of affairs, there is no prospect of a speedy reduction in prices; expectations are quite to the opposite effect. It seems that the wire lamp branch is not yet included in the upward movement. It may be that the severity of competition in this department has not yet caused some of the smaller German makers to discontinue the manufacture of these lamps.



**Indian Railway Administration.**

IN many respects the Administration reports on the Railways in India, while vastly superior to the returns issued by our Board of Trade, are even more detailed than the returns for the United States issued by the Inter-State Railroad Commission at Washington. Quite apart from such interesting data as the load factor (of course, this term is not used) of locomotives and rolling stock, the electrical details are decidedly good.

For instance, in regard to such an important matter as train lighting, by electricity and gas, to which Board of Trade inquiries in the United Kingdom have attached much weight, any person in England spending a few shillings can ascertain how Indian passenger rolling stock is lighted. We do not know any official publication doing the same for this country. In India, 3,636 passenger coaches are lighted with electricity, 12,455 are lighted with gas, and 4,811 are not fitted for either of these illuminants. Another column sets out the names of the systems in use on each railway.

Certain Indian railways have their own electrical generating plant for the lighting of stations or for power supply to their workshops. The cost of repairs and renewals of such plant is enumerated, and is set out in its half-yearly incidence per mile of line open, per train-mile, and per 1,000 gross ton-miles, under the respective headings of maintenance of works and stations, locomotive expenses, and carriage and wagon expenses. Again, under general charges the cost of electric telegraphs is expressed as a percentage of the total earnings.

Much more might be said in praise of this admirably designed statistical system. As the understanding of statistics becomes of increasing importance, in order to appreciate in their correct significance the many complex economic questions of the day—not least those connected with transport—the study of a model return such as the one to which we have referred will be found strikingly suggestive and valuable.

**Summer Meetings.**

NEXT week the first summer meeting of the Institution of Electrical Engineers will take place at Glasgow; an interesting programme has been arranged, combining physical and mental recreation, with ample provision for intellectual edification. Glasgow is admirably qualified to be the first city to be visited, being the birthplace of many of the most important developments in electrical science, an engineering centre of the first rank, and a convenient starting point for some of the most delightful excursions in Great Britain. Besides a paper of exceptional interest by Mr. J. S. Highfield, and a lecture by Prof. S. P. Thompson, there will be visits to some of those great engineering works and power stations that are the pride of the Clyde, and the familiar but ever-enjoyable steamer trip through the Kyles of Bute to Inveraray. The three days will, in fact, be crammed with interest and pleasure, and we hope that fine weather will enable the meeting to be numbered amongst the most successful efforts of the Institution.

The following week will be occupied by the annual Convention of the Municipal Electrical Association, to which, presumably, many of the Glasgow visitors will proceed. There are, no doubt, advantages in the close succession of these two functions, but there are also obvious disadvantages, and perhaps it would have been better to space them further apart. However, that is a question for another year.

Later in the month the Tramway Convention will take place at Swansea, and at the end of July the Faraday Society will probably carry out an expedition to Norway and Sweden—surely the most attractive proposal of them all.

**ELECTRICAL SIGNS AS ADVERTISING MEDIA.**

By G. A. COOPER.

OF the many methods used by advertisers for drawing attention to their wares, none has received such scant attention as the electrical sign. Development in the design and form of these signs has been on a very small scale, and to-day, with one notable exception, we cannot show any real novelty in their design on the patterns in use years ago. We still cling to the beaten track in sign work, and a writing sign or a colour change, or a blink in a box sign is the highest point attained so far.

The sensation created by the advent of the "Scotchman" sign on the Embankment, and the interest it aroused, has apparently made no impression on those who should study closely the application of electrical signs, and the effect of new ideas in the all-important advertising world.

The success of this moving picture sign would lead to a natural enough deduction that advertisers were inundated by the sign builders with designs and schemes for moving picture signs, but this cannot have been the case as, however much we may lag behind other nations in this branch of advertising, the fault does not lie with the advertisers. There is no body of men so anxious to get hold of new ideas as the large advertisers, and the cost of these signs cannot be a deterrent to their use here, for the amount of money spent by individual advertisers per year would provide dozens of these signs in every large town.

Incredible though it may seem, no determined attempt has been made to establish these signs in this country, although there is nothing in the world to compare with them as advertising media. Advertisers recognise that descriptive writing up of their wares is good enough in its way, but something more is needed to fix the name of the goods in the mind of the man in the street. That is why our hoardings are covered with pictures appealing to the imagination and helping the mind to retain what the eye sees.

What the moving picture sign does is to improve upon this, and by its action and effect *compel* the passer-by to take notice; it also impresses the advertisement upon his mind in a far stronger degree than does its brother the placarded hoarding. Its extensive use in America proves beyond all dispute its advertising value, and some idea of its development there may be gauged by an account of the gigantic composite sign used in Louisville.

A huge frame flanked by two pillars contains six illuminated moving advertisements. The two columns flanking the frame are lighted by strips of light from top to bottom, and are so controlled that the columns appear to be revolving constantly. A piano advertisement occupies the top left-hand corner and depicts a lady sitting at a piano (outlined in lights). The effect obtained is that the lady at intervals leans forward and begins playing, moving her hands backward and forward over the keys.

The second and middle space on the top row is occupied by a street car and advertises the tramway service. The street car stands still for a few seconds, a gong rings, wheels revolve, track moves and trolley pole emits sparks. A furnishing firm call attention to their goods in a picture situated in the middle of the frame at the bottom, and, apart from the picture, the wording is so decidedly trans-Atlantic that its repetition here needs no apology. You are told that—

You furnish the girl.  
We furnish the home;

the sentences being flashed in conjunction with a picture of a boy and girl with a wagon, both figures taking irregular steps, as if walking slowly, the cart wheels revolving and the ground apparently moving in the opposite direction. A florist's advertisement appearing on the frame shows a spray of roses gradually growing from a small stem, the leaves appearing first, then buds which open up to full bloom.

Another moving picture sign is a diving girl. The girl springs from the board, and the water splashes as she enters; then the girl disappears.



The few examples given above indicate the unlimited scope of the picture sign. There is no doubt that its general application in this country will come shortly.

Sign makers should be up and doing, or some enterprising foreigner will be here snapping up the business under their noses, and with the examples of the motor-car and aeroplane industries fresh in their minds, they should awaken to the opportunities which are now before them.

## A RADIO-TELEGRAPHIC COMPASS.

[BY OUR BERLIN CORRESPONDENT.]

THE Prussian Department of Public Works, some years ago, commenced some interesting experiments intended to find out a method for determining the position of ships, dirigibles, aeroplanes, &c., in foggy weather. On the Müggel Lake, near Berlin, were installed, at fixed points, transmitter antennæ, each comprising 32 small poles placed at equal distances apart, on the circumference of a circle 650 ft. in diameter. Each pair of opposite poles communicated with a wireless transmitter situated in the centre of the circle. This transmitter was successively connected with each pair of antennæ, and a different signal was given out from each. If an ordinary acoustic receiver with non-directed antenna happened to be in the plane of the pair of antennæ actually working, this receiver would get a maximum amount of energy. As the wave-length chosen was approximately equal to twice the distance between the poles, the wave impulses emanating with opposite phases from the front and back poles respectively would add themselves in this plane. If, on the contrary, the receiver was situated at right-angles to the pair of poles, the two opposite impulses would strike the receiver simultaneously, thus neutralising one another. As each pair of antennæ (corresponding to a given position in space) gave out a different letter, the telegraph operator only had to ascertain which letter was received with a maximum or minimum intensity. The position of each station and each pair of antennæ, with its corresponding letter, being marked on a map, the directions between the ship (or airship)

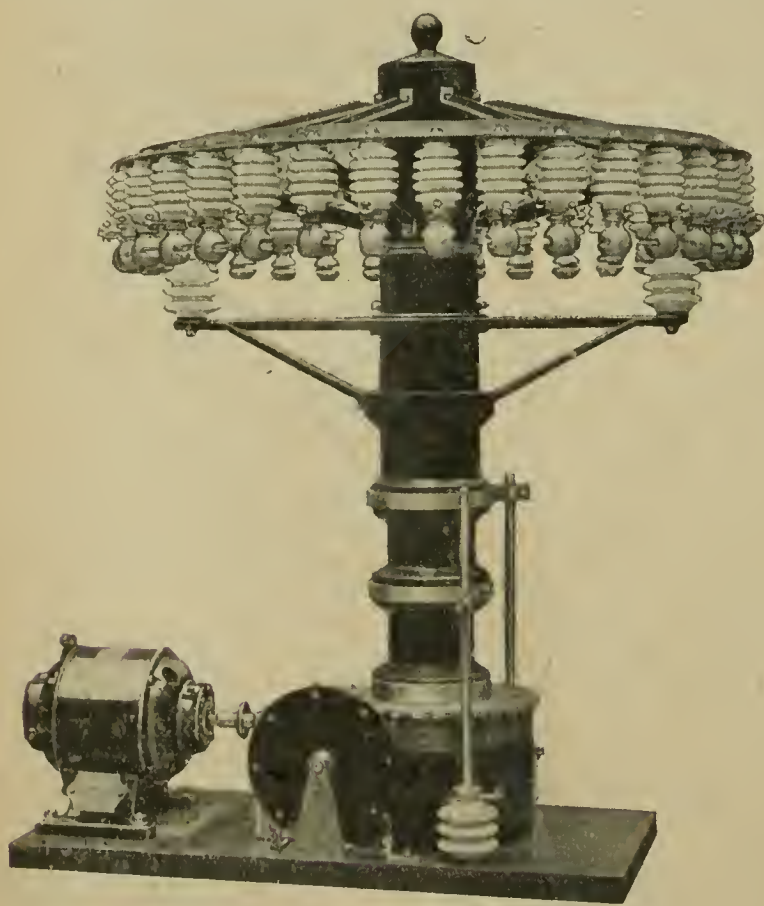


FIG. 1.—AUTOMATIC TRANSMITTER.

station and two such fixed stations would allow the position of the former to be determined. It is true that the necessity of remembering quite a number of letters and comparing the intensities of these signals put the memory of the telegraphist to considerable strain.

The Wireless Telegraph Co., of Berlin, on the basis of these experiments, developed a new method which greatly facilitates the work of the telegraphist. While retaining the general arrangement of the antennæ, another (non-directed) antenna is added (fig. 2). Before beginning an experiment, the transmitter is connected to this non-directed antenna (which gives out a short time-signal), and afterwards, by a self-acting switch, successively with each pair of directed antennæ, giving out each time a radio-telegraphic

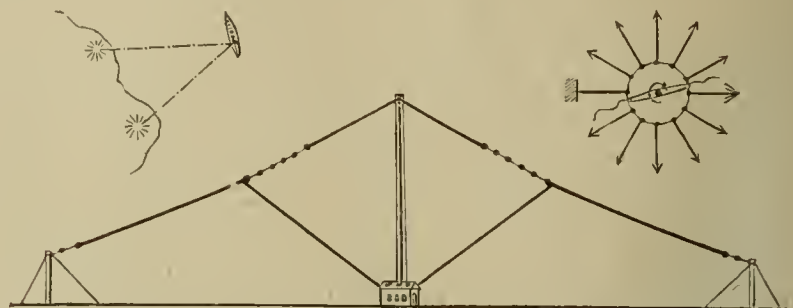


FIG. 2.—ARRANGEMENT OF TRANSMITTING ANTENNÆ.

signal. These signals are identical with one another, and always begin at a given antenna, *e.g.*, the north-south antenna, continuing in a clockwise direction at the constant speed of a stop-watch. The latter is graduated like a compass card, and works at the speed of rotation of the transmitter, its starting point being the north-south direction from which the transmitter starts its rotation. On hearing the time signal, the telegraphist presses the button of the stop-watch, and thus sets this working. At this moment, the transmitter begins giving out directed signals, first in a north-south direction, and so on, simultaneously with the rotation of the stop-watch. As soon as these signals are heard with a minimum intensity, the telegraphist stops his watch, the hand of which then marks the direction corresponding to the minimum of intensity in the reception of signals. Since each rotation of the transmitter (and the stop-watch) lasts just half-a-minute, 10 complete rotations, and accordingly 10 series of readings, are effected in five minutes. As the transmitters work quite automatically, they do not necessitate any superintendence.

If only a single stationary transmitter be available, only the direction of the receiver (on the balloon or ship), with regard to this transmitter can be determined. If, however, there be two fixed stations, the point of intersection of the two lines thus determined gives on a map the exact position of the receiver.

This arrangement, called the Telefunken compass, comprises at each sending station a vertical shaft, carrying at its upper end—on the circumference of a circle—a number of insulated contact points, communicating with the correspondingly directed antennæ. Two contacts, set rotating by an electro-motor, successively connect the 16 pairs of antennæ with the transmitter. After each half rotation the transmitter is for a moment connected to the non-directed time antenna. Fig. 1 shows the automatic transmitter.

In order to utilise this radio-telegraphic compass in the interests of aerial navigation, it has been suggested to install along the German frontier a series of fixed transmitter stations, so that the distance between these stations and an airship crossing the frontier district would at most be 30 miles. The airship passengers would thus be able accurately to determine their position and the moment they were passing the frontier. A similar series of stations installed on the north coast of Germany would protect aeronauts against the surprises of an involuntary flight over the sea. The maximum consumption of power of each station would be  $\frac{1}{2}$  kw., which could be derived from existing supply stations. Chimneys or the like could in most cases be used to carry the antenna systems.

**Barking Electricity Supply.**—The agreement with Messrs. Lawes & Co. for the supply of electricity for power purposes is to be extended for a further period of one year. The electrical engineer reports a breakdown of the 400-kw. engine at the electricity works, and states that the supply was maintained by arranging with two large consumers to limit their demand.



## A NEW ELECTRIC LIFT.

ELECTRIC lifts, or elevators, have become a most important factor in everyday life; the wide ramifications of electric supply mains, and the supplanting of old buildings by large modern edifices, are doing much to popularise them, and it is hardly an exaggeration to say that whenever a new lift is installed, in 99 cases out of 100 it is an electric one. It is not only in institutions and buildings devoted to business purposes that the electric lift has become so widely adopted; every modern residential flat invariably has one, and there is a growing tendency to use them in private houses, not only for domestic purposes, but also for passenger service.

The latest firm of our acquaintance to enter into the electric lift business is that of Messrs. Scholey & Co., who have entered into an

of the motor and gearing on the lift we are describing is an example of noiseless operation.

The drum is carried on a shaft of special quality steel; the worm and wheel are of high-grade material and are cut from the solid, thus ensuring perfect action. Placed alongside the driving gear is the switchboard on which are carried the main switch fuses, the relays for the push-button service, and four contactors, which are common to both the car control and the push-button control.

While safety in operation has been specially considered in both systems, there are one or two notable safety devices in connection with the push-button control. One is the overwinding gear, so designed as to operate if the cage from any cause should run above or below the top or bottom floor level. This overwinding gear has some points of resemblance to the well-known gear used on colliery winding plant.

On an extension of the main shaft a worm is carried, the length

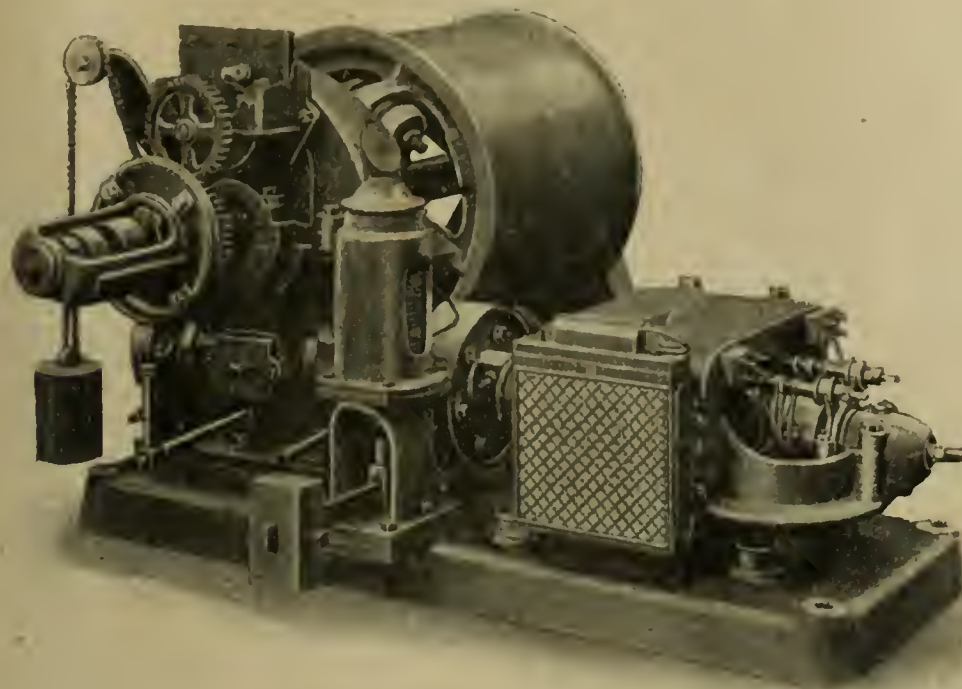


FIG. 1.—WINDING GEAR WITH D.C. MOTOR, SHOWING OVERWINDING DEVICE AND ELECTRIC BRAKE.

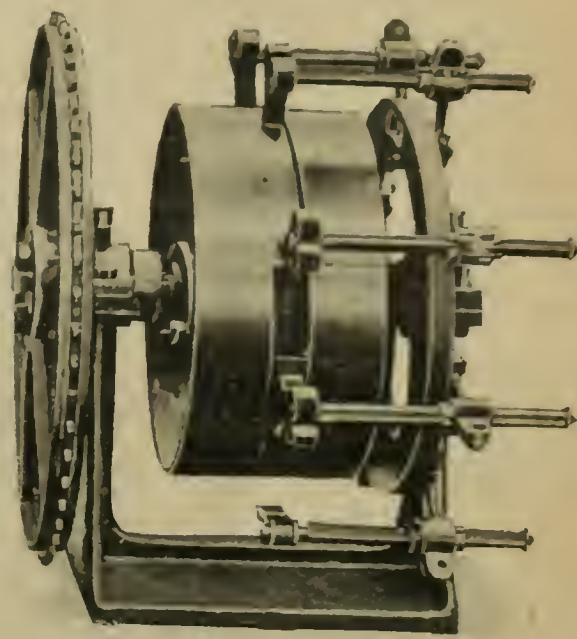


FIG. 2.—PUSH-BUTTON CONTROL DRUM.

alliance with Messrs. Graham Bros., of Stockholm, who are among the most expert lift makers in the world.

A lift which has been installed at 151, Queen Victoria Street, by Messrs. Scholey & Co. serves to demonstrate two systems of control—namely, the ordinary car-switch control and the push-button method—either system being used as the necessity arises. The lift traverses four floors. The whole of the driving gear is placed in the basement, and consists of a special type of D.C. motor working

of which is made to correspond to the travel of the cage. During the operation of the lift a large block nut traverses the worm, and in the event of the cage travelling beyond the normal



FIG. 3.—VIEW OF LIFT.

on 200-volt supply, and driving the rope drum through special worm gearing. The motor is an interesting variation from ordinary practice, but the design has been arrived at after long experience as being the most suitable on the score of reliability and noiseless running. Electric lifts have frequently been the subject of complaint on the score of noise, and while in some cases this may have been due to badly fitting gearing, a good deal of the noise very often proceeds from the motor. The Graham motor is stated to be specially built to guard against this trouble, and the performance

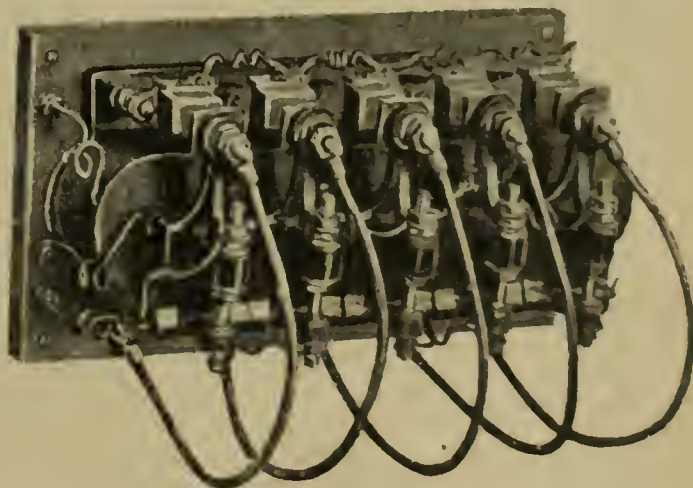


FIG. 4.—ROW OF CONTACTORS.

limits, this nut would engage with a catch and turn a contact ring (upon which carbon brush contacts are arranged) to such an extent that the brush would pass on to an insulated portion, thus

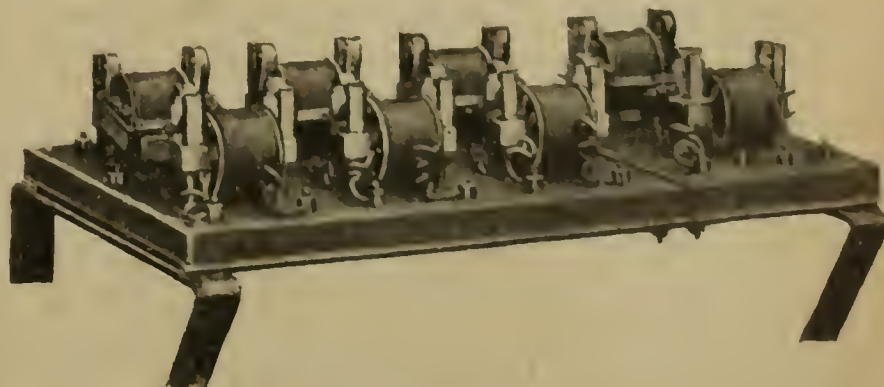


FIG. 5.—SET OF RELAYS.

interrupting the circuit. The contact rings, of which there are two, are so arranged that one ring has a slight lead over the other. The first one is connected in series with the contactor circuit, and



with the interruption of this circuit the cage would immediately come to rest. If by any chance the contactor were to stick, the main circuit would be interrupted at the second ring. The action of the overwinding gear also lifts a counterweight which has the effect of resetting the apparatus, so that when the overwinding has been prevented, on restarting the gear the weight descends and turns the contact rings to their normal position.

Another safety device which is worth noting is an automatic slowing arrangement. This is designed to come into action when the lift is operated by the ordinary car-switch control, travelling at 200 ft. per minute. In circuit with the main switch control are a series of ring contacts which are fitted on the end of the drum shaft, and operated by a reduction gear. The purpose of this device is that if the lift man by any chance should forget the floor he was approaching, the cage would be slowed up and stopped automatically at the top or the bottom.

The gear is fitted with an improved form of band brake, which is operated by a solenoid specially wound for elevator service. The brake is released by exciting the solenoid, which lifts an armature connected to a lever fitted with an adjustable weight, giving a large margin of adjustment. Further, there is fitted a switch which comes into operation immediately the brake is operated or lifted, this switch being opened automatically by the armature of the solenoid. By the operation of this switch a resistance is inserted in the solenoid circuit, thus reducing the current to a value sufficient to hold the brake off, and preventing the solenoid from being overheated by the continual working of the brake.

The push-button system of control provided appears to be as safe as human ingenuity can make it. A series of push buttons are carried in the car, each of which indicates a given floor. The operation of any one of these buttons will cause the car to proceed automatically to the corresponding floor. It is impossible to open any gate until the cage is completely at rest; further, the gear will not move until the gate has been properly closed, the closing of the gate completing the circuit, by which alone the lift will respond to the push button, and if any of the gates on any floor were not properly closed, the car would not travel.

The operation is as follows: As soon as the button is pushed, a relay keeps the circuit closed until the cage arrives at the floor desired. The circuit is maintained and broken in the following manner. A contact maker consisting of a split drum is driven from the main shaft, through the medium of a chain and sprocket wheel. Round this contact drum are arranged a number of arms carrying copper gauze contacts, an arm corresponding to each floor. Whenever a button is pushed, the relay closes the circuit, and current flows through the arm and the drum with which it is in contact. The contact drum is mounted on a screw, and, during the period of rotation, travels for a short distance in a lateral direction; the effect of this is that a small opening cut on the face of the drum passes sooner or later under each contact, and if such contact is in action, the circuit will be broken directly the gap in the drum face passes under it. The length of lateral travel depends entirely on the number of floors controlled. For instance, if the push button for the first floor were in operation, the control drum would only move a comparatively short distance before the contact arm (corresponding to that floor) came to the gap in the drum, and thus broke contact. Clearly, the act of breaking contact would coincide with the cage having reached the floor which was under control.

A distinctly new feature is the use of a second push-button arranged at each lift gate, by which the car is returned automatically to the ground floor.

The car-switch controller is very much on the lines with which we are familiar, an important point, however, being the provision of renewable contacts.

The gear is also supplied with an A.C. motor, in which case the brake is actuated by a small motor. The usual mechanical safety devices are, of course, provided.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"INQUIRER" writes:—"Is it legal for a member of a public board, who is a director of a public liability company, to vote in the interest of his company in the letting of a contract by that board?"

\* \* This brief query raises a question of considerable interest and importance. That the danger alluded to was foreseen when large powers were conferred upon the local authorities is manifest: for by Sec. 12 of the Municipal Corporations Act, 1882, it is provided that a person shall be disqualified for being elected and for being a councillor if, and while he "has directly or indirectly, by himself or his partner, any share or interest in any contract or employment, with, by, or on behalf of the Council." The fact that holding shares in, and, *a fortiori*, being a director of a company which contracts with the Council, is emphasised by a special exemption. Thus, a person is not disqualified, or deemed to have any share or interest in such a contract or employment by reason only of his having any share or interest in "any company which contracts with the Council for lighting or supplying with water or insuring against fire any part of the borough. In the case of an urban district ('Inquirer,' by the way, does not specify the nature of the district in which he is interested), it is provided

by the Local Government Act, 1894, Sec. 46, that a person shall be disqualified for being elected or being a member or chairman of a Council if he is concerned in any bargain or contract with the Council: provided that a person shall not be disqualified by reason of being interested in any contract with the Council... as a shareholder in any joint stock company; but he shall not vote at any meeting of the Council... on any question in which such company are interested, except that in the case of a water company or other company established for the carrying on of works of a like public nature, this prohibition may be dispensed with by the County Council." Having regard to what has been said, it seems that "Inquirer" could successfully protest against the director exercising the right to vote; any rate, can easily be identified.

## PROCEEDINGS OF INSTITUTIONS.

### The Behaviour of Direct-Current Watt-Hour Meters.

By S. W. MELSOM, A.M.I.E.E., and W. H. EASTLAND.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, May 9th, 1912.)

IN view of the questions which are constantly being raised as to the behaviour and accuracy under working conditions of direct-current watt-hour meters of various types, more especially regarding those used for measuring traction and other power loads, the authors have investigated at the National Physical Laboratory a number of these instruments, each of a different type, in order to ascertain, if possible, the source of the differences which undoubtedly often exist between meters of different types when used to measure power in the same circuit. The size of meter selected for the tests was for 200 amperes at 480 volts.

#### PARTICULARS OF WATT-HOUR METERS TESTED.

Allgemeine Electricitäts Gesellschafft ...	Oscillating type.
Aron Meter Co. ...	Short pendulum meter.
British Thomson-Houston ...	Motor type with external (copper) resistance and shielded brake magnets.
Chamberlain & Hookham ...	Shunted mercury motor type.
Everett Edgcombe ...	Shunted motor type with external (Eureka) resistance in pressure circuit.
Evershed & Vignoles ...	Motor type.
Siemens Bros. ...	Motor type.

With a view to determining any change in calibration with time, the meters have now, by the kindness of Mr. A. V. Mason, been connected in the traction circuit of the Sutton station of the South Metropolitan Tramways Co., where their behaviour will be noted under ordinary working conditions.

For the measurement of the quantity of electricity flowing through the main circuit of the meter, a copper voltmeter was specially constructed to take the full current continuously. In

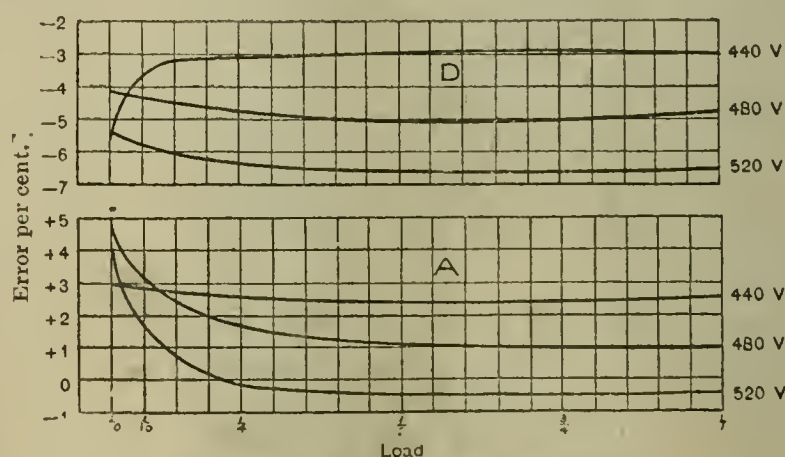


FIG. 1.—CURVES OF ERRORS AT DIFFERENT VOLTAGES.

order to ensure that the deposit was even and homogeneous, the electrolyte was kept agitated by means of a current of air, which served also to keep the temperature down, the maximum rise at the end of a 2-hour run being not more than 3° C.

The time over which each variable load test extended was not less than 2 hours, the voltage on the meter-pressure circuits being maintained at 480 volts during this time.

Before the tests with varying loads were commenced, the meters were thoroughly tested at intervals over a period of three weeks by short-run tests made by counting the revolutions of the rotor over a time of approximately 100 seconds, and by dial readings taken over runs of several hours at full load. Short-run tests were also made both immediately before and after each test on variable load.

The results obtained with the meters on steady load were not always consistent nearer than within  $\pm 1$  per cent. The mean of the constants obtained with the variable load agree with those



obtained on steady load to within these limits, and show conclusively that for all practical purposes there is no difference between the behaviour of any of the meters with a steady or a rapidly varying load: this confirms the conclusions of Messrs. Orlich and Günther-Schulze.

As a final check observations were taken over the first three weeks during which the meters were erected at Sutton. The load varies between 0 and 100 amperes, with occasional kicks to 300 amperes. The average current, determined by a mean of the meter readings, was about 50 amperes. The B. of T. units recorded by the meters, after being corrected in each case by the constant previously obtained at the laboratory, are given in column 1 of the following table, and the divergence of each meter from the mean of the whole six in column 2. It will be seen that the record of each meter agreed with the mean value to within  $\pm 1$  per cent., and in view of the fact that the average load was only equal to about one-quarter of the normal full load for the meters, and the possible error in testing was  $\pm 0.5$  per cent., this must be considered as very good agreement.

	(1)	(2)
Aron ... ..	7,605	+ 0.6 %
B.T.-H. ... ..	7,590	+ 0.4 %
O. & H. ... ..	7,520	- 0.5 %
Everett-Edgcombe ... ..	7,500	- 0.8 %
Evershed & Vignoles ... ..	7,560	0
Siemens ... ..	7,570	+ 0.1 %
Mean ... ..	7,560	

During the period of eight months covered by the tests the meters were twice dispatched on journeys—once by goods train to Tynemouth and back, and once by carrier to London. One meter was, unfortunately, injured in travelling to Tynemouth, and this necessitated it being recalibrated, but otherwise there was no appreciable change in the calibration of any of the meters as a result of the travelling.

In the majority of cases the meters were consistent during the whole time to within about  $\pm 1$  per cent., the variation being in general rather more at the lower loads. In one case, however, the rate decreased by about 3 per cent. at all loads during the first six weeks, but after this time remained constant to within  $\pm 1$  per cent. With another meter the results obtained towards the end of the time varied by about  $\pm 2$  per cent. from day to day.

The meters were practically unchanged at the higher loads as a result of the month's work at Sutton; at the lighter loads, however, some fairly large changes did in some cases take place. The changes coincided with a period during which the circuit breaker at the station came out several times owing to short circuits or other causes of excessive current, and this seems to confirm the conclusions of A. Durand, and also the results obtained with other meters at the National Physical Laboratory, that when a momentarily excessive current is passed through the meter the iron shield used to protect the brake magnets becomes slightly magnetised and affects the accuracy at light loads.\*

The curves in fig. 1 show the errors of two of the meters at normal voltage and at a voltage 10 per cent. above and below the normal. The changes are perhaps not excessive, but are large enough in some cases to require a correction if an accurate record is required at a voltage different to that at which the meters are calibrated.

So far as the authors are aware, no very definite data have been published as to the extent of the stray fields to which meters may be subject in generating stations. Experiments were, therefore, made by means of a coil carrying a current which was adjusted so that the field was equal to that which would be produced by a straight conductor carrying 1,000 amperes placed at a distance of 2 ft. from the meter. The curves, fig. 2, show the results obtained with one of the meters when this field was placed in the position at which it produced the maximum change—i.e., in the position most unfavourable to the meter. In the case of one meter there was no change in the rate owing to this field, and in another the difference was very small. In the cases of the other four meters, however the changes at light loads are large, and it is obvious that this question is one of the greatest importance. Difficulties of this sort can be met by erecting the meters in such a position that they will not be exposed to large stray fields.

The curves, fig. 3, show the results obtained with one of the meters when mounted  $3^\circ$  out of level; the errors at light loads are in most cases increased largely, while in one case the error at full load was altered by about 2 per cent.

The temperature coefficient of all the meters tested was in no case greater than  $\pm 0.1$  per cent. for a change in temperature of  $1^\circ \text{C}$ ., an amount which is probably negligible for most practical purposes.

Often a meter is put into a circuit the current in which rarely, if ever, reaches the maximum, the average load being often equal only to one-tenth of the full load for the instrument. This practice is not very satisfactory. It would be far better to install at first a meter of small capacity, adding when the load increased another meter of the same size connected in parallel with the first, or replacing it with a larger meter.

Care should be taken to erect meters, especially those having a temperature coefficient, well away from any extraneous sources of heat, such as field-regulating resistances or switchgear. Where the added resistance in the shunt circuit of the meter is wound of copper wire and mounted in a separate box, it is important that the box should be placed in such a position that it will be subject to the same temperature variation as the meter, and will not be

heated from an extraneous source of heat, or cooled by being placed in an air draught.

The possibility of stray fields should be carefully considered in selecting the position for erection; there may be very large fields in the vicinity of the angle-iron frame on which switchboards are usually mounted, and near large circuit-breakers of the magnetic type. When the meters are erected a simple test can be made to ascertain if any stray fields are affecting the meter by disconnecting the main

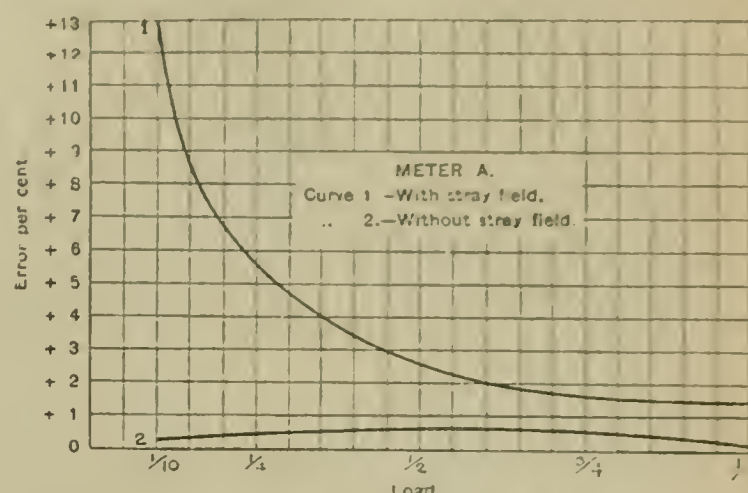


FIG. 2.—EFFECT OF STRAY FIELD.

current leads from the meter and short-circuiting them, the voltage circuit being left connected across the mains. Under these conditions the effect of any stray field should be shown by a movement of the meter dials.

The main current leads to the meter should be run with the lead and return close to each other. Great care should be taken to see that good contact is made at the meters, as otherwise errors may be introduced into the readings owing to the rise of temperature in the instrument; this is a matter of great importance in the case of shunted meters, where bad contacts may lead to very large errors. In the cases of two meters recently tested in the condition in which they were received it was found that in one (a 4,000-ampere meter) the watts lost in the contacts were almost equal to those dissipated in the instrument itself, and that the rate of the meter, after it had been run for  $1\frac{1}{2}$  hours, had increased by about 5 per cent.; and in another (a shunted meter), when first tested, the reading was found to be 30 per cent. too low, while after the contacts were cleaned it was correct to within 2 per cent.

A slight difference in level affects seriously only the accuracy of the lower loads; as, however, it is important that these should be accurate, it is desirable that the meters should be carefully levelled. Aron clock meters can be levelled by the small plumb-bob fixed inside the case, and motor meters by the well-known method of placing a coin or small weight on the outer periphery of the meter disk and adjusting the meter level so that the weighted disk does

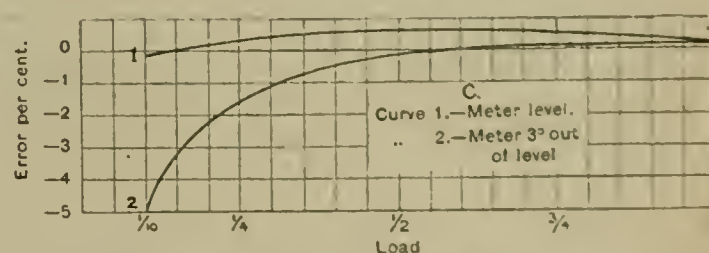


FIG. 3.—ERRORS DUE TO CHANGE OF LEVEL.

not move when the meter case is tapped. In the case of the oscillating-type meter, where the disk is not able to make a complete revolution, the method adopted by the authors was to time two oscillations with a small steady current, the level of the meter being adjusted until the time of oscillation was the same in each direction.

With most of the types of direct-current watt hour meters it is possible to obtain under proper conditions an accuracy of test to within  $\pm 0.5$  per cent. This, however, probably applies only where the measurements of current and pressure are made directly by a potentiometer. Where direct-deflection instruments are used for the measurement of power the possible error is of necessity somewhat larger, and the accuracy of tests under these conditions cannot be considered as being nearer than  $\pm 1$  per cent. Speaking generally, direct-current watt-hour meters are consistent to within  $\pm 1$  per cent. at the upper loads, and it is clearly shown by the results obtained at Sutton that the records obtained under working conditions when corrected by the constants obtained by the tests should be correct nearly to within this limit. In the case of a meter used to measure a large output, it is recommended that it be tested and, if necessary, cleaned and adjusted once every six months.

In making tests in the laboratory or test-room, the pressure circuit should be connected to the mains for several hours before commencing the test. This applies more particularly to those meters in which the series resistance is of copper and is situated inside the meter. One hour is not sufficient for the various parts of a meter to attain to a constant temperature.

\* A later examination seems to indicate that it is the steel spindle that has become magnetised and is affecting the accuracy of the meter at light loads



In addition to the usual test at various loads, made preferably with a chronograph as distinct from a stop-watch (chronograph is the name generally given to a centre seconds watch, the hands of which are put in and out of gear with the movement, while by the "stop-watch" is meant a watch in which the whole movement is stopped or started), it is necessary that the meter should be run for a considerable time at full load in order to ascertain the extent of the error due to heating. The main portion of the heating will take place in the first hour, and a short-run test taken at the end of that time will indicate very well whether the test need be continued further. In more than one meter tested by the authors, the accuracy changed by about 5 per cent as a result of running for five hours on full load.

Tests made in position are often of very little value. In the authors' opinion there is no direct-current meter at present on the market which can be relied upon to integrate a load sufficiently accurately to be used as a standard by means of which other meters can be checked. It seems to be most satisfactory to erect the meter in such a position that it is unaffected by stray fields or anything else which may impair the accuracy, and to have it tested from time to time under conditions, both as regards apparatus and time, in which the errors can be accurately determined and any special points fully investigated.

### Electrical Meters on Variable Loads.

By DAVID ROBERTSON, B.Sc., A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, May 9th, 1912.)

THE paper deals both theoretically and experimentally with the behaviour of electricity meters on variable loads. It is shown that an eddy brake meter without fluid friction and with perfectly compensated solid friction is correct on all loads whether steady or not; the extra record made during deceleration always exactly compensates for that lost during acceleration.

Solid friction makes the loss of record while the speed is rising exceed the gain while it is falling; while fluid friction, even if compensated for steady loads, has the reverse effect. The proportional starting and stopping error due to solid friction increases indefinitely as the duration of the load is made less and less, while that caused by the fluid friction only approaches a finite limit of the same order as the amount of the friction itself.

On a rectangular-wave cyclic load, the error due to solid friction is constant at all frequencies above that at which the rotor just comes to rest each cycle, and is such as to make the meter run at the same speed as it would with a steady load equal to the mean. The fluid friction error increases with the frequency, but is less than the starting and stopping error.

Experiments made at the Merchant Venturers' Technical College, and on the Devonport and District Tramways are described, and the results given and discussed. They confirm the theoretical conclusions, but show that the effects are small on a tramway load.

As is well known, the law connecting the resisting torque with the speed of a motor meter must be the same as that connecting the driving torque with the current, or power, being metered, if the meter is to be accurate on all loads. This agreement can only be approximately attained in practice, but if it could be made perfect, then, however complex the law might be, the meter, when properly calibrated, would be correct on all steady loads and also on all variable loads which change sufficiently slowly to make the inertia torque negligible. But it would not necessarily be accurate on loads which vary sufficiently rapidly to produce appreciable inertia torques on the rotor of the meter.

In ordinary meters we can conveniently divide the resisting torque into three components—solid friction torque, eddy-current torque and fluid friction torque—and assume these to be respectively constant, proportional to the speed and to the square of the speed. None of these assumptions is quite true, but within certain ranges for each the deviation can safely be neglected. The solid friction increases very considerably at low velocities, especially when the speed is almost zero. The eddy-current torque increases less rapidly than the speed at high speeds and reaches a maximum at a certain speed, beyond which it diminishes, owing to the inductance of the eddy-current paths; at all ordinary meter speeds the reactance effects are quite negligible, and the deviation from the proportional law is inappreciable. Fluid friction changes law at a certain critical speed which depends on the constants of the fluid; below that speed the fluid frictional torque is proportional to the speed instead of to its square.

In practically all modern motor-meters the main control is an eddy-current brake. When the solid friction is exactly compensated and fluid friction absent, the mean current or power being metered will be strictly proportional to the mean speed, and the meter, if properly calibrated, will always record correctly whether the load changes rapidly or slowly, whatever the wave-form of the load may be, and however much inertia the rotor may have. Its steady load characteristic is a horizontal straight line. Solid friction alters this into a rising curve. Under the worst conditions likely to occur in practice, the variable load error, compared with the rate at maximum load, is of the same order as the ratio of unbalanced frictional torque to the eddy-brake torque at the speed corresponding to the maximum load; it gets less as the load on the meter is made greater.

In electrical energy meters (watt-hour meters) the solid friction is generally compensated by putting some field turns in the shunt circuit, so that there is always a driving torque, whether there is a load or not. With the object of getting a low starting current, the

position of these coils is generally adjusted so that the rotor will just not continue to rotate when the load is removed. Creeping is then liable to occur if the meter be removed to a place where it is subject to vibration, or where the voltage is above normal, and the solid friction is, as a rule, considerably over-compensated at the running speeds. Owing to the variation of the solid friction, perfect compensation can never be obtained in this way, and so they are generally under-compensated at low loads and over-compensated at large ones.

When there is fluid friction, but no solid friction, the steady load characteristic becomes almost a straight line sloping downwards. The fluid friction can be more or less compensated for steady loads by a series coil which alters the division of the flux between the motor and brake portions in such a way as to diminish the eddy-current torque relative to the driving torque at the larger loads. But even if this adjustment were perfect at steady loads, the meter would run faster than it ought at variable loads. The limiting error, whether starting and stopping or on a cyclic load, is of the same order as the ratio of the fluid friction torque to the eddy-current torque at the speed corresponding to the maximum load, and it is *greater* for large loads than for small ones.

When both solid and fluid friction are present, the characteristics are intermediate between those considered. Each kind of friction tends to correct the errors due to the other. The curve for 5 per cent. solid and 1 per cent. fluid friction would give an excellent steady load characteristic, such as that obtained from the modern Ferranti meter. It should be remembered that the proportion of each friction with a given meter varies with the load.

In the experiments a variable current was passed through the main coils of all the meters, while a constant voltage was maintained on the shunts of the energy meters. The electricity passed through was measured by a copper voltameter, and the voltage by a Nalder volt potentiometer and Weston cell.

A complete calibration of the meters with a steady load was made before commencing the variable load tests, and steady load tests at 5 and 10 amperes were interspersed at intervals.

The experiments were devised so as to magnify any variable load peculiarities which might exist, in order to make certain of detecting them. Consequently the errors which are likely to arise in actual use are very much smaller than those shown by the curves obtained.

The meters tested were of the Ferranti, Hookham, Westinghouse, Electrical Co., B.T.-H., Siemens and Aron types, and the tests were conducted with intermittent direct current at frequencies up to 600 cycles per minute.

Experiments were also made by the author at the Devonport District Tramways switch-house. Standard B.T.-H. and Aron meters of 200-ampere size, known to be in substantial agreement on steady load, were placed in series with a tramway feeder whose load was within their range. Readings were taken hourly during the first day, and daily for some time afterwards. At first the Aron meter ran very slightly faster than the B.T.-H., but after some rather heavy traffic the latter began to recover its position, and by the end of the day the records agreed within  $1\frac{1}{2}$  parts in a thousand. This close agreement between two meters differing so widely in their construction and principle of action was taken as conclusive proof that neither of them behaved appreciably differently on a tramway load from what they did on a steady load.

Clock meters in which there is little damping of the pendulums are as accurate on variable as on steady loads except within a small range of load frequency in which resonance effects occur. This type of meter should not be employed on cyclic loads, such as flashing signs, unless the load frequency differs considerably from that of the pendulums (about 80 cycles per minute).

### JOINT DISCUSSION.

A joint discussion on the above papers was opened by MR. A. P. TROTTER (B. of T.), who said that some of their tests of tramway meters had been criticised because it was urged that they were not conducted on traction loads; he had felt the importance of the matter, which involved large sums of money, and he believed now there were two fairly good travelling meters which were quite satisfactory. If two meters of different types could be run in series on traction loads and found not to vary more than 1 or 2 per cent. over some weeks, this was not a fluke, and he felt, after hearing the papers, that good meters tested on steady loads in the laboratory were suitable for practical traction work. He disagreed with Dr. Robertson's general condemnation of mercury meters, which, under proper conditions, were exceedingly good instruments.

MR. G. H. HOLDEN said he had not had any opportunity of carrying out such tests as the N.P. Laboratory, and felt that their tests were of great value. Prof. Robertson had employed a rather obsolete type of Hookham meter in his test, and this explained his results to some extent.

MR. C. A. BAKER said that, although traction meters did not come his way, numerous variable load meters for signs passed through his hands. Variations in calibration coefficients due to temperature change offered considerable scope for study; a good average speed increase for small D.C. meters was 3 per cent. per degree C. rise in temperature, but he agreed with the author's figure for the meters they were considering. The temperature effect for A.C. meters was much less.

DR. A. RUSSELL said he had taken the best types of tramway meters, properly adjusted, and tested them in series on fluctuating loads and interrupted circuits, but found, as he had expected, uniform readings. As such meters gave varying results when in series on the switchboard, the discrepancy was studied and traced generally to stray fields, even pendulum meters and those with



astatic coils being affected. Vibration also caused errors. Meters for traction work were admirably made now and if put up properly would agree amongst themselves. It was no good sending a switchboard meter to the laboratory for testing, and expecting laboratory results when replaced on the board. He commended Prof. Robertson's paper, but had found some difficulty in understanding the appendix owing to the notation.

MR. A. J. CRIDGE said, referring to Mr. Melsom's paper, that it would be found that astatic windings in motor meters would largely obviate trouble with stray fields, while aluminium spindles in oscillating meters would get over the trouble. He asked if the 4,000-ampere meter was tested again after it had cooled down, and was the result the same. Prof. Robertson's tests, although he found no fault with them, were of little practical value.

MR. J. RENNIE said Prof. Robertson's paper should not be taken seriously as regards some of the results arrived at. His arrangement for holding the plates of the electrolytic cell was not so good as that shown by Mr. Melsom. Manufacturers should publish approved specifications and curves of accuracy for their meters, which they would be prepared to guarantee, as this would impress the user. The carriage question had exhausted their ingenuity; he considered from his experience that meters could travel without damage. The central station often did not appear to appreciate the meter, judging by the treatment given to it, and he thought that possibly a good looking meter would get better treatment than an ordinary one, judging by the experience of the gold watch.

MR. ROGER T. SMITH said railway people would be indebted to the authors for deciding that a large number of meters were correct on variable loads if properly installed and used. He described the fairly accurate results obtained by using two permanently installed meters and one calibrating meter in series on the Great Western Railway supply. The error was under 2 per cent. on a 16 days' test and almost negligible on a 6 days' run. The calibrating 4,000-ampere meter was sent periodically to the N.P. Laboratory for overhaul. Each sub-station had one spare meter which could be removed; permanent meters were adjusted on site to within about 1 per cent. agreement.

MR. A. P. YOUNG (in a communication) said that meter theory showed very clearly that the accuracy of a motor meter having eddy-current damping and no uncompensated friction was quite independent of whether the load was steady or fluctuating. The General Electric Co., of U.S.A., some 16 years ago carried out tests on the well-known Thomson watt-hour motor meter, which proved that the theoretical conclusions were justified in actual practice. These experiments were confirmed by the more elaborate and refined tests made by Mr. Melsom and Mr. Eastland, also by those of Prof. Robertson made on the B.T.-H. type "C" and type T.S. meters. "Any motor-meter to measure the product of some quantity (A) and the time (t) will record correctly, regardless of how (A) varies, provided that:—(1) The driving torque is directly proportional to A; (2) the retarding torque is directly proportional to the angular velocity of the moving system, and there is no extraneous friction or damping not in conformity with this law. This is at once apparent from the equation of motion governing such conditions—

$$K \cdot A = I \cdot dw/dt + K_1 w,$$

where, I = moment of inertia of the moving system;  $w$  = angular velocity of the moving system; K and  $K_1$  = constants. Multiplying through by  $dt$  and integrating—

$$K \cdot \int_{T_1}^{T_2} A \cdot dt = I \int_{T_1}^{T_2} dw + K_1 \int_{T_1}^{T_2} w \cdot dt,$$

$$\text{i.e., } K \cdot \int_{T_1}^{T_2} A \cdot dt = I (w_{T_2} - w_{T_1}) + K_1 (\theta_{T_2} - \theta_{T_1})$$

If it is assumed that initially at time  $T_1$  the moving element is at rest, and also at the final time  $T_2$  it has again come to rest, then—

$$w_{T_2} = 0 \text{ and } w_{T_1} = 0,$$

therefore

$$K \cdot \int_{T_1}^{T_2} A \cdot dt = K_1 (\theta_{T_2} - \theta_{T_1}).$$

The quantity on the left-hand side of this equation is that which has to be measured, whilst that on the right-hand side is proportional to the total angle moved through by the moving system, that is, to the number of revolutions made in the period from  $T_1$  to  $T_2$ . As regards ampere-hour motor meters of the mercury type wherein eddy-current damping is employed, the extraneous damping produced by mercury friction was not a negligible factor, and in all three types of meter a compounding coil was introduced for the purpose of compensating for the mercury friction, more particularly on high loads, where it became of increasing importance; the writer suggests that the error results in most part from this compounding coil, as a result most probably of some hysteresis effect in the magnet system; that is, that true compensation is not achieved, and the deleterious effect of mercury friction manifests itself by causing the meter to read considerably more than it should do. He considers it unfortunate that Prof. Robertson did not carry out tests on the mercury meter manufactured by the B.T.-H. Co., wherein no compounding device of any kind is employed. As mercury type ampere-hour meters are being used more and more for tramcar service, it would appear that meters in which compounding is employed are not so suitable for this class of service as that type in which the design has been so well carried out that a compounding device is found quite unnecessary. Reverting to Mr. Melsom's paper, that part dealing with the "Effect of Stray Fields" was exceedingly interesting, but it was unfortunate that tests were not made on any astatic type meters. Above 500 amperes all D.C. watt-hour meters manufactured by the

B.T.-H. Co. were of the astatic type, and they were, therefore, unaffected by uniformly distributed stray magnetic fields in the region of the two armature coils.

MR. S. W. MELSOM said (in replying) that Prof. Robertson had asked him to state that his conclusions were based on an old-type Hookham meter. He thought that no meter was thoroughly astatic, and he had not traced any particular effect from vibration. The 4,000-ampere meter, tested after cooling, showed exactly the same results as before. The N.P. Laboratory had found no effect on the accuracy of meters from journeys; the most severe test was a journey from Teddington to London by carrier. As regards standard meters, it was a question of having one meter and regarding it as right when others disagreed. He did not agree that any one meter was specially competent to detect errors in the others; no meter on the market was twice as good as any other.

#### Location of Icebergs by a Recording Microthermometer.

THE evening meeting of the ROYAL INSTITUTION on May 31st was occupied with a lecture by PROF. HOWARD T. BARNES, F.R.S., the distinguished Canadian physicist. His subject was the detection of icebergs in navigation, and the lecture was in the nature of a peroration to a series of Thursday afternoon discourses, in which he has discussed ice formation in Canadian waters, the work of ice-cutters on the St. Lawrence, and the need of bringing the wisdom of the laboratory to bear upon the safety of the northern route between Great Britain and Canada, which crosses the iceberg track. He started his experiments, he said, with scepticism, and ended them with optimism.

The lecture began with a lucid description of the shifting ice on the western shores of Greenland and its movement out to sea, where it formed the floating bergs, measuring in some cases 250 ft. from the surface of the sea to the pinnacles and 500 yards in length. Prof. Barnes endorsed Pettersson's theory that ice, melting in the sea, caused three currents to be set up, the cold sea water falling, the warmer sea water melting the ice and taking its place, and fresh water from the melted ice rising on the surface around it, but not mixing with the salt water. Scientific advantage might be taken of this last phenomenon, and the presence of fresher water be indicated by altered electrical conductivity. The "ice blink" and other signs of an iceberg's approach were more interesting than precise, and temperature changes in the sea had not hitherto been reliable owing to the crude methods of reading in vogue.

But Pettersson's theory that some temperature effect would be produced by currents of fresh water from the melted ice suggested the idea of a recording microthermometer. An instrument was required which should be sensitive enough to record a variation of temperature of a thousandth of a degree as easily as an ordinary thermometer would record a variation of 2°. After many attempts and failures, Prof. Barnes succeeded in evolving a form of electrical resistance microthermometer which would register variations otherwise entirely overlooked, and would indicate the presence of an iceberg at a distance of half a mile. The thermometer itself was fitted in a special iron cylinder attached to a guy rope for immersion in about 5 ft. of water and connected by wires to the recording instrument on deck. A portable form of galvanometer of somewhat special construction was employed, and its clock mechanism was so arranged that it would work anywhere and, indeed, worked better when there was vibration, the vibration destroying any false balance. The recording instrument contained a chart mounted on cylinders, on which a pen recorded the temperature.

A series of microthermometric charts, some made in the North Atlantic only a month ago, showed how changes of temperature denoted the presence of icebergs. The characteristic changes and the rate at which they took place were more significant than the temperature *per se*. Generally there was a rise as a ship drew near a berg, followed by a sharp fall, and a rise after the berg had been passed. The first rise was probably due to absorption of the sun's heat by fresh water from the berg. According to one chart, this iceberg effect was observable even in water at a depth of 16 ft. below the surface.

#### Private House Lighting by Electricity.

By W. R. RAWLINGS.

(Abstract of paper read before the ILLUMINATING ENGINEERING SOCIETY, April 16th, 1912.)

THE problem of the illumination of a mansion is entirely different from that of an institution, club or hotel. It might be supposed that the production of artificial daylight was the ideal illumination; but even if such light could be obtained at a low price, it is, in my opinion, unsuitable for the home, and should be confined to certain special applications, in cases in which the correct matching of colours, &c., is an all-important item. One desires the warm tone which the artificial illuminants of to-day naturally provide. From this standpoint the old carbon-filament lamp, with its yellow rays, gives greater satisfaction and a more pleasing effect than the white light of the metal-filament lamps.

The problem of house illumination is not so much one of foot-candles, as of convenience, taste, and personal requirements.

I admit that there is a minimum limit in foot-candles for specific work. For instance, a bedroom is comfortably illuminated with a variation from 2 to 1 foot-candle, but the dressing table and the part in front of the dressing mirrors must have at least 6 to 10 foot-candles on the dressing-table surface. A dining table requires not less than 2.5 foot-candles, and need not exceed 3.5; but the



ceiling and walls of that room should be kept from 5 to 1 foot-candle, so that the surroundings may be subdued in comparison with the table, and for this reason I do not advocate here indirect illumination.

Mr. Justus Eck, in a valuable paper on "Indirect Lighting," pointed out that animal life desired shade, and it is only when illumination for specific work is required that the brighter light is desired. While the billiard player likes a strong light on the table, he prefers a lower illumination for the rest of the room. I know of nothing more uncomfortable than a room equally illuminated on every square foot of the floor, and a room so lighted is, in my opinion, inartistic.

I suggest the following rules for illuminating the home:—

1. A room should not be evenly illuminated all over.
2. The filament of the lamp should be so placed as not to be in the line of vision under normal conditions.
3. The light should be so placed as to illuminate specific objects (according to the nature and purpose of the room).
4. Small units of light are in general to be preferred.
5. Indirect lighting should only be used for general lighting, or as supplementary to the necessary local illumination.

It is seldom that the engineer is allowed free scope in placing the lights as he, in his opinion, thinks best, and, in a word, it is more difficult to satisfy the taste of the owner than the actual requirements of the house.

The town house requires more light than the country house: the same people who consider a 16-C.P. lamp too strong in the country will complain that a 30-C.P. lamp is insufficient when in town. Excess of light in the town compels the same fault to be perpetrated in the home, and for this reason the hall and corridors should never be illuminated to a higher degree than the rooms. The effect would be to render the remainder of the lights insufficient by contrast. I have known a number of cases where the illumination of the house generally was considered satisfactory until a metal-filament lamp had been fixed in the hall, doubling the original candle-power and causing dissatisfaction with the rest of the lighting (which until then was considered ample). It is, therefore, important that in no case should any excess of light be provided in the less important positions in the house, such as the corridors, &c

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Combination Electric Fan.

DURING the hot weather most contractors are faced with the unpleasant necessity of stocking several patterns of electric fans, the demand covering "porthole" fans, ceiling fans, table fans, fans to fix on walls, &c.

The new "Union Interchangeable" fan motor has been specially designed by the UNION ELECTRIC CO., LTD., of Park Street, South-

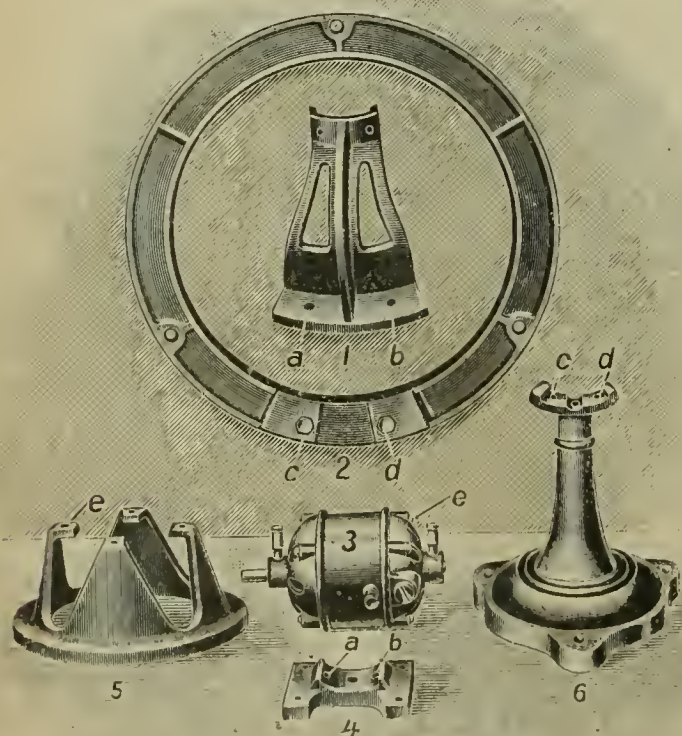


FIG. 1.—THE UNION INTERCHANGEABLE FAN PARTS—SEVEN COMBINATIONS

wark, S.E., to cope with this problem. Briefly, the scheme is as follows (fig. 1):—

The small motor (Part 3) is in itself complete as a moving agent. Mounted on the small base (4), and provided with a pulley, it becomes the familiar motor for light driving work; fixed to the pedestal (6), and fitted with blades and guard, it becomes the standard table fan; attached to the cylindrical stand (5), and provided with blades, it is converted to a vertical-spindle fan, which

may be used in its normal position as an exhaust fan, or, inverted, as a ceiling fan. It may be mounted on a bracket (1), and used with blades as a wall fan; or, by again mounting the bracket on the ring (2), it becomes the well-known "porthole" fan. It is obvious that any combination can be sold as a complete article, when it is only necessary to replace the parts thus disposed of.

The motors are made for alternating or direct current in a large range of sizes, and to run on all standard voltages; and all motors of the same output, for any speed or voltage, D.C. or A.C., are interchangeable with the fittings for that output. The design is such as to produce a motor of very small weight for output. The workmanship and finish throughout are of high quality, and the little machines operate smoothly, silently and without overheating. The windings have been specially designed to withstand climatic variations, particularly those of tropical countries.

### B.T.-H. Fan Motors.

The accompanying illustration shows the latest pattern of oscillating electric fan introduced by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby. The motor has a four-point regulating switch in the base, giving three running speeds, and the yoke is hinged to the base so that the same fan can be used either as a desk or a wall-bracket fan. The oscillating mechanism is contained in the small gear case shown on the back of the motor; the

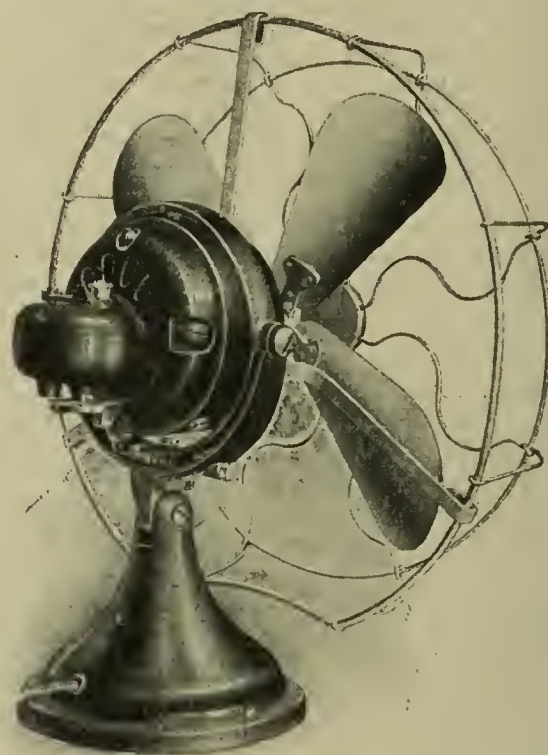


FIG. 2.—B.T.-H. OSCILLATING ELECTRIC FAN, D.C. DESK AND WALL-BRACKET TYPE.

connecting rod can be adjusted for three angles of operation, and a handle on the top of the gear case controls the mechanism, which can be put in and out of gear whilst the motor is running. The guard is strongly made, so that it can be used for handling the motor without risk of injury. The motor illustrated is for direct-current; similar A.C. sets are made, as well as a variety of other patterns, in two sizes, and are described in a list recently issued by the company.

### Household Reflector.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., are now placing



FIG. 3.—NEW HOLOPHANE SHADE.

on the market a new type of Holophane household reflector, No. S.F. 8054, which is shown in the accompanying illustration.

### Lamp Remover.

THE DAVIS ELECTRICAL CO., LTD., of 17, Moor Street, W., have introduced a simple, but effective, instrument for removing and replacing lamps otherwise inaccessible, except with the aid of a ladder. As shown in fig. 4, it consists of a set of spring fingers mounted on the end of a long cane, and provided with a pneumatic



india-rubber cushion, which, being pressed against the lamp bulb grips the latter, and enables the user to turn it in its socket so as to remove it from the holder. Similarly, a new lamp can be inserted with equal ease. The secret of success resides in the use of the rubber pad above-mentioned. To hold pendants firmly

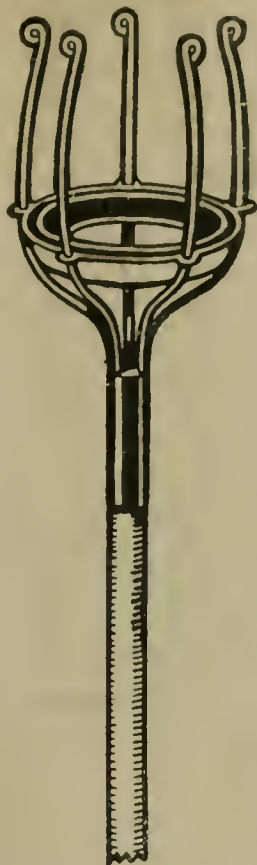


FIG. 4.—DAVIS LAMP REMOVER.

against the pressure of the lamp remover, a second cane is provided, fitted with a device for this purpose, and as we have proved, it is an easy matter with these two tools to change lamps without fear of breaking them or the filaments.

#### Theatre Dimmer.

The accompanying illustration, fig. 5, shows a bank of "Adams Igranic" metallic dimmers having three rows, each row consisting of six plates. This apparatus is suitable for use on a 105-volt 83-cycle single-phase circuit, and each row is capable of controlling 142 32-C.P. tantalum lamps. Each dimmer plate has its individual operating handle, and there is also fitted an interlocking master

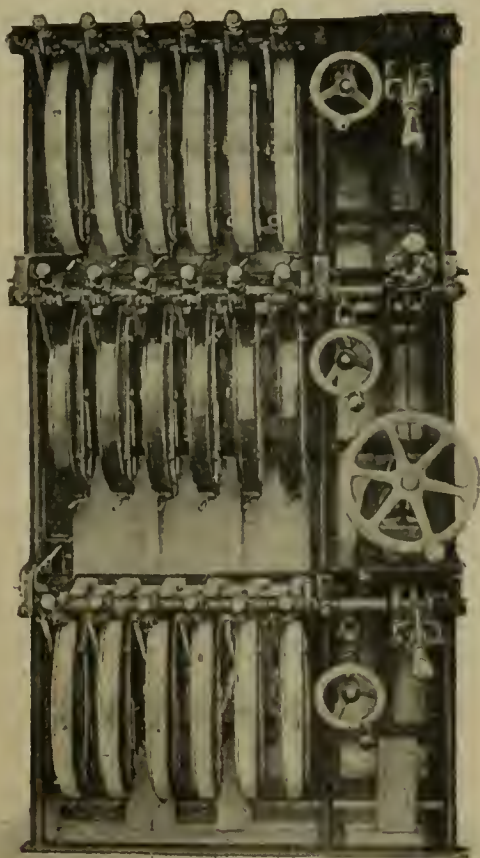


FIG. 5.—"ADAMS IGRANIC" THEATRE DIMMER.

lever to control the whole row, a handwheel also being provided for slow motion. In addition, the whole bank is controlled by one master handwheel. Each operating handle has a label indicating what circuit is controlled by it. The dimmer was made by the ADAMS MANUFACTURING CO., LTD., Bedford.

#### Henley Wiring System.

The wiring system introduced by MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., at the electrical exhibition at Olympia last year, and then described in our pages, has met with a

good reception from contractors, and has been widely adopted. A new patent fixing clip has now been brought out, of a very simple and neat design: it is illustrated in different stages of application in fig. 6. The clip is made of tinned brass, and may be fixed either with a nail or a countersunk screw. New bonding clamps and joint boxes of tinned brass have also been devised.

## LEGAL.

WEST HAM CORPORATION v. SHIELS.

LAST week, before Mr. Gillespie, Robert J. Shiels, an electrician of Upton Lane, Forest Gate, was summoned by the West Ham

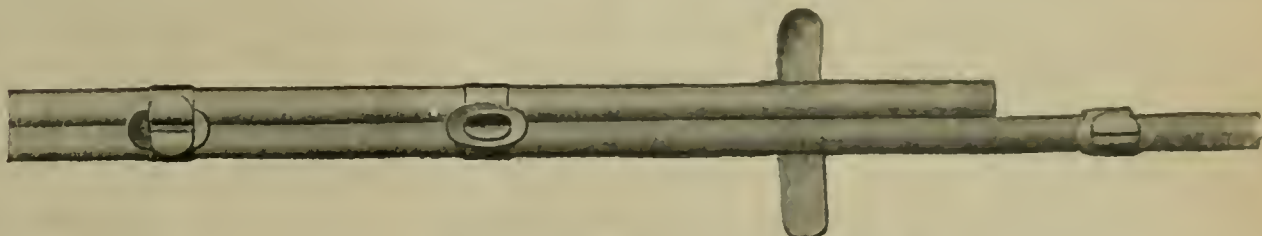


FIG. 6.—HENLEY'S "LINK" CABLE FIXING CLIP.

Corporation for connecting electric wires with those of the West Ham Electric Supply, without the consent of the Corporation.

MR. GEORGE E. HILLEARY, for the Corporation, said (according to the report in the *Morning Advertiser*) that a tradesman in Forest Gate, on April 10th, applied for the supply of electrical energy, and the defendant was named as the contractor who was to install it. The names of two references were given, but letters sent to them were not replied to, and the connection was consequently delayed. The Corporation intimated that they would supply electricity if a deposit of 10s. was paid, but the tradesman refused to pay the money, and the next day Mr. Shiels rang up on the telephone, saying that he was going to connect. He was told that he must not do so, but he did connect, and current was consumed though no meter was used.

MR. J. W. RICHARDS, for the defendant, admitted the facts. He said that the West Ham Corporation in their electrical department were a trading concern, and as such were rivals of the defendant in business; and the manner in which the Corporation acted was gradually squeezing out of business small electrical contractors. In this instance they were rival tenderers for this installation, and Mr. Shiels thought that as he had secured the contract, the Corporation were purposely withholding their consent to connect. Mr. Shiels's client had come to an end with his gas contract, and on April 16th—after a lapse of a week—he did connect with the Corporation wires; but he disconnected next morning, and the utmost value of the current used could only have been about a penny.

MR. HILLEARY stated that the defendant had on two other occasions connected in the same way, and that was really the reason for these proceedings.

MR. GILLESPIE pointed out that the defendant gave notice of what he was going to do, and in the circumstances he would only fine him 20s. and costs.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., v. HANDCOCK.

AN action and counterclaim by the Electric and Ordnance Accessories Co., Ltd., v. Handcock, were down for hearing by Mr. Justice Warrington, in the Chancery Division, on Tuesday. Counsel for the plaintiffs asked his Lordship for an order by consent upon terms agreed between the parties, giving judgment for the plaintiffs on the claim for £200, payable by 100 monthly instalments of £2 each, the first to be made on August 1st, 1912, and, in default of any instalment, the whole balance remaining unpaid to become payable forthwith; and also giving judgment for the plaintiffs on the counterclaim, each party to bear their own costs.

His LORDSHIP made the order agreed upon

SOUTH-EASTERN RAILWAY CO. AND THE SOUTH-EASTERN AND CHATHAM RAILWAY CO.'S MANAGING COMMITTEE v. THE LONDON ELECTRIC RAILWAY CO.

A MOTION in this action was down for hearing before Mr. Justice Parker in the Chancery Division on Tuesday, but counsel holding a brief for Mr. Percy Wheeler, who represented the plaintiffs, said that the parties were in negotiation, and there was every probability that minutes of an order would be signed. Under those circumstances he asked that the motion might stand over generally, with liberty to restore it on two days' notice.

His LORDSHIP assented.



## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## An Objectionable Clause.

In a specification for electric lighting which has just been issued on behalf of the Poplar Guardians, the following extraordinary clause appears, following the usual stipulations as to payment of Trade Union rates and observance of Trade Union conditions:—

“The contractor shall accept and recognise the Union in the trade affected as the sole arbitrator in any question arising under this clause.”

This clause is obviously very unfair to the contractor in view of the notorious bias of the Trade Unions, and it would be interesting to know if it is inserted with the knowledge and approval of the Local Government Board. The principle of admitting one party to a dispute, whether Trade Union, consulting engineer, or architect, to be the sole arbitrator is clearly a gross injustice, and one which you yourselves have often criticised. If, in this instance, every tenderer expressly excepts the objectionable clause from his tender, the Guardians will be obliged to drop what is, to put it mildly, an audacious attempt to extend the powers of the already too powerful Trade Unions.

Fairplay.

## A Minimum Wage for Electrical Engineers.

Reading my papers the other morning, I noticed an insertion from a Penang newspaper deploring the loss of “British prestige” in the engineering world, and attributing this to the degeneracy of the brain department more than the workmen. The word engineering, of course, covers a very wide circle, including, as it does, civil, mechanical, marine and electrical, but from the latter's point of view the article was more than right, and the fact should be studied seriously by those in authority.

Surely the powers that be are aware of the gigantic future before electrical engineering, and recognise the necessity of encouraging and keeping brains in this trade, to meet the demand and incidentally to cope successfully with the foreign competition which, even at the present day, is swamping our markets.

Having noticed the evil, it behoves us to discover its cause, and if possible apply a remedy. The object of this letter is to point out one cause which is apparent to all those who take the trouble to think. In a recent issue of the ELECTRICAL REVIEW was an advertisement inquiring for an improver, with technical training, who would give his services for 12s. per week. This means that a young fellow who has just finished his apprenticeship, for which he probably paid £200 to £300, and one who has spent his evenings studiously at a technical school, is of less worth to the community than a crossing-sweeper or a dustman.

The matter is (if I may use the expression) cynically humorous, but it is the state of affairs that greets the unfortunate apprentice on completion of his time.

How many cases are there of smart young electricians who, finding it an impossibility to get a situation at an adequate—and I might add living—wage, have thrown up their profession and embraced another, automobile engineering, for instance? I personally know of three, one of whom patented a very useful invention while serving his time, and there, you see, is a case of brains of proved worth being lost to a trade in England whose very existence depends upon her keeping up with the steady improvement of other nations.

My own experience will show precisely how matters are at the present day. I put in for an increase of salary, but the managing director of my firm politely told me he could get a bachelor of science for £3 a week, and that it was Mr. X (a commercial traveller with a large connection) who was worth his money to the firm. Yes, quite so; but, with all respect to Mr. X and his undoubted powers of oration, where would he be if he had nothing of worth to talk about? All the speeches in the world would not sell a dynamo made by a firm

with a reputation for indifferent design, and that is exactly the comparison that will shortly exist between Great Britain and foreign countries, simply because men with brains are forsaking the profession every day because it is not made worth their while to stay, and I wish I could live long enough to see the happy position of the “board of directors” who are responsible for the decline of British electrical engineering.

Having decided that the cause is due to the inadequate wage, and the opinion evidently held in some quarters that the electrical profession is taken up more as a hobby than a means of livelihood, I must speak about a remedy; but here a gigantic reform is necessary, and could be dealt with much better by wiser heads than mine, though one point seems obvious, that is, the Government should pass a minimum wage bill which would not only encourage those in the trade, but would enable the poorer man to work on a level with his more fortunate competitor who does not depend on his profession as a means of livelihood.

The Government ought to recognise that electrical machinery is rapidly replacing other kinds, and will, it does now in fact, command a great share in the world's imports and exports, and by allowing foreigners to forge ahead, we are injuring our shipping, and incidentally lots of other trades which have to do with electrical engineering.

P. Booker, Stud.I.E.E.

Richmond, May 29th, 1912.

## The Engineer and the Clerk.

Referring to your recent article on “The Engineer and the Clerk,” as a member of the clerical staff, and in a responsible position of a large supply undertaking, the question of subordination need not be considered in the least, each department being equally necessary to the welfare of the concern, and I can assure Mr. Goody that the duties are not only “the subsidiary and somewhat menial one of keeping records of work done and money spent,” there also being, besides “sticking on of stamps and copying letters,” the rather important one of money received, upon which the salaries of the engineers, and also the clerical staff, depend; and, again, the satisfying of consumers when making complaints—a very necessary adjunct to the welfare of an undertaking—usually depends upon the tact of the members of the office.

Referring to the pitifully small salaries received by clerks, Mr. Goody would do well to refer to the vacancies' list published in your paper weekly. Charge engineers at £80 per annum, rising to £100 per annum, and shift engineers at 30s. per week, &c. How munificent! At the same time, it would be interesting to know how many engineers are kept in comfortable positions by trading on the superior knowledge of their subordinates, getting this mere pittance. I can tell him of some. It might also interest him to know that there are many clerks whose education has cost more, whose wit and skill is keener, and are equally as, if not more, intellectual than the skilled (?) mechanic, but, owing to force of circumstances, have been compelled to earn their living at an early age.

The explanation of the junior clerk being referred to as “Mr. So-and-so,” and the meter superintendent as “So-and-so,” is the regrettable fact that many engineers, although they may be well educated, lack the ordinary manners and civility of everyday life.

A clerk is appointed to a position with the idea of his learning the entire business from a management point of view, and throwing his whole energies into its welfare, perhaps for the rest of his life; the engineer, on the other hand, is a migratory sort of bird and is frequently on the move, showing that his own interests are more to him than those of his employer, and the sooner the engineers and clerks realise that it is their duty to interest themselves in the commercial and engineering sides of their business, the sooner shall we arrive at “Utopia,” but so long as this agitative form of class hatred is taken up, which is so derogatory, so long will it be detrimental to the furtherance of the use of electricity.

In thanking Mr. Goody for this opportunity of expressing myself, I should like to point out that either as engineers,



clerks or labourers, we are only spokes of the same wheel, and if my employers again require technical services from me, as they have done in the past, I am prepared to undertake them, no matter whether I am called "Mr." or "Bill."

P. H.

RATING OF CABLES.

By J. WAGNER.

THE I.E.E. wiring rules of April, 1911, contained new ratings for V.I.R. and paper-insulated cables, based upon tests carried out in the National Physical Laboratory. The report rendered by Messrs. S. M. Melsom and H. C. Booth before the Institution of Electrical Engineers (see *Journal* I.E.E., May 21st, 1911) forms a very fruitful source for further investigation, and will be highly appreciated by all those interested in the question. It has already been pointed out, however, that the conditions of laying cables in practice differ somewhat from those under test, and no notice was taken of these differences in framing the new rules.

It will, therefore, be of some interest to compare the new rules with others most extensively used on the Continent, the German rules of the V.D.E. (German Association of Electrical Engineers). Table I printed below shows the ratings according to the new I.E.E. rules side by side with the German ratings.

When comparing the German with the English ratings, it must be borne in mind that the English values are based upon different temperature rises. But it will be noted that the German rules meet the demand for more closely specified ratings to a greater extent than do the new English rules. Both are, however, still unsatisfactory.

To recognise how far they still fall short of everyday practical necessities, one need only review the different kinds of insulation in general use and the different methods of cable laying which are employed for different conditions,

both of which have great influence on the temperature rise. The different kinds of insulation in use are :—

- 1. Vulcanised india-rubber insulation, with or without armouring.
- 2. Bitumen insulation, with or without armouring.
- 3. Paper or fibre insulation, leadless, with or without armouring.
- 4. Paper or fibre insulation, lead-covered, with or without armouring.

The most common ways of laying cables are the following :—

- 1. In wood casing.
- 2. In iron conduit, on or underneath the plaster.
- 3. On insulators (cleat or cable racks) on walls, in trenches or in earthenware troughing.
- 4. In wood troughing, bitumen filled.
- 5. Laid direct in the ground 25 to 30 in. deep.

The influence that the construction and laying of a cable have on its temperature rise for a given load is certainly not to be under-estimated, and while cables rated in accordance with the new rules will be perfectly safe under normal conditions, they will sometimes rise much more than 11·1 C. or 27·7° C. respectively. The economical, as well as the technical considerations, seem to justify the attempt to define more closely the carrying capacities of cables with a predetermined temperature rise dependent upon the construction and method of laying.

As the temperature rise increases for a given cable approximately as the square of the current, it is thought sufficient for practical purposes to compile tables for a temperature rise, such as would be convenient and practical in normal cases. On these conditions the following tables have been based. Table II is for vulcanised india-rubber and bitumen-insulated cable at 15° C. temperature rise, and Table III for paper or fibre-insulated cables at 25° C. temperature rise. For tropical climates, or especially hot rooms such as boiler houses, it seems advisable to take 80 to 85 per cent. of the values quoted for V.I.R. and bitumen, and 80 to 90 per cent. of those quoted for paper cables.

The tables cover the crowding of cables in conduit up to four cables per conduit. Beyond that it will be easy to

TABLE I.

Section per core.			Maximum amperes. Continuous load.											
Description.	mm <sup>2</sup> .	Square inches.	German V.D.E.	English I.E.E.	German V.D.E. (underground).									
			V.I.R. insulation.		Paper or fibre insulation (2½ C. rise; V.D.E.)									
			Rise.											
			26° C.	11·1° C.	27·7° C.	1-Core, 700 v.	2-Core, 3,000 v.	10,000 v.	3-Core, 3,000 v.	10,000 v.	4-Core, 3,000 v.	10,000 v.	Concentric 3,000 v. Double.	Triple.
3/22	1·16	0·0018	11·8	7·2	7·2	28·4	...	...	...	...	...	...	...	...
3/21	1·55	0·0024	14·5	9·5	9·5	32	...	...	...	...	...	...	...	...
3/20	1·93	0·0030	12·0	12	12	37·5	...	...	...	...	...	...	...	...
3/19	2·4	0·0037	19·0	14·8	17·8	39·5	...	...	...	...	...	...	...	...
7/22	2·7	0·0042	21	17	17	44	...	...	...	...	...	...	...	...
3/18	3·4	0·0053	23	20	21·2	50	...	...	...	...	...	...	...	...
7/20	4·5	0·0070	27	24	28	60	46	...	40	...	37	...	...	...
7/19	5·6	0·0086	30	28	34·6	65	50	...	45	...	40	...	...	...
7/18	8·0	0·0125	37	34	50	83	62	...	57	...	50	...	...	...
7/17	11·0	0·017	47	40	65	105	75	69	69	65	62	60	76	60
7/16	14·2	0·022	67	46	75	116	85	89	75	71	69	64	85	70
7/15	18·1	0·028	79	53	86	133	98	90	88	83	79	74	95	79
19/18	22	0·034	90	59	96	150	110	100	97	92	88	83	105	88
19/16	38·7	0·060	135	83	135	225	160	150	145	135	130	125	155	130
19/14	60·6	0·094	180	113	183	290	210	195	185	175	170	155	200	170
19/0·083	64·5	0·100	190	118	191	305	220	205	195	185	180	165	210	180
37/16	75	0·117	210	130	210	340	245	230	210	200	195	180	230	195
19/13	81	0·125	230	134	219	360	260	240	220	210	210	195	250	210
37/15	97	0·150	245	152	246	390	280	260	245	230	225	210	275	225
37/14	117	0·182	275	172	275	440	310	285	275	255	245	230	300	250
37/0·083"	129	0·200	295	184	296	475	335	305	295	275	265	255	330	270
37/13	161	0·250	350	214	343	550	390	360	340	320	310	295	390	310
37/12	194	0·300	400	240	385	600	425	400	350	353	345	325	425	345
37/0·112"	225	0·350	425	264	425	635	450	...	400	...	370	...	450	370
61/13	259	0·40	480	288	464	710	500	...	450	...	410	...	500	410
61/0·097"	290	0·45	510	310	502	740	525	...	470	...	430	...	525	435
61/0·104"	322	0·50	550	332	540	800	560	...	500	...	455	...	560	465
61/0·108"	355	0·55	590	357	583	850	590	...	530	...	...	...	600	490
61/0·112"	387	0·60	615	384	624	850	610	...	550	...	...	...	620	510
61/0·118"	420	0·65	650	410	662	920	...	...	...	...	...	...	...	...
91/0·098"	450	0·70	700	434	700	960	...	...	...	...	...	...	...	...
91/0·101"	484	0·75	740	461	738	1,000	...	...	...	...	...	...	...	...
91/0·108"	515	0·8	780	488	776	1,050	...	...	...	...	...	...	...	...
91/0·112"	580	0·9	840	540	854	1,150	...	...	...	...	...	...	...	...
91/0·118"	645	1·0	900	595	932	1,225	...	...	...	...	...	...	...	...



TABLE II.—VULCANISED INDIA-RUBBER AND BITUMEN INSULATED CABLES.

Section per core.				Maximum amperes continuous load for air = 30° C.; rise, 15° C.										
Description.	mm <sup>2</sup> .	Square inches.	Wood casing or bitumen-filled troughs.	Single core up to 650 volts.				Single and multicore up to 3,000 volts.						
				Laid in conduit.				Armoured laid underground or unarmoured in air.						
				Wires per conduit.				1-Core.	2-Core.	3-Core.	4-Core.	Concentric.		
				1	2	3	4					Double.	Triple.	
3/22	1.16	.0018	7.5	8.5	8.5	8.5	8	8.5	...	...	...	...	...	...
3/21	1.55	.0024	10	11	11	11	10	11	...	...	...	...	...	...
3/20	1.93	.0030	13	14	14	14	13	14	...	...	...	...	...	...
3/19	2.4	.0037	15	16.5	16.5	16	15	17	...	...	...	...	...	...
7/22	2.7	.0042	18	18.5	18	17.5	17	19	...	...	...	...	...	...
3/18	3.4	.0053	22	22	21	20	19	22	...	...	...	...	...	...
7/20	4.5	.0070	26	26.5	26	25.5	25	26.5	22	19	16	...	...	...
7/19	5.6	.0086	30	30.5	30	29.5	29	30.5	25	21.5	18	...	...	...
7/18	8.0	.0125	37	37.5	37	36.5	36	38	32	27.5	22.5	...	...	...
7/17	11.0	.017	42	44	42	40	39	48	41	35	28.5	38	28	...
7/16	14.2	.022	47	51	47	45	42	56	48	41	34.5	46	35	...
7/15	18.1	.028	56	58	56	50	45	64	55	47	39.5	55	47	...
19/18	22.0	.034	60	67	63	60	55	71	60	51	43	60	51	...
19/16	38.7	.060	85	98	90	85	80	103	85	71	62	85	71	...
19/14	60.6	.094	113	130	120	113	110	135	105	93	83	105	90	...
19/083"	64.5	.10	118	134	125	118	112	145	111	99	88	111	95	...
37/16	75	.117	130	148	...	...	...	155	120	105	95	120	102	...
19/13	81	.125	134	157	...	...	...	165	130	112	101	130	110	...
37/15	97	.150	152	170	...	...	...	180	143	122	112	143	120	...
37/14	117	.182	172	193	...	...	...	205	160	139	128	160	135	...
37/083"	129	.20	184	208	...	...	...	220	170	150	140	170	145	...
37/13	161	.25	214	235	...	...	...	250	195	175	165	195	165	...
37/12	194	.30	240	255	...	...	...	270	215	195	175	215	185	...
37/112"	225	.35	264	283	...	...	...	300	240	210	195	240	205	...
61/13	259	.40	288	320	...	...	...	340	275	240	215	275	230	...
61/097"	290	.45	310	340	...	...	...	360	295	250	230	295	240	...
61/104"	322	.50	332	365	...	...	...	390	310	275	250	310	265	...
61/108"	355	.55	357	400	...	...	...	425	340	300	...	340	290	...
61/112"	387	.60	384	440	...	...	...	465	375	325	...	375	310	...
61/118"	420	.65	410	470	...	...	...	500	...	...	...	...	...	...
91/098"	450	.70	434	505	...	...	...	535	...	...	...	...	...	...
91/101"	484	.75	461	540	...	...	...	570	...	...	...	...	...	...
91/108"	515	.80	488	570	...	...	...	605	...	...	...	...	...	...
91/112"	580	.90	540	635	...	...	...	675	...	...	...	...	...	...
91/118"	645	1.00	595	710	...	...	...	750	...	...	...	...	...	...

TABLE III.—PAPER-INSULATED LEADLESS AND LEAD-COVERED CABLES.

Section per core.			Maximum amperes continuous load for air = 30° C.; rise, 25° C.															
Description.	mm. <sup>2</sup>	Square inches.	Paper insulated, lead covered, and armoured, laid underground in trenches from 25 in. to 39 in. deep.								Leadless armoured and paper lead covered.				Underground or on insulators or in troughing.			
			Up to 3,000 volts.						From 3,000—10,000 volts.				Up to 3,000 volts.					
			Number of cores.				Concentric.		Number of cores.				Number of cores.				Concentric.	
			1	2	3	4	2	3	1	2	3	4	1	2	3	4	2	3
7/20	4.5	.0070	53	46	40	37	...	...	...	...	...	...	36	30	26	24	...	...
7/19	5.6	.0086	58	50	45	40	...	...	...	...	...	...	45	37	33	30	...	...
7/18	8.0	.0125	72	62	57	50	...	...	...	...	...	...	55	47	43	39	...	...
7/17	11.0	.0170	86	75	69	62	76	60	80	69	65	60	65	57	52	47	57	47
7/16	14.2	.022	98	85	75	69	85	70	92	80	71	64	75	65	57	52	65	52
7/15	18.1	.028	112	98	88	79	95	79	104	90	83	74	90	78	70	63	78	63
19/18	22.0	.034	125	110	97	88	105	88	115	100	92	83	100	86	76	69	86	69
19/16	38.7	.060	185	160	145	130	155	130	175	150	135	125	140	122	110	100	122	100
19/14	60.6	.094	243	210	185	170	200	170	225	195	175	155	185	160	140	125	160	125
19/083"	64.5	.10	255	220	195	178	210	178	237	205	183	162	195	168	145	130	168	130
37/16	75	.117	290	245	210	195	230	195	270	230	200	180	215	183	155	140	183	140
19/13	81	.125	365	260	220	210	250	210	285	240	210	195	230	195	165	150	195	150
37/15	97	.150	330	280	245	225	275	225	310	260	230	210	260	220	190	170	220	170
37/14	117	.182	365	310	275	245	300	245	340	285	255	230	300	255	225	205	255	205
37/083"	129	.20	400	335	295	265	330	265	370	305	275	255	315	265	235	215	265	215
37/13	161	.25	460	390	340	310	390	310	430	360	320	295	365	310	270	240	310	240
37/12	194	.30	500	425	380	345	425	345	470	400	355	325	400	310	305	275	340	275
37/112"	225	.35	530	450	400	370	450	370	...	...	...	...	450	380	338	300	380	300
61/13	259	.40	585	500	450	410	500	410	...	...	...	...	500	425	380	340	425	340
61/097"	290	.45	615	525	470	430	525	435	...	...	...	...	540	460	410	370	460	370
61/101"	322	.50	660	560	500	455	560	465	...	...	...	...	578	490	435	395	490	395
61/108"	355	.55	700	590	530	...	600	490	...	...	...	...	615	520	460	...	520	420
61/112"	387	.60	720	610	550	...	620	510	...	...	...	...	650	560	490	...	560	450
61/118"	420	.65	760	...	...	...	...	...	...	...	...	...	685	...	...	...	...	...
91/098"	450	.70	800	...	...	...	...	...	...	...	...	...	720	...	...	...	...	...
91/101"	484	.75	840	...	...	...	...	...	...	...	...	...	755	...	...	...	...	...
91/108"	515	.80	880	...	...	...	...	...	...	...	...	...	790	...	...	...	...	...
91/112"	580	.90	960	...	...	...	...	...	...	...	...	...	860	...	...	...	...	...
91/118"	645	1.00	1,040	...	...	...	...	...	...	...	...	...	935	...	...	...	...	...

derive reliable figures by comparison. Cables in wood casing, when carried in separate grooves, may be considered as single. Cables crowded in trenches or on cable racks in troughs, may be rated by the following rule of thumb:—Let  $n$  = number of cables;  $q$  = section of each core. Then the current carried by one of these cables would have a value corresponding to a section—

$$q \sqrt{n}, \text{ divided by } \sqrt{n}.$$

As an example, consider six 0.1-sq. in. three-core V.I.R. cables mounted on cleats. Then the section will be—  
 $0.1 \sqrt{6} = 0.245.$

From Table II it will be seen that the current corresponding to this section (0.245) is 172 amperes. The



current each cable will carry must therefore be  $172/\sqrt{6} = 70$ , while it will be seen from the same table that one three-core cable of 0.1 sq. in. will carry, with the same temperature rise, 99 amperes. If three cables were laid instead of six, the carrying capacity would be found in the same way to be 76 amperes.

This rule of thumb takes more into account the section of cables to be dealt with than does the German rule, which states that "if more than two cables are in one trench, the rating should be reduced to 75 per cent. of those tabulated in Table I." Examples calculated by the above rule of thumb show that the reduction in carrying capacity is much greater for a number of heavy section cables than for the same number of light section cables crowded together, and these results agree with those found in actual practice.

BUSINESS NOTES.

**Book Notices.**—*Lektrik Lighting Connections.* By W. Perren Maycock. London: A. P. Lundberg & Sons. Price 6d.—This is a booklet briefly describing the numerous methods of switching which have been worked out by the publishers in connection with their well-known manufactures. The author lays stress on the practical importance of the subject and the great advantages to be derived from the intelligent arrangement of switch circuits, and besides explaining nearly 70 methods of switching, some of which have not previously been published, he includes some useful notes on illumination and switching in general. The book should be very useful to contractors, wiremen and others interested in the installation of electric light.

"*Proceedings of the American Institute of Electrical Engineers.*" Vol. XXXI, No. 5. May, 1912. New York: The Institute. Price \$1.

"*Journal of the Western Society of Engineers.*" Vol. XVII, No. 3. March, 1912. Chicago: The Society. Price 50 cents.

"*The College Quarterly.*" No. 9. March, 1912. Melbourne: The Working Men's College. Price 6d.

"*Royal Commission on Mines Report, New Zealand.*" 1912. Wellington: Government Printer.

"*Methods of Analysing Coal and Coke.*" By F. M. Stanton and A. C. Fielder. "The Use of Mice and Birds for Detecting Carbon Monoxide after Mine Fires and Explosions." By G. A. Burrell. "Liquefied Products from Natural Gas." By I. C. Allen and G. A. Burrell. "Alaskan Coal Problems." By W. L. Fisher. "The Use of Permissible Explosives." By J. J. Rutledge and C. Hall. "Steaming Tests of Coals and Related Investigations." By L. P. Breckenridge, H. Kneisinger and W. T. Ray. 1912. Washington: Government Printing Office.

"*Railway Ready Reckoner.*" By Charles L. Harbert. 1912. Edinburgh: The Scottish Railway Traders' Association, Ltd. Price 2s. 6d. net.

"*Fuel Economy.*" By W. H. Booth. London: S. Rentell & Co. Price 1s. net.

*Quarterly Bulletin and Annuary of the American Institute of Architects.* January, 1912. Washington: The Octagon.

"*L'Electricité à l'Exposition de Bruxelles de 1910.*" By J. A. Montpellier. 1912. Paris: Dunod & Pinat. Price 15 fr.

"*Science Abstracts.*" Vol. XV, Part 5. May 25th, 1912. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

We have received from the *Australian Mining Standard and Electrical Record* of Sydney and Melbourne a copy of the new edition of their classified Directory of firms supplying mining, electrical and industrial machinery, and everything for the mine.

**Electric Clocks.**—THE SILENT ELECTRIC CLOCK CO., of Goswell Road, E.C., have secured the order for the turret clock to be erected on the Hovis Co.'s new buildings. This clock will have four dials, each 9 ft. 6 in. diameter, and will be automatically synchronised to Greenwich mean time. Other orders placed with the Silent Co. are for clocks for post office use in Newfoundland and New Zealand, and for Government Buildings in Canada and in this country.

**Private Meeting.**—S. BOTTONE & SON, LTD., electrical engineers, Manor Road, Wallington, Surrey.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on May 29th, at the offices of Mr. H. A. G. Lewis, Temple Chambers, Temple Avenue, E.C., the liquidator of the company. According to the statement presented by Mr. Lewis, the liabilities to unsecured creditors amounted to £186. As a going concern the assets were estimated to realise £192, from which had to be deducted £11 for preferential claims. Just prior to the liquidation, certain machinery was removed from the premises, but it was stated that the machinery belonged to a relative of one of the directors, and had been let to the company for a small sum weekly. Proceedings were instituted against the company, and to prevent an execution being levied upon the machinery in question it was removed. The company was regis-

tered in October, 1910, with a capital of £2,000, divided into shares of the face value of £1 each. The company was formed to take over a business carried on by Mr. A. Bottone. The purchase price paid by the company was £364, of which £314 was discharged by the issue of fully-paid shares, and the balance of £50 was paid in cash. No resolutions were passed, and the voluntary liquidation of the company will, therefore, be continued by Mr. Lewis. The latter explained that he had authorised a sale of the stock in trade and plant by auction.

**Dissolutions and Liquidations.**—DAVIS ELECTRICAL CO., LTD.—It is announced in the *London Gazette* that, by an order made by the High Court on May 14th, the following were appointed a Committee of Inspection to act with the Official Receiver as liquidator of this company:—Mr. J. W. Rook (Sloan Electrical Co., Ltd.), Mr. S. F. Pangbourne (Siemens Bros. Dynamo Works, Ltd.), Mr. Otto Loewi (Electrical Co., Ltd.), Mr. Gordon Low (James McDougall, Ltd.), and Mr. F. H. Nalder (Nalder Bros. & Thompson, Ltd.).

THE ELECTRIC CONVERSION SYNDICATE, LTD.—A meeting is called for July 5th to hear an account of the winding up from the liquidator, Mr. F. S. Salaman.

THE SUNBEAM LAMP CO., LTD., Newcastle-on-Tyne.—In another part of this issue we report the meeting of creditors of this company. The following are creditors:—

Elliott Bros. .. ..	£115	Newcastle Water Co. .. ..	£21
Cranmer & Cheshire .. ..	63	Newcastle Gas Co. .. ..	175
British Oxygen Co. .. ..	23	North-Eastern Railway Co. .. ..	39
Bastian Elec. Heating Synd. .. ..	30	Planchon Co. .. ..	381
British Traders' Association .. ..	60	Redheugh Colliery Co. .. ..	182
Bainville, A. .. ..	75	Pearson & Co. .. ..	32
Angus & Co. .. ..	39	Weightman & Co. .. ..	26
Electrical Review .. ..	26	Reyrolle, Ltd. .. ..	24
Finlay & Co. .. ..	39	Satchwell & Co. .. ..	113
Cookson & Co. .. ..	98	Robinson & Co. .. ..	28
Beall & Co. .. ..	24	Plutte & Co. .. ..	113
Berry, Skinner & Co. .. ..	56	Tucker, J. H., & Co. .. ..	141
Charles Joyner & Co., Ltd. .. ..	29	Vilright Works, Ltd. .. ..	287
Clayton & Walsh .. ..	30	Sterling Telephone Co. .. ..	140
Griffiths Bros. .. ..	32	Wandsworth Elec. Mfg. Co. .. ..	150
Hollefreyne & Co. .. ..	53	Watson, Burton & Corder .. ..	78
Credenda Co. .. ..	140	Hope & Sugden .. ..	133
Engineering Arc Lamp Co. .. ..	66	Westinghouse Metal-Filament Lamp Co., Ltd. (Vienna) .. ..	176
Doig Bros. .. ..	77	Ward & Goldstone .. ..	292
County of Durham Elec. Co. .. ..	262	Walsall Hardware Mfg. Co. .. ..	25
Grevener & Co., Ltd. .. ..	444	Marsh & Son .. ..	41
Cable Accessories Co. .. ..	32	Turner & Parser .. ..	65
Armorduct Co. .. ..	503	Sutter & Co. .. ..	46
Beecroft & Wightman .. ..	95	Blake Manure & Chemical Co. .. ..	1,526
Ingledeu & Sons .. ..	64	Merz, C. H. .. ..	493
Behrens, Ltd. .. ..	47	Kuhelmann & Co. .. ..	611
Gregory Bros. .. ..	27	Westinghouse Metal Lamp Co. (Royalty) .. ..	357
Armstrong, — .. ..	27		
Marshall & Son .. ..	69		

**German Lamp Imports and Exports.**—The imports to, and exports from, Germany of incandescent electric lamps during the past five years have been as follows:—

	Import value. Marks.	Export value. Marks.
1907 .. ..	1,063,000	10,478,000
1908 .. ..	1,081,000	20,082,000
1909 .. ..	1,696,000	36,414,000
1910 .. ..	1,110,000	49,520,000
1911 .. ..	1,310,000	47,758,000

The countries which buy most lamps from Germany are the United Kingdom, Russia, Italy, France, Austria-Hungary and the Argentine, but unfortunately, although the weights figures of last year's export can be given, the official value figures are not yet obtainable. With this exception a comparison of the last three years gives the following table:—

	1911. Weight in double centners.	1910. Weight in double centners.	Value in marks.	1909. Weight in double centners.	Value in marks.
United Kingdom	3 192	5,596	13,989,000	4,418	9,786,000
Russia .. ..	2,579	2,133	5,332,000	1,990	4,378,000
Italy .. ..	1,499	1,177	2,942,000	740	1,628,000
France .. ..	1,372	1,543	3,857,000	1,488	3,274,000
Austria-Hungary	1,148	1,348	3,362,000	1,152	2,535,000
Argentine .. ..	761	1,168	2,919,000	658	1,448,000

**Canadian Agency.**—A Canadian correspondent who has for 12 years held a position as chief electrician to an undertaking in Canada (near Montreal) is willing to take up an agency for alternating-current machinery and for wires. British or other manufacturers interested are invited to write Coteau du Lac, c/o ELECTRICAL REVIEW offices.

**The Electric Supply Publicity Committee.**—The permanent offices of this Committee are now 20A, Tudor Street, Ludgate Circus, E.C.

**Sale by Auction.**—At Newcastle-on-Tyne on May 31st by order of the Receiver for the debenture-holders, Messrs. Wheatley Kirk, Price & Co., offered for sale by auction the extensive engineering works of Ernest Scott & Mountain, Ltd., at Gateshead-on-Tyne, as a going concern. Mr. H. Sherley-Price said the site was freehold, covering 6½ acres, and the shops were level and served by railway sidings. The business was modern in design and equipment. The turnover had reached £100,000 a year, and even under the operations of the Receiver, who had not been prepared to take important contracts, it had been £20,000 a year. The property stood on the books of the firm at £120,000. Bidding commenced at £25,000, and advanced to £39,000, when the concern was withdrawn.



**Church and Hotel Lighting.**—The whole of the lamps and fittings for the lighting of the interior of St. James' Church, Streatham, which has recently been consecrated, were supplied by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., and the contractors responsible for the actual work were MESSRS. DENNIS, ADAMS & Co., London, W. The church is illuminated with tantalum drawn-wire lamps, and the fittings were especially designed by Messrs. Siemens for the installation. Among recent hotel installations carried out by Messrs. Siemens is that at the Portman Hotel, where "Wotan" pure-drawn tungsten wire lamps are used throughout.

**Bankruptcy Proceedings.**—A. F. MANDER, electrical engineer, 258, Lozells Street, Aston, Birmingham.—Application for debtor's discharge is to be heard at Birmingham on June 20th.

CHARLES HENRY STEEL, electrical engineer, 1, Nelson Square, Bradford (late 53, Queen Street, Cardiff, and 65, High Street, Merthyr Tydfil).—The first meeting of creditors herein was held on May 30th at 117, St. Mary Street, Cardiff. The liabilities were estimated at £313, and there was an estimated deficiency of £172. It transpired that the debtor commenced trading in August, 1910, with £10 capital. He obtained the contracting work for exhibitions, on which he lost money. The debtor alleged that his failure was due to bad debts and losses on contracts. The Official Receiver remains trustee.

E. J. CROSIER (Crosier, Stephens & Co.), engineer and merchant, Newcastle-upon-Tyne.—The last day for receiving proofs for intended dividend is June 24th. Trustee: Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

**For Sale.**—The Postmaster-General has for sale a quantity of electrical plant and machinery at the Birmingham G.P.O. See our advertisement pages to-day.

**Catalogues and Lists.**—THE BRITISH PROMETHEUS CO., LTD., Salop Street Works, Birmingham.—Illustrated price cards relating to liquid heaters, electric irons and electric kettles respectively.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, London, E.C.—New list (No. 69) of 20 pages, giving full information and prices relating to the Henley wiring system, concentric and twin, and its various details, together with instructions for its installation. The accessories that are illustrated and priced include the "H.W.S." fitting, bonding clamps, wood blocks, the "Link" cable fixing clip, saddles, protective covering, joint and tee boxes, distribution fuse-boards, transformers, and portable drums. The present list has been issued owing to the development of the system. Many additional sizes of cables are now listed, including a neat three-core cable of flat section, which will be useful in many instances. Copies of the list will be sent to any member of the trade not already supplied. Messrs. Henley's do no wiring work under any circumstances.

THE GENERAL ELECTRIC CO., LTD., inform us that they have organised a very extensive advertising campaign for popularising their well-known "Freezor" fans. One of the features of the campaign is the issue of two attractive advertisement folders, the covers of which are artistically printed in colours, whilst the contents set forth the various "Freezor" merits. These folders are for circularising direct to consumers, and the company are prepared to supply liberal quantities of same to the trade, specially printed with dealer's name and address.

MESSRS. SIMPLEX CONDUITS, LTD., London and Birmingham.—Abbreviated pocket fan list of eight pages, containing some revised prices, but not entirely superseding the 1910 general fan catalogue. Standard desk type fans, bracket type, porthole with propeller blades, are listed and shown, also the "Simplex" small motors from  $\frac{1}{16}$  to  $\frac{1}{2}$  H.P., sewing-machine motors, and starters for fans and small motors. The firm has introduced a new pattern low-priced 8-in. fan, consuming only 15 watts, which has bronze copper blades and a green painted body.

MESSRS. J. H. HEATHMAN & Co., Parsons Green, Fulham, London, S.W.—Leaflets relating to "Itiliti" folding platform steps and telescopic folding scaffold trestles.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, London, E.—Owing to alteration in the price of raw materials, the company has issued a 16-page revised price list (No. 27) relating to gutta-percha, india-rubber, silk and cotton-covered wires; also jointing tools and materials.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—12-page illustrated pamphlet (No. 15), containing a full technical description of their polyphase motors (pattern HD), with endshield bearings.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Two illustrated leaflets relating respectively to aluminium overhead conductors, and to aluminium for rolling stock construction. The former shows the trunk lines (four circuits) of aluminium standard conductors crossing the Dundas Valley Ontario. These conductors are used on the whole 280 miles of the newly-erected lines of the Hydro-Electric Power Commission of Ontario.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, E.C.—New price list of British-made "Gem" lamps, giving a variety of information re standard packages, economy effected, as compared with ordinary carbon lamps, technical data, &c.

THE RECORD ELECTRICAL CO., LTD., Caxton House, Westminster, S.W.—Several illustrated and priced leaflets describing their automatic battery cut-in and cut-outs, and S.P. and D.P. overload circuit breakers.

THE WILSON-WOLF ENGINEERING CO., LTD., Thornton Road, Bradford.—Pocket price list of D.C. fans for the 1912 season. Arctic propeller type fans are priced, also speed regulators, spare parts, &c. Copies of the card can be obtained with or without the firm's name, on application.

THE ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT, FOREIGN DEPARTMENT.—Pamphlets relating to electric crucible furnaces for laboratories and works, limiting device for electric brakes, and new overhead line materials. The A.E.G. Electrical Co., of South Africa, Ltd., Caxton House, S.W., have sent us a brochure (in English) giving very full illustrated information relating to the A.E.G. drawn-wire lamp; also a 40-page price list of three-phase, two-phase, and single-phase induction motors of from 7.5 to 100 H.P.

**Trade Announcements.**—MESSRS. SIMPLEX CONDUITS, LTD., announce that their telephone number "Central 15138" has been changed over to "City 6149," and the telephone numbers for the London Sales Department are now "City 6149 and 1875" and "Central 8101."

MR. H. FEATHERSTONE, electrical engineer and contractor, has opened premises at 41, Little Mount Sion, Tunbridge Wells.

MR. GEO. FISHER, electrical engineer, has opened new offices and showrooms at 23, St. Leonards Road, Bexhill-on-Sea.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., announce that, owing to increased business in electric lamps and supplies, they have taken premises to accommodate larger stocks of "Auriga" metal-filament lamps, electrical accessories and fittings, at 179, Wardour Street (off Oxford Street), London, W., where all communications in connection with their London supply business should henceforth be addressed.

THE FOSTER ENGINEERING CO., LTD., of Wimbledon, announce that they have secured the whole of the stock, patterns, &c., of the Beck Flame Lamp Co., Ltd., of Hayes, Middlesex, and that they possess the sole right to manufacture and sell "Beck" lamps, &c. Their works are fully equipped for carrying on the manufacture and further development of these lamps. They will keep a large stock of finished lamps, spare parts, and carbons.

The *Australian Mining Standard* states that the WESTERN ELECTRIC CO. (AUSTRALIA), LTD., has been registered in Sydney, with a capital of £20,000, in £5 shares, to acquire the Australian business of the London company of the same name. The directors are A. Williams and J. Clarke.

## LIGHTING and POWER NOTES.

**Argentina.**—The electric light station at San Andrés de Giles is now finished. A trial run has taken place, with satisfactory results. Public lighting consists of 40 8-ampere arc lamps.

Work has commenced on the electric light station at Coronel Vidal (Province of Buenos Ayres). The concessionaire is Sr. F. Mora.—*Review of the River Plate*.

**Baildon.**—The U.D.C. has decided to apply for a prov. order for electricity supply.

**Barrow.**—The Mayor in submitting the annual report on the electricity department, recently, said that the gross profit showed an increase of £1,110, and the net profit £967. The total gross profit was £9,138, against £8,028, and the net profit £1,673, against £706. The units sold had increased from 1,249,163 to 1,404,322, which was equal to 12½ per cent., whilst the cost of units sold was reduced from 1'231d. to 1'143d. There had been a steady improvement in the last few years, which was very satisfactory, but, as he told them 12 months before, they could not expect to reduce the costs very much until they had a larger consumption of electricity. They had reduced the costs last year, but for the coming year they would probably have to pay more for coal, &c. In 1907 there was a loss of £791; in 1908 a loss of £383; in 1909 a profit of £249; in 1910 a profit of £706, and this was increased to £1,673. The profit would be placed to the reserve fund.

**Brazil.**—A new electric power company in San Paulo is the "Empresa Luz e Força Meridional Paulista," formed to supply light and power to the towns of Faxina and Capao Bonito. The president of the company is Dr. Marcio Pereira Munhoz, and the vice-president is Victor Nothmann, jun.

**Bridlington.**—The electrical engineer to the Corporation has reported that there was a net profit on the year's working of £1,376, an increase of £369 on the previous year.

The T.C. has decided to supply current for heating and cooking at 2d. per unit for 200 units per quarter, and 1d. per unit beyond.

The L.G.B. has sanctioned a loan of £1,500 for the extension of the condenser plant at the electricity works.

**Brighouse.**—A L.G.B. inquiry was held last week into the Corporation's application for sanction to the borrowing of £3,000 for electricity purposes.

**Canada.**—According to the *Financier*, consideration is being given to a scheme of co-operation between the Governments of Alberta and Saskatchewan, and the Canadian Pacific, Canadian Northern and Grand Trunk Pacific Railway Companies, with a view



to the supply of an adequate water and hydro-electric power service to towns in the two provinces. The project involves the diversion of the south arm of the Saskatchewan River, and it is expected that the cost will reach close on £1,000,000.

**Christchurch.**—The B. of G. has decided to have the workhouse lighted by electricity, and a supply of current will be taken from the Bournemouth and Poole Electricity Supply Co. on the following terms:—For the new infirmary, 4d. per unit, reduced to 3½d. when the whole of the workhouse premises are lighted; power and heating, 1½d. per unit. Mr. Thos. J. Digby, of London, has been appointed as consulting engineer for drafting and issuing the specification and for supervising the work, at 5 per cent. on the total cost, and out-of-pocket travelling expenses.

**Continental Notes.**—**GERMANY.**—It is intended to enclose the Bürgermoor, in the north of the Osnabrück district, with the view of industrially utilising the turf for generating electricity, and the running of a power house to be built there. A section of the moor will also be set apart for experiments in the economic cultivation of turf.—*Zeit. für Elek. u. Masch.*

**SPAIN.**—For its sub-station lately erected in the Calle del Amparo at Madrid, the Co-operativa Electrica obtained from German works three groups of converters, of 1,000 H.P. each. The company has now acquired another site for a sub-station, in the Calle de Hermosilla, orders for the machinery equipment of which are about to be placed.—*Electron.*

**HOLLAND.**—It is proposed to erect an electric power station at Bergen-op-Zoom, North Brabant.

**FRANCE.**—La Société Hydro-Electrique has submitted a scheme to the municipal authorities of Bayonne (Basses Pyrenees) for the electric lighting of the town.

La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont, has an order in hand for 16 large electric cranes for the harbour authorities of Bordeaux.

The City of Meaux and the neighbouring districts are about to be adequately supplied with electricity, two companies being concerned in the matter. The Compagnie Générale d'Electricité is about to start working its new station in the city itself. On the other hand, the Société Omnium Français is actively engaged in constructing its Eastern Meaux system, with a view to supplying a number of communes.—*Revue pratique de l'Electricité.*

A Government inquiry is being held into the application of an electric company at Grenoble for an 80 years' lease of a feeder of the River Arc, with a view to the erection of a power station for the supply of electric current to the city of Grenoble, and the neighbouring townships of Bramans and Verney. The company also intends to use water from Lake Noir on the French side of Mont Cenis.—*Revue pratique de l'Electricité.*

**Cornwall.**—Both the St. Just U.D.C. and the West Penwith R.D.C. have granted permission for the Cornwall Electric Power Supply Co. to use overhead lines in the districts for the transmission of current.

**Darwen.**—Following successful negotiations with the Darwen Manufacturing Co. and Messrs. Harwood Bros. for electric power supply, an application has been received by the Corporation from Mr. Robert Entwistle for the supply of electricity for the same purpose to Norfolk Street Mill, and terms are being negotiated.

**Derby.**—The Electric Lighting Committee of the T.C. has recommended application for a prov. order extending the area for the supply of current, so as to include the parishes of Kedleston, Quarndon, Duffield, Allestree, Little Eaton, Spondon, Chellaston, and Mickleover.

**Dundee.**—The accounts of the Electricity Department, just issued, show that the net revenue from the sale of current for the past year amounted to £49,359, and from rents and feu duties to £7; after meeting working expenditure, the balance was applied as follows: Interest, £8,267; expense of loans, £353; property and income-tax, £211; sinking fund, £7,438; appropriation account, £10,338. The total units sold showed an increase of 620,731 on the total for the preceding year. The total estimated revenue for the current year is £48,707.

**Eastbourne.**—The Electricity Committee has deferred the consideration of a report by the electrical engineer as to the provision of new plant, and has given him instructions to inspect Diesel engines in use at other works, and submit a further report.

**Exeter.**—The annual report of the electrical engineer (Mr. H. D. Munro) shows a considerable advance in output during the year. The units sold totalled 1,479,696, an increase of 71,696 as compared with the previous 12 months. The number of consumers increased from 1,475 to 1,614; the motors from 148 to 175, an increase of 27, the total H.P. connected being now nearly 600. The reduction of the price for lighting, which came into force at the beginning of the year, affected the receipts by about £1,000, and the lower rate for traction by £65, but the increased output, especially for power supply, counteracted more than half this reduction. The reserve fund attained to nearly the statutory maximum of 10 per cent. on the whole of the capital expenditure of £111,000. Against the latter sinking fund amounting to nearly £40,000 has already been provided. The total receipts were £18,382, and the working expenses £9,999, which left a gross profit of £8,383.

**Farnham.**—A supply of current was available at Farnham for the first time on May 30th, when the current was switched on by Mr. E. H. Hart, a director of the Gas and Electricity Co., Ltd.

**Farnworth.**—The L.G.B. has granted the D.C. permission to borrow further sums for the electricity and destructor works.

**Halifax.**—A loan of £5,000 for prospective expenditure on new mains has been applied for by the T.C.

**Hastings.**—The annual report of the Corporation electricity department for the year ended March 31st last shows that the undertaking has now turned the corner. During the past year the sale of current realised £14,567, and in addition public lighting realised £5,311, making a total of £19,819. The total expenditure amounted to £9,491, and the gross profit carried to net revenue account £11,116. After allowing for interest, loans and sinking fund, &c., the net balance transferred to profit and loss appropriation account is £90. The quantity of electricity generated during the year was 1,033,055 units, and of this quantity 281,323 was sold for public lamps and 658,620 to private consumers. Thus the total quantity sold was 939,943. The total cost per unit sold works out at 2'17d.

**Haywards Heath (Sussex).**—At a meeting of the U.D.C. on Monday, a letter was read from Mr. Prior, of Burgess Hill, asking if the Council would consider or support a scheme of electric supply for the town. Several members spoke strongly in favour of the proposal, and the matter was referred to the Works Committee for consideration.

**Heywood.**—On May 31st, Mr. H. R. Hooper, of the L.G.B., held an inquiry into an application of the Corporation for power to borrow £3,000 for the electricity department. The Inspector alluded to the deficit of £2,541, and said that under the Electric Lighting Acts the deficit must be cleared up each year. The Board, he thought, would require that balance to be wiped out before any further loans were sanctioned.

**Keighley.**—The application of the Corporation for sanction to borrow £6,576 and £1,660 for electricity purposes has been the subject of an inquiry by the L.G.B. The principal items of the proposed expenditure are:—Water tower (£1,100), motor-generator (£550), water-tube boiler (£1,660), services (£1,100), and D.C. and A.C. mains (£1,500). The inquiry was adjourned in order that particulars of excess expenditure may be furnished.

**Littleborough.**—The U.D.C. has reappointed Mr. Hawtayne as consulting electrical engineer, at a fee of 25 guineas, plus 3 per cent. on contracts under £50 and disbursements.

**Liverpool.**—The Corporation Electricity Committee has instructed the electrical engineer to arrange for the extension of the existing railway sidings at the Lister Drive power station and for the accumulation of a stock of slack on the adjacent area. This is one of the outcomes of the labour troubles of last summer.

**London.**—**HAMMERSMITH.**—It seems quite appropriate that the cinematograph should be used to advertise the advantages of electricity; indeed, the possibilities in this direction have been drawn attention to in our pages. We are glad to note that the B.C. has come to an agreement with the Shepherd's Bush Empire to use the theatre cinematograph screen for this purpose for 12 months, at the cost of 6s. per week; the example could be advantageously followed in numerous towns, particularly where the electricity authorities supply electricity to the theatres.

**BERMONDSEY.**—The B.C. decided on Tuesday to inquire whether the L.C.C. was prepared to lend it £18,401 for the extension of the electric undertaking. The loan was sanctioned by the L.G.B., after it had been refused by the L.C.C.

**Loughborough.**—An account of the successful working of the electricity undertaking was given by Alderman Bumpus at the meeting of the T.C. on Monday last. He stated that the undertaking showed a balance for the year of £2,476, an increase of £603 over the previous year, on the net revenue account. The profit of £2,476 for the first time enabled them to do more than pay their way.

**New Zealand.**—The Thames B.C. proposes to raise a loan for the introduction of electric lighting in the town. Mr. Frederick Black, of Wellington, is the consulting engineer in connection with the project.—*Commercial Intelligence.*

**Nottingham.**—Upon the annual report of the Electricity Committee being submitted, at a meeting of the City Council, Councillor Huntsman referred to the "colourless character" of the document. The Committee, he said, had evidently not met the demands which existed. Sir John Turney (chairman of the Committee) pointed out that it was 19 years since the electricity plant was put down, and the Committee were advised by the best men they could find. If they had placed more of their earnings to a big reserve fund, they might have afforded to scrap a big lot of plant and have started on new lines, but since they had had the undertaking the Finance Committee had drawn £120,000 in alleviating the rates. If the Finance Committee cared to forego the £15,000 which was handed over this year to them, the price could be reduced a farthing a unit, but the matter was really not worth talking about. Of the sum paid for plant, £250,000 was still owing, and new plant would cost £150,000 or £200,000. That was not to be thought of in the present position of the finances of the city. Of the units which went out, 50 per cent. did so at 1½d. per unit. The demand was spasmodic, and they had practically few consumers. They could produce current at a cheaper rate if they had some big consumers. The report was adopted.



**Penistone.**—The R.D.C. has granted permission for the Yorkshire Electric Power Co. to lay underground mains at Cawthorne, and overhead lines from Tivy Dale to Banks Hall.

**Salford.**—The Committee has decided to enter into an agreement with Messrs. Hulse & Co., Ltd., for the supply of energy, subject to the company guaranteeing a minimum consumption of 50,000 units per quarter for all purposes at 85d. per D.C. unit for the first 50,000 units per quarter, and 75d. for all units over 50,000; when mixed A.C. and D.C. is supplied, the average price for A.C. is to be 705d. per unit lower than for D.C. supply.

**U.S.A.**—The Lehigh Navigation Electric Co., of Philadelphia, which is erecting a power station to utilise the waste production from the Lehigh Coal Co.'s pits, has placed an order for three 10,000-K.V.A. 11,000-volt 25-cycle three-phase turbo units, exciter turbines, &c. The maximum output contemplated is 100,000 kW., and it is expected to supply energy ultimately to Philadelphia, 80 miles distant.

**Warrington.**—The gross profit on the electricity department for the past year has been £7,709, and after paying contributions to sinking fund and loans, there is a net profit of £1,746, which has been retained in the appropriation account, bringing up the working balance to £3,078. The reserve amounts to £9,358 and the debt extinguished to date, to £27,000.

**West Bromwich.**—The profit of the Corporation's electricity works for the past year is reported at £2,853, an increase of £1,071 on the previous year. The Electricity Committee recommends that the profits be allocated as follows: £1,446 to depreciation fund account, £200 in aid of the general district rate, and £1,207 to be carried forward.

**Wolstanton.**—The Stoke-on-Trent T.C. intends applying for a prov. order for electric lighting in the district for the Wolstanton U.D.C. with whom an agreement has been drafted. In the meantime, a licence to supply current is to be applied for.

**Worthing.**—In a report to the T.C., the resident engineer states that the continued growth of the business of the electricity undertaking has necessitated a further sub-division of the distributing network and the provision of a new feeder cable to enable the electrical pressure to be maintained at the minimum prescribed in the provisional order. Since March, 1910, 228 new consumers have been connected to the distributing mains, and the number of units sold and the revenue derived from the private consumers has been increased respectively by 93,000 and £1,000. He accordingly recommends that a new feeder cable be laid at an estimated cost of £1,070, and also that additions be made to the switchboard at an estimated cost of £120, to accommodate two sets of future dynamo connections and four sets of feeder connections. A further sum of £1,615 is also asked for to cover the cost of house services, and another £880 for distributing mains, bringing the total additional outlay up to £3,770. Commenting on the provision for house services, Mr. Porter states that the number provided for (250) is greater than has been provided for at any one time previously, but seeing that 131 new services were connected during the last financial year, and that there is at present no falling off in the number of services applied for, he considers it necessary to make provision for a larger number in future. The Electricity Committee supports the proposal to apply for the additional loan.

**York.**—The Corporation proposes to extend the generating plant at the electricity works at an estimated cost of £9,700, and an inquiry has been held following the Council's application for sanction to borrow this sum. The extension is rendered necessary owing to the increased demand for light, power and tramway purposes.

The T.C. has been recommended to reduce the price of current for the tramways to a flat rate of 1½d. per unit as from October 1st next. The present sliding rate ranges from 1½d. to 2d. per unit.

It has also been recommended to instruct the electrical engineer to prepare a scheme for lighting Bishopthorpe Road along the tramway route by electricity.

A loan of £800 for motors for hiring purposes for two years has been applied for. The T.C. has received from the B. of T. an order enabling current to be supplied to premises at Fulford.

## TRAMWAY and RAILWAY NOTES.

**Accrington.**—The town clerk reported to a meeting of the Electricity Committee last week, that he had received an intimation from the Haslingden T.C. terminating, by six months' notice, the existing agreement as to working its system of tramways and the generation of current for same.

**Australia.**—The Hawthorn (Vic.) Municipal Council is negotiating with Trackless Trolley, Ltd., with the intention of adopting the "Ceas-Stoll" system for the proposed railless traction routes in the town.—*Commercial Intelligence.*

**Ayr.**—After visiting Leeds and Bradford, the Special Sub-Committee recommends that the Hawkhill district be served by the railless traction system.

**Belfast.**—The universal penny fare will not come into force for another year at least, according to the decision of the Corporation, which met on Monday last. The financial experts reckoned that the acquisition of the Glengormely line would mean a loss for some time, and that the general system would not bear a reduction of the fare until the Glengormely line was paying its way.

**Canada.**—*Electric Traction Weekly* says that the electrification of the Rossland division of the Canadian Pacific Railway in British Columbia, is being pushed forward to determine the applicability of such a course under the heavy conditions to be encountered. The section to be electrified runs from Rossland to Castlegar Junction. The length of the Rossland division is 29.3 miles, which with sidings and yard trackage, amounts up to a total trackage of 43 miles. The motive power installation will consist of four 70 to 80-ton electric locomotives, power being obtained from the West Kootenay Power and Light Co. at probably 60,000 volts. This will be utilised through motor-generator sets in sub-stations located either at Trail or Smelter Junction. Systems using A.C. 6,600 volts and D.C. 2,400 volts are being proposed.

**Continental Notes.**—**AUSTRIA.**—The Cracow Tramways Co. has secured a preliminary concession for the construction and working of several new lines of electric tramways in the district surrounding the town of Cracow.

**FRANCE.**—Plans are being prepared in respect of projected electric tramways between Limeuil and Bonnetil; between Sevres and Ville d'Avray and between Marnes and Chesnay in the Seine-et-Oise department.

The T.C. of Chateauroux has approved of the proposal of a company to install an electric railless service of motor-buses with overhead trolley.

**PORTUGAL.**—According to the *Times*, the Lisbon Electric Tramway employés and the men employed on the elevators in the hilly parts of the town have struck work, with a view to improved wages and labour conditions. The company has appealed to the Government for protection.

**ITALY.**—A contract has been signed between the president of the Provincial Deputation of Alessandria and the representatives of the Westinghouse Co., and of the firms of Draken and Alessi, whereby the former grants a three months' option for the construction of a group of provincial electric tramways which will complete the tramway and railway network of the province. With the help of subsidies from the Government, the province and the communes, the three companies will construct and work some 20 separate electric tramway lines of a total extent of 450 kilometres, allowing a return to the province of 4 per cent. of the receipts, exclusive of the subsidies. In the event of the utilisation of the waters of the Scriva and of the Orba, surveys of which are now being made on behalf of the province, preference will be given to the three companies under a parity of conditions, which will extend on similar terms to any future provincial electric tramway lines.—*L'Ingegneria Ferroviaria.*

A French Consular report says:—The Northern provinces, situated at the foot of the Alpine ranges, form the chief seat of the hydroelectric development, but the rocky ridge which splits the peninsula into two watersheds contains throughout its course stores of power. Thus Umbria may be considered at the present moment as the province possessing the richest reserves of power. The energy of natural and artificial cascades possessed by this region is roughly reckoned as equal to 10,000,000 H.P. On January 1st, 1910, the 4,132 motors placed at the service of industry and capable of supplying 238,377 H.P., were allocated as follows:—1,457 electric motors with 44,311 H.P.; 1,245 steam motors with 94,092 H.P.; 945 hydraulic motors with 67,876 H.P.; 465 gas motors with 31,943 H.P.; 20 petrol motors with 599 H.P. Compared with the foregoing year progress was most marked in Venetia, in the Marches, in the Abruzzi, and in Campania. On the other hand, noteworthy extensions were effected in the networks constructed in Piedmont, Lombardy Tuscany, and Latium. From the information available regarding 69 of the 86 generating stations sanctioned, it appears evident that water-power largely predominates, but it is also observed that gas is preferred to steam, and that there is a growing demand for heavy oil and petrol motors. Among the most remarkable installations effected in 1910 were:—(1) The line crossing the province of Chieti. Aquila, Campobasso and Caserta, ending within the precincts of Naples, after a course of 190 km. The pressure of this line (86,000 volts) is the highest existing in Italy up to the present time; (2) the line from Turin to Chivasso (86,000 volts); (3) the line from Goglion to Verampio (54,000 volts); (4) the connection of the Masino factory with the Plattamala-Lomazzo line, province of Como (45,000 volts); (5) the line from Anierolla Ifri (Sardinia) (32,000 volts); and (6) the Arco-Subiaco-Tivoli-Rome transmission line (30,000 volts).

Contrary to opposite reports which have been current, the *Giornale dei Lavori Pubblici* is able to state that no difficulty has been raised by either the French military or political authorities, and that electric traction will be extended to the 15 km. of the Cenisio Tunnel line on French territory worked by the Italian State Railways, the way being thus paved for the continuous electrification of the line as far as Modane.

**Dudley.**—The Tramways Committee has decided to join the Tottenham Council in an appeal to the Lords against the decision of the Court of Appeal that tramway companies shall be rated on assessments of one-fourth only of the annual value of their tramways.

**East Kent.**—The East Kent Light Railways Co. is applying to the Light Railway Commissioners for an order to construct a railway over four miles in length, from Little Mongeham, via Northbourne, Ham and Eastry, to Woodnesborough.



**Elland.**—Considerable disappointment has been occasioned by the failure of the project of the West Yorks. Tramway Co. to link Elland with Halifax and Huddersfield. The suggestion was that the company's lines should be connected with the Halifax system at West Vale, run through Elland, and join up with the Huddersfield tramways at Birkby. Support was given to the scheme by the Elland District Council, but negotiations have fallen through, and the project has been dropped.

**Gateshead-on-Tyne.**—At a meeting of the Birtley Council, on May 28th, a letter was read from the Gateshead Tramway Co., asking for the support of the Council to a proposed extension of the system to Birtley and Chester-le-Street. The proposal met with unanimous approval, and it was decided to ask the company for further details. At present the Gateshead Tramway Co. runs cars to Low Fell, which is on the Durham road, upon which also Birtley and Chester-le-Street are situated. Low Fell is about 3 miles from the Gateshead terminus, Birtley  $4\frac{1}{2}$ , and Chester-le-Street about  $7\frac{1}{2}$ .

**Glasgow.**—The Tramways Committee reports the breaking of another revenue record for the year ending May 31st. The total income was £987,280, compared with £946,021 for the previous year—an increase of £41,258. In 1910 the income was £893,591, and in 1909, £889,530. The big augmentation is accounted for by several reasons. The principal is the fact that, last summer, the Scottish National Exhibition was held in Glasgow. Two important experiments were made in the course of the year. The first was the two-stage ticket—a  $1\frac{1}{2}$ d. transfer ticket, which permitted a passenger to take a double  $\frac{1}{2}$ d. stage at the purchase of the ticket and complete a journey of similar distance at any time—and the second, which succeeded the "two-stager" in December, was the doubling of the  $\frac{1}{2}$ d. distances over the entire routes. Considerable loss was entailed by the dislocation caused by the tramwaymen's strike in August of last year, while the coal miners' strike, while it brought an augmentation to revenue through increased long-distance passengers carried, also, through increased fuel prices, cut down profits. The details of the traffic are: Average track mileage open during year (single),  $194\frac{1}{2}$  miles—increase,  $\frac{1}{2}$  mile. Car-mileage, 22,435,076 miles—increase, 730,839 miles. Passengers carried, 275,610,385—increase, 37,643,078. Passengers carried per car-mile, 12.2—increase, 1.3. The number of passengers carried at each fare was:—

	Year to May 31st, 1912.	Year to May 31st, 1911.
$\frac{1}{2}$ d. ... ..	121,212,468	66,290,055
First two stage ... ..	9,062,479	5,573,508
Second two stage ... ..	9,058,682	5,398,884
1d. ... ..	104,334,320	130,519,231
$1\frac{1}{2}$ d. ... ..	20,337,702	19,408,739
2d. ... ..	6,258,659	5,879,305
$2\frac{1}{2}$ d. ... ..	2,736,945	2,453,123
3d. ... ..	1,340,308	1,248,620
$3\frac{1}{2}$ d. ... ..	1,109,998	1,036,083
4d. ... ..	158,824	159,759
Totals ... ..	275,610,383	237,967,307

For some time the Tramways Committee has been in negotiation with the proprietary company in connection with the acquiring of the Harbour tunnels in order to facilitate the working of the tramway traffic from the north to the south side of the Clyde and *vice versa*, west of Glasgow Bridge. The Corporation offered the company to clear the tunnels of the water which had accumulated in them during the years in which they have been disused, and to bring them into good working order at a cost not to exceed £1,200, with the option of purchase at £100,000 at the end of the year should the experiment prove a success. The company has declined the second part of the offer as too low for acceptance, and adheres to its price of 50 per cent., or 10s. per £ of the original total cost. The Committee is to reconsider the matter.

**Halifax.**—The T.C. has applied to the B. of T. for a loan of £3,750 for the provision of six new tramcars.

**London.**—The Roads Improvement Association having considered the report of the L.C.C. Committee on its recent memorial on the question of obstruction, &c., to the B. of T., has communicated with the latter, urging that it should hold an inquiry into the allegations, which it complains are not answered by the L.C.C. Committee's report.

**Newcastle-on-Tyne.**—At a meeting of the Corporation Tramways Committee on May 30th, the chairman submitted the annual statement for the year ended March 31st last. He stated that the receipts from traffic were the largest that had ever been earned on the system and amounted to £216,590, which included £1,812 for parcels. (This is equal to 11.317d. per car-mile.) The receipts from other sources were £5,492 for street lighting, £3,637 for advertising, which with other small items made a gross income of £226,634. (Equal to 11.841d. per car-mile.) The total working costs had been increased by £8,039, making the total expenses for the year £122,012, against £113,973 last year. (Equal to 6.375d. per c.m., as against 6.164d. per c.m.) There was left a balance of £104,622 to carry to the net revenue account, compared with £95,694 for the previous year. Interest on loans totalled £30,972, and there was carried to the appropriation account £73,433, compared with £62,933. The repayment of loans and sinking fund accounted for £39,314. £12,000 was given as a contribution to the rates. £12,250 was paid to the Newcastle Electric Supply Co. as compensation for giving up the right of supplying electricity in Walker, and there was left £8,427 net profit to be carried to the reserve and renewals account. The last account would now stand

at £104,670. The chairman added that during the present year the Committee would have to spend £30,000 out of the renewals fund, for renewals of lines, junctions, and additional power at the generating station. During the year they had carried about 19,000,000 passengers, and their profit was about £32,000. But when they took into consideration that £14,000 of that amount was earned apart from traffic receipts, and when they considered that they ought to provide at least £11,000 for the year's contribution to the renewal funds, it would be seen how small a proportion of the profits were actual traffic receipts. The statement was adopted on the motion of Sir Joseph Ellis. It was decided to make a survey in the Heaton district, in connection with a proposal to extend the tramways in that part of the city.

**Nottingham.**—Councillor Swain, chairman of the Corporation Tramways Committee, stated at a meeting of the City Council that the Committee had considered the advisability of establishing the railless traction system in Nottingham, but nothing could be done at present, as they were awaiting the result of a Bill promoted by the B. of T. in the House of Commons to simplify the process of getting powers. As soon as the Committee knew its position he would bring the subject up again.

Presenting the annual report of the Tramways Committee, Councillor Swain said the receipts were £5,300 more than in the previous year. This was largely caused by the Coronation festivities and the fine summer, three-quarters of a million more passengers having been carried. The reduction of fares had made little difference to the receipts, and had given general satisfaction. Since the adoption of the halfpenny fares for children there had been an enormous increase, 97,000 tickets being issued last week.

**Warrington.**—The tramways department for the past year shows a net profit of £2,456; £1,500 has been kept in hand for the relief of the rates, and a further sum of £338 has been carried forward, and the balance of £618 has been transferred to the reserve fund, which now stands at £10,000. The debt extinguished to date is £25,802.

**West Bromwich.**—The Tramways Committee reports that the accounts of the tramways undertaking show that, after charging interest on loans and sinking fund instalments, the net profit amounts to £275, which extinguishes the deficiency of £239 brought forward, and leaves a balance of £53, which has been transferred to the repairs of track expense account.

**Western Australia.**—According to the *Standard*, the purchase of the Perth Tramways Co.'s undertaking by the State for £500,000 (which has been previously mentioned in these notes), has been completed.

## TELEGRAPH and TELEPHONE NOTES.

**Austria.**—The reform of the Vienna telephone service will be accomplished within the next 10 years. It was originally intended to introduce the full automatic system, but the engineer department of the Post and Telegraph Administration gave its decision in favour of the semi-automatic system. Ten semi-automatic exchanges, for 10,000 subscribers each, will be established. Three of these exchanges will be built in the first instance. Under the stimulation of the orders placed in connection with these operations, Austrian electrical manufacturing firms are experiencing a period of unwonted prosperity, and several are enlarging their works. Among the latter are the Ericsson Austrian Electrical Manufacturing Co. and the Telephonfabriks-Aktiengesellschaft, both of which are making extensive additions to their works. In addition to the orders already placed, commissions for some 20,000 instruments of various kinds are in sight, besides large orders for telephone cable for the projected lines to Trieste and Dalmatia, rendered possible by the 20,000,000 kronen credit for postal purposes included in this year's State Budget.

**Cable Record.**—It is stated that the special cable messages sent to the *Daily Telegraph* in connection with the loss of the *Titanic* and the consequent proceedings constituted a new trans-Atlantic record as regards dispatches addressed to one newspaper: 74,203 words were transmitted by the Commercial Cable Co., and 2,891 by the Anglo-American Co., a total of 77,094 words.

**High-Frequency Machine.**—Count Arco, the well-known inventor, to whose labours the technical development of modern wireless telegraphy owes much, has recently made a further important invention which is being taken up by the German Telefunken Co. The invention in question is a high-frequency machine for the direct production of electric waves for wireless telegraphy and telephony. Although the machine does not differ materially from the ordinary alternating-current machine, it is capable of generating any desired output at frequencies from 15,000 to 120,000 cycles per second, and, therefore, electric waves of lengths from 2,500 to 20,000 metres, which are necessary for large wireless stations. The machine is simple and cheap, runs at a moderate speed, and will produce waves at as high a frequency as may be desired. A machine for an output of 500 kw. is now under construction for the Nauen wireless station. Count Arco will explain and introduce his invention at the International Conference on Wireless Telegraphy which is now sitting in London.



**International Radio-Telegraphic Conference.**—The Conference was opened at the Institution of Electrical Engineers on Tuesday by the Postmaster-General, who nominated Sir H. B. Smith as President. Yesterday Mr. Samuel received the delegates at his house.

**Liverpool.**—Sir W. Hartley has presented to the University of Liverpool a wireless installation for experimental and research work, with standard Marconi apparatus as used on board ship.

**Radio-telegraphic Convention.**—The Senate of the U.S.A. has ratified the International Convention.

**The Right to Strike.**—A conference was held at Blackpool last week of the National Postal, Telegraph, and Telephone Engineering and Stores Association, at which a resolution was carried with only two dissentients, asserting the right of employés in the engineering and stores department to withhold their labour.

**Venezuela.**—According to an American Consular report, the President has issued a decree establishing four wireless telegraph stations at La Guaira, Puerto Cabello, Maracaibo, and Cumana. Wireless companies might address Spanish correspondence to the Department of Fomento (Promotion) at Caracas, or to Señor Manuel Ayala, 18, Broadway, New York City, who is the purchasing agent of the Venezuelan Government.

**Village Telephones.**—The P.M.G. has undertaken to establish telephone call offices at all villages where there is a likelihood of the offices being self-supporting, and these can be used for dictating telegrams to the nearest telegraph office.

**Wireless at Sea.**—It is reported from Berlin that new regulations will come into force on October 1st, according to which all German passenger steamers with a complement of 75 persons and upwards, inclusive of the crew, will be obliged to carry apparatus with a radius of at least 100 nautical miles. The same provision will apply to cargo vessels which regularly have more than 60 persons on board.

**Wireless Telephony.**—Experiments recently carried out by the Italian naval and military authorities have resulted in the transmission of speech with clearness over a distance of 160 miles.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Accrington.**—The electrical engineer has been instructed to obtain tenders from local firms for the supply of some 2,800 yd. of terra-cotta troughs and covers, required as conduits for cables.

**Australia.**—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" May 10th.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

NEW SOUTH WALES.—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

**Barnes.**—June 11th. Concentric paper-insulated and lead-sheathed cable for the U.D.C. See "Official Notices" May 31st.

**Belfast.**—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" May 17th.

**Belgium.**—June 11th. The municipal authorities of Namur are inviting tenders for an installation of electric lighting in the new Kursaal.

June 11th.—Tenders are being invited by the Capitaine Commandant la Compagnie des Telegraphistes (La Caserne Front, 5-6), Antwerp, for the supply and laying of the sub-river and underground cables required in connection with the establishment of a telephonic system in the sector of the fortified portion of Antwerp.

**Bristol.**—June 10th. Wiring and fittings for electric lighting at Stapleton Workhouse, for the B. of G. See "Official Notices" May 24th.

**British Columbia.**—June 10th. The city of Vernon requires one 125-KW. three-phase 60-cycle generator with direct-connected exciter, five-panel switchboard, and series tungsten arc lighting system. Tenders in duplicate to City Clerk. Consulting engineers:—Messrs. Mather, Ynill & Co., Ltd., Vancouver, B.C.

**Briton Ferry.**—June 19th. Overhead main, between Villiers Street and Grandison Hotel, for the U.D.C. See "Official Notices" to-day.

**Bury.**—June 21st. Electric light installation and bore-hole pump at the Aitken Sanatorium, Holcombe, for the Bury and District Joint Hospital Board. See "Official Notices" to-day.

**Croydon.**—June 24th. Conversion of two hand lifts into automatic push-button control electric lifts, at the Infirmary, for the B. of G. See "Official Notices" to-day.

**Derby.**—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

**Devonport.**—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" May 17th.

**Dublin.**—June 27th. Extra-high-pressure and low-pressure cables, for the Corporation. See "Official Notices" to-day.

**France.**—June 15th. The French Post and Telegraph authorities in Paris are inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

The Chamber of Commerce of Havre have decided to erect 15 electric cranes, to replace the existing 15 hydraulic cranes, and also two electric cranes for the sheds of the Booth Line. Definite decisions have likewise been come to by the Chambers of Commerce at Nantes and Rouen for the installation of electric cranes and other works. At the former port it is intended to erect three electric cranes and to re-organise the electric conduit equipment; and at the latter port to erect two new electric cranes and a 130-H.P. hydro-electric pump.—*Revue Pratique de l'Electricité*.

**Grays.**—June 13th. Coal for a year for the U.D.C. electricity works. Electrical Engineer.

**Hungary.**—The municipal authorities of Csepel are about to invite tenders for the concession for the electric lighting of the town.

**London.**—POPLAR.—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

June 8th.—Steam-driven boiler feed pump for the B.C. electricity works. See "Official Notices" May 31st.

HACKNEY.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, pipework, travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

HORNSEY.—June 10th. One electrically-driven turbine feed pump, for the T.C. See "Official Notices" May 24th.

ST. PANCRAS.—June 17th. Two sets of motor-generator balancers for the B.C. See "Official Notices" to-day.

**Newcastle-upon-Tyne.**—June 28th. Nine-ton electrically-driven crane for use in connection with an anti-coal breakage appliance at No. 5 Coal Shipping Staith, Whitehill Point, for the Tyne Improvement Commission. Deposit £1. Mr. J. M. Manson, general manager and secretary, Tyne Improvement Commission.

**Rochdale.**—Contract A 62.—Cable conduits. Contract A 63.—One three-phase motor-alternator. Particulars from Mr. C. C. Atchison, engineer and manager, Dane Street.

**Oldham.**—June 21st. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" May 31st.

**Salford.**—June 10th. Electric wiring of Nashville Street Council school. See "Official Notices" May 31st.

**South Africa.**—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

**Spain.**—July 2nd. Electric lighting of the City of Oviedo and its municipal buildings, for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

**Stockport.**—June 11th. One or more 1,500-KW. mixed-pressure turbine alternators, for the Corporation. See "Official Notices" May 24th.

**Sweden.**—June 22nd. Swedish Royal Board of Water-works. (1) 11,250-H.P. three-phase generator, 10,000 volts, 150 R.P.M.; transformers for raising to 70,000 volts. For State power station at Alfkärlaby. For further particulars see this column last week.

**Swindon.**—June 22nd. Steam coal, for the Corporation. See "Official Notices" to-day.

**Turkey.**—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

**Uruguay.**—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.



**West Ham.**—June 17th. Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 21th.

### CLOSED.

**Accrington.**—The Electricity Committee has accepted the following tenders:—

British Westinghouse Electric & Manufacturing Co., Ltd.—Transformer and regulators, £283.  
Dussek Trinidad Bitumen Co.—15 tons of bitumen, at £5 17s 6d. per ton.

**Australia.**—Postmaster-General's Department, Sydney:

300 telephones, £787 10s.—J. Paton & Co.  
One branching multiple magneto switchboard, with associated frames, racks and parts, for Post Office, Broken Hill, £3,277.—B.I. & Helsby Cables, Ltd.  
Protectors, £435.—Western Electric Co. (Australia), Ltd.  
One switchboard section at the telephone exchange, Edgecliff, £785; one switchboard section at the telephone exchange, William Street, £658; one switchboard section at the telephone exchange, Mosman, £939; total £2,362.—Western Electric Co. (Australia), Ltd.

Postmaster-General's Department, Perth:—

3,500 conduits, glazed earthenware, six ducts, at 5s. 9d. each, £1,006; 2,500 conduits, glazed earthenware, six ducts, at 5s. 9d. each, £719.—Mills and Co., Perth.

80 relays, polar, differential P.O. pattern, at £4 19s. 6d. each, £149.—I.-R., G.-P. & Telegraph Works Co., Ltd., Perth.

2,500 cells, dry, rectangular, at 2s. 10d. each, £354.—General Electric Engineering Co., Perth.

The P.M.G.'s Department in Melbourne has placed a large order for protectors, fuses, switchboards, condensers, lugs, relays, resistances and switchboard cable, with the Western Electric Co. (Australia), Ltd. Also one for keys, repeating coils, &c., with Jas. Bartram & Son, Pty., Ltd.; and one for 300 c.i. covers and frames, at £3 10s. each (£1,050), with Holden & Lewis.

The P.M.G.'s Department at Sydney has ordered additions to switchboard at Sydney G.P.O. from the Western Electric Co. (Australia), Ltd., at £4,774.

The P.M.G.'s Department has also ordered cords and ear-pieces from the Lawrence & Hanson Electrical Co., Ltd., and the I.-R., G.-P. and Telegraph Works Co., and cords from the Western Electric Co. (Australia), Ltd., and copper binders and tapes from the B.I. and Helsby Cables, Ltd., and the I.-R., G.-P. & Telegraph Works Co., Ltd.

Tenders for plant for electricity supply at Ararat (V.) have been accepted by the Council, and an immediate commencement will be made with the erection of the plant and the reticulation of the town. Messrs. R. Hornsby & Son secured the contract for two gas engines, the price being £1,523 10s. Several tenders for equipment were accepted, the largest being that of Warburton, Franki & Co., £680. Contract E, supply of aluminium wire and cable, £337, was gained by the B.I. & Helsby Cables, Ltd. Messrs. McLean & Co. will have charge of the erection of the plant, their contract amounting to £588. The whole of the work will be superintended by Messrs. G. B. Lincolne and K. MacDougall, of Melbourne.—*Australian Mining Standard*.

Sydney Municipal Council has, says the *Australian Mining Standard*, received the following tenders for a 11,000-volt cable:—

W. T. Henley's Telegraph Works Co., Ltd. . . . .	£3,684
Noyes Bros. (Sydney), Ltd. . . . .	3,725
Australian Metal Co. . . . .	3,772
B.I. & Helsby Cables, Ltd. . . . .	3,582
Western Electric Co. . . . .	4,170

The same exchange reports the following acceptances of tenders by the New South Wales Public Works Department, Irrigation and Drainage Branch:

Supply and erection at Yanco of engine and generator and exciter, £65; electrical generating set and transformer for Yanco, £840.—Cowlshaw and Rumford, Sydney.  
Boiler, fitted with patent integral steam superheaters, for Yanco, £789.—Babcock & Wilcox, Ltd.

The *Melbourne Age* states that tenders for the power plant for the Federal capital electricity generating works were opened on April 25th at the Home Affairs Department, and were referred to the works officers for report. They number about 20, and have been received principally from Australian agents of European and American firms. The plant is to be of 600 KW., and will form part of the central station when the progress of construction warrants the use of more than one unit.

**Barking.**—The T.C. Tramways Committee has accepted the tender of the British Thomson-Houston Co., Ltd., at £768, for a single-truck tramcar.

**Bolton.**—The Electricity Committee has accepted the following tenders:—

British Westinghouse Co.—Motors.  
Ferranti, Ltd.—A.C. meters.  
Electrical Apparatus Co. and the General Electric Co.—D.C. meters  
L. Andrew & Co.—Tapes, incandescent lamps, and I.R. gloves, &c.  
Henley's Telegraph Works Co.—Oil tape, service and other boxes.  
Siemens Bros. & Co.—Adhesive tape and u.r. compound.  
Union Oil & Bitumen Co.—Resin oil.  
Western Electric Co.—Solder and plumbing metal.  
Ward & Goldstone.—Porcelain cleats.  
B.I. & Helsby Cables, Ltd.—Insulated wires, boxes, pavement frames, covers, cut-outs, sealing boxes, &c.  
Lucy & Co.—Cut-outs.  
Edison & Swan Co., Johnson & Phillips, British Electric Transformer Co., W. E. Burnand & Co., and the Brush Electrical Engineering Co.—Transformers.  
Electrical Apparatus Co.—Motor starters.  
T. Moscrop & Co. and W. Priestley & Co.—Oils, &c.  
G. Reason.—Waste.  
Fisher, Raworth & Co.—Bolts, nuts, and sundry stores.  
Brabbin & Rudd.—Asbestos and india-rubber goods, &c.

**Belgium.**—M. L. C. Jause submitted the lowest tender for the supply and installation of four new boilers, with economisers, for the central electric lighting station in Ghent.

**Derby.**—The E.L. Committee of the T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a boiler, at £2,190.

**Eastbourne.**—The tender of the British Westinghouse Co. has been accepted by the T.C. for a six months' supply of electricity meters.

**Edinburgh and Govan.**—At both these places the tender of Messrs. Chamberlain & Hookham for electricity meters for the coming year has been accepted.

**Falkirk.**—The Corporation has accepted the tender of the Reason Manufacturing Co., Ltd., for electrolytic meters for the ensuing year.

**Galway.**—The U.D.C. has decided to have the Esplanade at Salthill, Galway, lighted by electricity, and has accepted the tender of the Galway Electric Co., Ltd., for a period of seven years.

**Glasgow.**—The Tramways Committee has placed the following contracts for the year:—

Steel wheels.—John Baker & Co., Ltd.  
Steel tires.—Brown, Bayley's Steel Works, Ltd., John Baker & Co., Ltd.  
Steel axles.—Glasgow Railway Engineering Co., Ltd.  
Bolts and nuts, &c.—Thos. Tudhope & Co., Rivet, Bolt & Nut Co., Ltd.  
Rubber-insulated cables.—W. T. Glover & Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd.  
Iron castings.—R. Howie & Co., David King & Son.  
Steel castings.—Dickson & Mann, Acme Steel & Foundry Co.  
Malleable-iron castings.—A. Shanks & Son, Ltd.  
Engineers' furnishings.—Wm. Landell, Pegler Bros., and Mitchells, Ashworth & Co., Ltd.  
Chilled brake blocks.—Wm. C. Yuille & Co., Ltd., Miller & Co., Ltd., and The Interchangeable Block Co., Ltd.

**Grimsby.**—The tenders of the Phoenix Dynamo Manufacturing Co., Ltd., and the Tudor Accumulator Co., Ltd., have been provisionally accepted by the T.C. for a motor-generator and switchgear, for £420, and an automatic booster and switchgear, at £332, respectively.

**Hounslow.**—In connection with the extension of plant at the electricity works, 59 tenders were received. Reporting on these tenders, the Electricity Committee stated that the lowest tender received for the engine and foundations was that of Messrs. Browett, Lindley & Co., at £1,544. The engine quoted for by this firm had the following advantages:—(1) low initial cost; (2) low steam consumption; (3) occupied less floor space than other makes; (4) slower speed. It would also be entirely suitable for the Council's requirements. The steam consumption per KW.-hour was 10 per cent. less than that of any of the other makes, and the initial cost of the engine was some £200 less. The reduction in speed would necessitate the adoption of a slightly larger dynamo at a slightly increased cost, but it was obvious that the reduced speed would entail less wear and tear on the plant, and was consequently a great advantage. The engine installed at the electricity works by the same firm two years ago was giving entire satisfaction. Should the new engine fail to fulfil the firm's guarantees in every respect, it was to be replaced with a triple-expansion engine, without any additional cost other than the difference in price for the two engines. As regards the dynamo referred to above, the Committee favoured the tender of the General Electric Co., Ltd., at £1,212. As, however, it was desirable that the complete contract should be given to one of these firms, and as the engine builders had agreed to work in conjunction with any dynamo maker, either maker agreeing to take the complete contract at the price quoted, the Committee had decided to give the whole contract to Messrs. Browett, Lindley & Co., Ltd., at a total of £2,766. For the supply of a boiler, &c., the Committee recommended the acceptance of the tender of Messrs. Babcock & Wilcox, Ltd., at £1,698. The Committee further recommended the acceptance of the tender of Messrs. Browett, Lindley & Co., at £998, for the condensing plant required. At the Council meeting all the recommendations were carried.

**Leyton.**—The U.D.C. has accepted the tenders of Venner & Co., Electrical Apparatus Co., Ltd., Siemens Bros. & Co., Ltd., and the British Insulated & Helsby Cables, Ltd., for supplies of motor, ordinary and slot meters, as and when required, for a period of one year.

**Liverpool.**—The Liverpool District Lighting Co., Ltd., have received instructions to light by electricity the Cavalry Barracks at Scaferth near Liverpool.

**London.**—ISLINGTON.—The Guardians have accepted the tenders of the General Electric Co., Ltd., Drake & Gorham, Ltd., and Baxter & Caunter, Ltd., for electrical fittings and sundries.

**HAMMERSMITH.**—The following tenders were received for a number of recording voltmeters:—

Everett, Edgecombe & Co. . . . .	£140 10
Nalder Bros. & Thompson . . . . .	141 10
Evershed & Vignoles . . . . .	141 10
Nalder Bros. & Thompson . . . . . (alternative)	151 10
General Electric Co., Ltd. . . . .	151 10
Johnson & Phillips, Ltd. . . . .	151 10
Elliott Bros. . . . . (recommended)	151 10
British Westinghouse Co., Ltd. . . . .	281 12

Amongst other orders recently placed by the South-Eastern and Chatham Railway Co., is one for 144 Westinghouse 10-amp. 45-hour magazine flame arc lamps.

**SOUTHWARK.**—The B.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., at £43, for the provision of a feeder pillar.



**SHOREDITCH.**—The B.C. has accepted the tender of the Western Electric Co., Ltd., for the supply of approximately 2½ miles of six-core, paper-insulated, lead-covered pilot cable, at £114 per mile. The other tenders were:—

	Per mile.
Siemens Bros. & Co., Ltd.	£115 10
W. T. Glover & Co., Ltd.	115 15
W. T. Henley's Telegraph Works Co., Ltd.	117 0

An order is to be placed with Messrs. Elliott Bros. for ten recording instruments, at £11 1s. 6d. each.

**Northampton.**—The T.C. has accepted the tender of Messrs. Mather & Platt, at £168, for centrifugal pumping plant and electric motor.

**Nuneaton.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a main switchboard, at £654; and that of the Electrical Engineering & Equipment Co. for cables, at £877. The latter contract is in place of that of Messrs. Blackwell & Co., who have declined the contract previously placed with them.

**The Rand.**—An order for eight high-pressure centrifugal pumps of 500 H.P. each has been placed with Messrs. Escher Wyss and Co. by Messrs. Hubert Davies & Co., for the new pit of the Rand Proprietary Mines. Each pump has to lift 60,000 gallons of water (acid-containing) per hour, against a vertical head of 1,150 ft. The pumps have to work under very unfavourable conditions, and are therefore of very strong design and special acid-resisting material.

**Salford.**—The following tenders have been accepted by the T.C.:—

Babcock & Wilcox, Ltd.—Electrically-operated travelling jib crane, bulk weigher and tray conveyor for coal, £2,698.  
W. Thorpe & Son.—Alterations to buildings and foundations at electricity works to accommodate two turbo-generators, £1,369.

#### ANNUAL SUPPLIES.

Chamberlain & Hookham, Ltd.—Continuous-current meters, approximate value of contract £546.  
General Electric Co., Ltd.—Ditto, £120.  
Electrical Co., Ltd.—Motor carbon brushes, £24.  
William Geipel & Co.—Rubber cables, £150.  
W. T. Glover & Co.—Ditto, £200.  
W. T. Henley's Telegraph Works Co.—Rubber strip and black tape, £46.  
Plutte, Scheele & Co., Ltd.—Arc lamp carbons, £83.  
L. Andrew & Co.—Rubber solution, white tape, copper strip, mica, and rubber gloves, £22.

The following have been accepted in lieu of that of Imeson Finch & Co., Ltd.:—

Biennial supply of mechanical car accessories.—Malleable Steel Castings Co., Ltd., Brecknell, Munro & Rogers, Ltd., Johnson, Clapham and Morris, Ltd. (£225), W. Boydell & Sons, Ltd.  
Special car accessories.—British Westinghouse Co., Ltd.

**South Africa.**—Contracts have recently been awarded by the Union Tender Board, Pretoria, on behalf of the Public Works Department, as follows:—A.E.G. Electrical Co., carbon lamps; Siemens, Ltd., tungsten lamps; British General Electric Co., Ltd., conduits and fittings; Hubert Davies & Co., Pretoria, cables; Henley's S.A. Telegraph Works, Ltd., cables; Telegraph Manufacturing Co., cables.—*Commercial Intelligence.*

## FORTHCOMING EVENTS.

**Institution of Mining Engineers.**—Friday, June 7th.—At 9.40 a.m. (from Fenchurch Street). Visit to the works of the Western Electric Co., Ltd., North Woolwich.

**Institution of Electrical Engineers.**—Summer meeting at Glasgow.  
Wednesday, June 12th.—At 10.30 a.m. At the Royal Technical College. Paper on "The Transmission of Electrical Energy by Direct Current on the Series System," by Mr. J. S. Highfield. At 2.15 p.m.—Visit to works (to be selected). Ladies' excursion. At 8 p.m.—Reception in the Municipal Buildings by the Lord Provost and Corporation.

Thursday, June 13th.—At 10.30 a.m. At the University. Lecture on "The Magnetism of Permanent Magnets," by Prof. S. P. Thompson; description and demonstration of "A Single-Phase Motor with Pole-changing Windings," by Messrs. J. S. Nicholson and B. P. Haigh. At 9.50 a.m.—Excursion to Edinburgh and Holyrood Palace. At 2.15 p.m.—Visit to works (to be selected). At 8 p.m.—At the University; reception by Principal Sir Donald Macalister.

Friday, June 14th.—At 9.35 a.m. Excursion on the Firth of Clyde. At 8 p.m.—At the Grosvenor Restaurant. Dinner.

**Physical Society.**—Friday, June 14th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "Demonstration of a Method of Determining very Small Differences of Density," by Mr. T. H. Blakesley; "The Maximum Sensibility of a Duddell Vibration Galvanometer," by Dr. H. F. Haworth; and "An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron," by Mr. F. Stronde.

**Newcastle Chamber of Commerce (Electrical Section).**—A meeting was held on May 29th in the Mayor's Chamber, Guildhall, Newcastle-on-Tyne, to consider the question of forming an electrical section of the Newcastle and Gateshead Chamber of Commerce. Mr. C. S. Vesey Brown presided. After some discussion, on the motion of the chairman, seconded by Mr. W. C. Mountain, it was resolved to form an electrical section of the Chamber. Those present, who included (in addition to those mentioned) Messrs. T. O. Hunt, W. C. Wilson, B. Gaffney, R. Robson, W. P. Potter, R. Jobson, H. S. Ellis, C. Turnbull, G. E. Carr, and H. Shaw (secretary), were formed into a Provisional Committee. It was announced that the Newcastle Branch of the Institution of Electrical Engineers would become members of the Section, and would nominate one of their members to serve on the Committee.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Drills, &c., are suspended from June 10th until October 7th, 1912, for all companies.

Saturday, June 15th.—Berehaven Camp. The party for this Camp will parade at headquarters at 12 noon. Dress:—Service dress, putties, haversack, waterbottle, belt and frog, greatcoat with one greatcoat strap (issued at headquarters) to be rolled *en banderole*.

Arms will be issued at headquarters from 12 noon. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

## NOTES.

**The Engineer as Arbitrator.**—The following interesting paragraph appears in the current minutes of the Hammersmith Borough Council:—

"A letter (25/3/12) has been received from the Bristol Corporation, stating that it is their practice, in common with many other local authorities, to insert in contracts for the execution of extensive works, a clause referring disputes under the contract to the arbitration of their own engineer. The Corporation point out that the validity of the clause was established in the case of Jackson v. Barry Railway Co. (1893, 1 Ch. 238), and experience has proved that it is a very necessary provision in the interest of employers, because it prevents contractors from bringing pressure on the engineer to decide in their favour the numerous points arising in the execution of large works, by constantly threatening an appeal to arbitration against the engineer's decisions. The Court of Appeal, in the case of Aird v. the Corporation of Bristol, have, after expressly exonerating the engineer from all the charges of conduct unfitting him for the position of Arbitrator made against him by the plaintiffs, refused to refer the matters in dispute to his decision, on the ground that out of a large number of disputes, two items (amounting to less than one-fourth of the total claim) did not fall within the arbitration clause. The Bristol Corporation are of opinion that the case involves a principle of great importance to local authorities, and counsel have advised that it is a case in which an appeal might properly be taken to the House of Lords. Very considerable expense has already been incurred in contesting this matter, and the Corporation are disinclined to go further unless they can obtain some assistance; and inquire whether, in view of the uncertainty now existing as to the form in which contracts for works should be prepared, the Borough Council would be willing, with others, to join in sharing the cost of an appeal to the House of Lords."

The Hammersmith Committee that considered the letter recommends:—"That no action be taken in the matter."

**Law Cases.**—The *Financial Times*, in the course of an article on the list of trials that are to come before the Law Courts at the present Trinity sittings, mentions that the arbitration proceedings relating to the acquisition of the National Telephone Co.'s undertaking will begin on Monday next, June 10th, before Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne Hardy and Sir James Woodhouse. Numerous counsel have, of course, been engaged, the principals being the Attorney-General for the Crown, and Sir Alfred Cripps, K.C., for the company. The proceedings are expected to last until the end of the term. In the Winding-up Court there is, amongst the new petitions, one against the Maxim Lamp Works, Ltd. In the Appeal Court there is to be the appeal of the "Z" Electric Lamp Manufacturing Co., Ltd., against the order made by Mr. Justice Warrington, in the action brought against them by the Osram Lamp Works, Ltd.

**Police Lanterns.**—An evening paper says that electric bull's-eye lanterns are to be provided for the Metropolitan Police.

**Strike Effects.**—A good instance of the evil effects of strikes on the trade of this country recently came to our notice. During the coal strike a certain South American port, which formerly insisted on having Welsh coal only, was obliged to purchase 15 steamer loads of American coal. The Americans had always failed previously to get their coal into the port and through it to the country. Now that the American coal has once been tried, the orders go to America instead of England. What a lesson this should be to our workmen, who are so often blindly led by paid agitators, thus permitting our legitimate industries to fall into the hands of foreign competitors!

**New Source of Rubber.**—An African exchange says that the "Tirucalli" tree of Natal, which has hitherto been regarded as commercially useless, has been found to yield a latex which contains rubber. A Singapore rubber planter first drew attention to the matter, and a company which has been working a concession in the Tugela Valley has exported about a ton of the crude coagulum weekly to London for some months, it having been found useful for electrical insulation and mixing with Para rubber. An unlimited number of tirucalli are found in Natal, and their recuperative qualities are such that they can be tapped once a month by experienced hands.



**American Industrial Affairs.**—It appears that the electrical industry in the United States has been subjected in most of its branches to the same depression that has been affecting the general business situation there for the past year or two, and at present, according to the *American Electrical Review and Western Electrician*, there is little indication of any reaction from this condition. Our contemporary, in dealing with the matter under the title "Industrial Regulation," says:

"In some quarters the general business situation has been attributed to the Government's activity in enforcing the Anti-Trust Laws. While this may have contributed somewhat to the existing uneasiness, it is probable that its effect has been overrated. In the two cases that were carried to the Supreme Court the results were not at all disastrous to the defendants, and have in no way impaired trade in those particular channels. As for the prosecution, which was started about a year ago against the 'Electric Trust,' a very amicable settlement was reached by the attorneys for the Government and for the companies affected, and neither the situation in the electrical industry nor the volume of trade can be said to have been at all affected by this proceeding. It is certainly desirable, nevertheless, that the Government should arrive at some definite policy regarding its attitude toward, and treatment of, the large business and industrial corporations of the country."

Our contemporary, later in its article, says that the natural tendency of the present generation is toward co-operation rather than competition, and that a policy which depends upon the latter seems to be a grievous mistake. "The Government's efforts toward relief from the oppression of large industrial combinations should take the form of regulation with the idea of co-operation as the ultimate goal, rather than an attempted forcing of business back into the old lines of competitive method."

Some interesting comments appear in a recent report by the British Consul-General in the U.S.A. respecting the importance of foreign markets and the difficulty of American traders in securing or maintaining a footing unless the cost of production can be reduced. The report says:—

"Foreign markets are absolutely necessary to secure full employment for American mills, but the high American tariff, while it has carefully protected the home market, has, together with the eight-hour day, increased the cost of production to such an extent that it is difficult to meet the prices of the British and German manufacturer. It is maintained by some that if America is to have her full share of the foreign trade, the cost of production must be reduced to the level of its competitors, and this can only be done by improving the methods of financing, by systematic management, with the lowering of tariffs and a general reduction in wages paid. Whether the American working man will agree to the last condition is a matter of some doubt. He will probably suggest that, if retrenchment is necessary, the employers' profits should contribute towards that end."

The New York correspondent of the *Times*, in discussing "Business in the United States," mentions that the filing of a civil suit two or three weeks ago for the dissolution of the Aluminium Co., of America, charged with being a monopoly to restraint of trade under the Sherman Anti-Trust Law, marks the successful conclusion of long negotiations between officers of the U.S. Department of Justice. The writer, who enters into the relations of the American and European aluminium companies, says that "the suit is a friendly one and will not be contested, since the company has already promised to re-organise so as to comply with the Anti-Trust Act; in fact, a decree to this effect has been agreed upon between the Government and the Department, and will be entered in the near future."

**Wireless Power.**—According to the New York correspondent of the *Daily Telegraph*, in an address before engineers at Buffalo recently, Mr. Frank Prentice, a well-known Canadian expert on electric traction, predicted that the use of wireless power would in a few years be greatly extended, and he foresees the day when motor-trucks, flying machines, and even trains, will be operated by such power. He declares that recent experiments demonstrate that wireless power really increases in velocity and strength the further it goes from the point of origin.

The significance of this paragraph (literally) lies in its last sentence. It appears that the speaker has discovered a new law, diametrically opposed to the ordinary law of inverse squares: clearly, on the basis of this principle, if you can get far enough away from your source of power, there need be no limit to the power developed at the far end of the system—the only question is whether there is room enough on the earth for the purpose. If so, it will readily be seen that, by transmitting the unlimited wireless power thus collected back to the point of origin, the power of the source can be indefinitely increased, and thus at last we realise the long-sought perpetual motion.

**Victoria Falls Power Employés.**—We have received two Johannesburg newspapers containing articles "by a Special Correspondent," in which ridicule is poured upon many irksome regulations and restrictions which are imposed upon the employés connected with the Victoria Falls Co.'s power stations. The articles form curious but interesting reading. The writer talks of "the threatened strike in the V.F.P. camp" being mainly attributable to the "retrenchment-cum-replacement system in vogue," also of "unrest and discontent," due to "petty oppression," which had since been "modified for obvious reasons." The stipulation that all shift men and others must live on the property, and the inspection of quarters (married and single) once a month by the engineer in charge or station superintendent, call forth comments respecting the "V.F.P. Barracks," "A White Compound," and so on. The writer suggests that it is courting a big disaster to have only one

tender for 16 boilers, and only one driver on night shift for the turbines, representing something like 2,500 h.p.; he also touches upon other matters which seem to be a source of irritation and friction.

**Electricity Supply Rifle League.**—The following are the results of the matches shot during May in connection with the above League: Central (Law. Greenwood 96) 558 c. Stepney (Barber, Jager 91) 531; Hackney (Hilling 94) 543 c. Stepney (Barber 98) 543; Ilford (L. Tufnell 96) 518 c. Shoreditch (Weekes 99) 564; Hackney (Hilling 96) 533 c. Shoreditch (Weekes 100) 551; Ilford (Partington 91) 530 c. Westminster (Neville 97) 572. The following is the position of Clubs to date:—

Club.	Matches.				Points.	Scores.	
	Shot.	Won.	Lost.	Drawn.		For.	Against.
Central ...	4	3	1	0	6	2,226	2,193
Westminster ...	3	3	0	0	6	1,705	1,620
Shoreditch ...	3	2	1	0	4	1,669	1,619
Stepney ...	3	0	2	1	1	1,619	1,666
Hackney ...	3	0	2	1	1	1,616	1,649
Ilford ...	2	0	2	0	0	1,048	1,136

The honour of putting up the first "highest possible" has been gained by Mr. Weekes, of the Shoreditch Club.

**Fatalities.**—A correspondent says that Arthur Francis Denholm, 21, a clerk employed in an insurance office at 71, George Street, Edinburgh, went to the basement of the building to turn off the electric current in connection with the lift, and while thus engaged he caught hold of a lever, with the result that he received a shock from which he died a few minutes later.

While erecting an electric lift at Paternoster Row, E.C., Alfred White, 44, fell a distance of 74 ft. to the bottom of the well. He died from fractured skull and other injuries. A verdict of accidental death was returned.

An inquest was held last Saturday into the death of Frank William Brown, an electrical engineer, aged 23, son of Mr. W. J. Brown, for 20 years manager of Messrs. Siemens's works, at Charlton. Deceased, according to the evidence, was out motor-cycling with friends, when a collision with a cab occurred. Brown and one of his companions fell with the machine on the top of them, and the cab horse also fell upon them. Deceased's left lower jaw was broken, and his skull was fractured; death was due to concussion and the fracture. Verdict: "Accidental death."

**Electrical Trade at Johannesburg.**—The annual report of the Johannesburg Chamber of Commerce for 1911, which is reproduced in the *South African Mining Journal* for May 4th, contains the following paragraph relating to the electrical trade: "Electrical business during 1911 showed a considerable falling-off as compared with 1910, owing to most of the orders for the construction work on the power companies' plants and on the mines in connection with the electrification scheme having been placed in the former year. Prices ruled extremely low, owing to severe competition, but, towards the end of the year, they were advanced somewhat in view of the risk of the heavy penalties now being inflicted by the mining houses."

**Injuring Cable.**—At the Lochgelly Burgh Court last week two young miners, named Joseph Faulds and James Smith, were charged with tampering with one of the Fife Electric Power Co.'s cables, by throwing a piece of barbed wire over it, in consequence of which the Leven and District Tramways were held up for four hours until the fault was discovered. The accused were each fined 10s.

**The Joint Committee on Textile Mill Driving.**—From the report of the textile section of the Joint Committee, appointed by the Textile Institute and the I.E.E. to inquire into the question of mill driving, it appears that such strong objection has been raised to the constitution of this Committee, that the Joint investigation will not be proceeded with, although a Standing Committee of the Textile Institute will carry on the work and report regularly on new developments. At the autumn meeting of the Institute at Hawick (September 12th-14th) papers on the driving of mills by steam, electricity, gas and oil are included.

**Nitrate Production from the Raw Material of Aluminium.**—The *Financier* quotes the following information from the report by H.M. Consul at Lyons (Mr. E. R. E. Vicars) on the trade of that district in 1911, which will shortly be issued: The most important development in the electro-metallurgical industry during 1911 related to the production of aluminium and its by-products, the French manufacturers of which have formed themselves into a company called "L'Aluminium Français," with a share and debenture capital amounting to £680,000. The most interesting part of this combination lies in the fact that the new company have acquired the exclusive rights all over the world in the Serpeck process of aluminium manufacture. The Serpeck process, by which the production of nitrates forms part of the manufacture of aluminium, consists in the treatment of bauxite in the electric furnace with air and coke so as to fix the nitrogen, thus producing a nitride of aluminium. This product is then treated with a solution of caustic soda, which produces aluminate of soda and ammonia gas. From the aluminate of soda is extracted pure alumina, and from this aluminium is obtained by the usual electrical process, while the ammonia gas is treated with sulphuric acid, producing sulphate of ammonia. The process is thus closely allied with that in use for the production of nitric acid and nitrates by the union of oxygen, nitrogen and steam in the electric furnace.



**Institution and Lecture Notes.**—THE FARADAY SOCIETY.—Preliminary particulars have been issued respecting a proposed 15 days' visit of members of this Society to Norway and Trollhättan, Sweden, in July or August next. The cost of the tour per head, starting from Hull and returning to Newcastle, including all travelling and hotel expenses and gratuities, will be 25 guineas. The visit has been suggested by several eminent Norwegian electro-chemists, and excellent opportunities should be afforded for inspecting some of the principal hydro-electric power installations and electro-chemical and electro-metallurgical plants, provided a sufficient number of members and friends are able to take part in the tour. Particulars may be obtained from the secretary, Mr. F.S. Spiers, 82, Victoria Street, S.W.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—At the annual meeting of the East of Scotland Branch, on the 25th ult., Mr. C. A. Carlow, of the Fife Coal Co., was re-elected President, for the third year in succession. Mr. R. H. Willis retired from the secretaryship, on his appointment as general manager for his firm, the British Electric Plant Co., at their headquarters in Glasgow. Mr. H. Gorton Fraser, Leven, was re-elected vice-president, and Mr. R. W. Peters, Lochgelly, agreed to take over the joint posts of secretary and treasurer. Mr. Neil A. Wilkie, manager at Bowhill for the Fife Coal Co., then read a paper on the new special rules as applicable to electricity in mines.

**NOTTINGHAM ENGINEERING SOCIETY.**—To-day (Friday) the members of this Society leave Nottingham for Newcastle and Tyne-side for their annual summer excursion. To-morrow they will visit the St. John Leather Works, Newcastle, and the works of Messrs. Clarke, Chapman & Co., at Gateshead, and other places of interest. On Sunday the N.E. Railway electro-pneumatic signalling works, power station, and pneumatic signalling box will be visited. On Monday the works of Messrs. Haggie Bros., Ltd., at Gateshead, and the engineering and shipbuilding yard of Messrs. W. Doxford & Sons, at Sunderland, are to be seen, after which the return to Nottingham will be made. The members of the Birmingham Engineering Society are to visit Nottingham on June 17th, and they will be met by the president and Council of the Nottingham Engineering Society.

**JUNIOR INSTITUTION OF ENGINEERS.**—A party of members recently paid a visit to the new engineering workshop and laboratory and the electrical laboratory of the Polytechnic, Regent Street. With the exception of a few of the best lathes and machines removed from the old workshop, the whole of the contents of the new shop, including many modern high-speed tools, is new equipment.

Mr. Hibbert conducted the party round the electrical workshop and laboratory, of which he is the head, and supplied the following particulars. Power is obtained from the mains of the Marylebone Borough Council at 480 volts, and by means of a series of eight motor-generators the laboratory is supplied with direct, alternating and polyphase currents. The laboratory contains series, shunt and compound motors, single, two-phase and three-phase motors, rotary converters, transformers, oscillographs, a telephone exchange (including a small working automatic exchange), arc lamps and all the usual appointments.

In connection with this Institution, a week-end visit to Sheffield is being arranged. The party will leave London for Baslow on June 21st, and will visit Haddon Hall and other places of popular interest on the Saturday, and on Monday the party will leave Baslow for Sheffield, visiting the works of Messrs. Firth & Sons, Ltd., and Messrs. Cammell Laird & Co., Ltd., returning to London in the evening. A movement is on foot to form a local section of the Institution in Sheffield, and it is thought that probably this visit will have the result of establishing the section.

**No Takers at 15s.**—At the Eccles T.C. on Monday, reference was made to an advertisement by the Lighting Committee for a switchboard attendant at a salary of 15s. a week. A member asked what was the minimum wage and requisite age of applicants, and Alderman Pearson, the chairman, said the minimum wage was 15s. a week, but receiving no reply to the advertisement, they raised it to £1, and had since made the appointment. They expected a well educated youth of 18 to 22, who would regard the appointment as a stepping stone to something better.

**Speaking Pictures.**—A demonstration was recently given at the Royal Institution by Prof. W. Stirling, of the Gaumont "speaking cinematograph" system. By means of electrical apparatus the inventor, M. Léon Gaumont, has succeeded in synchronising the operation of the phonograph and the cinematograph so that the sounds correctly accompany the appropriate action shown on the screen. Each instrument is driven by an electric motor, the two motors being of identical pattern and driven from the same source; the talking machine is driven at constant speed, and the speed of the cinematograph is adjusted to correspond with it by means of a differential gearing.

**Tennis.**—A match has been arranged between the Old Centralians tennis team and the City and Guilds (Engineering) College on Saturday, and it is hoped that in future this will be an annual event. Old students are invited to be present as spectators. The match will be played on the "Ryhall" Tennis Club ground, Barons Court Road, S.W. (opposite Barons Court Station). Play will commence at 3 p.m. There will be an informal supper afterwards at 7.30 p.m. at the Imperial Technical College Union Rooms.

**The Horticultural Exhibition.**—With reference to the notice in our last issue, we learn that the whole of the current required for lighting purposes at this exhibition was supplied from the mains of the Chelsea Electricity Supply Co., Ltd., in accordance with arrangements which had been made many weeks previously.

**Water-Power in Finland.**—It is announced from St. Petersburg that at the instance of the Electric Lighting Co., of 1886, of St. Petersburg, a Viborg firm has acquired extensive land and water utilisation rights in connection with the rapids of the river Vuozen, Finland, which form the so-called little Imtra falls. The company proposes to prepare a hydro-electric scheme for execution in the near future, and the use of the most important of the Finnish water powers therefore seems to have advanced a stage towards realisation. It is calculated that the minimum power to be utilised will amount to from 50,000 to 60,000 H.P., which can be considerably increased if required, except during occasional periods of low water. It is expected that a portion of the power will be employed in Finland, although the major portion will presumably be transmitted to St. Petersburg, where the company already supplies from steam power stations a considerable quantity of electrical energy to industrial establishments, in addition to the ordinary lighting service. The use of the Imtra falls, which now pass into the possession of a financially strong company, has been under consideration for a long time past, and the prospective hydro-electric works is regarded as being of special importance to St. Petersburg, inasmuch as the scheme seems destined to render the company partly independent of foreign supplies of coal brought by sea transport, the delivery of which might be interrupted at any time in the case of strikes or international complications.

**Improvement of Power Factors by Synchronous Motors.**—An interesting practical paper on this subject was recently presented to the Atlanta Section of the Am.I.E.E. by Mr. H. E. Bussey. As is well known, the effective rating of every part of an A.C. generating and distributing system is reduced when a load of low power factor has to be supplied. The increasing use of induction motors for industrial power purposes has rendered the maintenance of a reasonable overall power factor in supply systems a problem of great importance, and, in America in particular, active measures have been taken to encourage the use of synchronous motors where possible. These machines require a direct-current excitation supply, and need more skill in manipulation than induction motors, but wherever their characteristics will meet the power requirements, synchronous motors should be employed. Not only does a synchronous motor not draw idle magnetising current from the A.C. mains, but also, by its regulable D.C. excitation, it is enabled to supply magnetising current to inductive apparatus on the same lines. It is quite an economical proposition to install synchronous machines running light and over-excited for the sole purpose of improving the power factor, in which case the machine is usually termed a synchronous condenser to distinguish it from a synchronous motor, which, in addition to providing a leading wattless current, is also carrying a mechanical load. The cost of the synchronous condenser is about £1.20 per K.V.A., as against £2.00 per K.V.A. for the motor.

As an example of the evil effects of low power factor, suppose it be required to deliver 1,000 kW. at a pressure of 6,000 volts three-phase, over a distance of 5 miles with a 10 per cent. energy loss. The requisite section of each line would be 79,200 cm. at unity power factor; 97,533 cm. at 90 per cent. power factor; and 218,000 cm. at 60 per cent. power factor—i.e., the copper investment would be 2.8 times as great in the last as in the first case. If the same line were used (giving 10 per cent. loss at 100 per cent. power factor), the loss would be 28 per cent. at 60 per cent. power factor. A transformer giving 1 per cent. voltage regulation at 100 per cent. power factor will have about 3 per cent. regulation at 70 per cent. power factor, and in generating plant, the effect of low power factor is to decrease the rating of the generator as compared with its prime mover. If the power-factor of the load on the station bus-bars be 71 per cent., and if the K.V.A. of synchronous condenser capacity which must be floated on the line to raise the net power factor to 100 per cent. (thus increasing the available generator capacity by 29 per cent.), be denoted by 100—then 20 per cent. of this amount will add 11.5 per cent. to the effective generator capacity; 50 per cent. will add 22.5 per cent.; and 90 per cent. will add 28.7 per cent. Clearly, it is hardly economical to raise the power factor above 90-95 per cent.—requiring 40-60 per cent. of the synchronous K.V.A. needed to raise the power factor to unity. In order to improve the power factor of a distribution line (thus increasing its transmission capacity), synchronous condensers must be floated across the far end of the line.

In a particular case, a 24-hour induction motor load was carried at the end of a 10-mile line and two 1.650-K.V.A. synchronous condensers were installed. The power factor and load conditions under various circumstances are as follows:—

	P.F. of feeder and load.	Station end of feeder. KW.	Volts.	L.T.-bus at works. KW.	Volts.
Condensers out of use ...	0.74	9.100	2,200	5,800	450
Condensers taking full load amps. from L.T. bus at works ...	0.917	6.400	2,200	6,150	475
Condensers 25 % overload...	0.934	6,400	2,200	6,050	485

**Appointments Vacant.**—Borough electrical engineer for Limerick (£200; a knowledge of Irish language and history will be considered an additional qualification); chief assistant electrical engineer, for the Watford U.D.C. (£140); mains assistant for the City Electricity Department, Carlisle (35s. to 40s.); engineer-in-charge for the Newport Borough Electricity and Tramways Department (£2). See our advertisement pages to-day.



## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—It is recommended that the salary of Mr. P. P. WHEELWRIGHT, the engineer and manager of the Blackburn Electricity Works, be increased from £500 by annual increments of £50 up to £700.

The Hampstead Borough Council has, on the recommendation of the Finance Committee, granted Mr. G. H. COTTAM a super-annuation allowance by retaining his services as consulting engineer at 200 guineas per annum. The motion was passed by 19 votes to 13. The Council has appointed Mr. H. H. COUZENS, of West Ham, to the office of chief engineer recently advertised, at £750 per annum plus a bonus of 2 per cent. on the net surplus in excess of £4,500.

The Harrogate T.C. has increased the salary of Mr. NEIL MCLEAN, chief assistant to the electrical engineer, to a maximum of £230, by two annual increments of £10.

The Tramways Committee of the Dudley Corporation has increased the salary of Mr. GEO. SAVAGE, the electrical engineer, from £250 to £275.

The Grays U.D.C. has increased the salary of Mr. E. D. LONG, electrical engineer, by £25 a year.

The Heckinondwike U.D.C. has increased the salary of the chief engineer at the Electricity Works (Mr. G. H. CARVER), by £10 per annum.

Mr. W. HOLMES has been appointed acting electrical engineer and tramways manager to the Barking undertaking in place of Mr. H. L. Howard resigned, for a period of six months, at a salary of £200 per annum.

At Hampstead, London, on Tuesday, the marriage took place of Mr. HAROLD GRAY, borough electrical engineer of Accrington, and Miss Dinsdale, of St. Annes. Mr. Gray was the recipient of a handsome silver tray as a wedding present from the Corporation officials and members of the Accrington Town Council.

**Tramway Officials.**—The Ilford U.D.C. has decided to appoint a tramways manager at a salary of £400 a year, rising annually by £20 to a maximum of £500.

Mr. V. A. BELLAMY, third son of Mr. C. R. Bellamy, late general manager of the Liverpool Corporation tramways, has been appointed junior assistant engineer to the Manx Electric Railway Co. There were over 50 applicants.

**General.**—Our Indian correspondent sends us the following news:—"Mr. H. H. REYNOLDS, M.I.E.E., consulting engineer, Calcutta, has gone to England on urgent private business; he is expected back at Calcutta in three months. Mr. H. SPEYER, A.M.I.E.E., consulting engineer, has gone to Europe for a holiday. Mr. J. W. MEARES, electrical adviser to Government of India, has left for Simla and the new capital: his headquarters will no longer be Calcutta. Mr. A. K. TAYLOR, A.M.I.C.E., executive engineer, Electrical Division, Calcutta, has gone to England for a holiday. Mr. G. MALLETT, electrical engineer to the Amir, has just returned from England, and resumed his State duties in Kabul."

Mr. W. H. BIGGS, secretary for the Adams Manufacturing Co., Ltd., has accepted an appointment with Electromotors, Ltd., of Openshaw, Manchester.

Mr. P. H. SYMONDS, who has been representing the steam side of the Brush Electrical Engineering Co., Ltd., at their London office, will in future make his headquarters at Loughborough.

Mr. W. R. HARDING, A.C.G.I., and Mr. C. G. BARKER, A.C.G.I., sailed on Saturday, the 25th ult., to Buenos Ayres to take up positions with the United River Plate Telephone Co. Mr. Harding has been appointed assistant engineer-in-chief and Mr. Barker assistant engineer. Both gentlemen were students of the Central Technical College from 1904 to 1907, and gained the College Diploma in the latter year. Since 1907 they have been on the engineering staff of the National Telephone Co.

## NEW COMPANIES REGISTERED.

**Electrical and Industrial Investment Co., Ltd.** (122,256)—Registered May 29th, by Sydney Morse, 1, Kingsway, W.C. Capital £40,000 in £1 shares (200,000 6 per cent. cumulative preference). Objects: To carry on business as bankers, capitalists, financiers, concessionaires and merchants; to raise money by the issue of shares, to invest the money so raised in the purchase of, or otherwise, to acquire and hold any shares, stocks, debentures, debenture stocks, bonds, scrip, obligations, and securities, issued or guaranteed by any company constituted or carrying on business in the United Kingdom or elsewhere, and to adopt an agreement with the City of Birmingham Tramways Co., Ltd., and H. W. Brettell and T. Bower (the liquidators thereof), for the acquisition of the whole of the property of such company. The signatories are:—Emile Garcke, M.I.E.E., 1, Kingsway, W.C., 500 shares; C. G. Tegetmeier, Normanhurst, Brighton Road, Purley, director, 1 share; J. A. Christie, Sunbury House, Watford, Herts., bank director, 500 shares; G. C. Cunningham, M.I.C.E., 37, Craven Hill Gardens, W., consulting engineer, 500 shares; C. S. B. Hilton, 1, Kingsway, W.C., gentleman, 500 shares; R. B. Kingsford, 1, Kingsway, W.C., secretary, 500 shares; C. H. Dade, 1, Kingsway, W.C., secretary, British Electric Traction Co., Ltd., 1 share. Minimum cash subscription 5 per cent. of the share capital offered to the public. The first directors (to number not less than three or more than six) are:—Emile Garcke, M.I.E.E., J. A. Christie, G. C. Cunningham, M.I.C.E., C. S. B. Hilton, and R. B. Kingsford; qualification, £500; remuneration, £1,500 per annum, divisible. Registered offices, Electrical Federation Offices, 1, Kingsway, W.C.

**Tampico Electric Light, Power and Traction, Ltd.** (122,222).—Registered May 24th, by Thomas Cooper & Co., 21, Leadenhall Street, E.C. Capital, £250,000 in £1 shares. Objects: To acquire, by means of apportionment or otherwise, the undertakings and assets of the Compañía de Los Ferrocarriles Urbanos de Tampico, South America, and the Compañía de Fuerza Eléctrica de Tampico, South America, and the concessions held by J. and F. Borde for the supply of electric light and power at Tampico, Mexico, and to carry on the business of suppliers of electricity for light, heat, motive power, telephonic, telegraphic, industrial or other purposes, &c. The subscribers (with one share each) are:—G. Hutchins, 62, Flanders Road, Bedford Park, W., private secretary; W. M. Jackson, 82, Willow Road, Hampstead, N.W., secretary; A. Cotts, Heatherbrae, Harpenden, Herts, secretary; E. C. Wilson, 4, Exeter Mansions, Brondesbury, N.W., accountant; J. Baker, 52, Seward Road, Hanwell, W., clerk; H. J. Butchart, 40, South Grove, Highgate, N., accountant; E. J. Newman, 96, Old Road (West), Gravesend, assistant secretary. Minimum cash subscription, seven shares; the first directors (to number not less than three or more than seven) are to be appointed by the signatories; qualification, £500; remuneration as fixed by the company. Registered office, 47, Parliament Street, Westminster.

**Optalyte, Ltd.** (122,301).—This company was registered on May 30th, with a capital of £5,000 in £1 shares, to acquire patents relating to electric and other lamps and lenses, reflectors and accessories for use therewith, &c. The subscribers are:—F. Granger, Maryland Court, Maryland, Essex, gentleman, 100 shares; T. B. Dickinson, 6, Dudley Mansions, Abbey Road, N.W., member of Stock Exchange, 100 shares; S. F. Rumball, The Elms, Leighton Buzzard, stockbroker, 100 shares; F. P. Baxter, 13, Sise Lane, E.C., accountant, 25 shares; J. A. T. Good, 151, Queen Victoria Street, E.C., solicitor, 1 share; J. M. Kent, 4, Dalington Road, Tooting, S.W., clerk, 1 share; F. Hall, 181, Queen Victoria Street, E.C., managing clerk, 1 share. Minimum cash subscription, 1,000 shares. The number of directors is not to be less than two or more than five; the first are F. Granger and T. B. Dickinson; qualification, £100; remuneration, £50 each per annum (chairman, £100), and a percentage of the profits. Registered by Good, Good & Co., 151, Queen Victoria Street, E.C.

**Variable Speed Gear, Ltd.** (122,304).—Registered May 30th, by Sugden and Hextall, 36, King Street, E.C. Capital £75,000 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in, machinery, plant and apparatus, suppliers of motive or mechanical power or force of any kind and for any purpose, &c., and to adopt an agreement between Universal Transmission, Ltd., of the first part, E. Marshall Fox of the second part, and the company of the third part, for the purchase of the British patents for the Williams Janney inventions for improvements in power transmission devices. The signatories (with one share each) are:—Sir V. Caillard, Kt., Vickers House, Broadway, Westminster, S.W.; F. C. Vickers, Vickers House, Broadway, Westminster, S.W., gentleman. Private company. The first directors (to number not less than two or more than six) are Sir V. Caillard and F. C. Vickers. Registered office, Broadway Court, Westminster, S.W.

**W. A. Meadows & Co., Ltd.** (122,280).—This company was registered on May 29th, with a capital of £1,000 in £1 shares, to take over the business of an electrical and mechanical engineer, manufacturer of and dealer in electric, magnetic, telegraphic, telephonic and other appliances and apparatus carried on by W. A. Meadows at Percy Street, Hanley, Staffs., as "W. A. Meadows & Co." The subscribers (with one share each) are:—J. Boulton, Lorelli, Silverdale Road, Wolstanton, earthenware manufacturer; W. A. Meadows, Glenwood, Stockton Brook, Staffs., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. Boulton and W. A. Meadows (both permanent); qualification, 1 ordinary share; remuneration as fixed by the company. Registered office: Free Trade Buildings, Percy Street, Hanley, Staffs.

**Anglo-Swedish Electric Welding Co., Ltd.** (122,194).—This company was registered on May 24th, with a capital of £15,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement between Elektriska Svetsnings Aktiebolaget and J. B. Hamilton (for the company). The subscribers (with one share each) are:—J. H. Rosenthal, Oriol House, Farringdon Street, E.C., engineer; O. Kjellberg, Partille, Sweden, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are J. H. Rosenthal, G. W. Partridge, T. M. Aitken, B.Sc., E. H. N. Moxon, J. B. Hamilton (managing director), and O. Kjellberg; qualification, £200; remuneration according to profits. Registered by Geare and Willis, 51, Lincoln's Inn Fields, W.C.

**Isaria, Ltd.** (122,294).—This company was registered on May 30th, with a capital of £5,000 in £1 shares, to carry on the business of electrical and general engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—D. Kimber, 3-1, Great Winchester Street, E.C., managing clerk; W. A. Adams, 11, Western Broadway, Hammersmith, W., clerk. Private company. The number of directors is not to be less than two or more than 10; the subscribers are to appoint the first. Registered office, 208, Tower Bridge Road, S.E.

## CITY NOTES.

## German Electrical Companies.

THE Elektrizitäts Ges. vorm. W. Lahmeyer & Co., Frankfurt-on-Main, after deducting interest on loans, general expenses and providing for depreciation of the company's own supply works, reports net profits of £70,000 for 1910-11, as compared with £65,000 in the previous year. It is proposed to distribute 5 per cent. as against 4 per cent. in 1909-10.

The Ges. Fur Stickstoffdunger, of Knapsack, which was formerly known as the German Carbide Co., reports net profits of £870, for 1911, after making provision for depreciation to the amount of £11,900, as compared with £11,500 in 1910. This result compares with a loss of £2,300 in the previous year, which was extinguished together with the deficiency from 1909 by reducing the share capital. During 1911 the company produced 2,107 tons of nitrogen, which were disposed of in the form of nitrogen of lime and sulphate of ammonia. The proceeds from the carbide branch were unsatisfactory owing to the operation of old contracts at low prices, but improved prices are in force for the current year.

The financial results of the A.G. Mix und Genest, of Berlin, in 1911, were unfavourably affected by strikes and losses on investments. According to the accounts, the working surplus amounted to £47,000, as compared with £58,000 in 1910, and £60,000 in 1909. After meeting general expenses, and providing £15,000 for depreciation, as against a similar sum in 1910, there remain net profits and balance forward of £6,500. This amount has been carried forward, and compares with a dividend of 3 per cent. on share capital of £350,000 in 1910. The directors' report states that the lock-out of the metal workers affected the company, whose



inland departments were satisfactorily employed in general. In the telephone branch prices remained unprofitable; foreign markets were lost owing to high import duties, and politics also caused injury. The French subsidiary company in particular was unable to get into the business, and was compelled to liquidate, the Berlin company having thereby incurred a loss of £7,400. The English branch also resulted in a loss; preparations had been made for large orders arising from the nationalisation of the British telephone service, but they failed to make their appearance. The turnover in the new financial year, and the stock of orders, have so far been considerably greater than in the corresponding period in 1911.

The Deutsche-Ueberseeische Elektrizitäts Gesellschaft, of Berlin, which is the greatest German undertaking abroad as a supply authority and investment enterprise in South America, realised gross profits of £1,203,000 in 1911, as compared with £1,084,000 in the preceding year. After deducting general expenses in Berlin, taxes and insurance, interest on loans, and allocating £272,000 to depreciation, as against £221,000 in 1910, the accounts indicate net profits and balance forward of £526,000, as contrasted with £493,000 in 1910. It is proposed to pay a dividend of 10 per cent. on the share capital of £4,750,000 entitled to participate, this comparing with 10 per cent. on £4,500,000 in 1910, and 10 per cent. on £3,800,000 in 1909. The chief sphere of the company's activity is at Buenos Ayres, as is shown by the fact that the working surplus obtained there, the directors' report states, reached £1,011,000 in 1911, as against £890,000 in 1910 on a production of 193,350,009 kw.-hours and 161,700,000 kw. hours in the two years respectively. The development of the consumption was taking place by leaps and bounds, and the capacity of the six central stations was 74,760 kw., whilst extensions of 27,500 kw. would be brought into operation in 1912. It was also proposed to enlarge the Suddock station by the addition of plant of 7,500 kw. in order to comply with the concession for the extension of the public lighting by a further 4,000 arc lamps, and to supply power for the working of the future underground railway. The report refers to the working results of the other undertakings in which the company is also interested, as, for instance, the Moron electricity works, the Buenos Ayres and Quilmes tramway, the Compania Argentina de Electricidad, the Empresa de Luz y Fuerza of Mendoza, the Valparaiso electric tramway, the Trans-Atlantica tramway in Montevideo, and the Chilian Electric Tramway and Light Co., Ltd. As far as the last-named is concerned, it is mentioned that the company would distribute 6 per cent. on the preference shares for 1911, as was also the case in 1910, and that it would presumably also be able to pay an instalment on dividends in arrears. The share capital of the Deutsch-Ueberseeische Ges. has been raised to £6,000,000 in the present year, whilst the loan capital now stands at £4,223,000.

### New General Traction Co., Ltd.

AN extraordinary general meeting of shareholders was held on Monday at Winchester House, E.C., Baron Emile d'Erlanger in the chair. The object of the meeting was to consider resolutions for reducing the capital from £370,000, divided into 50,000 6 per cent. cumulative preference shares of £5 each and 24,000 ordinary shares of £5 each, to £262,000, divided into 50,000 6 per cent. cumulative preference shares of £5 each and 24,000 ordinary shares of 10s. each, and that such reduction be effected by cancelling capital which has been lost or is unrepresented by available assets to the extent of £4 10s. in respect of each of the 24,000 ordinary shares of the company, and by reducing the nominal amount of each of such ordinary shares to 10s. Resolutions to this and the following effects were proposed by the CHAIRMAN:—

That on such reduction of capital taking effect every two fully-paid ordinary shares of 10s. each be consolidated into one fully-paid ordinary share of £1, and that the directors be, and they are hereby, authorised to issue fractional certificates, each representing half an ordinary share, so far as may be necessary, to carry this resolution into effect.

That on such reduction of capital taking effect, each of the 50,000 fully-paid preference shares of the company of £5 be sub-divided into five fully-paid preference shares of £1 each.

That on such reduction of capital taking effect the 250,000 preference shares of £1 each arising from such sub-division as aforesaid, and the 12,000 ordinary shares of £1 each arising from such reduction and consolidation be consolidated into one class consisting of 262,000 shares of £1 each, all ranking *pari passu* in respect of capital and dividends and right of voting.

The CHAIRMAN said the reason which had given rise to the meeting was the repurchase by the Corporation of Coventry of the tramway system there. They had been somewhat disappointed with the result of the arbitration, but they had agreed years ago when they took the concession, to go before an arbitrator to fix the value of the undertaking as a going concern when the Corporation intimated its desire to repurchase, and, therefore, they must accept the award without demur. The result of the arbitration had been to put a fairly large amount of money in their hands which would be utilised to pay off the prior lien debt and the floating debt, and to pay off a large portion of the 5 per cent. mortgage debentures. A situation had, therefore, been created which they had been long waiting for, to see how they could reorganise the finances of the company to the best advantage of the shareholders. It might have been thought that the wiser course to have pursued under the circumstances would have been to liquidate the company. Against that, however, there was a very potent reason, which was that their securities, which were small in number, were large in amount, and their realisation would, therefore, be a matter of considerable difficulty, and it was only by nursing them that they would be able to realise them at their

intrinsic value. They had, therefore, to look upon the company as a holding company, and as the shareholders had for long been deprived of any return upon their capital, the board had to consider by what means they could make the earnings liquid, and available for future dividends. If they had allowed matters to stand as they were he was afraid that the period of paying dividends would not have arrived until their grandchildren became of age, because they had a debit of profit and loss of £22,000. They also had debentures amounting to about £8,000, and it was impossible to say that the securities which the company held were worth the price at which they stood in the books. They considered it necessary to write off £78,000 to bring down the value of those securities to their real and intrinsic value. They would therefore have to make good a loss out of earnings of £108,000 before they were able to divide any returns which they received on their securities. The only process by which this large amount could be written off was by obtaining from the Courts sanction for a reduction of capital. In a case where there were preference share-holders as well as ordinary it was only fair that the burden of the sacrifice should fall on the latter. On the other hand, it must be remembered that the consent of the Court to put through such a scheme could not be obtained without the consent of the ordinary shareholders, and, therefore, it was only fair that a certain amount of rights in the future of the company should be retained by the ordinary shareholders. The directors had endeavoured to find a scheme which would, as far as possible, be fair and just to both parties. The scheme entailed the loss by the ordinary shareholders of a sum of £108,000, so that out of the £220,000 ordinary share capital they would retain £12,000, which would rank *pari passu* with the capital of the preference shareholders, which was £250,000, so that the capital of the reorganised company would be £262,000. As a result of circularising 152 holders of preference shares 91 proxies had been received, representing 45,358 shares out of 50,000, in favour of the scheme. As far as the ordinary shareholders were concerned, there were 76 shareholders, and out of that number, 40, representing 20,133 shares out of 24,000, were present, either in person or proxy, to support the scheme. Such a result might almost be regarded as unanimous, seeing how the shares were spread, and how interest had been lost in the concern, owing to the non-payment of dividend for so many years. Some preference shareholders might think they were giving up their rights to cumulative dividends, but if they would consider the matter closely, they would see that they were only giving up 5 of 100 per cent. equity, they had in respect to accumulated dividends, because they retained 95 per cent. of the whole of all past rights, and all future profits. All they were giving up was 5 per cent. of future profits in allowing the ordinary shareholders to rank *pari passu* in respect of 5 per cent. of the capital.

The HON. A. BRAND seconded the resolutions, which were adopted unanimously.

### Birmingham and Midland Tramways Co., Ltd.

THE directors report that in 1911 the total revenue from all sources was £109,901, compared with £102,613 in 1910. The expenses £52,365, compared with £53,700. After providing for all expenses chargeable to revenue, including repairs, maintenance, sums payable to corporations, and placing £5,000 to renewals account, there remains £52,535, plus £306 brought forward, making £52,841. After deducting interest on loans, £7,296, and interest on debenture stock, £14,953, there is a balance of £30,592. After deducting for debenture sinking fund £4,463, and dividend for the year on the 5½ per cent. preference shares £11,538, there remains £14,591. According to the *Financial News*, the directors recommend a dividend on the preferred ordinary shares at the rate of 3 per cent. for the year, £10,500; to depreciation and reserve account, £3,750; carried forward, £341. The gross receipts from the tramways were £50,515, compared with £48,025 in 1910. The gross receipts from the lighting and power departments amounted to £26,469, a decrease of £268. The dividends from investments produced £29,861, compared with £25,177 in 1910. The total expenditure on capital account during the year was £6,211. The total amount of debenture stock now outstanding is £329,893. The directors have carefully considered the offer received by the directors of the City of Birmingham Tramways Co., Ltd., and have come to the conclusion that they may anticipate a substantial increase in dividends as a result of the exchange of shares in the City of Birmingham Co. for securities of the new company. They have therefore signified their intention to take debenture stocks and shares in the new company on the terms proposed. The Birmingham and Midland Motor Omnibus Co. is now proposing to make a new issue of £30,000 5 per cent. debentures, redeemable out of profits, at 110 per cent. An offer has been received by the company to exchange its present holding of debentures for debentures of the new issue, subject to the company agreeing to subscribe for £6,800 additional new debentures. The company has consented to participate in the issue, subject to the other debenture-holders agreeing to the same terms.

**Egypt.**—The balance sheet of the Compagnie Egyptienne Thomson-Houston, for the last financial year, shows a profit of only £4,064, which is being carried forward to the current 12 months.

**Richard Hornsby & Sons, Ltd.**—The directors have declared an interim dividend at the rate of 6 per cent. per annum.



## Kalgoorlie Electric Power and Lighting Corporation, Ltd.

MR. ROGER WALLACE, K.C., chairman, presided on Friday last at Winchester House, E.C., over the sixth ordinary general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 894), the CHAIRMAN said the profits for the year after deducting expenses in Kalgoorlie were £24,290, as against £18,106 last year, showing that they had made during the year a net profit in Kalgoorlie of more than £6,000 above the year 1910. This was very satisfactory, considering that they had had strikes and other things to meet during the period. They had decided to put £7,500 to reserve, and to make provision for the 2 per cent., premium payable on the redemption of the debentures. Under those conditions, of course, the first thing the shareholders would ask was why they did not propose to pay a dividend on the ordinary shares. They must remember, in the first instance, that the ordinary shares were not really capital shares, but they represented the deferred interest, which was profit to the promoters, and also certain interest which was not paid in the first few years of construction to the preference shareholders. Really the preference shares were the ordinary shares of the company, whilst the ordinary shares were really deferred shares. Therefore, they felt quite justified, under the circumstances which he would explain, not to pay a dividend on the ordinary shares. During the early portion of the year they had to submit to an event which they could not very well provide for. It was a cyclone, which blew down their cooling tower which unfortunately struck several of the lines communicating with the mines and stopped them for a few days. They were able to keep the tramways running. This mishap would involve an expenditure of about £3,000. Seeing that in that company they were liable to strikes and to breakdowns of machinery at a distance, they thought it advisable to keep money in hand so that they would not have to go to the bankers and borrow money to meet emergencies. Consequently they had made provision for the replacing of the part of the plant injured by the cyclone, and had made certain provision for new plant. Had it not been for the cyclone they certainly would have paid a dividend on the ordinary shares, but they would have to look forward to that next year. They had had the opportunity during the year of consulting with Mr. Crocker, their engineer, who had spent a long-deferred holiday in this country, and had taken the chance of seeing what improvements had been made in the electrical stations in this country. Mr. Crocker was of opinion that their plant was pretty well up to date, but he had confirmed the directors' view that their old Stewart engines, which had been used as a stand-by, would give more economical results if they also used a turbine, and consequently they had ordered a turbine which would not only use the steam, but also give them an independent unit. That would be paid for out of the revenue for the year. They also considered that by the installation of certain synchronising transformers they would get better results and store a great deal of energy now wasted in the cables. With these two alterations and certain other minor details the company's plant would be now quite up to date. They also had the best load factor in the world, which was due to the care of Mr. Crocker and his staff, and also to the direction on this side. The outlook was very promising, and so long as they could keep free of strikes he thought they would do very well. He should add that it was not strikes in their own works that they feared, but in the works of their consumers.

MR. E. POPE seconded the motion.

MR. MORGAN asked if the board had considered the question of using Diesel oil engines. He was a member of the Electricity Committee of a Corporation which had gone very carefully into the question and had decided to spend a considerable sum of money in the coming year on Diesel oil plant, and having had the figures before him he admitted frankly that he was astounded at the saving anticipated over steam. He did not know what the company paid for coal, but his Committee paid 12s. 6d. a ton. He hoped on another occasion to be able to say what the actual saving had been.

The CHAIRMAN said his first experience of Diesel engines went back 25 or 30 years, when he was asked by the Diesel Co. to go down and inspect their plant and machinery, and since then enormous improvements had taken place. They had always kept their eye on the question, but in all electrical stations they had to consider the conditions of the *locus in quo*. In Australia they had not even got coal and were obliged to use wood. If they could use oil it would undoubtedly be a great advantage to the company, but there was no oil, so far as he was aware, in Western Australia. He had been in communication for some time with the Shell Transport Co., and had talked the matter over with Sir Marcus Samuel with a view to getting a supply to Kalgoorlie, but they were a long way inland and railway freights were high, and it was quite impossible to use oil engines if the oil had to be transported in tanks. They would have to have a pipe line or something of that kind. There were also other matters, such as the temperature and the sand storms and so on to consider, but they did not overlook anything which was likely to benefit the company.

MR. CROSS asked how the reserve was employed, and pointed out that the present holders of the ordinary shares had paid a fair price for those shares, and were entitled to a dividend. He did not see why the board should have written off the debenture premium in one year. He asked why they did not have monthly reports, as they had no clue whatever as to the expenses of the company. Although the directors did their work well, yet £850 was rather heavy for fees. It seemed to him it was the intention of the board to use the reserve fund for the redemption of the debentures, which would be entirely at the expense of the ordinary shareholders.

The CHAIRMAN said the reserve was employed at present in purchasing the new plant, which was much more advantageous to them than by investing it outside the company. He agreed that people who bought the deferred shares did not look at the past, and wanted a dividend. It was not the intention of the board to disregard that view, or to build up a reserve fund to redeem the debentures. As to writing off the £1,200, the fact was they wanted the money, and they might as well write it off that item as anything else. It would make it easier for them to pay an ordinary dividend later. The directors did a lot of work, and no one would grudge them their fees. Returns came to the office every month, which shareholders were at liberty to see.

MR. L. BUTCHER criticised the figures in the balance sheet, and said the management expenses and office expenses were very high, whilst with regard to the engineer's fees, why could not they get an engineering shareholder to serve on the board?

The CHAIRMAN said that all the machinery which was sent out had to be tested, and they must have advising engineers.

MR. BUTCHER moved that the report be not adopted unless a dividend was paid on the ordinary shares.

MR. CROSS seconded the amendment.

Several shareholders endorsed the action taken by the board.

The amendment was defeated, and the report adopted, with one dissident.

The retiring auditors and director were re-elected.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Victoria Falls and Transvaal Power Co., Ltd.—Scrip, fully and partly paid, for £1,000,000  $5\frac{1}{2}$  per cent. second mortgage debentures, series "A."

And to allow the following securities to be quoted in the Official List:—

Companhia Ferro Carril do Jardim Botânico (Jardim Botânico Tramway Co.).—Further issue of £400,000 5 per cent. 40-year first mortgage bonds of £100 each, Nos. A8,001 to 12,000.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of \$250,000 general mortgage  $4\frac{1}{2}$  per cent. 30-year gold bonds of \$1,000 each, Nos. 9,833 to 9,932 and 10,083 to 10,232.

Metropolitan District Railway.—Further issue of £150,000 4 per cent. prior lien debenture stock.

Ordered the undermentioned securities to be quoted in the Official List:—

Montreal Water and Power Co.—Further issue of £16,600  $4\frac{1}{2}$  per cent. first mortgage prior lien gold bonds of £1,000, Nos. 8,948 to 8,997 and 9,098 to 9,213.

**An Indian Issue.**—We observe from an Indian newspaper that the Lahore Electric Supply Co., Ltd., recently offered for subscription in India, Ordinary shares (Rs. 100 each) one lac and preferential participating shares (Rs. 100) two lacs. It was mentioned that the Local Government was prepared to guarantee a total demand of not less than 150,000 units per annum. One lac of ordinary shares had previously been subscribed and two lacs of first mortgage debentures. Lala Harkishen Lal is the chairman of the company, and the offices are at McLeod Road, Lahore.

**Prospectus.**—*Thomas Bolton & Sons, Ltd.*—This company last week issued a prospectus inviting subscriptions for £300,000 in 3,000 5 per cent. first mortgage debentures of £100 each at par. The proceeds were to be used to provide for the redemption of the existing debentures (£160,000  $4\frac{1}{2}$  per cent. first and £120,500  $5\frac{1}{2}$  per cent. second) and for the requirements of the company's business.

**Traction and Power Securities Co., Ltd.**—The report states that the profit and loss account for the year to December 31st, shows a credit balance of £29,810, plus £5,185 brought forward, giving a total sum of £34,996 to be dealt with. Out of this the directors have transferred £25,000 to the investment reserve account, leaving a balance of £9,996 to be carried forward. The investment reserve account now stands at £160,000.—*Financier*.

**J. Stone & Co., Ltd.**—The directors have declared a dividend of 10 per cent. and bonus of 1s. per share (together 3s. per share) on the ordinary shares for the year to December 31st; £5,000 is placed to reserve and £49,380 carried forward. The *Financier* states that the directors are considering the advisability of subdividing the preference £10 shares into preference £1 shares.

**Hurst, Nelson & Co., Ltd.**—Owing to the stoppage caused by the coal strike, the directors recently informed the preference shareholders that they preferred to wait until the accounts for the year are completed before resolving upon payment of the preference dividend now due.

**Victoria Falls Power Co., Ltd.**—In regard to the paragraph published in our last issue, we understand that the preference dividend (6 per cent. per annum) there referred to as paid was for the period of nearly 15 months (from October 15th, 1909, to December 31st, 1910).

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended April 26th, 1912, amounted to 884,966, compared with 787,233 units in the corresponding four weeks of 1911.

**Consolidated Gas, Electric Light and Power Co., of Baltimore.**—The directors have declared a dividend of  $1\frac{1}{4}$  per cent. on the common shares for the quarter to June 30th.



## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 5th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. per lb.	22/-	..
a " Oxalic .. .. per lb.	23d.	..
a " Sulphuric .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. per ton	42/-	..
a Ammonia, Muriate (large crystal) .. ..	£29 10	..
a Bleaching powder .. ..	£5 10	..
a Bisulphide of Carbon .. ..	£18	..
a Borax .. ..	£16 10	..
a Copper Sulphate .. ..	£24 15	..
a Lead, Nitrate .. ..	£26 10	..
a " White Sugar .. ..	£25 10	..
a " Peroxide .. ..	£32	..
e Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks .. ..	33d.	..
a Potash, Caustic (88/90 %) .. ..	£22 10	..
a " Chlorate .. .. per lb.	33d.	..
a " Perchlorate .. ..	43d.	..
a Potassium, Cyanide (98/100 %) .. ..	74d.	..
(for mining purposes only)		
a Shellac .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ..	£6 10	..
a " Recovered .. ..	£5 10	..
a " Lump .. ..	£5 5	..
a Soda, Caustic (white 70/72 %) .. ..	£10 5	..
a " Chlorate .. .. per lb.	33d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. ..	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. ..	£70	..
b " Wire, in ton lots .. ..	£102	..
b " Sheet, in ton lots .. ..	£120	..
b Babbitt's metal ingots .. ..	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) .. ..	9d.	1d. inc.
c " Tube (brazed) .. ..	11d.	1d. inc.
c " (solid drawn) .. ..	9d.	1d. inc.
c " Wire, basis .. ..	9d.	1d. inc.
c Copper Tubes (brazed) .. ..	10 1/2d.	1d. inc.
c " (solid drawn) .. ..	11 1/2d.	1d. inc.
g " Bars (best selected) .. .. per ton	£94	£4 inc.
g " Sheet .. ..	£94	£4 inc.
g " Rod .. ..	£94	£4 inc.
d " (Electrolytic) Bars .. ..	£79 5	£2 15s. inc.
d " Sheets .. ..	£96 5	£2 15s. inc.
d " Rods .. ..	£84 5	£2 15s. inc.
d " H.C. Wire .. ..	10d.	1d. inc.
f Ebonite Rod .. ..	5/3	..
f " Sheet .. ..	4/9	..
n German Silver Wire .. ..	1/11	..
h Gutta-percha, fine .. ..	4/7 1/2	..
h India-rubber, Para fine .. ..	53/8	3 1/2d. dec.
i Iron Pig (Cleveland warrants) .. ..	£14	..
i " Wire, galv. No. 8, P.O. qual. .. ..	£17 10s.	15/- inc.
g Lead, English Pig .. ..	6/6	..
m Manganese Wire No. 28 .. .. per lb.	£8 5	..
g Mercury .. ..	6d. to 3s.	..
e Mica (in original cases) small .. ..	3/6 to 6/-	..
e " " " large .. ..	7/6 to 11/-	..
p Phosphor Bronze, plain castings .. ..	11d.	..
p " " rolled bars & rods .. ..	1/0 1/2	..
p " " rolled strip & sheet .. ..	1/1	..
o Platinum .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. per lb.	10 1/2d.	..
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. ..	£203 to £205	£8 dec.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/5	..
p White Anti-friction Metals .. ..	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) .. ..	£29 15	..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Shakespeare.	r W. F. Dennis & Co.
h Edward Till & Co.	

## STOCKS AND SHARES.

Tuesday Evening.

It cannot be said that Stock Exchange markets are in any particularly happy frame of mind. Though the mid-May settlement passed off with the disclosure of much less trouble than had been anticipated, the knowledge remains that weak accounts abound in several directions, and these will weigh upon prices until the public mood changes from caution to a more speculative feeling. Not a few members of the Stock Exchange look for the quietude to last during the summer months, and if this estimate is correct, there is not very much to go for at present.

The Home Railway market, after its severe shaking, pulled itself together and put a braver face upon its prices. The failure in the market was not unexpected, and it is thought that all the trouble is not yet over, various weak positions being known to exist. So

far as prices are concerned, the principal recoveries have been in Metropolitan, Districts and City and South London, while Central London issues have improved substantially. Metropolitan, which were down 5 1/4 last week, have rallied to the extent of 4 points. Districts, after their drop of 3, also rose 4. City and South London, which lost 4 last week, recovered its decline. Central London Ordinary and Deferred each regained 3 points of their 4-point losses, but the company's 4 per cent. Preferred stock is still weak at 85 middle, at which the yield is the substantial one for this class of security of 4 1/4 per cent., allowing for the accrued dividend in the price. Underground Electric started to recover, the company's shares and Income Bonds both rallying smartly. The 1s. "A" shares are 16s. middle. London United Tramways Preference regained 10s. in sympathy with London transport issues generally. British Electric Traction continue a dull market, although the only quotable change is a fall of a point in the 5 per cent. Perpetual Debenture stock.

Amongst English Electricity shares, County of London are hardening up again, and the Ordinary is up to 11 once more, while the Preference show 1/8 rise. Cities are quiet. The Ordinary shares, moving fairly freely, are nominally unchanged at 21, but the Preference went back another 10s. There is a scarcity of Bourne-mouth and Poole Ordinary, and although the official price is 9 1/2-10 1/2, sellers have been able to obtain as much as 10 1/2 this week. The list, as a whole, is steady, without any particular feature, liquidation in other parts of the House passing over this department and leaving it almost unscathed.

The feature in the Latin-Canadian group is the levelling up of prices of many of the bonds on to the basis of five dollars to the sovereign. On several occasions attention has been drawn here to the fact that in certain instances these bonds have been quoted on the basis of £102 14s. 10d. for the \$500 bond, but by a sensible rule the Stock Exchange ordered that from Saturday last all these exceptions should be quoted at the "flat" rate of 4s. per dollar. In consequence, a number of prices have been nominally raised, although the actual difference is nothing at all—a consideration entirely lost upon quite a number of estimable newspapers which commented upon the manner in which the prices of these bonds rose last Saturday. It is a good thing to have them all quoted in the same way, and it will render the market more popular than ever.

Sao Paulo Trams continue their monotonous rise, and after touching 260, reverted to 252 1/2, showing a gain of 8 points on the week. Mexican Light and Power Common shares have come into favour again, picking up their 2-point loss of a week ago. Mexico Trams put on 2, the progress of the revolution being regarded here as not unlike that of the silly strike of lightermen on the Thames. Rio Trams, supported largely by Continental buying, rose 4 1/2 points on top of their big advance of last week, the company's receipts for April being extremely good. The net earnings of £129,905 show an increase of £23,305. The rest of the changes in this section are caused mainly by the alteration in the manner of quotation just referred to.

Steady buying of Anglo-Argentine Tramways accounts for further rises in the prices of both Preference shares, while the 4 per cent. Debenture has crept up to within three or four points of par. Brisbane Trams have been put back to 7 1/2, but this *ex* everything—viz., 4s. dividend and bonuses of 20s. net in ordinary shares, with fractions in cash. Babcock & Wilcox shares, it may be mentioned here, are just halved in price by the deduction of the bonus, one new ordinary share having been given for every old Ordinary at present held. The capital being doubled, the yield on the shares, on the basis of the last dividend, works out to about 4 1/2 per cent.; but as the distribution will probably make a sensible difference to the dividend, it would be somewhat out of place to work out the return in the ordinary way, and for this reason we have taken out the yield figures in the columns which follow our quotations.

There is nothing much doing in Telegraph shares. Great Northern have started to regain part of their recent severe fall, and there is a little better feeling in the Anglo-American group. Amazons are a shade harder, and so are Westerns. The dividend of 1s. per share has been deducted from West India and Panama Ordinary, the price of which has recovered smartly, leaving a rise of 6s. 3d. on the week—this helps to confirm the impression mentioned in this column that the price would be put better as soon as the weaker brethren had got rid of their shares. Globes rose to 11 1/4 but Mackay Common shed 5 points upon American selling, although, curiously enough the Preferred shares are 1 higher. New York Telephone bonds went back a little on the new issue.

Buying has been resumed of National Telephone Deferred stock, the price of which showed a rise of 4 1/2, but Liverpool selling knocked off part of this. There are still left speculators hardy enough to deal in this dangerous security, speculators who maintain that the price to be paid by the Government will be agreed at a figure that will show a handsome profit on purchases made at anything below 160. As to that, however, time alone can show.

In the manufacturing division, Edison & Swan "A" shares put on 1/8, making the middle price 15s. On the other hand, Telegraph Constructions are £1 lower, and India-Rubber shares lost 5s. There is not much doing as a whole, and so far as the rubber market is concerned, dealings have again shrunk to a mere nothing.

**Sao Paulo Tramway, Light and Power Co.**—The directors have declared a quarterly dividend at the rate of 10 per cent. per annum.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 4th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 4th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9½-104	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 9	7½-7½	..	5 15 2
Do. 4½ % Pref. ....	10	4½ 4½	8½-9½	..	4 12 2	Do. 4 % Deb. ....	Stock	4 4	92-95	..	4 4 3
Do. Second 8 % Pref. ....	10	6 6	10½-11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ..	Stock	4½ 4½	80-84	..	5 7 2
Do. 4½ % Deb. Stock ..	Stock	4½ 4½	100-102	..	4 8 3	London Electric, Ord. ....	8	2 2½	1½-2	..	3 15 0
Brompton & Kensington, Ord. ..	5	10 10½	8½-8½	..	5 14 3	Do. 6 % Pref. ....	5	6 6	4½-5½	..	6 14 3
Do. 7 % Cum. Pref. ....	5	7 7	7½-8½	..	4 6 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	92-95	..	4 4 3
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	97-100 xd	..	4 0 0	Metropolitan ..	5	5 4	8½-4½	..	6 1 3
Charing Cross, West End & City	5	5 5	4½-5	..	5 0 0	Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½-4½	..	4 14 9
Do. 4½ % Cum. Pref. ....	5	4½ 4½	4½-4½	..	4 14 9	Do. 4½ % First Mort. Deb. ..	Stock	4½ 4½	101-104	..	4 6 7
Do. "City Undertaking" }	5	4½ 4½	8½-4½	..	5 2 10	Do. 8½ % Mort. Deb. ....	Stock	8½ 8½	85-88	..	3 19 7
Do. 4½ % Cum. Pref. ....	100	4 4	95-98	..	4 1 8	Midland Electric Corporation }	100	4½ 4½	96-98	..	4 11 10
Chelsea, Ord. ....	5	5 5	4½-4½	..	5 2 7	4½ % First Mort. Deb. }	5	5 5	4½-5	..	5 0 0
Do. 4½ % Deb. ....	Stock	4½ 4½	98-101	..	4 9 1	Newcastle-on-Tyne 5 % Pref., }	5	5 5	4½-5	..	5 0 0
City of London, Ord. ....	10	7 8	20-22	..	3 12 9	Non-Cum. }	100	5 5	97-100	..	5 0 .
Do. 6 % Cum. Pref. ....	10	6 6	16-18	..	3 6 8	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5 5	97-100	..	5 0 .
Do. 5 % Deb. ....	Stock	5 5	119-123	..	4 1 4	Notting Hill, 6 % Non-Cum. Pref.	10	.. 6	10½-11½	..	5 6 2
Do. 4½ % Second Deb. ....	100	4½ 4½	101-104	..	4 6 7	Oxford ..	5	7½ 7½	5½-6½	..	5 13 9
County of London, Ord. ....	10	5 5	10½-11½	..	5 7 0	St. James' and Pall Mall, Ord.	5	10 10	8-8½	..	5 14 3
Do. 6 % Pref. ....	10	6 6	11½-11½	..	5 1 1	Do. 7 % Pref. ....	5	7 7	6½-7½	..	4 15 0
Do. 4½ % Deb. ....	Stock	4½ 4½	108-110	..	4 1 10	Do. 8½ % Deb. ....	100	8½ 8½	85-87	..	4 0 6
Do. 4½ % Second Deb. ....	Stock	4½ 4½	100-103	..	4 8 3	Smithfield Markets, Ord. ....	5	Nil 2	1½-1½	..	6 8 0
Edmundson's, Ord. ....	5	Nil Nil	3-3½	..	Nil	South London, Ord. ....	4	5 5	2½-3½	..	6 8 0
Do. 6 % Cum. Pref. ....	5	Nil Nil	3-3½	..	Nil	Do. 5 % First Mort. Deb. ....	100	5 5	99-102	..	4 18 0
Do. 4½ % First Mort. Deb. ..	100	4½ 4½	85-89	..	5 1 2	South Metropolitan, 7 % Pref. ..	1	7 7	1½-1½	..	6 1 0
Folkestone ..	5	5 5	4½-4½	..	5 3 1	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	96-99	..	4 11 0
Do. 5 % Cum. Pref. ....	5	5 5	4½-4½	..	5 5 3	Urban, Ord. ....	5	5 5	2½-3½	..	3 6 8
Do. 4½ % First Deb. ....	100	4½ 4½	93-96	..	4 13 9	Do. 5 % Cum. Pref. ....	5	5 5	2½-3½	..	3 6 8
Hove ..	5	9 9	6½-7½	..	6 4 2	Do. 4½ % First Mort. Deb. ..	100	4½ 4½	86-88	..	6 2 3
				..	..	Westminster, Ord. ....	5	10 10	8½-9	..	5 11 1
				..	..	Do. 4½ % Cum. Pref. ....	5	4½ 4½	5½-6½	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	6 6	5½-5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	88-90	..	5 11 1
Calcutta, Ord. ....	5	8½ 8½	7½-7½	..	5 9 8	5 % 1st Mort. Deb. }	\$100	7 8	211-215	..	3 14 5
Do. 5 % Pref. ....	5	5 5	5-5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$500	5 5	39-42	..	11 18 2
Calgary Power, 1st Mort. Bds.	100	5 5	96½-98½	..	5 9 3	Northern, Lt., Power and Coal, }	Stock	10 10	240-250	..	4 0 0
Canadian Gen. El. Com. ....	\$100	7 7½	112-116	..	6 0 8	5 % 1st Mort. Bonds }	Do.	6 6	109-114	..	5 5 3
Do. 7 % Pref. ....	\$100	7 7	118-122	..	5 14 9	River Plate, Ord. ....	Do.	5 5	103-105	..	4 15 3
Cordoba Lt., Power and T., Ord.	1	3 3½	1½-1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ....	100	4½ 4½	99-101	..	4 9 1
Do. 5 % Deb. ....	100	5 5	94-97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5 5	103-105	..	4 15 3
Eleo. Lt. and P. of Cochabamba, }	100	6 6	95½-97½	..	6 3 1	Roy. Elec. Co., Montreal, 4½ % }	100	4½ 4½	99-101	..	4 9 1
6 % Bonds }	100	5 5	83-86	..	5 16 3	1st Mort. Deb. }	\$100	4 4½	140-144	..	3 9 5
Eleo. Supply Victoria, 5 % 1st }	100	5 5	95-97	..	5 3 1	Shawinigan Water, Capital ..	\$500	5 5	111½-113½	..	4 8 1
Mort. Deb. }	\$500	5 5	95-97	..	5 3 1	Do. 5 % Con. 1st Mort. Bonds }	Stock	4½ 4½	103-105	..	4 5 9
Elec. Dev. Ontario, 5 % 1st }	10/-	Nil ..	7-7½	..	Nil	Do. 4½ % Per. Deb. ....	Do.	4½ 4½	100½-102½	..	4 7 10
Mort. Bonds }	1	6 6	106-108	..	8 6 0	Toronto Power, 4½ % Deb. ....	100	5 5	92½-94½	..	5 5 10
Kalgoorlie Eleo. P. and L., Ord.	\$500	5 5	106-108	..	4 12 7	Vera Cruz Lt., P. and T., 5 % }	1	Nil 11½d.	88-88½	..	5 11 7
Do. 6 % Pref. ....	5	.. ..	2½-2½	..	..	1st Mort. Deb. }	100	6 6	105½-107½	..	5 11 7
Kamistiquia Power, 5 % G. Bs.	100	5 5	104-107	..	4 13 6	Victoria Falls Power, Pref. ....	1	Nil 11½d.	88-88½	..	5 11 7
Madras, Ord. ....	5	.. ..	2½-2½	..	..	West Kootenay Power and Lt., }	100	6 6	105½-107½	..	5 11 7
Melbourne, 5 % 1st Mort. Deb.	\$100	4 4	90½-92½	..	5 8 1	1st Mort. 6 % Gold }	100	6 6	105½-107½	..	5 11 7
Mexican El. Lt., 5 % 1st M. Bds.	\$100	4 4	91-93	..	4 6 0						
Mexican Lt. & Power, Common	\$100	7 7	105-107	..	6 10 10						
Do. 7 % Cum. Pref. ....	..	5 5	96-98	..	5 2 0						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	96-98	..	5 2 0						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½ 7½-7½	..	5 0 6	Monte Video Telephone, Ord. ..	1	6 6	1-1½	..	5 6 3
Do. 5 % Deb. Red. ....	Stock	5 5	97½-99½	..	5 6 8	Do. 5 % Pref. ....	1	5 5	100-103	..	5 14 3
American Telep. & Teleg., Cap.	\$100	8 8½	148-150	..	4 2 1	National Telephone, Pref. ....	Stock	6 6	151½-153½	..	..
Do. Collat. Trust ..	\$1000	4 4	95½-97½	..	4 9 7	Do. Def. ....	Do.	6 6	6½-6½	..	..
Anglo-American Telegraph ..	Stock	8½ 8½	65-67	..	5 9 7	Do. 5 % Non-cum. 3rd Pref. ....	5	5 5	99-100	..	4 10 0
Do. 6 % Pref. ....	Do.	6 6	108½-109½	..	5 15 5	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	14½-14½	..	4 13 0
Do. Def. ....	Do.	80/- 80/-	25½-26	..	4 16 2	Oriental Telep. and Eleo. ....	1	8 8	1½-1½	..	4 16 0
Anglo-Portuguese Tel., 5 % }	100	5 5	102-104	..	4 10 4	Do. 6 % Cum. Pref. ....	1	6 6	88-91	..	4 8 0
Mort. Deb. }	Stock	4 4	83-85	..	5 14 3	Do. 4 % Red. Deb. ....	Stock	4 4	99½-101½	..	3 18 10
Chili Telephone ..	5	7 7	7½-8	..	5 14 3	Pacific and European Tel., 4 % }	Do.	4 4	11-11½	..	3 9 7
Commercial Cable, Stlg. 4 % Deb.	Stock	10 10	16½-17½	..	5 14 3	Guar. Debs. }	8	5 5½	127-130	..	4 12 4
Cuba Telegraph ..	10	6 6	16½-17½	..	5 14 3	Reuter's ..	Cert.	6 6	99-101	..	4 9 1
Do. 10 % Pref. ....	10	10 10	7½-8	..	6 9 0	Submarine Cables Trust ..	Stock	4½ 4½	7½-7½	..	5 1 7
Direct Spanish Telegraph, Ord.	5	4 4	99-101	..	6 5 0	Telephone Co. of Egypt, 4½ % }	5	5 5	6½-6½	..	4 8 11
Do. 10 % Cum. Pref. ....	10	4½ 4½	99-101	..	4 9 1	Deb. Red. }	2½	2½ 2½	1½-1½	..	4 0 0
Direct United States Cable ..	10	4½ 4½	99-101	..	4 9 1	United River Plate Telephone	100	4 4	94½-97½	..	4 2 1
Direct W. India Cable, 4½ % }	25	4 4	97-100	..	4 0 0	Do. 5 % Cum. Pref. ....	10	1½ 1½	2½-2½	..	3 18 2
Reg. Deb. }	Stock	7 7	131-134 ex all	..	5 4 6	Do. 4 % Debs., 1 to 1,500 }	10	6 6	10½-10½	..	5 13 0
Eastern Telegraph, Ord. Stock	Do.	8½ 8½	78-81 xd	..	4 6 5	guar. by Braz. Sub. Tel. }	10	6 6	9½-10½	..	6 0 0
Do. 8½ % Pref. Stock ..	Do.	4 4	99½-101½	..	3 19 3	West India and Panama Teleg.	100	5 5	102½-104½	..	4 15 8
Do. 4 % Mort. Deb. ....	Do.	10 10	12½-13½	..	5 9 7	Do. 6 % Cum. 1st Pref. ....	10	7 7	13½-13½	..	5 1 10
Eastern Extension ..	10	7 7	12½-13½	..	..	Do. 6 % Cum. 2nd Pref. ....	Stock	4 4	98-100	..	4 0 0
Do. 4 % Deb. ....	Stock	4 4	99-101	..	..	Do. 5 % Debs. ....	\$1000	4½ 4½	100-103	..	4 7 5
East and S. Africa Tel. 4 % }	25	4 4	97-100	..	..	Western Telegraph, Ltd. ....	10	7 7	13½-13½	..	5 1 10
Mt. Db. Mauritius Sub. }	10	5½ 5½	11-11½	..	..	Do. 4 % Deb. ....	10	6 6	98-100	..	4 0 0
Globe Telegraph and Trust ..	10	6 6	13-13½	..	..	Western Union 4½ % Fdg. Bonds	100	4½ 4½	100-103	..	4 7 5
Do. 6 % Pref. ....	10	18 18	29½-30½	..	..						
Great Northern Telegraph ..	25	18 18	56-58	..	..						
Indo-European Telegraph ..	\$100	5 5	82-85	..	..						
Mackay Companies Common ..	\$100	4 4	70-73	..	..						
Do. 4 % Cum. Pref. ....	1	5 5	6½-6½	..	..						
Marconi's Wireless Telegraph	1	16 ..	5½-6	..	..						
Do. 7 % Cum. Partic. Pref.	1	.. ..	5½-6	..	..						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.



inl  
+ SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 4th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 4th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	Nil		Nil	Metropolitan Railway Consol. ..	100	13 17	66 1/2—66 3/4	+4	2 16 0
Do. 5 % Pref. ..	1	5	5		6 3 1	Do. Surplus Lands ..	100	2 3/4	66—68		4 4 7
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 8 5	Do. 3 1/2 % Deb. ..	100	3 1/2	89—91		8 16 11
Brit. Elec. Trac., 6 % Pref. ..	100					Do. 3 1/2 % Pref. ..	100	3 1/2	86—88		3 19 7
Do. Do. Deferred ..	100					Do. 3 1/2 % Con. Pref. ..	100	3 1/2	87—89		3 18 8
Do. Do. 6 % Cum. Pr'f. ..	100		6		6 7 8	Metropolitan District Ord. ..	100	Nil	44—44 1/2	+4	Nil
Do. 7 % Non-Cum. Pr'f. ..	100					Do. 6 % Deb. ..	100	6	144—146		4 2 2
Do. 5 % Perp. Deb. ..	100	5	5		5 3 1	Do. 4 % Deb. ..	100	4	96—98		4 1 8
Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	4 1/2		5 8 5	Do. 4 % Prior Lien ..	100	4	99—101		3 19 8
Central London Railway, Ord.	100	8	8	+3	3 13 2	Do. 4 1/2 % First Pref. ..	100	8 1/2	90—92		4 17 10
Do. Pref. ..	100	4	4		4 13 0	Do. 3 1/2 % Gtd. ..	100	3 1/2	76—78		4 9 9
Do. Def. ..	100	2	2	+3	2 8 9	Metropolitan Elec. Trams, Ord.	1	5 1/2	1 1/2—1		6 0 0
Do. 4 % Deb. ..	100	4	4		3 17 8	Do. Def. ..	1	Nil			Nil
City & South London, Ord.	100	1 1/2	1 1/2	+4	4 5 6	Do. 5 % Pref. ..	1	5	2 1/2—2 1/2		5 10 6
Do. 5 % Pref., 1891 ..	100	5	5		4 11 0	Do. 4 1/2 % Deb. ..	100	4 1/2	98—100		4 10 0
Do. Do. 1896 ..	100	5	5		4 15 3	Do. 5 % Deb. ..	100	5	98—100		5 0 0
Do. Do. 1901 ..	100	5	5		4 14 4	Potteries, Ord. ..	1	2	5 1/2—5 1/2		6 13 1
Do. Do. 1903 ..	100	5	5		4 15 3	Do. 5 % Pref. ..	1	5	5 1/2—5 1/2		5 0 0
Do. 4 % Deb. ..	100	4	4		3 19 3	Do. 4 1/2 % Deb. ..	100	4 1/2	87—90		5 0 0
Dublin United Trams, 6 % Pref.	10	6	6		5 2 2	South Metro. Trams, 6 % Pref.	1	6	11 1/2—11 1/2	xd	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil			Nil	Do. 4 % Deb. ..	100	4	72—77		5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	6		8 0 0	Underground Elec. Railways	10		4 1/2—4 1/2	+ 3/8	Nil
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2		5 18 5	Do. 4 1/2 % Bonds ..	100	4 1/2	99—101		4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	2 1/2		4 11 0	Do. 6 % Income ..	100	1	90—92	+2	Nil
Do. 4 % Deb. ..	100	4	4		5 0 0	Yorkshire (West Riding), Ord.	5	Nil	1 1/2—1 1/2		Nil
Lancashire United, 5 % Deb. ..	100	5	5		5 17 8	Do. 6 % Pref. ..	5	Nil	2 1/2—2 1/2		Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4		4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	80—84		5 7 2
London United Trams, 5 % Pref.	10	Nil									
Do. 4 % Deb. ..	100	4	4	-1	5 0 0						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2—5 1/2	+ 1/8	4 18 10	La Plata Elec. Trms, Ord. ..	1					
Do. 2nd Pref. ..	5	5	5 1/2	5—5 1/2	+ 1/8	5 4 9	Do. Pref. ..	1	6	6	2 1/2—1		6 0 0
Do. 4 % Deb. ..	100	4	4	95 1/2—97	+ 1/8	4 2 6	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6	1—1 1/2		4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	101 1/2—103 1/2	- 1/2	4 7 0	Do. 6 % Pref. ..	1	6	6	1—1 1/2		4 16 0
Do. 5 % Deb. ..	100	5	5	102—104 xd		4 16 2	Do. 5 % Deb. ..	100	5	5	95—99		5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	104—106		4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	100—102		4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 1/2—11 1/2		5 3 3	Manaos Trams & Lt., 1st Deb. ..	100	5	5	93—96		5 4 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98—100		4 10 0	Manila Elec. R. and Ltg., Bonds	\$1000	5	5	102 1/2—104 1/2		4 15 8
Do. 5 % 2nd Deb. ..	100	5	5	99—101		4 19 0	Mexico Trams Com. ..	\$100	7	7	123—125	+2	5 12 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 1/2—7 1/2 ex. all			Do. Gen. Con. 5 % Bonds ..		5	5	98 1/2—100 1/2		4 19 6
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2 xd		4 15 3	Do. 6 % Bonds ..	100	6	6	102 1/2—103 1/2		5 13 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103		4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7—7 1/2		6 15 7
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	140—144		5 11 1	Do. 6 % Pref. ..	5	6	6	5—5 1/2		7 0 4
Do. Pref. Ord. ..	100	6	6	126—129	+1	4 13 0	Do. 5 % 1st Deb. ..	100	5	5	100—102		4 18 0
Do. 5 % Pref. ..	100	5	5	111—114		4 7 9	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2		1 1/2—1 1/2		1 18 4
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	98 1/2—101 1/2		4 8 8	Do. 5 % 1st Deb. ..	100	5	5	101—104		4 16 2
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	103—105		4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2—5 1/2		5 6 8
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	104—106		4 5 0	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	99—101		4 9 1
Calcutta Trams, Ord. ..	5	6	7	6 1/2—6 1/2		5 5 8	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	140 1/2—142 1/2	+4 1/2	3 10 2
Do. 5 % Pref. ..	5	5	5	4 1/2—5 1/2		4 16 5	Do. 1st Mort. 5 % Bonds ..		5	5	106 1/2—107 1/2		4 13 3
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	100—103		4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	99—100	+ 1/4	5 0 0
Cape Electric Trams ..	1	Nil	2 1/2	2—2 1/2			Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	250—255	+8	3 18 5
City Buenos Aires Trams (1904)	5	5	5	5 1/2—5 1/2		4 10 6	Do. 5 % 1st Deb. ..	\$500	5	5	106—108 xd	+3	4 12 7
Do. 4 % Deb. ..	100	5	5	101—103		4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	79—82		5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94—98		5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	95—97	+2	5 5 3
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101—104		4 16 2	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2—6		6 1 11
Kalgoorlie Elec. Trams ..	1	Nil		2—2 1/2		Nil	Do. 6 % Pref. ..	5	6	6	5—5 1/2		5 14 3
Do. 5 % A Deb. ..	100	5	5	91—94		5 6 6	Do. 5 % 1st Deb. ..	100	5	5	100—103		4 17 1
Do. 5 % B Deb. ..	100	5	6 1/2	56—60		10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	104 1/2—106 1/2	+1 1/2	4 4 6

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	1 1/2—1 1/2		7 7 8	Dick, Kerr ..	1	5		2 1/2—2 1/2		5 3 1
Do. 6 % Pref. ..	1	9	6	2 1/2—2 1/2		7 2 2	Do. Pref. ..	1	6	6	1 1/2—1 1/2		5 12 11
Babcock & Wilcox ..	1	26	28	3 1/2—3 1/2 xd			Do. Deb. ..	100	4 1/2	4 1/2	97—100		4 10 0
Do. Pref. ..	1	6	6	1 1/2—1 1/2		3 13 10	Edison & Swan, A. £3 paid	5	Nil				Nil
B.I. & Helsby Cables ..	5	10	10	7—7 1/2		6 13 4	Do. fully paid ..	5	Nil				Nil
Do. Pref. ..	5	6	6	6—6 1/2		4 12 4	Do. 4 % Deb. ..	100	4	4	68—72		5 11 1
Do. Deb. ..	100	4 1/2	4 1/2	101—103		4 7 5	Do. 5 % Second Deb. ..	100	5	5	75—78		6 8 2
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	91 1/2—94 1/2		4 15 3	Electric Construction ..	2	Nil	2 1/2	1—1		
British Westinghouse, Pref. ..	8	Nil				Nil	Do. Pref. ..	2	7	7	1 1/2—2		7 0 0
Do. Deb. ..	100	4	4	63—66		6 1 3	Greenwood & Batley, Pref.	10	7	7	7 1/2—8 1/2		8 5 8
Do. 6 % Prior Lien ..	100	6	6	100—103		5 16 6	Do. Deb. ..	100	5	5	94—96		5 4 2
Browett, Lindley, Ord. ..	1	Nil		1/6—2/6		Nil	General Electric, Pref. ..	10	5	5	9—9 1/2		5 5 3
Do. Pref. ..	1	Nil		5/6—6/6		Nil	Do. Deb. ..	100	4	4	85—90		4 8 11
Brush, 7 % Pref. ..	2	Nil		0—1		Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2—12 1/2		6 0 0
Do. 5 % Prior Lien Deb. ..	100	5	5	77 1/2—82 1/2		6 1 3	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2—5 1/2		4 6 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	54—59		7 10 6	Do. Deb. ..	100	4 1/2	4 1/2	101—103 xd		4 7 5
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	87—92		10 14 4	India-Rubber, G. & T. ..	10	10		8 1/2—9 1/2	- 1/2	
Callender's Cable ..	5	15	10 1/2	10 1/2—11 1/2		6 10 5	Do. Pref. ..	10	5	5	94—10 1/2		4 17 7
Do. Pref. ..	5	5	5	5—5 1/2		4 15 3	Telegraph Construction ..	12	20	10 1/2	33—35	-1	6 19 5
Do. Deb. ..	100	4 1/2	4 1/2	99 1/2—101 1/2		4 8 8	Do. Deb. ..	100	4	4	99 1/2—101 1/2		4 9 0
Castner-Kellner ..	1	17 1/2	20	3 1/2—8 1/2 xd		5 10 2	Willans & Robinson ..	1	Nil		1 1/2—1 1/2		Nil
Do. Deb. ..	100	4 1/2	4 1/2	105—109		4 10 7	Do. Pref. ..	5	Nil		1 1/2—1 1/2		Nil
Crompton & Co. ..	8	Nil	Nil			Nil	Do. Deb. ..	100	4	4	58—60 xd	+1	6 13 4
Do. Deb. ..	100	5	5	58—68		7 7 1							

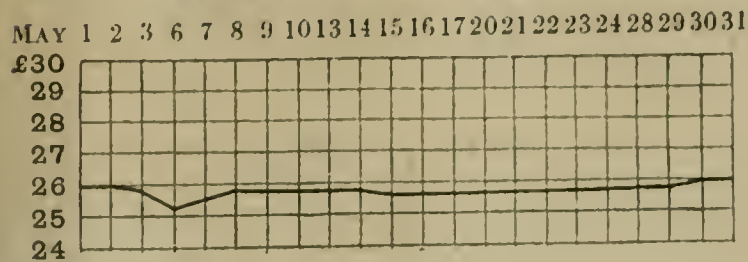
\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



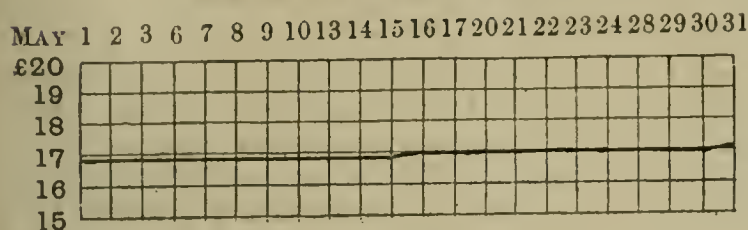
## METAL MARKET.

Fluctuations in May.

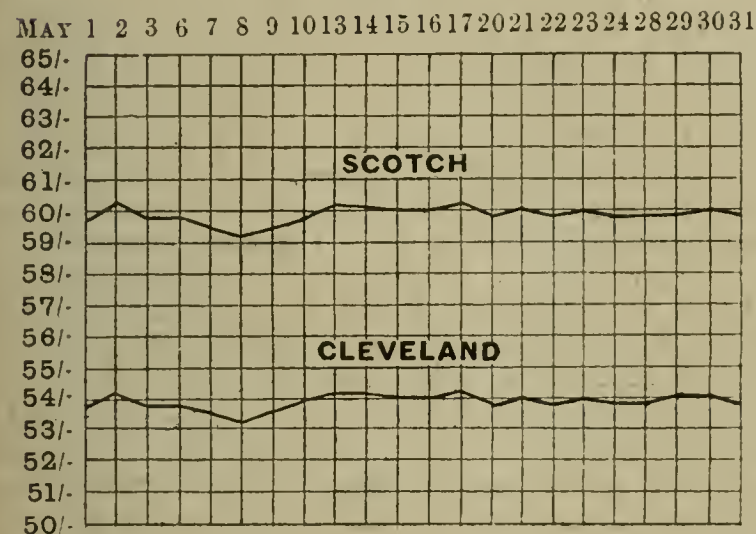
### SPELTER (G.O.B's.).



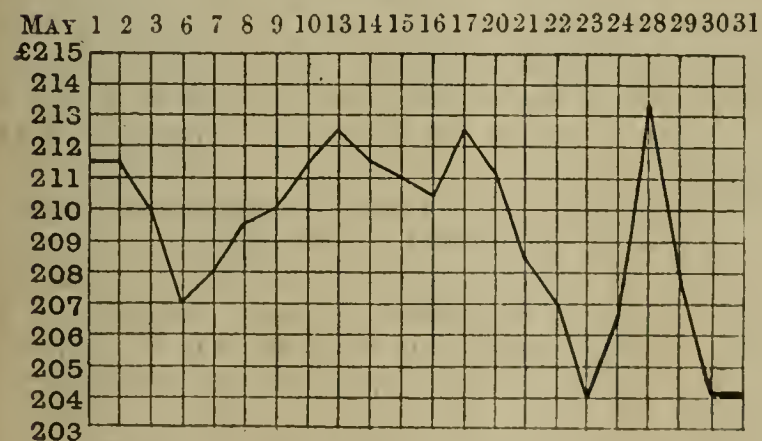
### LEAD (ENGLISH).



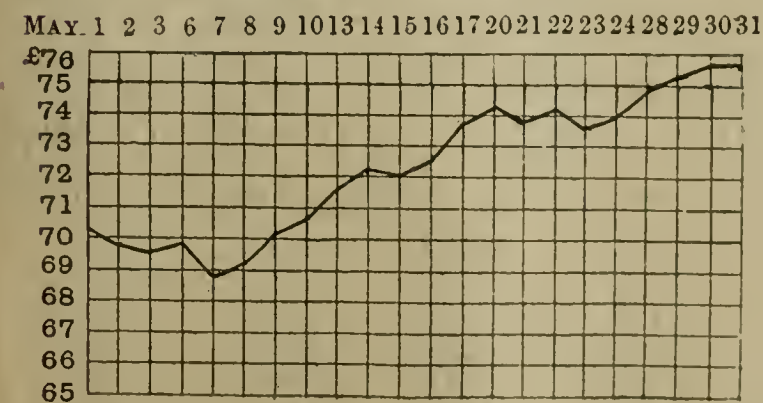
### IRON.



### TIN.



### COPPER (G.M.B's.).



## THE AUSTRALASIAN TRAMWAY OFFICE<sup>on con-</sup> ASSOCIATION<sup>tion</sup>

We have had sent to us a copy of the proceedings at the third annual conference of the above Association, which was held at Adelaide on October 31st, November 1st, 2nd and 3rd, last year.

Mr. O. W. Brain, M.I.E.E., electrical engineer to the New South Wales Government Railways and Tramways, Sydney, presided, and 23 members of the Association, representative of the various tramway undertakings in the Commonwealth, were present.

The president, in his opening address, stated the Association represented 17 undertakings, having £11,387,513 invested in them, with an annual revenue of £3,182,065, a staff totalling 12,469 employes and carrying over 471,000,000 passengers per year.

He then went on to consider the methods in use on the Continent of Europe and the United States to extend the area of service by the employment of high voltages, and expressed the view that the 1,000 or 1,200-volt direct-current method was the one best fitted to meet Australian needs.

The papers read at the conference included a description of the Adelaide tramways system, by Mr. W. G. T. Goodman, M.I.C.E., M.I.E.E., the engineer and manager, a paper on "Steel Tyred Wheels and Axles," by Mr. F. B. Shenstone, works manager, New South Wales Government tramways, and another on the "Use of Meters on Cars," by Mr. C. H. Wickham, A.M.I.E.E., the rolling stock superintendent of the Adelaide tramways system. Two papers were then presented dealing with sinking funds, namely, one by Mr. C. A. Smith, accountant to the Municipal Tramways Trust, Adelaide, on "Depreciation and Sinking Funds," and one by Mr. W. A. Strangward, secretary to the Prahran and Malvern Tramways Trust, Victoria, on "Depreciation Reserves and Sinking Funds." This latter was largely a reply to certain points advocated by Mr. Smith, who had rather minimised the necessity of provision for obsolescence, considering that, like earthquakes, the need for definite provision was unnecessary. Mr. Strangward took exception to this, maintaining that it was a real and important risk which needed special provision. He instanced his own company, the Melbourne Tramways Trust, which had at the moment a cable system costing nearly two millions, which it was proposed soon to supersede with an overhead electric system. Here very little of the cable cost could be utilised, and had not a sinking fund for this purpose been established and maintained, which would go far towards wiping out the cost of the conversion, the financial burden to be borne by the electrified system would be very onerous. Mr. Strangward's contention was that while it was unnecessary to hand down a tramway system to the next generation free of debt, we should certainly endeavour to bequeath to our successors assets to the full value of the debt thereon.

The last two papers were by Mr. James Coghlan, A.M.I.E.E., station superintendent at the Adelaide Station, on "The Operation of Steam Turbines and Turbo-Alternators;" and by the secretary of the Association, Mr. S. Russell Booth, secretary of the Adelaide Tramways Trust, upon "Discipline." In view of events following after this conference, the strike at Brisbane and the claim brought by the men's Union for higher wages and improved conditions of service, it is interesting to note the spirit animating the responsible officials of the undertakings. Mr. Booth pointed out the necessity for proper training, so that doing the correct thing became almost a habit, thus leaving the mind freer to deal with emergencies. The importance of loyalty and obedience were insisted on, and the effect of the observance of these not only on the undertaking but on the individual was insisted upon.

The writer was complimented upon the tone and spirit of the paper, various speakers emphasising special points of the subject. One mentioned how personal and general tidiness had much to do with efficiency, and another recommended as much sympathy as possible between all grades of the service. In his reply, Mr. Booth spoke of the importance of cultivating the sympathetic feeling of mutual loyalty and help. He referred to the club they had established at Adelaide, with its special rooms, committees on which officials and workers equally served, and the way in which the interchange of opinions on matters of mutual interest was carried on. It is to be hoped that after the present fights are over the various parties, in the spirit manifested in this discussion, will bury the hatchet, and endeavour to maintain the Australian tramway systems in the position they have already reached in the tramway world.

Various votes of thanks concluded the proceedings, Mr. P. J. Pringle remarking that he considered the discussion on the papers compared very favourably with those at similar gatherings at home.

Mr. Goodman, the chief engineer and general manager of the Adelaide Tramways Trust, was elected President of the Association for the present year, and Mr. Badger, of the Brisbane Tramways Co., first vice-President. It was arranged that if possible the next conference should be held at Brisbane.

**Stow-on-the-Wold Lighting.**—The Rural Electric Supply Co. has applied to the R.D.C. for permission to use overhead lines for the supply of current to Bourton-on-the-Water, where promises to take current equivalent to between 500 and 600 lights have been given. Over 500 persons signed in favour of the request being granted, but the Council has referred the matter to a parish meeting for approval.

**Acton Electricity Supply.**—Councillor G. W. Page has again been elected chairman of the Electricity Committee, and negotiations are being continued with the Metropolitan Electric Supply Co. in respect to questions of finance in dispute, respecting the terms of the transfer to the company of the Council's undertaking.



## THE USES OF COPPER-CLAD IRON WIRE.

IN view of the high cost of copper on the one hand, and the liability to corrode of iron or steel on the other, it is not surprising that numerous attempts have been made to protect steel wire from the effects of atmosphere by giving it a copper coating and to use this for many purposes where copper wire has been considered essential, more especially in connection with electric transmission work. Some of these attempts have not proved successful, but the duplex wires manufactured on the Monnot patent have demonstrated their value to such an extent, that it is worth while referring briefly to some of the experiments and tests which have been made on such wires by the Duplex Metal Co., of Chester, Pennsylvania, and the experts who have been interested in the subject.

Before doing this it may be interesting to mention one or two of the earlier attempts. The first was probably made by Farmer and Milliken, who wrapped a copper strip round a steel wire and then tinned the complete wire. This was not much used commercially. In 1880 Martin in France made bi-metallic wire by the method, it is believed, of casting a sleeve of copper round the middle of a steel ingot, heating the combination and passing it through rolls, so that the copper spread in both directions of the steel, producing a rod which was afterwards drawn into wire. The cost of production was probably fairly high. In 1883 bi-metallic compound wire was formed by electro-depositing copper on steel wire. This, however, was not equal to a weld, and electrolytic effects were observed. Moreover, the cost of deposition is somewhat high. A practical improvement on Martin's work was, however, achieved by Monnot, who established the company mentioned above in 1905 to manufacture billets of compound metal under his patents, weighing 20 lb. each. At the present day these billets are made of 800 lb. weight. The process of manufacture is to take steel billets of any suitable composition, which are rolled to  $5\frac{1}{16}$  in. round, and the bar is cut into 26-in. lengths. The ends of these billets are then drilled and tapped, and after being pickled and washed, the billets are given a preheating. The billet is then drawn inside a tube by means of a rod and a bushing screwed into the billet. This rod slides up and down in the centre hole of a three-jawed chuck which holds the tube and centres the billet in it. A steel flange is then screwed on to the bottom of the billet, forming with the tube a mould in which the billet is the core. The mould and billet are carried to a furnace of special design containing specially-prepared molten copper. The billet with its attached flange is then lowered out of the tube into this copper, being kept there for a sufficient time to wet the surface of the steel and form with it an alloy. When the reaction has reached a certain point the billet is drawn into the tube again and the whole is carried to a second furnace of the pit type, whose pots contain the purest commercial copper. The tube with its contained billet is lowered into the crucible; the molten copper rushes in through two openings in the top of the tube, unites with the alloyed areas and fills the mould. The tube is then withdrawn from the crucible, and when the copper is set, the chuck, rod and flange are unscrewed, the copper-clad billet is pushed out of the mould, and after the necessary preliminary heating, it is rolled to any required size and shape in a manner generally similar to the way in which steel is handled. In connection with this process, for the particulars of which we are indebted to an article by Mr. W. Tassin, in the *Chemical Engineer* of July, 1910, it may be said that although there is a difference between the physical properties of copper and steel, the two metals when welded by this process flow practically as one, and the proportional areas of copper and steel remain practically constant from the larger to the smaller passes in the rolls. There is a considerable amount of expense in crucibles, fuel, copper refining, copper lost as oxide, steel lost in oxide and scrap, and in addition the metal has to be rolled very carefully, and the drawing costs more than twice as much as that of the copper wire, if not for any other reason than that of speed. In spite of this, however, it appears quite evident that the duplex wire thus formed is well worth the attention of electrical engineers.

As regards the physical constants of the material, some tests made by the Ordnance Department of the United States Army at the Watertown Arsenal, Massachusetts, give the following figures:—

True elastic limit ... ..	50,825 lb. per sq. in.
Johnson elastic limit ... ..	66,675 " "
Modulus of elasticity before stressing ...	21,400,000 lb.
Modulus of elasticity after stressing ...	22,637,500 "
Tensile strength per square inch after repeated stresses ... ..	90,275 "

Some similar samples were also sent to the National Physical Laboratory, Teddington, where the modulus of elasticity was determined to be 23,100,000 lb. per square inch, while the linear coefficient of expansion for 1° C. was found to be 0.000012. This is only two-thirds that of copper and half that of aluminium, and owing to this small coefficient of expansion, combined with high elastic limit, it will be seen that very favourable conditions as to small variations in sag with great variations in temperature can be obtained. Where river crossings and power spans are under consideration special calculations have to be made, taking into account the loads of sleet and wind, for which provision has to be made, but for ordinary telephone service, for example, where pole spacing usually is 40 to the mile, it appears to be quite safe to use an increased span of 50 per cent. to 100 per cent., this giving fully as strong a line with copper-clad wire as is obtained with ordinary galvanised wire on the present spacing. For bond wire and other special uses, the Monnot wire is annealed, and it is then almost as pliable as soft-drawn copper wire. Bare copper-clad wire can be produced in this way in practically any form in which copper wire is made, that is to say, it may be either round, square, elliptical or flat. The only exception to this is the grooved trolley wire used in tramway undertakings, inasmuch as, in forming the groove, it is necessary so to gouge out the copper that it is cut through to the steel. Although probably the wire would wear out before appreciable corrosion occurred, it is necessary to point out this exception. Unless otherwise specified, the bare wire is always drawn hard, so as to give the highest possible tensile strength. In addition to bare wire, stranded products are also made. These are of two grades, electrical and mechanical. For the latter the same guarantee is given as for copper wire for mechanical purposes as regards strength, weld and non-corrosion, while for electrical purposes conductivity is also guaranteed. Weather-proofing and insulation can be accomplished by the ordinary methods, and if care is used in tinning there is no difficulty in applying rubber insulation.

Some particulars of the regular specification for 40 per cent. copper-clad steel wire may be interesting. The test of the weld is that the wire, when broken by torsion, shows no separation of the copper from the steel. Similarly, if the wire is broken by repeated bending, or if it is heated to a dull red and then quenched with iced water, there shall be no separation of the two metals. In the wire rod before drawing, when the surface is properly polished and etched, the alloy film is distinctly visible under a microscope. The wire in all shapes is free from all surface imperfections not consistent with the best commercial practice, and is accurate in diameter. The permissible variations from normal diameters are for wires  $\frac{1}{8}$ -in. and larger in diameter, 1 per cent. over or under; for wire  $\frac{1}{16}$ -in. to  $\frac{1}{8}$ -in. in diameter,  $1\frac{1}{2}$  per cent. over or under, and for wire less than  $\frac{1}{16}$ -in. diameter 2 per cent. variation is permitted. The breaking

Diameter in inches.	Breaking weight.	Diameter in inches.	Breaking weight.
0.460	10,000	0.128	1,200
0.410	8,300	0.114	975
0.365	6,850	0.102	800
0.325	5,700	0.091	650
0.289	4,800	0.081	510
0.258	4,000	0.072	410
0.229	3,200	0.064	330
0.204	2,600	0.057	250
0.182	2,200	0.051	200
0.162	1,800	0.045	165
0.144	1,450	0.040	130

weight of 90 per cent. of the coils tested must be at least equal to the value stated in the table above, while the remaining 10 per cent. of the coils are not allowed to be more than 5 per cent. below these values; the breaking



weight of tinned wire is taken at 90 per cent. of the values given in the table on the previous page.

For electrical purposes the conductivity is determined by resistance measurements at a temperature of 75° F. The conductivity of 40 per cent. copper-clad steel wire is to be 35 per cent. of that of the same size and length of copper wire. For 30 per cent. material the conductivity may be as low as 25 per cent., while for 47 per cent. material the minimum conductivity is 45 per cent. of the same size and length of copper wire.

It will be interesting to make a *résumé* of the practical uses of this wire. For telephone work copper wire will not be absolutely displaced by it. For very long toll lines and for small wiring cable copper is still the best material; but in open-line distribution money can be saved by using a smaller copper-clad wire instead of standard copper, so making a saving of, perhaps, 40 or 50 per cent. in first cost, while obtaining greater strength than is furnished by copper; or an equal size of copper-clad wire can be used with a first-cost saving of 10 or 15 per cent., with a reduction of maintenance cost of, at least, 75 per cent.

For subscribers' connections the copper-clad twisted pair is claimed to show a saving in first cost over standard copper, the copper-clad having the same strength as copper, while weighing less than half as much, and, owing to its smaller size, supporting easily a greater weight of sleet than copper will. The difference of weight means a large saving in the cost of handling the wire. As compared with galvanised iron wire, it will be seen that no allowance need be made on the duplex metal for loss of strength due to rust.

For telephone lines up to at least 200 miles No. 9 Brown and Sharpe gauge copper-clad wire gives practically perfect results, costs less than copper, and is stronger, and the Great Northern Railway system of America has installed this size of duplex wiring for telephone train dispatching. This means nearly 9,000 miles, or 1,800,000 lb. of duplex metal.

In addition to this, duplex wire is rapidly becoming standard material for municipal, fire, and police telegraphs. The City of New York has several hundred miles in use, some of which have been at work for over three years, the importance of a strong wire for this purpose being recognised. Other cities are following this example, the decision not being reached on a cost basis, but on account of strength. Over 60 railways in the United States are using copper-clad duplex metal wires in their signal systems, where the mechanical strength of the duplex metal wire has shown itself superior both to copper and to galvanised wire. For bond or tie-wires it is being largely adopted, as the difference of conductivity between these bonds and those of galvanised iron is most apparent. While the first cost of the copper-clad bond is much above that of the galvanised type, the difference is made up in a short time by the saving in cost of current. The bonds can be made theft-proof by sherardising them in order to produce a surface exactly like galvanised iron bond-wire.

The principal uses for the wire which will interest electrical engineers, however, are in connection with electric power transmission and electric railways. As regards the former purpose, copper-clad wire was first used as a guard-wire for lightning protection, inasmuch as galvanised wire, when used for this purpose, rusted. When copper was tried, it was found that the usual span in power transmission required an excessively large size of copper in order to sustain its own weight. Copper-clad wire then came into use over river crossings. The Great Western Power Co., in California, has had in service for over two years seven 3,100-ft. spans and seven 2,600-ft. spans of this wire. Later, in 1909, the Canadian Niagara Power Co. utilised the metal in four 4,000-ft. spans to cross the Niagara River, while a year later 16 more spans were used, owing to the fact that no other material ever stood up so well under the conditions of service in this locality. For telephone line service, for generating stations and distributing stations, a great deal of duplex wire has been used, because it can be strung on to the poles carrying the transmission line, whereas if bare copper were used it would be necessary to run a separate line to carry it. Many secondary circuits running from transformers to consumers carry so little current that the copper wire used is based on strength, and not on resistance. In such places copper-clad wire can be used to

great advantage, and, in addition to this, a great series arc and series incandescent circuits are operated with duplex wire, the requisite here also being strength, and not conductance. In electric railways, besides telephone and signal lines, it is found that copper-clad wire is especially useful for curves, as its high strength permits the curve to be kept up tight, while it wears about half as fast as copper. It has been used on the Williamsburg Bridge, connecting New York with Brooklyn, and before the company mentioned sold a foot of trolley wire, 3,000 ft. of No. 4 B and S gauge duplex wire had been used by 800,000 cars on this route. In places of dense traffic the slow wearing property of the duplex metal wire becomes very valuable, because in such cases a break in the wire means stoppage of the cars or trains, which again means a heavy loss of money. For high-speed transit, although copper-clad wire has increased resistance, its good wearing properties are most valuable, and it has, therefore, in many cases been found advisable to increase the section of the feeders, in order to compensate for the increased resistance of the duplex metal, and at the present time copper-clad trolley wire is in use, or under test, by over 200 electric traction systems in the United States.

From the above notes, therefore, it is evident that a distinct development in the materials for electric power transmission has been obtained by Mr. Monnot's invention, and in view of the increasing use of overhead transmissions for heavy power purposes, it is highly advisable that British engineers should take into consideration the possibilities of this material.

---

## REVIEWS.

---

*The Induction Motor.* By B. F. BAILEY. London: Hill Publishing Co., Ltd. Price 10s. 6d. net.

The author in his preface admits the existence of many excellent works dealing with the induction motor, and proceeds to justify the issue of his own book on the subject by the following rather vague and involved sentence: "The endeavour has been to produce a work that will have the greatest possible value for those who wish to inform themselves more fully regarding the theory of the induction motor than they can by studying the elementary text-books, but who, at the same time, do not care to go too deeply into the theoretical aspects of the question."

The reviewer is inclined to take this sentence, in which the author summarises his purpose, as being typical of his execution also. The chief defects of the book (and such defects cannot be unimportant when they are found in a text-book intended for the use of students) are a general looseness in style and in reasoning and a tendency to deal in generalities in a way which makes it difficult for the reader to gather either clear ideas or exact knowledge. In this connection, one more passage may be quoted from the preface. "It is the writer's belief that nine-tenths of the trouble experienced by many people in studying the action of electrical machinery comes from the lack of a clear idea of the elementary physical actions. An attempt is made to apply mathematical reasoning to the problem before this understanding is obtained, and the result is a mental haze, which is, perhaps, never dissipated." It has seemed to the reviewer that it is just in the explanation of the physical actions that the author is least successful, and that the last sentence which has been quoted might be applied not unfairly to the more theoretical parts of the author's own book.

The first chapter deals with the elementary theory of the induction motor and leads up to a simple vector diagram of the currents, voltages and fluxes of the motor. The theory is presented in a rather general form of discussion, which would be much helped by a better selection of diagrams and more exact reasoning. A good diagram and more concrete presentation of the matter would have made impossible such statements as the following (p. 13): "As soon as we put load on a motor, current is produced in the rotor, and this current tends to produce a flux through the air-gap. This



ould be in the same direction as the rotor current, and consequently nearly at right angles to the main flux." Is such a statement as this calculated to promote "a clear idea of the elementary physical actions?"

The second chapter carries the theory further, and in it is developed a more complete form of diagram for the motor, in which the losses are taken into account. The diagram is practically equivalent to the Heyland form, but with the modifications which are usually found in American textbooks. Whatever may be said in favour of the Heyland diagram from the point of view of its utility in practice, it can hardly be described as likely to give "a clear idea of the elementary physical actions" of an induction motor to a student, without a much more careful introduction than we find in this book.

In this chapter, again, we find statements which are calculated to produce entirely wrong impressions on the student's mind. Thus, on page 17, we read "For example, it will be evident at once (it was *not* evident at all to the reviewer) that doubling the number of turns on the rotor and at the same time making the cross-section of the conductors half as great, would in no way change the characteristics of the machine. Hence, in general we are at liberty, in developing the theory, to choose the ratio of the rotor to stator winding, which gives the simplest ratio. For this reason we choose the ratio of one to one." Accordingly, the diagram which is to show the behaviour of the induction motor is constructed for a motor having equal turns in the stator and rotor windings. This would be quite legitimate, if its application to a real motor having a different ratio of windings were subsequently explained. How completely the author has forgotten the real motor, and how far he has confused actual conditions with hypothetical ones, is shown in the definition which he gives for the leakage coefficient of an induction motor on page 26. He defines this coefficient as "the ratio of the magnetising current to the rotor current of the motor with the rotor locked, and assuming that the rotor has only reactance and no resistance." This definition could only be correct for his ideal motor, and is absolutely untrue and misleading when offered as a general statement.

The measurement of torque in terms of units called "synchronous watts" has often been criticised as tending to produce confusion between units of power and units of torque, which are of different dimensions. What would the critics have to say of the following sentence (page 24)? "The *mechanical output* of the motor is evidently  $D(1 - s)$ , where  $D$  is the *synchronous torque*." It is to be remembered that the factor  $(1 - s)$  is here a pure numeric,  $s$  being the slip expressed as a fraction. No hint is anywhere given that power and torque cannot be measured in the same units, and that they can only have a *numerical* equality.

Chapter IV deals with starting devices, and in it are described and illustrated a number of forms of starters, auto-transformers and protective devices. There follow chapters on variable-speed motors, general considerations relating to design, an example of a design, special types of motors, single-phase motors and single-phase commutator-type motors. These chapters contain a good deal of interesting information, most of which is, however, easily available from other sources, while its presentation has hardly sufficient merit to form a strong recommendation for the author's work.

The book will, perhaps, prove more useful to American readers than to readers here, on account of the illustrations of American apparatus which it contains. In this country, the reviewer does not anticipate that it will meet with a wide circulation, or that it will fill any general want.

*Radio-Telegraphists' Guide and Log-Book.* By W. H. MARCHANT. London: Whittaker & Co. Price 4s. 6d. net.

The author's object has been to provide a book useful to those engaged in the practical operation of wireless stations, and in this he has succeeded. The introductory chapter surveys the principles and developments of wireless telegraphy. Possibly the author assumes too great familiarity with the subject in parts, at least as judged by the ele-

mentary matter occasionally interspersed. In later sections of the volume greater practical knowledge might safely have been assumed in a number of places. The expert operator would probably appreciate a wider and more critical treatment of the arrangement of transmission circuits than is actually given in Chapter II. The descriptions of individual systems of working are well arranged and most instructive. There seems no reason why the variometer notes (pp. 91-2), should not be included in Chapter IV. Improved forms of condensers and other accessory apparatus might have been discussed at greater length, and there are quite a number of new detectors which should have received some mention. More attention should have been paid to the selection of telephone receivers and the conditions for maximum sensitivity, and examples might well have been given to enable operators to design inductances, &c., for temporary or permanent use.

Military wireless sets are well treated, but no information is given concerning the numerous special equipments recently designed for, and adopted by, fishing vessels, &c. In a later edition the author will probably deal with wireless telephony; this subject is already of great interest to every wireless operator, and there can never be any such distinction between wireless telegraphy and telephony as exists between the two means of communication over wires.

We should have liked more information concerning directive wireless telegraphy and more definite particulars regarding the relative merits of various detectors and the relationship between transmitting power, aerial dimensions and distance of effective transmission.

The book is admirably illustrated, and has a serviceable index. The tables and curves, &c., in the appendices are most useful, and the list of stations (transmitting commercial messages), with their code calls, ranges, wave lengths and hours of attendance will be much appreciated by users. A complete list of all wireless stations of any importance, preferably illustrated by a map, would be very valuable.

We are inclined to think that some of the matter included in the text will be redundant so far as operators are concerned, though it will be quite necessary and interesting to the general reader. With regard to the log-book which forms such a feature of the volume, this is quite useful, but many operators will prefer an independent log volume, and we question whether the cost of inclusion of the log sheets might not better have been devoted to expanding the information given in the book itself (for example, in quoting quantitative data drawn from the author's experience, standard results to be expected in working, and so on). If the log-sheets are retained in later editions, the width of the columns might well be increased by sacrificing some of the present marginal allowance.

*Manual of Wireless Telegraphy for the use of Naval Electricians.* By COMMANDER S. S. ROBISON. London: S. Rentell & Co., Ltd. Price 7s. 6. net. Second Edition.

The information given in this work of 212 pages has a distinct leaning towards the practical working side of the subject, and should, therefore, fill a requirement much felt in the literature of wireless telegraphy. It is primarily intended for use in the U.S. Naval Institute, and it is this particular field of usefulness that the author has had mainly in mind in framing the work. It is, therefore, to a large extent a set of instructions as to the manner of construction and use of wireless installations, together with a sufficient amount of technical information and theoretical matter to render the whole an intelligent and concise explanation of the subject. Details of working adjustments and tests are fully treated. The work has been considerably revised and added to by Dr. Austin, and, as a result, its value has been much enhanced since its first publication.

Some of the diagrams, especially those relating to the disposition of lines of electric and magnetic flux, are crude and wanting in accuracy, but on the whole the illustrations, of which there are some 115, are good and clear.

A chapter on wireless telephony, and appendices of useful electrical tables and data, form features of the work. The latter are much fuller than usual in works on wireless telegraphy, and are of a very useful character.



The work has much to commend it, and should be specially useful to those concerned in the practical operation of wireless telegraph stations.

Chapter V on transmitters is especially good, and describes various methods involving the use of modern rotating spark gaps giving musical transmission. Chapter VII on installation and adjustments is also a commendable one.

*Dynamo and Motor Attendants and their Machines.* By F. BROADBENT. Sixth Edition. London: S. Rentell & Co. Price 1s. 6d. net.

In revising this book the author has rewritten the introductory chapters, those on starting and controlling switches, on testing motors for horse-power and on A.C. motors. The addition of information on accumulator charging and the paralleling of alternators has increased the value of Chapter 8, but a short, independent chapter on accumulators and their charging would be preferable to the present arrangement. In the next edition it would be well to give attention to the arrangement and care of the special, more or less, "automatic" house lighting equipments which are gaining such popularity.

Chapter 5, on choosing a dynamo or motor, might with advantage include notes on the considerations governing the choice of type of winding. The information in Chapter 1 might well be distributed between Chapters 6 and 8, and, by collecting all the notes on faults and breakdowns in one place, considerable space might be saved without detracting from the importance which is rightly attached to this subject, and without sacrificing the clearness and accessibility of the information presented.

The new chapter on the brake horse-power of motors deals with the subject in a manner admirably suited to the class of readers concerned. A few simple diagrams would undoubtedly facilitate the comprehension of the otherwise excellent notes on the principles of alternating-current motors: repulsion and single-phase commutator motors deserve rather longer treatment than is actually given, space for such additional matter being found by reducing the size of a number of the present line blocks. The illustrations in the new edition are exceptionally clear and useful: most of the half-tone blocks have been omitted, but of the remainder there are still a few which might well yield place to more instructive material. Throughout the book, the matter on theory and general principles is clear and sufficient for the end in view. The information presented is thoroughly practical, and the volume can be cordially recommended to all dynamo and motor attendants. The author and publishers are to be congratulated on producing so valuable a treatise at so low a price.—R. E. N.

## BIRDS AND HIGH-TENSION LINES.

By WM. MANKTELOW

THERE are still large numbers of birds killed outright, or so far incapacitated that they die of starvation, by injuries received in collision with telegraph wires. Undoubtedly there are relatively fewer fatalities now than in the early days of the telegraph (demonstrating a gradual instinctive avoidance of the danger by birds), but heavy toll is still demanded among partridges, pheasants, snipe and such species, despite the practice of hanging small metal plates on the wires to make them more visible in game districts.

A more insidious danger to bird life is now to be found in the high-tension electric transmission wires, which are rapidly enmeshing every civilised country. The old collision risk still exists, though, if anything, in a less degree, for the larger wires are more readily discerned than telegraph conductors; but the special danger occurs when the bird alights on or rises from the wires. How popular telegraph wires are as resting-places for all birds and as assembly centres for migratory species need hardly be mentioned. On these wires the birds incur no special risk, but if when settling on or rising from high-tension lines they happen to touch two wires simultaneously, instant death is their reward. In the

case of extra-high-tension lines, the distance between conductors is usually too great for such simultaneous connection to be effected, but the overall span of even comparatively small birds is surprisingly large, and is quite sufficient to bridge the distance between lines at a sufficient difference of potential to inflict a fatal shock. Ironically enough, birds probably regard these lines as specially safe, owing to their exceptional height from the earth and their human enemies.

On a typical German overland transmission route, dead birds, varying in number from two or three up to 20 or more, were found in groups at the feet of the various supporting poles and towers (which offer a specially tempting perch). The larger birds are, of course, specially liable to destruction; starlings, crows, jackdaws, yellow-hammers and buzzards, besides an extraordinary number of hawks, have been found dead along German transmission lines, and it has been suggested that there is grave danger of the latter birds being practically exterminated in districts traversed by high-tension transmissions. Hawks are particularly fond of perching on high spots, and as many as five have been found dead beneath three masts: in view of the comparative rarity of the species, such wholesale slaughter must soon lead to its extirpation in districts where high-tension lines are common.

We have no reason to suppose that birds have either intelligence or instinct which will enable them to discriminate between high and low-tension wires; they may ultimately come to regard *all* overhead wires as unsafe perches, but the development of such instinct must take many years, and, meanwhile, high-tension lines are steadily increasing in number. Apparently our feathered friends and enemies alike must be subject to a decimation, which neither Bird Laws nor other protective measures can avert.

There is, however, another side to the question. The killing of a bird places the transmission line practically under short-circuit for a greater or less period, according to the time the body remains suspended between the lines. So far it has happened that extra-high-tension lines have chiefly traversed countries where large birds, such as eagles, are common. These creatures can easily span the distance between the transmission lines, and their great size makes it a difficult matter to "burn-out" the heavy short-circuit placed on the line, should the carcass remain in position after the bird is dead. At the best, the mishap will probably strike an arc, which is blown along the line—often for great distances—and it is not uncommon to experience a more or less serious cessation of supply from this cause.

One of the most extraordinary mishaps in high-tension distribution due to birds occurred last summer in a certain Wurtemberg community (a full account may be found in the *Elek. Anzeiger*, No. 92, 1911). The township is supplied by a large "over-land" distribution scheme, and the transformer house serving the locality is built on top of a lattice-work tower, which is connected to an earth-plate and on which are mounted the stems of the insulators carrying the incoming and outgoing lines.

The incoming 10,000-volt lines are attached to strain insulators, and from each line current is led, through inductance coils, to the apparatus within the transformer house. The original inductances were in the form of spirals held vertically between the strain insulators and a second higher set of insulators.

On the day of the disaster, a sparrow hawk threw a flock of starlings into a panic, and the birds flying blindly towards the transformer house, some of them became entangled between the inductance spirals and the insulator pins. As a result, the transformer house tower was connected to the 10,000-volt line, and had its earth plate been effective, the resulting rush of current would have opened the main station breakers. Unfortunately, only one earth plate had been provided, and after an exceptionally dry summer this was found to be in quite dry soil, hence the high-tension charge took the easiest remaining path to earth, which proved to be *via* the various house installations (designed to operate at  $3 \times 220$  or  $3 \times 130$  volts). Quite a number of fires naturally resulted, in endeavouring to extinguish which (of course with *water*!) several persons received violent shocks. Fortunately, no one was seriously injured, and only one house, which was unoccupied at the time, was seriously



damaged by fire. A number of birds—among them the chief culprit, the hawk—were found in a more or less fragmentary condition near the transformer house, and to avoid a repetition of this episode, several earth plates have been installed in parallel and straight leads have been substituted for the spiral inductances.

## COMPLETION OF WORKS IN TIME.

[FROM A LEGAL CONTRIBUTOR.]

AMONG the clauses which give rise to disputes between employer and contractor there is none more difficult than that which specifies the time within which the works are to be completed. A number of causes may operate to bring about delay. The ever-increasing complexity of commercial relations; labour disputes; carriage by land and sea—all these are factors in the matter. Finally, it is often necessary to sub-contract for portions of the work, and the pace is then the pace of the slowest. For these reasons it is important for the contractor to see that he gets as much rope as possible in the first instance, or to make sure that the employer's engineer has full power to extend the time.

Failure to erect works within the specified time, where time is of the essence of the contract, may lead to grave consequences for a contractor. In one case the defendant contracted to fit up and complete machinery for the plaintiff within a reasonable time, but failed to do so. It was held that the jury, though not bound to assess the damages at the amount of the profits under a contract with a third party which the plaintiff was prevented from earning, might do so if they were satisfied by reasonable evidence that the plaintiff would have earned these profits if not prevented by the breach of contract.

Delay on the part of the contractor may be excused if it can be shown to have been caused by failure on the part of the employer to give access to the site or to deliver plans.

It is hardly necessary to consider the case of a contract, the performance of which has not to be carried out within a specified time, in view of the fact that every well-known form of contract provides for work being completed by a particular day. It may be useful, however, to consider the meaning of some of the terms used in relation to time. Thus a contract may have to be performed "directly," or as soon as practicable. In one case the plaintiffs employed the defendants to make a gunpowder pile-driver, which they agreed to provide "as soon as possible." It was held that by the words the defendants must be taken to have meant that they would make the gun as soon as it could be made in the largest establishment with the best appliances. "I do not think," said Cotton, L. J., "that these words can be taken to mean that the defendants merely promised to make the machine as quickly as the means at their disposal might allow, however rashly they might have entered into the contract, as such a stipulation would be unusual."

The following is a simple form of time clause:—"The contractor shall commence the works immediately, and shall proceed with the works to the satisfaction of the engineer, and shall complete and deliver over to the employer the entire works by or before the (naming a day), unless the engineer shall fix or substitute in writing another date for the completion of the contract, in which case the substituted date shall be the date for completion, as though the same had originally been inserted in the contract." This form makes no provision for delay caused by the ordering of extras, strikes, inevitable accident, "the act of God," &c. Many contractors will insist upon the insertion of clauses relieving them from responsibility in such cases; but sometimes it is given to the engineer by notice in writing "to delay or suspend the whole or any part of the work during unsuitable weather, or for any other sufficient reason." It is obvious that a comparatively short delay by stress of weather might involve very great delay in the completion of the whole work, as where, for instance, it became impossible to complete work in the summer time which could not be efficiently done in the winter season.

The ordering of extras may render completion within the time limit wholly impossible; but if the contract provides that the work shall be completed by a certain time, whether extras are ordered or not, the contractor will be bound by his rash undertaking. This was laid down in the well-known case of *Jones v. St. John's College*, 1871, L.R. 6, Q.B. 115. There the plaintiff contractor agreed to do the work by a certain day. The contract provided that extra works should be ordered in a particular manner, and that, notwithstanding such extra work, the time limit was not to be extended, unless by an order signed by the clerk of the works, and countersigned by the college bursar. Extra work was done, but there was no express extension of the time limit. It was held that as the contractor had agreed expressly to do all the work, and extra work if ordered, within the original time limit, the contractors were bound to complete within the specified time limit, although it might involve an impossibility. It may be assumed, however, that the Courts will not be very willing to bind a contractor down to the completion of all the work, including extras, within the specified time; and it is settled law that if the employer orders extras and there is no clause similar to that considered in the case of *Jones v. St. John's College*, an extension of time will be allowed to the contractor. This is well illustrated by the case of *Dodd v. Churton*, 1897, I.Q.B. 562. There the contract provided that the work was to be done within a specified time, but it also contained a clause to the effect that other work might be ordered by way of addition to that specified in the contract. It was also provided that any authority given by the architect for alterations or additions was not to vitiate the contract. Extra work having been ordered, the builder was unable to complete the contract in the specified time. It was held that he was excused. The provision that the contract was not to be vitiated was held not to exclude the commonsense principle that where performance of a condition is rendered impossible by one party to a contract, the other party is exonerated from the performance of it. If the engineer has power to extend the time, and the contractor applies for a decision as to an extension of time, he is bound by that decision. In *Sattin v. Poole*, 1901, 2 H.B.C. 337, the plaintiff agreed to build a house for the defendant. The work was to be completed by a certain day, but the contract provided that if, in the opinion of the architect, the works were delayed by reason of authorised extras or additions, or, in consequence of the contractor not having received in due time necessary instructions from the architect, for which he should have applied in writing, the architect should make fair and reasonable extension of time. The work having been delayed, the builder applied for an extension, but the architect did not reply at once. The builder then sued for £681, which had been allowed on a certificate, subject to the question of penalties for delay. After this the architect wrote granting an extension, but not to the actual date of completion. The builder then sought to call evidence to show that the delay was caused by the architect in ordering extras. In effect, he wished the Court to go behind the decision of the architect. This the Court declined to do, holding that the architect's ruling was final. The Judge said: "The construction of the clause is that the parties did not intend to let it be held that there was any delay, unless the builder applied to the architect."

## TRADE WITH MEXICO.

THE British Consul at Vera Cruz in referring to the Vera Cruz Electric Light, Power and Traction Co., a British company which supplies the town with electric light and power, and also operates the electric tramway system, states that this company is projecting the extension of its system during the coming year to reach certain neighbouring villages, where it is estimated that the return on the outlay would prove profitable owing to the large Sunday and holiday traffic which it is presumed would be created by excursionists and others who would be attracted to these neighbouring resorts. The materials for the permanent way and a greater part of the machinery purchased by the company were of British manufacture, but the cars are all of American build, being of light structure, single-deckers, completely open in order to meet the conditions of the climate.



Later in his report the Consul states that the trade of Vera Cruz, as far as foreigners are concerned, is principally in the hands of Spaniards, Germans, and French, in the order named, there being only one British house. All the wholesale houses without exception maintain a retail department. A large part of the commerce of Vera Cruz is in the hands of commission agents, these concerns generally acting as Custom-house brokers, forwarding agents, steamship agents, &c. All are ready to undertake commissions, either buying or selling, but none of them will make purchases direct from abroad for their own account with a view of introducing new goods, if there is any personal risk in the undertaking. If a commission agent gets an inquiry for any particular speciality, he will endeavour to secure an order, but without an inquiry he will do nothing. The Consul points out that many of the inquiries for information sent to him by manufacturers at home, are of such a nature that it is very difficult to give a satisfactory reply, the conditions in Vera Cruz differing very greatly from those in the United Kingdom. Frequently information is asked respecting the addresses of wholesalers, brokers or retailers, distinctions which can hardly be said to exist in this country at large. For example, wholesale machinery and hardware importers will sell you anything from a needle to a complete sugar mill. There are wholesale haberdashers and linen drapers doing a very large business who will also sell you a cargo of cement and are likewise interested in the manufacture of cigarettes. A timber merchant is also the owner of a plant for rectifying spirits and distilling liquors. Goloshes and other waterproof articles are sold principally by the ironmonger. The wholesale chemist with the usual retail department attached will carry in the window of his shop at Christmas time probably the best selection of dolls to be found in the town, and so on throughout all branches of trade. It would be an advantage to representatives if in addition to being equipped with a full line of samples and prices, they would get a knowledge of the Mexican Customs tariff and post themselves on ocean freight rates. The "Mexican Year-Book" which is on sale by McCorquodale & Co., Ltd., 40, Coleman Street, London, gives valuable information on this and other points of interest to manufacturers and their agents. Catalogues and other trade literature should, if possible, be in Spanish. An American mercantile agency has a branch in this port, from whom can be derived any information as regards the financial responsibility of business houses in this district. All persons engaged in commerce in this port and many of those in the interior are members of the "Camara Nacional de Comercio de Vera Cruz" (National Chamber of Commerce of Vera Cruz), to whom catalogues and similar matter can be sent.

The use of petroleum as fuel is rapidly supplanting that of coal in all branches of commerce; all the railways having their termini in Vera Cruz have now had their engines converted in order to use liquid fuel, with the result that the coal trade, in connection with which the handling of cargoes gave employment to a large number of people, has practically ceased. Arrangements are now being made whereby in the near future it will be possible for oil-burning vessels to count on a constant supply of fuel which will be available apparently at an economical figure, judging by the prices ruling at present and the figures at which contracts have been made.

The British Vice-Consul at Jalapa reports that the Jalapa Railway and Power Co. owns and operates the railway connecting Jalapa with the small towns of Coatepec, Jico and Teocelo. The company also owns the power plant, which produces about 1,700 H.P. derived from a waterfall near Jico, some 14 miles from Jalapa. The power is used for lighting the towns above-named, and also supplies various small industries in these towns with power. It is an American-owned concern.

## A DIRECT READING WAVE METER.

By S. M. POWELL.

IN wave meters, hitherto in use, it has generally been necessary to adjust a variable capacity or inductance in a tuning circuit till maximum current flow is attained in the latter. The corresponding frequency and wave length for each setting of the variable capacity or inductance, being determined once for all, the frequency and wave length of the oscillation examined is at once known.

A new type of wave meter, by Erich Huth, depends also upon the principle of resonance, but it is no longer necessary to determine by trial the resonant setting of a variable tuning condenser or inductance. Resonant conditions are attained automatically, and the frequency and wave length of the oscillation examined are read directly on a permanent scale.

In figs. 1 and 2, representing the construction of the new instrument, C is a plate condenser, L an inductance coil, and A a neon or helium tube, connected so as to show, by its illumination, the occurrence of resonance in the tuning circuit. The movable plate of the condenser, carrying the neon tube on an extension arm, is rotated by clockwork or an electric motor, so that the capacity of C varies continuously and periodically over the whole range between its minimum and maximum values. During each rotation of C, the resonant relationship between C and L for the particular case examined, is swept through and, at the moment of its realisation, the neon tube is lighted. This occurs at the same point in each revolution and, at a speed of the driving motor of 300 R.P.M., the resonant setting is passed five times per second, so that by persistence of vision, the observer sees a steady band of light at the resonant position of C (and A). By placing a suitably calibrated scale B behind the path of motion of the tube A, the frequency and wave length of the oscillations exciting L can be at once read.

The observed position is the mean of a number of rapidly successive automatic settings, and the whole conditions of working result in the readings being much more accurate than individual hand settings, besides being more easily obtained. Variations in the excitation of the tuning circuit merely alter the brightness of the indicating tube; fluctuations in the wave length measured cause a broadening or waving of the luminous band according to their frequency of occurrence.

The energy consumption of the meter is lower than that of meter circuits using hot-wire instruments. The neon, or helium, tube only consumes energy during the fractions of a second in which the resonant setting is traversed, and it is possible to work

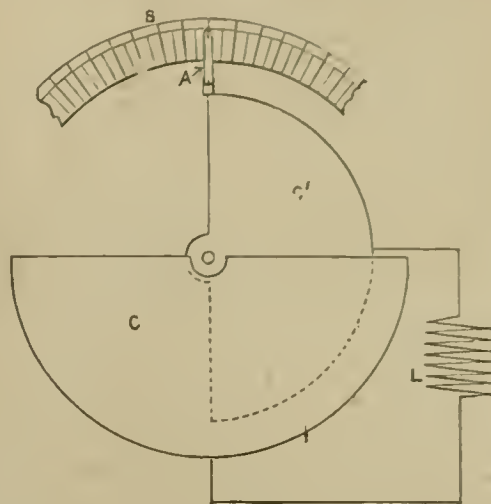


FIG. 1.

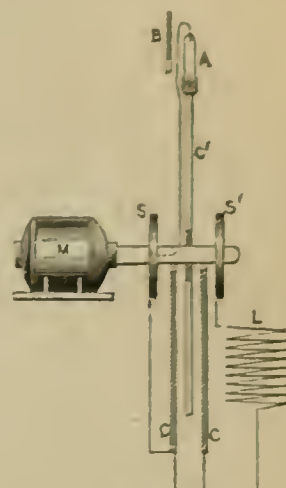


FIG. 2.

with much looser coupling than is required by indirectly reading wave meters. This further enhances the accuracy obtainable by avoiding appreciable reaction of the tuning circuit on the primary circuit. Owing to their limited burning period, the indicating tubes will last several months, in every day use. The outward appearance and component parts of the tube are as shown in fig. 3: the tube is held in a cartridge consisting of a central sleeve of insulating material, and two screwed metal end caps. The rotary disk carrying the tube is accessible through a door in the containing case of the meter, and thus tube replacement is effected with the minimum of trouble and delay.

The wave meter is built in two forms; one, a self-contained set, mounted between pivoted forks, capable of being used in any position, and very suitable for portable work and for laboratory and demonstration use; the other, a wall type for permanent erection on switchboards, &c. Both types have two ranges, covering wave lengths from 500 to 1,200 m. and from 1,200 to 3,000 m. respectively. Conversion from one range to the other is effected by turning through 180° a vulcanite switch knob at the centre of the dial. This switches in or out auxiliary condenser plates; only a single inductance coil is required, hence the length of a strange wave can be determined within a very few seconds.

In using the meter, the coupling coil is moved to and from the circuit under examination till the indicating band of light is from  $\frac{1}{2}$  to 1 mm. broad. If sufficiently loose coupling cannot be obtained to yield a narrow band, readings are taken at the brightest part of the narrowest band obtainable. Readings should be taken on the

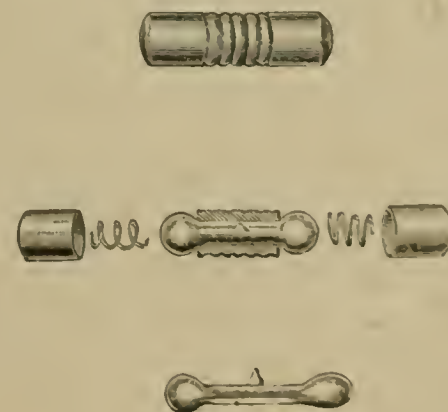


FIG. 3

lower range of the instrument wherever possible; on changing from the higher to the lower range, the indicating band widens considerably, and looser coupling should be secured. The accuracy of the instrument is such that wave lengths can be determined correct to the nearest metre.

By simply disconnecting the condenser C, by withdrawing a knob in the base-plate of the instrument, the latter indicates the amplitude and purity of the oscillations examined, and, thus used, the instrument is indispensable to wireless stations working with undamped oscillations. When used as an "amplitude controller" the energy consumption of the instrument is considerably increased, the neon tube being permanently excited; the coupling of the inductance coil must, therefore, be considerably tightened.

This instrument should be of great value as a permanent indicator of wave lengths in all wireless stations, particularly in those using an arc as the source of high-frequency oscillations. Variations in the arc length may easily cause 5 per cent. alteration in the wave length of the station. This not only increases the difficulty of tuning at the receiving station, but may even



materially reduce the effective transmitting radius of the sending station. The root of the trouble may be avoided by the use of the new wave meter, the indications of which, varying in instantaneous and exact sympathy with every alteration in the conditions of the primary oscillating circuit, make possible a permanent control of frequency such as could not be obtained by any of the older methods of measuring wave lengths.

The need for, and advantage of, the instrument is even greater in arc stations using more than one frequency, and in all stations engaged in wireless telephony, the success of which depends essentially on constancy of the transmitting wave lengths.

## TRADE STATISTICS OF SOUTH AFRICA.

THE following statement, showing the imports of electrical and similar goods into British South Africa during the year 1911, has been taken from the recently issued official trade statistics. The figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1910.	1911.	Increase or decrease.
	£	£	£
<i>Detonators.—</i>			
From Great Britain ...	27,000	25,000	— 2,000
" Germany ...	8,000	8,000	—
Total ...	35,000	33,000	— 2,000
<i>Fuses.—</i>			
From Great Britain ...	81,000	83,000	+ 2,000
" Germany ...	46,000	41,000	— 5,000
" Other countries ...	—	1,000	+ 1,000
Total ...	127,000	125,000	— 2,000
<i>Asbestos manufactures.—</i>			
From Great Britain ...	700	700	—
" Other countries ...	500	1,700	+ 1,200
Total ...	1,200	2,400	+ 1,200
<i>Brass manufactures.—</i>			
From Great Britain ...	21,000	27,000	+ 6,000
" Germany ...	1,000	1,000	—
" Other countries ...	2,000	3,000	+ 1,000
Total ...	24,000	31,000	+ 7,000
<i>Copper, plate and sheet.—</i>			
From Great Britain ...	5,000	4,000	— 1,000
" Germany ...	1,000	1,000	—
Total ...	6,000	5,000	— 1,000
<i>Copper manufactures.—</i>			
From Great Britain ...	3,000	3,000	—
" Other countries ...	—	1,000	+ 1,000
Total ...	3,000	4,000	+ 1,000
<i>Electrical cable and wire.—</i>			
From Great Britain ...	182,000	156,000	— 26,000
" Germany ...	75,000	62,000	— 13,000
" United States ...	4,900	12,000	+ 8,000
Total ...	261,000	230,000	— 31,000
<i>Electrical fittings, including posts.—</i>			
From Great Britain ...	118,000	144,000	+ 26,000
" Germany ...	215,000	93,000	— 122,000
" Holland ...	2,000	1,000	— 1,000
" United States ...	21,000	19,000	— 2,000
" Other countries ...	4,000	9,000	+ 5,000
Total ...	360,000	266,000	— 94,000
<i>India-rubber of all kinds.—</i>			
From Great Britain ...	30,000	32,000	+ 2,000
" Germany ...	2,000	5,000	+ 3,000
" United States ...	3,000	15,000	+ 12,000
Total ...	35,000	52,000	+ 17,000
<i>Lamps and lampware.—</i>			
From Great Britain ...	19,000	20,000	+ 1,000
" Germany ...	14,000	18,000	+ 4,000
" Sweden ...	1,000	—	— 1,000
" United States ...	10,000	10,000	—
" Other countries ...	2,000	3,000	+ 1,000
Total ...	46,000	51,000	+ 5,000

	1910.	1911.	Increase or decrease.
	£	£	£
<i>Machine bands and belting.—</i>			
From Great Britain ...	131,000	123,000	— 8,000
" United States ...	24,000	37,000	+ 13,000
" Other countries ...	1,000	1,000	—
Total ...	156,000	161,000	+ 5,000
<i>Electrical machinery.—</i>			
From Great Britain ...	254,000	172,000	— 82,000
" Germany ...	480,000	318,000	— 162,000
" United States ...	71,000	40,000	— 31,000
" Other countries ...	5,000	4,000	— 1,000
Total ...	810,000*	534,000	— 276,000

\* Large figures, due to purchases for Victoria Falls Works.

<i>Cranes, elevators and lifts.—</i>			
From Great Britain ...	73,000	37,000	— 36,000
" United States ...	2,000	2,000	—
" Other countries ...	3,000	1,000	— 2,000
Total ...	78,000	40,000	— 38,000
<i>Mining machinery.—</i>			
From Great Britain ...	910,000	666,000	— 244,000
" Germany ...	161,000	119,000	— 42,000
" United States ...	164,000	159,000	— 5,000
" Other countries ...	16,000	32,000	+ 16,000
Total ...	1,251,000	976,000	— 275,000

<i>Machinery not specially mentioned (other than agricultural, manufacturing, &amp;c.).—</i>			
From Great Britain ...	466,000	429,000	— 37,000
" Germany ...	32,000	22,000	— 10,000
" United States ...	41,000	47,000	+ 6,000
" Other countries ...	13,000	10,000	— 3,000
Total ...	552,000	508,000	— 44,000

<i>Railway rails.—</i>			
From Great Britain ...	33,000	12,000	— 21,000
" Belgium ...	76,000	80,000	+ 4,000
" Germany ...	71,000	60,000	— 11,000
" United States ...	3,000	2,000	— 1,000
Total ...	183,000	154,000	— 29,000

<i>Telegraph and telephone material.—</i>			
From Great Britain ...	6,000	6,000	—
" Germany ...	2,000	4,000	+ 2,000
" Sweden ...	3,000	8,000	+ 5,000
" United States ...	2,000	—	— 2,000
" Other countries ...	—	2,000	+ 2,000
Total ...	13,000	20,000	+ 7,000

<i>Tramway rails.—</i>			
From Great Britain ...	10,000	5,000	— 5,000
" Germany ...	7,000	6,000	— 1,000
" United States ...	24,000	8,000	— 16,000
Total ...	41,000	19,000	— 22,000

<i>Tramway rolling-stock.—</i>			
From Great Britain ...	17,000	3,000	— 14,000
" United States ...	2,000	1,000	— 1,000
Total ...	19,000	4,000	— 15,000

<i>Other tramway materials.—</i>			
From Great Britain ...	15,000	8,000	— 7,000
" Germany ...	1,000	2,000	+ 1,000
" United States ...	5,000	4,000	— 1,000
" Belgium ...	3,000	1,000	— 2,000
Total ...	24,000	15,000	— 9,000

In addition to the above the following were imported as "Government Stores":—

<i>Brassware.—</i>			
From United Kingdom ...	5,000	5,000	—
<i>Copper, plate and sheet.—</i>			
From United Kingdom ...	8,000	15,000	+ 7,000
<i>Electrical cable and wire.—</i>			
From United Kingdom ...	44,000	65,000	+ 21,000
" Germany ...	—	1,000	+ 1,000
Total ...	44,000	66,000	+ 22,000
<i>Electric fittings.—</i>			
From United Kingdom ...	25,000	15,000	— 10,000
<i>India-rubber.—</i>			
From United Kingdom ...	7,000	9,000	+ 2,000



	1910.	1911.	Increase or decrease.
	£	£	£
<i>Lampware.—</i>			
From United Kingdom ...	2,000	2,000	—
<i>Cranes and elevators.—</i>			
From United Kingdom ...	8,000	28,000	+ 20,000
<i>Electrical machinery.—</i>			
From United Kingdom ...	23,000	14,000	— 9,000
<i>Other machinery.—</i>			
From United Kingdom ...	67,000	52,000	— 15,000
„ Other countries ...	5,000	3,000	— 2,000
Total ...	72,000	55,000	— 17,000
<i>Railway rails.—</i>			
From United Kingdom ...	204,000	39,000	— 165,000
„ Germany ...	1,000	25,000	+ 24,000
„ Russia ...	40,000	—	— 40,000
„ Belgium ...	—	6,000	+ 6,000
Total ...	245,000	70,000	— 175,000
<i>Telegraph and telephone material.—</i>			
From United Kingdom ...	143,000	63,000	— 80,000
„ Sweden ...	2,000	17,000	+ 15,000
Total ...	145,000	80,000	— 65,000

### THE SUNBEAM LAMP CO., LTD.

A MEETING of the creditors of this company was held at the offices of Messrs. Watson, Burton & Corder, Newcastle-on-Tyne, on June 3rd.

Mr. Thomas Wallace (the liquidator) said the meeting had been called for that date because it was the latest date permissible under the Act, and it had not been possible to formulate a scheme of reconstruction up to the present; but they hoped in the course of the next week or two that something tangible would be evolved. At the shareholders' meeting at which it was decided to go into liquidation, a Committee of Inspection was appointed of Mr. F. S. Newall and Mr. R. P. Sloan. Later the debenture-holders appointed Mr. Swan as receiver for the debenture-holders. The company was formed in 1887, and for the past 25 years had been in the forefront of manufacturers. Latterly, the carbon-filament lamp, which had been a great success so long, was displaced by the introduction of the metal-filament lamp, and they entered into negotiations so that they could manufacture the latter themselves. In order to do this the capital was increased from £25,000 to £75,000, and the debentures were increased by £25,000. When the manufacture was commenced it was hoped they would have substantial profits, but in a short time competition became so keen that a rapid reduction of price took place. There were also some troubles as to patent rights, in which the Westinghouse Filament Co. were concerned. Then came the tungsten drawn wire lamp, which superseded the metal-filament for small lamps, which necessitated them unloading themselves of the older lamps, and stocks were reduced to a minimum. At that time, having regard to their position and to the fact that creditors were pressing for payment, voluntary liquidation was deemed necessary. They hoped for a scheme of reconstruction of the company to take over the assets. Dealing with the financial position of the company, he gave the following details as to assets and liabilities:—Assets—Land, £1,292; erections, £10,041; plant and machinery, £15,683; general works and tools, £1,700; office furniture, £675; stocks, £10,000; book debts, £7,047; a total of £47,000. These figures (he explained in answer to a creditor's question) were taken from the last report. The liabilities were:—Debentures, £21,650; unsecured creditors, £9,890; preferential claims, £250; a total of £31,000 roughly, leaving a surplus, on paper, of £16,000. There were 354 creditors, and of these 111 were for sums of over £10. The liquidator concluded by stating that although no scheme had been formulated, they had tried hard.

Mr. Scholey (for the Allied Electrical Trades' Association) drew attention to the fact that a circular letter had been issued to some creditors and not to others, and he wished to know why proxy forms were sent out to some and not to all. He would like to know with what view they were sent out.

Mr. R. P. Sloan said he took it he was free to act in that matter. He wrote to some and not to others. He wrote because he did not want that business to go into the Courts, because he thought a scheme might be formulated, which would be prejudiced if they were to go into Court.

Mr. Scholey: Have you a scheme?

Mr. Sloan said there was a scheme.

Mr. Scholey was further questioning Mr. Sloan when the latter refused to be cross-examined.

Mr. Scholey said surely they should have some information as to the present position of affairs. Could the Receiver not give them some figures? They were accustomed in those cases to ask for the present position.

The Liquidator said they could not give that, as they had no valuation.

Mr. Scholey drew attention to the fact that the assets were £47,000 and the liabilities £31,000, yet the company found it necessary to go into liquidation. He would like to know if they had formed any idea, or had had a valuation taken, of the stock and general works. He also asked who were the debenture-holders in addition to the bank; what were the circumstances under which the Receiver was appointed; if the liquidator was a relative of a director of the company; if interest was paid on the debentures, or what induced the bank to appoint a Receiver. He also asked what were the prospects in case of a realisation.

The Liquidator said the company was not able to carry on for want of cash.

Mr. Scholey: Could not the shareholders have subscribed new capital?

The Liquidator said all the capital had been called up on the issued shares, but all the shares had not been issued.

Mr. Scholey asked if he would tell them what the scheme was they had in contemplation.

The Liquidator said he could not at present.

Mr. Scholey said, failing details, he should press for investigation.

The Liquidator (reverting to Mr. Scholey's former questions) said he was a nephew of one of the directors, but he resented the question, which he did not think should have been put.

A question was raised as to the collateral security held by the bank, and it was stated that there was a personal guarantee by some of the directors for £10,000.

The Receiver (Mr. Swan) said the bank appointed a Receiver because of the resolution to voluntarily wind up the company. As to the suggested scheme, if that estate was to be dealt with in the most advantageous manner, forced realisation must be avoided. They must appreciate that there was a difference between negotiations and an absolute scheme. They had got no cut-and-dried scheme, but they had laid the groundwork. Mr. Sloan had been working very hard to assist in bringing out a scheme. It was to the interest of that creditors' meeting to support any scheme in any shape or form. They knew the usual result of liquidation. They knew that after the debenture-holders, claiming £22,000, and special claims, £250, had been met, with the expenses of winding up there would not be much out of the £47,000. More money, too, would be required. They would do the best they could, but certainly any application to the Courts, or anything hostile, would not assist the scheme, and he did not see how the creditors would gain by it.

The representative of another creditor said he did not think he had ever attended a meeting where there had been put before it such a policy of "Open your mouth and shut your eyes and see what we will send you," as in that case. For his part, he must have some definite suggestion.

Mr. Sloan said he was far too busy a man to give his time if he did not think it were of use. He had done little else lately but work for that scheme, and he was not doing it for fun; he was doing it because he thought a scheme might be formulated and carried through. But personally, if it went into the Courts he washed his hands of it. He thought he understood the position as well as anybody else. Any application in Court would prejudice the matter.

Mr. Scholey asked if there were any scheme for a dividend for the creditors.

The Receiver said there was no definite scheme, but one was under consideration, and their position would be definitely known in the course of a week or so.

Mr. Scholey: Does it provide any cash for the creditors?

The Receiver: No. It might give them an interest.

Mr. Scholey: In shares?

The Receiver: It might be. He added that there was no advantage in a forced realisation.

Mr. Scholey suggested the appointment of a liquidator to represent the creditors.

The representative of another creditor asked whether the Liquidator was prepared to have a joint liquidator and a committee.

The Liquidator: I cannot answer that.

It was then suggested that the meeting might be adjourned, and, after some debate, it was decided to adjourn until Friday, June 21st.

A list of creditors appears under "Business Notices."

**Curative Properties of Radium.**—The Vienna correspondent of the *Standard* states that some interesting information about the therapeutic use of radium is contained in the first annual report of the Austrian State Kurhaus at Joachimsthal, published by the Austrian Ministry of Public Works. Over 10,000 baths of water from the radium mines have now been given, and good effects have been noticed, not only in cases of rheumatism and gout, but also in spinal paralysis of children, hæmorrhage of the brain and certain cases of neurasthenia. Further, it has been observed that corpulent patients are reduced in weight by a course of radium baths, and that teeth loosened by chronic inflammation can be made firm again by rinsing the mouth with highly radio-active water. Experiments made with the treatment of cancer are, so far, inconclusive, owing to the shortness of time.

**Congress of Medical Electrology and Radiology.**—

In accordance with the decision of the Congress of Barcelona, the sixth Congress will be held at Prague on July 26th-31st, 1912. Particulars can be had from Dr. Krist. Hynek, Hôpital Général, Prague II, Austria.



## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**NEW ZEALAND.**—The Customs Authorities have issued the following decisions as to the duties to be levied on certain goods; in all cases the duties quoted are those under the British Preferential Tariff:—

Distributors, being parts of magnetos for motor-car oil engines:

- |                              |     |     |     |              |
|------------------------------|-----|-----|-----|--------------|
| (1) If attached to engines   | ... | ... | ... | free         |
| (2) If detached from engines | ... | ... | ... | 10 % ad val. |

**JAMAICA.**—The Board of Trade have received a copy of a telegram from the Governor stating that the rate of import duty leviable on goods dutiable at the general rate of 16½ per cent. *ad valorem* will be reduced to 10 per cent. *ad valorem* from July 1st next. No change will be made in the rates of duty on goods dutiable at specific rates.

**GREECE.**—In connection with the law in force in Greece providing that the maximum octroi duty to be levied by municipalities on imported goods should be 4 per cent. *ad val.*, the Board of Trade have received information to the effect that the present rates of octroi duty vary for different articles and in different localities, but are generally as follows:—At Athens, 2½ per cent.; at Piræus, 1½ per cent.; at Corfu, 3 per cent. at Patras, 2½ per cent.; at Vola, 3 per cent.; at Larissa, 3 per cent.; at Syra, 2 per cent. (flour 4 per cent.); at Kalamatta, 3 per cent.

The percentage rates of duty are assessed on the valuations contained in a special Valuation Tariff which may be inspected by British traders interested at the Board of Trade, 73, Basinghall Street, E.C.; and the Branch will also be prepared to furnish British traders, in response to written applications, with information as to the valuations for octroi duty purposes of any particular article or articles in which they may be interested. In the case of imported goods, the octroi duty is levied in addition to the Customs duty.

**SANTO DOMINGO.**—A decree has recently been passed fixing the amount of the fees to be charged by Santo Domingo Consular Officers abroad:—

For the certification of four copies of each invoice and corresponding bill of lading; the value of the goods included in the invoice being:

	Pesos.
From 1 to 50 pesos	1'00
" 51 to 200 pesos	2'00
" 201 to 1,000 pesos	3'00
" 1,001 to 2,000 pesos	4'00
" 2,001 to 4,000 pesos	5'00
And for each 1,000 pesos in excess of 4,000	1'00

NOTE.—When the Consul is asked to sign more than four copies of the invoice or bill of lading, the fee charged will be 50 per cent. more than that chargeable for the four copies.

[£1 = 4'87 pesos.]

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 11,900. "Generation and utilisation of electrical energy." C. S. NORTHCOTE. May 20th.
- 11,957. "Devices for damping the oscillations set up in machines driven by prime movers." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, May 20th, 1911, Germany.) May 20th. (Complete.)
- 11,964. "Telephone systems." E. A. MELLINGER. May 20th.
- 12,001. "Means and apparatus for retaining incandescent electric lamps in their holders." C. H. KRUGER and H. E. HODGSON. May 21st.
- 12,014. "Electric auto-masseur." F. R. MILLER. May 21st.
- 12,023. "Installations for supplying electric current for lighting, heating and other purposes, on motor-cars, trains and the like." C. A. VANDERVELL and A. H. MIDGLEY. May 21st. (Complete.)
- 12,047. "Ignition systems." C. F. KETTERING. (Convention date, May 22nd, 1911, United States.) May 21st. (Complete.)
- 12,059. "Electric circuit-breakers." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 21st.
- 12,060. "Electric relays." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 21st.
- 12,075. "Electric heating device." H. S. MARTIN. May 21st.
- 12,079. "Electric light fitting." A. COLOMB. May 21st.
- 12,093. "Electric current graduating devices or resistances." W. SUNNER. May 22nd.
- 12,109. "Incandescent lamps and burners." G. HELPS. May 22nd.
- 12,116. "Telephone receivers." LONDROME SYNDICATE, LTD. (L. Gallotti, France.) May 22nd.
- 12,133. "Electric advertising appliances." J. MEYER and NEUREITEN VERWERTHUNG G.m.b.H. May 22nd. (Complete.)
- 12,134. "Speed regulation of asynchronous motors." BERGMANN ELEKTRICITÄTS-WERKE AKT.-GES. (Convention date, May 22nd, 1911, Germany.) May 22nd. (Complete.)
- 12,174. "Telephony." S. G. BROWN. May 22nd.
- 12,193. "Magneto-electric ignition apparatus." W. A. HILL. May 23rd. (Complete.)
- 12,212. "X-ray fluorescent screens." SIR D. L. SALOMONS. May 23rd. (Complete.)

- 12,223. "Dynamoes." G. H. JACKSON and H. E. MOORE. May 23rd.
- 12,228. "Device for locking together an incandescent electric lamp of the bayonet-capped type and lampholder." G. E. MEEK. May 23rd. (Complete.)
- 12,252. "Telegraphic apparatus." S. G. BROWN. May 23rd.
- 12,270. "Mercury-vapour lamps." P. G. TRIQUET. (Convention date, August 30th, 1911, France.) May 23rd. (Complete.)
- 12,273. "Electric fuse." W. B. BOYD and J. B. TANNAHILL. May 23rd.
- 12,305. "Manufacture of cable studs and analogous articles." L. BAXTER and E. VAUGHAN (trading as Baxter, Vaughan & Co.). May 24th. (Complete.)
- 12,313. "Clutch gear for Hughes telegraph apparatus." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 24th. (Complete.)
- 12,320. "Current interrupter for high-tension lines." C. CLAR and T. CLAR. May 24th. (Complete.)
- 12,330. "Electrical heating apparatus." R. B. MATTHEWS. May 24th.
- 12,347. "Hygienic shields or protectors for transmitters or receivers of telephones, speaking tubes and instruments of a similar nature." M. H. FERGUSON. May 24th.
- 12,367. "Vacuum electric water heater." J. MANN. May 24th. (Complete.)
- 12,374. "Telephone installation for mines and the like." STERLING TELEPHONE AND ELECTRIC Co., LTD., and F. G. BELL. May 24th.
- 12,376. "Ironclad change-over switches and fused switches." H. H. BERRY and W. J. MARKHAM. May 24th.
- 12,379. "Timing devices for the electric ignition of internal combustion engines." ROBERT BOSCH (Firm of). (Convention date, July 14th, 1911, Germany.) May 24th. (Complete.)
- 12,380. "Electric search lights." SOCIETA ANONYMA OFFICINE GALILEO. (Convention date, May 31st, 1911, Italy.) May 24th. (Complete.)
- 12,381. "Holders for incandescent electric lamps." J. P. NAYLOR. May 24th.
- 12,425. "Electric printing." C. A. MUSGRAVE. May 25th.
- 12,444. "Arrangement of receiving stations for wireless telegraphy." CAPT. Z. DAN and G. ROTHLENDER. May 25th. (Complete.)
- 12,445. "Couplings and means for fastening wires together and to the terminals of electric batteries, lamps, walls and other apparatus or appliances." V. C. H. GIBSON. May 25th.
- 12,449. "Apparatus for operating electric search lights from a distance." SOC. ANON. OFFICINE GALILEO. (Convention date, May 31st, 1911, Italy.) May 25th. (Complete.)
- 12,469. "Drawing of wires, and more particularly of tungsten and other metal filaments." C. GLADITZ. May 25th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- HYDRAULICALLY-BALANCED ELECTRIC LIFTS. E. M. T. Boddam. 8,356. April 4th.
- HIGH-TENSION ELECTRICAL COILS, SUCH AS INDUCTION COILS, TRANSFORMER COILS, ARMATURE AND OTHER WINDINGS, AND THE PROCESS OF FORMING SAME. J. L. Milton. 10,827. May 4th.
- MAGNETO IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES. J. L. Milton. 10,828. May 4th.
- ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. A. T. Dawson and G. T. Buckham. 11,019. May 6th.
- MACHINE FOR MAKING ELECTRICALLY-WELDED CHAINS. M. B. Ryan. 11,794. May 16th.
- ELECTRICAL SWITCH DEVICES, APPLICABLE TO THE WIRELESS CONTROL OF MINES, OR OTHER APPARATUS. C. Stille. 13,648. June 7th. (July 20th, 1910.)
- TELEPHONE TRANSMITTERS. Siemens Bros. & Co. and C. R. Riber. 14,683. June 21st.
- GLOW LAMPS FOR ADVERTISING PURPOSES. G. Rainand. 14,731. June 21st. (June 22nd, 1910.)
- ELECTRIC HEATING AND COOKING DEVICES. Ferranti, Ltd., and M. B. Field. 15,889. July 8th.
- TELEPHONIC INSTRUMENTS, INCLUDING TRANSMITTERS. E. C. R. Marks. (G. R. Webb.) 16,956. July 24th.
- ELECTRICAL INFLUENCE MACHINES (WITHOUT SECTORS). T. Clark. 17,462. August 1st.
- ELECTRIC LAMPHOLDERS. H. Lucas and F. Jenkins. 19,183. August 26th.
- ELECTRICAL CONNECTING APPARATUS OPERATED FROM A DISTANCE. G. A. Betulander. 19,553. September 2nd. (September 3rd, 1910.)
- ELECTRIC MEASURING INSTRUMENTS. H. W. Brown. 20,452. September 15th. (October 8th, 1910.)
- ELECTRIC COOKERS. R. Haddan. (Copeman Electric Stove Co.) 22,001. October 5th.
- ELECTRICAL APPARATUS FOR SIGNALLING OR COMMUNICATING PERIODICALLY BETWEEN ONE PART OF A SHIP OR PLACE AND ANOTHER. R. H. H. Pring. 22,039. October 6th.
- TELEPHONE TRANSMITTERS. C. E. Egnor and J. G. Holmstrom. 22,049. October 6th.
- INCANDESCENT ELECTRIC LAMP AND HOLDER THEREFOR. C. Harvey. 23,979. October 30th.
- ELECTRIC SWITCH. R. Heilbrun. 24,003. October 30th. (November 2nd, 1910.)
- SOUND AMPLIFYING DEVICES FOR TELEPHONES, EAR- AND SPEAKING-TRUMPETS AND THE LIKE. H. C. Petersen. 24,098. October 31st. (November 11th, 1910.)
- PROCESS FOR TREATING ANODE RESIDUES. H. Wehrlin. 25,179. November 11th. (January 11th, 1911.)
- ELECTRICALLY-HEATED OVENS. G. Barker. (V. Weber & Co.) 25,962. November 21st.
- ELECTRIC INSPECTION LAMPS FOR USE ON AUTOMOBILES. W. Peto and Peto and Radford, Ltd. 27,155. December 4th.
- VAPOUR DEVICES FOR RECTIFYING ELECTRIC CURRENTS. F. Conrad. 27,686. December 9th. (December 10th, 1910.)
- COLOUR SCREENS FOR LAMPS. Korting & Mathiesen Akt.-Ges. 27,850. December 12th. (May 29th, 1911.)

### 1912.

- AUTOMATIC SAFETY SWITCH FOR ELECTRIC CURRENTS. F. Gruber and A. Frühwirth. 579. January 8th.
- ELECTRIC FURNACES FOR ENDOTHERMIC GAS REACTIONS. H. Grohmann. 919. January 11th. (March 31st, 1911.)
- ALKALINE ELECTRIC ACCUMULATORS. W. K. L. Dickson. 957. January 12th.
- ELECTRIC SWITCH MECHANISM. J. W. Record. 1,817. January 23rd.
- ELECTRIC HEATERS FOR LIQUIDS. J. P. Bland and E. G. Simister. 1,983. January 24th.
- ELECTRICAL SWITCHES. A. Crawford. 2,896. February 5th.



# THE ELECTRICAL REVIEW.

VOL. LXX.

JUNE 14, 1912.

No. 1,803.

## ELECTRICAL REVIEW.

## BRITISH TRADE ABROAD.

Vol. LXX.]	CONTENTS: June 14, 1912.	[No. 1,803.
		Page
British Trade Abroad	...	949
Malingers and the Workmen's Compensation Act	...	950
Open Specifications	...	951
Water Economy and Electric Pumping	...	951
Artistic Street Lamp Standards ( <i>illus.</i> )	...	952
The Transport of Modern Large Units of Machinery ( <i>illus.</i> )	...	953
Notes from Canada	...	953
Correspondence:—		
An Objectionable Clause	...	954
The Limerick Appointment	...	954
The Indirect Lighting of Rooms ( <i>illus.</i> )	...	954
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	956
Legal	...	957
Australian Tramway Companies and their Employés.—V	...	959
Business Notes	...	960
General Electric Developments ( <i>illus.</i> )	...	967
High-Pressure Direct-Current System of the Metropolitan Co.	...	970
Notes	...	972
City Notes	...	974
Stocks and Shares	...	977
Electric Tramway and Railway Traffic Returns	...	978
Share List of Electrical Companies	...	979
Wages Systems ( <i>illus.</i> )	...	981
Electrical Progress in New Zealand	...	982
Proceedings of Institutions:—		
Condensers in Series with Metal-Filament Lamps ( <i>illus.</i> )	...	983
The Transmission of Electrical Energy by Direct Current on the Series System ( <i>illus.</i> )	...	985
New Patents Applied For, 1912	...	988
Abstracts of Published Specifications	...	988
Contractors' Column	Advertisement pages xxiv, xxvi and xxviii	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

**Binding.**—Subscribers' numbers bound, including case, for 4s. each volume.

**Cases.**—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

**Foreign Agents.**—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHIER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill London, E.C.

THE disturbed state of the labour world renders it impossible, or at any rate unwise, to attempt to make any particular deduction from the trade returns for the past month or two. We may have to wait until the end of the year before we shall be able to see exactly how things are going. Electrical exporting, however, seems to be proceeding at a fairly satisfactory rate, and the recently reported statements of manufacturing companies show that there is a great deal of foreign and colonial work in hand. British electrical firms are undoubtedly putting more zest into export trade development, and though the margin of profit even on this class of business is not all that is desired, the result is gratifying. We believe that the need for continuing to show a spirit of enterprise has not diminished. There is a multitude of markets to exploit, and there is a keenness in the method of the foreign competitor—one of which factors affords encouragement, if the other urges the argument of necessity.

The private trader may receive assistance in his future study of the prospective fields from the Imperial Trade Commission, which holds its first meeting in London next month. The members of this Commission will first, it is thought, make a close investigation into the trade conditions of the United Kingdom, and they will then journey from place to place armed with intelligence and authority, inquiring, we suppose, into the prospects of reciprocally strengthening our trade connections with them and opening up new channels for the inflow of the product of the British manufacturer. Therefore, we cannot reasonably expect to have the results of the inquiry in our hands for some time—one member says three years. In no sense can we look to a Government Commission to do for us as individual traders what we ought to do for ourselves. The necessity for individual enterprise and personal initiative is as imperatively demanded as it ever was.

In the *Chamber of Commerce Journal* for June there are two appeals to British traders and manufacturers which should command attention. One emanates from the Secretary of the Board of Trade at Calgary, urging the "business section of England" to pay proper heed to the opportunities for trade in Western Canada, and promising that those who take trouble to investigate these will be amply repaid. The writer (Mr. W. H. Wilson) says that the business men of the United States have not waited for a second invitation to participate, but possessing a full appreciation of the wonderful prospects of the future in this tremendous, but still very sparsely settled, territory, they are establishing themselves in Western Cities with plants large enough to handle present business, and reserving land for the all-assured extension. Our manufacturers would do well to communicate with Mr. Wilson at Calgary, for he is open to advise anybody who will carefully sound the propositions and send experts to test the advantages of the country.



This appeal comes at a moment when British electrical and engineering firms are giving evidence of a great awakening and an earnest desire in regard to Canada, and it will hardly require any additional support from us after the aggressive policy that we have so long and so consistently advocated in regard to this market.

The second appeal comes to the *Journal* from the British Vice-Consul at Ensenada, Baja California, Mexico. It relates to the approaching completion of the Panama Canal and the consequent extraordinary advantages that await the development of British trade in the North Pacific, if our traders, financiers and settlers are only properly alive to the possibilities of the situation for those who show reasonable enterprise in embracing opportunities as they arise.

Alert on the spot, watching matters at close range, Mr. W. D. Madden, the Consul referred to, says, "It is a most patent fact that unless we bestir ourselves with all the most modern enterprise and resourcefulness at our command, we shall be outstripped by other nations in the race for the great trade and commerce of this region." Everything that can be done by the United States and Germany to entrench themselves firmly, to the exclusion of all others, is being done, and the writer deplores the fact that we in this country seem inclined to apathy and inertness, combined sometimes with obsolete methods. This sounds like an old stereotyped criticism, but it appears to be justified in respect of this market. Obviously there is a pressing need there for British trading initiative. Mr. Madden goes on to show that he has a belief in his own people's ability to deal with the situation if the matter be given enough publicity in these islands.

We believe there is a great deal of reason for this plea for greater trade publicity. It is deplorable that our own newspapers nowadays are so filled with domestic political affairs, industrial differences, and a thousand comparatively small and petty matters, while they ought to be devoting their space freely to the great trading matters of the world, bringing it home to every trader and manufacturer, and to every worker too, how essential it is that Britain should assure her own necessary prosperity in the future by keeping her eyes ever open to the great development that is proceeding throughout the entire world, and to the opportunities thus opened to employer, worker, and investor alike. In our opinion the reports that are issued by British Consuls and commercial attachés abroad lose much of their real value because they are perused by so few, and are not served up in a suitable form for interested consumption, say over the average breakfast table, or in the cityward train. It has been argued that Consular reports are really not of much practical value to the manufacturer or exporter, except as a stimulus to first interest, which, in the proper course, should be followed up by a systematic investigation and trade-getting campaign. Maybe Mr. Madden bears in mind this criticism when he urges everybody British to read his reports issued down to, and including, that of, December, 1911. He will be content if the first stimulus be effectively aroused, for then, he says, the public will find both the settlers and the capital, and when these are provided a great trade and commerce can be "built up" in "British channels."

Turning our attention now to another market, where we hope to have greatly extended business relations almost immediately, we note with interest the observations of a

correspondent of the *Times*, who, after a visit to the province of Hunan, writes home respecting a great Chinese trade revival which is in progress. Students of Chinese affairs know that the Hunanese include some of the finest men to be found in the whole of China, and they have afforded a new illustration of their superiority by sticking to their trading operations while the revolutionary fires were raging elsewhere. Here and in other parts the population is "heartily sick of politics," and is "desirous only of the restoration of confidence and the resumption of trade." We cannot resist the temptation to an aside upon the similarity of the current feeling in China to that which is growing in the British Isles. After a period of strife, wasting resources and effort in international war, or industrial conflict between capital and labour, or revolutionary conflict dethroning a monarch, all the nations must inevitably return, sooner or later, to normal living and to trading operations, and with deep feelings of relief and satisfaction. Let us hope that readjustments consequent upon upheavals will eventuate in greater prosperity for all.

If the present appearances in China are not misleading, it will not be long before the import trade assumes huge proportions. The spring trade at Hankau, "this fast-developing commercial emporium of Central China," is described as enormous. Accumulations have, however, now been cleared off, and there is every prospect of a continuation of the remarkable expansion noted there in recent years. The prospect seems to be encouraging to all British firms who have during the last few years laid schemes for securing some of the electrical and other engineering trade that the progress of modernisation and civilisation is sure to promote; the movement toward, let us hope, prolonged peaceful trading operations, is also, doubtless, being noted with satisfaction by the large number of leading engineering and electrical firms who have joined hands in the recently-formed British Engineers' Association, whose prime object is to promote and protect our interests in China.

#### **Malingers and the Workmen's Compensation Act.**

A CASE was recently decided at the Huddersfield County Court in which the judge made some strong observations about a new form of malingering. It appeared that the employers of a miner made application to terminate or diminish the compensation payable on the ground that the man had recovered. He was said to be suffering from a curious visual disease known as "miner's nystagmus"—an affection of the eyes which is brought on by work in the pit. Two eminent members of the medical profession gave evidence to the effect that this man was able to bring on nystagmus at will, and that he was in fact doing so. A doctor called on the part of the workman admitted that a man can control and also aggravate all the symptoms of nystagmus, and make the disease last longer than it otherwise would. His Honour said: "I quite agree with the submission by the applicants in this case that the respondent was malingering or unduly and improperly prolonging the duration of the disease. Such a practice is grossly dishonest, and the sooner it is stopped the better. I am convinced that the respondent has been malingering in the sense that he has discovered and used means whereby he can produce within reasonable limits for such period as he desired all the symptoms of miner's nystagmus." As the man was still suffering from the complaint to some extent, compensation was not taken away altogether, but the award was reduced to 1d. per week. That a man will go the length described in this case serves to show the extent to which employers in other industries may be exploited. If these things be done by those who are entitled to claim benefits under the Workmen's Compensation Act, one trembles to think of what will happen when the Insurance Act comes into full force.



### Open Specifications.

THE subject of uncommercial specifications has often been mentioned in these columns, it being frequently averred that engineers put forward specifications which cannot be filled on commercial lines owing to obsolete articles being required, or that in one way or another the contractors are prevented from supplying commercial material. Much has been done by way of standardising such things as girders, pipe flanges, &c., and this has put contractors into a much better position in many respects. An engineer writes us that he recently determined to make a thoroughly open specification, and he left open almost every detail, merely specifying that his specification should be followed in the intention, its figures indicating the class of work and the strengths that should be afforded. And what was the result? A storm of abuse, because the specification was so open that no bill of quantities was given. Obviously a bill of quantities is out of the question in a specification which leaves the actual design open to the contractor. Not a single really satisfactory tender was received, and the engineer finally divided up the work among the several sub-contractors, selecting those he could rely upon to do good work, and, by picking out firms whom he knew to be competent in each special line, obtained better and cheaper results.

The same engineer tried again to secure tenders on a specification which left the contractor free to furnish his own standard plant, in everything but a few essential details which experience had shown were rarely produced satisfactorily by any manufacturing firm. Of the firms to whom the specification was sent to tender upon, just one-half went behind the engineer's back and communicated with his client, endeavouring to oust him from the job, representing that he knew nothing of the work, appealing to their own experience, and so on, and specially pushing their own very inferior details and methods in the very few items that were tied fast by the specification. The other half of the tenderers were all firms of better standing and longer experience than the above-mentioned firms; they put in offers that embraced the special points of the specification, and filled the open points substantially with things of their own pattern.

If engineers are to be exposed to such treatment as is described above, it is hardly a matter for surprise that the open specification does not appeal to them. By half the firms, the liberty was utilised to attempt to do the engineer serious injury—the engineer who had selected them to be among the recipients of the specification—while, in the first case, one firm at least became coarsely abusive.

There is thus another side to the commercial or open specification, and the honest and rational contractor suffers because of the bad faith of some of his competitors. Some contractors will beg an engineer to let them have specifications when he has them to give out, and yet the same contractors will go to an engineer's clients and endeavour to secure the work on their own specification, which contains such explanations of details as "large," "of ample size," "approved design," and similar vague and unmeaning terms.

It would be of much greater interest were it possible to write such a note as this with full particulars of the matters touched upon. This, however, is not practicable, and only more or less vague generalisations can be employed. Suffice it to say that the facts at the back of this are substantially as set down, and that it is not easy to put out an open specification unless the engineer has full choice of the firms to whom to send it. When tenders must be publicly advertised, the use of the open specification lays it open to the less scrupulous man to put in shoddy work on the lowest-tender basis. The almost compulsory acceptance of the lowest tender in municipal work is one of the worst features of modern municipal trading, yet it is very difficult to see a way out of the dilemma.

### Water Economy and Electric Pumping.

ESPECIALLY in London, the imposition of a water rate on City property on the basis of the rental, instead of on the consumption, often operates unfairly, and has resulted in a good deal of striving after private water supplies. Where a consumption of 1,000 to 10,000 gallons per day will cost only a few shillings to pump, it might cost hundreds of pounds per year if charged for by the Water Board.

Many private supplies have thus been installed with artesian wells and deep-well pumps electrically driven. Electricity at power rates lends itself particularly well to the work of pump driving, and a deep-well pump not too clumsily made will run for years efficiently at a low speed with very little wear.

Some years ago the air-lift pump was introduced. Its one advantage is that it will raise more water from a given well—if the water is there to be raised—than can be raised by an ordinary pump. But against this one advantage several disadvantages have to be set. First, it is necessary in London to bore a well deeper by 50 to 150 ft. than is necessary for water supply, in order that the air lift may work. Secondly, an air compressor is needed, and requires its full share of attention. Thirdly, unless even another 200 to 300 ft. of boring is added to the already excessive depth, the air lift cannot raise water to the roof tank, and a separate surface pump must be installed. Fourthly, the expenditure of power by an air-lift pump is from three to five times that necessary for an ordinary pump. This extravagance is carefully kept in the background when the air-lift pump is offered. Lastly, the copious impregnation of the water with oxygen is very detrimental to all the iron or steel with which it comes into touch. Oxygen has double the solubility of nitrogen, and the pressure in a London well at the extreme depth of submersion may be several atmospheres, and implies severe oxygenation and great destruction of parts. On this detail alone the wear and tear of an air lift will very soon go far beyond the wear of a slow-running pump.

The extravagant use of power by the air-lift apparatus is very liable to convey a wrong impression of the cost of electrical driving. To begin with, the compression of air and its subsequent use for power generation is a very inefficient process: it may be justified in a mine, where the air which goes to waste is useful as a cooler of the atmosphere: but to use air to work a pump is one of the most inefficient methods of air utilisation. Users know nothing of the intermediate process of the pumping plant. They receive so much water and pay for so much electricity and compare the costs, and this gives an undeservedly bad name to electricity, which receives the blame for the inefficiency of the whole plant. A simple pumping plant with worm gear, direct driven from an electric motor, or a properly-designed double reduction gear, or a chain drive with a high-class chain, will run at a high efficiency, and show as cheap a power cost as a producer-gas engine, without the labour cost and the dirt, which may mean so much in a city building. There are justifiable uses for the air lift, and it may be employed in many instances where the water is not far from the surface, but the inefficiency increases with depth, and so also does the corroding influence of the oxygen-saturated air. A good deal of charlatanism has been connected with the sale of air lifts, especially in regard to the advocacy of particular ways of letting the air into the water at the base of the deeply submerged water-rising main. How air can be coaxed into a water pipe 400 to 500 ft. long in such a manner as to influence its behaviour in that length of main, is a proposition that no engineer is likely to consider seriously. Suffice it to say that while electric driving is a proved success in plain pumping work, it is liable to suffer in character if combined with the notorious inefficiency of the air-lift pump; and users should be careful lest they be dragged into the expense of this system of driving, when they may employ a simple electric drive at a proper and reasonable cost.



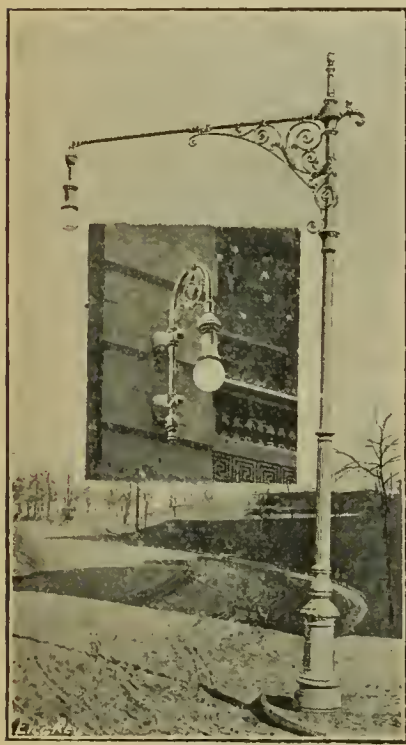
## ARTISTIC STREET LAMP STANDARDS.

WE have received the following letter from Mr. S. G. Rhodes, superintendent of the arc lamp department of the New York Edison Co.:—

"The ELECTRICAL REVIEW of March 22nd, 1912, has an article devoted to the consideration of street lighting that is somewhat ambiguous, in that the article in question has to do with standards designed exclusively for special display lighting, limited in most cities to several squares in their main thoroughfares, and not as your editorial in the same issue might lead one to assume, to standards for municipal street lighting. The erroneous impression that might possibly obtain has induced me to take the liberty of addressing you relative to this detail of the street lighting equipment in the United States, without, however, discussing that phase of it considered by your article and editorial, except to say that they have suffered somewhat in reproduction, and that your contributor is correct in that this form of standard for "White Ways" has been very satisfactory to

by standards, which, from the æsthetic point of view, leave nothing to be desired, and in which also is considered the practical and efficient side of the lighting unit made part of the equipment. This detail of attention has become specially prominent in the design and treatment of standards for viaducts, bridges and other forms of public highways, and to the advantage of the artistic as well as the utilitarian side of the matter. Municipal Art Commissions, or similar bodies made up of architects or representatives from allied professions, have been given in practically all cities jurisdiction as to the suitability of street fixtures that will be placed in the public highways, and as their decision is final, you will note that it is a remote possibility that other than satisfactory units will be installed.

"I trust you will pardon this unsolicited discussion of this matter, my sole excuse being to ensure that public opinion, as represented by your readers, should not confuse the special form of lighting standards with that devoted to municipal lighting. The effort on the part of all concerned, in addition to the cost of the development of lighting standards in all our principal cities, is receiving too much the undivided, and, I must add, unselfish consideration of our central station companies to have to stand, as a matter of record, a criticism that, in the least, reflects on the work they



(1 and 2)



(3)



(4)



(5)



(6)



(7)

## EXAMPLES OF STREET LAMP-POSTS; NEW YORK EDISON CO.

1. Arc lamp-post; tubular steel mast and arm, with iron scrolls and ornamental castings; for use in wide thoroughfares or tree-lined roads.
2. (Inset.) Arc lamp-bracket for use where space is limited.
3. Arc lamp-post, tubular shaft and scroll bracket, standard pattern, for Manhattan and Bronx.
4. Arc lamp-post, twin suspension, used only in Fifth Avenue.
5. Arc lamp centre post with lyre suspension, for busy thoroughfares.
6. Arc lamp-post, bishop crook type, standard pattern, for Manhattan.
7. Tungsten lamp-post, for Central Park.

the merchants and municipalities where they have been installed.

"The state of the art as it is reflected by the standards installed for the various municipalities throughout the country is on a very high plane, as will be appreciated when it is considered that the electricity supply companies have for the most part turned this work over to an architect, and, in collaboration with the electrical engineers of the company, designed the standards for the system to be used with consideration for the locality in which they are to be installed. To such an extent has this form of development proceeded, that our most prominent designers are retained by either the municipality or the electricity company, with the result that our broad avenues, boulevards, park streets and open squares, as well as the usual city thoroughfares, are lighted

are doing. The improvement of the public highways appeals to those having the civic advancement of their city in mind, and the lighting companies yield to none in this matter.

"It has occurred to me that a few photographs of some of the designs of standards in use by one company—the New York Edison Co., New York City—would serve to illustrate this point. You are at liberty to retain these photographs and to use them if you so desire. Permit me to express my appreciation in advance for your consideration of this communication.

"SAMUEL G. RHODES,  
"Superintendent, Arc Lamp Department."

We have much pleasure in printing this courteous communication from Mr. Rhodes, and in expressing the opinion that the illustrations which we reproduce will give a very different impression from that left by the article to which he refers. The designs now shown are graceful and artistic, and bear witness to the care devoted to them by the authorities in New York. It will be noted that Mr. Rhodes refrains from discussing the merits of the designs which we felt called upon to criticise adversely, merely stating that the forms of standard in question have been very satisfactory to the people who use them; we infer from this that his associates were not responsible for them—an inference which is borne out by the general excellence of the designs here illustrated. In this country we have not as yet developed enthusiasm for "White Ways," and we are therefore compelled to have regard, first of all, to the utilitarian aspects of the subject.



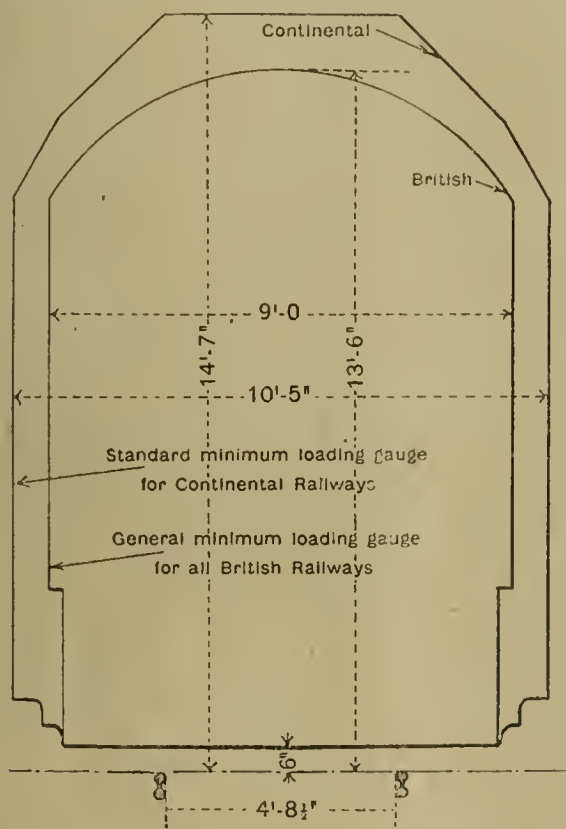
## THE TRANSPORT OF MODERN LARGE UNITS OF MACHINERY.

BY ADOLF R. STELLING, DIPL. ING.

WITH the growth of the demand for high power electric motors and generators there has arisen a difficult series of problems connected with their transport; it also appears that the cost of installing an extra-high-power unit is considerably increased by the difficulties encountered in the forwarding.

In the first place, the actual freight charges increase with the weight of the package. Take, for example, the freight of electrical machinery to South Africa; the charge per ocean ton from British port to Durban varies between 30s. per ton for packages weighing 10 cwt. or less and 90s. per ton for packages of 10 tons. This increased cost is largely due to the necessity of handling heavy consignments by special cranes or other lifting apparatus, but there are very few goods yards equipped with the tackle necessary for the handling of modern machinery.

When forwarding a 25,000-H.P. Parsons-Brown-Boveri turbo-alternator from the works at Le Bourget to the St. Denis (Paris) central station, it was found that three items, namely, the turbine rotor and the upper and lower halves of



The complete journey was accomplished in 10 hours, and the damage done was confined to the crushing of 1,850 paving stones, sundry kerbs, and the cracking of one iron grating. No damage was done to the gas or water mains, and the total cost of the transport of the three items (the second and third journeys being made without incident) was between £400 and £450. A full account is published in the *Revue Industrielle*.

The most serious restriction of economical transport of large units is the loading gauge on the railway: here the British designer is more handicapped than his Continental colleague, as the accompanying diagram will show. To pass the loading gauge stators must be designed to divide into two or four parts, and it has even been found necessary to forward the rotors of large induction motors (for winding engines) in their component parts, *i.e.*, copper, stampings, bolts, &c., in separate cases, and the hub split in halves. One of the rotors in question had a finished diameter of 144 in., and was consigned by the British Westinghouse Co. to South Africa; on being taken into the interior the portions could only be unloaded with the help of a wrecking crane sent by the railway company.

The loading gauge can be exceeded if special arrangements are made with the railway company concerned, but this is often an expensive proceeding. A consignment such as a stator frame which is wider than the gauge can be forwarded overhanging the truck on the 6-ft. way-side; this means stopping all the traffic on the other line across the 6-ft. way.

For the transport of these large burdens special "well trucks" are designed giving a loading level of 2 ft. above the rails, and having a bogie at each end. These trucks are designed for well-lengths of 15 to 35 ft., and to carry weights up to 40 tons on the longest size; to convey modern electrical machinery, and especially large turbo-generator sets, trucks are required which will carry as much as 60 tons. The trucks, however, which are at present being constructed, are being designed with a well length of 35 ft. This seems too long to give satisfactory running results, as the great majority of the loads will be practically central loads for such a long truck. In view of modern practice and modern tendencies, well lengths of not more than 25 ft. seem more suitable. In support of this statement may be taken the example of the 25,000-H.P. set in which the maximum indivisible length is 22 ft. 2 in. Further, for "Lancashire" boilers 30 ft. in length, the standard boiler trucks can be used.

### NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE Department of the Interior has recently created a water-power branch which will deal with the control, &c., of water-powers in Manitoba, Saskatchewan and Alberta. Engineers have already been set to work to investigate and report on the water-powers of the West.

The terminal of the Grand Trunk Pacific Railway, Prince Rupert, B.C., is likely to become an important centre in the near future as lumber mills, cement works, smelters, flour mills, &c., are to be erected, and heavy demands for power will probably be made on the Prince Rupert Hydro-Electric Co.

The Ottawa Light, Heat and Power Co. have recently decided to take what appears to be rather an extraordinary step in connection with an extension to their power plant. Although Ottawa occupies an almost unique position, even in Canada, for the economical development of hydro-electric power, the company referred to have decided to put in some 6,000 H.P. in the form of steam plant. It appears that the idea is to use this plant primarily to take peak loads, and, secondarily, to act as a stand-by, and the management of the company is of opinion that though, for continuous operation, water power is the cheaper, yet for intermittent loads steam power has the advantage.

the turbine casing, were too heavy to be handled by the cranes at the railway sidings near the power station, and therefore the journey of 5½ miles had to be made by road.

The dimensions of this set are:—

Overall length, 44 ft. 8 in.; overall width, 13 ft. 2 in.; length of turbine, 27 ft. 10 in.; length of alternator, 18 ft. 10 in.

The turbine rotor is 22 ft. 2 in. long and 10 ft. in diameter; it weighs 40 tons. The cradle in which it was conveyed weighed 3 tons and the lorry itself 12 tons; 35 horses were necessary for the haulage. The width of each of the four wheels being 12·2 in., the load on 1 in. periphery of the rear wheels was 6,800 lb. per sq. in.

On leaving the works, the branches of trees impeded the cavalcade; these being sawn off, no further check was received until, by mistake, a turning to the right instead of to the left was made. The services were then requisitioned of a salvage contractor, whose cart, with levers, barks, chains, jacks and winches, had accompanied the load. Their services were again in demand when the vehicle skidded and crushed the kerb. Four hours were occupied in jacking back to the centre of the road. The iron gratings of two ventilating shafts were crossed after covering them with ¾-in. boiler plate. One level crossing and two bridges were crossed without mishap, one of the bridges being a drawbridge over a canal, supported on this occasion by a structure built on the towing paths.



A deputation of five Senators from New York State has recently been visiting a number of places in Ontario in order to secure information respecting the operations of the Hydro-Electric Power Commission of this province. The advisability of establishing a similar system in New York State is now under consideration by the legislature there, and a report on the subject is to be submitted at the next session of that body by the deputation referred to.

Application for power has been made to the H.E. Power Commission by representatives from the districts around the towns of Beaverton, Cannington, Sunderland, and other places lying about 50 miles north of Toronto, and the Commission's engineers will shortly investigate and report on the subject. It was stated that, if the Commission's system were extended in this direction, many farmers would use it.

Two applications have recently been made for power rights on the Rainy River, which is situated in the extreme west of Ontario, and which connects the Lake of the Woods with Rainy Lake, one by the Ontario and Minnesota Power Co. and the other by the Rainy River Improvement Co.; these are being investigated by engineers of the Public Works Department. As the Ontario Government is concerned in the matter, the question of a site for the necessary dam is to be considered by it, and as a question of water levels also comes in, the report drawn up by the engineers of the Public Works Department must go before the Canadian Section of the Waterways Commission.

The recent coal strike in England lends some interest to the statement that the municipal council of Calgary in Alberta favour the idea of municipal ownership and operation of a coal mine, coupled with the actual selling of the coal to residents at a reasonable price.

A report from Saskatoon states that 14,000 H.P. could be developed on the South Saskatchewan River and power delivered thence to the town referred to. The cost of the scheme, including transmission lines, would be about £440,000.

### CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

#### An Objectionable Clause.

*A propos* of "Fairplay's" letter, headed "An Objectionable Clause," I certainly think all reputable electric wiring contractors should have nothing to do with a specification which contains a clause with such arbitrary powers. A contractor accepting work under these conditions would obviously lose money, as it is now general knowledge that no Union man is ever satisfied, therefore, like Oliver Twist, he is always "asking for more." I presume the Socialist Guardians have in view the curtailment of the contractor's right of authority. If so, I can congratulate them on inserting a stipulation which will rob the contractor of his say in the matter as to whom he shall employ and whom he shall dismiss, or, to be more precise, the Electrical Trades Union will be the authority, whilst the contractor will play second fiddle, he, at the same time, financing the work and taking the risk of bad work and tests.

Now the term Trade Union plainly means Socialism; I would suggest that all reference to the term Trade Union be deleted, and "local conditions and rate of pay," with schedules, be substituted; also any differences of opinion arising between the contractor and his employes should be settled instantly by the contractor dismissing the complaining workman.

Percy D. Collins.

Wimbledon, June 10th, 1912.

#### The Limerick Appointment.

This hardy annual is with us once again! You publish in your current issue a long advertisement inviting applications for the office of borough electrical engineer to this notorious borough.

As the writer happens to know something of the manner in which municipal matters are managed in this town, let me say that it is quite useless (fortunately) for English engineers to waste their ink, paper, stamps, and time, in applying for the position.

On three occasions within the past few years the position has been open for competition, and on two occasions selected candidates were required to sit for a technical examination. On each occasion English candidates came out at the top of the list. What was the result? Were they appointed? No! Why? Simply because Anglo-Saxons are not tolerated in this part of Ireland. The appointment went to men who were either able to sign their name in Gaelic, or to produce a birth certificate showing that they were born and reared in Ireland. A knowledge of engineering was quite a secondary consideration.

The job would be no sinecure if the salary offered were £1,000 per annum.

In the Know.

June 8th, 1912.

### THE INDIRECT LIGHTING OF ROOMS.

By "WHISTLEFIELD."

INDIRECT lighting by means of arc lamps and inverted shades has long been recognised as the best method of illuminating drawing offices and other places where even and shadowless lighting is desirable, but this method of lighting was not extended to the lighting of rooms, because, with the exception of arcs and Nernst lamps, it was hardly possible to get lamps of high enough efficiency and candle-power for the purpose.

The advent of the high candle-power metal-filament lamp, however, has altered this, and now indirect lighting, with all its many advantages, can be applied to any room that has a white ceiling.

Many of the indirect lighting fittings on the market are designed with a view to their decorative effect, and seem to

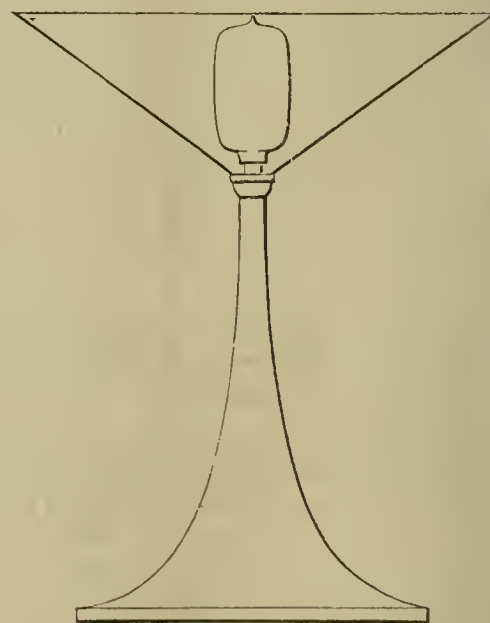


FIG. 1.

treat as of quite secondary consideration the main object of the fitting, which is to reflect as much light as possible, not only on to the ceiling, but all over the ceiling.

One of the finest reflectors for this purpose is the ordinary white opal shade, which is made in such standard sizes as 18 in. diameter by 6 in. deep, and 15 in. diameter by 4½ in. deep, and the following experiment, which is easily carried out, is well worth a trial in any room, such as a drawing-room, where inverted lighting could be advantageously applied.

Take any table or portable lamp and fix under its shade-carrier ring a 15-in. opal shade (see fig. 1); put a 50-c.p. metal lamp into the holder, switch on and hold this lamp over the head in the centre of the room so that all the light is thrown on to the ceiling; if every other light is



switched off, the room will be flooded with a soft white light, the beauty of which will hardly be credited unless seen. By moving the fitting nearer to or further from the ceiling a position will be found where the whole of the ceiling will be evenly illuminated, and the general lighting effect will be at its best.

Fig. 2 shows a very simple fitting, consisting of a 15-in. diameter  $\times$  5-in. deep cardboard conical shade, suspended below a plain pendant. It is quite clear from the diagram

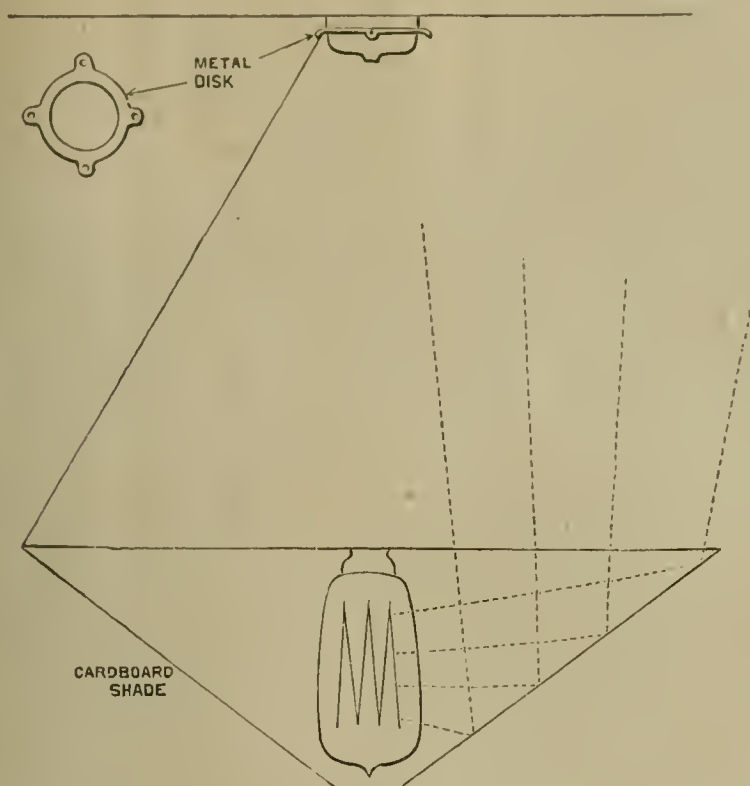


FIG. 2.

that practically all the light given off by the lamp is reflected upwards and outwards, thus illuminating a large area of ceiling. This fitting while being quite serviceable as a reflector is not sufficiently decorative for a room, and fig. 3 shows the same kind of arrangement, only in this case the shade is of opal and is fitted with a metal band carrying a fringe of beadwork or silk; the opal shade rests on the lip of the

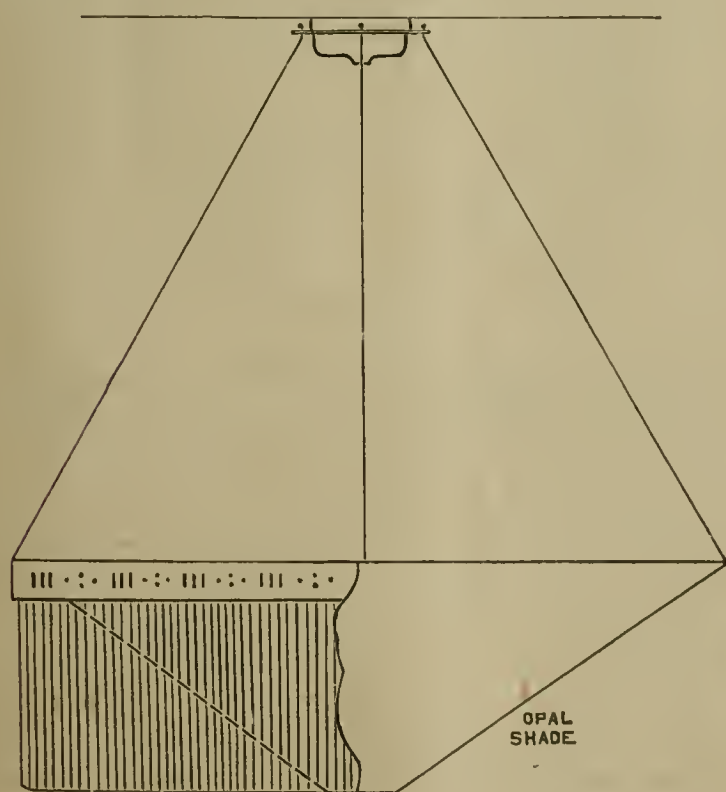


FIG. 3.

band, and the whole fitting is suspended by means of cords attached to this band.

Fig. 4 shows a wire frame which any electrician can readily make up with stout birdcage wire of such a size that a 15-in. diameter  $\times$  4½-in. opal shade, if it is to be used with a 50-C.P. or 80-C.P. lamp, or 18-in. diameter  $\times$  6-in. deep shade if a 100-C.P. lamp, will just fit into the tapered part as shown. The taste and ingenuity of the ladies of the household, aided by scraps of silk, will convert the wire frame

into a thing of beauty, figs. 5 and 6 affording a mere indication of what is possible in that direction: it will be found that white is the best colour for the groundwork, and as a fair amount of light filters through this background, it lends itself to decorative work.

The cords by which the shade is hung may be either silk or ribbon, while strings of beads are very effective in cases

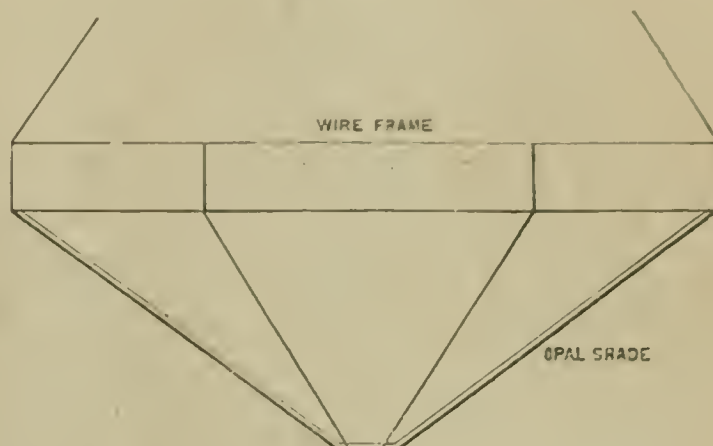


FIG. 4.

where bead fringes have entered into the scheme of shade decoration.

Before leaving the subject, it may be well to add a few notes regarding efficiency in this method of lighting. It is not efficient to put a group of lamps inside an inverted shade, and there is no reason for doing it: lamps can be obtained of practically any candle-power, and certainly a



FIG. 5.

100-C.P. lamp gives as much light as can possibly be required from a single fitting. It must be remembered that metal-filament lamps, from the very nature of their construction, shed most of their light in a horizontal direction, and a conical shade, such as that shown in fig. 2, will reflect up the maximum quantity of light from the lamp.



FIG. 6.

but if a group of three or four lamps hanging at an angle be placed in a bowl fitting, as is the case in a large number of fittings on the market, it is impossible to design a reflector which will not send a good deal of light back into the lamps and holders, and a loss of efficiency will be the result. On the ground of first cost as well as running cost, the single lamp easily holds its own, and the only point not in its favour is the fact that when a lamp fails all the light is out; but



that factor is not worth taking into account in most cases, compared with the gain in efficiency.

The human eye readily adjusts itself to the intensity of the illumination that it has to endure, and anyone stepping from bright sunlight into a room well knows that it takes some minutes for the eye to be adjusted to the lower scale of intensity, but when this has taken place it is quite as easy to see clearly in the room as in the sunlight. This fact explains why it is that indirect illumination appears so bright compared with direct lighting where the same candle-power of light has been used.

In indirect lighting the illumination is practically even, and there are no bright points for which the eye has to be adjusted, so that the iris is open to a larger extent than would be the case were bright lamps dotted about as in direct lighting; thus the eye can see more clearly with less light than is the case with badly-arranged direct lighting. The cases are comparable to a man sitting in a room and another who is continually stepping out into the sunlight. The latter thinks the room dark, and the former sees quite clearly, simply because the eyes are differently adjusted; and as this adjustment is quite automatic and beyond our control, and the eye is always adjusted for the strongest light that it is called upon to endure at the time, the problem of the lighting engineer is to arrange his lamps so that there are no bright lights visible, and all the illumination is as far as possible even. Indirect lighting by means of inverted shades is the only solution, so far, to this problem in the lighting of rooms, and the restfulness of this light on the eyes, and, therefore, on the whole system, is well worth the trouble of making up a few fittings as described above.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Simplex Heating Apparatus.

MESSRS. SIMPLEX CONDUITS, LTD., London and Birmingham, are introducing a series of boiling plates, which are of very solid mechanical construction, and in which no material is used which is likely to be detrimentally affected by the high temperature at which these plates are required to work. They are made in three sizes—6 in., 8 in. and 10 in. diameter—and these sizes may be obtained arranged for temperature regulation, either by means of the usual three-pin terminal, which gives four variations from one quarter to full heat, or when required for use on circuits not under



FIG. 1.—SIMPLEX HEATER IN CAST-BRASS, GILT-FINISH FOR SHIPS' SALOONS.



FIG. 2.—SIMPLEX CAST-IRON BOILING PLATE WITH HEAT-REGULATING SWITCH.

200 volts, with a special three-heat regulating switch, which is attached to an extension piece at the side of the plate in the manner shown in fig. 2. This heat switch is fitted with an indicating dial, which clearly shows the exact regulation which is being worked to.

A number of Simplex heaters have recently been supplied for ships' use, and these are, of course, of special design and construction. A typical pattern shown in the firm's new catalogue, to which we refer elsewhere, is that appearing in fig. 1. It is very heavily constructed in brass and gilt finished, and affords an excellent example of the work of the company's artistic metal and fittings department.

### Belling's Electric Geysers.

MR. C. R. BELLING, of Enfield, Middlesex, has applied for patents on an electric geyser consisting of a heating element of resistance ribbon, each side of which is kept in perfect insulated contact with one face of the metallic body part of the geyser, the other face of

which consists of a number of webs or radiating fins, so arranged as to give the water to be heated a long tortuous passage, thus causing it to impinge on the webs and immediately absorb the heat generated by the element. With this system a maximum heating with a minimum cooling surface is obtained. The geysers are being constructed in two patterns, namely, the "Spiral" and the "Maze" type. In the "Spiral" pattern (fig. 3) the element is in two parts, one wound on the central delivery tube, and one on the main body. The whole is enclosed in a water jacket through which the supply enters at the top; it passes thence to the bottom of the spiral waterway, rises through this (at the same time finding its level in the water jacket), and is finally delivered to the top of the central tube, the lower end of which forms the outlet. The geyser is, therefore, always full. The jacket has an air valve to prevent air locks. Tests taken with this pattern show that a continuous delivery of hot water is obtained at the rate of one gallon per minute, raised from 15° C. to 39.5° C. with an efficiency of 95.8 per cent. The water reaches this temperature 1½ minutes after switching on, and the flow is then continuous. This type must be used in the vertical position.

The "Maze" Pattern, fig. 4, is of simpler construction, and is the standard line. Having no cold water jacket, its efficiency is slightly lower than that of the "Spiral" pattern, but it has several compensating advantages. The heating element is securely clamped between the two inner insulated faces of the body of the geyser, and is completely surrounded by water (as will be seen from the sectional view). Owing to the perfect contact obtained, the conduction of the heat to the water is almost instantaneous, thus the

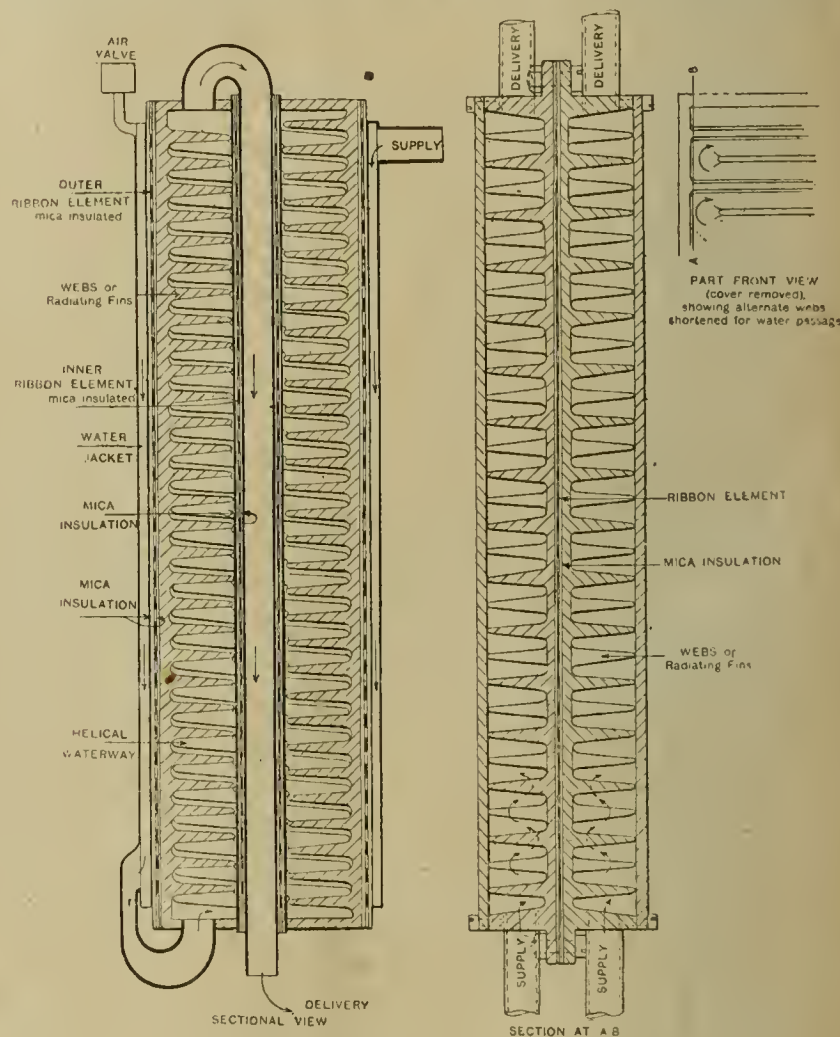


FIG. 3. FIG. 4.  
ELECTRIC GEYSERS.

temperature of the element itself can never rise much above the temperature of boiling water, under which conditions its life is practically unlimited. With this pattern the water passes through both mazes in parallel, thus eliminating all air valves and other accessories. This type will also stand any pressure up to 160 lb. per sq. in., and can, therefore, be fitted in connection with any existing hot-water supply system, enabling the water to be heated by the coal fire normally, or by the geyser when the fire is not available. Any desired quantity of hot water at any specified temperature can be arranged for by fitting a multiple geyser built up of a number of the "Maze" pattern units in parallel.

The use of these geysers, in addition to the excellent lighting, heating and cooking apparatus already on the market entirely dispenses with the necessity for gas or coal in any house. With electricity at 1d. per unit, a hot bath of 15 gallons, at the temperature of 100° F. can be obtained in 15 minutes at a cost of a fraction over 2d. There is only one control handle, which gives cold, hot or boiling water at will.

It is claimed that the control is quite foolproof; there is only one handle to operate, and this is arranged at the right-hand side of the case, keeping the over-all projection of the apparatus from the wall down to 5 in. The operating handle is actually the water tap handle, to which the electric switch is mechanically connected inside the case, it being impossible to switch on the current before the water, or to turn off the water without first switching off the current.

Each pattern is supplied complete with specially designed control gear, and the whole is enclosed in one case, the over-all dimensions of which are 16 in. × 16 in. × 5 in. The gear consists of a screw-down water tap and union; double-pole independent quick make-and-break switch, breaking at four points; double-pole fuses, and terminals for fixing main supply.



An additional safeguard is provided against the possibility of the main water supply failing whilst the geyser is left working unattended to. This consists of a special fuse in the body of the geyser, which melts at a pre-determined temperature, and so breaks the electrical circuit, preventing any damage to the apparatus.

The whole apparatus is made throughout with metal, mica and porcelain, and there is no inflammable material whatever in its construction.

## LEGAL.

DIESEL ENGINE CO., LTD., v. CRITTALL MANUFACTURING CO., LTD.

In the King's Bench Division on June 6th the Lord Chief Justice and a special jury had this action before them.

Mr. Holman Gregory, K.C., and Mr. W. Allen were for plaintiffs; Mr. Montague Shearman, K.C., and Mr. R. F. Colam for defendants.

MR. GREGORY said the claim was for £1,129 10s., being 50 per cent. of the purchase price of a 225-B.H.P. Diesel engine and dynamo and accessories, this being the first instalment due. The contract to purchase the engine was in writing between the parties, the Crittall Manufacturing Co. having agreed to pay in all £2,259 for the engine, and it was part of the bargain that half the amount should be paid on completion, 25 per cent. when the engine was running, and 25 per cent. three months afterwards. The engine had been delivered, and the plaintiffs were now asking for their money. In the year 1910, said counsel, the plaintiff company were the owners of the Diesel patents. They were not manufacturers of engines, but entered into contracts with different firms to manufacture the engines. The plaintiffs, in fact, bought engines of different power made by different manufacturers under their licence. In this way plaintiffs obtained engines from Messrs. Carels Frères, of Ghent, as well as from Messrs. Willans & Robinson, of Rugby. One of those obtained from the latter firm, and numbered "23," was the one dispatched to the defendants' works at Braintree, in Essex. On March 23rd, 1911, the defendants were apparently anxious to acquire a Diesel engine for the purpose of running a dynamo for general electric lighting and power, and negotiations took place with the result that on July 11th, 1911, a contract in writing was entered into. The terms were accepted, and following that contract, the plaintiffs, having delivered one of the Willans & Robinson engines to the defendants, asked for the payment of the 50 per cent., and then the defendants raised several difficulties. The defence was first of all that the plaintiffs had not delivered a complete machine, but, as a fact, the machine had not only been delivered, but had been erected, and was now in running order. The defendants said the plaintiffs had tendered parts of a Willans engine, which was a different engine to that contracted for, but, said counsel, a Diesel was a Diesel, whoever it was manufactured by, and it was made upon the Diesel patents. Another defence was that the contract was to supply an engine which would give 195 revolutions a minute, whereas that supplied by plaintiffs gave only 180 revolutions a minute. As a matter of fact, the engine supplied by Willans was of 200 H.P. at 180 revolutions per minute, but it could safely run at 195 revolutions a minute, developing 225 H.P. This engine, of which the defendants complained, was properly constructed, and provided the power specified in the terms of the contract. The sister engine had been running for months at 195 revolutions a minute and developing 225 H.P., to the satisfaction of everybody concerned. Another of the defences was that the engine tendered was not one of the best quality construction as contracted for, but "one of a batch of engines which, to the knowledge of plaintiffs, were defective and inferior in construction, and which they themselves had advertised in the ELECTRICAL REVIEW of February 3rd, 1911, for sale on the terms that no reasonable offer would be refused for them." As a matter of fact, said counsel, it was not one of these engines that was supplied to defendants. It was part of the plaintiffs' contract with Willans & Robinson that before the defendants took over the engine they should have a running test, and that the engine should pass the test. An expert was sent down by the plaintiffs, and he found one or two minor faults, and they were put right by Willans and Robinson, and the engine was passed. Then they said this was one of the engines advertised in the ELECTRICAL REVIEW, but it was not. The plaintiffs had entered into a contract with Willans & Robinson to make more machines than they found they could sell, and, anticipating that the patents would soon run out, the advertisement was inserted. When persons did apply they were, in fact, asked a higher price than the defendants contracted for. Defendants said they were shown a Carels engine at the Hoffman Manufacturing Co.'s works at Chelmsford, and were promised one like that, which was denied, and defendants, by taking away two little bits from the remainder of plaintiffs' letters, alleged fraud. Counsel submitted that the defendants had either to accept or reject the engine, and the correspondence clearly showed that they accepted it. Their only claim could be one for damages for breach of contract, inasmuch as the engine supplied was not the engine they contracted to send, and there was not a word of such a claim in the counterclaim.

MR. WILLIAM BATHO, managing director of the Diesel Co., said his company did not manufacture engines, but granted licences to manufacturers under their patents while they lasted. One of these firms was Willans & Robinson, who also manufactured engines for

the plaintiffs. The specification sent in reply to defendants' inquiry was in the usual form.

HIS LORDSHIP: That describes it as "one Diesel engine."—WITNESS said it was the usual printed form sent out generally. At the interview in June, 1911, with Mr. Crawter (of the Crittall Co.), when the matter was discussed, there was no mention of a "Carels" or any other make. Carels did not make an engine of that size. Witness told Mr. Crawter he could take him to see several of the Diesel engines running, but he never sent defendant to examine that working at Chelmsford.

Cross-examined by MR. SHEARMAN, WITNESS said many hundreds of these engines had been installed in England. Speaking roughly, about a quarter of these were "Carels," and a good many were by Sulzer.

Have the Carels engines been remarkably successful, and have they a high reputation?—Yes. Witness said they gave a trial order for a dozen machines to Willans & Robinson, and they also agreed to take 100 cylinders, this contract afterwards being rescinded by agreement.

Was this because they were extremely unsatisfactory?—No.

Did you insert this advertisement in the ELECTRICAL REVIEW?—"To clear: Several Willans-Diesel oil engines, that have only been run on the testing bed. No reasonable offer refused. For full particulars, apply Diesel Engine Co., Ltd., 179, Queen Victoria Street, London, E.C." Did you put that advertisement in to get rid of this lot cheap?—No.

How many of these engines did you have on hand when you offered them for sale?—We had at that date, I think, six. They were at Rugby.

How many have you sold in England since the date of that advertisement?—None.

Is it a fact that nobody will look at a Willans-Diesel engine?—No. There is no such thing as a Willans-Diesel engine. WITNESS said it was not true that the demand for Carels engines was so great that they could not get delivery under eight months. He could deliver a Carels 200-H.P. engine within six or seven weeks.

Did you sell any of those you advertised in the ELECTRICAL REVIEW?—No.

Is not the Willans & Robinson engine notorious?—No.

MR. SHEARMAN (holding up the page advertisement in the ELECTRICAL REVIEW): Would not an advertisement like that serve to spoil the market?—No.

On the 7th inst. MR. BRANCH, assistant engineer, gave evidence.

MR. FERGUSON, engineer for Messrs. Willans & Robinson, spoke as to the efficiency of the engines, which were made to the drawings supplied by the Diesel company.

In cross-examination, WITNESS said that on February 3rd, 1911, his firm had at Rugby three sister engines to that supplied to the Crittall Co. He saw the advertisement in the ELECTRICAL REVIEW at that time, saying that no reasonable offer would be refused.

Were Willans & Robinson annoyed about it?—That was the Diesel company's business. Witness added that his company were still manufacturing Diesel engines, and had a large number on order now.

Evidence was also called as to the satisfactory working of Diesel engines, made by Willans & Robinson, at the First Garden City at Letchworth; at the Uralite Co.'s works; and at the Suffolk Electricity Co.'s works at Felixstowe.

MR. CHARLES FREDERICK BENNETT, manager of the works for Messrs. Willans & Robinson, said that the engines they supplied to Letchworth, the Uralite Co., the Suffolk Electricity Co., and the Crittall Co. were identical.

MR. SHEARMAN, opening the defence, said he would prove that the order for this engine was given and accepted at an interview on July 4th. The plaintiffs took the order on the understanding that they were to supply a Carels engine, and with the intention of supplying a Willans engine. The Willans engine, said Counsel, was known to the public to be a doubtful engine—an engine which was known to create trouble. The Carels engine was known throughout the world as a good engine. The defendants ordered a Carels engine, and they were supplied with a Willans. The defendants gave an order for a 225-B.H.P. engine, and they were supplied with a 200-B.H.P. engine, and this engine was sent up to London from Rugby as a 200-B.H.P., stopped there and sent on to defendants as a 250-B.H.P. engine.

MR. CRITTALL, of the defendant company, said the contract was really made in his office, between himself and Mr. Branch, of the plaintiff company, at an interview on July 4th. The contract was for a Carels engine. Witness went to the works one morning and found that a Willans engine had come in. He then gave his instructions to Mr. Crawter. Witness was always willing to accept a Willans engine, subject to satisfactory guarantees as to its running. The engine was at the works, but had never been running, and the company had hired another at a cost of about £38 a week.

HIS LORDSHIP said he was going to rule that the defendants' remedy would be in damages. They had the engine erected, and did not reject it.

WITNESS said that his company did not use the engine, because the plaintiffs took away the material parts—the atomisers—so that they could not use it.

Cross-examined: The contract was for a Diesel engine and spare parts, cooling apparatus, and dynamo. That contract was made by Mr. Branch and himself in his office. The price, £2,259, was afterwards arranged by Mr. Crawter. He did not know that the Diesel company supplied any other than the Carels engine.

MR. SHEARMAN intimated that he was not going to persist in the charge of fraud.

HIS LORDSHIP: I am very glad to hear that.

When the case was called on Saturday, the LORD CHIEF JUSTICE



said he had read the correspondence, and had come to the conclusion that on the documents, neither party had stood on their strict legal rights. He had very grave doubts whether the defendants could raise the question as to the power of the engine.

MR. SHEARMAN said he was not there to say that the engine would not develop 225 H.P., with 195 revolutions. His point was whether they could call the engine supplied a 225-H.P. engine.

His LORDSHIP remarked that the Diesel Co. said that there were three sister engines to that supplied to the Crittall Co., all running satisfactorily at that speed. After Mr. Crittall's evidence on the previous day, in which he undertook the responsibility, he (his Lordship) could understand that he had taken a hasty view of the position.

MR. WM. CRAWTER was called and sworn, and on the suggestion of the Lord Chief Justice, counsel had a consultation.

On returning to Court,

MR. SHEARMAN said his Lordship and the jury would not be further troubled with the case. There had no doubt been a genuine dispute between the parties, but the defendants were now thoroughly satisfied that there was no fraud on the part of the plaintiffs. Mr. Gregory appeared to be under the impression that he (Mr. Shearman) had used words which might be construed into an imputation on the engines manufactured by Messrs. Willans & Robinson. If he had by any error or slip of the tongue used words which conveyed that impression, he wished it to be understood that he had no such intention. It was now agreed that the document of July 11th constituted the contract, and the plaintiffs had agreed to provide a competent man for one year, to be the servant of the defendants. The defendants would pay the full contract price at once—that was 14 days after the passing of the test. The test was to take place before an engineer, to be approved by both parties, and if they could not agree, then an engineer should be appointed by the President of the Institution of Electrical Engineers.

MR. HOLMAN GREGORY, for the plaintiffs, agreed.

The LORD CHIEF JUSTICE said that in his opinion the settlement arrived at was a credit to both parties. He (his Lordship) had not the slightest doubt that Mr. Crittall did think he was going to get a Carels engine, because he thought that all Diesel engines were Carels engines. This was the sort of dispute which drifted on, and it was not until they got the whole facts out that they could come to a decision. His Lordship remarked that he had an interest in, and considerable knowledge of, Willans & Robinson's works, and had they been materially affected, of course he could not have tried the case. He thought this was a very satisfactory settlement to both parties.

#### CAPEL v. DUDLEY.

IN the Shoreditch County Court, on Friday, before his Honour Judge Smyly, K.C., Messrs. Capel & Co., of 168, Dalston Lane, Dalston, engineers, sued W. W. Dudley, of High Road, New Southgate, Middlesex, the proprietor of the Coronation Picture Palace, to recover £15 15s. 2d., the balance due for the supplying and fixing of a suction gas engine. There was a counterclaim for £9 9s. Mr. H. C. Davenport was counsel for the plaintiffs, and Mr. Godwin for the defendant. The plaintiffs' case was that they were asked to provide a suction-gas engine to provide the electric power for the operating room of the picture palace, which they did for £210. The amount claimed was the balance due. When the engine was fixed it was a success, and although there was a trivial fault or so, it was put right. The defence of Mr. Dudley was that the engine never worked satisfactorily, and accordingly on quite a number of occasions they were unable to open the picture palace, whilst on two or three other occasions the engine broke down and the electric light failed in the middle of the performance, and people had to have their money returned. He was recommended to go to Capel's by an electrical engineer, who said they were noted for the gas engines they supplied for picture palace work. The one he had was a Crypto. When he ordered it, it was on a guarantee that the gas engine should be in every way satisfactory, but it never had been, although at times it would go fairly well. Many times the engine "raced," and had to be shut off. The price originally agreed was £207, and he never agreed to £210. He heard subsequently that the dynamo they had intended to supply was not forthcoming, so, on the recommendation of a friend, he agreed to take another, but it was on the understanding that it was to cost no more. His counterclaim consisted of the loss he had sustained through being unable to open for business, and the expense he was put to in putting the gas engine right. The engine was fitted by plaintiffs' own men, and they stayed a fortnight to try and put matters right. Weights were put on the governors to make them work, and he complained of that, as he said not only had he never seen such a thing on a gas engine before, but it made a new engine look very unsightly. It looked just like a second-hand engine, and made a great noise, but he was told it would be all right after it had run for a little while. After the plaintiffs' engineer had gone, it stopped, and he at once 'phoned for it to be put right, but nobody came except once, and then they did nothing. It was true he had been asked for money on a number of occasions, but he declined, because he considered the guarantee to supply a good running gas engine had not been carried out. He told them on the 'phone that the engine was really no good, and they replied "send along the money and we will see after it," but he could not see the force of that. He promised to pay as soon as the engine was in proper running order. He had been called a fool to part with anything at all.

MR. PUDDICK, the engineer employed by the defendant, said he had a life-long experience of steam engines, but this was the first gas engine he had controlled, although he understood

the running. When the pictures stopped, the engine raced. He might be called inexperienced, and had no idea of mixing gas, but he followed out instructions given by the plaintiffs' engineer.

MR. PERCY WM. DAVIES expressed the opinion that the engine was all right, but was carelessly fitted.

MR. DAVENPORT: We have nothing to do with that.

JUDGE SMYLY: Oh, indeed yes. An engine cannot run unless it is properly fitted.

MR. CHADDERTON, of Barking Road, Canning Town, who stated that he had had a great deal to do with combustion engines, said he found a quantity of wood-wool on the spindle, which had caused the engine to run wrong. He thought it had got there in the packing. The action of the spindle had caused the stuff to turn into a hard wad. It was certainly a remarkable thing that it had never been discovered all these months, but still the fact remained.

After hearing further evidence, JUDGE SMYLY found for the plaintiffs on the claim and counterclaim.

#### REDUCTION OF CAPITAL.

IN the Chancery Division on Wednesday, June 5th, Mr. Justice Swinfen Eady had again before him the petition of Edward Foster and Son, Ltd., brassfounders and electrical engineers, of Halifax, to confirm a special resolution to reduce the company's capital by £14,665, by cancelling 1,981 of the vendor's ordinary £5 shares—£9 905—and 952 of his preference £5 shares, viz., £4,760, making £14,665. The capital of the company was originally £50,000 in 5,000 £5 preference, and 5,000 £5 ordinary shares; 1,000 of the former and 2,000 ordinary were issued as fully paid to Mr. Foster, the vendor. The petition was adjourned from May 21st for the production of the balance-sheets.

MR. RUSSELL, K.C., for the company, said the loss would be borne by one person only, viz., Mr. Foster, the chairman of the company and its vendor. At one time in the company's existence, Mr. Foster agreed to postpone certain of his preference shares, and to put them in the same position as ordinary shares, and they appeared in the balance-sheet as deferred ordinary and preference shares, which, in fact, they were not. The petition had been amended, but since that was done, certain inaccuracies had been discovered and a reamendment was necessary. The amount of the loss £14,660 had been ascertained by a revaluation of the assets. The agreement by which Mr. Foster deferred the shares had been cancelled, and it was in order to restore this position with regard to 953 such shares that Mr. Foster had entered into an agreement under which 653 of his preference shares would rank as ordinary shares. It would have been simpler to have provided for a large number of preference shares to be cancelled, leaving a larger number of ordinary shares untouched.

His LORDSHIP sanctioned the scheme.

#### THE NATIONAL TELEPHONE PURCHASE.

THE Railway and Canal Commission, consisting of Mr. Justice Lawrence, the Hon. Gathorne Hardy and Sir James Woodhouse, sat in the King's Bench Division to-day to commence the arbitration proceedings between the National Telephone Co. and his Majesty's Postmaster-General to decide claims by the company arising out of the purchase of their system by the Government. Some 20 millions of money are involved, and the proceedings are expected to last many weeks.

The counsel engaged in the case were:—For the Telephone Co., Sir Alfred Cripps, K.C., M.P., Mr. W. O. Danckwerts, K.C., Mr. Forbes Lankester, K.C., Mr. E. Morten, K.C., Mr. H. H. Gaine and Mr. Aubrey T. Lawrence.

For the Postmaster-General:—Sir Rufus Isaacs, K.C. (Attorney-General), Sir J. Simon, K.C. (Solicitor-General), Mr. Buckmaster, K.C., Mr. Rowlatt and Mr. Branson.

In opening the case for the National Telephone Co., SIR A. CRIPPS said the company's claim exceeded in the aggregate £20,000,000, which was probably one of the largest claims in one case ever before the Courts. There was a great mass of detail to be gone into. Proceeding with the history of the matter, Sir Alfred said the career of the telephone in this country dated back to 1876, when Graham Bell's invention was put on the market. In 1877 and 1878 there were further well-known patents by Mr. Edison. He believed that in those early days the patents were offered to the Post Office, but that department refused to take them up. The next step was the case of the Attorney-General v. the Edison Co., of London, which decided that telephones came within the telegraph monopoly. Negotiations then took place, and, as a result, the first of a series of agreements was entered into in 1881 under which the various licences were granted by the Postmaster-General, and although dated as of that year, the licence to the Telephone Co. was not granted until 1884. That licence was for a duration of 30 years. It expired on December 31st, 1911, and as a consequence of its expiry the present arbitration came before the Commissioners. Under the 1884 agreement the Postmaster-General and the State received a royalty of 10 per cent., which had amounted in the course of the term to some £3,810,000. In 1905 a further agreement was entered into which contained the purchase clause with which the Court had to deal. Between 1881 and 1892 the National Telephone service absorbed all other licences from the Postmaster-General, and thus became themselves the sole telephone undertaking, with the exception that at that time, in small exceptional instances, the Postmaster-General's department was carrying on a telephone business. In 1894 the net income of the National Telephone Co. was £279,000, whilst at the end of 1911 it had increased to £1,229,000. The gross



income had increased during that period from £738,000 to £3,685,000. When the business was taken over by the Postmaster-General at the end of last year there were about 18,000 employes in the company's service, and that number would have undoubtedly been largely increased had the company been dealing with the concern as a business which they were going to carry on for all time. Going back again to the history of the matter, Sir Alfred said that about 1899 or 1900 difficulty arose, particularly in London, in regard to the laying down of conduits for the purpose of constructing an underground telephone system. The London County Council refused to grant to the company the necessary assent to their laying their wires in underground conduits. This action by the L.C.C. resulted, undoubtedly, in the construction of a very much larger amount of overhead system in London than would otherwise have been the case. In 1901 came the London agreement under which the Postmaster-General decided to compete with the company in the London area. This agreement contained a provision for the rental of underground wires from the Postmaster-General by the company. In 1904-5 negotiations were entered into which led up to the purchase agreement of 1905. The company's expenditure on capital account—and this did not include a very large sum paid out of revenue which would properly have been chargeable to capital account—amounted to £16,519,772. The heads of claim before the Court were, first, the licence business under agreement of 1884; secondly, what was known as the private wire business; thirdly, the fire alarm business; and fourthly, the telephone business. In regard to the two last-named, the question arose whether they were properly to be included within the ambit of the valuation. The principle upon which the Court would have to proceed was that the valuation must be made on what were known as "tramway terms." Under those terms the principle laid down was that they must consider not what the rental value or scrap value of the plant was, but what was the value of the plant, stores, furniture, &c., *in situ*, ready for use by the incoming purchaser.

MR. JUSTICE LAWRENCE: Is no allowance to be made in respect of depreciation?

SIR A. CRIPPS: Oh, yes; certainly. I shall have to deal with the question of depreciation. We do not ask for what I may call "value as new" for depreciated plant.

Continuing, COUNSEL proceeded to deal at length with the various agreements, and said that Clause 2 of the 1905 agreement defined the subject matter with which the Court had to deal. It stated that, subject to the provisions of the agreement, the Postmaster-General should buy and the company should sell and convey on December 31st, 1911, all plant and buildings of the company in use or in process of being brought into use on February 2nd, 1905, the date of the agreement: in the case of plant acquired after the date of the agreement, the sale should consist of plant erected in accordance with certain specifications attached to the agreement, and thirdly, of land and buildings acquired or erected after the date of the agreement which had received the sanction of the Postmaster-General. The Court would thus see that the agreement provided an actual definition of the subject matter for sale, and here the word "suitable" under the tramway terms did not come into the matter at all. Referring to the inventory of the items to be valued, Sir Alfred said it involved many millions of items and had been made jointly between the parties and signed by them. In the result, for every £100 worth of articles to be valued, according to the company, the Postmaster-General excluded 5s. worth. His contention was that there must be some enhancing of the tramway terms in this case, viz., the addition of some small percentage. The question at issue was what was to be excluded as "spare," and "not in use" on December 31st, 1911. As regarded the efficient service, the company had performed all the duties thrown upon it in this respect.

Going into details, SIR ALFRED said the actual claim was for £20,924,700, and they had included all the plant they said was purchaseable under the 1905 agreement. The miles of circuit, or pairs of wires, amounted to 411,919. They valued this at £3,377,355. Then there was the equipment to be considered in 1,500 exchanges. These things came under one head, which totalled £19,821,458. An amount, however, was allowed for depreciation, which reduced that figure to £17,379,196. Commenting on a sum of £7,592 for printing, plant, machinery, &c., counsel said that was an agreed amount. There would be no difference of opinion on the percentage of deduction to be allowed. The main fight would be as to the items on which depreciation would be allowed out of a total of items amounting to 17 millions of the claims. With regard to the claim for buildings, the company expected to have about 80 claims for compensation from all parts of the country, and there was a negotiation on which they hoped to come to an arrangement with the Postmaster-General for ascertaining the proper cost to be taken, either as the amount to be paid, or as a basis for the amount. There had been depreciation in town properties, and he would suggest to the other side whether it would not be a satisfactory basis to start on the ascertained figures, and take the real cost to the company of the properties. As regarded Portsmouth and Brighton the licences did not expire until 1926. With regard to Hull a rather peculiar position had arisen. The telephonic system there was carried on by the local authority and their licence expired on December 31st, 1911, the same time as that of the National Telephone Co. The Hull local authority, however, were still carrying on the telephone system, and the National Telephone Co. were told that they were doing so as agents for the Postmaster-General on a continuing licence for one year. The company knew of no power or right of the Postmaster-General to employ a Corporation or body as agents for that purpose. If there was such a right in the case of the Hull Corporation then the National Telephone Co. also had a

right to be granted a continuing licence for a year and in respect of this they claimed £11,699. The figures in their total claim were based on estimates of the cost to the company, plus the contractor's profit, which undoubtedly was the best basis to proceed upon. After dealing with a mass of figures and tables showing how the company worked out the depreciation, &c., of plant, Sir Alfred said he had finished his remarks in opening.

MR. FRANK GILL was then called, and said he was appointed Engineer-in-Chief of the National Telephone Co. in 1902, and remained with the company in that capacity until the undertaking was acquired by the Postmaster-General. During his term of office 300,000 new stations were added to the company's system, and he was concerned in the construction of 570 new exchanges. Witness described the method in which the inventory was taken, and said that in minor matters both sides were able to agree with a view of saving labour. For instance, on every telephone pole there was what was known as the earth wire. They felt that it would be silly to count the number of staples fixing that wire to the poles, so the number on each pole was agreed to and reckoned in with the value of the pole. The insulators on the bare wires were dealt with in much the same way. Both sides agreed after checking a certain amount of such wires that there were 29 insulators per mile of wire, and they were reckoned upon that basis of calculation. Witness stated that the taking of the inventory cost £200,000, and occupied a large staff for 14 months. In his opinion the inventory substantially included only the proper plant.

(To be continued.)

## AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—V.

THE cross-examination of Mr. Ovenden, a motorman in the employ of the Adelaide Tramway Company, was continued by Mr. Goodman, the manager of the company. Asked why they demanded double pay on holidays and Sundays, he stated that the greater number of passengers carried involved heavier work and extra responsibility. He also claimed that tramway employes should not be debarred from serving on Local Authorities or from going into hotels in uniform when off duty.

Mr. Simmons, a sweeper formerly with the Brisbane Co., gave evidence that he had only signed the petition for the cancellation of the men's union charter under fear of dismissal and on being told that he would not be liable for financial demands.

Mr. Kirby, a signalman on the Adelaide trams, stated that he was paid 1s. 1½d. per hour with overtime and Sunday pay at time and a quarter. Overtime commenced after eight hours. The claim, therefore, was for an advance from 9s. to 12s. per day. He claimed there was a great deal of responsibility in a signalman's duties. Some of them had asked for an increase of pay, but had been refused.

Mr. Iles, a pitman, stated that they asked for 11s. per day, and he was not aware that according to the claim forbidding work in repair shops and car factories after 5.15 p.m. at ordinary rate, the amount really demanded was about 20s. per day.

Mr. Foster, a fireman, said he was getting a little over £3 per week, and they were now asking for 12s. per day of eight hours. He did not know of any firemen being paid at that rate, but he considered the work very unhealthy.

The conditions at Hobart were then further inquired into. It will be remembered that Mr. Bryant, the secretary of this branch of the men's Union, had stated that after a general rise in wages given by the company, the men were not discontented with their wages. Mr. Buckley, a motorman, stated that his permanent wages were now £2 16s. per week, the hours 54 per week, and with overtime he averaged about £3 8s. per week. He could not understand why Mr. Bryant had made such a statement. Personally, and to his knowledge, some were very dissatisfied with the wages, hours and conditions of service, and wanted everything which had been asked for in the Union claim. It would appear that Mr. Marshall, a Melbourne conductor, visited Hobart, and persuaded the men there to form a branch of the Union. At the same period, efforts were made to form an Independent Workers' Union; this was done, however, without the knowledge or approval of the manager of the company, Mr. Parker.

At this stage the Judge intimated that he would be pleased to consider any suggestions the various managers might make to him as to what concessions might, in their opinion, be practicable. He quite understood that some of these might only be applicable to certain lines.

Mr. Lalorv, another Hobart motorman, testified to dissatisfaction with prevailing conditions, and intimated that he thought preference was given to members of the Independent Workers' Union over members of the claimant union.

Mr. Marshall, who had organised the Hobart branch, then gave evidence, stated that as a result of two meetings which he held over half the employes of the company joined his Union. The men were dissatisfied with their wages, lack of protection on the cars, and the absence of seats for motormen. Another ground of complaint was that motormen had to provide their own trousers, as in oiling the cars they got them soiled.

Mr. Wotton, a gripman on the Brunswick cable line, gave evidence in support of their claim to 11s. per day. He had been in the employ of the company for over 20 years, and had had very



few accidents. He had no holidays or extra pay for Sunday work. He did not know of any other body of employés except those on other tramway systems and the railways, who obtained annual leave of absence at the expense of the employers.

Mr. Snelling, an assistant track ganger with the Melbourne Co., stated that his present wages were 8s. 6d. per day, and at a meeting of trackmen the present claim for 12s. per day was decided upon. Asked whether if it had been suggested to ask for 13s. per day, he would have voted for it, he said yes, but did not know whether he was in favour of asking for 14s. per day. Mr. Prendergast, on behalf of the men's Union, then put in as evidence a number of replies he had received from various municipal councils showing the rates of pay of pitcher setters, labourers, members of tar gangs, &c. These ranged from 8s. 6d. to 11s. per day. The hearing was at this point adjourned.

## BUSINESS NOTES.

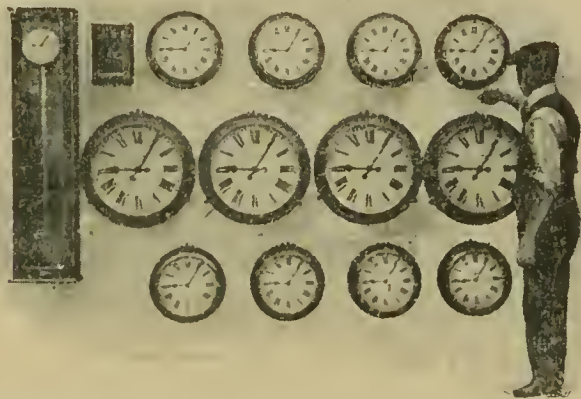
### Extensions at Siemens Bros. Dynamo Works.—

MESSRS. ESLEY & SON, contractors, Stafford, have secured the contract (amounting to £9,000) for the enlargement of Messrs. Siemens's electrical works. The contemplated new building is to be erected between the existing works and the railway line, and when completed—it is stipulated it must be finished in a little over three months—it will enable the firm to employ 600 hands in addition to the 2,000 now in their employ at Stafford.

**Italy.**—La Societa Fabbrica Lampade Incandescenza, Longoni & Co., is the name of a new company which has lately been formed at Novi Ligure, Italy, to continue the manufacture of "Fulgor" electric lamps.

**A.E.G. in Bulgaria.**—The Allgemeine Electricitäts Gesellschaft has formed in Berlin a new company with a capital of £25,000, and the title the A.E.G. Bulgarische Electricitäts Gesellschaft, to look after the A.E.G. interests in Bulgaria.

**Electric Clocks.**—We illustrate a set of electric impulse clocks, which is one of a number of installations which MESSRS. GENT & Co., of Leicester, have on hand at the moment. This particular set, which is under test before despatch, will be installed forthwith by Messrs. T. Burton & Co., of Blackburn (who are the contractors for the installation) in the Blackburn Police and Sessions Courts, now nearing completion. A feature of this installation is that the transmitter or master clock, is fitted with mechanism



ELECTRIC CLOCKS FOR BLACKBURN SESSIONS COURT.

for receiving the daily Greenwich time signal, the mechanism being such that the clocks in the Courts will automatically show Greenwich mean time. In addition, the pendulum of the transmitter is provided with a rod of the new non-expanding nickel-steel alloy recently placed on the market by Messrs. Gent & Co., and known as "Sinevar." A feature of Gent's system is the weak battery warning bell, shown in the small case at the right hand of the master clock. This apparatus automatically gives timely warning when the battery needs attention. These clocks work with a very small current, and we understand that an installation is still working on the original battery of ordinary Leclanché cells which were installed with the clocks three years ago.

**Effect of Foreign Prices.**—At last week's meeting of Accrington Town Council, Alderman Higham said that tenders from foreign firms for electrical necessities were considerably lower than those received from English firms. The Electricity Committee had, however, prevailed upon English firms to modify their prices, and so the tender of one of them had been accepted. The purchases were needed to carry out the Clayton-le-Moors electric power and lighting extension.

**The Price of Aluminium.**—We learn from the BRITISH ALUMINIUM CO., LTD., that the price of aluminium ingots is £75 per ton, not £70, as quoted in our "Market Quotations" last week.

**For Sale.**—MESSRS. MANN, EGERTON & CO., LTD., Ipswich, have for disposal a quantity of electrical plant, accessories, carbon-filament lamps, &c. See our advertisement pages in this issue.

**Buenos Ayres.**—The Budget expenditure of the Argentine Republic for 1912 comprises, among other items, 2,650,000 fr. for new telegraphic lines, 13,000,000 fr. for hydraulic works, 18,000,000 fr. for the enlargement of the Port of Buenos Ayres, and 145,000,000 fr. for sundry works, including railway construction, bridges, &c.

**Admiralty List.**—The Lords Commissioners to the Admiralty have placed the name of the MIDLAND ELECTRIC MANUFACTURING CO., LTD., on the Admiralty list of contractors for the supply of small switchboards suitable for torpedo boat destroyers, frames and auto-charging, and also for switches up to 100 amperes rating.

**Liquidations.**—GLOBE ELECTRIC CO., LTD.—At a meeting, held at 11, Farringdon Avenue, E.C., on June 3rd, a resolution was passed winding up the company. Mr. E. C. Pegler, 60, Watling Street, E.C., is liquidator. We are informed that this action has been taken on legal advice in regard to an agreement for the supply of a large quantity of arc lamps to a foreign customer, which agreement was not fulfilled owing to a third party. An action for damages has been commenced against the Globe Co., but it is stated that, should the liquidator of that company prosecute a claim against the supplier and succeed, the financial position of the company and its creditors would be improved. A meeting of creditors is to be held on June 18th at Cannon Street Hotel, E.C., at 12 o'clock.

CITY OF BIRMINGHAM TRAMWAYS CO., LTD.—This company is winding up voluntarily, with Messrs. H. W. Brettell and T. Bower as liquidators. The assets are to be sold to the Electrical and Industrial Finance Corporation, Ltd., upon terms set out in a letter of May 2nd from the B.E.T. Co., Ltd. A meeting of creditors will be held on June 17th at Electrical Federation Offices, Kingsway, W.C. Creditors must send in the usual particulars by July 8th to Mr. Bower.

BRITISH TUNGSTEN LAMP CO., LTD., Huyton Quarry, near Liverpool.—Liquidator's release dates from May 31st.

COWPER-COLES GALVANISING SYNDICATE, LTD.—This company is winding up voluntarily, in view of the sale of the assets to the Magnet Galvanising and Plating Co., Ltd. Mr. A. E. Tugwood, 9, Pattison Road, Child's Hill, N.W., is liquidator. A meeting of creditors is called for June 20th at 11, Ironmonger Lane, E.C.

**Catalogues.**—THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—An eight-page list just issued (No. 2,290) gives in tabular form particulars of the Curtis steam turbines sold up to April 30th, 1912, including the name of customer, output, speed, pressure type, &c. They are classified in different sections, but a summary of all of these gives the following total result:—Great Britain and Ireland, Municipalities, 64,730 KW.; Tramways and Power Companies, 49,480 KW.; Railway Companies, 6,350 KW.; Collieries, 28,820 KW.; H.M. Government, 782 KW.; Industrial Applications, 24,411 KW.; Export, all purposes, 54,036 KW.; total, 228,609 KW.

MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deansgate, Manchester.—Leaflet giving particulars and prices of india-rubber gloves and gauntlets for electrical purposes, acid work, &c.

THE ELECTRICAL POWER STORAGE CO., LTD., 4, Great Winchester Street, London, E.C.—New leaflet giving coloured illustrations, tabulated prices, and curves, of improved pattern E.C.C. dry-cells.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, London, E.C.—Price list of "Mazda" automobile lamps, including lamps for headlight and rear-lights; and tubular and festoon lamps for interior lighting. These lamps range in size from 1 to 32 C.P. and in voltage, from 2 to 12 volts. Copies of this list (No. 344) will be sent on application.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Catalogue No. 501, of 32 pages, containing illustrations and price particulars of cable-laying and erecting accessories, including india-rubber gloves and mats, blow-lamps, jointers' tents, tool-carts and kits, lifting jacks, cable suspenders, and sundry appliances. Several pages are devoted to prices of jointing materials, and there are also tables of wire gauges and copper conductors.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.—New catalogue of 150 pages containing illustrations of a very large assortment of artistic electric light fittings. The contents include brackets, bronze figures, candle fittings, electroliers of many designs and several finishes, electroliers with Holophane glassware, lantern fittings for inside and outside service, and for street lighting, pendant fittings for various kinds of rooms, standards, water-tight fittings, reflectors, shades, switches and accessories. The catalogue is being issued to the trade generally.

THE WARNER INTERNATIONAL AND OVERSEAS ENGINEERING CO., LTD., Carteret Street, Westminster, S.W.—Eight-page pamphlet containing a reprint of an article in an engineering contemporary describing the non-parallel axle rolling stock.

MESSRS. NEWTONS, LTD., Taunton.—New catalogue of close upon 40 double pages in which a great deal of information is given relating to Zone dynamos and motors. Specification particulars of these machines and descriptive notes respecting their construction, diagrams of connections, tabulated dimensions, outputs and prices, are given. The contents also include information respecting boosters, motor-starting panels, paraffin and petrol-electric sets, motor-driven pumps, &c. The opening pages are occupied with useful electrical tables, data and general information, and a telegraph code. Copies of the book can be obtained on application.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Catalogue of 48 pages relating to the firm's electric



cooking and heating apparatus. It is divided into two sections, viz., "C" and "H," dealing with electric cooking utensils and electric radiators and convectors respectively. A brief general description of the Simplex system applicable to both sections is followed by Section "C," wherein there are excellent illustrations and brief tabulated notes and prices of appliances such as kettles, water heaters, urns, irons, hot cupboards, series boiling plates, and so forth. The firm are now specialising in supplying, or converting, high-class silver-plated goods to electric heating. These are intended for presentation purposes, &c. A range of five appliances is illustrated in the catalogue, consisting of two types of kettles, a foot-warmer, a chafing-dish and a toast-maker. In the heating section, in addition to ordinary types, are special patterns such as the Humidifier type, special convectors for office and corridor heating, car heating, special heaters for ship use, &c.

MESSRS. ALFRED WISEMAN, LTD., Glover Street, Birmingham.—74-page catalogue containing illustrations, prices, and code-words of a large variety of fittings for overhead tramway insulation, long-distance transmission material, gears, pinions, &c. Catenary suspension, high-tension straining towers and porcelain insulators are among the contents.

THE ELECTRICAL CO., LTD., 122-4, Charing Cross Road, London, W.C.—June leaflet giving a few notes and particulars of prices of D.C. and A.C. fans.

**Diesel Engines.**—MESSRS. MIRRIEES, BICKERTON AND DAY, LTD., Hazel Grove, Stockport, have recently received orders for the following Diesel engines, in addition to a large number of orders varying from 50 to 200 B.H.P.:—

One 500-B.H.P. for the Moose Jaw Street Railway, Canada; one 750-B.H.P. for the Borough of Wallasey Electricity Works; one 320-B.H.P. for the Admiralty for Hong Kong Dock Yard; one 250-B.H.P. for St. Sampsons Electricity Works, Guernsey (repeat order); one 240-B.H.P. for Messrs. Kodak, Ltd., Wealdstone; three 375-B.H.P., War Office, for Tidworth & Bulford Camp; two 240-B.H.P., Battleford Electricity Works, Canada; one 500-B.H.P., Khatau Makanji Spinning and Weaving Co., Bombay; two 240-B.H.P., South-Eastern and Chatham Railway Co.'s works, Ashford; one 500-B.H.P., Messrs. Foy & Gibson's Woollen Mills, Fitzroy, Australia.

The firm have also several engines in hand for electric generating sets for new battleships for the British Admiralty and the Turkish Government, and seven engines for driving pumps for the Metropolitan Water Board.

**Book Notices.**—"Copenhagen and Its Environs" is a useful and interesting illustrated booklet which has been published free by the Danish Tourists' Association (Den Danske Turistforening). We understand that this is the first time such a guide to Copenhagen has been issued gratis, and readers who desire to have a copy should write to the bureau of the Association at Frederiksberggade, 14, Copenhagen.

"Shorthand for Electricians. The Oxford Shorthand (International Phonography), 23rd edition and After," is a 16-page illustrated descriptive booklet which the inventor, Mr. Percy Kingsford, Ellesmere Port, will send free to any reader of the ELECTRICAL REVIEW who writes promptly for it. It describes the system fully.

"The Economic Position of Ireland and its Relation to Tariff Reform. Published for the Tariff Commission, by P. S. King and Son, London. 3d.

The *Faraday House Journal* for June contains, amongst other interesting items, an article on the "Necaxa Power-House Dams and Pipe-Line," by Mr. E. B. Ritson, an old Faradian.

**Bankruptcy Proceedings.**—C. A. SMITH (trading as C. J. Smith, electrician, 23, King Street, Regent Street, London).—A supplemental dividend of 2d. in the £ is payable at Bankruptcy Buildings, Carey Street, W.C., on any day.

**Cricket Match.**—On Saturday last, on the Green at Sarisbury, a cricket match was played between the Portsmouth Dockyard electric generating station staff and the employes of Messrs. Johnson & Phillips, Ltd., of Old Charlton, which firm has been carrying out work in the Portsmouth Dockyard and at other naval shore establishments in the district for the past eight years. A long intimacy which had existed between those concerned added interest to the event. The match was somewhat evenly, but strongly, contested, and after several hours' play the contractors proved the victors. A very enjoyable repast was served at the New Inn, after which Mr. Harding, secretary to the electrical engineer of the Dockyard, made a presentation of a cricket-bat to Mr. J. Roberts, A.M.I.E.E., who has been the resident engineer for the contractors for several years. Mr. Roberts, in responding, thanked the donors, and hoped they would shortly be playing a return match.

**Trade Announcements.**—Owing to the rapid increase in the manufacturing branch of their business, MESSRS. ISENTHAL AND CO. have now removed the whole of their works and offices to the factory at Denzil Road, Neasden, to which address all correspondence should now be directed.

THE UNION CABLE CO., LTD., are this week moving into their new offices and factory at Dagenham Dock. The machinery for cable manufacture is not yet all erected, but it is expected that in about six weeks' time the company will be in a position to manufacture all sizes of rubber, paper and bitumen-insulated cables, lead-covered and armoured. The firm's new telephone number is "Rainham, 23," and their postal address Dagenham Dock, Essex.

MR. J. H. BAKER, late senior partner in the firm of Baker and Farnfield, has commenced business on his own account as a lighting engineer, at 59, Station Road, Town Hall Square, Bexhill-on-Sea.

MESSRS. H. B. BARNARD & SONS, of 144, Lambeth Walk, London, S.E., purchasers of old metals, have altered their telephone number to "Hop 4520."

MR. PHILIP S. DOHERTY has severed his connection with the Worthington Pump Co., Ltd., and has started as an engineer and agent on his own account at 25, Victoria Street, Westminster, S.W., representing, amongst others, the Eureka Pump Co., of Christiania.

The registered office of the OAKBANK OIL CO., LTD., has been altered to 29, St. Vincent Place, Glasgow.

GUALTIERO FARINA & Co. is the title of a new company with offices at Corso P. Nuova 9, Milan, and a capital of 10,000 lire, formed to act as agents for electrical goods.

MESSRS. FYFE, WILSON & Co. have removed to 155A, St. Vincent Street, Glasgow. Telephone Nos "City 7181 and 7182." The firm have the sole selling rights of the Kelvin petrol and paraffin-electric generating sets. They also represent the Electric Construction Co., Ltd., and the E.P.S. Co., Ltd.

## LIGHTING and POWER NOTES.

**Australia.**—In the year ending December 31st, 1911, the Sydney electricity department sold 17,768,210 units, of which 1,742,207 were supplied to the street and park lamps and 16,026,003 units to private consumers. At the same date the total connections in lamps, motors, &c., were equivalent to 29,200 kw., of which 16,750 were in lamps and 12,450 in motors, &c. The number of separate premises connected amounted to 4,655. The gross revenue for the year was £172,693, of which working expenses absorbed £95,428, leaving a balance of £77,265. Interest, sinking fund contribution, depreciation, &c., took £48,874, leaving a surplus of profit on the year's working of £28,391. The sum of £95,428 for working expenses includes £17,596 paid to companies taken over by the City Council on account of goodwill.

**Bacup.**—The new cotton weaving shed which Messrs. Hoyle Bros., of Bacup, have decided to erect on a site near their Olive Mill, will be run by electricity on the individual drive system.

The T.C. has decided to retain the services of Mr. C. D. Taite as consulting electrical engineer.

**Bexhill.**—Notwithstanding the coal strike, which put up the costs towards the end of the financial year, and other adverse circumstances, there was a net profit of £360 on the Corporation's electric light undertaking during the past year. The total revenue from all sources was £11,439; working costs amounted to £6,192, and the gross profit was £5,247, which on the capital borrowed showed a return of 7 per cent. Interest and sinking fund absorbed £4,662, making the total costs for the year £11,078. Units sold for private lighting amounted to 434,978, with an average revenue per unit of 4'48d., while 198,621 units were sold for public lighting, for which the average revenue was 3'90d. The average revenue from both private and public lighting was 4'19d. per unit. The cost per unit was 2'33d., compared with 2'28d. the previous year. The number of consumers connected last year (105) was, with one exception, the largest since the first year of working. The engineer (Mr. W. T. Le Feuvre) reports that the general adoption of the metal-filament lamps has proved thoroughly satisfactory, and considers that the reduced cost of the lamp renewals indicates that a better and stronger lamp is now on the market.

**Birkenhead.**—On the minutes of the Electricity Committee coming before the T.C. at a recent meeting the department was criticised, one of the members comparing it with the neighbouring undertaking at Wallasey, and a proposal was moved and seconded that the minutes, which included references as to the borrowing of £20,000 and £14,230 respectively, for distributing mains and extensions to plant, be referred back. It was urged, on the other hand, that in 12 months' time the concern would be in a prosperous condition. The chairman (Mr. Clarke), in replying to the discussion, stated that while he could not commit his Committee to having a check taken of the stock and stores by the borough treasurer, he would bring the matter before the Committee. On this understanding the amendment was withdrawn, and the Committee's minutes approved.

The estimate of expenditure upon the extensions to the plant at the Craven Street and Bentinck Street power stations is:—For two 750-kw. mixed pressure turbines and generators, together with surface condensers, pumps, steam pipes, switchboard and gear, cables, &c., £12,400; foundations, £250; high-pressure steam pipe between Craven Street and Bentinck Street stations, together with superheaters for nine boilers, £1,580. Application is to be made to the L.G.B. for sanction to borrow the amount required for the scheme, £34,230, less £1,600 for meters, which will be provided out of revenue.

**Birmingham.**—The accounts of the Electricity Department for the year ended March last occupy more pages than usual, as they incorporate the figures for the added areas of Handsworth and Aston Manor. For the old area, a total of 40,190,547 units were sold, including 13½ millions for traction purposes, and the motor H.P. connections totalled 32,584. The gross revenue amounted to £236,990 and the gross profit to £129,231. This, after meeting loan charges, was allocated £25,000 to renewals—the fund now standing at £52,586, while £20,237 was contributed to the rates. The reserve fund account which benefited by interest, &c., on investments, now stands at £77,958. In the Handsworth area 1,955,398 units were sold, including 1,149,116 for tramways. The revenue amounted to £14,098 and the gross profit to £7,633, leaving a



surplus of £1,343 on the year. In the Aston Manor area, 7,519,161 units were sold, the maximum load being 4,180 kW. The total revenue amounted to £37,687 and the gross profit to £13,430. After meeting loan charges, £3,616 was placed to renewals, that fund now standing at £4,265. The capital expenditure on the three undertakings is: Birmingham, £1,535,693; Handsworth, £77,909; Aston Manor, £195,953—a total of £1,809,555.

**Bootle.**—It was reported at a meeting of the Electricity Committee that a number of cables were required between the new generating works and Marsh Lane, and it was recommended that a new conduit line with a few spare ways be laid at an estimated cost £590. Messrs. Callender had been asked to submit a tender, but the Committee recommended that unless the amount of the tender was lower than the cost of executing the same by the department, the work be carried out by its own staff. The T.C. at its meeting on June 5th, adopted the recommendation. The borough electrical engineer reported an inquiry from Messrs. Harland & Wolff, as to the terms of a supply of electricity for their new ship-repairing works at the North Dockyard.

**Burton-on-Trent.**—Sanction has been received from the L.G.B. to the borrowing of £14,555 for extensions to plant at the electricity works. This amount includes £1,993 for mains, £4,788 for a turbo-alternator and switch gear, and £2,280 for a rotary converter. As requested by the Board, it has been decided to return the sanction for £600 for new meters granted some time ago, as the Council has decided to pay for these out of revenue.

**Chester.**—The T.C. has been informed that the L.G.B. has sanctioned loans amounting to £14,000 in respect of the scheme devised by Mr. S. E. Britton, electrical engineer to the Council, for the erection of a hydro-electrical plant on the River Dee. Of the total amount, £7,090 is for plant consisting of turbines and dynamos, a grant of £500 to the Dee Fishery Board, for the construction of a fish pass, and £1,610 for crane, cables and power house. In addition, £1,500 is to be paid out of reserve.

**China.**—The annual statement of the Shanghai municipal electricity department contains much of interest to our readers, as showing the progress of electrical matters in this important Chinese city. Briefly some 8,300,000 units were sold and accounted for during the year ending 1911—an increase of 21 per cent. on the previous year. Besides private supply, the output includes 913,000 units for public lighting, 58,580 for heating and cooking, 761,000 for power, and 2,550,000 for traction. The load factor recorded was 23.65 per cent., and the maximum load, on Coronation Night, June 22nd, 4,200 kW. The net result of the year, after meeting interest charges £12,306, and depreciation charges £15,157, was a profit of £13,777, but sums were also applied out of revenue towards the cost of new plant, which might have been charged to capital. A great deal of information is contained in the report, from which we note that 73 miles of additional mains were installed, nearly all overhead; four new transformer sub-stations were erected, bringing the total to 68 transforming centres, with an aggregate transformer capacity of 5,145 kW.; 52,000 additional 30-watt lamps (including fans, heaters and cookers, but excluding street lamps) were connected, as against 25,000 in 1910, and 50 per cent. of these were for Chinese consumers. There were 791 additional fans, bringing the total to 4,848, and the heating and cooking connections increased during the year by 218 per cent. reaching 381 kW., being a most satisfactory feature. The motor load, which we gather offers great possibilities, increased by 705 H.P. to a total of 1,775 H.P., and includes the first electrically-driven flour mill in China, while negotiations are now in hand for the supply of 2,200 H.P. of motors, in addition to the normal connections which may be expected. For public lighting purposes there were 350 arc lamps and 632 metal lamps in use, the majority of the former being enclosed arcs, while the latter varied from 60 to 400 C.P. Particular attention is drawn to the success with which electric radiators and heaters have been introduced by the hiring branch of the department, without which it is considered that this form of heating would have remained undeveloped for years. The report states that electric lighting is being more and more used by the Chinese, and indicates great extensions in this direction; while as regards power supply, it is expected that the new 4,000-kW. Riverside power station, now being built, will not be able to do more than meet the demands of local mills and factories for about two years. The undertaking is under the control of Mr. T. H. U. Aldridge, who is to be congratulated on the forward state of electricity supply work in Shanghai.

**Continental Notes.**—**FRANCE.**—The industries of France make use of power to an aggregate of 3,550,000 H.P., of which 2,604,000 are supplied by steam, 773,000 by electricity, and 173,000 by various other means. The 773,000 electric H.P. represents the harnessing of 55,000 falls, 76 per cent. of which do not yield more than 10 H.P. Water-generated electricity has received its greatest extension in the Alpine region. Savoy makes use of 104,000 H.P.; the department of the Isere, 970,000 H.P.; Upper Savoy, 34,000 H.P.; the Alpes Maritimes, 17,000 H.P.; and the Rhone, 10,000 H.P., &c. In the Pyrenees region there are 70,000 H.P. utilised; 16,000 H.P. in the Tarn district; 14,000 H.P. in that of Puy-de-Dome; 10,000 H.P. in Haute Vienne; 19,000 H.P. in the Vosges; 16,000 H.P. in the Ain department; 15,000 H.P. in that of the Daubs; 13,000 H.P. in the Jura, &c. These various figures are, moreover, subject to steady increase. To the 3,550,000 H.P. allocated to French industries must be added 1,200,000 H.P. for commercial navigation, and 400,000 H.P. for automobiles and motor-cycles.—*La Lumière Electrique.*

The City of Paris is about establishing a new gasworks which will comprise an electric station. All the machinery and apparatus will be worked by electricity, and will be controlled from a central cabin in each workshop.

**GERMANY.**—The Niedersachische Kraftwerke Gesellschaft is the name of a new company which has lately been formed at Osnabruck, with a capital of £200,000, to establish a large electricity-generating station for the supply of current for lighting and power purposes in Lower Saxony.

**Crewe.**—A Sub-Committee is to consider the question of reducing the rates for the supply of electricity for power purposes.

**Dundee.**—Dealing with the finance of the Corporation Electricity Department at the T.C., Treasurer Soutar said the past year had been a record one for the department, the accounts closing with a net surplus of £10,338. The units sold were 8,354,466, an increase of fully 600,000. The total income amounted to £49,359, an increase of £3,300, while the costs showed reduction of £300, notwithstanding the fact that the assessments and taxes were increased by fully £800. When the conversion of the system from L.T. to H.T. took place £22,000 was shown to be the resulting depreciation, and when borrowing powers were asked in 1908, the Secretary for Scotland stipulated that this should be paid off in five years. Although there was still another year to run the department had been able to pay off the full balance this year. The remainder of the profit, amounting to £5,039, had been added to reserve fund, which now amounted to £14,356. It was proposed to further reduce the rates for next year. For power supply the sliding scale would still be in operation, but instead of starting at 2½d. per unit it had been reduced to 1½d. for the first 10,000 units per quarter, the next 40,000 units 2d., and all above 50,000 units 3d. The 3d. rate under the guarantee and two-rate system was in future to be 3d., with the incentive to consumers that they could have all units above 50,000 at 3d. With regard to lighting, if a consumer would guarantee the average number of units and price he had paid during the last three years all units in excess of this amount would be charged at heating and cooking rates, viz., 1½d. for the first 100 units per quarter, and 2d. for all above that amount per quarter. Mr. Nairn, the electricity convener, said the changes would be appreciated, especially by the manufacturers, who might now have an electric drive at a price which compared favourably with any other city. He emphasised the need for building up a good reserve fund for the department, pointing out that there were so many improvements being effected in electrical equipment that they could never tell when it would be found advisable to scrap some of their plant. The meeting agreed to fix the rates at the figures mentioned.

**Dover.**—The result of the last year's operation of the electricity department was a net profit of £3,254, which was utilised in reducing the outstanding deficit on net revenue account, which now stands at £1,370.

**East Ham.**—The Electric Lighting Committee reports having had under consideration a report upon the cost of lighting the whole of the streets at present cabled by electricity. It has decided as an experiment to authorise the engineer and manager to convert and adapt for electricity the existing street lamp columns in certain streets.

**Falkirk.**—Recent increases in the business of the Corporation electricity department have rendered additions necessary, and plans for an extension of the works, costing £1,300, have been submitted by the T.C. and passed. Some time ago there was an extension of cables to Bainsford, and now Camelon is also supplied with electricity.

**Felixstowe and Walton.**—The U.D.C. has decided to borrow £2,031 for extensions to the electrical plant for the Suffolk Electricity Supply Co., Ltd.: the question of converting the arc lighting on the front to metal-filament lighting is being considered.

**Feltham.**—In reply to a letter received by the District Council in regard to a proposed electric lighting syndicate, the clerk has been instructed to state that the Council has at present no intention of applying for power to supply the district with electricity, but it would be willing to favourably consider an application promoted by private enterprise for such powers.

**Hastings.**—At the last meeting of the T.C., at which the annual accounts of the electricity department (particulars have already appeared in our columns) were presented, Councillor Hill (chairman of the Committee) said they were better off to the extent of £1,760 compared with last year. The only extra increase in expenditure had been £353 in respect to coal. They had increased the number of private consumers and the number of street lamps. The electrical exhibition, carried out by the enterprise of Mr. Ferguson, was a great success, and had brought them a number of new consumers.

**Hornsey.**—Application is to be made to the L.G.B. for sanction to borrow £4,000 for mains extensions. According to the report of the professional accountant the electricity undertaking shows a profit for the year of £2,038, after charging all instalments and interest on loans properly chargeable against the year's revenue. This profit, added to credit balance at the beginning of the year, gives a total of £5,140, which is reduced by £984, balance of interest on loans accrued due, but not chargeable against the year's profits, leaving a credit balance carried forward at March 31st, 1912, of £4,156.

**Kingston-on-Thames.**—A L.G.B. inquiry was held on June 11th into the application of the T.C. for a loan of £13,500 for electricity purposes.



**Korea.**—A charter has been granted to the Okura Co. to supply electrical energy for power purposes at the gold mines in Korea. The generating plant will be installed at the Penhsihu Collieries.

The British Acting Consul-General at Seoul reports that a Tokio company, acting as agents for a well-known German firm, have prepared a scheme for supplying electric power to the gold and other mining companies in North Pyeng-an Province, and will devote a capital of about £102,000 to the purpose. The German firm will supply all the necessary plant and machinery, which will be similar to that installed at the Fushun coal mines. The new power plant will be erected at Reibi, just north of Shinanju on the Seoul-Wiju Railway, and power and light will be supplied to Unsan and Kosung, as well as to neighbouring towns such as Shinanju, Yengben, and Pukchin. In view of the increasing scarcity of wood-fuel, this new enterprise is of great importance to the mining interests of north-west Korea.

**Leigh.**—The town clerk has been instructed to make application for the sanction of the L.G.B. to the borrowing of the sum of £2,511 to cover the probable cost of extensions to mains and new services for the three years ending March 31st, 1915.

**Lewes.**—The T.C. has sealed a contract with the Electric Supply Co. for public lighting for a portion of the borough. The Council has asked the company to give a demonstration of different lamps.

**London.**—ISLINGTON.—The B.C. has again considered the report of the Electric Lighting Committee recommending that tenders be obtained for additional plant to cost £13,000. The proposal led to a lengthy discussion, in which the opposition of advocates of bulk supply played a prominent part, but in the end the Committee's recommendation was carried.

**Macclesfield.**—Mr. W. Essen, director of the new Electricity Co. of Macclesfield, Ltd., has informed the T.C. that the company is now negotiating for a site for a generating station, and that £25,000 capital had been secured to carry out the works.

**Nelson.**—The T.C. is applying for powers to borrow £3,000 for purposes of electric lighting in the district; the L.G.B. is instituting an inquiry.

**Newton (Lancs.).**—The U.D.C. has been informed that the B. of T. has declined to grant the Council's application for an electric lighting order, on the ground that there appeared to be no real demand for electricity, and that the scheme was too speculative and not likely to be a paying one.

**Perth.**—The T.C. has decided not to withdraw opposition to the Loch Erich Water and Power Scheme, unless certain clauses are inserted in the Bill safeguarding interests of the city.

**Reading.**—We are glad to be able to record that the Reading Electric Supply Co. has introduced a new tariff for cooking and heating purposes at 200 volts. Thus, where a supply is taken for lighting purposes, the charge is  $\frac{1}{2}$ d. per unit, and where no lighting supply is taken, the charge is, for any amount up to 20 units per quarter, 13s. 4d. per quarter, with  $\frac{1}{2}$ d. per unit for all extra energy consumed. No charge is made for the use of meters.

**Runcorn.**—The Mersey Power Co., Ltd., which is a subsidiary concern of the Salt Union, Ltd., and was originally formed to deal with the power for working the triple-effect vacuum plant for making salt at the Weston Point Works, Cheshire, has been informed that its application for consent to the erection of overhead electric cables under the provisions of the Runcorn Electric Lighting Order, 1910, has been granted. The scheme provides for the erection of a H.T. electric line for the purpose of supplying energy at a pressure of 6,300 volts between Runcorn and Helsby. It will connect to a sub-station to be erected near the pumping station, Ship Street, Frodham, and terminate on the premises of the British Insulated and Helsby Cables, Ltd., at Helsby.

**St. Anne's-on-Sea.**—It has been decided to apply to the B. of T. for a provisional order for supplying electricity in the urban district of Lytham for all public and private purposes. Notice of this has been served upon the Lytham U.D.C.

**Sheffield.**—The Special Committee appointed in connection with the electric light undertaking has decided to appoint a sub-committee to investigate such complaints as may be brought before it, with reference to the management of the commercial side of the undertaking, and the Electrical Traders' Association is to be invited to submit to the sub-committee and to support with evidence, such complaints as it may desire to make.

**Skelton and Brotton.**—At a meeting of the U.D.C. on Friday last, a letter was read from Messrs. Graham Bros., electrical engineers, withdrawing their offer to light the district by electricity, "owing to the attitude adopted by several members of the Council interested in the local gas companies."

**Sowerby Bridge.**—At the last meeting of the U.D.C. a circular letter was submitted from Mr. A. Wood, canal boat owner, Sowerby Bridge, in which he suggested a scheme for the propulsion of canal boats by electricity, utilising batteries.

**Stretford.**—During the year ending March 31st last, the total number of units generated amounted to 2,298,856, or an increase of 49,790, as compared with the previous year. Of the former number, 1,424,537 units were used for traction, 253,062 for private lighting, while 60,192 were unaccounted for.

**Tonbridge.**—The U.D.C. has decided to extend the mains in order to supply electricity for power to the works of the Whitefriars Press.

**Tunbridge Wells.**—The T.C. has decided to decline the offer of the National Electric Construction Co., Ltd., to accept one-half of the original cost of installations in the town carried out on the deferred payment system.

**Wallasey.**—The T.C., as a safeguard to the public supply of electricity in case of a coal strike, has decided to supplement the coal-fired plant at the electricity station by machinery operated by oil fuel. The plant to be installed consists of a 500-kw. alternator and Diesel engine, and it is proposed to apply to the L.G.B. for sanction to a loan of £6,980 to cover the expenditure.

**Walsall.**—An arrangement has been made with the Walsall Theatres Co., Ltd., which under it will take a minimum supply of 40,000 units per annum.

**Watford.**—The U.D.C. has applied to the L.G.B. for a loan of £9,253 for three years' requirements for the electricity undertaking.

**Wimbledon.**—On and after October 1st next, the charge for lighting purposes in the Maldens and Coombe district is to be reduced from 6d. to 5d. per unit.

**Wolverhampton.**—The Electricity Committee of the Corporation is to incur an expenditure not exceeding £100 in the purchase and equipment of a model house with electrical fittings for exhibition at the forthcoming Wolverhampton Floral Fête.

**Workshop.**—The U.D.C. has decided to ask the L.G.B. for permission to increase the loan for electric lighting extension by £200.

**Yarmouth.**—The annual financial statement of the Corporation electricity department shows that the gross trading profit was £9,191. Of this amount £702 was written off the cost of new meters, transformers, and other works, including part of the cost of altering the system of street lighting, for which there are no sinking funds, £7,898 applied to interest, sinking funds, rebates, and discounts, and £590 added to the appropriation account, making it £858.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The Corporation tramways show an increase in revenue for the past year of £3,705, and total receipts amounting to £77,175. The total number of passengers carried was 18,096,938, or upwards of 944,000 more than in the previous year, while the number of miles run was 1,643,242, or 23,739 more.

**Aldershot-Farnborough.**—The B. of T. has granted the application of the Aldershot and Farnborough Light Railway Co. for an extension of time for a year for constructing the line. The Aldershot U.D.C. has been officially informed that the National Electric Construction Co., Ltd., is engaged in raising the necessary capital, and has subscriptions amounting to between £30,000 and £40,000.

**Argentina.**—It is expected that the electric tramways in Mendoza will be finished by July 1st. The concession was granted to M. Herlitzka, who is looking after the construction for the company which acquired it from him. To commence with there will be 15 km. of line within the city, and it will afterwards be extended to the departments. Current will be supplied by the Hydro-Electric Works at Lujan.—*Review of the River Plate.*

**Ayr.**—The T.C. has agreed to extend the tramway system at a cost of £18,000. The Tramways Committee recommended that the railless system of traction should be adopted, but the recommendation was not discussed.

**Birmingham.**—Out of a surplus of £96,000 on the tramway undertaking of the Corporation, £50,000 is being carried to reserve and £46,000 towards the relief of the rates.

**Blackpool.**—The introduction of the "toast-rack" car for the circular route has been a great success; two were purchased last year, and the department soon bought six more. It was found that each of the cars could earn £10 a day. Last week it was decided to order four more "toast-rack" cars to be delivered in time for the approaching season, bringing the total to a dozen. The cars cost about £850 each and accommodate 70 passengers.

The Blackpool, St. Annes and Lytham Tramway Co. is claiming to be assessed at one-fourth the rateable value only for general district rate purposes, in accordance with the decision of the Tottenham case. The claim has been lodged with the St. Annes Council.

**Clayton-le-Moors.**—The B. of T. has confirmed the order made by the Light Railway Commissioners, authorising the construction of a light railway.

**Continental Notes.**—ALSACE-LORRAINE.—Plans are being prepared in respect of a projected electric tramway in the town of Mâtchitch.



**AUSTRIA.**—Permission to undertake the preliminary surveys has been accorded to Eduard August Schroeder, of Teschen, for an electric railway from Teschen, through Bobrek, Krasra, Baumgarten and Haslach, to Pogwisdau.—*Elek. und Masch.*

**FRANCE.**—The management of the Compagnie du Midi have voted a sum of 1,800,000 fr. for the completion of the electrification of the line from Perpignan to Villefranche de Conflent. The company have also decided to construct forthwith a new hydro-electric station near Pontpédrouse, utilising the waters of the Cassagne station coming from the Bouillouses.

A Presidential decree has declared as of public utility the conversion to electric traction of the line of steam tramways from Bayonne to Biarritz, and that to the Lycée de Marrac; also other modifications detailed in the plans. The works must be completed within the space of two years.

**ITALY.**—The Italian Railways Co. has at last decided to resume the operations for the conversion to electric traction of the line from Modane to Bussoleno, interrupted a year ago owing to non-fulfilment of certain administrative formalities. Public demands for the conversion of the line have been frequent for a long time past, and recently the French Government has taken action to such effect, that the Italian Government has decided to resume the conversion works at an early date. Electric driving will not only tend to speedier transit, but will suppress the smoke nuisance in the tunnel, and both advantages will facilitate the increase of the flow of tourist traffic.—*La Revue Pratique de l'Electricité.*

La Società Generale Italiana Edison di Electricità, of Milan, has recently secured concessions for the construction and working of electric tramways between Affori and Varedi, and between Corsico and Abbiategrasso.

**SPAIN.**—It is proposed to construct an electric light railway between San Adrian and Barcelona; the power station will be at the latter town.

**RUSSIA.**—The municipal authorities of Minsk are reported to be considering a scheme for the construction of an electric tramway in the town.

**SWITZERLAND.**—The Federal Council has submitted to the Swiss Chamber the application for a concession made by MM. Glardon and Leresche, syndics of Vallorbe and Ballaignes respectively, for an electric railway to be constructed between Day, Vallorbe and Ballaignes. The estimated cost of the undertaking is 700,000 fr.—*La Lumière Electrique.*

**Coventry.**—The electric tramway system recently purchased by the Corporation, is now under the management of a specially-appointed tramways committee, and its first recommendation to the City Council will be for sanction to a loan for the amount of the arbitrator's award, £202,132, and the following items:—Cost of arbitration, including the Tramway Co.'s taxed costs, £6,869; stamp duty upon the conveyance of the undertaking, £2,021; purchase of stock and provision of working capital, £5,000; and a sum of interest at 4 per cent. upon the amount of the arbitrator's award from January 1st last until the date when the purchase is actually completed. The Committee has decided to relay a short part of the single track with new rails and setts at the estimated cost of £605.

**Darlington.**—The T.C. has decided to obtain tenders for two cars of the double-deck type with covered-in top decks, capable of seating about 50 passengers. The cost will be between £1,200 and £1,300.

**Dundee.**—The Corporation Tramways have had another successful year. By the introduction of a penny-all-the-way fare system it was estimated that the revenue would diminish to the extent of £2,200, but the decrease of drawings on this account has turned out considerably less, the drop being restricted to between £400 and £500. The receipts are thus about £1,700 more than anticipated.

**Glasgow.**—The Tramways Committee is to receive a deputation of blind persons from Paisley in support of a petition by Paisley residents so afflicted for the permission to permit them to travel free on cars of the T.C. and of the Paisley Tramways Co. Consideration of a similar request by the blind people of Renfrew has been deferred.

**Keighley.**—The T.C. is applying to the B. of T. for an extension of time to September 20th, 1913, for commencing, and to September 20th, 1914, for completing, the works authorised by the Tramways Order, 1909.

**Korea.**—According to the local Press, a Tokio company has obtained the option to build an electric railway from a point on the Seoul-Wiju Railway near Shinanju to the Yalu River, traversing the mining districts of Unsan and Yengben, but details of the scheme are not yet forthcoming.—*Board of Trade Journal.*

**Leeds.**—In consequence of largely increasing tramway traffic, the tramway authorities propose to acquire some Corporation property in Sovereign Street, off Swinegate, for the extension of the Kirkstall Road dépôt, at which at present there is insufficient workshop accommodation. The proposal is to erect off Swinegate sheds, capable of holding 30 to 40 cars, and one result of the adoption of the suggestion will be the saving of a lot of "dead" mileage when football and cricket matches, and other events, calls for an accelerated service of cars.

**Leith.**—For the year to May 15th last, the tramway revenue amounted to £34,056, an increase of £3,384 over the figures for the previous year. There were 9,339,324 passengers carried, an increase of 1,082,707. Penny tickets issued totalled 3,802,577, the value being £15,844, an increase of £1,004. The number of 1d. tickets issued was 817,031, amounting to £1,703,

and the workmen's tickets totalled 1,540,190, amounting to £3,208 in value. This year there was a surplus of £2,076, as against a deficit last year of £1,903.

**Little Hulton.**—Last week the D.C. decided to urge upon the South Lancashire Tramways Co. the necessity for proceeding with the construction of tramways in the township, failing which other action in the matter is to be taken. The Tramways Co. renewed its powers for this work a couple of years or so ago.

**London.**—**HAMMERSMITH.**—The oft-recurring question of repairs to the London United Tramway track in the borough led to a long discussion and several resolutions being passed on June 5th. These in effect notify the company to at once repair its track; provide for a deputation to urge on the L.C.C. and the B. of T. the necessity of at once reconstructing the track; and urge the necessity of at once repairing the margins of the roads on which tracks are laid. The situation has become complicated owing to the L.C.C. having practically acquired the L.U. Tramways in the London area; some details are not as yet settled, and it is thought that these may possibly delay matters for an indefinite time.

The Select Committee of the House of Commons which has been considering the matter, has agreed to the running of not more than one trailer car attached to an ordinary car on the L.C.C. tramways, the first car only being electrically driven.

**London-Southend Electrification.**—The consideration of the Midland Co.'s Bill for purchasing the Tilbury line, in Parliament, led to Lord Claud Hamilton intimating that it was the intention of the Midland Co. to electrify the Tilbury and Southend line, and that the Great Eastern Co. would also be compelled to adopt the same course with its route.

**Manchester.**—The Tramways Committee on Tuesday approved of a recommendation that half-fares be charged for passengers under 16 years of age. The scholars' ticket system is to be abolished.

**Mexico.**—A new electric railway is to be constructed between the towns of Puebla and Atlixco. The concession for the construction and working of this has been granted to an American financier, Mr. James McCarthy.

**Salford.**—During a severe thunderstorm which broke over Salford shortly after one o'clock on Monday afternoon, the tramway wires in Regent Road, on the Corporation system, were struck by lightning, and the electric fittings of a car were fired causing considerable excitement. Fortunately, no one was injured, and the outbreak was speedily subdued.

The Corporation Tramways Committee is to be approached again with a view to securing the extension of its system from Peel Green to Irlam and Cadishead, two growing industrial localities.

**Sheffield.**—It is proposed to continue the doubling of the tramway line from Tapton Park Road, to a point near Manchester Road, at a total estimated cost of £10,475; also to renew and double the line in Nethergreen Road, at a cost of £2,300.

**South Africa.**—A railless traction system has been recommended for installation by the Germiston Municipality by Mr. H. N. Thomas, general manager of the Durban tramways. The total route suggested is 6½ miles in length, and the capital outlay would be £40,000.

An experimental mile of railless traction is to be constructed at Aberdeen, Cape Province. Only two cars will be purchased at first.—*British and South African Export Gazette.*

**Southport.**—The annual report of the Electricity and Tramways Committee shows a net profit of £2,151, an increase of £1,149. The Tramways Committee was merged with the Electricity Committee about two years ago, and although the two committees show a profit this year, the tramways have themselves lost £4,000 in the last two years. The T.C. as a consequence has been recommended to engage the services of an expert to report upon the undertaking.

In connection with its scheme of electric railways in the district, the Lancashire and Yorkshire Railway Co. is erecting workshops, stores, &c., at the electrical department, Southport.

**Stalybridge.**—The strike on the Joint Board's Tramways still continued at the time of writing, negotiations with a view to a settlement having failed.

**Westhoughton.**—It is reported that further representations are to be made by influential ratepayers in this district to the Bolton Corporation with a view to securing the continuation of the Bolton tramways to Westhoughton.

**Wolverhampton.**—The total profit of the tramways for the last year amounted to £22,801, and after meeting financial charges, &c., amounting to £12,423, the balance was applied £3,881 to renewals and £2,719 to reserve, also £3,777 in aid of the rates. The total receipts were £51,452, as compared with £48,909 in 1911; 11,253,196 passengers were carried, or 9'84d. per car-mile, and the percentage of working expenses to total revenue was 56'73.

**Yarmouth.**—The annual financial statement in connection with the electric tramways shows a gross profit of £8,584, as compared with £8,126 in the previous year. Bank interest amounted to £100. Loan charges for interest and sinking fund required the sum of £6,713, leaving £1,981 to be added to the appropriation account, and making a disposable balance of £2,434. The Council decided that £2,000 be transferred to the general renewal fund, which would then amount to £7,739.



## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The wireless station at Hobart, Tasmania, has been opened by the Federal Postmaster-General. Working during the night time recently with one-twentieth of its power, the new Pennant Hills (Sydney) station reached every known official station within a radius of 2,000 miles, including Fremantle (2,000 miles), Suva (1,732 miles), Wellington (1,230 miles), and Macquarie Island (1,281 miles).

**Austria.**—The Austrian Government has established under the Ministry of Commerce a State department for wireless telegraphy, which will undertake the working of this service on board Austrian ships, the technical management to be in the hands of an inspectorate in Trieste. The system chosen for adoption is that of the Telefunken Co., and the six installations already carried out by the latter on six Austrian vessels will be purchased by the Government. The equipment for 26 other ships has been ordered, and will be made by the company's Austrian branch in Vienna.

**Canada.**—The first report of the Department of Railways and Canals, Ottawa, dealing with telephone operations in the Dominion, states that the total number of telephone organisations, which includes companies of all kinds, is 537. Of these, Ontario contributes 319, Quebec 32, New Brunswick 16, Nova Scotia 14, and Saskatchewan 143. In Alberta and Manitoba, practically all the separate companies which existed a few years ago have been merged under Government control, and in Saskatchewan the process of absorption is under way. The total liabilities amount to a little over \$40,000,000. The total number of telephones in use is 302,759. The gross earnings of all the Canadian companies amounted to a little over \$10,000,000; operating expenses were almost \$7,000,000, leaving net earnings of slightly over \$3,000,000. The equipment of all the companies' lines includes 687,728 miles of wire; of this, 576,712 is urban, and 111,015 rural. The total number of employes reported was 10,425, who received \$915,636 per year.—*Electrical News*.

Marconi wireless equipment has been ordered for all the steamers of the Northern Navigation Co., the Grand Trunk Railway's Great Lakes route.

**Germany.**—A temporary wooden tower has been built pending the reconstruction of the Nauen wireless station. The permanent iron structure will not be finished for some months; it will be 250 m. high, and of much more solid character than its ill-fated forerunner. When it is completed experiments will be undertaken on the transmission of electric waves through the earth. The wires in this case will be sunk 100 m. in the earth.—*E.T.Z.*

**Hull.**—The annual report and accounts of the Corporation Telephone Department show gross receipts £13,279, and gross profit £5,555, compared with £12,550 and £5,026 in 1910-11. The total amount carried to loan repayment account is now £8,330; to temporary sinking fund, £3,716, and to reserve fund, £7,722 (including this year's surplus of £1,849). The system comprises 37 miles of pipe, and 4,133 miles of underground circuit (double), as well as 628 miles of overhead circuit. The proportion of telephones in use in Hull is one to 23 of the population, compared with one to 40 in Liverpool, and one to 48 in Manchester. The unlimited subscription is £6 6s. per annum, and the capital outlay per station is £19 13; measured service is given for £3 per annum, and 1d. per outward call. The royalty paid was £1,326. The original loan sanctioned in 1903 was £43,202, repayable in 25 annual payments, of which £7,265 has been repaid; a further loan was sanctioned in 1905, of which £19,526 was borrowed, to be repaid in 20 years by instalments, of which £3,716 has been repaid. The total indebtedness of the undertaking was therefore £62,728, of which £51,747 was outstanding on March 31st, 1912. During the eight years' working of the undertaking £10,981 has thus been repaid. According to the statement of Sir Alfred Cripps in connection with the telephone transfer, reported elsewhere in this issue, the Postmaster-General alleges that the Hull Corporation is now carrying on the undertaking as his agent.

**Memorial to Wireless Operator.**—A monument is to be erected in Godalming, to the memory of J. Phillips, the Marconi operator, who went down with the *Titanic*.

**Peru.**—The Government has just erected a wireless station on Mont San Cristobal, overlooking Lima, thus placing that city in communication with Iquitos.—*Revue Pratique de l'Electricité*.

**U.S.A. Telegraph Operators' Dress.**—According to the *Standard's* New York correspondent, the Western Union Telegraph Co. has a mutiny on its hands among its women employes because of an order just issued that no low-necked dresses, nor "peek-a-boo" blouses, nor sleeves shorter than elbow length, shall be worn during the hot summer months. Dr. Anna H. Shaw, president of the National Woman Suffrage Association, says that the style of dress affected by many girls who work in offices, justifies the Western Union's attitude, and that "it is the very girls who wear these things who get the most invitations to dinners and theatres, and the most marriage proposals. It is an outrage."

**Wireless at Sea.**—It is stated that new regulations, making wireless telegraphy compulsory for German vessels, will come into force on October 1st.

**Venezuela.**—The Government has decided to install wireless telegraph stations at La Guayra, Puerto Cabello, Maracaibo and Cumana. The Ministry of Trade will shortly publish full particulars regarding the conditions of tender for the constructional work.

**West Africa.**—A wireless station is to be put up at Accra, Gold Coast, by the Marconi Co.

A wireless station is also to be erected at Lusambo in the heart of the Congo. It is hoped before long to be able to transmit messages direct between Belgium and the Congo.—*African Engineering*.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Alford (Lines).**—June 24th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

**Australia.**—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" May 10th.

VICTORIA.—P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

NEW SOUTH WALES.—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" June 7th.

**Austria.**—VIENNA.—June 20th. Supply of a 40-ton electric crane for the station at Prague. Particulars of Fachabteilung der Zuförderungsdienst, Schwarzenbergplatz, 3, Vienna I.

**Bedford.**—June 19th. About 9,630 tons of coal (nutty slack), for the Corporation electricity works. Mr. Chas. Stimson, town clerk.

**Bradford.**—June 29th. Tramcar equipments, trucks, timber and car fittings, for the Corporation. See "Official Notices" to-day.

**Bridlington.**—June 21st. Smudge coal (about 2,000 tons), for the Corporation Electricity Works. Arthur J. Beckett, electrical engineer.

**Briton Ferry.**—June 19th. Overhead main, between Villiers Street and Grandison Hotel, for the U.D.C. See "Official Notices" June 7th.

**Bury.**—June 21st. Electric light installation and bore-hole pump at the Aitken Sanatorium, Holcombe, for the Bury and District Joint Hospital Board. See "Official Notices" June 7th.

**Clacton-on-Sea.**—June 19th. Electrical service fittings, joint box compound and bitumen, for a year, for the U.D.C. Mr. G. T. Lewis, clerk, Town Hall.

**Croydon.**—June 24th. Conversion of two hand lifts into automatic push-button control electric lifts, at the Infirmary, for the B. of G. See "Official Notices" June 7th.

**Darlington.**—The T.C. has decided to obtain tenders for two double-decked tramcars.

**Dewsbury.**—July 4th. One 1,000-KW. turbine, two 500-KW. D.C. generators, and jet condensing plant for the T.C. See "Official Notices" to-day.

**Dublin.**—June 27th. Extra-high-pressure and low-pressure cables, for the Corporation. See "Official Notices" June 7th.

**Edinburgh.**—School Board invites tenders for electric light installation at Tollcross School. Crawford & Cumming, 41, George Street.

**Exminster.**—June 22nd. Electrical appliances for a year, for the Devon County Lunatic Asylum. Mr. H. E. Morgan, clerk.

**Grimsby.**—June 18th. Electric lighting and fittings for the new Council School, Victoria Street, for the Education Authority. Mr. H. C. Scaping, architect, Court Chambers, Grimsby.



**Hull.**—June 21st. The Corporation is inviting tenders for 1,000 tons of tramway rails of special section in Sandberg steel, together with fishplates and soleplates. Specifications and forms of tender, £1 (returnable), from the City Engineer, Town Hall, Hull.

June 24th.—Mains for the Corporation Electricity Department. See "Official Notices" to-day.

**Leith.**—The Corporation Electricity Department invites tenders for coal. Mr. T. B. Laing, town clerk.

**London.**—**POPLAR.**—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

**HACKNEY.**—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, pipework, travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

**ST. PANCRAS.**—June 17th. Two sets of motor-generator balancers for the B.C. See "Official Notices" June 7th.

**HAMMERSMITH.**—June 26th. High and low-tension switchgear and cable, for the B.C. See "Official Notices" to-day.

**ISLINGTON.**—July 24th. One 3,000-kw. steam turbine alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" to-day.

**STEPNEY.**—July 1st. The Electricity Supply Committee is inviting tenders for meters, demand indicators, time-switches and carbons. See "Official Notices" to-day.

**Manchester.**—June 28th. Traction feeder cables and two years' supply of transformers, D.C. and A.C. motor starting switches, time switches and clock-controlled circuit-breakers, D.C. and A.C. motors, and meters, for the Corporation. See "Official Notices" to-day.

**Newcastle-upon-Tyne.**—June 28th. Nine-ton electrically-driven crane for use in connection with an anti-coal breakage appliance at No. 5 Coal Shipping Staith, Whitehill Point, for the Tyne Improvement Commission. Deposit £1. Mr. J. M. Manson, general manager and secretary, Tyne Improvement Commission.

**New Zealand.**—August 1st. Public Works Department. The following plant is required in connection with the Lake Coleridge electric power scheme. Section 3A.—Valves and expansion joints. Section 10A.—Steel standards for transmission lines. Section 10B.—Ferro-concrete standards for distribution line. Tenders to the Minister of Public Works, Public Works Office, Wellington, N.Z., from whom specification, &c., can be obtained. Deposit £200.—*Board of Trade Journal*.

H.M. Trade Commissioner reports a possible opening for trackless trams and commercial motor vehicles in New Zealand. Further particulars on application to the Commercial Intelligence Branch of the Board of Trade, London.—*Board of Trade Journal*.

**Oldham.**—June 21st. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" May 31st.

**Plymouth.**—June 20th. High grade steam coal (8,000 tons), for the Corporation electricity works. Mr. E. G. Okell, electrical engineer, Prince Rock. £1 deposit (returnable).

**Portsmouth.**—June 27th. Permanent way material and electrical equipment in connection with the Twyford Avenue tramways route, for the Corporation. See "Official Notices" to-day.

**Rotherham.**—July 8th. (a) Tramway stores and materials for a year for the T.C., and (b) Electricity meters; (a) Tramways manager; (b) Borough electrical engineer.

**River Plate.**—According to the *Review of the River Plate*, the municipality of Santiago del Estero will shortly call for tenders for the installation of an electric tramway in that city. "The population is estimated at about 15,000 inhabitants, but it is rapidly increasing, and there has been a satisfactory development of business, due to the forestal industry of the province, which is progressing rapidly."

**Rhondda.**—July 18th. Refuse destructor, generating plant, mains, transformers and switchgear, for the U.D.C. See "Official Notices" to-day.

**Sheffield.**—June 28th. Roof principals and structural steelwork, for Neepsend power station extension, for the Corporation. See "Official Notices" to-day.

**South Africa.**—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

**Spain.**—July 2nd. Electric lighting of the City of Oviedo and its municipal buildings, for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

**MADRID.**—According to the *Gaceta de Subastas*, of Madrid, the Consejo de la Compania Madrileña de Urbanisacion will receive offers for the supply of eight electric vehicles for the Colmenar Railway; also for the rails for the branch line to the Asylum at Paloma.

**Sweden.**—June 22nd. Swedish Royal Board of Waterworks. 11,250-H.P. three-phase generator, 10,000 volts, 150 R.P.M.; transformers for raising to 70,000 volts. For State power station at Alfkärlaby. For further particulars see this column for May 31st.

June 20th.—Swedish State Railways Administration. (1) 147,200 arc lamp carbons; and (2) 35,000 electric incandescent lamps. Tenders, marked "Anbud a baglampskol" in the case of (1), and "Anbud a glödlampor" in the case of (2), to be sent to "Kungliga Järnvägsstyrelsens Förradsbyrå," Stockholm. Specifications and forms of tender (in Swedish) may be obtained, and an English translation of the specifications relating to the arc lamp carbons may be seen, at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

**Swindon.**—June 22nd. Steam coal, for the Corporation. See "Official Notices" June 7th.

**Swinton.**—June 26th. Electric light installation at the Refuse Destructor, for the U.D.C. See "Official Notices" to-day.

**Sunderland.**—June 27th. Cooling tower, travelling crane and switchgear, for the Corporation. See "Official Notices" to-day.

**Warrington.**—June 25th. E.H.T. cable, for the Corporation. See "Official Notices" to-day.

**West Ham.**—June 17th. Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 24th.

**Workshop.**—June 17th and July 3rd. (a) Low-tension cables; and (b) battery switchboard and cast-iron exhaust pipes, for the U.D.C. See "Official Notices" to-day.

**Worthing.**—June 24th. 350 tons of Welsh coal through and through, 60 per cent. large, or washed nuts; 700 tons of Linby Head hard steam or Shirebrook loco. hard steam coal; and 150 tons of Tredegar large steam coal, for the Corporation Electricity Works. W. Verrall, town clerk.

## CLOSED.

**Accrington.**—The correct title of the firm which received the contract for 15 tons of bitumen (see ELECTRICAL REVIEW last week, page 929), is the Dussek Bitumen Co. not the Dussek Trinidad Bitumen Co.

**Barnsley.**—The contract for the installation of electric light in the new premises of the London City and Midland Bank, Market Hill, has been secured by Mr. Fred Burns, Barnsley.

**Bedford.**—The Borough Education Committee has accepted the tender of Mr. R. H. Crawley, of Bedford, for electrical work for six months.

**Belfast.**—The Corporation has accepted the tender of Messrs. Robert Dempster & Sons, Elland, for the supply and erection of electric telfer coke-handling plant, at £5,500.

**Belgium.**—Eight concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux for the construction of the overhead conductors required in connection with the light electric railway between the Belgian capital and Halcht, the lowest offer being that of M. C. Duterme, of Brussels.

**Bootle.**—The T.C. has accepted the following tenders in connection with tramway renewals and improvements:—

The Railway and General Engineering Co., Ltd.—Facing 200 renewable plates to joints, at 29s. 3d. per joint.

Titan Trackwork Co., Ltd.—100 pairs of mild steel cranked fishplates, at 1s. 11d. per pair.

Thermit, Ltd.—Rail grinder and equipment complete.

The tender submitted by the British Insulated and Helsby Cables, Ltd., for the renewal of trolley wires, was accepted.

**Bransby.**—For installing the E.L. in 11 houses being erected here by Mr. S. Turner, the tender of Messrs. H. Burns and Sons, of Whitehaven, has been accepted.

**Dartford.**—The U.D.C. on June 6th accepted the following tenders:—

Browett, Lindley & Co., Ltd.—Steam generator, £3,081.

Foster Bros., Ltd.—Pipework and superheaters, £689.

Worthington Pump Co., Ltd.—Feed pump, £168.

**East Ham.**—The tender of Callender's Cable and Construction Co., Ltd., has been accepted by the T.C. at £1,705, for a supply of 75 sq. in. sectional area concentric, lead-covered and steel-armoured cable. They are also to supply a feeder pillar at £62 10s.

**Felixstowe and Walton.**—The U.D.C. has accepted the tender of Mr. Haydn Harrison for the conversion of the lamps on the Promenade from arcs to metal filament, at £146.

**Germany.**—The Deutsche Maschinenfabrik, of Duisberg, have secured a contract from the Harbour Authorities of Bremerhaven for the supply of two 50-ton electrically-driven cranes.

(Continued on page 971.)



# GENERAL ELECTRIC DEVELOPMENTS.

## NEW FAN WORKS AND CENTRAL STORES.

THE steady growth of the General Electric Co. from its modest beginning a generation ago to the present time constitutes an object lesson in manufacturing progress and

A despatch department will be arranged correspondingly across the other end of three bays, thus providing a natural flow of manufacture from stores to despatch. The first bay



Carbon works.

New fan works.

Large machine shops.

Central stores.

Conduit works.

THE WITTON WORKS OF THE GENERAL ELECTRIC CO., LTD.

skilful business organisation of which the directors may well be proud. Since the company first started business in 1886



COIL WINDING BAY, NEW FAN WORKS.

it has been our privilege from time to time to visit its various manufacturing establishments in London, Birmingham and Manchester, as these have been brought into use, and on Friday last through the courtesy of the company we were able to inspect the latest addition, consisting of several new bays, which are devoted primarily to fan making and small motor building.

This department was originally started in Manchester and removed to Witton some two years ago, when for some time it shared the present switchgear accommodation. The growth of both departments soon required a re-arrangement, and as a result, the new shop has recently been erected to accommodate the small motor and fan work. It consists of six single storey bays, each 300 ft. by 30 ft. of girder construction with brick filled walls and saw-tooth roof with windows giving a north light. The artificial illumination is effected by Osram high candle-power lamps, suspended from the roof, with individual lights for some of the machines. Each bay is spanned by a chain operated power travelling crane and the floors are served by narrow gauge tramways. All the machine tools are electrically driven; some individually, and others in groups according to suitability. The stores are arranged across the end of the bays, so that successive bays may be added without disturbing existing arrangements.

is devoted to press work and is well equipped with modern tools, large and small, mostly by Messrs. Taylor & Challen, for all classes of sheet metal stampings. Small armature rotor and stator punchings are produced complete in one operation from the blank, while under the indexing presses segmental stampings have been made up to 18 ft. diameter, the department being equipped for meeting the whole of the demand at Witton.

Conveniently adjacent in the next bay is the die, jig and tool making department, which is staffed with expert tool makers, many of whom have worked with the company a great number of years.

The greatest care is exercised to ensure the accuracy of dies and small tools, for it is just at this point that the interchangeability or otherwise of most component parts is settled for the whole works.

The machining department for manufacturing is in the third bay, the equipment of which is specially adapted for the rapid production of interchangeable work.

The tools include seven duplex boring mills together with turret lathes, grinding machines, millers, profilers, &c. The most recent addition is a large all-g geared horizontal milling machine driven by its own motor on an extended baseplate.



MACHINE BAY, NEW FAN WORKS.

Both in this and the adjacent winding and assembly departments everything is manufactured in the same systematic way as for large machines.

Every part of even the smallest motor is machined or



drilled to jig, and mechanically gauged or electrically tested after each single operation, so that assembling does not necessitate hand fitting and interchangeability is assured.

All the work in the shop is done on the piecework system, and before each operation is paid for the inspector must sign

The motors are flash-tested at from 500 to 1,000 volts A.C., according to size, and further insulation, running and silence tests are carried out.

The new works at present deal with small alternating and direct-current motors of from  $\frac{1}{10}$ th to 2 H.P., which, in addition to fan driving, are largely used for working advertising signs, emery wheels, vacuum cleaners, &c.

The company, of course, manufactures fans of every description—desk, ceiling, oscillating and revolving fans for any purpose, punkahs for use in tropical climates, and exhaust fans up to 42 in. diameter.

The company's now well-known "Freezor" fan has been arrived at after long trial and experiment, and it is claimed, for instance, that the 12-in. "Freezor Liteweight" fan represents a saving over 40 per cent. in energy for the same effect, as compared with many similar

12-in. fans; moreover, the weight has, by careful design, been reduced to only 10 lb.

In addition to the newly built fan department, the visitors were enabled to inspect other portions of the works, including the works power station and test house, the foundry, the large



GENERAL VIEW OF THE ASSEMBLY BAY, NEW FAN WORKS.

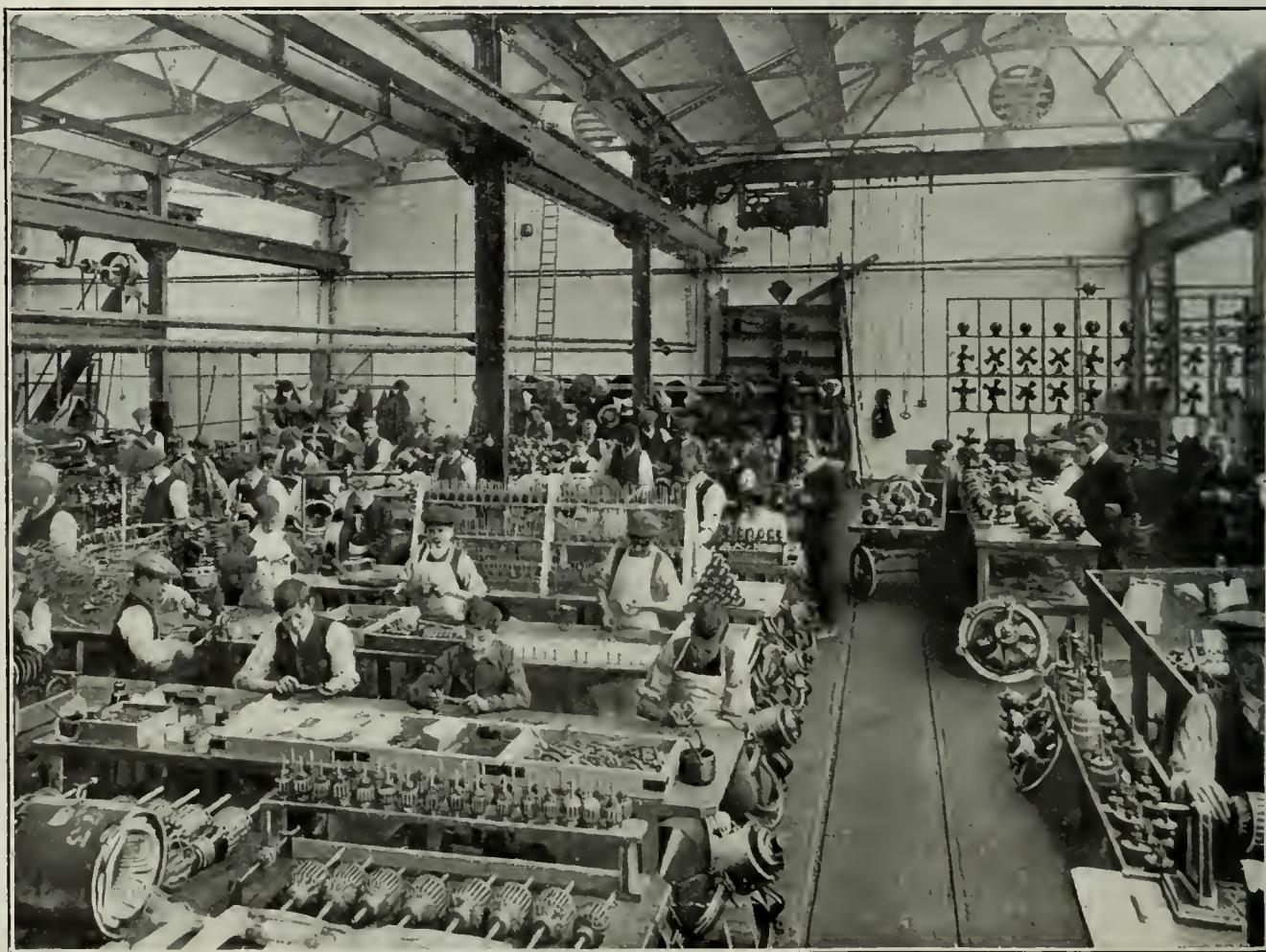
approval of the work on the piecework ticket. A staff of about 400 hands has been specially trained in this class of work by the foremen and inspectors, and consequently only an almost negligible amount of work is turned back as scrap.

All motor parts are made on the company's premises, the castings being produced in a wing of the foundry devoted to machine moulding and small castings.

The armature and field coils are wound in one of the bays shown in our views, and insulated by hand, or machine wound according to size. As an example of the system of inspection adopted, the armature shaft, core and commutator are checked, tested and assembled; the coils, wound on formers, are tested for resistance, taped and placed in the armature slots (which are lined), then tested for earths, short or open circuit, or reversal of connections; soldered to commutator; tested again; dipped in varnish and stove dried twice; the commutators turned; the whole tested finally and then sent to stores as a finished component.

Most of the girls are provided with a single testing equipment; but the tests which each makes before passing on her own work are duplicated in an official test room.

In the case of all standard work, both the finished article and component parts are manufactured to stock, and in assembling the finished article, the parts are drawn from the stores.



ASSEMBLY BAY; TEST BENCH ON THE RIGHT.

machine shops, switchgear and arc-lamp departments, and, last, the recently completed central stores.

Of particular interest in the large machine shops were the examples of turbo-electric machinery under construction, including two 3,000-kw. machines for Poplar. In the case of turbo-alternator work, it is the firm's practice to machine rotor and shaft from the solid, the coils being placed in

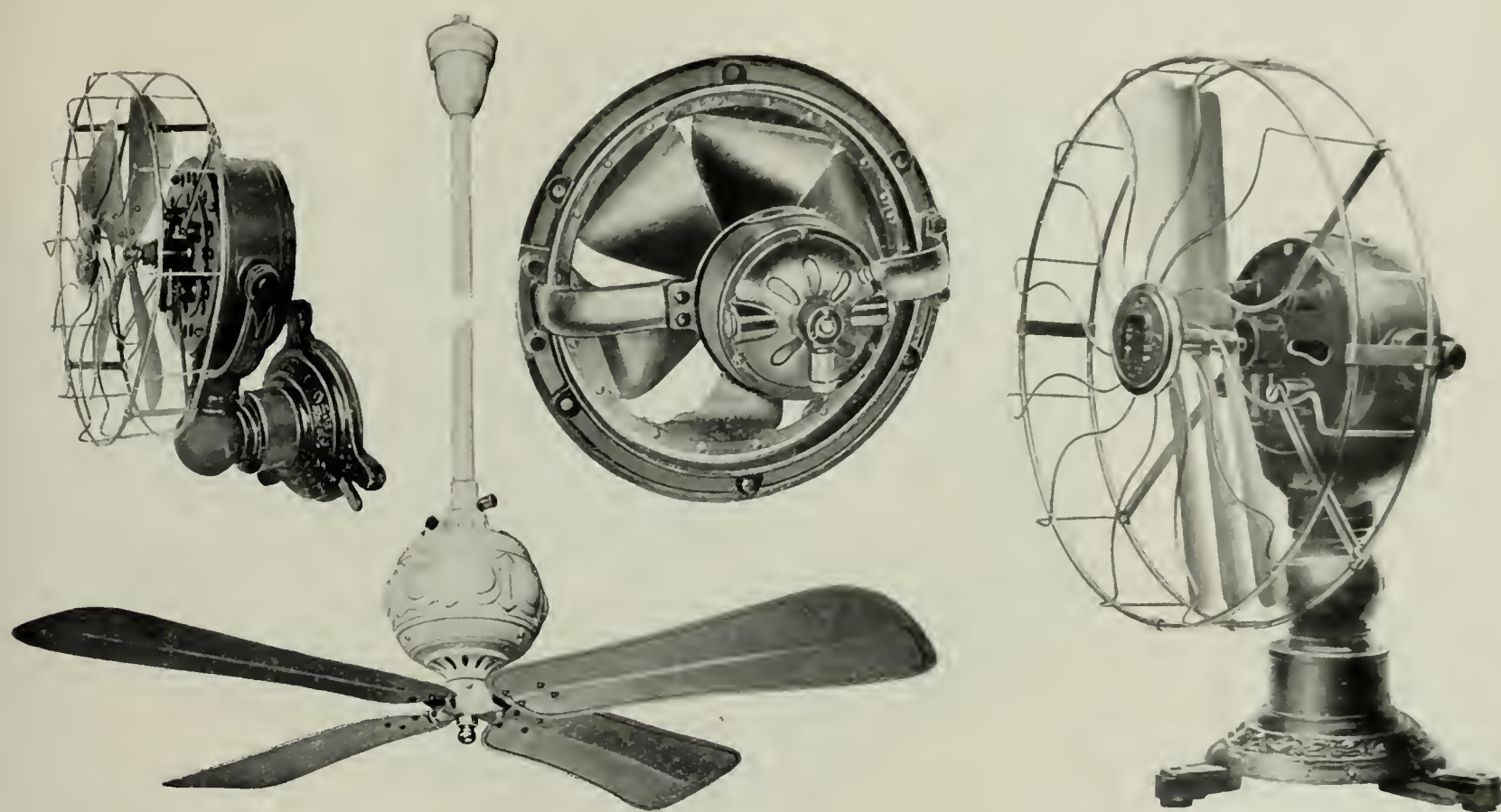


open slots, closed by metal wedges, while the projecting end turns are built up practically solid by hard wood packing pieces, secured in position by enclosing end shields. The slots under the rotor windings and through the poles are utilised for ventilation purposes.

We understand that the company has recently secured

metal lamp, the Butt flame lamp in its latest form and the Angold magazine lamp were shown, the latter, it may be recalled, constructed for up to 100-hours burning, with 5 second periods of extinction when changing carbons.

The central stores is a recent development of great interest in connection with the selling end of the company's



SOME G.E.C. "FREEZOR" FANS PRODUCED AT WITTON.

both Belgian and Dutch contracts, in competition with Continental firms; as regards the latter, the 1,000-KW. "outside" fly-wheel alternator intended for a cotton mill in Holland, attracted considerable attention by reason of its novel design.

An interesting feature was several large Witton-Kramer

business. It consists of a three-storey building 350 ft. long, equipped with lifts, cranes, &c., for housing the finished stock from all the various works, which comprises, one might say, everything electrical, and its function is to supply at short notice the requirements of any of the company's numerous selling branches at home or abroad. That this

may be successfully accomplished, a complete index is kept of every article in the building, and a complete stock list is issued weekly to all branches, so that stock delivery can be assured.

The scope of the company's activity at Witton may, to some extent, be gathered from our first view, and large as it now is, we understand that there will shortly be added the manufacture of electric heating and cooking apparatus, at present carried on at the Ilene Works — the company's fittings factory — at Edgbaston. Two at present unoccupied bays adjoining the fan

works are to be equipped with a view to developing this growing branch of the electrical business.

In conclusion, we are indebted to the company for an instructive and enjoyable visit, towards which the courteous guidance of Dr. A. H. Railing, and the complete arrangements of Mr. H. C. Palmer, contributed not a little.



VIEW IN THE LARGE MACHINE SHOP, WITTON WORKS.

lifting magnets for 9 or 10-ton lifts for a Japanese dockyard; the uses of these in conjunction with the company's electric runway hoists were demonstrated to the visitors. In the arc lamp department, which we were informed handled 50 per cent. more work last year than in the preceding 12 months, despite the competition of the high candle-power



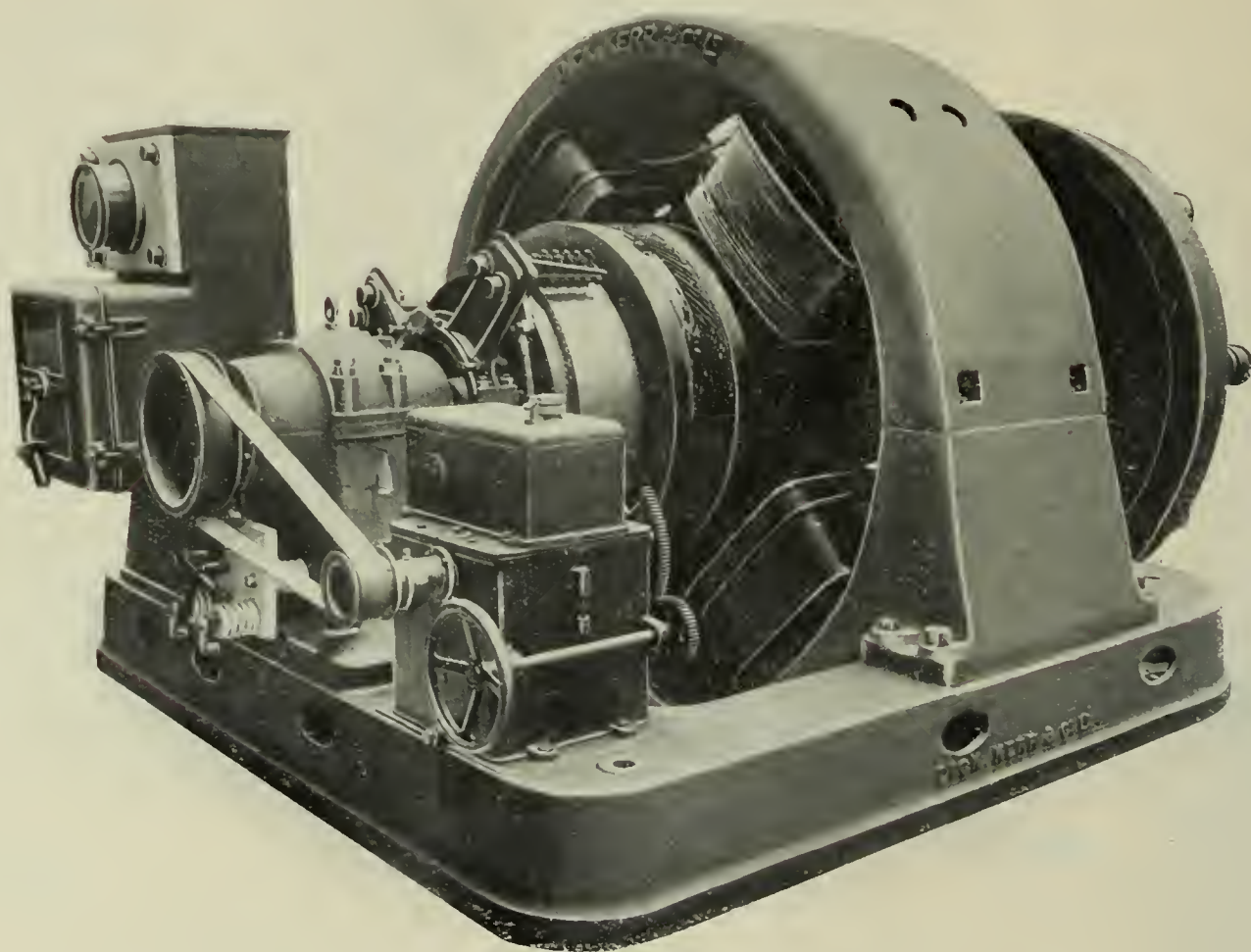
## THE HIGH-PRESSURE DIRECT-CURRENT SYSTEM OF THE METROPOLITAN CO.

ON Monday last, by the courtesy of Mr. J. S. Highfield, engineer and manager of the Metropolitan Electric Supply Co., Ltd., we were enabled to inspect the installation of high-pressure direct-current plant which he has carried out, on the Thury system, for the supply of the western areas from the company's works at Willesden. This, being the first example of its kind in this country, is of exceptional interest: it is fully described in the paper read by Mr. Highfield at the Glasgow meeting of the I.E.E. on Wednesday, of which an abstract is commenced in this issue, and we reproduce herewith two views of the machines in the Ironbridge sub-station, one showing the complete installation and the other one of the motors.

As our readers will remember, Messrs. Dick, Kerr & Co., Ltd., some years ago took up licences under the Thury patents for this country, and they have carried out the work with entire success, the installation having operated from the start (March, 1911) with scarcely a single hitch.

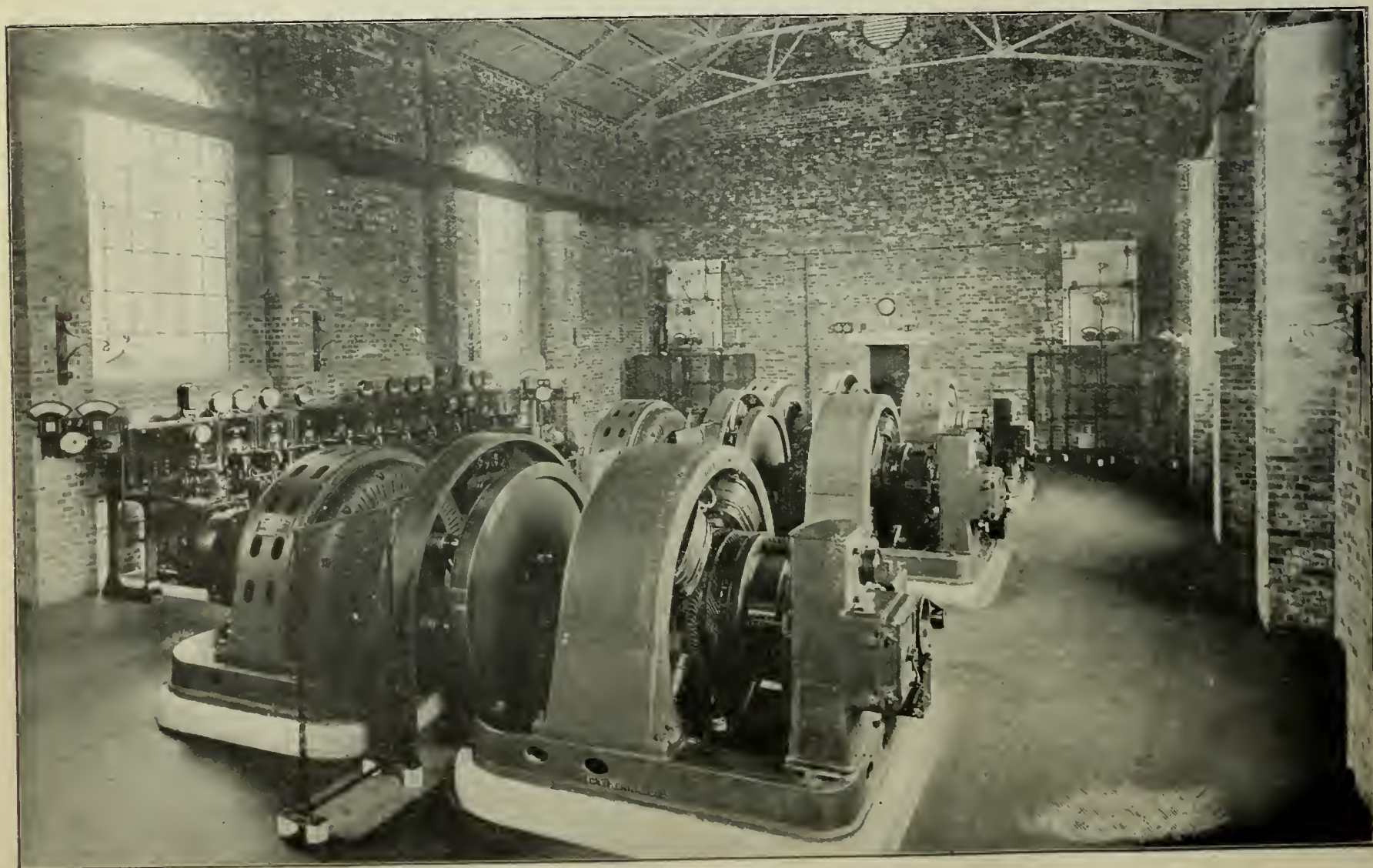
We have on various occasions described the Thury system

as installed on the Continent, where it is used to an extent hardly realised here; we may refer especially to the Montiers-Lyons system (ELECTRICAL REVIEW, August 10th, 1906), supplying 4,300 kW. at 57,600 volts over a distance of 112 miles, and the St. Maurice-Lausanne installation (ELECTRICAL REVIEW, September 12th, 1902) supplying



DICK, KERR 5,000-VOLT, 300-KW., D.C. MOTOR.

4,000 kW. at 27,000 volts, but these are only two out of some scores of installations. There are certain advantages inherent to the use of direct current at high pressure on transmission lines which go far to counteract the drawbacks met with in the generating and converting plant employed



INTERIOR OF IRONBRIDGE SUB-STATION OF THE METROPOLITAN ELECTRIC SUPPLY CO., LTD.



in connection with it. The chief of these are the high efficiency at which the copper in the line is used; the greatly increased reliability of insulating materials when the electric stress is constant in direction; and the fact that the earth can be utilised as a return conductor in case of need. With the same maximum voltage stress on the insulation, and the same percentage loss in the line, a given weight of copper will transmit 50 per cent. more power on the direct-current system than on any alternating-current system. Experiment has proved the second claim, and the fact that the Board of Trade and the Postmaster-General have sanctioned the use of an earth return at Willesden—after, of course, demonstration of non-interference with other interests—substantiates the third. Dielectric hysteresis, capacity current, low power factor, and inductive effects are all absent from the D.C. system, and the simplicity of the switchgear and of the running of the plant leaves nothing to be desired in this respect. A full discussion of the earth-return question is given in the concluding portion of Mr. Highfield's paper; the only disadvantage attaching to the earth as a return is the fact that it cannot be tapped, and therefore all the sub-stations must be looped in on the outgoing cable. But any section of the line between two sub-stations can be cut out by temporarily using the earth as a conductor, and thus the earth acts as an efficient stand-by. Mr. Highfield has found the Thury system the most economical means of providing a supply to the awkwardly situated areas in the west, and states that the cost of the line in many cases does not exceed that of an equivalent three-phase system employing overhead conductors. The cable is exceedingly simple—merely a single core heavily insulated with paper and lead-sheathed,  $\frac{1}{2}$ -in. of paper sufficing for 100,000 volts; it was made by the British Insulated and Helsby Cables, Ltd. The generators work at up to 5,000 volts each, with a constant current of 100 amperes. Distribution is effected on the three-phase system, so that the whole of the high-pressure D.C. system is under the immediate control of the company's staff. The generators, motors and D.C. switchgear were made by Messrs. Dick, Kerr & Co., Ltd., and the three-phase switchgear was supplied by Messrs. A. Reyrolle & Co., Ltd.

## CONTRACTS CLOSED.

(Continued from page 966.)

**Hastings.**—The T.C., on June 7th, decided to accept the tender of the Oliver Arc Lamp, Ltd., for 100,000 pairs of carbons for Oriflamme arc lamps, at £2 15s. per 1,000 pairs.

**Glasgow.**—The T.C.'s Committee on Tramways, Works and Stores has recommended acceptance of the following tenders:—

Trolley poles.—Estler Bros.  
D.C.C. wire.—London Electric Wire Co.; British Insulated and Helsby Cables, Ltd.  
Lead-covered cables.—British Insulated & Helsby Cables, Ltd.  
Special track work.—Lorain Steel Co.; Edgar Allen & Co., Ltd.; Hadfield's Steel Foundry Co., Ltd.

The Clyde Trust Navigation has accepted the offer by Sir W. G. Armstrong, Whitworth & Co., Ltd., to supply, at £565, the cradle and seat for the 32-ton electric crane being made for Rothesay Dock.

**London.**—The Brush Electrical Engineering Co., Ltd., has received the order for the supply of the whole of the incandescent lamps, with carbon and metal filaments, required in connection with the illumination of this year's Shepherd's Bush Exhibition. This is the outcome of the satisfactory results derived from the use of the firm's lamps at the Exhibition last year.

**HACKNEY.**—The B.C. has accepted the tenders of the British Insulated and Helsby Cables, Ltd. (the lowest submitted) for a supply of low-tension and extra-high-tension underground cables. The other tenderers were W. T. Glover, Callender's Cable Co., Siemens, Henleys, and Johnson & Phillips. For the supply of joint-boxes, frames and covers, it has been decided to divide the contract between (a) W. Lucy & Co., Ltd., and (b) the British Insulated and Helsby Cables, Ltd., as follows:—(a) Buried network boxes, dead end boxes, service tee boxes, terminal end boxes and frames and covers; (b) feeder network boxes, disconnecting network boxes, house service boxes and fittings, fuse boxes, meter boards, and special boxes and roadway frames and covers.

**Montevideo.**—The Uruguayan Government has accepted the tender of the Deutsche Maschinen Fabrik, of Germany, for the supply of 13 electric cranes for the port of Montevideo. The cost is \$103,230 gold.—*Review of the River Plate.*

**Morley.**—The T.C. has accepted the tender of Belliss & Morcom, Ltd., for a new engine with base plate for the electricity works.

**Newcastle-under-Lyme.**—The T.C. on June 5th accepted the following tenders:—

J. Bagguley & Son.—Balancer, £90; alterations to switchboard, £200.  
S. Wilton.—Alterations to engine room, £251.  
Midland Coal, Coke & Iron Co.—Coal for a year, 15s. 6d. per ton.  
Silverdale Coal Co., Ltd.—Black for a year, 9s. 6d. per ton.

**Sheffield.**—The T.C. has accepted the tender of Brown Bayley's Steel Works, Ltd., for 500 steel tramcar tires, at 24s. 6d. each; also the tender of the British Electric Transformer Co., Ltd., at £1,010, for four transformers. An order is to be placed with Mr. T. Scott Anderson for welding 250 worn rail joints.

**Walsall.**—The tender of Cole, Marchant & Morley, Ltd., has been accepted by the T.C. for fitting up two tramcars with Spencer-Dawson automatic brakes, at £100 each, less 10 per cent.

**Watford.**—The U.D.C. has accepted the tender of Messrs. J. Howden & Co. for a new engine, at £455.

**West Ham.**—The T.C. has accepted the tender of Leslie and Co., Ltd., at £19,150, for carrying out extensions to the generating station; also the tender of Power's & Deane Ransomes, Ltd., at £2,144, for steel coal bunkers.

## FORTHCOMING EVENTS.

**Institution of Electrical Engineers.**—Summer meeting at Glasgow. Friday, June 14th.—At 9.35 a.m. Excursion on the Firth of Clyde. At 8 p.m.—At the Grosvenor Restaurant. Dinner.

**Physical Society.**—Friday, June 14th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "Demonstration of a Method of Determining very Small Differences of Density," by Mr. T. H. Blakesley; "The Maximum Sensibility of a Duddell Vibration Galvanometer," by Dr. H. F. Haworth; and "An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron," by Mr. F. Stroude.

**Municipal Electrical Association.**—Annual Convention at Harrogate, June 18th to 21st inclusive. The proceedings include papers and discussions; visits to works at Leeds and Middlesbrough; a reception at the Kursaal and annual dinner at the Hotel Majestic (7.30 p.m. Wednesday). For further particulars see our note, page 867.

## NOTES.

**The Visit of the I.E.E. to Glasgow.**—The summer meeting of the Institution of Electrical Engineers was opened on Wednesday morning at the Glasgow Royal Technical College, Mr. S. Z. de Ferranti presiding.

On behalf of the City of Glasgow, Lord Provost Stevenson gave a cordial welcome to the visitors, and, in doing so, he spoke of Glasgow's contributions to engineering generally. He referred to the forthcoming Smoke Abatement Exhibition, and asked the help of electricians to make Glasgow a smokeless city; if they could accomplish that, they would erect a monument which would never fade. Mr. Ferranti, in responding on behalf of the I.E.E., said that people did not realise the immense difference that it would make if there were really a general application of electricity for heating and power purposes. They admired Glasgow for pushing forward its scheme, having that object in view.

Mr. J. S. Highfield read his paper, which appears elsewhere in this issue, on "Transmission of Electrical Energy by Direct Current on the Series System," and in the discussion that followed Professors Marchant and Bailly, Mr. Roger T. Smith, Dr. E. Rosenberg (of Manchester), Mr. Wigham (of Edmundson's Electricity Corporation), Mr. McWhirter, of Glasgow, and others took part.

Demonstrations followed in the Junior Laboratory and the dynamo room of the College. In the afternoon the party devoted itself to visiting works, dividing its attentions among the following: W. Beardmore & Co., Ltd., Dalmauir; John Brown & Co., Ltd., Clydebank; Clyde Valley power station, Yoker; and Yarrow & Co., Ltd., Scotstoun. Excursions through the city and to Rouken Glen were arranged for the ladies. On Wednesday evening the Lord Provost and Corporation gave a reception in the Municipal Buildings.

Yesterday (Thursday) the meeting was held at the James Watt Laboratory, Glasgow University.

After Prof. S. P. Thompson's lecture on "The Magnetism of Permanent Magnets," an experimental single-phase motor was described by Mr. J. S. Nicholson, B.Sc., and Mr. B. P. Haigh, B.Sc., and was afterwards shown running on load. This motor is fitted with pole-changing windings, and is worked as a repulsion motor. Up to half speed (500 R.P.M.) eight-pole connections are employed, while for higher speeds the windings are changed over to four poles, and the field is obtained by passing a magnetising current through the armature. It was pointed out that as a repulsion motor works best when running at a speed close to synchronous value, the use of a pole-changing winding allows of the best results being obtained over a wider range of speed than usual, as two synchronous speeds are available. The motor is started with the greater number of poles; and as the flux per pole is thus reduced to one half the usual value, the voltage induced in the armature turns is considerably reduced, and a much greater starting torque is obtainable without sparking. This effect was demon-



strated by starting the motor against a certain load with each of the two connections. With eight poles the motor started against full torque almost sparklessly, while, on the other hand, with four poles the sparking was excessive. By taking advantage of this improvement, it should be possible to build motors of greater output within given overall dimensions, as the commutator and windings require less space than in the standard type of repulsion motor. The action of the pole-changing motor when running at full speed is similar to that of other "compensated-repulsion" motors; thus the power-factor approximates to unity, and the motor may be used with shunt connections, in which case regenerative braking may be employed.

It was suggested that the motor was not only suitable for multiple-unit trains on account of its high acceleration, but also for locomotives required to handle high-speed passenger traffic by day and heavy goods trains by night. The method of changing the number of poles involves the use of switches, but as each transformer tapping gives two speed ranges instead of one, the total number of contactors is not greater than usual.

We understand that a paper dealing with the motor fully is in preparation for the coming Session of the Institution, and that this will give the results of exhaustive tests on the motor exhibited, which is rated at 10 H.P. at 850 R.P.M., 150 volts, 30 cycles. The motor was built by Messrs. Mavor & Coulson under Mr. B. P. Haigh's patents.

**Ironmongers and Municipal Trading.**—The Ironmongers' Federated Association, at their conference held at Glasgow at the end of May, spent part of their time very profitably in a discussion on municipal trading, the competition of the municipality in such matters as gas cookers, electrical fittings and apparatus, vacuum cleaners, &c., coming in for severe and searching criticism. One speaker referred to the effect of strong co-operative action on the part of the ironmongers of Stockport in stopping the hiring-out of vacuum cleaners there. Another member mentioned that Corporations had power to cut off the supply of light if customers failed to pay their bills for fittings and stoves, whereas the private trader had no such remedy. Yet another speaker urged all local associations to keep pegging away at municipal trading generally, and referred to the fact that the Electrical Contractors' Association was vigorously working to the same end. According to the report of the proceedings in the *Ironmonger* for June 1st the following resolution was carried unanimously:—"That this Federation, in conference assembled, places on record the increasing encroachment of the municipality upon the rights of the private trader, and calls upon all Ironmongers' Associations and kindred bodies throughout the country to use every effort to oppose all legislation for increasing the trading powers of municipalities in this direction, and advises all such associations to recommend their respective municipal authorities to sell their gas, electricity, and other products to the ratepayers at such prices as will cover the cost of production (including dead charges) only."

**American Deputation to England.**—Following a meeting of the Executive Council of the Department on Regulation of Interstate and Municipal Utilities of the National Civic Federation, it was announced that R. H. Whitten, librarian-statistician of the New York Public Service Commission for the First District, had been secured for approximately four months' special investigation work into the matter of public-service corporations in England. Mr. Whitten sailed recently from Boston and will proceed direct to London on his arrival at Liverpool. In his investigation particular emphasis will be given to the questions of profit-sharing, the sliding scale and control of capitalisation. The contemplated investigation in England is a part of the general scheme of the investigation that is being made by this department of the Civic Federation into the question of what constitutes adequate regulation of public utilities. The present investigation is the logical result of a former one which inquired into the merits of public ownership and operation.—*Electrical Review and Western Electrician*.

**Copper.**—The diminution in stocks over the whole month of May, as shown by Messrs. Merton's circular, is, for Europe, 5,183 tons. The withdrawals are chiefly from English ports, though Havre also has dropped 776 tons, and there is less afloat from Chile than at the end of April. Supplies from North America to Europe are about three-quarters of the average: from Spain and Portugal to England and France, the quantity is above the average. Chile shipments are down, but Australian are well maintained. The total deliveries are not unduly low at 39,891 tons. Rotterdam stocks were reduced 1,000 tons during the month, Hamburg rather more. The world's total visible supply was steady from the end of March to the end of April, but has dropped 21,678 tons since January 1st. American stocks appear to have increased during April by 1,205 tons, so that it would look as if the price was bringing up the output.

The copper position, from the point of view of the producer, has even been assisted by a strike, as we learn (from the *Ironmonger* of June 1st) that the shutting down of the Baltimore electrolytic refinery, by stopping a production of 500 tons a day, will distinctly affect the position. The point of view of the electrical manufacturer must necessarily be in favour of cheap copper, and the present shortening of supply, and increase of home consumption (in the States) coinciding with the earnest efforts of manufacturers to improve trade, has only the negative consolation of coincidence of misfortune. The stimulus to trade in the United States is evidenced by the figures of the Copper Producers' Association, which, as given in the *Times* for June 8th, show an increase of 465 tons in output for May as compared with March last, against

an increase in home consumption of 2,328 tons. The stocks, compared with those of a year ago, have dropped 51,955 tons. Production for five months is given as 613 million lb., or 126.5 million lb. per month. In 1911 (*Financial News*) we find that the average production was 119.3 million lb. per month, and in 1910 it was 121 million lb. The domestic consumption for the same five months of 1912 is 65.6 million lb. per month, while the average for 1910 was 62.4 million lb. per month. Calculating from the basis of consumption of pig-iron, a writer in the *Ironmonger* estimates the United States consumption of copper for the current year to reach 337,350 tons, or a monthly average of 63.8 million lb.

**Electricity in Mines.**—At an inquest at Newport on the victims of an explosion at the Navigation Colliery, Bedwas, on March 27th, the theory put forward by the manager, Mr. James Jordan, and supported by Mr. E. L. Hann, mining engineer, was that a spark from an electric signal bell had ignited a small blower of gas. It was stated that experiments made at the Rhymney Valley rescue station showed that gas could be ignited at four volts.—*Standard*.

**Bequest to Science.**—Under the will of the late Sir Julius Wernher, £100,000 is bequeathed to the Imperial College of Science and Technology, South Kensington, to be used at the discretion of the Governing Body. Two-twelfths of the residuary estate (but not in excess of £50,000) will go in the same direction.

**Gas Mantle Variations.**—A French author, quoted by the *Gas World*, points out that there is room for improvement in the manufacture of gas mantles; what is wanted is uniformity rather than durability. At present, he says, the differences in lighting power among mantles from the same batch may amount to 40 per cent.

**How an Appointment was Made.**—According to the report of a speech by Councillor A. W. Tapp, in the *Chatham, Rochester and Gillingham News* of June 1st, the speaker referred to a matter which was recently mentioned in our "Correspondence" columns, as follows:—"A short time past an assistant was wanted at the Gillingham electric lighting works. One of the conditions of the advertisement was that applicants must have had experience with about 1,000 consumers. Three candidates were selected by the Committee. They had to come a good distance. On the night of the Council meeting the best one of these three should have been selected. After the interview one of the members of the Council asked why the local applicant had not been present. Another member moved that the local man should be allowed to come in. He was present, and was called in. He admitted that he had had nothing to do with electrical concerns for 15 years, and at that time he was at Chatham, and the number of consumers he dealt with was 250; yet he was appointed. Was that honourable? Were they prepared to support persons who did things like that?"

**International Radio-Telegraphic Conference.**—On Monday last the King and Queen received the delegates of the Conference, who were presented to their Majesties by the Postmaster-General and Sir Henry Babington Smith.

**Institution and Lecture Notes.**—THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—A meeting of the Managers' Section of this Association was held at Cardiff on June 6th and 7th. About 40 members attended, and they were welcomed at the Council Chamber in the City Hall, in Cathays Park, by the Lord Mayor (Alderman J. W. Courtis, J.P.). The president (Mr. H. E. Blain) presided. Mr. Arthur Ellis, city electrical engineer and tramways manager, gave a lengthy and interesting description of the Cardiff City tramways system. Mr. L. Mackinnon, traffic superintendent of the Glasgow Corporation tramways, introduced a discussion on the Glasgow fare system. Due to the amount of discussion on these subjects, the paper on "Protective Devices for Motormen" was held over until the following day. At the invitation of the Lord Mayor, the members were entertained to luncheon in the City Hall, where they were joined by several members of the Electric Lighting and Tramways Committee. In the afternoon the members journeyed by special cars to the car depot and power station, and were there afforded every facility for inspecting these places. In the absence of the Lord Mayor, Mr. Councillor Vivian, the deputy chairman of the Committee, took charge of the party, and with his able assistance, and that of Mr. Ellis, the members had a very interesting visit. Refreshments were provided, after which the members returned to town. To fill up the remainder of the day, a boat excursion was organised to Bristol, and the majority of the members took advantage of it, and had a most pleasant journey, which occupied about four hours, the weather being very favourable for the occasion.

On the Friday the members again assembled at the City Hall, and the following subjects were introduced for discussion: "Protective Devices for Motormen," Mr. A. Baker, general manager, Corporation Tramways, Birmingham; "The Relative Merits of Petrol Buses and Railless Trolley Vehicles," Mr. E. Hatton, general manager, Corporation Tramways, Newcastle; "Tramway Track: Methods of Construction and Maintenance," by Mr. J. Grierson, permanent way engineer, Glasgow; Mr. H. Mattinson, permanent way engineer, Manchester; and Mr. R. B. Holt, permanent way engineer, Leeds.

Hearty votes of thanks were accorded the Lord Mayor and Corporation of Cardiff, the Deputy Chairman and Members of the



Tramways Committee, to the general manager (Mr. Ellis) and members of his staff for the kind welcome extended to them, for the use of the Council Chamber, and for the generous hospitality which had been extended to them during their stay in Cardiff. A vote of thanks to the President and to the Hon. Secretary (Mr. C. J. Spencer) concluded the proceedings. After the ordinary business meeting, Mr. Ellis again kindly provided special cars for the members to inspect other interesting points of the system, and these were greatly appreciated.

**JUNIOR INSTITUTION OF ENGINEERS.**—At a meeting on Friday, May 31st, Mr. Arthur Bourne gave a lecture on the "Standardisation of Engineering Catalogues." He referred to the chaotic conditions under which manufacturers introduced their productions to the notice of consumers, and urged that more care, science and system should be brought into the extremely important question of catalogue production, upon which so much money was spent. Under existing conditions it was difficult to know how to file catalogues, and he doubted if there was a really satisfactory system. What buyers abroad welcomed was literature that gave not only detailed illustrations, but also full and complete information such as net and gross weights, shipping measurements, code words, and approximate prices, so that if necessary, a quotation could be given without having to refer home. It was really surprising what a large percentage of catalogues failed in this respect.

**INSTITUTION OF MUNICIPAL ENGINEERS.**—This Institution has lately been interesting itself in aviation, and held a meeting at the Hendon Aerodrome this week, at which papers were read on the subject. Mr. B. Wyand, in putting forward suggestions for regulations in relation to aviation, said that the practice of laying overhead wires should now cease; the danger to aviators, even in the daytime, was obvious. Existing overhead wires should be laid underground as speedily as practicable, those at the greatest height being dealt with first. Mr. Wyand's clever paper contains many amusing passages, and we hardly know whether to take him seriously or not; but we can assure him that houses and trees are as likely to be levelled for the benefit of the aviator as electric overhead wires to be laid underground.

**ROYAL SOCIETY.**—The 250th anniversary of the Royal Society will be celebrated on July 15-19th by an evening reception of delegates at Burlington House, a short commemorative service in Westminster Abbey, a formal reception of delegates in the Great Library of the Royal Society, a dinner in the Guildhall, a garden party at Syon House, and a *conversazione* at the Royal Society's rooms. On July 18th the King and Queen will receive the President, Council and delegates of the Society at Windsor Castle, and the Universities of Oxford and Cambridge will entertain the delegates on the following day.

**THE VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.**—At a meeting in Melbourne on April 25th, a paper on the compulsory licensing of electrical wiremen was read by Mr. H. Smith. To obtain a licence, the writer maintained that a wireman should have served at least five years at practical work, and also passed an examination before a committee.—*M. and E. Review.*

**Accident.**—A Bellshill, Lanarkshire, boy, who climbed on a roof in search of a ball, caught hold of an overhead electric wire. As a result of the shock, he fell to the ground and was seriously injured.

**Inquiry.**—Correspondents are asking for the address in this country of Mr. Arthur Allison, of the Cassilis Gold Mines of Victoria.

**Errata.**—In the article on "Rating of Cables," p. 921, Table 1, col. 10, line 23, for 350 read 380; col. 11, line 23, for 353 read 355. P. 953, col. 1, line 33, for 6,800 read 2,800.

**Parliamentary.**—In the House of Commons on 6th inst., the debate on the second reading of the National Electric Construction Co.'s Bill was adjourned.

**Annual Outings.**—The employes of the Clyde Valley Electrical Power Co. held their annual outing to Auchenlochan on the Kyles of Bute on Saturday, 8th inst. The outing was graced with fine weather, and was most enjoyable in every way. A large party travelled, all the departments of the works being well represented, and in the course of the afternoon the company's general manager, Mr. D. A. Starr, and his wife, were presented with a solid silver tea service on the occasion of their silver wedding. Provost Johnstone, Rutherglen, presided.

On Friday night last, the staff, employes, and friends of Messrs. Kelvin & James White, Ltd., numbering about 350, had a most enjoyable evening cruise in beautiful weather. By the courtesy of the North British Railway Co., a special train was in waiting for them at Queen Street Station at 6.30 p.m., and the party joined the steamer at Craigendoran, and thereafter proceeded on a cruise up the Kyles of Bute. The outing was, from beginning to end, a complete success, and it is proposed to make it an annual one.

**Educational Notes.**—The former students of Prof. Henrici, F.R.S., who has retired, after 27 years, from the Mathematical Chair at the City and Guilds Engineering College, have had engraved in his honour a medal to be awarded annually "for proficiency in mathematics."

The Board of Education announces that owing to the complicated questions raised by a general revision of the Regulations for Technical Schools, the existing regulations will be continued in force as regards England during the educational year 1912-3. A circular was issued on June 6th explaining this and other matters relating to Technical Schools.

**Flying Tour.**—The International Correspondence Schools have arranged for Mr. R. Slack, one of their students, to fly round Great Britain on an 1,100-mile tour in a monoplane, which will afterwards be presented to the nation by the I.C.S.

**Appointments Vacant.**—Tramways manager for the Ilford U.D.C. (£400). Junior engineer, for the Rochdale Corporation Electricity Department (10s.). See our advertisement pages to-day.

**Causes of Fires in U.S.A.**—The April issue of our American contemporary, *Insurance Engineering*, contains a very complete account of the campaign that has been in progress in the States for some months past against the pernicious match. The large number of fires due to the use of matches has led to an agitation in certain quarters for legislation controlling their sale and use. One of the articles (by D. W. Sleeper) contains the following comments:—

"There was a time, not so many years ago, when it seemed to be the custom to report the cause of all fires of unknown origin as being due to defective electric wiring. Largely through the efforts of fire insurance and fire prevention interests, drastic rules for the proper installation of electric equipment and the safeguarding of life and property were compiled and their adoption by the different cities secured after long and bitter struggles. To-day we seldom hear of 'defective wiring' fires. Instead, it is now customary to place the blame for unknown-cause fires on rats and matches."

Will the English newspaper Press be so good as to follow the trans-Atlantic lead in this matter?

**Electricity Works Table.**—Our Electricity Works Table is now in the press: corrections can still be made if received by June 21st at latest. Central station engineers and managers who have not already forwarded statistics to date are earnestly requested to do so as soon as possible.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The wedding took place on June 8th, at Ashover, in Derbyshire, of MR. HERBERT BELL, city electrical engineer, Hull, and Miss Millicent Harker Coburn, of Millbrook, New York State, U.S.A.

The Accrington Electricity Committee presented a handsome silver tray to MR. HAROLD GRAY, the borough electrical engineer, on the occasion of his marriage recently to Miss Dinsdale: the staff of the electricity works also presented him with a complete set of cutlery.

The Lancaster T.C. has increased the salary of the electrical engineer by £25 a year forthwith, with a further increase of £25 next year.

With reference to the proposal to increase the salary of MR. P. P. WHEELWRIGHT, borough electrical engineer at Blackburn, from £500 to £700 per annum by four annual increments of £50 each, at a labour meeting held on 6th inst. on the local market place, attended by over 400 people, a resolution was passed as follows: "That this meeting strongly protests against the proposed increase of £200 in the electrical engineer's salary. It was clearly understood, when appointed, that his present salary of £500 should be the maximum. The meeting further asserts that instead of increasing the salaries of already well-paid officials, the Council should devote its attention to increasing the wages of the low-paid workers."

The E.L. Committee of the Bexhill-on-Sea T.C. has recommended the Council to increase the salary of MR. C. A. FROST, assistant engineer, from £175 to £200 per annum.

The Electricity Committee of West Ham T.C. reports the resignation of MR. H. H. COUZENS, electrical engineer to the undertaking, to take up an appointment under Hampstead B.C. Owing to the fact that there are several very important matters pending relating to the undertaking, in which it is essential that the Council should have the advantage of Mr. Couzens's assistance, it has been decided, subject to the Hampstead Council's consent, to retain his services as consulting electrical engineer for a period of one year, at a fee of 200 guineas.

Owing to the resignation of MR. R. V. TASKER, shift engineer to the Sheffield undertaking, MR. T. ROBERTS, at present switchboard attendant, is to be transferred to Mr. Tasker's position, at a salary of £110 per annum.

The E.L. Committee of Torquay Town Council has decided that, having regard to the extra services rendered by the electrical engineer, MR. SALT, in connection with the installation of new plant, and the financial and other improvements effected by him in the working of the undertaking, his salary should be increased from £300 to £350 per annum.

The Warrington T.C. has increased the salary of MR. H. B. JACKSON, chief assistant electrical engineer, from £180 to £190 per annum, rising by £10 next year to a maximum of £200.



MR. P. J. S. TIDDEMAN, late borough electrical engineer at Stoke-on-Trent, has been appointed general manager of the Llanelly and District Electric Light and Traction Co., Ltd.

MR. WALTER G. HURST has been promoted from station superintendent to chief assistant engineer at the Heckmondwike electric light and power station.

**Tramway Officials.**—The Tramways Committee of the Bradford T.C. recommend that the salary of MR. C. J. SPENCER, general manager, be increased from £700 to £800 by two annual increments of £50, commencing at the beginning of the current financial year.

The Wolverhampton T.C. has been recommended to increase the salary of MR. W. A. LUNTLEY, tramway manager, from £350 to £400 as from May 1st.

The General Purposes Committee of the Southport T.C. have confirmed the following resolution of the Tramways and Electricity Committee:—"That on the report of Mr. Black, electrical engineer and tramway manager, the Tramway Committee are of opinion that there is no necessity for a deputy engineer and manager. The Committee, therefore, although with regret, resolved that Mr. Kendrew be requested to resign his position as from June 25th next, and to accept three months in addition to his salary up to that date."

BAILIE NELSON and COUNCILLOR W. F. RUSSELL, convener and sub-convener of the Glasgow Corporation Tramways Committee along with the general manager and the engineer, are to attend the Biennial Conference of the International Tramways Union at Christiania next month.

**General.**—MR. HARRY NIMMO has resigned his position as electrical engineer to the Irrawaddy Flotilla Co., Ltd., in order to take up an appointment on the staff of the Rangoon Electric Tramway and Supply Co., Ltd. Before going to Burma, three years ago, Mr. Nimmo was for some time electrical engineer to the Oakbank Oil Co., Ltd. Previous to that, he was on the outside erection staff of the British Westinghouse Co. and in the works of Messrs. Bruce Peebles & Co., Ltd.

MR. W. H. M. BIGGS, secretary to the Adams Manufacturing Co., Ltd., who, as stated in the ELECTRICAL REVIEW last week, is leaving to take up a position with Electromotors, Ltd., Openshaw, Manchester, has been presented by the staff with a mahogany bureau.

## CITY NOTES.

### Birmingham and Midland Tramways, Ltd.

THE annual meeting of this company was held on Tuesday at Electrical Federation Offices, Kingsway, Mr. C. S. B. Hilton presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 934), said that the year had been marked by expansion in both branches of the business, and he thought he might congratulate the shareholders upon a fairly successful year. The total revenue from all sources was £109,901, compared with £102,618 in 1910—an increase of 7 per cent. The expenses for the same period were £52,365, compared with £53,703—an actual decrease of over 2½ per cent. The number of passengers carried on the tramways increased by 600,000, and the proportion of expenses to receipts had been reduced from 63 to 56 per cent. After providing for interest on sinking fund debentures, and paying the 5½ per cent. dividend on the preference shares, placing £5,000 to renewals, against £3,000 in 1910, and £3,750 to reserve, against £1,000 last year, they were able to recommend an increased dividend of 3 per cent., as against 2 per cent. for the previous year. The capital account was increased during the year by £6,211, of which £6,092 was spent upon the electricity supply undertaking and £118 upon the tramways. In order to comply with the terms of the trust deed, £4,803 of debenture stock was cancelled during the year. In the traction section of the business, the traffic receipts had increased by £2,400—over 5 per cent.—and the average profit per route-mile had also expanded satisfactorily, while the expenses showed an actual decrease of £900, chiefly in repairs and maintenance, owing to the heavy expenditure on cars in past years having now been largely overtaken. In the electricity supply branch the sales of current showed a very satisfactory increase in revenue, although the actual number of units sold was less by 1,308,000, owing to the loss of one large consumer at a very low rate. He was glad to say they were gradually overcoming that shrinkage by adding new consumers paying better prices. The balance carried to profit and loss account from the lighting section amounted to £10,410, practically the same as in 1910. They had every reason to be satisfied and hopeful about this side of the business, which continued to show regular and healthy expansion, and they looked with every confidence to the future. He was pleased to be able to say that they neither reduced the tramway service nor disappointed a single customer taking a supply from their Smeethwick station, during the recent coal strike. It was important they should bear in mind that the effect of the coal strike would give them considerable anxiety in the future, as not only had the cost of coal gone up, but the price of all other materials had a tendency to rise. Therefore, the working expenses were certain to show an in-

crease, whilst it was very difficult to obtain increased fares or increased rates for electric current. An interesting decision had recently been given by the Court of Appeal in a case brought by the Metropolitan Electric Tramways Co. on the question of the assessment of tramways for the general district rate. If that decision stood, tramways would in the future be entitled to be assessed at one-fourth of the full annual value. That should result in a considerable saving in the item of rates and taxes, which amounted in their case last year to close on £2,300. The interest received on their investments last year amounted to £29,861—an increase of £4,700, due to the greater prosperity of the associated companies. With regard to the City of Birmingham Tramways Co., Ltd., in which they had a large holding, and which company was now in liquidation, they decided to support the directors in their policy of forming a new company to liquidate the assets. The Electrical and Industrial Investment Co. had now been registered, and application had been made on behalf of that company for the ordinary and preference shares and the debenture stock to which they were entitled under the scheme. They were to receive £17,500 of 5½ per cent. debenture stock; £53,772 of 6 per cent. preference shares, and no less than 161,316 ordinary shares of £1 each in the new company. The directors had every anticipation that the result of that investment would be to substantially increase in future the return received on their securities.

MR. J. A. LYCETT seconded the motion, and the report was adopted.

Subsequently a resolution was agreed to changing the name of the company to the Birmingham District Power and Traction Co., Ltd.

### British Electric Traction Co., Ltd.

THE directors' report for the year ended March 31st, 1912, which is to be presented at the meeting at the Holborn Restaurant, W.C., on June 20th, has been issued. To it there are appended various schedules, and it is accompanied by a pamphlet giving particulars and statistics of progress for 1911 of the associated companies included in the British Electrical Federation, which is a combination of electric traction, lighting and other companies in which the B.E.T. Co. is financially interested. It is stated that the federated companies have during the year in almost every case again made good progress. The total traffic receipts for the past year amount to £1,770,748, showing an increase of £80,421, compared with 1910, and a satisfactory feature of the development is that the receipts and the passengers carried per route-mile have steadily increased—the receipts having gone up from £3,638 to £3,780 per route-mile, and the passengers carried from 699,043 to 725,321 per route-mile; the total number of passengers carried in 1911 was 339,696,820, as compared with 324,796,450 in 1910. In the electricity supply department substantial progress has also been made; the number of units generated at the power stations of the electricity supply companies was 59,833,512—an increase of nearly 10 per cent. compared with 1910. The net profits of the Associated Companies show an increase of over £85,000, compared with 1910. The amount applied in the payment of interest on debentures and distributed as dividends shows a substantial increase, and the amounts placed to reserve are also larger. The B.E.T. Co. has received £35,060 more interest and dividends from Associated Companies than in 1910. The directors recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock. They are of opinion that on the present occasion the best interests of the company will be served by strengthening its position, and they have therefore decided to apply the increased profits to writing down certain items in the balance-sheet by £34,043, and also to place £25,000 to reserve as in the preceding year. In addition to the progress shown by the accounts, the investments and undertakings of the company have in several instances materially improved.

The City of Birmingham Tramways Co. having parted with the whole of its tramways is about to be liquidated, and is returning £4 in respect of each ordinary share of £1. The British Electric Traction Co. ten years ago purchased a large holding at £1 17s. 6d. per share—showing an appreciation of £113,904. These shares now belong to the Birmingham and Midland Co., in which the B.E.T. Co. is largely interested. An investment company with a nominal share and debenture capital of £800,000 has been formed, which will take over the whole of the assets and liabilities of the City of Birmingham Co. The constitution of the company will enable it to carry out much more effectively the business of an investment company than could be done by the City of Birmingham Co., which was originally formed for the purpose of leasing and working tramways, but which, owing to the expiry of the leases and the sale of its tramways, had large sums invested in electrical and other securities. The directors are of opinion that the interests of the B.E.T. Co. will benefit by reason of its connection with the investment company referred to. In the case of the Swansea company, the position has been improved by an agreement which has been made with the Corporation (subject to confirmation by Parliament) for the co-ordination of the varying tenures.

A satisfactory improvement is shown in the profits of the North Metropolitan Electric Power Supply Co., the Metropolitan Electric Tramways, Ltd., the Auckland Electric Tramways Co., Ltd., and the Bombay Electric Supply and Tramways Co., Ltd., the latter company paying its first dividend on the ordinary shares at the rate of 3 per cent. for the year.

During the year the company has taken an important participation in the British Canadian Power Co., which has been formed to develop water-power rights in Canada. The company supplies electric power, compressed air and electric light to the mines and



other consumers in the town of Cobalt and the surrounding districts—one of the richest silver-producing districts in the world.

The directors regret that the Brush Co., in common with other electrical manufacturing companies, is still suffering from intense home and foreign competition, but the volume of business has increased, and prices obtainable are slightly better. It is hoped that the improvement will continue, but a reduction of its capital is unavoidable.

The re-arrangement of the capital of the B.E.T. Co., as proposed by the directors after consultation with a committee of representative shareholders, was confirmed by the proprietors, and the subscribed capital of the company at March 31st, 1912, was £2,947,380, as follows: 6 per cent. cumulative preference stock, £403,592; 7 per cent. non-cumulative preference stock, £807,185; 6 per cent. preferred ordinary non-cumulative stock, £1,070,097; deferred ordinary stock, £666,505. The debenture stock outstanding at the same date was, £1,895,632, namely, 5 per cent. perpetual debenture stock, £1,461,575; 4½ per cent. second debenture stock, £434,057. During the year the directors purchased in the market and cancelled £2,670 5 per cent. perpetual debenture stock and £5,539 4½ per cent. second debenture stock of the company. The outstanding debenture stocks have been reduced by these amounts, and the difference of £1,323 between the nominal value and the purchase price has been added to reserve.

The reserve at March, 1911, was £666,332. This amount has been increased by £2,832 net profit on sale of investments and by £1,323 above referred to and also by £25,000 transferred out of the profits of the past year. The reserve has been debited with £11,119 loss on sale of Consols, and with £60,636, which has been written off various investments by reason of reductions of capital. The balance at credit of this account is now £623,733. Having dealt with the depreciation of all assets other than investments and undertakings, the whole of the reserve becomes available for depreciation of this item, and the directors have shown the reserve in the balance-sheet as a deduction from the amount at which the investments and undertakings stand in the books. They will continue to add to the reserve all profits made by realisation of the investments and charge against the reserve any losses on realisation. The Associated Companies have created depreciation and other reserve funds of their own, which amounted at December 31st, 1911, including the balances carried forward, to £1,124,998. The reserve of £502,446 of the City of Birmingham Tramways Co., shown in last year's schedule, has been reduced by £300,278, which has been applied in writing down the property account. The amount now standing to credit of the reserve of that company is £202,264, which represents the surplus of assets over its capital and liabilities.

In regard to investments and undertakings, this item, after deducting the reserve for depreciation above referred to, stands at £4,695,103, and consists of shares and debentures in associated tramway, electricity supply, manufacturing and other companies, Consols, and sundry securities and undertakings. The yield for the past year on the total investments and undertakings standing in the books at £5,318,836 was 3·32 per cent., compared with 2·7 per cent. for the preceding year on £5,204,667; and the yield on the total at which the investments and undertakings stand, after deducting reserve, is 3·77 per cent.

The gross profit for the year amounted to £195,041, as compared with £166,108 for the year 1910-11. After deducting management expenses and other charges amounting to £19,064, there remains a balance of £175,977, to which must be added £10,832, the amount brought forward making £186,809, from which has to be deducted debenture stock interest amounting to £92,799, leaving a balance of £94,010. The total amount placed to reserve or written off is £59,043, and the dividend of 6 per cent. on the cumulative preference stock for the year ended March 31st, 1912, on account of which an interim dividend of 3 per cent. has already been paid, amounts to £24,216, leaving £10,751 to be carried forward.

Since the last ordinary general meeting of the company Sir Charles Rivers Wilson and the Hon. Sir Charles W. Fremantle have resigned their seats on the board, and after consultation with the committee of representative shareholders, the directors appointed Mr. G. T. Symons and Mr. C. G. Tegetmeier to fill the vacancies, subject to confirmation by the shareholders. The directors who retire this year are Mr. C. Shirreff Hilton and Mr. William L. Madgen, and they will be proposed for re-election.

**Continental.**—GERMANY.—The Braunschweig-Hannoversche Überlandcentrale A.G., Berlin, has been formed for the generation and supply of electrical energy in the province of Hannover and the Duchy of Brunswick, and neighbouring districts, with a capital of 1,000,000 marks. The Bergmann Elektrizitäts Unternehmungen A.G. are the founders of the company.

The Wilhelmshaven Strassenbahn G.m.b.H. is the style of a company formed at Frankfurt a/M. to build and work tramways, &c., in Wilhelmshaven.

FRANCE.—The balance-sheet of La Société Electro-Metallurgique Française, of Fréges (Isère), for the last financial year, shows a net profit of £85,583, as compared with only £72,767 in the preceding 12 months.

**Western Telegraph Co., Ltd.**—The directors have declared a third quarterly interim dividend of 3s. per share, free of income-tax, for the year ended June, 1912, being at the rate of 6 per cent. per annum. The transfer books will be closed from June 17th to 22nd.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

County of London Electric Supply Co., Ltd.—Further issue of 19,000 ordinary shares of £10 each, fully and partly paid (No. 80,001 to 29,000).

And to allow the following securities to be quoted in the Official List:—

Tramways (M.E.T.) Omnibus Co., Ltd.—Fully-paid scrip for £100,000 4½ per cent. guaranteed debenture stock.

The Committee have appointed special settling days as under—

Wednesday, June 19th.—Sudd Fuel (Suddite), Ltd.—75,400 7 per cent. cumulative participating convertible preference shares of £1 each, 15s. paid (Nos. 1 to 75,400).

Thursday, June 20th.—Marconi Wireless Telegraph Co. of America.—Temporary certificates for 2,000,000 shares of \$5 each, fully paid.

Vancouver Power Co., Ltd.—Scrip, fully paid, for £500,000 4½ per cent. perpetual guaranteed debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of \$250,000 general mortgage 4½ per cent. 30-year gold bonds of \$1,000 each (Nos. 9,833 to 9,932 and 10,083 to 10,212).

South American Light and Power Co., Ltd.—£150,000 5 per cent. registered debentures of £100 each (Nos. 1 to 1,500).

Vancouver Power Co., Ltd.—£800,000 4½ per cent. perpetual guaranteed debenture stock.

**Manila Electric Railroad and Lighting Corporation.**—The directors' report (as abstracted in the *Financial News*) shows that the gross earnings for the year ended December, 1911, were \$1,452,688, an increase over the previous year of \$135,659, or 10·30 per cent.; operating expenses and taxes increased \$30,680, or 5·02 per cent., while the net earnings from operation were \$810,849, an increase of \$104,979, or 14·87 per cent. Interest charges during the year were \$277,092, and sinking fund requirements were \$27,933, leaving surplus earnings for the year of \$505,825. The directors increased the annual appropriation for the replacement and renewal fund from \$60,000 to \$80,000, and, deducting this from the year's surplus earnings, leaves an available surplus for the year of \$425,825. From this amount there were paid three dividends of 1½ per cent. each and one dividend of 1½ per cent., aggregating \$262,500, leaving \$163,325 over all disbursements and reserves, which has been transferred to surplus account, making the total accumulated surplus with reserves at December 31st, 1911, \$1,080,078, an increase over 1910 of \$329,953. During the year there were purchased by the trustee under the sinking fund provisions of the company's mortgage, \$31,000 face value of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds, making a total of \$119,000 face value of bonds held by the trustee at the end of 1911. The directors have authorised for 1912 the construction of about 5½ miles of track on other city streets not at present occupied, an addition of 800 H.P. in boiler capacity, and an addition of nine cars to the rolling equipment, of which three have already been purchased and six will be built in the company's shops. The foregoing will require an expenditure of over \$200,000. Dividends have been paid as follows: 1906, 3 per cent.; 1907, 3 per cent.; 1908, 4 per cent.; 1909, 4 per cent.; 1910, 4 per cent.; 1911, 5½ per cent. Since the beginning of the current fiscal year there has been added \$31,000 face value of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds to the sinking fund, making the total bonds in that fund \$150,000.

**Swedish Telephone Companies.**—The Stockholm Allmänna Telefon A.B., which is largely interested in telephone companies in Stockholm, Moscow, Warsaw and Mexico, and which carried out large telephone installations in Russia in 1911, reports net profits of £252,000 for that year, as compared with £208,000 in 1910, on a share capital of £313,000. It is proposed to pay a dividend of 37 per cent., this rate contrasting with 33 per cent. in 1910. The L. M. Ericsson Co., which has a share capital of £373,000, earned net profits of £159,000 in 1911, as contrasted with £93,000 in the previous year, and intends to distribute 14 per cent., as against 12 per cent. in 1910. The company owns telephone factories in various countries, and is also interested in factories in other countries.

**Gwynnes, Ltd.**—The directors report that the accounts for the year to January 31st show (says the *Financial*) that after providing for debenture interest, writing £18,750 off for depreciation of buildings, plant, &c., the debit balance of £7,432 brought forward was increased to £20,614.

**Electric and General Investment Co., Ltd.**—The directors, subject to the completion of the audit, recommend the following dividends for the year ended May 31st: Ordinary shares, the full dividend of 2s. per share, being 10 per cent. per annum on the capital paid up; deferred shares, a dividend of 6d. per share. Both are subject to deduction of income-tax. It is proposed to add £3,075 to the contingencies fund, raising the amount standing to the credit thereof to £82,000, carrying forward £2,726.

**Canadian General Electric Co.**—The directors have declared a quarterly dividend on the common stock for the three months to June 30th at the rate of 7 per cent. per annum.

**Globe Telegraph and Trust Co., Ltd.**—The directors have declared final dividends of 3s. per share on the preference and 6s. on the ordinary shares. £28,000 is carried forward.

**Siemens Brothers & Co., Ltd.**—The directors have declared a dividend of 4 per cent. (4s. per share) for the year ended December 31st, 1911. The annual meeting was held yesterday in London.



## United Electric Tramways of Montevideo, Ltd.

The directors' report for the year ended March 31st, 1912, gives the following table of results of the operation of the tramways for the year to October 31st, 1911:—

	1910-11.	1909-10.	Increase.
Gross receipts .. ..	\$1,403,200	\$1,315,955	\$87,245
Operating expenses .. ..	791,692	731,394	62,698
Net receipts .. ..	\$608,508	\$583,961	\$24,547
At Exchange of \$4.7 to the £	£129,470	£124,247	£5,223
Passengers carried .. ..	34,662,138	32,474,355	2,187,783
Car-miles run .. ..	6,358,057	6,185,737	172,320
Percentage of operating expenses to gross receipts ..	56.63	55.62	1.01

The results are considered satisfactory when account is taken of the loss of traffic and increase in working expenses arising out of the disturbances in May, 1911. The increase in rates of wages granted by the company came into operation during the second half of the year, and the effect of the permanent addition to the labour charges is not fully shown in the above figures.

The extension of the lines to the suburb of Maldonado was completed during the year, and a further extension of approximately two miles from the existing terminus at Colon is now being constructed. The latter extension completes the lines required by the company's concessions. The enlargement of the hotel at Pocitos was finished by the end of 1911, in time for the summer season, but after the closing of the accounts for the year. The growth of the business has necessitated the provision of larger premises for the administration and office staff, and the company are erecting a new building for this purpose in one of the principal streets in Montevideo. Part of the building will be occupied by the offices of the company, the remainder being let as public offices. The large increase in the volume of traffic has made it essential to provide additional rolling stock, and 25 new cars have recently been ordered for delivery in Montevideo in time for the next summer season. It is anticipated that further expenditure will be required in the near future for the extension of the power plant.

The amount received from La Sociedad Comercial de Montevideo in respect of dividend and interest was £126,544. The profit and loss account for the year, after providing for administration expenses and charging £44,575 for debenture interest, shows a credit balance of £79,178. To this must be added the balance of £13,755 brought forward from last year, making a total to be dealt with of £92,933. There has been set aside for the purpose of the debenture stock redemption fund £2,675, and transferred to renewals and contingency account £25,000. The preference dividend of 6 per cent. per annum and one of 8 per cent. per annum on the ordinary shares, leave £13,467 to be carried forward. The meeting is called for to-day at Winchester House, E.C.

## Woking Electric Supply Co., Ltd.

A GOOD deal of fault-finding was indulged in by shareholders at the annual meeting of this company on Saturday afternoon, arising from the fact that the dividend on the ordinary shares had dropped from 5 per cent. to nil. Mr. John Ashby (chairman) presided.

The directors reported that the revenue for 1911 was £14,475, and the expenditure connected with the generation and distribution and management £7,666, leaving a balance on the year's working of £6,809, plus £499 brought forward and £61 income-tax accumulations, making a total of £7,370. This they proposed to appropriate as follows:—Interest on the 4½ per cent. debentures, £2,176; interest on temporary loans, £853; dividend on the 6 per cent. cumulative shares, £2,361; depreciation and renewals fund, £1,250; reduction of various capital expenses, £166; leaving a balance to be carried to the net revenue account of £562. Progress during the past six years had been as follows:—

	Consumers.	Lamp connected.	Revenue.
1905.. ..	880	33,735	£11,476
1906.. ..	1,003	40,030	12,296
1907.. ..	1,109	45,305	14,130
1908.. ..	1,225	51,070	14,452
1909.. ..	1,348	55,089	15,740
1910.. ..	1,496	62,293	13,785
1911.. ..	1,628	70,710	14,134

During the year the directors had issued £400 4½ per cent. debenture stock, and £2,030 6 per cent. cumulative preference shares, and, owing to the continuous growth of business, they were looking towards issuing further debenture stock, preference and ordinary shares. The capital expenditure to date had been £130,701, and during the past year 6½ miles of cable had been laid. The sale of apparatus for domestic purposes showed a steady advance.

The CHAIRMAN, in moving the adoption of the report, said the increase of £349 in the revenue, as compared with 1910, occurred mainly during the latter part of the year. It was not till then that they really overtook the loss that had been occasioned by the introduction in 1909 of the metal-filament lamp. The suggestion had been made that they should increase the price of current, but the directors decided that this would not be wise. Referring to the continued growth of business, the speaker said the company delivered 13,042 units for the week ending the 6th inst., as against 10,611 for the corresponding week last year. Owing to the railway strike, coal cost £265 more last year than in 1910, and rates and taxes were up £65. They were still experiencing trouble in regard to their coal supply, and the directors had come to the conclusion that it would be to the advantage of the company if they partly replaced coal with oil, and introduced the Diesel engine into their works. They had asked their colleague, Mr. Bowden, to look into the matter, and if his report was satisfactory, they would probably put down an engine of this type, for which £2,000 or £3,000 further capital would be required.

MR. STRATHERN said it seemed very strange that, with an increasing revenue, the company should be unable to pay any dividend this year on its ordinary shares after paying 5 per cent. Was that office and shop a financial success or otherwise? And why were the other premises vacated when the directors knew the metal-filament lamp was going to affect the company adversely? He suggested that there was something wrong with the management, and that the sooner they got the late manager reinstated the better.

MR. BERRY asked if the increase of £349 in the revenue was the result of the 6½ miles extension of cables, because if so it did not seem a very profitable investment.

DR. WYATT-SMITH said that nearly all the neighbouring companies were doing better than they were, and Guildford was paying 5 per cent. That company seemed everlastingly to have been trying for new business when they did not make good business of that at hand. By endeavouring to run the concern without a technical manager they were making themselves a laughing-stock. He was told that their machinery was antiquated, and that they ought to have had a Diesel engine years ago. By opening the shop and competing with local tradesmen, they had made powerful enemies, and, if proper accounts were submitted, he believed they would show a loss. After 15 years' working the company ought to show at least some dividend on its ordinary shares.

MR. SAVAGE asked who was managing the concern now, and what were his qualifications? It seemed to him that if things were to improve, they must have a shrewd and far-seeing manager.

In reply, the CHAIRMAN agreed that it was hard that the ordinary shareholders should get nothing this year, but pointed out that 75 per cent. of the ordinary shares were held by the directors, who, while dissatisfied at getting no dividend now, were fairly satisfied as to the future. Those premises, in the opinion of the board, were quite a success, and had answered all their expectations. They sold a great deal of apparatus which increased their output of current. With regard to management, in the place of their late manager, they now had three superintendents, one at the works, one for the mains, and another for wiring: and, in the opinion of the directors, this arrangement was working very satisfactorily. Moreover, they had on the board the general manager of one of the largest electric light works in London.

MR. SAVAGE: Were these officials with the company while Mr. McLean was manager?—The CHAIRMAN: Yes, but not in their present capacity.

Proceeding, the CHAIRMAN said the existing machinery was of the most up-to-date type, and it took 12 months for new cable to earn money.

MR. STRATHERN wished to move that discount on promptly-paid bills be discontinued.

MR. KILBY: That is virtually raising the price of current.

The CHAIRMAN said the matter was one for the directors. He would sooner reduce the price than raise it.

The report and accounts were then adopted.

## Marconi Wireless Telegraph Co., Ltd.

THE directors, in submitting their report for the year ending December 31st, 1911, deal also with the important developments of the first five months of this year. A circular issued in March stated that satisfactory terms had been settled between the Postmaster-General and the company for the construction of all the long-distance wireless stations required within the next few years for the Imperial wireless scheme. Ten per cent. of the gross receipts of so important a commercial telegraphic service must represent to this company a very considerable revenue for many years to come. All the stations to be erected under this Imperial scheme will be fitted with the latest duplex invention of Mr. Marconi, and also with apparatus for automatic transmission and reception, under which conditions the company guarantees a speed of not less than 50 words per minute, which under favourable conditions should be considerably exceeded. All the long-distance commercial stations which the company will be erecting in the future will be fitted with similar apparatus for automatic transmission and reception.

During 1911 the gross trading profit amounted to £214,407, as compared with £127,453 for 1910, and the net profit was £141,717, as compared with £60,513. But for the fact that the company's business completely outgrew the capacity of its Chelmsford works, delaying the completion until this year of much of the work pertaining to 1911, the figures would have been even more satisfactory. The amount due from the Marconi Wireless Telegraph Co. of Canada, Ltd., was reduced during 1911 from £163,866 to £78,588. This figure is likely to be increased during 1912, as this company will render for the present the financial assistance which is required by the Canadian company for its development. In the balance-sheet "patents and shares in associated companies" are again taken into account at their cost price, with the exception of Spanish shares, which are taken at their par value. The company's shareholdings have been reduced by the sale of 50,000 Canadian shares at 15s. per share, and the redemption by the International company of £40,000 debentures at par, and increased by the addition of Spanish, Russian, and French shares. The company now holds shares in associated companies of a total par value of £2,074,724, many of which are quoted at a premium.

The new 250,000 ordinary shares of £1 each were issued at £1 per share premium, of which £99,072 was paid during 1911, the balance falling due on or before June 1st, 1912, thus increasing the premium account to the end of 1911 to £105,702, which figure in the next balance-sheet will be increased to £256,630. To the extent of three-quarters of the issue these shares were offered to



the shareholders; the remaining 25 per cent. were dealt with at the same price and served to guarantee the issue without cost to the company. The acquisition of the patents of the Lodge-Muirhead Syndicate has further strengthened the company's patent position.

In October last the control of the Russian Company of Wireless Telegraphs and Telephones was acquired, and, it is expected, will commence to pay substantial dividends in the early future.

The Compania Nacional de Telegrafia sin Hilos has completed its first chain of stations.

The company entered into an engagement to obtain a quotation and settlement in the shares of the Compania Nacional de Telegrafia sin Hilos. Owing, however, to the difficulties which arose through the shares of that company being 500 pesetas each, the Spanish and General Wireless Trust, Ltd., was formed, enabling those who so desired to convert their shares in the Spanish company into shares of £1 each in the Trust company, facilitating the fulfilment by the company of its obligations.

The Belgian company has declared a dividend for the year ending December, 1911, amounting to 50 fr. per capital share (10 per cent.), and 24 fr. per founder's share.

The French company has declared a dividend for the past year at the rate of 5 per cent. per annum.

The Marconi International Marine Communication Co., Ltd., is about to declare a dividend at an increased rate for the year ending December 31st, 1911.

The Deutsche Betriebsgesellschaft für Drahtlose Telegraphie m.b.H. (Debeg), in which this company is interested through its Belgian company, has declared its first dividend of 4 per cent. for the year ending September 30th, 1911.

The Marconi Wireless Telegraph Co., of Canada, continues to show satisfactory progress. Negotiations for a further contract with the Government have been pending for some time. The terms have now been practically agreed, and the contract is likely to be executed at an early date.

Circumstances have delayed somewhat the proposed developments of the Argentine company. A representative of this company, however, is now in Buenos Ayres.

Progress of the greatest importance has been made in the United States of America. For some years past the American company was able to transact but a comparatively small business owing to the severe competition to which it was submitted by the United Wireless Telegraph Co. The business methods adopted by that company were such as to render effective competition impossible unless business were to be conducted at a substantial loss. There was, however, no doubt that the United Wireless Co. was infringing the patents of this company, and proceedings at law were therefore commenced. The chairman and managing director proceeded to New York, accompanied by Mr. James Swinburne, F.R.S., to give evidence on behalf of the American company, the case having been fixed by the Judge to be heard on March 25th. Following the prosecution and subsequent conviction of the directors of the United Wireless Telegraph Co., the business was being conducted by trustees under the Court, pending the completion of the arrangements which were in course by a shareholders' re-organisation committee. As a result of negotiations, agreements were eventually entered into by which this company acquired the whole of the tangible assets both in and out of the United States of the United Wireless Telegraph Co. These assets in so far as they related to the United States of America, were re-sold to the Marconi Wireless Telegraph Co. of America. The United Wireless Telegraph Co. acknowledging the validity of the Marconi patents, and admitting the infringement, judgment and a perpetual injunction were granted by the Court. The business is now being directed by the Marconi Wireless Telegraph Co. of America, and for their account as and from March 31st last. Arrangements are in progress for the transfer to this company of the property out of the U.S.A. possessed by the United Wireless Telegraph Co., and judgment by consent in favour of this company will be taken in the actions pending against the United Wireless Telegraph Co. in our High Courts of Justice. The satisfactory ending of this litigation together with the acquisition of the tangible assets of the United Wireless Telegraph Co. is of the greatest importance. It should at once convert the business of the American company into one of considerable magnitude, controlling all the coast stations of importance on both the east and west coasts, besides practically the whole of the American Mercantile Marine at present fitted with wireless telegraphic installations. It may be reasonably anticipated that this business alone should prove sufficiently remunerative to enable the payment of dividends even upon the largely increased capital. A considerable impetus, however, to the ship and shore business in the United States is to be expected from recent events by the extension of the scope of the existing law rendering wireless telegraphy compulsory upon practically all vessels.

During the visit of the chairman and managing director to New York, a further agreement of great significance and importance was entered into with the Western Union Telegraph Co. and the Great North-Western Telegraph Co. This agreement, *inter alia*, furnishes the Marconi Co. with some 25,000 telegraph stations for the delivery and despatch of Marconigrams throughout the United States and Canada. The agreement enables this company in conjunction with the American company immediately to embark upon the erection of the stations which will open up by wireless improved and cheaper telegraph services to all these parts of the world, fulfilling an important section of this company's programme.

The stations to be constructed by the American company necessitate a large expenditure. It was, therefore, resolved to increase the capital of the American company to \$10,000,000, and to split the existing shares of \$25 into shares of \$5 each. By the laws of the State of New Jersey, any increase of capital must in the first instance be offered to shareholders. It was not contemplated that the shareholders would have taken more than a small proportion of the total number, and this company had undertaken to place whatever number of shares there remained unsubscribed. The total \$7,000,000 was, however, subscribed in cash, and is available for the construction of a large number of stations and the development of a very extensive telegraph service.

Arrangements are now in progress, and the work will be carried out as expeditiously as possible, for the construction of stations placing this country in direct communication with New York, instead of, as at present, passing through the company's station at Glace Bay, for the construction of stations at San Francisco communicating through the Hawaiian Islands to the Philippines, China and Japan, and from New York south to Cuba, Panama, and, subsequently, with each of the South American States. Each of these

stations when completed should ensure to the American company, as well as to this company, a very considerable revenue.

An important contract has recently been entered into, provisionally, with the Portuguese Government. The directors hope to be in a position to give fuller information at the general meeting.

The Coltano (Italy) long-distance station was opened in December of last year, and is working most satisfactorily with the Italian Colonies on the East Coast of Africa.

The trans-Atlantic service has continued to work satisfactorily. From May 1st, 1912, all the postal telegraph offices throughout the United Kingdom have been opened for the reception of messages, "via Marconi," to any part of the United States of America and Canada. The company has now the use of a private line from eight at night until eight in the morning, by which it is able to send its messages directly from its office in the Strand to the Clifden station, thus materially curtailing the delays which occur on the landlines. It is hoped that the use of a private line in the day time will be obtained shortly. There has been a considerable increase in the number of commercial messages and in Press work, many thousands of words being dispatched every day from London to the New York Press.

The successful development of the company has brought into prominence a large number of inventions and patents in connection with wireless telegraphy, most of which, if not all, are first offered to this company. A staff of able engineers, under the direction of Mr. Marconi, are employed in examining carefully every patent specification which has any connection with wireless telegraphy, and a practical test is made of every device or system for which patent application is made, or which is submitted to this office.

The company makes a point of keeping itself very well informed in these matters, and is at all times prepared to pay reasonably for anything new and of value which comes to its notice.

It has entered into arrangements by which it obtains the sole rights of the world of the wireless compass invented by Messrs. Bellini & Tosi. This invention will be worked in conjunction with existing wireless telegraphic installations on board ships, and will define the position of an approaching ship or of land in a dense fog, thus eliminating a further danger, and, perhaps, one of the greatest to which navigation is subjected. Active steps are now being taken for the commercial development of this process.

Since the last report further valuable patents tending to further perfect wireless telegraphy have been applied for by Mr. Marconi on behalf of this company.

The report refers to the *Titanic* disaster, which, it says, brings us nearer to the day when ships of every nation will be compelled to carry wireless telegraph apparatus. The report continues: It may not be out of place here to refer to the general fallacy of which one has heard so much in recent times respecting the so-called tapping of wireless messages, and to remind shareholders that, under the Berlin Convention of 1906, it was agreed by all the nations who are adherents to that Convention, that ships at sea must be at attention on a wave-length of 300 m., and that conversations between ships at sea and coast stations shall be carried on by the use of wave-lengths of either 300 or 600 m. The very object of this international law is that in case of distress or otherwise every ship at sea shall be capable of calling or being called by any other ship at sea or any coast station, thus, every ship is necessarily able to overhear any other vessel or station within range. This, however, applies to ship communications only. Mr. Marconi's famous No. 7,777 patent enables stations to tune to any wave-length by simple means, and only stations tuned to the same wave-length can communicate together.

Owing to the continuous and considerable development of the company's business, the Chelmsford factory has been kept at work night and day, but has proved totally incapable of coping with the continued increase of business. The directors have found it therefore incumbent upon them to purchase some 10 acres of freehold land close to the Great Eastern Railway, and erect thereon new works capable of the output which is required of them. The machinery is now in course of being installed, and it is hoped within a few days to be in full occupation.

During last year interim dividends were declared at the end of June and the end of December amounting in all to 7 per cent. on the preference shares and 10 per cent. upon the ordinary shares. The directors recommend the payment of a final dividend of 10 per cent. for the year 1911, to which all classes of shares will be entitled. The directors will continue the policy adopted last year of declaring interim dividends pending the preparation of the balance sheet, and in view of the fact that the actual business in hand at this time last year was represented by orders amounting to £254,000, whereas to-day the amount considerably exceeds £1,000,000, the directors feel that they will be adopting a sufficiently conservative policy in declaring 7 per cent. on the preference shares and a first interim dividend of 10 per cent. on the ordinary shares as against the 5 per cent. of last year, thus leaving preference and ordinary shares to participate equally in all further distributions for the current year.

## STOCKS AND SHARES.

Tuesday Evening.

ONCE more the railway position has dominated a good many of the markets in the Stock Exchange, and the shadow of the transport strike hangs over everything. Writing on Tuesday night, it is difficult to do more than generalise, and to refer to the grave



uneasiness which still exists. The Stock Exchange, however, hopes that the masters will make a firm stand, and see the thing through. Even members known to have Socialistic sympathies have been heard to endorse this view, on the ground that a straight fight to a finish is better than a constant series of out-breaks to which there seems to be no finality. In the meantime, however, uncertainty makes for decreased business and sagging prices. The wonder is that quotations have not given way much more in the circumstances.

The Home Railway market is reasonably firm, considering all things. A smart drop in Brighton Deferred was partially recovered, and it is understood that underwriters of the new issue—the money being required mainly for the purpose of further electrification—were relieved of their responsibilities. Districts suffered a sharp setback, the price falling a couple of points regaining  $\frac{1}{2}$  later. Underground Electric Railways fell  $\frac{1}{4}$ , and the income bonds 1, while Metropolitans went back 1 $\frac{1}{2}$ , although the Surplus Lands stock gained a point. Central London issues lost part of their previous week's recovery: City and South London added 1 to its earlier 4-point rise. There has been further demand for London United Tramways Preference, and the price gained  $\frac{1}{2}$ . On the other hand, British Electric Traction are dull, falls of 1 being recorded in the Deferred stock and in the 7 per cent. Preferred. East Londons from 8 $\frac{3}{4}$  fell back to 8, from which there was a slight rally.

The shrinkages that have occurred in most of the speculative departments during the past few weeks are making their influence felt in some of the investment markets as well, the invariable result of over-speculation being that holders of sound securities have to realise some of them in order to meet their differences. For this cause, there is a certain amount of weakening in a few of the English Electricity Supply shares, although the effect on prices is comparatively small. Falls of £2 in City of London Ordinary and of £1 in the Preference are the result of sales by tired bulls, who bought the shares originally in the hope of much higher prices being reached. Incidentally, exception may be taken to the practice of sending out these two quotations with a margin of £2 between buying and selling prices, inasmuch as there is almost always a margin of no more than 10s.—at all events, in the case of the Ordinary. This, however, by the way. Amongst the other shares, London Electrics are down to 30s. middle, which makes it look as though our surmise of a possible overhanging block of shares may be near the mark. Westminster eased off to the extent of  $\frac{1}{4}$ , but Counties are very steady. In such times of unsettlement as these, it is impossible to expect any market to go ahead with any degree of assurance.

The demand for Anglo-Argentine Tramways, which has recently raised the prices of the first Preference and the Debenture stocks, is now being turned to the company's second Preference, a further rise of  $\frac{1}{16}$  being scored this week. The 4 per cent. Debenture rose 1, but the 5 per cent. lost an equal amount. The Mexican group is unusually quiet, prices showing very little change. Rio Trams went back 1 $\frac{1}{2}$  on sales by some of the speculators with big profits to take, but further buyers came along, and put up the price 2 points. Sao Paulo Trams, after their huge rise, receded 2. Mexico Trams fell 1, but the Mexican Light and Power issues are firm, and Monterey Debenture hardened a little. As a reflex to the insurrection difficulties in Mexico, Cuba has also developed a revolution, and although the matter seems to be very much a storm in a tea-cup so far, the stocks and shares of companies operating in Cuba are mostly weak, which has its effect upon other things as well. British Columbia Electric Preferred went back 2 after its rise of last week. Madras Tramways Debenture is 1 to the good. An important scheme is on foot in regard to certain of the tramway companies in the Argentine Republic, but to mention details at present would be premature.

Telegraph descriptions are little moved by the considerations which have made other markets weak. Eastern Ordinary went back a point, but Anglo-Americans are good. American Telephone, and Telegraph put on  $\frac{1}{2}$ , and Anglo-American Telegraph Preferred gained the same amount. To give an idea of the tenderness of investment shares, it may be mentioned that Western Telegraphs fell  $\frac{1}{2}$  on the sale of no more than 30 shares. West Coast of American Debentures are firmer, but West India and Panama Ordinary receded a little.

Marconis are jumping about in their usual volatile style. The report which came out this week has been received with mixed feelings, possibly because the figures are so vast that it is difficult to gain a fair view of them. At first the price went down, and on the week the loss amounts to 17s. 6d., both as regards the Ordinary and Preference. So far as the former are concerned, the present price of 5 $\frac{1}{2}$  appears to be full value, as things stand now, and the 7 per cent. Participating Preference at 5 middle look much the better bargain of the two. Canadian Marconis went back to 23s. 6d. and Americans to 1 $\frac{1}{2}$ , the special settlement in the last-named having been officially fixed for the 20th inst.

The opening of the arbitration between the National Telephone Company and the Government resulted in a loss of 2 $\frac{1}{2}$  in the price of the company's Deferred stock. The claim of £20,000,000 is regarded by some people as a good round sum, pretty to talk about, but not at all likely to be realised. The company's Third Preference shares, however, are  $\frac{1}{16}$  higher.

Manufacturing issues are mainly quiet. British Thomson-Houston Debenture has risen 3 points, while British Westinghouse descriptions are easier. The substantial rise in the price of copper has had no influence upon industrial shares; and the Rubber share market is dull, without there being much pressure to sell.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	Inc.
Aberdeen ..	June 8	3,186	— 19	..	..	..	14.4 ..
Ayr ..	" 8	621	— 16	3	1,048	— 87	8 ..
Bath ..	May 29	2,112	+ 1,189	22	18,085	+ 1,692	14.75 ..
Birkenhead ..	June 9	2,531	— 52	10	11,201	— 587	13.68 ..
Birmingham Corp.	" 1	22,871	+ 8,476	9	94,793	+ 28,198	57.17 ..
Blackburn ..	" 5	2,764	— 95	10	12,395	— 98	14.62 ..
Blackpool Corp.	" 6	5,523	+ 1,932	..	14,117	+ 2,248	11.87 ..
Blackpool-Fleetw'd	" 8	2,768	— 615	22	10,311	+ 535	8 ..
Bournemouth ..	" 5	4,117	+ 174	9 $\frac{3}{4}$	17,502	+ 762	21.95 ..
Bradford ..	" 1	12,824	+ 1,588	9	51,377	+ 1,014	56 1.2
Brighton ..	" 9	2,155	— 250	10	9,913	— 531	9.5 ..
Bristol ..	" 7	16,799	+ 1,018	..	149,273	+ 12,894	30.5 ..
Brit. Elec. Trac. Co.							
Airdrie ..	May 31	619	+ 150	22	6,225	+ 1,556	3.65 ..
Barnsley ..	" 31	414	+ 32	"	8,571	— 298	.. ..
Barrow ..	" 31	978	+ 894	"	7,520	+ 2,058	5.87 ..
Devonport ..	" 31	1,215	+ 184	"	11,509	+ 1,770	8.85 ..
Gateshead ..	" 31	2,215	+ 96	"	21,797	— 51	11.25 ..
Gravesend ..	" 31	508	+ 70	"	4,442	+ 295	6.5 ..
Greenock ..	" 31	1,784	+ 95	"	16,600	+ 2,194	7.25 ..
Hartlepool ..	" 31	672	+ 104	"	5,432	+ 458	6.72 ..
Kidderminster ..	" 31	428	+ 203	"	2,313	+ 286	.. ..
Leamington ..	" 31	499	+ 167	"	3,429	+ 351	.. ..
Merthyr ..	" 31	487	+ 72	"	3,978	— 280	2.9 ..
Metropolitan ..	" 31	20,815	+ 1,939	"	183,492	+ 11,157	22 ..
Middleton ..	" 31	815	+ 44	"	6,833	+ 88	8.5 ..
Mid. Joint Com'tee	" 31	8,510	+ 2,860	"	68,732	+ 5,454	.. ..
Oldham—Ashton	" 31	1,433	+ 241	"	12,920	+ 1,025	9.13 ..
Peterborough ..	" 31	316	+ 67	"	2,622	+ 1,025	5.31 ..
Potteries ..	" 31	4,202	+ 274	"	39,358	— 2,157	29 ..
Rothsay ..	" 31	406	+ 17	"	3,025	+ 111	2.75 ..
Southport ..	" 31	867	+ 157	"	5,885	+ 235	8.17 ..
S. Metropolitan ..	" 31	2,482	+ 195	"	17,711	+ 875	.. ..
Swansea ..	" 31	2,762	+ 477	"	23,976	+ 682	12.5 ..
Tynemouth ..	" 31	760	+ 260	"	4,035	+ 263	3.75 ..
Weston-s-Mare ..	" 31	493	+ 218	"	1,370	+ 185	3 ..
Worcester ..	" 31	735	+ 123	"	5,785	+ 151	5.75 ..
Wrexham ..	" 31	258	+ 47	"	2,327	+ 274	.. ..
Yorks. Wool. Dist.	" 31	2,575	+ 359	"	23,022	+ 956	17 ..
Miscellaneous ..	" 31	572	+ 82	"	3,710	+ 220	.. ..
Burnley ..	June 8	3,063	+ 49	..	..	..	11.73 ..
Burton-on-Trent ..	" 9	598	— 35	10	2,540	— 20	9.7 ..
Bury ..	" 9	2,763	— 117	10	13,470	+ 5	22.5 ..
Cardiff ..	May 25	2,379	— 2	8	16,646	+ 2,424	17.35 ..
Chatham and Dist.	June 6	1,933	— 205	23	18,481	+ 85	14.98 ..
Cork ..	" 6	1,098	— 162	23	10,594	+ 202	9.89 ..
Croydon ..	May 31	4,208	+ 492	..	14,475	+ 533	11.6 75
Darlington ..	June 8	477	+ 6	10	2,161	+ 33	4.87 ..
Darwen ..	" 7	602	+ 8	10	2,809	+ 52	4.36 ..
Dover ..	" 1	535	+ 43	9	2,084	— 27	4.75 ..
Dublin ..	" 7	11,941	— 1,765	..	128,180	+ 5,724	54.25 ..
East Ham ..	" 8	2,187	— 236	10	10,668	— 4	7.87 ..
Exeter ..	" 7	774	— 44	10	3,210	— 216	5.5 ..
Glasgow ..	" 8	38,776	— 3,010	1	22,926	— 1,073	98 25
Hastings ..	" 6	2,210	— 341	..	..	..	19.3 ..
Huddersfield ..	" 8	4,552	— 40	10	19,899	— 126	29.5 1
Hull ..	" 8	5,891	+ 74	10	23,227	— 594	13.5 1
Ilkeston ..	" 6	248	— 62	10	828	— 532	.. ..
Ipswich ..	May 25	439	+ 15	8	3,318	+ 122	10.5 ..
Kilmarnock ..	June 1	316	— 9	2	431	— 14	4.25 ..
Lancashire United	" 5	3,227	+ 142	23	29,005	+ 254	89 ..
Leeds ..	" 8	17,091	— 41	10	77,175	+ 1,748	112.7 ..
Leicester ..	" 8	5,751	— 59	..	..	..	20 ..
Leith ..	" 8	1,325	— 83	3 $\frac{3}{4}$	2,333	— 50	8.72 ..
Liverpool ..	" 1	25,461	+ 1,387	21 $\frac{1}{2}$	256,373	+ 12,468	116 ..
L.C.C. ..	May 29	91,560	+ 1,447	..	373,117	+ 172	140.5 1.5
London United ..	June 8	16,480	— 1,744	23	140,158	+ 1,474	.. ..
Lowestoft ..	" 8	153	— 103	36	5,556	— 227	8.5 ..
Manchester ..	" 8	36,261	+ 395	10	168,646	+ 6,952	105 ..
Newcastle ..	" 8	8,467	— 330	..	41,853	— 761	31.3 ..
Newport ..	" 1	876	+ 122	9	6,041	— 523	7.25 ..
Oldham ..	" 9	4,077	— 90	11	22,601	+ 230	23 ..
Pontypridd ..	" 8	723	— 226	10	4,418	+ 947	5.5 ..
Portsmouth ..	" 1	4,876	+ 484	9	19,223	+ 601	15.75 ..
Preston ..	" 5	1,844	— 61	10	8,101	+ 123	10 ..
Rotherham ..	" 5	1,561	+ 62	9 $\frac{3}{4}$	6,500	— 14	12 ..
Salford ..	" 10	11,013	— 522	10	52,276	+ 1,249	41 ..
Sheffield ..	" 11	14,120	+ 185	..	70,487	+ 261	40 ..
Southampton ..	" 5	2,774	— 34	9	11,706	+ 650	11 ..
Southend-on-Sea ..	" 5	1,847	— 774	10	6,919	+ 960	7 ..
South Shields ..	" 1	1,386	+ 119	9	5,364	+ 85	10.25 ..
Tyneside ..	" 5	1,118	— 167	23	10,371	+ 846	11 ..
Wallasey ..	" 8	2,567	— 112	9 $\frac{3}{4}$	10,983	— 474	8.72 ..
Walthamstow ..	" 8	1,341	— 192	10	7,950	— 16	9 ..
West Ham ..	May 30	6,003	+ 453	8 $\frac{1}{2}$	23,942	+ 777	16.45 1
Wolverhampton ..	June 5	2,615	— 30	10	9,748	+ 35	13.75 1
Gen. London Rly...							
City & S. Lon. Rly.	" 8	8,797	— 1,025	23	106,805	— 12,385	6.32 ..
Dublin-Lucan Rly.	" 9	5,984	— 189	23	72,678	— 4,686	7.26 ..
G.N. and City Rly.	" 7	400	+ 11	23	2,969	+ 78	7 ..
L'pool Overh'd Rly.	" 8	3,162	+ 301	23	37,760	+ 2,365	3.5 ..
Llandudno-Col. Bay	" 9	3,486	+ 232	..	35,129	+ 2,280	6.6 ..
Lond. Elec. Ry. Co.	" 7	1,001	+ 187	27 $\frac{3}{4}$	5,126	+ 351	6.5 ..
Mersey Railway ..	" 8	27,450	+ 865	23	325,260	+ 4,490	21.25 ..
Metropolitan Rly...	" 8	4,484	+ 198	23	47,686	+ 204	4.5 ..
Met. District Rly...	" 9	36,191	+ 262	23	381,687	— 9,715	25.75 ..
Anglo-Argentine ..	" 8	26,357	+ 2,471	23	288,945	+ 13,170	26 ..
Auckland ..	" 3	101,955	+ 2,791	..	1,133,553	+ 42,559	.. ..
Bombay (B.E.T.) ..	April 5	17,472	+ 1,098	..	172,044	+ 13,495	23.8 ..
Brisbane ..	May 10	6,315	+ 239	19	57,740	+ 8,536	.. ..
Brit. Columbia Rly.	" ..	..	..	..	..	..	.. ..
Calcutta ..	June 8	7,578	+ 154	..	..	+ 8,403	.. ..
Cape Electric T.Ld.	" ..	..	..	..	..	..	.. ..
Kalgoorlie, W.A. ...	May ..	8,270	..	5	15,303	..	20.5 ..
Lisbon ..	" ..	..	..	..	..	..	.. ..
Madras ..	May 31	1,738	+ 387	..	16,653	+ 1,931	13.5 75
Montevideo ..	May ..	26,669	+ 10,352	7	212,030	+ 29,536	.. ..
Perth (W.A.) ..	June 7	3,618	+ 462	..	43,290	+ 6,132	29 ..

\* Compared with the corresponding period of 1911.

† One week only.

‡ Includes horse, steam and other receipts.

§ One month.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividend for	Closing Quotations June 11th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividend for	Closing Quotations June 11th.	Rise or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9½-10½	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 9	7½-7½	..	5 16 2
Do. 4½ % Pref. ...	10	4½ 4½	8½-9½	..	4 12 2	Do. 4 % Deb. ...	Stock	4 4	92-95	..	4 4 3
Do. Second 6 % Pref. ...	10	6 6	10½-11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ...	Stock	4½ 4½	80-84	..	5 7 2
Do. 4½ % Deb. Stock ...	Stock	4½ 4½	100-102	..	4 8 3	London Electric, Ord. ...	8	2 2½	1½-1½	..	4 5 6
Brompton & Kensington, Ord. ...	5	10 10½	8½-8½	..	5 14 3	Do. 6 % Pref. ...	5	6 6	4½-5½	..	5 14 8
Do. 7 % Cum. Pref. ...	5	7 7	7½-8½	..	4 6 2	Do. 4 % First Mort. Deb. ...	Stock	4 4	92-95	..	4 4 3
Central Electric Supply, 4 %	100	4 4	97-100 xd	..	4 0 0	Metropolitan ...	5	5 4	8½-4½	..	6 1 3
Guar. Deb. ...						Do. 4½ % Cum. Pref. ...	5	4½ 4½	4½-4½	..	4 14 9
Charing Cross, West End & City	5	5 5	4½-5	..	5 0 0	Do. 4½ % First Mort. Deb. ...	Stock	4½ 4½	101-104	..	4 6 7
Do. 4½ % Cum. Pref. ...	5	4½ 4½	4½-4½	..	4 14 9	Do. 8½ % Mort. Deb. ...	Stock	8½ 8½	85-88	..	3 19 7
Do. "City Undertaking"	5	4½ 4½	8½-4½	..	5 2 10	Midland Electric Corporation	100	4½ 4½	96-98	..	4 11 10
Do. 4½ % Cum. Pref. ...	100	4 4	95-98	..	4 1 8	4½ % First Mort. Deb. }					
Chelsea, Ord. ...	5	5 5	4½-4½	..	5 2 7	Newcastle-on-Tyne 5 % Pref. }	5	5 5	4½-5	..	5 0 0
Do. 4½ % Deb. ...	Stock	4½ 4½	99-102	+1	4 8 3	Non-Cum. }					
City of London, Ord. ...	10	7 8	18-20	-2	4 0 0	North Metropolitan Power Sup-	100	5 5	97-100	..	5 0 0
Do. 6 % Cum. Pref. ...	10	6 6	15-17	-1	3 10 7	ply, 5 % Mortgages (Red.) }					
Do. 5 % Deb. ...	Stock	5 5	119-123	..	4 1 4	Notting Hill, 6 % Non-Cum. }	10	.. 6	10½-11½	..	5 6 8
Do. 4½ % Second Deb. ...	100	4½ 4½	101-104	..	4 6 7	Oxford ...	5	7½ 7½	5½-6½	..	5 13 9
County of London, Ord. ...	10	5 6	10½-11½	..	5 7 0	St. James' and Pall Mall, Ord.	5	10 10	8-8½	..	5 14 3
Do. 6 % Pref. ...	10	6 6	11½-11½	..	5 1 1	Do. 7 % Pref. ...	5	7 7	6½-7½	..	4 15 0
Do. 4½ % Deb. ...	Stock	4½ 4½	108-110	..	4 1 10	Do. 8½ % Deb. ...	100	3½ 3½	85-87	..	4 0 6
Do. 4½ % Second Deb. ...	Stock	4½ 4½	100-103	..	4 8 3	Smithfield Markets, Ord. ...	5	Nil 2	1½-1½	..	..
Edmundson's, Ord. ...	5	Nil Nil	3-3½	..	Nil	South London, Ord. ...	4	5 5	2½-3½	..	6 3 0
Do. 6 % Cum. Pref. ...	5	Nil Nil	3-3½	..	Nil	Do. 5 % First Mort. Deb. ...	100	5 5	99-102	..	4 15 0
Do. 4½ % First Mort. Deb. ...	100	4½ 4½	86-89	..	5 1 2	South Metropolitan, 7 % Pref. ...	1	7 7	1½-1½	..	6 1 0
Folkestone ...	5	6 6	4½-4½	..	6 3 1	Do. 4½ % First Deb. Stock ...	100	4½ 4½	96-99	..	4 11 0
Do. 5 % Cum. Pref. ...	5	6 6	4½-4½	..	5 5 3	Urban, Ord. ...	5	..	2-2½	..	..
Do. 4½ % First Deb. ...	100	4½ 4½	93-96	..	4 13 9	Do. 5 % Cum. Pref. ...	5	5 2	2½-3 xd	..	3 6 8
Hove ...	5	9 9	6½-7½	..	6 4 2	Do. 4½ % First Mort. Deb. ...	100	4½ 4½	86-88	..	5 2 3
						Westminster, Ord. ...	5	10 10	8½-8½	..	5 14 3
						Do. 4½ % Cum. Pref. ...	5	4½ 4½	5½-6½	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ...	5	6 6	5½-5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	88½-90½	+½	5 10 6
Calcutta, Ord. ...	5	8½ 8½	7½-7½	..	5 9 8	5 % 1st Mort. Deb. }					
Do. 5 % Pref. ...	5	5 5	5-5½	..	4 15 3	Montreal, Lt., H. and Power ...	\$100	7 8	211-215	..	3 14 5
Calgary Power, 1st Mort. Bds. ...	100	5 5	97-99	+½	5 1 0	Northern, Lt., Power and Coal, }	\$500	5 5	39-42	..	11 18 2
Canadian Gen. El. Com. ...	\$100	7 7½	112-116	..	6 0 8	5 % 1st Mort. Bonds }					
Do. 7 % Pref. ...	\$100	7 7	118-122	..	5 14 9	River Plate, Ord. ...	Stock	10 10	240-250	..	4 0 0
Cordoba Lt., Power and T., Ord.	1	3 3½	1½-1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ...	Do.	6 6	103-114	..	5 5 3
Do. 5 % Deb. ...	100	5 ..	94-97	..	5 3 1	Do. 5 % Deb. Stock ...	Do.	5 5	103-105	..	4 15 3
Elec. Lt. and P. of Cochabamba, }	100	6 6	95½-97½	..	6 3 1	Roy. Elec. Co., Montreal, 4½ % }	100	4½ 4½	99-101	..	4 9 1
6 % Bonds }						1st Mort. Deb. }					
Elec. Supply Victoria, 5 % 1st }	100	5 5	83-86	..	5 16 3	Shawinigan Water, Capital ...	\$100	4 5½	139-143	-1	3 10 0
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds ...	\$500	5 5	111½-113½	..	4 8 1
Elec. Dev. Ontario, 5 % 1st }	\$500	5 5	91½-96½	-½	5 3 8	Do. 4½ % Per. Deb. ...	Stock	4½ 4½	103-105	..	4 5 9
Mort. Bonds }						Toronto Power, 4½ % Deb. ...	Do.	4½ 4½	100½-102½	..	4 7 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	7-7½	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5 5	92½-94½	..	5 5 10
Do. 6 % Pref. ...	1	6 6	2½-2½	..	8 6 0	1st Mort. Deb. }					
Kaministiquia Power, 5 % G. Bs. ...	\$500	5 5	106-108	..	4 12 7	Victoria Falls Power, Pref. ...	1	Nil 11½d.	8½-8½	..	..
Madras, Ord. ...	5	..	2½-2½	..	..	West Kootenay Power and Lt., }	100	6 6	105½-107½	..	5 11 7
Melbourne, 5 % 1st Mort. Deb. ...	100	5 5	104-107	..	4 13 6	1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds. ...	..	5 5	90½-92½	..	5 8 1						
Mexican Lt. & Power, Common ...	\$100	4 4	91-93	..	4 6 0						
Do. 7 % Cum. Pref. ...	\$100	7 7	105-107	..	6 10 10						
Do. 5 % 1st Mort. Gold Bds. ...	..	5 5	96½-98½	+½	5 1 6						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ...	10	Nil	4½ 7½-7½	..	..	Monte Video Telephone, Ord. ...	1	6 6	1-1½	..	5 6 3
Do. 5 % Deb. Red. ...	Stock	5 5	97½-99½	..	5 0 6	Do. 5 % Pref. ...	1	5 5	1-1½	..	5 14 3
American Telep. & Teleg., Cap. ...	\$100	8 8½	148½-150½	..	5 6 4	National Telephone, Pref. ...	Stock	6 6	100-103	..	..
Do. Collat. Trust ...	\$1000	4 4	95½-97½	..	4 2 1	Do. Def. ...	Do.	6 6	149-151	-2½	..
Anglo-American Telegraph ...	Stock	3½ 8	65-67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ...	5	5 5	6½-6½	..	..
Do. 6 % Pref. ...	Do.	6 6	109-110	+½	5 9 1	New York Telep., 4½ % Gen. Bnds. ...	100	4½ 4½	99-100	..	4 10 0
Do. Def. ...	Do.	80/- 80/-	25½-26	..	5 15 5	Oriental Telep. and Elec. ...	1	8 8	14½-14½	..	4 13 0
Anglo-Portuguese Tel., 5 % }	100	5 5	102-104	..	4 16 2	Do. 6 % Cum. Pref. ...	1	6 6	1½-1½	..	4 16 0
Mort. Deb. }						Do. 4 % Red. Deb. ...	Stock	4 4	89-91	..	4 8 0
Chili Telephone ...	5	7 ..	7½-8	..	4 10 4	Pacific and European Tel., 4 % }	Do.	4 4	99½-101½	..	3 18 10
Commercial Cable, Stlg. 4 % Deb. }	Stock	4 4	82-85	-½	4 14 2	Guar. Debs. }					
Cuba Telegraph ...	10	6 6½	9½-10½	..	5 14 3	Reuter's ...	8	5 5½	11-11½	..	3 9 7
Do. 10 % Pref. ...	10	10 10	16½-17½	..	5 14 3	Submarine Cables Trust ...	Cert.	6 6	127-130	..	4 13 4
Direct Spanish Telegraph, Ord. ...	5	4 4½	8½-8½	..	5 6 8	Telephone Co. of Egypt, 4½ % }	Stock	4½ 4½	99-101	..	4 9 1
Do. 10 % Cum. Pref. ...	5	10 10	7-7½	..	6 9 0	Deb. Red. }					
Direct United States Cable ...	10	4½ 5	7½-8	..	6 5 0	United River Plate Telephone ...	5	8 8	7½-7½	+½	5 0 10
Direct W. India Cable, 4½ % }	100	4½ 4½	99-101	..	4 9 1	Do. 5 % Cum. Pref. ...	5	5 5	5½-5½	..	4 8 11
Reg. Deb. }						West Coast of America ...	2½	2½ 2½	1½-1½	..	4 0 0
Eastern Telegraph, Ord. Stock	Stock	7 5½	130-133 ex. all	-1	5 5 3	Do. 4 % Debs., 1 to 1,500 }	100	4 4	95-98	+½	4 1 8
Do. 8½ % Pref. Stock ...	Do.	3½ 3½	78½-80½ xd	+½	4 7 0	guar. by Braz. Sub. Tel. }					
Do. 4 % Mort. Deb. ...	Do.	4 4	99½-101½	..	3 18 10	West India and Panama Telep. ...	10	1½ 1½	2½-3½ xd	-½	1 13 4
Eastern Extension ...	10	7 5½	12½-13½	..	5 5 8	Do. 6 % Cum. 1st Pref. ...	10	6 6	10½-10½ xd	..	5 18 0
Do. 4 % Deb. ...	Stock	4 4	99-101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ...	10	6 6	9½-10½ xd	+½	5 17 1
East and S. Africa Tel. 4 % }	25	4 4	97-100	..	4 0 0	Do. 5 % Debs. ...	100	5 5	102½-104½	..	4 15 8
Mt. Db. Mauritius Sub. }						Western Telegraph, Ltd. ...	10	7 6½	13½-13½	-½	5 2 9
Globe Telegraph and Trust ...	10	5½ 6	11-11½	..	5 4 4	Do. 4 % Deb. ...	Stock	4 4	98-100	..	4 0 0
Do. 6 % Pref. ...	10	6 6	13-13½	..	4 9 0	Western Union 4½ % Fdg. Bonds	\$1000	4½ 4½	100-103	..	4 7 5
Great Northern Telegraph ...	10	18 18	29½-30½	..	5 18 10						
Indo-European Telegraph ...	25	18 5½	56-58	..	5 12 1						
Mackay Companies Common ...	\$100	5 5½	82-85	..	5 17 8						
Do. 4 % Cum. Pref. ...	\$100	4 4	70-73	..	5 9 7						
Marconi's Wireless Telegraph ...	1	5 20	51½-51½	-½	3 8 10						
Do. 7 % Cum. Partio. Pref. ...	1	16 17	4½-5½	-½	3 6 5						

\* Unless otherwise stated, all shares are fully paid.

† Interim dividend.



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 11th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 11th.	Rise + or Fall	Present Yield p.c.
	*	1910. 1911.			£ s. d.		*	1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil Nil	72—114	..	Nil	Metropolitan Railway Consol. ..	100	13 17	64—65	-13	2 17 9
Do. 5 % Pref. ..	1	5 5	74—85	..	6 3 1	Do. Surplus Lands ..	100	2 2	67—69	+1	4 3 4
Do. 4½ % Deb. ..	100	4½ 4½	78—83	..	5 8 5	Do. 8½ % Deb. ..	100	8½ 8½	89—91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	.. ..	104—124	..	..	Do. 8½ % Pref. ..	100	8½ 8½	86—88	..	3 19 7
Do. Do. Deferred ..	100	.. ..	54—75	-1	..	Do. 8½ % Con. Pref. ..	100	8½ 8½	87—89	..	3 18 8
Do. Do. 6 % Cum. Pr'f. ..	100	.. 6	93—95	+1	6 6 4	Metropolitan District Ord. ..	100	Nil ..	42—43	-1½	Nil
Do. 7 % Non-Cum. Pr'f. ..	100	.. ..	43—47	-1	..	Do. 6 % Deb. ..	100	6 6	144—146	..	4 2 2
Do. 5 % Perp. Deb. ..	100	5 5	98—97	..	5 3 1	Do. 4 % Deb. ..	100	4 4	96—98	..	4 1 8
Do. 4½ % 2nd Deb. ..	100	4½ 4½	79—83	..	5 8 5	Do. 4 % Prior Lien ..	100	4 4	99—101	..	3 19 3
Central London Railway, Ord.	100	8 8	79—81	-1	3 14 1	Do. 4½ % First Pref. ..	100	8½ 4½	90—92	..	4 17 10
Do. Pref. ..	100	4 4	84—86	..	4 13 0	Do. 3½ % Gtd. ..	100	3½ 3½	76—78	..	4 9 9
Do. Def. ..	100	2 2	78—80	-2	2 10 9	Metropolitan Elec. Trams, Ord.	1	5½ 0	—1	..	6 0 0
Do. 4 % Deb. ..	100	4 4	101—103	..	3 17 8	Do. Def. ..	1	Nil ..	—	..	Nil
City & South London, Ord.	100	1½ 1½	38—39	-1	4 3 4	Do. 5 % Pref. ..	1	5 5	—	..	5 10 6
Do. 5 % Pref., 1891 ..	100	5 5	108—110	..	4 11 0	Do. 4½ % Deb. ..	100	4½ 4½	—100	..	4 10 0
Do. Do. 1896 ..	100	5 5	104—106	..	4 15 3	Do. 5 % Deb. ..	100	5 5	—100	..	5 0 0
Do. Do. 1901 ..	100	5 5	104—106	..	4 14 4	Potteries, Ord. ..	1	2 ..	—	..	..
Do. Do. 1903 ..	100	5 5	108—105	..	4 15 3	Do. 5 % Pref. ..	1	5 5	—	..	6 13 4
Do. 4 % Deb. ..	100	4 4	99—101	..	3 19 3	Do. 4½ % Deb. ..	100	4½ 4½	67—90	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6 6	103—11½	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6 ..	—	..	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil ..	—	..	Nil	Do. 4 % Deb. ..	100	4 4	72—77	..	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil 6	—	..	8 0 0	Underground Elec. Railways	10	.. ..	35—4½	-¼	Nil
Do. 4½ % Deb. ..	100	4½ 4½	71—76	..	5 18 5	Do. 4½ % Bonds ..	100	4½ 4½	99—101	..	4 9 1
Isle of Thanet Trams, 5 % Pref.	5	2½ 2½	21—2½	..	4 11 0	Do. 6 % Income ..	100	1 1½	89—90	-2	..
Do. 4 % Deb. ..	100	4 4	75—80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil ..	—	..	Nil
Lancashire United, 5 % Deb. ..	100	5 5	83—85	..	5 17 8	Do. 6 % Pref. ..	5	1 1	24—34	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4 4	97—99	..	4 0 10	Do. 4½ % Deb. ..	100	4½ 4½	80—84	..	5 7 2
London United Trams, 5 % Pref.	10	Nil ..	54—54	..	..						
Do. 4 % Deb. ..	100	4 4	77—80	..	5 0 0						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5½—5½	..	4 18 10	La Plata Elec. Trms, Ord.	1	..	..	—	..	..
Do. 2nd Pref. ..	5	5	5½	5½—5½	+1	5 3 6	Do. Pref. ..	1	6	6	—	..	6 0 0
Do. 4 % Deb. ..	100	4	4	96½—98	+1	4 1 8	Lisbon Elec. Trams, Ord.	1	5½	6	1—1½	..	4 8 0
Do. 4½ % Deb. ..	100	4½	4½	101½—103½	..	4 7 0	Do. 6 % Pref. ..	1	6	6	1—1½	..	4 16 0
Do. 5 % Deb. ..	100	5	5	101—103xd	—1	4 17 1	Do. 5 % Deb. ..	100	5	5	95—99	..	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	104—106	..	4 14 4	Madras Elec. Tr. (1904), Deb.	100	5	5	101—103	+1	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11½—11½	..	5 3 3	Manaos Trams & Lt., 1st Deb.	100	5	5	92—95	—1	5 5 3
Do. 4½ % Deb. ..	100	4½	4½	98—100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	102½—104½	..	4 15 8
Do. 5 % 2nd Deb. ..	100	5	5	99—101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	122—124	—1	5 13 0
Brisbane Trams Invt., Ord.	5	8	8	63—7½	—	..	Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19 6
Do. 5 % Pref. ..	5	5	5	48—5½xd	..	4 15 3	Do. 6 % Bonds ..	100	6	6	103½—105½	..	5 13 9
Do. 4½ % Deb. ..	100	4½	4½	100—103	..	4 7 5	Para Elec. Rlys. & Lt., Ord.	5	10	10	7—7½	..	6 15 7
B. Columbia Elec. Rly., Def.	100	8	8½	140—144	..	5 11 1	Do. 6 % Pref. ..	5	6	6	5—5½	..	7 0 4
Do. Pref. Ord. ..	100	6	6	124—127	—2	4 14 6	Do. 5 % 1st Deb. ..	100	5	5	100—102	..	4 18 0
Do. 5 % Pref. ..	100	5	5	111—114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1½—1½	..	1 18 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½—101½	..	4 8 8	Do. 5 % 1st Deb. ..	100	5	5	101—104	..	4 16 2
Do. 4½ % Vancouver Deb.	100	4½	4½	103—105	..	4 5 9	Rangoon El. Tr. & Sup., Pref.	5	6	6	58—58	..	5 6 8
Do. 4½ % Con. Deb. ..	100	4½	4½	104—106	..	4 5 0	Do. 4½ % 1st Deb. ..	100	4½	4½	99—101	..	4 9 1
Calcutta Trams, Ord.	5	6	7	62—68	..	5 5 8	Rio de Janeiro Trams ..	\$100	4½	5½	141—143	+½	3 10 0
Do. 5 % Pref. ..	5	5	5	41½—5½	..	4 16 5	Do. 1st Mort. 5 % Bonds	..	5	5	105½—107½	—½	4 13 0
Do. 4½ % Deb. ..	100	4½	4½	100—103	..	4 7 5	Do. 5 % Mort. Bonds	100	5	5	99—100	..	5 0 0
Cape Electric Trams ..	1	Nil	2½	—	..	..	Sao Paulo Tram, Lt. and P.	\$100	10	10½	248—253	—2	3 19 0
City Buenos Aires Trams (1904)	5	5	5	5½—5½	..	4 10 6	Do. 5 % 1st Deb. ..	\$500	5	5	105½—107½	—½	4 13 0
Do. 4 % Deb. ..	100	5	5	101—103	..	4 17 3	Singapore Trams, 5 % Deb.	100	5	5	79—82	..	5 19 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94—98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	96—98	+1	5 2 0
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101—104	..	4 16 2	Un. Elec. Trams Monte Video	5	6	7	5½—6	..	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil	..	—	..	Nil	Do. 6 % Pref. ..	5	6	6	5—5½	..	5 14 9
Do. 5 % A Deb. ..	100	5	5	91—94	..	5 6 5	Do. 5 % 1st Deb. ..	100	5	5	100—103	..	4 17 1
Do. 6 % B Deb. ..	100	5	6½	56—60	..	10 0 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½—106½	..	4 4 6

## MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	Nil	6	11—11	..	7 7 8	Dick, Kerr .. . . .	1	5	..	87—8½	..	5 3 1
Do. 6 % Pref. . . . .	1	9	6	—	..	7 2 2	Do. Pref. . . . .	1	6	6	—	..	5 12 11
Babcock & Wilcox . . . . .	1	26	28	3½—3½xd	..	..	Do. Deb... . . . .	100	4½	4½	97—100	..	4 10 0
Do. Pref. . . . .	1	6	6	—	..	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	—	..	Nil
B.I. & Helsby Cables . . . . .	5	10	10	7—7½	..	6 13 4	Do. fully paid .. . . .	5	Nil	..	—	..	Nil
Do. Pref. . . . .	5	6	6	6—6	..	4 12 4	Do. 4 % Deb. . . . .	100	4	4	68—72	..	5 11 1
Do. Deb... . . . .	100	4½	4½	101—103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	75—78	..	6 8 2
British Thomson-Houston, Deb.	100	4½	4½	95—97	+3	4 12 9	Electric Construction ..	2	Nil	2½	—	..	..
British Westinghouse, Pref. . . . .	3	Nil	..	—	—1½	Nil	Do. Pref. . . . .	2	7	7	1—2	..	7 0 0
Do. Deb... . . . .	100	4	4	61—64	—2	6 5 0	Greenwood & Batley, Pref.	10	7	7	7½—8½	..	8 5 8
Do. 6 % Prior Lien . . . . .	100	6	6	100—103	..	5 16 6	Do. Deb... . . . .	100	5	5	94—96	..	5 4 2
Browett, Lindley, Ord. . . . .	1	Nil	..	1/6—2/-	..	Nil	General Electric, Pref.	10	5	5	9—9½	..	5 5 3
Do. Pref. . . . .	1	Nil	..	5/-—6/-	..	Nil	Do. Deb... . . . .	100	4	4	85—90	..	4 8 11
Brush, 7 % Pref. . . . .	2	Nil	..	0—½	..	Nil	Henley's, Ord. . . . .	5	15	10½	11½—12½	..	6 0 0
Do. 5 % Prior Lien Deb. . . . .	100	5	5	77½—82½	..	6 1 3	Do. Pref. . . . .	5	4½	4½	4½—5½	..	4 6 9
Do. 4½ % Deb. . . . .	100	4½	4½	54—59	..	7 10 6	Do. Deb... . . . .	100	4½	4½	101—103xd	..	4 7 5
Do. 4½ % Second Deb. . . . .	100	4½	4½	37—42	..	10 14 4	India-Rubber, G. & T. . . . .	10	10	..	8½—9½	..	..
Callender's Cable . . . . .	5	15	10½	10½—11½	..	6 10 5	Do. Pref. . . . .	10	5	5	9½—10½	..	4 17 7
Do. Pref. . . . .	5	5	5	5—5½	..	4 15 3	Telegraph Construction..	12	20	10½	33—35	..	6 19 5
Do. Deb... . . . .	100	4½	4½	100—102	+½	4 8 3	Do. Deb... . . . .	100	4	4	99½—101½	..	4 9 0
Castner-Kellner . . . . .	1	17½	20	3½—3½xd	..	5 10 2	Willans & Robinson . . . . .	1	Nil	..	—	..	Nil
Do. Deb... . . . .	100	4½	4½	105—109	..	4 10 7	Do. Pref. . . . .	5	Nil	..	—	..	Nil
Crompton & Co. . . . .	3	Nil	Nil	—	..	Nil	Do. Deb... . . . .	100	4	4	58—60xd	..	6 13 4
Do. Deb... . . . .	100	5	5	58—68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



## WAGES SYSTEMS.

BY J. WALTON AND A. E. BREWERTON, A.M.I.E.E.

It is not often that workshop wages systems find any place in the electrical Press, yet it is surprising they do not do so in view of the keen competition which exists in the manufacture of electrical goods at the present time, and of the increasing influx of foreign apparatus; no doubt this state of affairs is felt by makers of small, rather than large, work, but competition is universal, and whilst its effect is good to the extent to which it stimulates a necessity to reduce selling prices, there certainly exists a bad influence tending to sacrifice efficiency, unless the manufacturing costs can be reduced by scientific handling.

Roughly, manufacturing costs are made up of the cost of labour and material, plus the factory and dead charges. To reverse the order of things, factory and dead, or administration, charges cannot be drastically diminished, and although in an existing factory it may be possible to reduce waste or supervision items, such savings are often made at considerable expense in other directions; so that, unless a works has been badly managed in the past, the analogy of "swings and roundabouts" is applicable.

The cost of material must obviously be minimised, but the methods of so doing are beyond our province.

It is, therefore, necessary to consider how the labour item can be reduced. Of course, this is controlled largely by the quantities manufactured, the tools and gauges employed and the rate paid for labour: all of which are distinct from any method of reducing the cost of unit production under existing circumstances by the adoption of some sort of piecework or premium system of wages. There are numerous systems of these kinds in vogue, and it will be of interest to cite a few points in connection with them before passing to a system which bears some elements of originality and has distinct advantages.

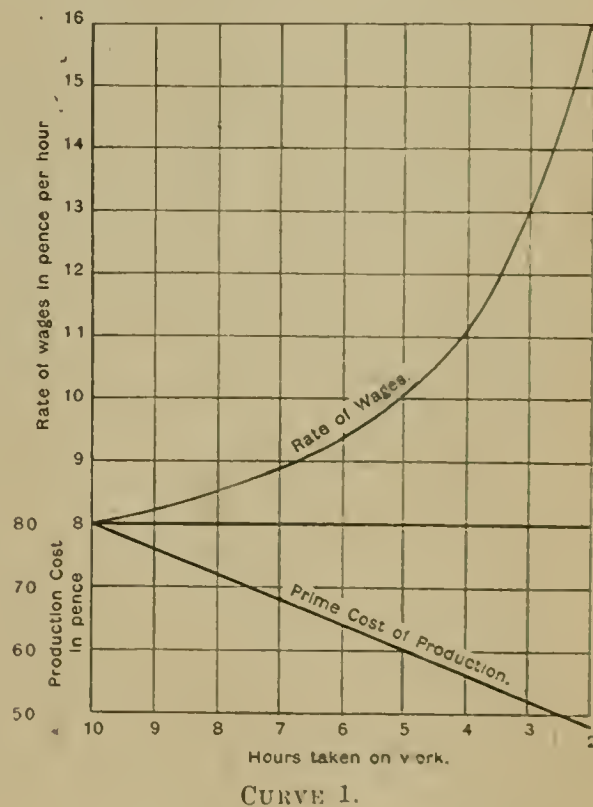
The ordinary hourly rate system requires no explanation, and is, of course, the most simple method by which labour can be paid for, but unfortunately it gives no incentive for a man to work at a greater rate than he is compelled. There are certain sections who fight for the maintenance of this system, and against all innovations, upon the ground that no man should be made to do more than a good day's work such as he would do upon an hourly rating, and also the contention is put forward that if the cost of labour is reduced unemployment will be increased, and so on. These arguments are, however, too hackneyed to be answered here. The fact remains that a departure from the hourly rate system invariably leads to increased efficiency. Undoubtedly the crux of the problem lies in creating an incentive and recognising that where skilled labour is employed, each man is or should be an expert in his own particular sphere. The latter fact has been made use of in the "Suggestion Scheme" whereby all suggestions which lead to improvements in designs or productions are paid for by the employer; for various reasons this practice is becoming less popular, possibly because it allows individual workpeople to be in touch with the management above the heads of their foremen.

It has been proposed that bonuses should be distributed in a works according to a firm's yearly profits: this may be feasible in a very small concern, but there are obviously weak points, inasmuch as the firm's profits are affected by numerous factors which are quite beyond the control of workpeople, either individually or collectively. Moreover, very few workers are inclined to exert themselves in January for a possible reward in December.

The piecework arrangement has gained almost universal popularity, as it is infinitely better to make payments upon the actual work done than according to the time at which people come and go, but careful handling is absolutely necessary to obtain efficiency without friction. Whether a rate-fixer be employed, or whether the prices are fixed by the works manager and foremen, depends upon the class of work and size of factory, but the rates must be fairly correct. Theoretically, piecework prices should be very seldom altered, otherwise the cutting of prices produces ill-feeling and lack of faith upon the part of the workers towards the manage-

ment. Often these points are not considered, particularly in larger firms, but there is little doubt that continuity of service and amicable working are valuable acquisitions. In practice, piecework prices have to be reduced from time to time, and hence "nursing" is bound to be prevalent. "Nursing" possibly is a technicality requiring explanation: if it becomes a practice to reduce prices frequently and to judge the value of work upon the increase which a man makes upon his hourly rate, he very quickly realises that, as soon as he exceeds a certain proportion over his rate, the price is to be cut, and his course is obvious; again, there is little reward for any suggestion he may make, if, in consequence, a reduction is made. To take the opposite, and perhaps impossible, view, where a price is fixed once for all, then the workman does his utmost to increase the output, but the result is hardly fair, since the whole of the profits are his, the only profit to the employer being the indirect advantages of producing work quickly and the consequent reduction in factory charges. Besides being unfair from the employer's point of view it may re-act upon the man, inasmuch as the cost of production is fairly uniform, and the necessity of keeping a man well supplied with material is not paramount, since it makes but little difference if the man remains idle for a few minutes in every hour or so. In the same way it does not greatly add to efficiency to keep machines tuned up and to facilitate rapid production except for the reasons stated. What is wanted, therefore, is not only an incentive, but some system worked upon a profit-sharing basis.

The premium system fills the latter requirement, and cannot, therefore, be passed over: according to this plan each job is given a certain time, and a bonus is given in accordance with the number of hours saved, the amount of which is often based upon half the hourly rate for every hour saved. For example: if a man whose rate is 8d. per hour is given a job to do in 10 hours and does it in five hours, then he receives five hours at 8d. = 3s. 4d., plus five hours



at 4d. = 1s. 8d., total 5s., or in other words, the rate in this case rises from 8d. to 1s. per hour. It will be noticed, however, by referring to Curve 1, that the rate of wages increases out of proportion to the saving in cost of production.

The system which the writers have recently evolved shows a much fairer state of things, as will be seen from Curve 2, since the hourly rate increases at exactly the same rate as the decrease in cost of production; the profit upon the time saved is, therefore, equally divided. The method of working this system is to divide the money earned upon the hourly rate by the time allowed and multiply by the time saved, thus:—

$$\text{Bonus} = \text{amount earned upon hourly rate} \times \frac{\text{time saved}}{\text{time allowed}}$$

It will at once be noticed that it is impossible for any man to earn double his rate, which is a good point when it is considered that no man should be paid at double the rate







since they were presented, the project is subject to the rate-payers sanctioning the further loan now required.

The towns of Gisborne and Hastings are installing plant, in each case driven by Diesel engines, and both are proposing to deal with their sewage by means of electrically-driven pumps. Gisborne has purchased two Edison storage battery cars, and if they prove successful, their number will be added to. Of private works may be mentioned the scheme for supplying the Waibi gold mines with power transmitted at high pressure from a hydro-electric station, and the equipment of the Union Steamship Co.'s new works at Evan's Bay, Wellington. Of new work coming forward, by far the most important is the initial scheme of the new hydro-electric department of the public works, which involves the supply of power through the fertile Canterbury Plains from Lake Coleridge to Christchurch and Timaru. The contract for the tunnel through which the water will flow, from the lake to a point near the power house, has already been let, and specifications are also issued for the main items of machinery, &c. The ultimate capacity of the station is 9,000 kw., of which half is to be installed at first in three units of 1,500 kw. each. The transmission lines to Christchurch will be worked at a pressure of 66,000 volts, and the distance is 70 miles. The scheme, in addition to supplying power in bulk to the city of Christchurch, also includes the electrification of the railway to its port, Lyttleton, a distance of seven miles, of which two miles is tunnel. Christchurch being one of the principal industrial centres, it is anticipated that, when the new supply is available, there will be a considerable demand for power at the various works.

Timaru has already secured expert opinion as to a tramway and lighting scheme, and the growth of the borough, as well as its port expansion, makes a cheap supply of electric power altogether desirable.

The Government also anticipates a considerable aggregate demand from the farming community and others adjacent to the transmission lines, not only for lighting, but also for the driving of farm machinery; but the individual demand from this source will necessarily be small.

Whilst the Government now retains the rights to water-power development throughout the Dominion, it is not expected that it will actively commence any further schemes until the Lake Coleridge transmission is actually at work, although prospecting and surveying have already been carried out elsewhere. For instance, the experts of the various bodies interested have already conferred, with a view to supplying the city of Wellington with power from the Hutt River, involving transmission of about 20 miles. This line would incidentally be available for the Government railway workshops at Petone, for two of the largest freezing works in the Dominion, and for a woollen mill *en route*, as well as for one or two local bodies.

In the same neighbourhood is one of the steepest gradients of the State railways, and the department is studying the problem of the working of main lines in Europe and in America, in view of the possible saving in running cost, as well as time, by the substitution of electric for steam traction.

Again, New Plymouth has decided to go ahead with its tramway scheme, and has called in a consultant to advise as to the route. Palmerston North is placing before the rate-payers a project for the installation of a tramway service involving an expenditure of about £60,000. The borough of Miramar, which is now served by the lighting and tramways systems of Wellington, has adopted a scheme for an independent plant driven by Diesel engines, and the town of Feilding is contemplating a lighting scheme in the near future.

Apart from these public service schemes, the State Mines Department has called for tenders for a power and lighting plant for the collieries at Greymouth, on the West Coast, and there are to be installed at the outset continuous-current dynamos, steam-driven, aggregating 270 kw., variable speed motors for driving ventilating fans totalling 187 h.p., and two further motors of 80 and 45 h.p. respectively.

Although the list is still unexhausted, probably sufficient has been said to show that New Zealand is alive to the benefits which electrical supply gives. Should success attend

the development of its oil resources, a further fillip may be expected with the advent of crude oil for fuel, and the popularity of the Diesel engine may be still further increased.

It may be noted incidentally that the oil field, which up to the present has shown the best results, is in the Taranaki district where there are unlimited supplies of iron-sand, requiring no mining, awaiting a simple process of smelting and a supply of cheap power for the purpose.

It is proposed in a subsequent article to deal with the usual methods of calling for tenders, and the formalities to be observed by manufacturers in submitting offers. Since the Dominion does seven-eighths of its trade with the British Isles, the market may be regarded as an increasingly important one.

## PROCEEDINGS OF INSTITUTIONS.

### Condensers in Series with Metal-Filament Lamps.

By A. W. ASHTON, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, May 16th, 1912.)

THE object of this paper is to describe certain developments which have recently taken place in connection with the running of low-voltage metal-filament lamps in series with condensers on alternating current circuits.

In adopting condensers the improvement in the power factor of the whole circuit, although merely incidental, should not be lost sight of: a consumer taking a leading current should not be debited with the same proportion of capital cost as an ordinary lighting consumer. In the case of small houses the cost of wiring and of lamp renewals becomes of increasing importance, and it is in this direction that the use of condensers appears especially advantageous.

The condensers which have been employed in connection with metal-filament lamps have been of the Mansbridge type, consisting of tinfoil paper impregnated with paraffin, the impregnation being carried out by a new process, which is the invention of Mr. E. A. Bayles, of the British Insulated and Helsby Cables, Ltd. Prior to the introduction of the improved impregnating process it was the practice to carry out the paraffin-wax impregnation under vacuum. The condensers manufactured by this process have been found thoroughly satisfactory for telephone circuits, and certain other purposes for which they have been largely used.

In testing a large number of such condensers with alternating pressure it was found that breakdowns always occurred along a certain curve, viz., that connecting points of equal temperature in the wax while cooling after impregnation. This pointed to the possibility of the dielectric becoming weakened electrically due to shrinkage in cooling, and to the fact that the interstices between the layers of paper and tinfoil were not completely filled with paraffin. This drawback is obviated by the new process, the interstices being completely filled with paraffin, which results in the dielectric strength of a condenser of given thickness of paper being practically doubled.

The new process consists essentially in the immersion of the condenser roll in melted paraffin wax after vacuum impregnation, and the subjection of the wax to high mechanical pressure during the process of cooling. This pressure is about 1 or 2 tons per sq. in., and it is important to note that while the pressure is maintained on the paraffin, the condenser itself is not pressed upon in such a manner as will flatten or otherwise distort its shape. The pressure is maintained until the paraffin is cooled and set.

The superiority of the condensers produced by this process compared with the paraffin condensers hitherto produced is most marked, particularly with regard to dielectric strength and reliability when working on A.C. circuits; the recent developments in the use of condensers have been largely due to the introduction of this process.

A series of tests for the determination of the dielectric losses in condensers manufactured by the new process have been made by the author in the electrical engineering laboratories at Battersea Polytechnic.

The curves given in figs. 1 and 2 show the results obtained for a 15-microfarad condenser suitable for pressures up to 250 volts. In each case the losses are expressed in watts per microfarad, and also as percentage power factor. In obtaining the results shown in fig. 1, the voltage on the condenser was kept constant at 200, and the frequency was varied from about 40 to 100 cycles. The loss is very nearly proportional to the frequency within these limits, the power factor only increasing 25 per cent. when the frequency increases from 40 to 100 cycles per second.

In fig. 2 the results of tests on the same condenser at different voltages from 80 to 240, and a constant frequency of 50 cycles, are given. The loss increases with the voltage, and the power factor is considerably lower at the higher voltages, being as low as 0.38 per cent. at 240 volts, and increasing to 1.3 at 80 volts.

At 200 volts 50 cycles the power factor is 0.44 per cent., corresponding to a total loss of 0.85 watt for the 15-microfarad condenser. The overall dimensions of this condenser are  $5\frac{1}{2}$  in.  $\times$   $5\frac{1}{2}$  in.  $\times$   $4\frac{1}{2}$  in., giving a total external surface of 160 sq. in., from which it is obvious that the temperature rise is absolutely



negligible. When this condenser is fully loaded, the lamps will aggregate from 80 to 90 watts, so that the efficiency is about 99 per cent. at full load. If this condenser is left continuously on a supply circuit it absorbs energy at the rate of about seven units per annum. Thus from every point of view the condenser is a highly efficient piece of apparatus, and owing to its small losses and negligible temperature rise it is practically impossible for it to deteriorate in use.

For incandescent lighting the condenser possesses certain valuable features, which, combined with its moderate cost, make it suitable for use in conjunction with low-voltage lamps where otherwise either high-voltage lamps would be used or an auto-transformer installed.

Apart from the higher efficiency and longer life of the low-voltage lamp, the latter is considerably cheaper to manufacture, and has a more robust filament. Further, when one considers the fact that the initial cost of a condenser for a single lamp is often not more than twice the cost of the lamp, it is evident that the prevention of one or two accidental breakages will easily cover the cost of the condenser.

The parallel system of connections necessitates the use of a condenser corresponding to each switch, as owing to the "constant-current" property of the condenser the number of lamps connected in parallel must be constant.

The size of the condenser must be determined with reference to both voltage and current of lamp, as well as the supply voltage and frequency. The capacity required is given by:—

$$K = \frac{C \times 10^6}{2 \pi f \sqrt{V_1^2 - V_2^2}}$$

where  $K$  = capacity in microfarads,  $C$  = rated current of lamp,  $f$  = supply frequency,  $V_1$  = supply voltage,  $V_2$  = lamp voltage.

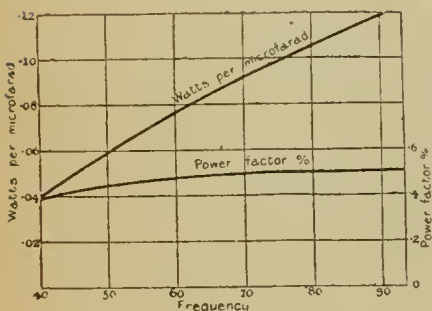


FIG. 1.

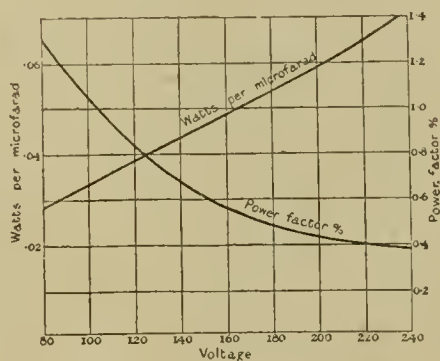


FIG. 2.

The capacity required is, therefore, directly proportional to the lamp current, and inversely proportional to the frequency and to the vectorial difference between supply and lamp voltages. Generally speaking, the application of condensers is limited to supply voltages of 200 or more at 50 cycles, except for comparatively low candle-power lamps (up to 10 watts). At frequencies of 70 to 100, however, the cost of condensers for running 50-volt lamps on 110-volt circuits comes out reasonably low even in the case of 28-watt lamps.

The capacities required for different lamp voltages are shown in figs. 3 and 4, from which some idea of the size of the condenser for any given lamp can be obtained. The capacity is inversely proportional to the supply voltage in the neighbourhood of 220 volts, i.e., from 200 to 250.

From fig. 4 it can be seen that when using the parallel system for lamp voltages of less than 25, the cost of the condensers becomes rather excessive: but it must be noted that three 25-volt lamps may be run on the same condenser without appreciably increasing the capacity, and by adopting the series system these need not be all in one room, but can be separately controlled by short-circuiting switches.

The cost of the condensers may be represented approximately by the equation:—

$$\text{Cost in shillings} = a + bK,$$

where  $a = 2.0$  and  $b = 1.5$  for 250-volt condensers of capacity  $K$  microfarads.

Owing to the small dimensions, viz.,  $2\frac{1}{2}$  in.  $\times$   $2\frac{1}{2}$  in.  $\times$  6 in. for the five-microfarad condenser, and the fact that the condensers work continuously with no appreciable temperature rise, they may be fixed in any out-of-the-way place.

The adoption of this system implies practically no disturbance of the existing wiring, but it becomes rather expensive in first cost where the aggregate of voltages of lamps in series with one condenser is low. The minimum capacity is required when the voltage on the lamp or lamps is 70.7 per cent. of the supply voltage.

On 200-volt circuits any lamp of a lower voltage than 60 can be replaced by a lamp of different candle-power provided the two lamps have the same rated current. Thus the same condenser is always suitable for a 5-watt 25-volt lamp and a 10-watt 50-volt lamp; and if the candle-power requires to be still further increased a 17 or 18-watt 100-volt lamp should be used.

The condensers are listed for running 25, 50, or 100-volt lamps on circuits of any pressure or frequency met with in practice, and it has been found convenient to refer to them by using serial numbers instead of the actual capacities

This system is particularly applicable to the case of houses of moderate size, viz., of less than about 25 lights, in which the number of points where less than 25 watts is required will be about one-third of the total. In these cases condensers would be required

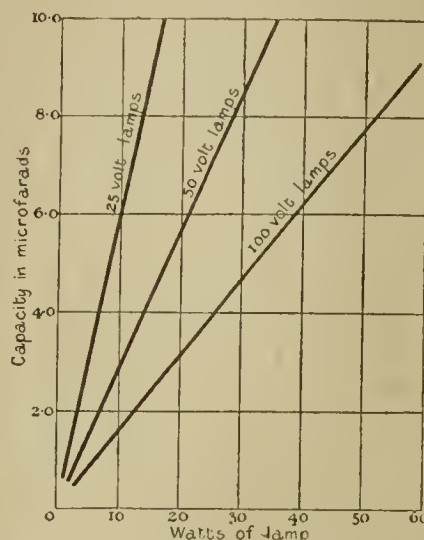


FIG. 3.

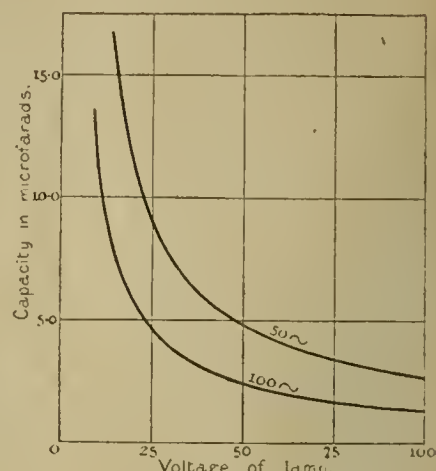


FIG. 4.

only on the lower candle-power points, and in those positions where the lamps are liable to be handled.

The first cost is less than when an auto-transformer is installed, all "no-load" losses are obviated and the running losses are considerably reduced. Compared with the use of high-voltage lamps at all points, there is considerable saving in the cost both of energy and of lamp renewals, amounting in a number of cases to more than 50 per cent. on the assumption of equal life for the high-voltage and low-voltage lamps. It appears very probable that the actual saving will be greater.

The possibility of running a variable number of low-voltage lamps, all having the same rated current, in series with a single condenser and controlled by "short-circuiting" switches, is due to the fact that the vectorial difference between the two quantities in quadrature, when one is much smaller than the other, is very slightly less than the greater of the two quantities. Thus the condenser splits the supply voltage into two components in quadrature, and when the lamp voltage is as much as 30 per cent. of the supply voltage the condenser voltage is only 4.6 per cent. less than the supply voltage. With tungsten-filament lamps in series with the condenser the actual reduction in current is less than this, due to the decreased resistance of the filament when the current is below normal. The maximum percentage variation can be still further decreased by adjusting the capacity of the condenser to such a value that the lamps get their correct voltage when the aggregate of voltages of the "switched-in" lamps is 25 per cent. of the supply voltage. Under these conditions it is possible to use a variable number of lamps up to 35 or 40 per cent. of the supply

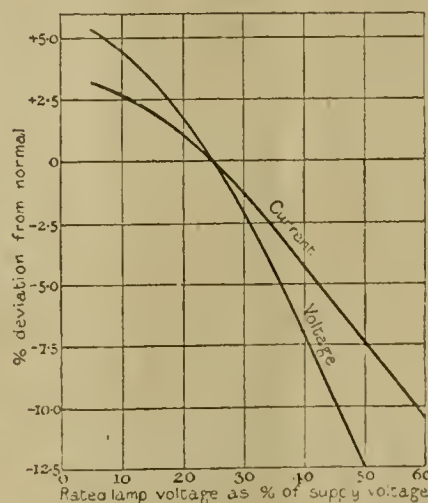


FIG. 5.

voltage without the lamp current deviating more than 3 per cent. from the normal.

In fig. 5 is given the percentage deviation of lamp current and voltage from the normal for different nominal lamp voltages, the rated current being correct when the lamp voltage is 25 per cent. of the supply voltage. Under these conditions the variation in the candle-power of the lamps is no greater than is given by carbon-filament lamps due to ordinary variations in voltage, but in any case the current variation may be made less than 3 per cent. if necessary by keeping below 35 per cent. of the supply voltage, i.e., by adopting lower voltage lamps.

The necessary condition to be followed by the lamps in series with any one condenser is that they should all have the same rated current, the voltage being therefore proportional to the wattage required. Thus for a condenser giving 1 ampere, a 25-watt lamp must be rated at 25 volts, a 10-watt lamp at 10 volts, &c. With such a condenser the maximum wattage of lamps simultaneously in use on a 220-volt circuit would be about 80, but where, as



would generally be the case, all lamps are not required at once, the wattage of lamps installed may be about 120. Any required wattage of lamps can be used in connection with a single condenser by varying the rated current of the lamps, but it will generally be found more convenient to run each group of 10 lamps on a separate condenser.

Compared with the parallel system, the chief advantages of the series system are:—

1. Although low-voltage lamps of 10 to 25 volts can be used, the cost of the condenser is only about 2s. 6d. per lamp on 220-volt 50-cycle circuits.

2. The condenser acts as a current limiter and effectually prevents the consumer increasing his maximum demand to any serious extent without the knowledge of the supply authority.

3. By using switch-holders a considerable reduction can be effected in the cost of wiring due to there being only one wire run from ceiling rose to ceiling rose.

4. The electric stress on the insulation of the wiring is considerably reduced, and risk of fire due to "short-circuits" occurring is entirely eliminated, due to the fact that the power supplied by the circuit to the fault is limited by the condenser.

The series system is more particularly applicable to small houses or flats not requiring more than about 10 lights, and to groups of low candle-power points in larger houses. In the latter case the lamps may be all in one room and divided for convenience in illumination, or the whole of the smaller rooms in a house may be wired in series.

The current taken by the condenser is a maximum when all the lamps are short-circuited, and in the series system this will be about 3 per cent. greater than the normal current.

A further result of the current-limiting effect of the condenser is the prevention of the excessive rush of current which takes place when metal-filament lamps are switched on.

The extensive use of condensers will affect the power factor of any system in which they may be adopted.

The use of the series condenser system in which the condenser is generally in circuit will effectually compensate for lagging currents, provided the condensers are located near the apparatus taking lagging currents, and are in the circuit mainly for the same periods as those in which lagging currents appear.

Though these conditions are not fulfilled in residential districts, yet for the smaller class of property in industrial districts the compensation would be found to be satisfactory, having regard to the fact that over-compensation is an advantage as far as the generators are concerned.

The following is a comparative estimate of the cost of wiring a 6-roomed house with 10 points, on the ordinary "loop-in" system using 200-volt lamps, and on the series condenser system using switchholders.

The estimate is on exactly the same basis for each system, viz., for a plastered house and using 600-megohm cable of English manufacture, in enamelled close-joint steel tubing with slip-socket fittings. The prices include wiring contractor's profit, and labour taken at 1s. 6d. per hour for wireman and mate. The cost of the condenser is not included in (2), as it is assumed that this would be balanced approximately by the cost of a current limiter for system (1).

	(1)	(2)
Cable and conduit ... ..	£1 17 6	£1 2 6
Labour on cable and conduit ...	2 10 0	1 6 4
Pendants, switches, main switch and fuses, including labour ...	2 9 2	2 2 6
Lamps ... ..	1 10 0	0 15 0
Total ... ..	£8 6 8	£5 6 4

These estimates show a saving of 38 per cent. by using the series system, and this has been effected in labour and material due chiefly to the reduction of cable from 17 yd. to 8 yd. per point, and a corresponding saving in labour, conduit and fittings. The prices are for wiring a single house in each case; they would, of course, be considerably lower where a number of houses could be wired at the same time.

Whenever lamps are used in series with a condenser, the power factor is given as the ratio of the voltage on the lamps to the supply voltage. It is obvious that, in the case of a single 10-volt lamp on a 200-volt circuit, the power factor will be 0.05. Since the standard types of meter have not been designed for use on such low power factors, it is an interesting point to consider how far they may be relied on to start and to register accurately in such cases.

A 5-ampere 100-volt induction-type watt-hour meter, which was tested against a sensitive precision wattmeter of the deflectional type, was remarkably accurate at low power factors and as adjusted, i.e., reading nearly 1 per cent. high for a current of 3 amperes at unity power factor, it is more accurate with leading than with lagging currents. With a power factor as low as 0.08 (leading) the meter reads only 2 per cent. low, but reads nearly 5 per cent. low when the power factor is reduced to 0.04.

This type of meter would appear to read sufficiently accurately in connection with the series system, and could be adjusted so as not to register with the condenser alone in circuit, and to start with certainty when the smallest lamp is switched on.

Since in the series system the current is constant, a volt-hour meter connected across the lamps would accurately register the energy used in the lamps, and would reduce the meter losses to a minimum.

Where a number of lamps are run in series, one disadvantage is that, in the event of one lamp failing, all the others go out. In the case of the series system, a cheap type of relay can be adopted, which will automatically short-circuit any lamp thus failing.

Although, for lighting small houses or flats, such relay would appear unnecessary, for public lighting, where reliability is of greater importance, the extra expense might be justified. By arranging for a suitable amount of self-induction in each relay and connecting the lamp switch so as to short-circuit the relay when the lamp is not in use, the presence of the relay will improve the regulation.

This arrangement permits of using lamps whose aggregate of voltage is more than 50 per cent. of the supply voltage, as compared with 35 per cent. when inductances are not used.

The series system is particularly suitable for wiring small houses or flats of five or six rooms—a class of consumer at present almost untouched by electric supply authorities, and the inhabitants of which form the great bulk of the population.

In order to make electricity supply profitable in such cases, it is necessary to adopt a system implying minimum costs to the supply authority, the property owner and the consumer.

An endeavour has been made to show that the series system fulfils these conditions in the first case by the limitation of the maximum demand, and the compensation for lagging currents: in the second case, by the reduction of wiring costs, and in the third by the reduction of the initial cost of lamps and of renewals, as well as the provision of a low candle-power lamp. With these advantages, the system should commend itself to those supply engineers who contemplate the possibility of gaining some portion of that great body of potential consumers who are at present outside their influence.

Where a block of flats or houses can be supplied so as to reduce the cost of the house service to a minimum, an unlimited supply could be profitably given at from 6d. to 9d. per week.

The discussion was opened by MR. PERREN MAYCOCK, who described some of the more recent Lundberg switch arrangements for electric lighting with condensers in circuit, concluding with an example of complete house lighting through a condenser in the kitchen.

MR. RAWLINGS said some description of the apparatus and its size was wanted in the paper, as the size of condenser had an important bearing on its use for domestic purposes. The 5-mfd. size appeared to be too large to use as the author proposed. He thought the condenser for electric lighting purposes had received its death-blow owing to the rapid development of the metal lamp, and this point appealed to him personally, as he had devoted some time to the condenser, although his only had a cubic capacity of 1.4 in., as against the author's 7.5 in. This condenser had been applied to switches and fittings (some examples of which were shown on the lantern screen). He disagreed with the author's estimate for house wiring on the series system, as short-circuiting by switch lampholders was not to be recommended. A better application of the condenser was for dimming light, and for this purpose he had brought out a switch containing a number of contacts and the condenser in the base, and occupying but little more space than a tumbler switch.

MR. W. M. MORDEY thought the author showed that the electrostatic condenser could now be regarded as ranking with the transformer in suitability for practical use. The very small transformer for one or two lamps could not be constructed with a sufficiently low no-load loss, but even with the smallest condenser the losses were very small, in fact, no more than with large sizes. The buffer action of the condenser and self-regulation of the series arrangement were important.

The AUTHOR, in a communicated reply, said: With regard to the use of slip-socket fittings in the comparative estimates of wiring costs, it was not clear that slip sockets were prohibited by the Institution Wiring Rules, provided continuity was obtained by some system of earthing grips; and in any case 99 per cent. of ordinary dwelling houses were wired with slip sockets without any special method of obtaining continuity.

With regard to the size of the condensers, this depended entirely on the factor of safety which was considered necessary. The condensers in use at present were tested at 1,000 volts for use on circuits up to 250 volts. By reducing the straining voltage to 500, it would be possible to reduce the dimensions to about one quarter of the present size. It was not considered advisable, however, to reduce the factor of safety, because it was realised that to extend the use of condensers an absolutely reliable article must be offered.

He did not think the reduction of the dimensions of such importance as was assumed, as the condenser could generally be put in such a position that its dimensions were relatively unimportant.

## The Transmission of Electrical Energy by Direct-Current on the Series System.

By J. S. HIGHFIELD, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Glasgow, June 12th, 1912).

IN my paper of March 7th, 1907, bearing the above title, I had the privilege of putting before this Institution some facts and theories in regard to this very interesting system. Since writing that paper matters have progressed. After the most careful consideration the Metropolitan Electric Supply Co. decided to use the series system for supplying their western area, and the plant was put to work in March of last year, and has been running steadily ever since: two sets of colliery winding gear have been constructed, and the



Moutiers-Lyons system (the largest series transmission yet erected by M. Thury) has been largely extended.

The western area system of the Metropolitan Co. is designed ultimately to feed an area containing 300 sq. miles, the extreme distance by road to the remote points from the power station at Willesden being about 28 miles. The company hold, and are now working, the orders in Southall, Hanwell, Brentford and Acton, and possess bulk supply powers in the remaining districts to which it is not certain when the opportunity will arise for giving supplies.

Owing to the small load existing in a great part of the district, the important matter was to design a system which would involve the least possible cost in mains, and, at the same time, admit of ready and inexpensive expansion to meet the requirements of a rapidly increasing population. It was also necessary to use a system which, while being inexpensive for short distances, could be readily extended to very long distances.

It was decided to lay mains having a capacity of 10,000 kw. with sufficient reserve in the case of breakdown, and after much research it was found that two single-conductor cables having a core of 0.125 sq. in. section with  $\frac{1}{2}$  in. of paper insulation, sufficient for 100,000 volts direct current, could be laid in iron pipe at less cost than any other system of similar capacity. To provide for continuity of supply in case of breakdown of one of the mains, it was desirable to use the earth as the spare conductor. Further research having shown that this was possible without risk of interference with other electrical circuits, this method with the consent of the Board of Trade, was decided upon; thus, the cost of a third or stand-by cable was avoided.

For the secondary supply the mains are of much less capacity, and can be tapped at frequent intervals to supply small sub-stations for town and village lighting and fairly large power consumers. A somewhat high pressure being necessary for this purpose, it was decided to use three-phase alternate-current mains at 3,000 volts pressure, and for the low-tension system supplying small consumers a three-phase four-wire system at 415 volts pressure

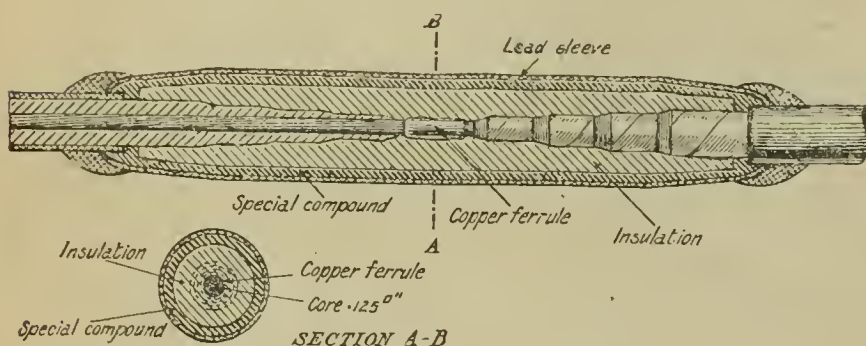


FIG. 1.—JOINT FOR 100,000-VOLT LEAD-COVERED CABLE.

between phases. This network showed lower costs and greater convenience than any other. The comparatively high secondary pressure enables an area of about 10 sq. miles to be worked from each sub-station. Thus in spite of the scattered nature of the demand each sub-station will grow to considerable dimensions, enabling larger plant to be used.

The transmission cable system consists of two plain lead-covered paper-insulated cables drawn into cast-iron pipes  $2\frac{1}{2}$ -in. inside diameter, the pipe joints being made with yarn and clay, and electrically bonded by means of three corrugated iron wedges which bite into the iron. These wedges make a very good joint and are inexpensive. Special split cast-iron boxes are used to hold each cable joint, and small split boxes are used at bends. There are no brick pits or surface covers; the cable is surrounded throughout its length by cast-iron, thus the cable is admirably protected. The present system supplies from the power station to Southall, a distance of about 7 miles.

The joints in the cables are shown in section in fig. 1, and are made in the following way. The lead is first carefully removed. Steps are made in the paper insulation by carefully unrolling each layer and tearing, not cutting it off to form four steps. The conductors are joined by a sweated sleeve, and the whole is covered by a paper ribbon 1 in. wide, wound on to the joint off a reel. In this way the paper is never handled, and consequently moisture is not left in the joint. A lead sleeve is then drawn over the joint and plumbed to the lead sheath of the cable. It is then filled with compound. The joints are inexpensive, and have proved themselves most reliable.

Each cable length of 220 yards was tested in the factory to 75,000 volts alternating current at 60 cycles, the pressure being applied for 10 minutes. A 6-ft. piece of each length manufactured was tested to 130,000 volts alternating current at 60 cycles, which pressure was resisted for about 5 minutes. The type of joint used was tested at 150,000 volts, 60 cycles, without breaking down. After laying, the whole length of cable was tested to an alternate-current pressure of 20,000 volts, 60 cycles, every 35 minutes.

It was decided to test the cables with direct current at a pressure

of not less than 150,000 volts. In order to obtain this pressure a special machine was constructed of a similar type to that used by Mr. Watson in the experiments he has described to this institution, but having a greater capacity. The machine consists of a generator of the Voss type, direct driven by a motor at about 1,000 revs. per minute. The generator and motor are completely enclosed in a cast-iron case, the high-tension terminals for the supply to the

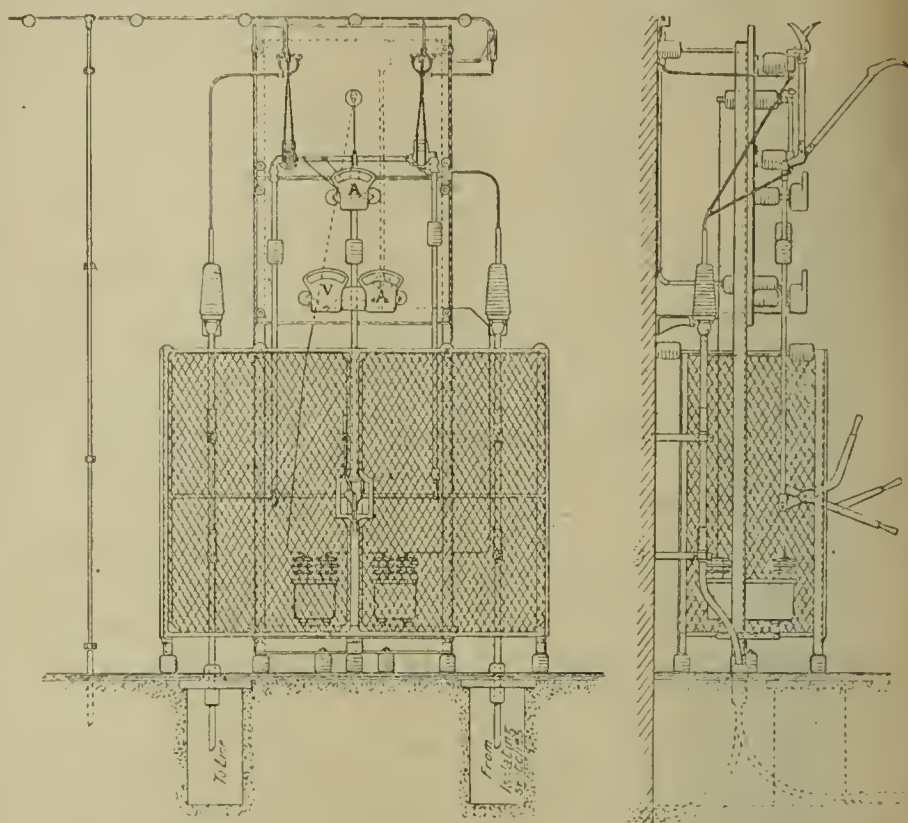


FIG. 2.—MAIN SWITCHBOARD WITH LINE AND EARTH SWITCHES AND INSTRUMENTS.

motor being brought through the case by large ebonite insulators. The case is then filled with nitrogen at a pressure of 200 lb. per square inch. The motor is supplied with current from a small generator which, owing to its direct connection with the motor, is charged at the full pressure; it is therefore necessary to insulate this generator from earth in the same way as the whole machine is insulated. This generator is in its turn driven by a motor by means of two wooden pulleys and a cotton rope which provides ample insulation for the maximum pressure given by the machine. When connected to one cable with its switchgear the machine maintained for periods of about 30 minutes a pressure of 130,000 volts, and for short periods a pressure of 150,000 volts, the total energy put into the cable and switchgear being approximately 500 watts, this leakage being due to small discharges at various points. The pressures were measured by a single-cell Kelvin type voltmeter working in compressed air at a pressure of 200 lb. per sq. in.

I regard the construction of this machine as a notable achievement, and think that Mr. Watson and the makers are greatly to be congratulated.

Each end of each cable is connected to its own switching panel, shown in fig. 2. The panel contains two switches, one for coupling

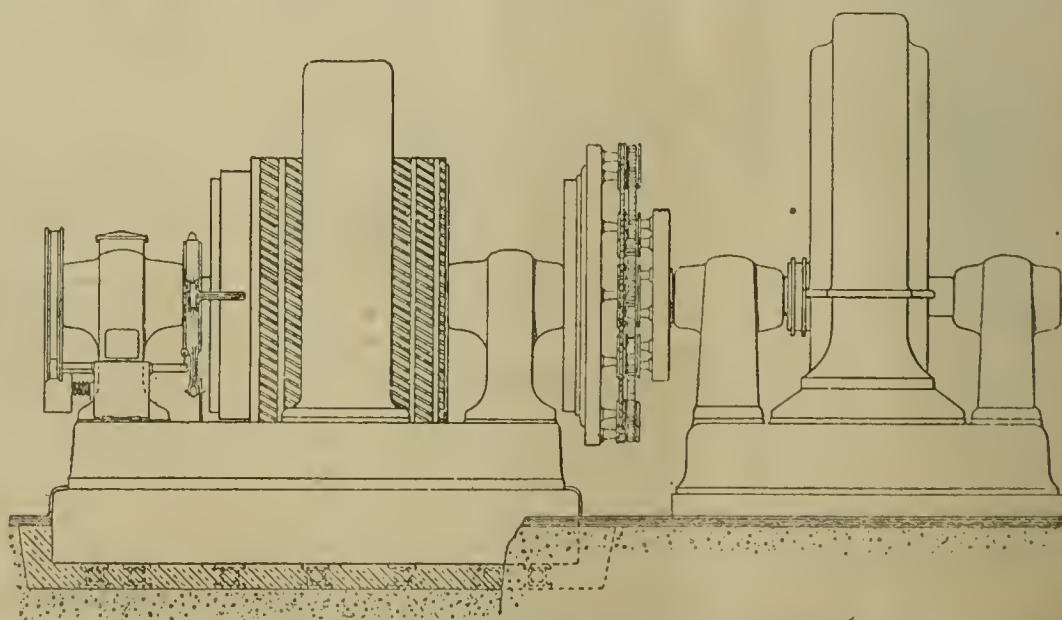


FIG. 3.—MOTOR-GENERATOR, SHOWING INSULATED FOUNDATIONS.

D.C. Generator Output: 100 amperes at 5,000 volts.

the cable to the power station or sub-station circuit, and the other for coupling the station circuit to earth. The two switches are interlocked, so that it is impossible to draw one until the other has been closed. The instruments consist of an ammeter in the line, an ammeter in the earth circuit, and a voltmeter to show the pressure between the line and earth; the latter is provided with a switch, so that it can be conveniently disconnected from the circuit. The panels provide for double insulation, the various instruments and switches being carefully insulated with large porcelain



insulators from the panels; the frames carrying the panels are again insulated from earth. It is a special advantage of the series system that, with the exception of the cable, it is possible to provide double insulation at all points.

It was decided to drive the first machines by means of synchronous motors supplied with energy from the A.C. generators already installed in the power station. Later on, when steam-driven direct-current sets are installed, these machines will form a convenient link between the direct and alternate-current systems. There is nothing special about the synchronous motors, which

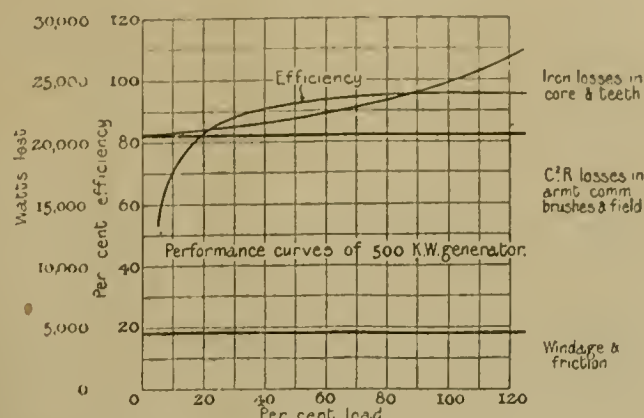


FIG. 4.—PERFORMANCE CURVES OF 500-KW. GENERATOR.

were machines already in the possession of the company. It was for this reason that so low a speed as 200 R.P.M. was chosen.

The direct-current generators shown in fig. 3 have six poles. The commutators are 60 in. in diameter and  $6\frac{3}{4}$  in. long, and contain 1,439 segments. Since the maximum current to be collected is 120 amperes, only two sets of brushes are required. Consequently, not only does the commutator run almost without noise, but the wear is inappreciable. The machines are designed to run sparklessly at any load, but will allow the current to be varied from 70 to 120 amperes. The normal pressure is 5,000 volts; this is the highest pressure for which a machine of this type has, so far, been designed. Therefore, the output of the machine at 100 amperes is 500 kW., and at 120 amperes 600 kW. The performance curves of these machines are shown in fig. 4.

The current is maintained constant by a regulator which serves to regulate the working field by moving the brushes from full to no-load position, and at the same time shunting a part of the field current by means of a diverter. The regulator, shown in the diagram, fig. 5, is driven by a small belt from the end of the generator shaft. It consists of a small turbine C, wholly submerged in oil, maintaining a pressure of about 25 lb. per sq. in. In the case containing the turbine is a vertical cylinder A, in which moves a gate B, on a vertical shaft through a segment of the cylinder. This gate is immersed in oil, and the supply under pressure from the turbine can be directed to either side, so as to rotate with great force the shaft to which it is attached. This shaft is geared by means of bevel wheels to a horizontal shaft, which acts directly on the brush rocker. The supply of oil from the turbine is taken through a small piston valve D, which serves to distribute it to either side of the gate. The position of the main valve is controlled by a solenoid G, through which the main current passes, pulling against a spring E, and controlling a relief valve F. It will be seen

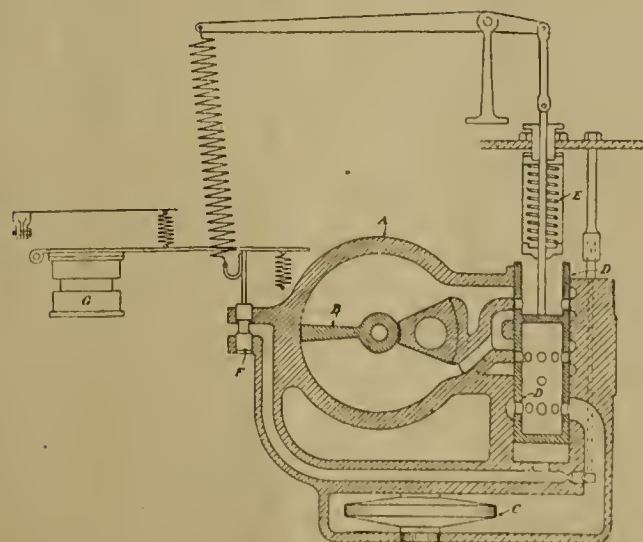


FIG. 5.—DIAGRAMMATIC SECTION OF REGULATOR.

that the governor is of the relay type, and that any variation in the current through the solenoid changing the direction of the flow of oil brings a very large force into action to move the brush rocker and diverter switch. The rocker is mounted on roller bearings, so that it will move with great ease, and, owing to this, and the great force exerted by the regulator, there is very little possibility of failure. In addition to the main spring, there are additional springs to prevent hunting and to provide for the even distribution of load between the machines. The changes in load on the system are not very rapid, and consequently the regulators are not adjusted for regulating at very great speed, but the type of regulator is capable of being adjusted for handling variations from no load to full load taking place in less than 1 second.

The generators are driven through an insulating coupling of the Zodel type, consisting of two disks fitted with pins and rollers for carrying the main forward driving belt, and the reverse belt which is necessary to enable the set to be started from the direct-current end and to keep the whole coupling rigid. This coupling has also a slipping member, which is essentially a disk form of clutch. This is set to slip when the load on the generator exceeds 25 per cent. overload. If the action of the governor could be made instantaneous, this slipping coupling would not be required; but it is a useful device to prevent damage to the generator, and, by slipping, it gives time for the regulator to bring the brushes to the right position to meet sudden changed conditions of load on the system.

In addition to the regulator, each generator is fitted with a short-circuiting switch and operating mechanism, which short-circuits the machine in the event of reversal of direction. This could happen under certain conditions; for instance, if the coupling belt broke on one generator out of several in series, this machine would pull up and reverse its direction; as soon as this occurred the switch would short-circuit the machine and cut it out of circuit. The operating switch shown in fig. 6 for putting the generator into circuit consists of a four-point rotary switch. This is mounted on a pillar, which also carries a carbon break switch, which works in parallel with the rotating switch in such a way as to prevent damage to the latter by the arc formed when the inductive circuit of the generator is opened. In addition, the pillar carries an ammeter to show the current given by the machine, and a voltmeter for measuring the volts across the terminals.

In addition to these switches on the machine, isolating switches are fitted under the floor for the purpose of disconnecting the machine switches from the circuit. These switches have all been

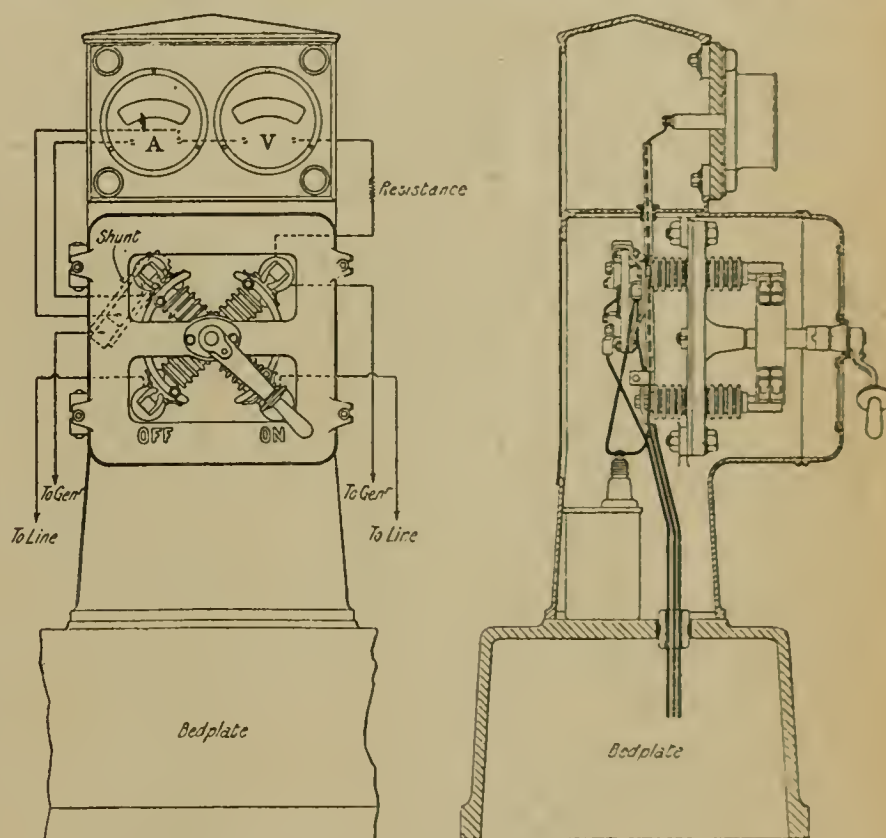


FIG. 6.—GENERATOR SWITCH AND INSTRUMENT PILLAR.

tested with a pressure of 110,000 volts alternating current, applied for about 10 minutes.

The generators themselves are carefully insulated from earth. The details of the foundations are shown in fig. 3. The generators are bolted to concrete blocks, which are supported on stoneware insulators embedded in highly insulating asphalt, the space round the beds being filled in with pure bitumen. This makes a very much sounder job both mechanically and electrically than the older method of supporting the machines on pot insulators.

The object of the whole design of the cable and gear inside the station is to make it practically immune from either mechanical or electrical breakdown; all live metal is doubly insulated from the point where the cables are attached to the switchboards.

The floor itself is constructed of concrete, on which asphalt to the thickness of 2 in. is laid with the greatest care in order to provide the highest possible insulation. Experiment indicated that a floor constructed in this way would require many hundreds of thousands of volts to produce a puncture.

A resistance of 0.8 megohm is fitted to the machine frame, the ends being connected across the terminals of the machine. The centre point of this resistance is connected to the frame of the machine, and, consequently, the total pressure between either pole and the frame is limited to half the pressure given by the machine, and an operator standing on the frame of the machine and touching one pole cannot receive more current than the high resistance will allow to pass. Guards are provided on each machine to prevent accidental contact between the insulated frame of the D.C. machines and the earthed frames of the A.C. motors.

Three motor-generators are now installed at the power station, two being fitted with A.C. motors for starting from the A.C. side; the third machine is always started by means of the D.C. generator.

The plant at Southall consists of three D.C. motors driving three 250-kw. generators supplying three-phase energy at 3,000 volts, 50 cycles, at a speed of 500 R.P.M.

Owing to the high speed at which these machines run, they are,



for their output, smaller, and the commutators are smaller than the generators at the power station. The motors drive the generators through an insulating coupling of a similar type to that used at the power station, but they are not provided with a slipping member. The speed of the machines is kept constant by a regulator of a similar type to that employed at the power station, with the exception that in place of the piston valve being controlled by a solenoid it is controlled by the pressure supplied by the oil turbine. This pressure is balanced against a spring. Since the pressure given by the turbine varies with the square of the speed, a very sensitive speed governor is obtained. Any increase in the speed of the turbine produces an increased pressure which acts on the piston valve which serves to convey the pressure to one or the other side of the gate which controls the position of the brushes. The motor regulator is provided with a supplementary spring, which prevents hunting in the same way as the springs on the generator regulators.

The switchgear in the sub-station is precisely similar to that in the power station, panels of the same type being fitted; the mains are carried to isolating switches from which cables are laid to the starting switches on the machines, the only difference being that ammeters are not required on the motors, and consequently are not fitted. The earthing switches are connected to the earth-plates in a similar way to those at Willesden.

The generators are connected to the main switchboard, from which the 3,000-volt feeders are carried.

(To be concluded.)

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,505. "Storing and charging of electric hand lamp and like, secondary batteries and apparatus therefor." W. MAURICE. May 28th.

12,509. "Means for and method of clearing faults on alternating-current systems." A. M. TAYLOR. (Addition to 27,560, 1911.) May 28th.

12,530. "Self-varnishing and fibre-insulating apparatus for covering bare electrical wires, wound direct from the apparatus into coils or used separately." L. FRENKEL. May 28th.

12,545. "Combined transmitters and receivers." W. B. THOMPSON. (Convention date, June 20th, 1911, United States.) May 28th. (Complete.)

12,547. "Telephone exchange systems." E. R. CORWIN. May 28th. (Complete.)

12,556. "Electric hand or pocket lamps." H. W. SCOTT. May 28th.

12,569. "Electric heating and cooking devices." R. F. VENNER. May 28th.

12,592. "Arc lamps." DEUTSCHE BECK BOGENLAMPEN-GESELLSCHAFT M.B.H. (Convention date, May 29th, 1911, Germany.) May 28th. (Complete.)

12,604. "Telephone repeaters." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) May 28th. (Complete.)

12,644. "Telephonic relays and the like." C. H. PRITCHARD. May 29th.

12,645. "Electric machines." W. CURLETT. May 29th.

12,653. "Electro-magnetic curtain-holder (designed especially for theatrical stage drapery curtain)." J. A. PROBST. May 29th.

12,679. "Trolley wheels for use on cars of overhead system electric railways." W. F. SVOVELAND and W. J. HENRY. May 29th.

12,680. "Apparatus for the operation of electrical clocks by electric waves." F. SCHNEIDER. (Divided application on 3,966/12, February 16th.) May 29th. (Complete.)

12,682. "Alternating-current distribution systems." S. D. STRONG and W. E. MCCOY. May 29th. (Complete.)

12,687. "Synchronous motors." L. ROUZET. May 29th. (Complete.)

12,692. "Incandescent lamp sockets." A. SCHUCHARDT. May 29th. (Complete.)

12,701. "Electric fuses." S. D. STRONG and W. E. MCCOY. May 29th. (Complete.)

12,709. "Telegraphic photography." C. STILLE. (Convention date, June 2nd, 1911, Germany.) May 29th. (Complete.)

12,713. "Lugs of accumulators." J. C. WOOD. May 30th.

12,728. "Petrol-electric transmissions." W. A. STEVENS. May 30th.

12,738. "Earthing arrangements for electrical systems." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, May 30th, 1911, Germany.) May 30th. (Complete.)

12,752. "Process for the manufacture of filaments of alloys of tungsten and the like metals." J. HUBERS. (Julius Pintsch Akt-Ges., Germany.) May 30th.

12,757. "Electrical apparatus for medical and other purposes and articles to which such apparatus may be applied." C. H. IVINSON and G. BRYANT. May 30th. (Complete.)

12,761. "Electric boat hoists." SIR W. G. ARMSTRONG, WHITWORTH & Co., LTD., and R. WRIGHT. May 30th.

12,764. "Devices for protecting telegraph lines against inductive action from neighbouring circuits." O. MOLL and P. KESCHWITZ. May 30th. (Complete.)

12,766. "Bi-polar form wound rotor windings." H. SCHNEIDER. May 30th. (Complete.)

12,775. "Thermo-electric piles or generators." SIR J. W. SWAN. May 30th.

12,784. "Processes of repairing electric incandescent lamps." MAXIM DU MOULIN. May 30th. (Complete.)

12,802. "Electric lamp lock for electric light holders." A. RICHARDS and J. BROCKLEBANK. May 31st.

12,809. "Spark plugs." H. J. C. FORRESTER. (Marshalltown Motor Material Manufacturing Co., United States.) May 31st. (Complete.)

12,833. "Electric conveyors or transporting devices." ELEKTROMOTORENWERKE HERMANN GRADENWITZ. (Convention date, May 31st, 1911, Germany.) May 31st. (Complete.)

12,834. "Means for and methods of charging and discharging electric accumulators or secondary batteries." A. M. TAYLOR. May 31st.

12,847. "Automatic switching system for telegraphy and the like, and apparatus for the same." J. GELL. May 31st.

12,892. "Friction-clutch gear for use in electric boat hoisting and other apparatus." J. FIELDING. June 1st.

12,908. "Prevention or control of excess voltages in electric conductors." F. A. BECKER. (Convention date, January 6th, 1912, Germany.) June 1st. (Complete.)

12,909. "Wall plugs or other couplings for electrical purposes." V. C. H. GIBSON. June 1st.

12,929. "Telephone indicating and metering apparatus." H. von LAS-KOWSKI. June 1st. (Complete.)

12,951. "Electric induction machines." Soc. ANON. MONTHARBON. Convention date, June 22nd, 1911, Belgium.) June 1st. (Complete.)

12,952. "Electric induction machines." Soc. ANON. MONTHARBON. (Addition to 12,951/11.) (Convention date, November 8th, 1911, Belgium.) June 1st. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

ELECTRIC WELDING OR SOLDERING. O. Kjellberg. 3,762. February 14th.

ELECTRIC SWITCHES. British Thomson-Houston Co. and E. B. Wedmore. 3,877. February 15th.

METHOD OF, AND MEANS FOR, VARYING ELECTRICAL CAPACITY AND INDUCTION. A. W. Isenthal. 11,209. May 9th.

ELECTROMAGNETICALLY-OPERATED DEVICES FOR CONTROLLING ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co.) 11,349. May 10th.

SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co.) 11,351. May 10th.

ELECTROPLATING. E. R. Royston. (Electro-chemical Rubber and Manufacturing Co.) 11,543. May 12th.

APPARATUS FOR MEASURING MECHANICAL POWER OUTPUT. E. C. R. Marks. (Siemens Schuckertwerke Ges.) 12,025. May 18th.

PROCESS AND APPARATUS FOR PRODUCING AND UTILISING MICRO MOVEMENTS, SUITABLE FOR TELEGRAPHIC, TELEPHONIC AND OTHER PURPOSES. J. A. Johnsen. 12,141. May 19th.

SHADE-HOLDERS FOR INCANDESCENT ELECTRIC LIGHTS AND THE LIKE. J. Watkinson and A. E. Payne. 12,571. May 24th.

ELECTRIC LIGHTING OF MOTOR ROAD VEHICLES AND THE LIKE. W. F. Grafton. 13,888. June 10th.

ELECTRIC MOTOR STARTERS. R. H. Barbour. 14,032. June 13th.

CAR LIGHTING OR LIKE SYSTEMS. United States Light and Heating Co. and W. E. Lake. 14,233. June 15th.

SWITCHES FOR CONTROLLING THE ELECTRIC LIGHTING SYSTEMS OF AUTOMOBILES. J. B. Brooks and W. Holt. 15,503. July 4th. (December 27th, 1911.)

ELECTRIC ARC LAMPS. Engineering and Arc Lamps, Ltd., and A. T. Dowdell. 16,678. July 20th.

DISTRIBUTORS OF MAGNETO-ELECTRIC MACHINES FOR INTERNAL-COMBUSTION ENGINES. B. Brooks and F. H. Alston. 16,878. July 24th.

REVERSING SWITCHES FOR ELECTRIC MOTORS. Easton Lift Co and J. Huggett. 16,919. July 24th.

TELEGRAPHIC SYSTEMS. P. Faiella. 17,151. July 26th. (July 30th, 1910. Addition to 4,920 of 1911.)

TELEPHONES. B. Gwozdz. 17,278. July 28th. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,300. July 28th. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,429. July 31st. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,530. August 1st. (Convention date not granted. Addition to 11,234 of 1911.)

HEATING MEMBER FOR THERMIC TELEPHONES. B. Gwozdz. 17,587. August 2nd. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,595. August 2nd. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,820. August 4th. (Convention date not granted. Addition to 11,234 of 1911.)

FIXING THE COVERS OF ELECTRICAL SWITCHES AND THE LIKE FITTINGS. H. J. Railing and G. H. Ide. 18,584. August 17th.

WIRE-COVERING MACHINES. British Thomson-Houston Co. (General Electric Co.) 18,949. August 23rd.

ELECTRIC MOTOR AND OTHER DRIVING ARRANGEMENTS FOR MACHINE TOOLS AND THE LIKE. J. Feyer. 19,162. August 26th.

PLUG AND SOCKET OR OTHER CONNECTIONS FOR ELECTRIC CIRCUITS. J. Lucas and F. Jenkins. 21,419. September 28th.

EMERGENCY BRAKE FOR TRAMCARS AND THE LIKE. E. J. McDeimid and G. Jenson. 24,504. November 4th.

PRODUCTION OF HIGH-GRADE STEEL AND SLAG, RICH IN SOLUBLE PHOSPHATES, IN AN OPEN HEARTH OR ELECTRIC FURNACE. Deutsch-Luxemburgische Bergwerksund Hutten Akt-Ges. and A. Vegler. 27,400. December 6th. (Addition to 19,640 of 1911.)

### 1912.

REGULATION OF DIRECT AND ALTERNATING-CURRENT DYNAMO-ELECTRIC GENERATORS. Siemens Schuckertwerke Ges. 3,924. February 16th. (February 18th, 1911.)

COVER FOR DIRECT-CURRENT ELECTRICITY METERS. Korting & Mathieson Akt-Ges. 4,535. February 23rd. (November 10th, 1911.)

WINDING OF THE ROTORS OF DYNAMO-ELECTRIC MACHINES. Siemens Schuckertwerke Ges. 7,574. March 28th. (March 28th, 1911.)

MOUNTING OF FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. Deutsche Gasgluhlicht Akt-Ges. (Aueres). 873. January 11th. (August 12th, 1911.)

TELEPHONE EXCHANGE SYSTEMS. P. Jensen. (Clement International Engineering Corporation.) 4,984. February 28th. (Divided application on 9,142 of 1911. April 12th.)

TELEPHONE EXCHANGE SYSTEMS. P. Jensen. (Clement International Engineering Corporation.) 5,877. March 8th. (Divided application on 9,142 of 1911. April 12th.)

RESONATING RELAYS. H. von Kramer and G. Kapp. 5,950. March 9th. (Addition to 10,856 of 1911.)

ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 6,500. March 15th.

**British-made Cables.**—At a meeting of the Southwark Borough Council on Thursday last week, Alderman Hewitt gave notice that at the next meeting he would propose that it be an instruction to the Electricity Committee that prices for the supply of cable be only obtained from firms whose works are in Great Britain.



THE  
ELECTRICAL REVIEW.

VOL. LXX.

JUNE 21, 1912.

No. 1,804.

ELECTRICAL REVIEW.

Vol. LXX.]	CONTENTS: June 21, 1912.	[No. 1,804.	Page
The I.M.E.A. Presidential Address	...	...	989
The King's English	...	...	990
The Waste of Compensation Money	...	...	990
The I.M.E.A. Bill	...	...	990
The Benevolent Institution	...	...	990
The I.M.E.A. Convention, 1912	...	...	991
Electrical Progress in Australia	...	...	994
Correspondence:—			
Electric Signs	...	...	994
An Objectionable Clause	...	...	994
The "National Code" in Canada	...	...	995
Indirect Lighting ( <i>illus.</i> )	...	...	995
Domestic Lighting and Heating...	...	...	995
The Inter-Relation of Capacity in Three-Phase Three-Core			
Cables ( <i>illus.</i> )	...	...	996
Parliamentary	...	...	997
Business Notes	...	...	997
Electric Driving in a Keighley Mill ( <i>illus.</i> )	...	...	1007
Notes from Canada	...	...	1010
Notes	...	...	1011
City Notes	...	...	1014
Stocks and Shares	...	...	1018
Market Quotations	...	...	1018
Share List of Electrical Companies	...	...	1019
Proceedings of Institutions:—			
The Transmission of Electrical Energy by Direct Current on the Series System ( <i>illus.</i> ) ( <i>concluded</i> )	...	...	1021
The I.E.E. Summer Meeting	...	...	1023
Legal	...	...	1025
New Electrical Devices, Fittings and Plant ( <i>illus.</i> )	...	...	1026
Our Legal Query Column	...	...	1027
New Patents Applied For, 1912	...	...	1028
Abstracts of Published Specifications	...	...	1028
Contractors' Column	...	Advertisement pages xxiv and xxvi	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE  
UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill London, E.C.

THE I.M.E.A. PRESIDENTIAL ADDRESS.

IN his address to the seventeenth annual convention of the Municipal Electrical Association, delivered at Harrogate on Tuesday of this week, Mr. George Wilkinson takes a brief survey of the history of the development of electricity supply, and indicates directions in which further developments may, in the future, be profitably made.

The address is couched in that lucid and graceful language which, although one may not always agree with his opinions, always makes it a pleasure to listen to Mr. Wilkinson's contributions to discussions at the meetings, both of the Incorporated Municipal Electrical Association and of the Institution of Electrical Engineers. Our readers will remember that, in the past, Mr. Wilkinson has turned his attention to various details of electrical work, and has brought out several ideas, some more successful than others, but all ingenious. Thus we are assured beforehand that an address penned by him will make interesting reading.

Turning from the address as a whole to the constituent parts of it, we are afraid that Mr. Wilkinson is a little over-sanguine when he says that "gas for internal illumination need no longer be regarded as a serious competitor in new districts." If this is the case in Harrogate, it must be very encouraging for the electricity undertaking, but it is not true in every case; nor, indeed, in the majority of cases. To take the not far distant city of Sheffield, for example, the price of gas is, as most people are aware, very low—1s. 3d. per 1,000 cb. ft. It is not even yet an easy matter to induce landlords to wire new houses, nor to ensure that, if they do so, all the tenants will use electricity at 4d. per unit for lighting. Any electricity supply authority where the price of gas is below 2s. per 1,000 cb. ft. is confronted with very serious competition in obtaining each new consumer.

Mr. Wilkinson's experience in the direction of street lighting, and with service cables of special design, is familiar to those who have read his papers presented to the I.E.E. After touching upon these points, he goes on to demonstrate that as metal lamps are much less responsive to voltage fluctuations than carbon lamps, the Board of Trade Regulations as to pressure variation might be relaxed in the ratio of, say, from four to six, thereby enabling some 50 per cent. more revenue to be obtained from the existing low-pressure mains.

Publicity and advertising are next dealt with, and we are reminded that the gas industry also is not standing still in this matter. All electricity supply authorities should give their whole-hearted support to this campaign, and support should come not only from the heart, but from the pocket. Reference is made to the I.M.E.A. Bill for wiring powers which was before Parliament until a few days ago. Opinions vary as to the merits of the proposal to give wiring powers to all municipalities. Mr. Wilkinson rightly says that "one of the greatest evils from which the *bona fide* contractor, and also the public, suffer, is that any person or small firm, regardless of training or fitness, is at liberty to start business as an electrical engineer and contractor." This



is truly a serious matter, and has been the subject of frequent comment, but nothing in the way of improving matters has been done by any of the bodies interested—the I.E.E., the B.E.A.M.A., or the E.C.A. It should be made impossible for any person to engage in electrical work without having passed the examination, corresponding to his age, of the Institution, and it should be compulsory for every electrical contracting firm to be registered, and capable of being guaranteed by the association registering it.

Power house economies next engage Mr. Wilkinson's attention, and we are far from wishing even to seem to detract from the importance of running the boiler house and engine room in the most efficient way. It has, however, been pointed out over and over again, that whereas the practicable economies in the power house are represented by a fraction of a penny per unit, careful distribution and—notably—the use of accurate meters and of care in maintaining them in an accurate condition, increase the revenue by several pence for every unit recovered. This matter receives no attention at all in this address. Indeed, the only reference to meters is contained in Mr. Pearce's paper, to which we shall refer in another article.

National power houses ought, Mr. Wilkinson thinks, to be erected on the coalfields. In this connection Mr. Highfield's paper, read at the Glasgow meeting of the I.E.E. last week, is interesting. Mr. Wilkinson hopes, as all must hope, for the coming of the large gas turbine. In the meantime he points out an opening for money-making in the sale of low-pressure steam. This is done in America to some extent, and gives better financial results than the expenditure of large amounts of capital on cooling towers and condensing plant.

The address contains much food for thought, and although presidential addresses are not open for formal discussion, we have no doubt that it will receive a great deal of attention among the members of the Association.

#### The King's English.

WE think it was one of the books of the "Wisdom While You Wait" series in which we found the remark: "Letters in the third person are more dignified, but they want watching." We are forcibly reminded of this need for watchfulness by the perusal of the I.M.E.A. papers. For reasons best known to itself the Council directs that all papers shall be written in the third person. The presidential address is allowed to be exempt, and the I.E.E. does not make any such stipulation. Of course, it is best to write impersonally, but this is not so easy. The references to "the author," "he" and "him" are miserable reading, and very often "the author" has been left pages behind when we reach the "he." Why cannot the I.M.E.A. allow the use of the first person? It would simplify matters considerably, and do no harm at all. There is an Editing Committee, but we suppose it does not condescend to deal with the literary merits of the papers. It certainly does not excise split infinitives and "and whiches." If the engineer of Limerick is asked to know something of Irish history and literature, it is surely not too much to expect that British engineers should write English correctly.

#### The Waste of Compensation Money.

PRIOR to the Compensation Act, 1906, it had become apparent that the system of paying lump sums to workmen was inexpedient from the point of view of the workman. He receives an amount which, even if well invested, can only bring in a very small income; and he is, therefore, tempted either to live upon his capital or to buy the goodwill of a business. Cases are frequently reported from which it appears that the workman who proposes to set up in business is generally misled as to the purchase price, and hopelessly fails to understand the business into which he is suddenly plunged. In a case recently heard at Sheffield, a workman who had received a sum of £170 by way of compensation for an accident, purchased a greengrocer's round, including a horse and dray, for £35. This turned out to be nothing but a hawking business, which was a hopeless failure. His next venture was the purchase of a green-

grocer's shop for £70, from which the vendor represented he was making a profit of £6 a week. He brought an action against this vendor for misrepresentation, but lost the action, and finally returned to work with his old employer. It was for the protection of workmen who squander their money in this fashion that the County Court Judges were authorised by the Act of 1906 to retain a lump sum and pay it out by instalments; but it is surprising what pressure is brought upon County Court Judges to make payment of a lump sum. We recall a case where a workman, to whom an employer was under no legal obligation, had a choice of accepting £30 down or a pension of 25s. a week. He actually chose the lump sum, and spent it in about a month!

#### The I.M.E.A. Bill.

ON Monday last, after having passed through the initial stages, the "Further Powers" Bill promoted by the Municipal Electrical Association came to an untimely end; it was, in fact, abandoned. No one, we think, who is interested in the electrical industry can do other than deplore the time, money and effort expended upon this ill-fated movement by promoters and opponents alike, more especially as, we believe, a reasonable compromise was within measurable distance of attainment. Agreement is essentially more permanent and satisfactory than compulsion in any form, and it would be far better for all parties if they resolved to permit no obstacle to prevent its achievement.

We cannot regard with favour the institution of wiring departments by electricity works in general; it may be contended that the larger undertakings can find continuous employment for the staff, and conduct the department on a commercially sound basis—though Woolwich is a notoriously disastrous warning to the contrary—but certainly small undertakings cannot hope to make a success of such a business; and not a few central station managers who possess the necessary powers prefer to leave them dormant and to do the work through contractors.

On the other hand, contractors in general do not wish, and cannot afford, to stock motors and other apparatus for hiring-out, whereas the electricity works can do this at cost, and reap their profit on the supply of energy, the policy which has proved so lucrative to the gas companies. Why, then, cannot the wiring be allotted to the contractors and the hiring to the supply authorities? An agreement on these lines ought not to present any great difficulties—it only calls for co-operation in place of competition.

In the meantime, great harm is being done to the industry by this continual strife, which, like most domestic quarrels, is based rather upon obstinacy and misunderstanding than upon any just grounds for contention.

#### The Benevolent Institution.

WE have received from the secretary of the Electrical Trades Benevolent Institution one of the collecting books suggested at the recent Festival, which should prove a valuable means of raising funds for the worthy objects of the Institution. Not only has the user the gratifying consciousness of *doing something* to aid the cause of charity, and that without cost to himself, but he also has the satisfaction of knowing that if he succeeds in collecting 10 guineas in one year, he becomes a Life Subscriber, with a vote, while if he succeeds in obtaining only £5, he is entitled to membership for one year. Thus he earns the right to a pension, should he fall on evil days. We earnestly commend this offer to the notice of our readers; there must be few establishments of any size in which 10 guineas cannot be got together in 12 months, especially if the donors be persuaded to contribute small sums at stated intervals: we may suggest, too, that where a number of persons combine on such a basis to make up the required sum by periodical payments, they be allowed to ballot for the life subscribership. Thus, nine men each paying 6d. a week would cover the amount without feeling the burden, with the certainty that one of them would receive the reward at the end of the year, and this would enlist the interest of the whole of the subscribers, instead of one only. The collecting-books can be obtained from the Secretary, 18, Park Mansions, Vauxhall Park, S.W.



## THE I.M.E.A. CONVENTION, 1912.

THE seventeenth Annual Convention of the I.M.E.A. was opened at Harrogate on Tuesday, when the Mayor, Councillor J. S. Rowntree (who is also a member of Council of the I.M.E.A.), welcomed a numerous attendance of members and visitors in the Kursaal. He said that he saw they had a number of interesting papers to discuss, and he hoped they would do all in their power to ensure that heating and cooking by electricity would out-distance rival methods and truthfully appeal to all.

The thanks of the President, Mr. Geo. Wilkinson, and of Bailie Willock having been duly accorded, Mr. Wilkinson read his presidential address, an abstract of which we print herewith. This was followed by a discussion (initiated by Mr. Frank Ayton) on "Means for Securing Reliability and Maintaining Continuity of Electricity Supply."

Mr. Ayton's remarks drew many expressions of opinion from fellow engineers, which left no doubt as to the necessity for adequately fusing mains networks, with a view to isolating faulty sections, but which also voiced the necessity of carrying out the work with discrimination. The feeder pillar received general approval, indeed, its advantages obviously outweigh anything which can be claimed for the pavement box.

The coal strike found an echo in the discussion, and has evidently served at least one useful purpose in reminding the engineer of the paramount importance of the coal pile and the storage possibilities of oil fuel.

After the luncheon adjournment, the meeting was resumed at the Hotel Majestic, when a lengthy discussion ensued on the papers by Mr. F. M. Long, on "A Cooking Load from the Supply Station Point of View," and by Mr. H. H. Holmes on "Electrical Cooking and Cooking Apparatus."

Mr. Long's paper introduced the question of something in the nature of a  $\frac{1}{2}$ d. tariff, and while the great majority of those present were apparently sceptical as to the practicability of such a low price being remunerative, it is noteworthy that about a dozen engineer enthusiasts have courageously adopted the  $\frac{1}{2}$ d. per unit rate for cooking—both with and without a fixed initial charge—and as they are perfectly satisfied with the results obtained, it is not unlikely that many others will follow suit. Whether as low a rate as  $\frac{1}{2}$ d. is material or not, it can scarcely be denied that its fairly general introduction will give an enormous impetus to electrical cooking, and it will then only remain for the maker of cooking apparatus to bring its cost down to reasonable and competitive proportions.

The discussion, so far as Mr. Holmes's paper was concerned, consisted mainly in a refutation of many of his remarks on stove construction by Mr. Grogan, who, of course, represents the "Tricity" interests, and, it must be admitted, speaks from long experience both as a user and maker.

The question of the "bright" as against the "insulated" stove claimed attention; while, in order to get over first cost difficulties, Mr. J. Christie suggested that surplus moneys, instead of going to rate relief, should be diverted to the purchase of cooking outfits, which, from his experience, would provide an excellent load if let out at the low rentals which would then be possible.

The discussion would, no doubt, have drawn many other speakers had time permitted, as there is much evidence that electric cooking is gaining support in every direction, only the lack of reliable information being a bar to more rapid progress.

In the evening a reception was held in the Royal Spa Rooms by invitation of the Mayor and Mayoress, and both this and the concert which followed were largely attended by the visitors.

On Wednesday the Association met at the Albert Hall, Leeds, being welcomed by Alderman Brown, chairman of the Electricity Committee, in the absence of the Lord Mayor. Mr. S. L. Pearce read his paper on "Limitation of

Rate Relief from Profits," and the discussion was opened by Alderman Bruce. The general trend of his and other speakers' remarks was unfavourable to the policy of rate relief from trading profits. Alderman Smith, of Liverpool, was a notable exception. The discussion was naturally an attractive one to the Council representatives, who nearly all deprecated Parliamentary interference. Mr. C. M. Shaw's paper on "Organization in Electrical Supply Undertakings" was then read before a depleted audience. Only a brief discussion followed. Mr. Shawfield said that it described the practice in vogue in vast American stations, adding, amidst applause, that all electricity supply accountancy should be in the hands of the electricity departments. Bailie Willock, Councillor Crowther and Alderman Smith, of Liverpool, continued the discussion, and Mr. Shaw briefly replied.

## Presidential Address.

By MR. GEORGE WILKINSON, Chief Electrical Engineer, Harrogate.

THE last few years have seen a conspicuous change in the duties of the municipal electrical engineer. In the earlier years of the industry, his chief concern was to see that the capacity of his generating plant increased at approximately the same rate as the demand. Little, if any, effort was necessary to obtain consumers, and the field of operation was rendered attractive by the presence of considerable numbers of comparatively large consumers. At a later stage, the convenience and adaptability of the electric motor for industrial work were recognised, and, in due course, conversion of horse tramways into electric tramroads gave another impetus to the business. A few years ago, due to the introduction of the gas mantle, it looked as if the gas authorities would regain a part of the lighting business. The advent of the metal electric lamp has, however, effectively neutralised any tendency of this kind, and gas for internal illumination need no longer be regarded as a serious competitor in new districts, nor in better-class areas where electricity supply is available.

With regard to street lighting, in the main thoroughfares of our larger cities, the old standard of lighting has become insufficient. In such thoroughfares, improvements call for the introduction of high-pressure gas lighting or flame arc lamps. In cases where access can be had to the accounts, it is found that flame arc lighting compares favourably with pressure-gas lighting, both in capital cost and maintenance, while the lighting effect is emphatically in favour of the electric lamp.

For side-street lighting, where the local authority controls both the gas and electricity undertakings, the economy of changing from the old illuminant to the new, excepting in new streets, has, I think, yet to be demonstrated. Examples of such conversions from gas to electric lighting may be seen in many streets in Harrogate. Out of a total number of 2,300 ordinary posts in the side streets, 650 have already been taken over and converted by the Electricity Department, at an average cost of 32s. per post, including all charges. The metal lamps are maintained by the lamp manufacturers at a fixed price per post per annum, and the cost of the lamp per annum, including lamp renewals, is the same as is paid for gas, excluding renewals.

As regards service cables, the minimum size allowed, under the latest revised regulations, at 1,000 amperes per square inch, has a carrying capacity of 7 amperes. At 200 volts such a service cable is capable of carrying 1.4 kW.

This regulation has for many years caused an extravagant waste of copper, and with metal-filament lamps the case is much worse.

One reason given for insisting on large service cable is the plea that conductors of smaller sectional area are mechanically weak. This is not so if such cables are made with the lead and return conductors arranged concentrically and enclosed in a lead tube.

For services to small properties, cottages and the like, the Harrogate Corporation have obtained the Board of Trade's permission to use concentric lead-covered cable consisting of 7/22 inner conductor, with an approximately equivalent section in the outer made up of 39/30 s.w.g. copper. For services to street lamps in side streets, permission is also granted to use a concentric lead-covered cable having a single No. 18 s.w.g. inner conductor with an equivalent aggregate section in the outer made up of No. 30 s.w.g. copper strands. The copper contained in these services is ample for all practical purposes. To prevent strain on them they are laid in wrought-iron tubing.

One valuable feature of this street lamp cable is that in no case can it develop a short-circuit on the distribution mains. On short-circuiting the service cable, the 1/18 inner conductor has, in every case, volatilised and disappeared, at once locating the fault.

The early modification of the Government Regulation with regard to service cables is a task to which I think this Association may with advantage address itself.

The clause in the Board of Trade Regulations relating to the permissible variation in electrical pressure at consumers' terminals has an important bearing upon the cost of distribution, and it is, in my opinion, another matter that calls for attention on the part of this and kindred associations.

A 4 per cent. + or - variation of electrical pressure on 200 volts, in terms of candle-power variation, is shown by the following table. In the same table is given the + and - electrical



pressure variation, which gives—within close limits—the same variation of candle-power in a 200-volt metal-filament lamp (tungsten):—

Carbon-Filament Lamp.		Metal-Filament Lamp (Tungsten).	
	Volts. c.p.		Volts. c.p.
4 % — pres. variation	192 33'6	7 % — pres. variation	186 32'7
	200 44'4		200 44'4
4 % + pres. variation	208 59'4	7'5 % + pres. variation	215 57'9

These figures show that for the same variation in light with metal lamps, the pressure variation may be increased approximately in the ratio of 4 to 6. The Official Regulations should be modified accordingly. Such modification will allow supply authorities to earn 50 per cent. more revenue without additional expenditure on L.P. mains, provided the increased load is imposed with approximate uniformity.

A leading feature in the management of supply undertakings in recent years has been the inauguration of a publicity and advertising campaign. In this connection much useful work has been done by the Electric Supply Publicity Committee.

At present the members consist exclusively of representatives from the metropolis and the south, and I venture to suggest that representatives from other parts of the country might be placed on the executive with advantage to all concerned.

With the same object in view and in the interests of a competitive industry, the Institution of Gas Engineers in the autumn of last year launched a new association called "The British Commercial Gas Association." This movement is apparently receiving strong support, and should be met by increased activity on the part of the electrical industry. With this end in view, there should be a closer alliance between all branches of the profession, including supply authorities, manufacturers and contractors.

The Further Powers' Bill appears to have met with favour from all branches of the industry, excepting from the wiring contractors, who, rightly or wrongly, look with alarm to the time when municipal authorities shall have powers comparable with those long enjoyed by the gas authorities.

It is difficult to see on what grounds Parliament can deny to certain municipal authorities what they have already granted to others. There is no doubt that when the Bill becomes an Act it will prove of substantial benefit to contractors as well as to the other interested parties.

The local contractors whose businesses were built up on the big wiring contracts cannot afford to canvass and develop a business in fitting up small properties—it does not pay; but when the Bill becomes law it will pay the supply authority to develop these large areas which, under existing conditions, it does not pay the electrical contractor to exploit, and, in turn, the contractor will benefit by carrying out the work on fair terms under the control and supervision of the supply authority.

On the question of economies in the generating station, the author points out that it is standard practice in some of our largest works to pass the same amount of cooling water through the condensers, irrespective of the load on the plant. The temperature of the condensed steam on a vacuum of 28 in. ought not to be below 95° F., and the amount of cooling water passed through the condenser should be regulated in accordance with the readings of a thermometer, so as to maintain the outlet temperature practically uniform under all variations of load.

The approximate value of 10° F. in the water being equal to 1 per cent. saving in fuel, recorded emission temperatures of 79° and 69° F. represent a coal loss of 1½ per cent. at full load and 2½ per cent. at half load.

Another loss easily avoidable is due to employing a hot well or feed-tank of too large a capacity.

Careful consideration will show that feed-water should be no hotter than the discharge temperature from the condensers, and in cases where there are no condensers the water in the feed-tank should be cold. The necessary minimum initial temperature of the feed-water passed through the economiser can be obtained by connecting a small pipe from the hot end of the economiser to the suction of the feed-pump. Actual experiments have proved that by this re-arrangement the economiser efficiency can easily be raised 10 per cent., which means a saving of approximately 1 per cent. in fuel.

It needs no argument to prove that steam-traps are exceedingly wasteful; if they are used at all, they should be of a type where the water, having once formed, remains quiescent during discharge with a small upper surface only exposed to the heating action of the steam.

It is satisfactory to note that the production of boiler furnace draught by means of hot gases ascending tall chimneys is on the wane, and the much more economical fan draught is being substituted, whereby the heat losses from the spent gases may often be halved.

Recent inquiries have revealed the astonishing amount of make-up feed water required in present day power houses. If water had been an expensive commodity, measures would have been taken long ago to curtail its use, with a corresponding saving in the coal account. Much of the make-up feed is accounted for in blowing-off the boilers, a process which wastes fuel, inasmuch as the water is blown out at full boiler temperature.

If the water put into the boilers were pure at the start, and if all steam evolved from it were put back into the boilers immediately on condensation, there would be no waste of water, no accumulation of scale, and no concentration of salts in the boilers. Blowing off would then be unnecessary. Further, no water-softening or purifying plant would be required.

This condition cannot be actually arrived at in practice, but it can be approximated to much more closely than at present. If all

the water from the steam range and separators is taken back to the boilers direct, and if the water from the air pumps of the surface condensers is taken through a closed pipe system, direct into the boilers, extra feed water in very small quantity will be required to make up for the losses by leakage from the steam seals on the turbine shaft-bearings, glands, and the like. Such make-up feed could with advantage and economy be pumped into closed cylindrical tanks, and there raised to the full steam temperature before passing on to the boiler; in these tanks the suspended matter and scale-forming impurities would be deposited, and they could be readily cleaned out when required. As to the gradual concentration of destructive salts or acids in the boilers, we should be able to rely upon the chemist to neutralise these, in a more direct and economical way than by blowing to waste large quantities of high-temperature water from the boilers.

Present day practice does not represent a final solution of the electricity supply problem. The multiplicity of power houses with their respective staffs is not economical.

National power houses, built on the coal fields and on other sites to which coal would be cheaply transported by water, would supply the power for all extensions in existing areas, and would gradually assume the whole of the supply, as the plants in local works became worn out or obsolete. They would also supply power for all industrial purposes and for locomotion, including the railways of the country. Thus the load and diversity factors would be high, with a corresponding beneficial effect in the reduction of costs.

Such power houses would be equipped with high-pressure steam turbo-generators of, say, 25,000 and 50,000 kw. sizes. The power houses would be interconnected and distribution effected at, say, 100,000 volts to sub-stations.

It is the generation of steam that calls for a radical change in present day practice.

The solution appears to lie in the introduction of gas firing, by means of flameless surface combustion on the lines first discovered by Sir Humphrey Davy, and more recently developed and set out by Prof. Bone in his lectures before the Royal Institution of Great Britain in 1911. So far as investigations have gone at present it is shown that an evaporative duty from boilers exceeding 20 lb. of steam per sq. ft. of heating surface can easily be obtained with a thermal efficiency corresponding to the transmission to the water in the boiler of nearly 95 per cent. of the energy represented by the net calorific value of the gas. At a slightly lower efficiency the evaporation may be increased from 20 lb. to 30 lb. of steam per sq. ft. On these high duties the internal boiler surfaces are stated to be self-cleaning, and the scale in thin flakes becomes detached, and is deposited in the bottom of the boiler. The boiler installation would be comparatively small and the steam range short, as all the auxiliaries would be driven by internal-combustion engines.

If in the future a gas turbine of larger power is developed, which proves more efficient than the steam turbine, it can be brought into use without waste of capital, or extensive scrapping of plant.

The manufacture of the gas will take place adjacent to the power-house, and the by-products will form a valuable asset against the cost of gas production.

A national electric power supply on the lines indicated would greatly minimise the disastrous effect of a coal strike, such as the country has recently suffered from. Low-grade fuel could also be profitably employed, which at present is dumped upon the pit banks as useless.

Many of the largest industries in the country, notably the cotton, woollen, dyeing, chemical, distilling and brewing trades, use immense quantities of low-pressure steam in their various manufacturing processes. Steam for such industries could be supplied from the national power-houses at less cost than it can be produced at by the manufacturers themselves.

There are many district steam heating schemes in operation in America, and in numbers of instances the revenue from the heat distribution is larger than that from the sale of electric power.

### Means for Securing Reliability and Maintaining Continuity of Supply.

Mr. Frank Ayton (of Ipswich), in introducing the above subject, contributes what is a short and very interesting paper to the practical man, who in these ultra-commercial days is apt to find his time fully occupied with matters other than engineering. The author's remarks are based upon his own experience, and bear on a variety of points in central station and distribution practice.

For instance, experiment at Ipswich has shown that with banked marine boilers of the dry-back type, by making the damper practically an air-tight fit in its frame, and keeping the brickwork air-tight, it is possible to reduce the pressure drop to at most 10 lb. between night and morning, and, moreover, the mere turning-over of the fires after opening the damper suffices in about 20 minutes to bring up the boiler pressure, no extra fuel being used. The hint is worth



considering for those stations where banked boilers are kept in readiness for emergency loads over considerable periods of light load. The author has fitted new dampers of the sliding type to all his boilers.

Next to claim attention is the question of signalling apparatus between driver, switchboard and boiler house. The author favours an electrical arrangement, if energised from a battery, in preference to the ordinary ship telegraph, but in this many engineers will not agree with him, in so far as simplicity and reliability are concerned.

A serious breakdown due to seizing on the engine of a 500-kw. Reavell set was traced to the presence of gritty dust in the funnel top of a cylinder flushing cup, the dust being carried into the cylinder along with the lubricating oil; the author has adopted the obvious remedy of providing protecting covers to cups and lubricators.

Turning to electrical matters, the Ipswich switchboard is provided with a set of battery excitation bus-bars for the generator panels, and links are provided on the latter by means of which the shunt field circuits can be separately excited on emergency occasions—as, for instance, when a reversal of polarity has occurred due to a short. A red board bearing the words “Not excited” is always suspended across the circuit-breakers of dead machines, in order to prevent attendants pulling wrong switches, and the author usefully suggests painting apparatus on adjacent panels different colours, in order to distinguish them.

He discarded nearly nine years ago the usual method of earthing the middle wire by a maximum current circuit-breaker shunted by a resistance, with a view to avoiding the effects of the momentary short before the breaker opens, and has since relied on a large resistance only, carrying 50 amperes with 230 volts across it.

In the case of the three-phase H.T. supply being introduced at Ipswich, the author has come to the conclusion not to earth the centre point, on the score of greater reliability with pressures up to 6,600 volts. He has found in the case of several 6,000-volt systems that the omission of earth has been advantageous.

The supply network probably offers more chances of interruption and trouble to the engineer than any other part of his multifarious plant, and discussing this question, Mr. Ayton says that on direct-current systems some engineers prefer to connect up solid without the intervention of any safety devices such as automatic circuit-breakers or fuses, right away from the switchboard bus-bars to the consumers' cut-outs. Of course, fuses on the mains to isolate one feeder district from another are required by the Board of Trade Regulations. On the other hand, there are some engineers who prefer to protect each feeder at the switchboard by either a fuse or an automatic circuit-breaker. Others go further and insert fuses in the connections to the distributors themselves, in the feeder boxes or pillars. The author thinks there are some who go further still and fuse each individual distributor at every point where it connects to adjacent distributors. In connection with his own undertaking, he has no protective devices between the bus-bars and the consumers' cut-outs, but his experience has led him to think that such an arrangement, from the point of view of maintaining continuity of supply, is not an altogether desirable one, especially in connection with a three-wire system. Anything in the nature of a dead short on the mains, as a rule, means a complete shut-down. In his opinion, feeders should be arranged, by means of time limit maximum circuit-breakers or fuses, to free themselves from the bus-bars in case of any serious fault.

On the question of pillars or underground disconnecting boxes, the author is not alone in preferring the former; he draws attention to the old, old defect, apparently not yet appreciated by some firms, of providing ventilating holes or keyholes in such positions as to enable a mischievous person to insert a wire and touch a live part. The practice of fixing a pair of high-rated fuses inside the service box for small street lamp connections, which are liable to damage, is commended, as with the usual arrangement of fuses in the lamp switch there is a risk of shorting or earthing the service conductors if the switch is removed, the alternative being to make the main dead for awhile. On only three occasions have the 25-ampere fuses in the service boxes blown.

The author also touches on the matter of inspection and

testing, and his remarks are sufficient evidence that even in these days of cut-and-dried practice, the latter can with advantage receive an occasional airing.

MR. W. W. LACKIE (Glasgow), following Mr. Ayton's remarks, said the first thing necessary to continuity of supply was a good coal heap. He outlined the features of a modern generating plant, pointing out the need for duplicating feed pumps, and the superfluity of providing ring steam mains. At Glasgow each alternator had its own exciter, and there was a stand-by motor-generator. While general duplication of feeders was unnecessary, network sections fed by isolated feeders could be fused to adjoining sections. In his own case two fuses in series were employed on some feeders, the smaller of the two for light loads being short-circuited during normal working. It was essential to have duplicate feeders between generating and sub-stations, and theatres were given two independent services, but one or two of them had installed a small battery sufficient for two hours' lighting in case of emergency, and this arrangement was preferable to a single large battery at the power station.

MR. ALEX. CRAMB (Croydon) drew attention to the importance of the employé—the majority of small failures being due to carelessness and neglect on the part of the employé. Unfortunately, it was difficult under municipal rule for engineers to enforce the strict discipline and care which was necessary to avoid such occurrences. The supply company's engineer was in a much superior position in this respect.

MR. H. H. COUZENS (Hampstead) mentioned that the auxiliary works supply at West Ham had been a difficulty, but a battery was being introduced which would automatically pick up the load if the main supply were shut down. As regarded the boiler question, in his experience it was more economical to run a number of boilers lightly, and thus have a large reserve of steam at hand almost immediately; the boiler efficiency did not suffer much down to about half-load.

MR. H. RICHARDSON (Dundee) strongly recommended the fusing of all feeders, according to the number of consumers and the load. Fusing required discrimination and observation of the conductors at the fusing points. After some experience of shut-downs due to breakage of switch pillars, he was going in entirely for underground boxes, but he admitted that conditions varied in different towns.

MR. H. R. BURNETT (Barrow) thought most engineers were agreed that feeders should be taken to pillars and then fused—underground boxes had been discarded by most people. He suggested that a demand indicator should be placed in the pillar for a week or so in order to indicate the load conditions for the fuses.

MR. J. CHRISTIE (Brighton) condemned the practice of using very small exciters to large alternators. At Brighton the exciters were very much underloaded, and the commutators and machines gave no trouble; he also disagreed with the use of excitation pressures of 50 or 60 volts, feeling that under present-day conditions there was no reason why from 200 to 250 volts should not be used. The ship telegraph was, in his opinion, much preferable to electric signalling in the central station.

MR. J. K. BRYDGES (Eastbourne) voiced his preference for the switch pillar as against the underground box. He believed in fusing, and thought it was almost compulsory now; it was necessary and advantageous, from the pressure point of view, to link adjoining networks by small fuses, which would blow and isolate faulty sections in emergencies.

MR. C. FURNESS (Blackpool) thought that discussion might more profitably centre on the question of fuel supply and the boiler house in view of the recent coal strike. In his opinion, the steam side was the most liable to failure.

MR. CARR (Leek) emphasised the value of the Diesel engine during the strike, pointing out the facility of oil storage.

MR. S. J. WATSON (Bury) was surprised to find any advocate of underground street boxes, which, in frosty weather, sometimes required two hours' thawing in order to get the lids off.

ALD. SMITH (Liverpool) felt that it was futile to keep coal bunkers full, if stokers were liable to go on strike at any minute, as had been the experience in his city. He felt that in such cases there should be no reinstatement of strikers, except under special circumstances.

ALD. BRUCE (Sunderland) and ALD. CROWTHER (Sheffield) and other Council representatives also referred to the coal strike, and MR. AYTON briefly replied to certain points raised.

(To be continued.)

**Tramways Exhibition.**—According to a report in the *Light Railway and Tramway Journal* it is proposed to hold an exhibition of tramway appliances in the depot paint shop of the West Ham Corporation tramways, on the occasion of the Municipal Tramways Association's annual conference at West Ham next September. A definite period will be fixed on the afternoons of September 25th and 26th for inspection of the exhibits by the delegates. A meeting of firms interested was recently held. Mr. W. Hopkins, of the West Ham tramways department, is hon. secretary and treasurer of a committee that has been appointed to carry out the arrangements. Mr. H. E. Blair, the president of the Association, will act as chairman of the committee.



ELECTRICAL PROGRESS IN AUSTRALIA.

[FROM A SPECIAL CORRESPONDENT.]

MELBOURNE, May 8th.

MR. O. W. BRAIN, President of the Electrical Association of New South Wales, in his address to the members of the Association on Friday evening, May 3rd, reviewed the progress made in electrical matters in Australia during the 21 years that the Association has been in existence. In 1891 all the electric lighting in Sydney consisted of private plants in two newspaper offices, five hotels, three arcades, and seven or eight small installations. Now the Sydney City Council supplies current to 14 municipalities, while a private company supplies five others. The total supply in New South Wales is equivalent to 764,000 60-watt lamps. The employes engaged in the work of installing, operating, maintaining and repairing the electrical equipment of the State (not counting the telegraph and telephone staffs) has risen from 160 to about 8,000.

A comparison of the progress made in the various States of the Commonwealth during the period under review is—

	Electric supply in 60-w. lamps.		Total generating plant.	
	1891.	1912.	1891. KW.	1912. KW.
New South Wales ...	10,000	764,000	600	56,389
Victoria ...	31,000	616,300	1,680	20,660
South Australia ...	300	200,000	20	9,150
Queensland ...	6,000	114,600	450	8,212
Western Australia ...	100*	210,000	3	16,000
Tasmania ...	30	84,000	3	6,500
Total ...	47,430	1,988,900	2,758	116,902

These figures are eloquent of the stagnation of Victoria and Queensland, and the progressiveness of New South Wales and Western Australia. The backwardness of Victoria, and the go-a-headness of her great rival, are evidenced, too, in the figures showing the electric traction of the States to-day. Twenty-one years ago there were in the whole of Australia only three cars in service, now the figures are :—

New South Wales ...	1,017
South Australia ...	180
Queensland ...	125
Victoria ...	120
Western Australia ...	105
Tasmania ...	45
Total ...	1,592

During the current financial year 130 new cars have been put into service on the New South Wales Government lines, 10 more than are in service in the whole of Victoria ; and the orders for the next financial year exceed this year's by 50 per cent. The electrical equipment, axles and tires are imported from England, but the complete cars, under-frames and trucks are constructed and equipped in the State. The Ultimo power plant has been increased to over 30,000 KW., and an order has been given for the first instalment of machinery for a new power house now being constructed at White Bay, with provision for ten 7,000-KW. units, capable of carrying a load of 100,000 H.P. Provision is being made at this new station for the use of more than 1,000 tons of coal daily, equal to almost the total daily consumption on the Victorian railways. The station is designed for construction and operation in complete separate units, so that pace may the more easily be kept with engineering progress.

**Greenwich L.C.C. Power Plant.**—In the report of the L.C.C. Highways Committee, it is stated that the cylinders of one of the reciprocating engines at the Greenwich generating station have recently become irregularly worn, and during the Whitsuntide recess they arranged with the makers, Messrs. John Musgrave and Sons, Ltd., for the cylinders to be rebored and new pistons and piston rings to be fitted at a cost of £147, the Council supplying certain unskilled labour, the cost of which will amount to a further £25. The company has in addition guaranteed a saving in steam economy of £1 per KW.-hour, which will amount to from £180 to £190 a year.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Signs.

We have read with interest Mr. Cooper's article on "Electrical Signs as Advertising Media," and while wholly agreeing with him, would like to point out that the lack of animated and novelty signs in England is not due to any want of push by electrical sign builders. One of the most difficult problems is to convince an English advertiser that a sign can be built embodying practically any suggestion for a moving advertisement consistent with the specialities which he wishes to advertise. The writing type of sign and change-colour letter has now been on the market over ten years and save for an occasional one or two since put up here and there, the matter has been practically at a standstill from that time. The greatest difficulty to surmount is the objection which the London County Council have to any electric signs ; no signs are allowed to be fixed on the roof, and no signs are allowed to have any intermittent flashing arrangement on any licensed premises. The only chance there is to have anything of a moving description, is on premises which are not under the licence of the L.C.C.

Another drawback also is that should a scheme be submitted to the advertiser which meets with his approval, he will more often than not practically promise the order providing that the sign builder can find him a position in perhaps either Piccadilly Circus or Leicester Square or some other spot where it is almost impossible to get any more signs fixed, as, although there may be space enough for a small sign, there is nothing to be had for a sign of such size as would be required for a picture sign.

In order to overcome these difficulties, after much experimenting we have succeeded in bringing out animated signs illuminated with our well-known L.C.P. lamps and patent holders. These are considerably cheaper than signs with ordinary lamps, and they are being readily taken up by a number of well-known firms who advertise. We have at present in our shops several animated signs in the course of manufacture, one illustrating a firework display, another a cascade, and a repeat order of the clown sign that we recently fitted in the Strand.

Regarding the last paragraph of Mr. Cooper's article, we are constantly having visits from "enterprising foreigners" with ideas that will revolutionise the sign business of England, but as these gentlemen do not know quite what has to be contended with, we have no fear that there will be any "snapping up" of the English sign business.

The Franco-British Electrical Co., Ltd.,

A. H. BRACKENSIECK, Secretary.

London, W., June 13th, 1912.

An Objectionable Clause.

The amount of twaddle that has appeared under the heading of "An Objectionable Clause" is hardly understandable. It is either an attempt to bluff your readers into believing the Electrical Trades Union is a combination that is out to rob contractors, bring them to the Bankruptcy Court, do bad work, in fact, play the part of wreckers generally, or else to give our Society a cheap advertisement. The E.T.U. have a trade card for the London district, and the reading of the clause, to my mind, is that the contractor shall recognise the said card. Otherwise we might have a member of the E.C.A. employing men under the standard rate, and sending in their (the E.C.A.) card in excuse of non-compliance with a "Fair Wage Clause," with the usual "Didn't know," &c.

What a howl has gone up, because for once the Electrical Trades Union has got a fair show. The clause is objectionable, wicked, an attempt to rob the poor contractor, &c. Mr. Collins would not only like to have this said clause knocked out, but also all reference to Trade Unions, leaving it to the "fairness" of the contractors (and believe me I know some of their fairness) what rate should be paid. He



also would like the contractor to be the arbitrator, and not the Trade Unions. To an outsider it would very much suggest "Codlin's the friend, not Short."

My Society have to thank both "Fairplay" and Mr. Collins for suggested rules for our new London trade card which is in course of construction, also for their illuminating ideas of what the Electrical Trades Union really is.

W. J. Webb,  
Electrical Trades Union.

London, S.W., June 15th.

#### The "National Code" in Canada.

I have read with some interest and no little amusement and considerable regret the effusions printed in your excellent journal on the "National Code." I regret that it seems quite impossible for Englishmen to become familiar with conditions before condemning everything in sight.

I am quite prepared to say, with all sincerity, that my experience has taught me that, in the long run or last analysis, the real Englishman is the very best bird of the kind. For real genuine worth, honesty and aggressiveness, he is, *par excellence*, "it." I am an English Canuck, so can afford to lay it on thick; nevertheless, we owe much to the "hearts of oak."

The newly arrived Englishman is aptly described by a reference to a scene I witnessed in the well-known comedy, "The Rich Mr. Hoggenheimer," where the newly arrived Englishman walks down the gangway, and before having seen anything of America whatever, places his monocle to his eye, and says, "Ah! this America, eh? Beastly place."

Now, the National Code is the consensus of opinion in America, and has grown from the natural soil, and brings forth the flowers that are best suited to the surroundings. True, the Code has not dwelt very much on the life hazard, but in the last edition there is little left undone in this respect. A real good job done under close inspection, and thoroughly in accordance with the Code, is nothing to be ashamed of.

As to the laboratories being pro-American; English, American, Canadian and German companies doing business in this part of the world all support these laboratories, and their geographical location on the map should not be used as an argument against them. Certain standards have developed as the result of years of experience, the particulars of which are printed to the minutest details.

All the American and Canadian manufacturers have worked out their products to comply with these rules, and the underwriters very fairly stand behind them, not entirely to benefit themselves, but as a protection to the trade also. The result is that perfect satisfaction exists between both parties.

Incidentally, the contractors know just what they can use and what they cannot. Now, the Englishman comes along with his stuff (material) and says, "We use this and that in England" by special appointment to King George, and that should be final, but the underwriters, very ungraciously, no doubt, think they know as much about wiring as "Royalty," and this is said with due deference to our beloved King.

If England wants the trade here, she must come here and make the goods here, and if prices are right then all will be well. One more point, and that is, that by far the larger percentage of fittings are made here, not 90 per cent. as stated being made in the States. Practically all the wire used here is made here, and what isn't made here is sold here by local supply houses doing business here.

The underwriters' laboratories are probably the finest, best equipped and most capably manned institutions of their kind in the world, and anyone submitting material there will get a square deal. They have the reputation of being absolutely fair from coast to coast, and I think rightly deserve it.

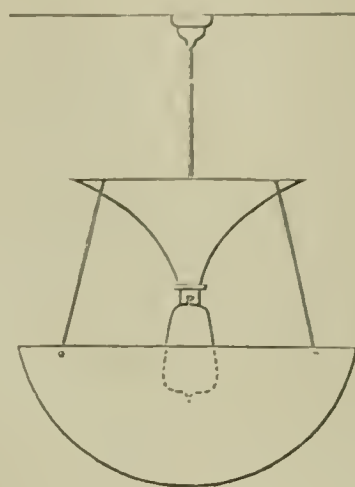
The Province of Ontario will probably have the latest regulations when completed, and if they in their wisdom see fit to establish purely Ontario laboratories, no doubt things will change, but so long as the Underwriters' are the only established and accepted rules, it is only fair when adopting them, to abide by them and treat all people alike.

Canuck.

Canada, June 4th, 1912.

#### Indirect Lighting.

Mr. Whistlefield's article on indirect lighting of rooms is not before its time. Last October I made an opal bowl by cutting round an arc lamp globe, and drilled three holes in the rim for suspension from a "Witelite" opal reflector. I wrote to several firms asking if they could supply opal bowls



about 9 in. diameter, and only one firm could take the matter up; they sent me a German catalogue illustrating such fittings.

I think the time has passed when the public appreciated a glaring lamp, and there is a future for some simple indirect lighting fittings; they will increase the lighting load.

The "Witelite" opal reflector I refer to has a neat curve, and is about 6 in. diameter, and is reversed when fixed on the holder.

I enclose a sketch of the fitting, and should be pleased to have the addresses of firms that could supply such opal bowls.

Resident Engineer.

Electricity Works, Stoke,  
June 17th, 1912.

#### DOMESTIC LIGHTING AND HEATING.

By "AN OUTSIDER."

THE public is not yet completely educated on questions of economy in its lighting bills; or, at least, its education is not yet up-to-date. The central station engineers cannot be held responsible, as they are so intelligently alive to their true interests as to try their best on all occasions to show how the customers' bills may be reduced. This is not due to altruism, but to the competition of gas, which promptly takes advantage of the least dissatisfaction on the part of the consumer to persuade him to go back to the rival illuminant.

The writer knows well a newly-built district where, as a general rule, gas piping and wiring are both installed, so that this competition has free play. If the electric lighting company only hears in time of any contemplated change from electricity to gas, it is speedily on the scene with practical and sound advice; but sometimes it loses a customer, and only hears of the fact too late.

The voltage is 240, and many of the residents have installed transformers to bring it down to 50, and are enjoying the full benefit of metallic-filament lamps. There are still, however, large numbers who use the full pressure, and carbon lamps; and these are occasionally the prey of the incandescent-gas man.

Apparently, they never think of applying to the electric light company for advice; but they become dissatisfied (naturally enough) with their quarterly bills, and change over to gas with but little persuasion.

The advantages of a gas cooker at a nominal rent, and a geyser for the bath water, generally weigh in pretty heavily.

The electric light engineers now spend their evenings after dark walking round the district and "spotting" the carbon-filament lamps in the homes, and then they give their advice unsolicited. Now they are pushing the new



high-voltage metallic-filament lamps, and pointing out that it is no longer necessary to transform down from 240 volts, but not everybody is aware of the fact; and, of those who are, some object to the higher price of the high-voltage lamps.

Among those who have transformers, it is safe to say that not one in ten knows that there are stand-by losses in connection with them. Naturally, they do not switch off at the main during the night, because the bedroom lights must be available; and they never think of switching off in the daytime either, because they do not know that the transformer is costing them something whether the lights are on or not.

In a recent case a heating circuit has been put in, at the high pressure, of course, and a transformer is being retained for the lighting circuit, or rather the downstairs portion of it. The question arose whether the transformer should be removed, and high-pressure lamps adopted all over.

The disadvantages of this course were, first, the necessity of scrapping the transformer, and a whole outfit of lamps, already installed; and, second, a little uncertainty in the mind of the customer as to the durability of the high-voltage metallic filament in small lamps.

In the end it was decided to put carbon-filament lamps in the bedrooms on the high-voltage circuit, as the usage of these lamps is so short each night that the loss as compared with metallic filaments will not be heavy; and the bedroom lamps are, under this arrangement, always ready for use.

The downstairs lamps are all metallic-filament 50-volt lamps, and are on the transformer, which is shut down at the main switch at all times, except the evening hours when the sitting-room lamps are required.

The heating circuit is available for cooking both in kitchen and dining room, and for heating in several other rooms upstairs and down, and the plug connections on the heating circuit are also available for driving an electric vacuum cleaner or similar plant. There is, of course, a separate meter and a lower price for the heating current.

In the house referred to, the great hot-water question still remains unsolved, and, for the present, the kitchen fire-back boiler must pursue its wicked career.

In spite of all the enterprise and energy of the electrical men, there is still some better organisation required for bringing them on to the scene in time, especially when a new house is being built.

Architects, as a rule, do not specify very closely the detailed requirements of the electric lighting outfit. As for the builder, he is generally in favour of the system which gives him the least trouble and expense in the first instance, thereby fulfilling the law of his being. And it is amazing to watch in a new house going up, how, owing to a lack of design and foresight in the first instance, so much of the work has to be done twice over.

The different trades seem to take a positive delight in destroying one another's work. The wireman takes his leads in the roof right across a trap-door, and has to be brought back to alter them. The plasterer cheerfully plasters down everything, including bell wires and electric conductors. The electric fittings man has to hack down most of the wall to find them again, and then the plasterer is again sent for to make good. Finally, the main connections are made by the company after the house is finished, for which purpose holes are broken through walls, tiled floors ripped up, and quite a lot of finished work destroyed.

In the end, the job gets "muddled through," and gives satisfaction; and such an installation is fairly proofed against the gas interest, except in the matter of the hot water, which is still a very weak point in the armour of the electrician.

**Superheaters and Recorders.**—Among the orders recently received by the SUN PATENT EVAPORATOR CO., LTD., of Liverpool, are the following: Sun patent superheaters for the Hoylake and Wallasey Electricity Departments; Sun patent turbo pumps for various firms, and Albion recorders for Bombay Electricity Department; Charing Cross Electricity Co.; Manhattan Corporation, N.Y.; South Metropolitan Electricity Department; Wandsworth Gas Co.; Midland power station, and many other works.

## THE INTER-RELATION OF CAPACITY IN THREE-PHASE THREE-CORE CABLES.

By W. T. MACCALL, M.Sc., A.M.I.E.E.

THE following points may prove useful in continuation of Mr. A. B. Clark's article published in the ELECTRICAL REVIEW of April 5th (p. 532):—

While it is possible to obtain the capacities between each core and the sheath ( $K_1$ ), and between each pair of cores ( $K_2$ ), from the results of any two capacity tests (with one exception mentioned below), difficulty in working out the values is avoided by choosing these tests from the following:—

No.	Between	and	Capacity.	
1.	One core	sheath and other two cores.	$K_1 + 2 K_2$ .	Fig. 2
2.	Three cores	sheath.	$3 K_1$ .	Fig. 3.
3.	One core	another core.	$\frac{1}{2} (K_1 + 3 K_2)$ .	Fig. 6.
4.	One core	the other two cores.	$\frac{2}{3} K_1 + 2 K_2$ .	Fig. 7.
5.	Two cores	third core and sheath.	$2 K_1 + 2 K_2$ .	Fig. 9

The figures are from Mr. Clark's paper (reprinted for reference).

N.B.—In Test No. 3 it makes no difference whether the third core is connected to the sheath or not, since they are both at a potential midway between those of the cores under test.

The capacity measured in Test 3 is three-quarters of that in Test 4, hence only one of these may be included in the two chosen, if the determination of the separate values of

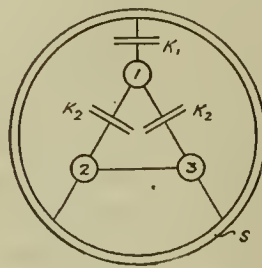


FIG. 2.

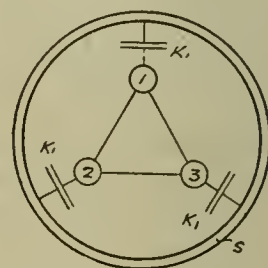


FIG. 3.

$K_1$  and  $K_2$  is desired. This theoretical ratio is confirmed by Mr. Clark's measurements, which give ratios of .75, .73, .75, and .745 respectively.

For the purpose of obtaining the capacity current which a cable will take when in use, a single measurement of capacity is sufficient. For it can be shown that the capacity current for sinusoidal waves is given by the formula—

$$C = p (K_1 + 3 K_2) E = p (K_1 + 3 K_2) E^1 / \sqrt{3},$$

where  $C$  = capacity current per core (in microamperes if the capacities are in microfarads);

$p = 2 \pi \times \text{frequency};$

$E^1 = \text{line voltage};$

$E = \text{voltage to star point.}$

Now,  $K_1 + 3 K_2$  is twice the capacity obtained by Method 3, and  $1\frac{1}{2}$  times that obtained by Method 4. Hence a single measurement by either of these methods is sufficient for calculating the capacity current.

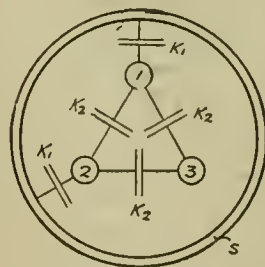


FIG. 6.

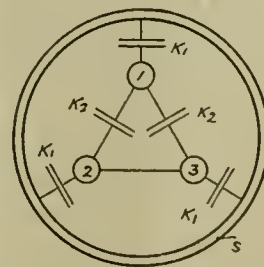


FIG. 7.

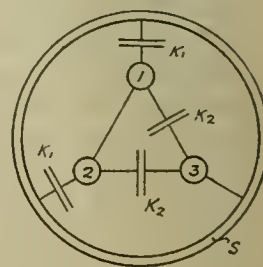


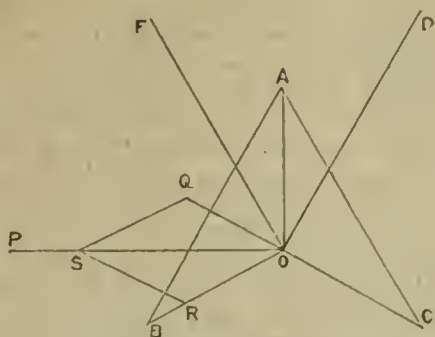
FIG. 9.

Thus it appears to be advisable to employ one of these methods in all cases; and to use one of the other three tests tabulated (preferably No. 2), when it is desirable to determine  $K_1$  and  $K_2$  separately, *e.g.*, for voltage waves differing considerably from the sine form.

The proof of the above formula is as follows:—Let  $O A$ ,  $O B$ ,  $O C$  in the accompanying vector diagram represent the (equal) voltages of the three cores above the sheath (star point). Then the current in line No. 1, due to the capacity



$\kappa_1$  between it and the sheath, is  $p \kappa_1 E$ , and leads  $OA$  by a right angle, as shown by  $OP$ .



The voltage of Core 1 above Core 2 is represented by  $BA$ , or by  $OD$  parallel to  $BA$ , and its magnitude is  $\sqrt{3} E$ . Hence the current due to the capacity  $\kappa_2$  between Cores 1 and 2 is  $\sqrt{3} p \kappa_2 E$ , leading  $OD$  by a right angle as represented by  $OQ$ ; thus  $Q$  lies in  $CO$  produced.

Similarly, the voltage of Core 1 above Core 3 is represented by  $CA$  or  $OF$ , and the corresponding capacity current is again of magnitude  $\sqrt{3} p \kappa_2 E$ . It leads  $OF$  by a right angle, and is represented by  $OR$ ; thus  $R$  lies in  $OB$ . Since  $OQ$  and  $OR$  are equal and inclined at  $60^\circ$ , the vector sum ( $OS$ ) of  $OQ$  and  $OR$  is  $\sqrt{3} OQ = 3 p \kappa_2 E$ , and bisects the angle  $QOR$ , and thus is in phase with  $OP$ . Hence the total capacity current per line, which is the vector sum of  $OP$ ,  $OQ$  and  $OR$ , is  $OP + OS = p \kappa_1 E + 3 p \kappa_2 E = p (\kappa_1 + 3 \kappa_2) E / \sqrt{3}$ , as stated above.

## PARLIAMENTARY.

### L.C.C. Tramways.

A SELECT COMMITTEE of the House of Commons, presided over by Sir Luke White, commenced the consideration of the L.C.C. Tramways and Improvements Bill before the Whitsuntide recess, and concluded its deliberations on June 11th. The Bill as originally framed proposed the construction of new tramways as follows:—(1) Double line between the existing tramways in Wood Lane and Harrow Road, *via* a new street, Walmer Road, Silchester Road, Clarendon Road, Cornwall Road, Westbourne Park Road and Perchester Road; (2) Double line between the existing tramways in Hampstead Road and Euston Road, *via* Euston Road; (3) Double line between the existing tramways in Essex Road and Kingland Road, *via* Englefield Road and Stamford Road; (4) Double line extension of existing tramways in Farringdon Road, along Farringdon Road and Farringdon Street; (5) Double line between the existing tramways in High Street, Shoreditch, and in Bishopsgate, *via* Norton Folgate and Bishopsgate; (6) Partly double and partly single line extension of the existing tramways in Tooley Street; (7) Double line between the existing tramways at Rushy Green and in Bromley Road; (8) Additional single line of tramways in South Lambeth Road. Proposals (2, 3 and 4) failed on Standing Orders, and the Council, in view of local opposition, themselves dropped the proposals in (1).

There was a good deal of opposition to the proposed extension in Tooley Street from owners and occupiers of warehouses, but the Committee decided to pass the proposal after visiting the spot in order to acquaint themselves with the neighbourhood and the conditions of the traffic. The tramways will thus be brought to a point some 300 yards nearer to London Bridge than the present terminus in Tooley Street, and the estimated cost of the extension is £6,900.

The Bill also contained a clause giving the Council power to run trailer cars on any of their tramways. Mr. Pollock, K.C., for the Council, stated that these trailer cars were needed to cope with the morning and evening rush traffic. He explained that the Board of Trade sanctioned the use of coupled cars in 1905 for the purpose of carrying stores in the morning and evening—following on experiments. Further experiments were made last year, but in August the Commissioner of Police, without whose licence those cars could not be run, refused to allow them to continue, on the ground that there was no convenience which would compensate for the obstruction and danger of accident.

MAJOR PRINGLE, giving evidence on behalf of the Board of Trade, said that the Department objected to the proposed clause, in that it contained no limit as to the number of trailer cars which could be run. They were strongly opposed to running more than one trailer, and only the leading car ought to have motive power on it. The hours of use, too, should be limited; the type of car should be determined upon, and the routes should be subject to the approval of the Board of Trade. He also thought that the Department should be given power to deal with the question of brake power and speed.

After hearing further evidence for and against the proposal, the CHAIRMAN announced that the Committee were unanimously of

opinion that the preamble of the Bill had been proved, subject to the following conditions—that trailer-cars and coupled-cars should be fitted with brakes approved by the Board of Trade; that no trailer or coupled carriage should be used by the Council unless it had been approved by the Department; that there be no more than two cars linked together except by consent of the Board of Trade, and that the motor should be attached to the leading car only.

**Kidderminster Local Government Board Order.**—The Local Government Board Order relating to the extension of the borough boundaries of Kidderminster, which has been submitted to the House, contains the following provisions:—"So much of the area of supply under the Stourport and Kidderminster Electric Lighting Order, 1906, as is added to the existing borough under this order shall be added to the area of supply under the Kidderminster Electric Lighting Order, 1891, and the provisions of the last-mentioned order, and of the indenture of the transfer, dated May 5th, 1899, and made between the Corporation and the Kidderminster and District Electric Light and Traction Co., Ltd., shall apply thereto in lieu of the provisions of the Stourport and Kidderminster Electric Light Order, 1906."

**Newton-in-Makerfield Urban District Council Electrical Supply.**—Viscount Wolmer asked the Parliamentary Secretary to the Board of Trade whether the application of the Newton-in-Makerfield U.D.C. for a provisional order to authorise them to generate and supply electricity, had been refused on the ground that there was an insufficient local demand for electricity; if so, whether he could state how great a demand would have to be guaranteed by local consumers, and for how long, to enable the Board of Trade to reconsider their decision; and whether any other conditions would have to be fulfilled before that decision was reconsidered, and if so, what conditions. Mr. Robertson said that the answer to the first question was in the affirmative. The report of the consulting engineer of the Council showed that the success depended on certain large commercial firms taking a supply of electricity for power purposes, there being, in his opinion, no probability of any considerable demand for lighting purposes, and the Council were unable to satisfy the Board that they would be able to supply at a price which would secure these firms as consumers without imposing a burden on the rates. It was not possible for him to state definitely what demand would be sufficient to justify the Board in granting an order, and, in any case, he could not hold out any hopes of an order being granted this session.

**Board of Trade Electricity Orders.**—Viscount Wolmer asked the Under Secretary to the Board of Trade, whether he would publish a return of the orders granted by the Board of Trade during the last three years to local authorities to enable them to supply electricity in their localities, showing in each instance the population, the rateable value, the amount of local rates and indebtedness, and the nature and number of any guarantees forthcoming that the estimated demands for units of electricity by consumers would be taken by such consumers over certain periods of years, and other considerations that led the Board of Trade to sanction such orders. —Mr. Robertson said, in reply, that he did not think it possible to tabulate in a return the guarantees or considerations which had led the Board of Trade to make provisional orders authorising local authorities to supply electricity. A return could be prepared showing the population, rateable value, local rates and indebtedness in each case, but he doubted if it would be of sufficient interest to justify the expense.

**Second and Third Readings.**—In the House of Commons on June 13th the National Electric Construction Co.'s Bill was read a second time.

In the House of Lords on June 12th, the Loch Ericht Water and Electric Power Bill was read a second time.

The Ramsbottom Urban District Railless Traction Bill was read a third time.

## BUSINESS NOTES.

**Consular Notes.—Italy.**—The British Vice-Consul at Messina reports that the steam tramway services between Messina and Barcelona northwards, and between Messina and Giampiglieri southwards, were resumed during last summer, and had contributed in no small measure to the general well-being of the community. On both these lines steam will be replaced by electric traction shortly, and the existing services will be quadrupled.

The British Consul at Genoa reports that the Riviera Electric Supply Co. at Bordighera (a British concern) is steadily increasing its supply of electric energy, especially with regard to the application of electric power for irrigating the flower gardens. This company has extended its distribution of electric power to the neighbouring small towns of Camporosso and San Biagio, and another important extension is nearly completed from Ventimiglia, Latte, La Mortola, Grimaldi, and Balzi Rossi. The Società Elettrica Riviera di Ponente, with a paid-up capital of 10,000,000 lire (£400,000) has two hydro-electric power stations up the Roja Valley, above Ventimiglia; these stations produce respectively 10,000 and 6,500 H.P. Besides these the company is building a more powerful station higher up the same valley at San Dalmazzo, which will produce 50,000 H.P. The electric energy is distributed over the provinces of Porto Maurizio and Genoa.

The British Vice-Consul at Savona reports that a company has



been formed for the construction and working of an electric tramway line from Savona to Vado. This line is nearly completed, and will be ready for use early in 1912. The fare is 5 centimes per kilometre with a maximum of 30 centimes for the whole distance, which is about 7 kiloms. A new service of motor-omnibuses has been opened between Savona and Altare. With this exception, communication with the neighbouring towns and villages is still carried on by omnibuses drawn by two or three horses, but it is anticipated that most of these will shortly be superseded by motor-omnibuses.

The British Vice-Consul at Spezia reports that, after shipbuilding, the next most prosperous trade in the district in 1911 was the building trade. During the year several large blocks of flats sprang up. Many of these flats contain bathrooms, and nearly all are provided with the necessary fittings for illumination by electricity. Electric light was also installed in many of the older apartment houses, which have now become more desirable as places of residence. The telephone company, too, has extended its circle of subscribers, the number of whom, at the end of the year 1911, had reached 380. From the central office in Spezia, communication can be made with Genoa, Rome and other of the larger Italian towns.

The Austrian Consul at Milan, in a recent report, gives the following figures as showing the spread of the utilisation of electrical energy from 1895 to 1910, the figures being given in horse-power:—

	<i>Hydro-electric.</i>	<i>Steam.</i>	<i>Total.</i>
1895	... 25,000	—	—
1900	... 82,000	—	—
1902	... 92,000	65,000	157,000
1904	... 139,000	100,000	239,000
1905	... 190,000	125,000	315,000
1906	... 245,000	155,000	400,000
1907	... 383,000	195,000	578,000
1908	... 409,000	225,000	634,000
1909	... 510,000	240,000	750,000
1910	... 725,000	275,000	1,000,000

Lighting by electricity is rapidly spreading throughout Italy, and is more and more superseding all other kinds of lighting on account of the constant increase of power plants using water-power and the use of metallic filament lamps. About 12,000,000 electric incandescent lamps are used annually in Italy, of which the greater proportion is still imported from abroad, and notably from Germany, Austria, Switzerland, Holland, France, &c., although there are now works in Italy exclusively engaged in the production of these lamps. The better class glassware for electric lighting is imported chiefly from Austria and the cheaper varieties also from Germany. The greater part of the demand for brass and bronze fittings is covered by a considerable home industry, and only a few specialities and novelties are imported from abroad.

**Venezuela.**—The British Consul at Ciudad Bolivar reports that during 1911 an electrical plant was provided by a local company, and since the end of July of that year the town has been lighted by electricity.

**Servia.**—The Austrian Consul at Belgrade reports that the imports of steam engines, motors, and similar machines for power purposes in 1910, amounted to 1,063,143 kilogs, valued at 1,103,575 dinars, of which 356,125 dinars were from Germany, 331,630 dinars from Austria, and 385,150 dinars from the United Kingdom (a large increase). The use of motors is rapidly spreading and competition is keen. The imports of dynamos and electric motors amounted in value to 162,993, a decrease as compared with the previous year; France supplied 122,553 dinars and Germany 37,365 dinars. The imports of transformers, accumulators, condensers, and electrodes are not important, and amounted in value to 51,854 dinars in 1910, almost equally from Germany and Austria. The imports of electrical cables and wire were valued at 74,237 dinars of which Germany supplied about two-thirds, and Austria about one-third. Telegraph and telephone apparatus, meters, rheostats, microphones, &c., accounted for 115,390 dinars, chiefly from Germany, France, and Belgium; there was a large decrease as compared with the previous year owing to the fact that in that year large orders were completed for the Belgrade municipal telephone system. Arc lamps accounted for 5,502 dinars, and incandescent lamps for 189,719 dinars; imports are chiefly from Germany in arc lamps, and from Austria and Germany in incandescent lamps.

**Poland.**—The Austrian Consul at Warsaw points out in a recent report that Austrian firms take a very important share in the trade in steam engines and turbines in his district. The demand at present is limited owing to the fact that new works are slow in appearing, but a large development of the trade is to be expected in the near future, and the Consul advises Austrian firms to keep a close watch on the market in order to take advantage of any opportunities which may present themselves.

Later in his report the Consul points out that Warsaw is the seat of a fairly large lamp industry, four big works with Austrian capital being engaged. The production in 1910 was valued at about 2½ million roubles, of which three-quarters was sold in Russia. The goods produced are ordinary cooking lamps, all kinds of cast-iron hanging and table lamps, brass lamps, fine bronze work for gas and electric lighting. Many articles, such as brass hanging lamps which, five years ago, were being imported largely from Germany, are now being produced in Poland in good qualities. Nevertheless, there is still a large importation of lighting materials for gas and electricity, of which Germany supplies about 90 per cent.

**South Africa.**—The Austrian Consul at Johannesburg in a recent report refers to the fact that with the erection of the Victoria Falls and Transvaal Power Co.'s works and the Rand Mines

Power Supply Co.'s works at Brakpan, Simmer Pan and Rosherville, the electrification of the Witwatersrand has begun. Within a short space of time the use of electricity in the gold mines will be general. The above works are designed to produce 125,000 H.P. The demand for machinery and cables for these works has been extremely large, and has strongly influenced the total imports. As German capital was largely invested in the Victoria Falls Power Co., the demand for machinery, &c., has been to a great extent supplied by German houses, and the figures for 1910 showed that out of the total imports of electrical machinery valued at £803,168, Germany was credited with £479,617. The demand for electrical material, cooking apparatus, lamps, &c., in Johannesburg and district has grown tremendously, and will still extend if current for household use is cheapened, as will probably be the case. In no other district is the taste more up-to-date. Not only are the most modern cooking utensils required, but art lamps of all kinds are in strong demand, particularly taking into consideration the relative smallness of the population. The imports of electric lamps, and particularly metal-filament lamps are also growing rapidly, and Austrian firms are advised that they will find in South Africa excellent opportunities for their goods. The Consul also states that if Austrian firms would produce a lamp under a branded name, and advertise it well, they would be amply repaid in the South African market. In the trade in machinery and similar goods, a technical representative on the spot is absolutely essential.

**France.**—The British Vice-Consul at Caen reports that the electric lighting which has been installed along the canal there is a great improvement, and is much appreciated. The light is provided by a Westinghouse apparatus; but though the lights are sufficient from Caen to Culix and Bensenville, beyond these places they are insufficient. On dark nights some sharp bends of the canal make navigation difficult.

The British Consul at Rouen reports that firms wishing to do business with France should express themselves in a clear and detailed manner, which, should they employ an agent, would enable the latter to answer at once all questions which a client is likely to ask from the supplier. It is necessary that all answers to inquiries should specify:—

1. The price per article, per dozen or gross, or per lb., cwt., &c., for goods taken at the works.
2. The cost of packing, and the cost of transport, separately, from the works to the British port.
3. The commission, the discount, and the terms of payment.
4. For all industrial supplies the necessary dimensions, and for machinery the space occupied, the diameter, and the width of the driving pulleys, the practical speed, approximate production, and H.P. required.
5. The gross and net weights are indispensable for the calculation of the transport weights and Customs duty. In the case of crates, cases, &c., weighing over one ton, the weight of the heaviest parcel is necessary.
6. The shortest date of delivery which can be promised *without fail* should be indicated.
7. When possible, all offers should be accompanied by samples, as many articles are only accepted on presentation of the same.

Catalogues or price lists, preferably in French, should be sent; circulars about 8½ in. by 10½ in., are the most practical, and the most appreciated.

**Greece.**—The British Consul at the Piræus reports that the publication in the Government *Gazette* of invitations for tenders for supplies to the Greek Government is made at such short notice that, in the majority of cases, there is no time for British manufacturers (not already represented on the spot) to compete. It frequently occurs that not more than a week elapses between the appearance of the Government *Gazette* and the date of the submission of tenders. This is especially so with reference to yearly supplies for the various services. Certain agents are aware of the approximate dates when supplies will be required, and they take steps accordingly, but so far as general competitors are concerned, the Government *Gazette*, as a source of information, is valueless. In the case of contracts for public works more time is given, but the original specification is frequently incomplete or faulty, so that further details must be obtained before a definite offer can be made. In some instances supplementary specifications are issued, but, in general, application must be made to the department concerned.

**Mexico.**—The British Vice-Consul at Tuxpan reports that in general the United States control the commercial situation there both as regards imports and exports. This is owing to the proximity of the American markets and also to the energy of the American traveller. American goods of all kinds, as a general rule, are made to sell on their appearance, although, on the average, they are inferior to goods of British manufacture, to say nothing of the inferiority in packing. Owing to carelessness in packing and despatching cases from America, cases are often broken or damaged and the contents partly missing, either having been stolen or merely having fallen out and been lost. The contrary is the case with British goods, which show a marked superiority. Nevertheless, American firms continue to get business, and from inquiries made by the Consul in the United Kingdom, it appears that the reason is that British firms are unwilling to give credit, claiming that profits are too small to allow of it. For certain parts of Mexico, however, where so much delay is experienced in the arrival of merchandise, it is necessary to give three months' credit.

**Hungary.**—The British Consul-General in Buda-Pest reports that although there are many first-rate business houses in Hungary, care should be taken to ascertain the reputation of firms. It is difficult to do business promptly; patience is required, and representatives of British firms might with advantage remain at Buda-Pest longer and study the commercial habits of the Hungarians with greater care. Credit inquiry agents at Buda-Pest are not always reliable. The



Consul is convinced that with more energy on the part of British traders larger business might be done. The prices of many British articles—making every allowance for duty, transport, risk, &c.—are so high at Buda-Pest, that it is thought that a general store, supplied with only good-class reasonably cheap British goods, might have a marked success. The Hungarian, as a rule, does not seem to understand that to sell a 100 articles with a small profit may pay better than to make a high profit on 10. In general, genuine British goods are at present only retailed by the larger firms, which charge partly according to their position and reputation. Great numbers of sham British goods are sold in the smaller shops at prices which should command fair qualities of the genuine article. The Consul suggests for the consideration of British firms interested, that their circulars, price lists, &c., should be translated either into Hungarian preferably, or German, giving equivalents of English weights, measures, and prices in the metric system. Cash payments on delivery in wholesale business are not usual in Hungary: British merchants should, therefore, be prepared to give credit, the length of which varies in the different trades. The British Vice-Consul at Koloszar, himself a Hungarian merchant, reports that the soundest method of conducting business with Hungary would be to include freight and duty in prices, as is already done by some Continental firms. It should be borne in mind that the success that has been attained by some Continental commercial travellers in Hungary is said to be due in part to their greater efficiency, as well as to the long credit allowed by the firms which they represent.

**Bolivia.**—The British Vice-Consul at La Paz, reports that goods which have to be forwarded to the interior of Bolivia require to be especially strongly packed, as they will be carried on muleback, and will receive extremely rough handling. Cases should be marked *via* either Mollendo or Antofagasta, and, in addition, should bear the words, "En Transito para Bolivia," as well as the actual address in clear lettering. The usual credits given are three and six months. Several complaints have reached the British Legation at La Paz during the past year as to people to whom undue credit has been given by British firms, and who have not met the drafts when presented. The only advice which can be proffered to meet such cases is that British firms should not do business with unknown persons without first making due inquiry. In all cases it is best to do business only with the larger importing houses. During the past year several of the larger British firms doing business on the West Coast of America have opened offices in La Paz or Oruro, and a merchant who is opening up trade with Bolivia as a new departure might do well to correspond with them or their agents in the United Kingdom, before seeking to do business elsewhere.

The British Vice-Consul at Sucre also reports that some measure of credit must be given to traders in Bolivia if business is to be extended. German and French importers understand this, and avail themselves fully of the advantages of taking apparent risks. They also know that even some unpunctuality in the payment of bills is not always discreditable in some of their customers, as it is scarcely to be expected that people who are not habitually punctual in most things should always be so in this, as a matter of principle. The above remark does not imply that such unpunctuality should be extensively tolerated—a proceeding which would undoubtedly lead to much abuse—but that this circumstance, taken by itself, does not afford sufficient grounds to justify the total withdrawal of credit. The very nature of the country, with all its uncertainties in the matter of communications and transport, conduces to unpunctuality. As a case in point, bills at 90 days' sight sent for collection at the time of shipment of goods, with bill of lading and invoices attached, would be expected to fall due about the same time that the goods arrived, yet sometimes the goods only arrive several months after.

The Vice-Consul has been acquainted with the business of two banks for many years, and can testify that foreign bills of this class very rarely have to be protested for want of payment.

**Rubber Manufacture for Electrical Purposes in Japan.**—The *Board of Trade Journal* prints the following information from the report of H.M. Commercial Attaché at Yokohama (Mr. E. F. Crowe) on the trade of Japan in 1911, which will shortly be issued:—"In the electrical department of the rubber industry considerable progress has been made in Japan. The mills that exist have more capital than the majority of the mechanical rubber factories, the copper mine owners being connected with all the insulated wire mills, either as owners or as suppliers of the raw material. In the latter case they assist the mills by allowing credit on the sale of bare wire. The immediate future of the rubber industry is very much more promising in this branch of manufacture than in the mechanical branch. The one difficulty with which the mills have to contend is the lack of experienced technical men. They have up-to-date machinery, but the industry is so young in Japan that there are no native-trained rubber chemists. Several mills have experimented with foreign instructors, but the result has not been satisfactory in most cases, owing to the inability of the instructors to make themselves understood, and the inadequacy of interpreters for this purpose. The difficulty is one which will doubtless disappear as time enables the technical men to acquire their experience, but many costly mistakes have been made. The manufacture of insulated wire has already had its influence in checking the import of European rubber-covered wire, and, in addition to this manufacture, three of the largest mills have installed plants for making lead-covered telephone and high-tension cables. Although this is hardly directly connected with the rubber industry, the fact that mills have branched out in this direction merits attention, as having a bearing on the future importation of high-tension cables from abroad."

**Manufacturing in France.**—The report of the Ateliers de Constructions Electriques du Nord et de l'Est of Jeumont, whose share capital was increased from £500,000 to £1,000,000 during 1911, states that the year was a period of great activity, and the works were extended by the addition of a steel foundry and wire-drawing and rolling mill. The value of the turnover increased from £184,000 in 1910 to £508,000 last year, whilst that in the new financial year would be considerably greater owing to the extensions of plant and the abundance of orders on the books for all departments. Among the latter were orders in connection with the conversion of the Paris suburban railways, the Western State Railway and various tramways: the Nantes Electricity Co. had ordered various turbo-alternators of large powers, and the single-phase locomotive of 1,500 H.P. submitted in the competition opened by the Southern Railway Co. had successfully undergone the severe trials to which it had been subjected. The Bordeaux Chamber of Commerce, which had previously obtained from the company four electric cranes with alternating-current motors, had ordered 16 further cranes. An enlargement of the pig-iron and bronze foundry had taken place, the steel foundry and its two open hearth furnaces were started early in 1912, and the electric furnace was on the point of being put into operation, whilst the wire-drawing mill, which was first set to work in April, was now at full output. The gross profits earned in 1911 amounted to £84,000, as compared with £77,000 in the previous year. After meeting general expenses and allocating £22,000 to depreciation, as against £20,000, the accounts show net profits of £59,900, as contrasted with £54,700 in 1910. It is proposed to pay a dividend of 12s. per share (6 per cent.), as compared with 11s. 3d. per share in the preceding year.

**Electrical Trade in Finland.**—The following information is from the report by H.M. Consul at Helsingfors (Mr. V. Kestell Cornish) on the trade of that district in 1911, which will shortly be issued: All goods connected with electrical machinery, &c., are supplied by Germany in far greater quantities than by the United Kingdom, with whom Sweden also competes in this trade. There does not appear at present to be any means by which the British import trade can be improved in such articles as telephones (received exclusively from Sweden), lamps, bells and other apparatus; but in electrical machinery, motors, &c., the United Kingdom might well compete, and is doing so to some extent, although the import is as yet insignificant. It should be noted in this connection that Finland is a country with great wealth in water-power, and that turbines and electrical machinery must needs be used in large quantities. It, therefore, appears extremely probable that the import of the latter goods will improve, as it is considered that the local factories will not be able to meet the demand. There should thus be an opening for a thorough study of the Finnish market in this trade, and for an attempt to supply, if possible, the particular article required. The British share of the imports of suction gas and other motors is important, and, it is considered, might be improved. It is difficult to say whether the import trade in this line developed in 1911, as no separate statistics are available, but it should be mentioned that motors of all kinds are largely employed in Helsingfors for boats and cars, and also in the building industry, &c.—*Board of Trade Journal*.

**Catalogues and Lists.**—THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Folder No. 229 entitled "Cooling Breezes," giving a few particulars with illustrations and prices of their electric fans, bracket and desk types (oscillating and non-oscillating), for the 1912 season.

THE "ALBION" RECORDERS CO., 427, Tower Buildings, Water Street, Liverpool.—Folder containing particulars and prices of the "Albion" CO<sub>2</sub> combustion meter and recorder, and showing some typical records.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—18-page list containing tabulated sizes, weights, and prices, &c., of an extensive range of wires, cables, and flexible cords for lighting and power work, &c., including rubber-insulated wires, lead-covered ditto, flexible wires, both single and twin, including various types of armoured flexibles, also flexible wires with earth return to comply with Home Office requirements. Motor-car flexible, bell wires, &c., are also priced. All B.T.H. wires and cables are manufactured according to C.M.A. specification, and in both 2,500 and 600-megohm grades. A table gives particulars of copper conductors, and it is followed by another showing the maximum number of Mazda lamps of various sizes that can be connected to any particular size of cable, and also suitable casing or conduit for two conductors of any given size. The company holds large stocks of cables, &c., at Mazda House in London, and at its branches.

MESSRS. MATHER & PLATT, LTD., Park Works, Manchester.—Twelve-page pamphlet containing an illustrated description of their system of electric train lighting and its working, also showing the parts of the equipment, and giving dimensional drawings. The information is very detailed with explanatory line diagrams and half-tone views, and it should be of service to all interested in the subject of train lighting.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, London, N.E.—Price list D 4 (28 pages) second edition, dealing with all types of Holophane glassware now obtainable, together with the Holophane Benjamin steel reflector for "Wotan" and tantalum lamps. The Benjamin reflectors are designed to obtain an even diffusion of light on similar lines to that obtained by Holophane glassware, and they are made in the extensive, intensive, and focusing patterns in similar manner to the glassware. They are of special service in outside positions, workshops, large warehouses and stores where glassware is impossible on



account of its fragility. In this edition of the list there is also included their new type of household Holophane glass reflector, which we understand looks very effective on the ordinary type of electrolier which is largely used in private houses. Large stocks are held of the material shown in this list.

MESSRS. KRUPKA & JACOBY, 11, Queen Victoria Street, London, E.C.—Circulars giving prices of table, bracket, ceiling, and portable fans, also "Graetzin" metal-filament lamps.

MESSRS. ISARIA, LTD., 208, Tower Bridge Road, London, S.E.—Leaflets giving illustrations of, and brief information relating to, electric fans and instruments: also one giving prices of "Isaria" metallic-filament lamps.

THE ELECTRIC CONSTRUCTION CO., LTD., 9, New Broad Street, London, E.C.—Sheet No. B/285 giving an illustrated description of their E.C.C. oil-immersed starters for C.C. motors.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—Leaflet No. 30 describing and showing Hatry's patent indicating fuse bridge, which allows of a fuse being easily replaced in the dark. It is used at hotels and hospitals, and large stocks are held.

**Dissolutions and Liquidations.**—GLOBE ELECTRIC CO., LTD., 11, Farringdon Avenue, E.C.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors in this matter was held at the Cannon Street Hotel on Tuesday last, when Mr. Ernest C. Pegler, F.C.A., liquidator of the company, presided. A statement of affairs as regards creditors, and disclosing the position as at June 3rd, 1912, was presented, showing liabilities to unsecured creditors £2,301, of which £1,418 was due to ordinary trade creditors and £884 to Mr. K. Weinert. There was stated to be a contingent creditor for a claim for damages for breach of contract, but the amount was put down on the statement as unascertained, and the liquidator stated that he would deal with the matter later in the meeting. The assets consisted of cash at bankers and in hand £493; bills receivable estimated to produce £239; stock estimated to produce £450; furniture, fixture, &c., £30; debtors (good), £1,316; doubtful and bad, £430 (estimated to produce £50), making total assets of £2,578. From this amount had to be deducted mortgage debentures for £2,000, and rent recoverable by distraint £57, making together £2,057, and thus leaving a surplus of assets subject to the costs of realisation available to meet claims of unsecured creditors of £520, or a deficiency as regards creditors of £1,781. The statement showed that first mortgage debentures had been issued amounting to £1,000, and second mortgage debentures to a similar amount. The chairman said that the company went into liquidation on June 3rd, and by the resolution passed he had been appointed liquidator of the company. The company had been formed in April, 1909, for the purpose of dealing in arc lamps, and in the autumn of 1910, or a little earlier than that, negotiations were entered into with a German firm, which resulted in a contract being signed in substitution of a previous agreement. That contract provided, or agreed for the supply, by Mr. Weinert of what were called Multax Century Lamps—i.e., arc lamps designed to burn from 80 to 100 hours. That was a form of lamp which had not apparently been produced, and for which there was a very large demand in America. The Globe Co. had entered into a contract with Messrs. Fox Bros., a firm in America, to supply this lamp, and the contract was certainly one which was favourable to the Globe Co. if it could have been duly fulfilled, and would have undoubtedly resulted in considerable profits accruing to the company, and might, and probably would, have avoided the position that had now arisen. Unfortunately, however, Mr. Weinert found himself unable to fulfil his part of the agreement, and as a result the Globe Co. found themselves unable to deliver the lamps to Messrs. Fox Bros., although they made from time to time numerous endeavours to get Mr. Weinert to fulfil his contract; but all they received, apparently, were promises of deliveries. However that might be, the lamps could not be delivered, and ultimately Messrs. Fox Bros. put in a claim against the Globe Co. for £5,000 damages for breach of contract. The Globe Co. found themselves in a difficulty to meet this claim, and eventually it was decided to consult counsel and obtain advice. Counsel's opinion was therefore taken, and this was to the effect that the company should go into liquidation. This, said the chairman, was shortly the origin of the company going into liquidation; it was due to the failure on the company's part to fulfil their contract with the American firm, and to the failure on the part of Mr. Weinert to fulfil his contract with the Globe Co. Proceeding, the liquidator said that the American firm in question were substantial people, and good evidence had been given of this. There could be no doubt that a very large demand had existed in America for this lamp, and could it have been produced, as had been hoped and believed, the very large orders that would have resulted would have brought a large profit to this company. A creditor asked whether the liquidator was suing Mr. Weinert. The chairman replied that he had not commenced any action, and he did not want to take any actual steps until this meeting of creditors had been held. He had, however, informed Mr. Weinert that he was not delivering up to him the consignment stock which was estimated to produce £1,000, and which was held as security against the company's claim. He had also informed Mr. Weinert that the company would have a substantial claim to make. With regard to Mr. Weinert, he repudiated all liability under his contract, and he claimed about £1,500, which he contended the company owed to him, so that at the present moment they could not be said to be exactly in agreement. It would depend largely upon subsequent events as to what actually happened. Whether he remained as liquidator, however, or whether any other liquidator were appointed, it would be his duty to consider the position as regard Mr. Weinert very seriously.

Mr. Scholey asked why Mr. Weinert had not carried out his

contract, and the chairman replied that the reason was because of technical difficulties, and, as he understood it, they could not get the combination of long-burning hours and satisfactory behaviour as well from the lamps.

Mr. Scholey asked whether the directors had not satisfied themselves as to that in the first instance, before entering into a contract. The chairman replied that he believed a sample lamp was sent over and was found to be satisfactory, but it could not be reproduced. Definite representations were made by Mr. Weinert that he could produce this lamp, and the sample had been tested up to a point in the presence of a representative of the American firm who also expressed himself satisfied, so that Messrs. Fox Bros. were in possession of full knowledge of the whole matter. Information was then sought by creditors as to who were the debenture-holders. The liquidator replied that the first debenture of £1,000 was issued on January 10th, 1912, to Mr. S. J. Atkinson, who was one of the directors, the consideration being for cash. The reason why this debenture was issued was because it was imperative that the company should have further capital, and the directors were still in hopes at the time that it would be possible to obtain from Mr. Weinert a lamp which would fulfil the conditions that were required, and under which circumstances they would have been able to enter into negotiations again with Messrs. Fox Bros. The only possible means of enabling the company to carry on for a certain time was that it should have further capital, and this debenture had been issued in pursuance of that. The second debentures were issued on the next day as to £500 to Mr. Atkinson and £500 to Mr. Schmahl. The £500 debenture to Mr. Atkinson was for cash advanced by him, and it was part of the arrangement under which the £1,000 was advanced to the company that Mr. Atkinson should receive a first mortgage for £1,000 and a second mortgage for the £500. In regard to Mr. Schmahl, £250 of this was in respect of cash and the remainder his remuneration as a director which had not been paid to him for some time. Mr. Scholey asked for information as to when the unsecured creditors' debts were incurred, and the chairman said that he was unable to give details of this. The last balance-sheet of the company, according to his recollection, showed the position as at March 31st, 1910, and he believed that it showed a small loss. With regard to the share capital, as to which another creditor asked for information, the total capital was about £2,102; £500 was issued as fully paid and the rest for cash. There was nothing owing in respect of share capital at present. Asked as to what the £500 represented, the chairman said £250 was for goodwill and £250 for stock.

A Creditor: Who was the vendor?—The Chairman: Mr. Santoni.

Later in the meeting a representative of the firm of Michael Abrahams & Sons, solicitors, stated that he represented Mr. Weinert, and as his client had been to some extent the scapegoat, he thought it was fair that he should put his client's position before the meeting. He said that he had seen the agreement between Mr. Weinert and the Globe Electric Co., and he was satisfied that there was no breach of the agreement whatever. His client's claim against the company was £1,488, and there was stock belonging to his client of the value of £1,900. The agreement between his client and the Globe Co. distinctly provided that no debentures should be issued to anybody without his client's consent. Yet, notwithstanding this, in January last debentures for £2,000 had been issued and taken up by the directors of the Globe Co., or, in other words, by the very persons who had entered into the agreement that they would not issue debentures without his client's consent. So far as any alleged breach of agreement was concerned, this was entirely contradicted by Mr. Weinert. He suggested in January last that the matter should go to arbitration, and those proceedings had gone on from January until April, when the Globe Co. wrote that Messrs. Fox Bros. refused to continue the arbitration, and that they therefore could not go on. The solicitor for the company here interposed, and said that the reason why the arbitration did not proceed was because Messrs. Fox Bros. refused to go on with it. This point had already been adjudicated on by the Court, and the Globe Co. took the defence that the matter was the subject matter of an arbitration, but the Court decided that the agreement was not a good agreement, and that the action must proceed. Later in the meeting the solicitor said that an action was pending against the Globe Co. by Messrs. Fox Bros., and, in his judgment, if any claim for damages against this company were allowed, the Globe Co. would have an absolute right to recover the same from Mr. Weinert. He would not, of course, discuss the merits of the action, but he had advised the liquidator that he should not part with any of the goods which he held as stock of Mr. Weinert, until the whole of the questions were disposed of. If it was ultimately decided that Mr. Weinert was a debtor to this company, then the liquidator would have the right to hold the stock for the benefit of the creditors.

A creditor asked the chairman whether he was the Receiver for the debenture-holders as well as liquidator of the company, and the chairman replied in the affirmative. Another creditor said that there were those present who would probably like to have some voice in the liquidation of the company, and it was undesirable that the Receiver should also be the liquidator. He would move that the meeting be adjourned for 14 days. This resolution was seconded, but the company's solicitor said he could not advise the chairman to accept that resolution, as there was nothing in the Companies' Act to show that the creditors could adjourn a meeting.

Mr. Scholey insisted that adjournments of such meetings were frequently arranged, and he contested the solicitor's right to say that no such adjournment could be decided on.

Mr. Luker then moved that the liquidation be left in the hands



of Mr. Pegler, and this resolution was duly seconded. It was later put to the meeting, but on a show of hands was clearly lost, and the chairman, with regard to the first resolution, namely, that of the adjournment of the meeting, said he was obliged to rule it out of order, although it had been carried. This brought the meeting to an end. The following are creditors:—

Armorduct Manufacturing Co. . . . .	£237	Conradty, — . . . . .	£53
Batt & Hart . . . . .	33	"Electrical Review" . . . . .	27
Beaudreaux . . . . .	18	Ediswan United E.L. Co. . . . .	43
Electrical Co. . . . .	45	Electric Magneto Tool Co. . . . .	34
Greenwood & Co. . . . .	25	Falk, Stadelmann & Co. . . . .	10
North-Western Appliances . . . . .	83	Plania Werke . . . . .	77
Perry, F. A. . . . .	72	Regina Electric Co. . . . .	328
Quitman, Carl . . . . .	41	Smith Premier Co. . . . .	20
Sloan Electric Co. . . . .	18	Adolf Schuch . . . . .	46
Ships Carbons, Ltd. . . . .	353	Weinert, K. . . . .	883

In the Chancery Division on Tuesday, on the petition of SIEMENS BROS. DYNAMO WORKS, LTD., Mr. Justice Swinfen Eady made a compulsory order for the winding up of Taylor, Plinston Bros. and Co., Ltd.

SUNBEAM LAMP CO., LTD.—The adjourned meeting of creditors is to be held at Pilgrim House, Newcastle-upon-Tyne to-day, Friday, at 3.30 p.m. The committee appointed by the shareholders have informed the liquidator that they have come to the conclusion that it is not possible to devise any scheme of reconstruction which, under the circumstances, could be carried through.

LIGHT AND POWER FITTINGS CO., 25, City Arcades, Birmingham.—Messrs. T. Phillips and J. A. Charnock have dissolved partnership. Debts will be attended to by Mr. Charnock, who will continue the business at the same address.

STASSANO ELECTRO FLEX STEEL AND FURNACE CO., LTD.—A meeting is called for July 19th at 49, Leadenhall Street, E.C., to hear an account of the winding up from the liquidator, Mr. A. Hobbs.

ARC LAMPS, LTD.—A meeting is called for July 23rd at 3 and 5, Crown Court, Old Broad Street, E.C., to hear an account of the winding up from the liquidators, Messrs. H. B. Clark and G. E. Corfield.

**Victoria Turbo Pumps.**—Recent orders for "Victoria" turbo pumps booked by MESSRS. JENS ORTEN-BOVING & Co. include several important mining and waterworks installations, amongst which are included the following:—

Montreal Water and Power Co., repeat order, for two pumps, each to deliver 7,000 G.P.M. against a head of 455 ft. at 1,260 R.P.M., each pump being coupled to a 1,400-B.H.P. motor.

One pump for the Berrida Tinfields, Ltd., to deliver 1,900 G.P.M. against a head of 103 ft. at 600 R.P.M.

One pump for the Great Western Colliery, S. Wales, to deliver 417 G.P.M. against 750 ft. head at 1,450 R.P.M.

One pump for the Goss Moor Tin Alluvials Co., Ltd., to deliver 3,130 G.P.M. against 112 ft. head at 580 R.P.M.

Four 600 G.P.M. pumps for the City of Moose Jaw, Canada.

And others for the Tanaka Gold Mine, Japan; the Lothian Coal Co. (fourth repeat order), &c.

**A Fireproof Osram.**—We have before us as we write a print received from the GENERAL ELECTRIC CO., LTD. It is a reproduction from a photograph received by them from the General Electric Co. of China, Ltd., showing the utter indifference of an Osram lamp and fitting to fire, looting, and other experiences through which the native city of Tientsin recently passed. The looting was consequent upon an outbreak amongst the Republican troops, and the damage done was very serious. Among the premises burned was a goldsmith's shop—indeed, the whole of the street in which the premises were situated was burnt out—and after the fire the Osram lamp and fitting was the only article remaining intact within the whole area affected by the fire.

**Private Meetings.**—BALCHIN SCHULTZ & Co., LTD., Electrical Engineers, Gloucester Street, Theobalds Road, London, W.C.—The creditors interested in this matter were called together last week, when it was stated that the principal creditors had previously been consulted and they decided that a general meeting should be held. According to the figures presented the liabilities totalled £2,643. The assets totalled £3,720, and a considerable surplus, therefore, was disclosed. It was reported that the book debts had been written down by over £300, while a sum stated for the work in progress was the realisable amount and was not subject to any deductions. The stock had been valued at a low figure, while the plant and fixtures had been taken on the basis of a going concern. Even if sold at a break-up price they would realise from £350 to £400. It was further stated that the principal trade creditors were of the opinion that the position of the company was fairly disclosed. During the year ended June, 1910, there was a loss of £200 on the trading, while in the ensuing twelve months the loss was nearly doubled. Up to May of the present year a small net profit had been made. The turnover had been in excess of £3,000 per annum, upon which a gross profit of about £1,200 had been made. It was stated that the establishment expenses would be materially reduced and the company should then show a good net profit. With regard to a superheater patent, it was stated that its actual value ran into thousands of pounds. If the company had time in which to dispose of the patent it was expected that a large profit would be made. A proposal was made that the trade creditors should undertake not to press the company, and to accept payment in full by instalments. Should the patent be disposed of the creditors would be paid in full at once. The offer made was accepted, the debenture-holder undertaking not to appoint a Receiver without giving seven days' notice to a committee consisting of the representatives of Messrs. Baxter & Caunter, Ltd., Messrs. Pfeil & Co., and Messrs. J. & H. Greverer.

**Angold Street Lighting.**—THE GENERAL ELECTRIC CO., LTD., have received an order from the Dundee Corporation for 80 of their Angold magazine flame arc lamps for street lighting. This order was placed after the lamps had been subjected to severe tests extending over several months. The Sunderland Corporation has also placed an order for 28 Angold magazine flame arc lamps, this being the third repeat order received from it by the G.E.C. during the past nine months.

**Installation Contracts.**—MESSRS. W. G. HEATH & Co., of Plymouth, have the following electrical installation work in hand:—

Buckfastleigh.—New station equipment, complete, consisting of suction gas engine and plant, with storage battery, switchboard and generators, for the Buckfastleigh Electric Supply Co.

Ivybridge.—New storage battery and control gear for the Ivybridge Electric Supply Co.

Ottery St. Mary.—Complete installation of power station, with generators, storage battery, switchboard and overhead wiring on steel pillars for public supply, lighting and installation of about 500 lights, for Messrs. Coleberg & Co.

Truro, Cornwall.—Complete mill installation for both lighting and pumping, consisting of generator, switchboard, storage battery and lighting for 50 lamps, for Messrs. Hosken, Trevithick, Polkinghorne & Co.

St. Austell, Cornwall.—Country house installation, complete with oil engine, generator, switchboard, battery, motor, pumping set and wiring complete at "Hembal," for Mr. B. C. Andrew, architect, St. Austell.

Penzance.—New Pavilion, lighting throughout for approximately 70—100 lights, for connection to supply company's mains.

Southampton.—Lighting throughout Shirely Warren Infirmary, for 300 lights, for the Guardians.

**Book Notices.**—"Proceedings of the American Society of Civil Engineers." Vol. XXXVIII, No. 5. May, 1912. New York: The Society.

"Report of the Departmental Committee on the Science Museum and the Geological Museum." Part II. 1912. London: Wyman and Sons, Ltd. Price 6½d.

"Proceedings of the Association of Mining Electrical Engineers." Vol. II. 1910-1911. London: Iron and Coal Trades Review. Price 6s.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVI. Nos. 4 and 5. April and May, 1912. Milan: Stucchi, Ceretti e C.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Speciales." May, 1912. Liège: The Association. Price 75 cents.

"Journal of the American Society of Mechanical Engineers." June, 1912. New York: The Society. Price 35 cents.

"The Engineer Directory." 1912. London: Engineer Office. Gratis.

**Metric System.**—From April 1st the metric system has been made compulsory in Denmark, and English exporters to that country would do well to take note of the innovation.

**Trade Announcements.**—MESSRS. W. C. MARTIN AND Co., of Glasgow, announce that Mr. Gilbert Austin has been assumed as a partner, and the business of the firm will continue to be carried on as before, under the name of W. C. Martin & Co. Mr. Austin has occupied the position of manager for many years, and will continue to give his personal attention to the practical work of the business.

Mr. F. J. Borland announces that he has now transferred his business to the firm of BORLAND, HAGEDORN & Co., LTD., electrical engineers, Garrick Yard, 66A, St. Martin's Lane, London, W.C., who will carry on the manufacture of the Scissors arc lamp and other specialities with which his name has been associated for the last 17 years at his works in Leeds. The new firm will make a speciality of novelties in theatrical lighting, of which lists will be issued from time to time.

THE BENJAMIN ELECTRIC, LTD., of 117, Victoria Street, S.W., announce that some of their correspondence has been recently intercepted, and if letters have not received prompt attention, they will be glad to hear from the writers.

MR. F. L. WARREN, engineer and surveyor, has removed to 155 Fenchurch Street, London, E.C. Telephone No. "4972 Central."

Owing to a large increase of orders received during the last year, MR. GEO. ELLISON has had to take additional premises. He has secured a large works situated in Summer Hill Street (14 to 17), Birmingham, which will be devoted to the manufacture of parts of his well-known A.C. control gear, also to new lines such as D.C. and A.C. controllers, crane panels, limit switches, &c., which he has recently taken up. The acquisition of the new premises will enable the staff employed at Victoria Works, Warstone Lane, Birmingham, to be increased: all correspondence will continue to be dealt with at these works.

MESSRS. ISARIA, LTD., of 208, Tower Bridge Road, London, S.E., announce their formation as a limited company to devote special attention to the sale of electricity meters, motors, fans, measuring instruments, metal-filament lamps, and other products of the Isaria Zaehlerwerke, of Munich, for which they have the sole agency for the British and Colonial markets. A large stock will be held in London, and a meter-testing station and repair works are attached to the offices.

Premises in Market Street, Heckmondwike, have been opened by MESSRS. H. HAINSWORTH, LTD., electrical engineers.

**Bankruptcy Proceedings.**—CECIL WRAY, electrical and mechanical engineer, Bradford.—Application for debtor's discharge is to be heard on July 23rd at Bradford.



## LIGHTING and POWER NOTES.

**Australia.**—At a meeting of the Williamstown (V.) Council, it was proposed that the Council should enter upon schemes for the electric lighting of the town and the provision of a railless trolley system between Williamstown and Melbourne. The matter was referred to a committee for full investigation and report.

Owing to the large present and prospective demand for the supply of electricity for both power and lighting purposes, the Melbourne Electric Supply Committee contemplates spending £140,000 during the next three years.

**Barnes.**—The double link from Lower Richmond Road is to be extended at an estimated cost of £120. The £1,000 standing to the credit of the electricity fund is to be put aside as reserve.

**Bath.**—The Street Lighting Committee has recommended that electric lighting replace the old gas lamps in several thoroughfares. This change is consequent on the extension of the boundaries.

For the new electric bakery for the Twerton Co-operative Society, which has just been opened, Messrs. Joseph Baker & Sons, Ltd., undertook the installation of the ovens and fittings, and Messrs. Melvin & Sons the machinery, of which about £1,000 worth has been installed. The electric current is supplied by the Bath Electric Light Works.

**Batley.**—Negotiations with the Yorkshire Electric Power Co. for a bulk supply have been re-opened. A few weeks ago the Electricity Committee rejected an offer of energy in bulk from the company, and decided to extend its works, generating plant and cables at an outlay of £16,000. This recommendation was arrived at after exhaustive inquiries and visits paid to many works, and it was proposed that a 750-kw. steam reciprocating set should be purchased, because sufficient work could not be found to run a 1,000-kw. turbine set profitably. It is understood that the Electricity Committee now proposes to withdraw its scheme altogether, and to buy energy from the power company if the latter will withdraw a condition which seeks to bind the Corporation not to install any plant for the generation of alternating current.

**Bedford.**—The T.C. has applied to the L.G.B. for loans of £500 for mains, £700 for services, £300 for meters, £600 for transformers, £1,000 for public lighting and £2,952 in respect of excess expenditure.

**Brighton.**—The Electricity Committee of the T.C. has again recommended the adoption of the assisted wiring scheme, by which it is proposed that all wiring contractors in the borough who will undertake wiring and fitting work are to be invited to accept 1d. per unit received by the Corporation over 4d. per unit for energy consumed by the occupiers of premises wired under the scheme.

**Buluwayo.**—At the annual meeting of the Buluwayo Waterworks Co., Ltd., held in London last week, the chairman, the Right Hon. A. R. M. Lockwood, C.V.O., M.P., said that £4,411 was spent on capital account upon the electricity supply extensions. The gross profit on sales of electrical energy showed a very satisfactory increase. The profit was £6,841, as against £2,777 in 1910. The improvement in the department was referred to at the general meeting last year, and was the result partly of the general improvement in trade and partly of the various economies which have been effected by the manager, Mr. B. K. Ward. The number of consumers in December was 744, as compared with 649 in December, 1910, and the total number of units sold during the year was 121,614, as compared with 96,358 in 1910. The arrangement with the municipality for further payment in consequence of the additions to the street lighting came into force on December 1st, and they were now receiving £1,500 per annum from that source. The manager stated that the experiment of supplying electric power, which was started in August last, was expected to be a decided success, the result so far being an increase monthly from this source. The current was being most usefully employed at the present time for pumping the water from the boreholes.

**Bury St. Edmunds.**—The T.C. has decided to supply day-load current to Messrs. R. Boby, Ltd., at the following terms: 50,000 units, 1d. per unit; 75,000,  $1\frac{1}{2}$ d.; 100,000 units,  $\frac{3}{4}$ d.

**Cheam.**—At the last meeting of the Parish Council offers received from the Electric Lighting Co. and the Gas Co. for lighting the district were considered. The former company offered to maintain 60 lamps of 100 C.P. at £3 3s. per lamp per annum, but for every new lamp erected, at £2 5s. per lamp; while the Gas Co.'s prices were £3 5s. for one part of the district, and £3 9s. 4d. for another part. After discussion, it was decided to ask the Electric Light Co. to supply a light outside Cheam House as a test.

**Cheltenham.**—The Cheltenham Gaslight and Coke Co. have given notice of opposition in the House of Commons to the Cheltenham Electric Lighting Extension P.O.

**Clacton-on-Sea.**—The U.D.C. has decided to extend the lighting mains to St. James's Estate, which is being rapidly developed, at a cost of £460.

**Colchester.**—The accounts of the Electricity Department show that the units sold increased last year from 1,488,458 to 1,497,425, an increase of 8,967 units, but the value decreased from £15,929 to £15,857, a reduction of £71. This was caused by the large decrease in units at  $3\frac{1}{2}$ d., due mainly to the alterations in the Government installation. There was an increase of 15,269 units for lighting purposes at 4d., and an increase in power units (other than tramways) of 66,918. Tramway power units decreased 33,994. Miscellaneous income increased from £319 to £478, an advance of £159. The net increase in the total income was, therefore, £87, and the total income amounted to £16,335. The total expenditure amounted to £16,213, thus leaving a surplus of £122, compared with £212 a year ago. The year's working showed an appreciable decrease in the cost of coal per unit, but the cost of heavy repairs to boilers has more than swallowed up the saving effected.

**Continental Notes.**—**FRANCE.**—The municipal authorities of Beaumont-sur-Oise (Seine-et-Oise) have lately granted a concession for the electric lighting of the town.

A scheme is under consideration to put down a plant to utilise the water-power of the River Isère, at Chateau Neuf d'Isère (Department of Isère) in the generation of electrical energy for lighting and power purposes. It is estimated that about 2,000 H.P. is available.

**ITALY.**—A concession has lately been granted for the supply of electrical energy for lighting and power purposes in the town of Cosseline.

**HUNGARY.**—The municipal authorities of Izsak are at present considering a project to establish a central electric lighting station in the town.

**AUSTRIA.**—Herr Max Asiel, a mineowner, of Vienna, has made application for a concession to use three waterfalls on the Rivers Raab and Moder in connection with a project to build hydro-electric stations.

The firm of B. Fischer-Reinau, of Zurich, supported by a foreign capitalist group, has applied for sanction to a scheme to build a power station on the left bank of the Danube between Au and Hütting, of a total capacity of 150,000 H.P. It is intended to construct a canal 15 km. long and 150 m. broad. The cost of the scheme is placed at 100,000,000 kronen.—*Der Elektrotechniker.*

**Dundee.**—The electrical engineer of the Corporation has reported that it will be necessary to proceed immediately with extensions to the Carolina Port station, as these must be ready for operation in the winter of 1913. The Committee has agreed to go forward at once with an application for borrowing powers to the Secretary for Scotland. The amount required will be £68,000.

**Ealing.**—At the last meeting of the Council the following scale of charges for the supply of electricity to those using a supply which is neither purely for power nor for lighting was adopted:—Up to 200 units per quarter,  $3\frac{1}{2}$ d. per unit; 200 to 400, 3d.; 400 to 600,  $2\frac{1}{2}$ d.; 600 to 800,  $2\frac{1}{4}$ d.; 800 to 1,000, 2d.; 1,000 to 1,500,  $1\frac{3}{4}$ d.; 1,500 and all units over,  $1\frac{1}{2}$ d.; the minimum charge to apply in all cases where the amount taken over the 12 months does not, together with meter rent, reach the sum of 26s. per annum.

**Falkirk.**—A special meeting of the Falkirk and Larbert Water Trust was held on Monday to consider the attitude of the Trust to the Falkirk and Linlithgow Electric Lighting Order. The Board of Trade recently announced that they did not think it necessary to include in the order the protective clauses asked by the Trust. It was decided to make a further petition, in order to have the clauses desired, which are the same as those contained in the Scottish Central Electric Power Act, 1903, included in the order.

**Glastonbury.**—The Council is taking legal and technical advice as to the legal aspects and the financial possibility of successfully combining the provision of electric light with its gas undertaking.

**Greenock.**—The deadlock which was threatened between Greenock and Port Glasgow on the question of the supplying by the former of electricity to Port Glasgow power users has happily been averted. Under an arrangement come to, Greenock is to be allowed to supply the shipbuilding firms of Port Glasgow, and the suggestion of applying for a prov. order on the part of the Port Glasgow Corporation has been dropped. Mr. Lithgow has also entered into an agreement with Port Glasgow T.C., which will allow him to make arrangements with Greenock to supply electric light to the houses in the Bay area. This contract between the two Corporations is to hold good for 30 years.

**Hereford.**—The annual report of the electrical engineer (Mr. W. T. Kerr) shows that the total number of consumers connected is now 664, an increase of 85, or 14 per cent. The output of units increased 11.3 per cent., chiefly in power units. Up to December, 1911, the total units increase for the nine months over the corresponding period for 1910 was 51,995, whereas, from January to March, 1912, there was a decreased output of 5,227 units, due to the coal strike and metal-flament lamps, notwithstanding the fact that 85 new consumers had been connected. The revenue up to December had increased by £382, the revenue for March being down £70, which, under normal conditions, should have been £120 up. The total costs, including interest, sinking fund and works cost, have fallen from 2'82d. to 2'716d.; the average price received has fallen to 2'348d., due to a drop in the output of higher priced units. The motor load portion of the business has developed considerably, there being 562 H.P. connected. The fittings account showed a net profit of £48, as compared with a loss of £94 last year. The net profit, after providing for interest, was £1,656, as



compared with £1,554. The net profit has been carried to the revenue account, and increased by £505 contributed from the borough fund, making a total of £2,161, out of which have been provided instalments of principal repaid, £800; instalments payable to the sinking fund, £1,375; and amount written off switch-board extension account, £100; leaving a deficiency for the year of £114. This, added to last year's deficiency of £371, makes a net deficiency to be carried forward of £486.

**Highbridge.**—The U.D.C. has asked Dr. Purves to submit in writing his proposal to extend the electricity cables to the town from Burnham.

**Hipperholme.**—The Lighting Committee has resolved that arrangements shall be made for the lighting of some of the street lamps in the district by electricity next year.

**Japan.**—The Tokio Electric Light Co. has considerably reduced its rates for the supply of electricity for power purposes and for the running of arc lamps, &c.

**Kilmarnock.**—A profit of £1,200 has been made on the electricity department for the past year.

**King's Lynn.**—The electricity accounts for the year ended March 31st last show a profit of £504, as compared with £1,034 in the previous year. It was explained at a Council meeting that the reduction in the profit was caused principally by the reduction of the price to ordinary consumers from 4½d. to 4d. per unit. Additional coal bought in view of the coal strike increased the expenditure by £150, and there was a falling-off of £100 in the profit on fittings. On the recommendation of the Committee £231 was ordered to be appropriated for reduction of capital account, and a sum equivalent to 1d. in the £ (about £330) to the relief of rates.

**Launceston.**—The T.C. on Monday had before it a tender received from Launceston and District Electric Supply Co., containing their terms for lighting parts of the town. Mr. E. Hicks said the price was a favourable one, but they had not suggested lighting the whole town. The question the Council had to consider was to make arrangements with the gas company for the other part of the town. The Council discussed the letter in committee.

**Ledbury.**—Messrs. Brown & Parsons, Ltd., electrical engineers, Leamington, have informed the U.D.C. that a syndicate has been formed for the purpose of supplying electricity to the town, and have asked for the Council's support. The Council has passed a resolution to the effect that it sees no reason to object to the proposal at this stage.

**Leeds.**—Mr. H. R. Hooper, of the L.G.B., held an inquiry on June 14th, concerning the application of the City Council for permission to borrow £58,960 for the purpose of providing additional generating plant with the necessary boilers and accessories at the Whitehall Road station. The application was opposed by Mr. Totty, acting for the Ratepayers' Association, whilst Alderman Badlay drew attention to the heavy indebtedness of the city which existed at present, and said that it would have been better not to have reduced the rates last year than to borrow money. The Town Clerk replied to the statements made by Mr. Totty and Alderman Badlay, and the inquiry was closed.

**London.**—CITY.—The *City Press*, commenting upon the recent rumour of a contemplated purchase by the Corporation of the undertaking of the City of London Electric Lighting Co., Ltd., says that it has every justification for announcing that no such step will be taken—at any rate, just yet. "The opinion of the Committee who have been considering the matter is that the purchase of the company would be inadvisable, because it would involve either the acquisition of the City undertaking of the Charing Cross Co., or entering into competition with that concern. The Committee will present a formal report on the subject to the Court of Common Council at an early date."

**LEWISHAM.**—The Guardians have accepted the estimate of the South Metropolitan Electric Light and Power Co., Ltd., at £30 11s. 8d. for lighting the various rooms and offices of the infirmary laundry, subject to the company offering to supply energy upon reasonable terms for a number of years.

**FULHAM.**—A loan of £3,200 is to be taken up from the L.C.C. to defray the cost of the necessary cable extensions, transformers, &c., required in connection with the supply of energy to the Earl's Court Exhibition.

**Mansfield.**—A L.G.B. inquiry was held on June 12th into the application of the T.C. for a loan of £4,000 for electricity purposes. Mr. H. R. Hooper, the inspector, strongly advised the Council to purchase meters, for which £500 was applied for, out of revenue, instead of applying £500 to the relief of the rates. By doing that they would save £100 in five years.

**Nelson.**—With reference to the Council's application for sanction to borrow £3,000 for the purpose of electric lighting in the borough, an inquiry was recently held by the L.G.B., when it was stated that the estimated requirements for the next four years—including the period since sanction was applied for—included £848 for mains, £150 for boxes and pillars, and £1,244 for services, &c. The electrical undertaking was growing satisfactorily, and if the present rate of increase in the number of consumers was maintained, the sum for which sanction was asked would not suffice for so long a period as the four years. No opposition was raised against the proposal.

**New Zealand.**—The *Australian Mining Standard* states that the Auckland (N.Z.) City Council has recently erected a new power-house, at Mechanics' Bay, at a cost of £20,000. There are to be four sets of generators, which will enable the City Council to supply power to outside companies, if required.

**Rawdon.**—The Highway Committee is considering the question of lighting the public street lamps with electricity, and is asking the Yorkshire Power Co. its terms.

**Rawtenstall.**—The T.C. has applied to the L.G.B. for sanction to borrow £7,500 for the purposes of the electricity undertaking.

**South Africa.**—The Cape Town municipality is about to extend its electric lighting works, and also to purchase the interests of the Cape Peninsular Lighting Co., for which purposes a loan of £75,000 is being raised.—*British and South African Export Gazette*.

**Southmolton.**—Messrs. Crompton & Co., Ltd., have informed the T.C. that, as no Order for the electric lighting of the town can be obtained from the B. of T. until August of next year, they have decided not to proceed with the scheme.

**Stafford.**—The annual report of the electricity department shows that the revenue from all sources amounted to £5,493, and that the total expenditure was £2,684, leaving a gross profit of £2,809, compared with £2,730 last year. The total charges against net revenue account amounted to £2,171, leaving a net profit of £639, to which has to be added the amount brought forward £152, leaving an available balance of £792. From this the Committee proposes to transfer £600 to depreciation account, the same as last year, and after deducting the bonus to officials and workmen, to carry the balance forward. The total expenditure remains at £32,500, and the loans repaid amount to £14,911, leaving £17,589 now owing on this account. The bonus to officials and workmen amounts to 11·7 per cent. on the wages, as compared with 10·4, 7·9 and 7 per cent. in the three preceding years.

**Surbiton.**—According to Mr. J. F. C. Snell, in his half-yearly report on the electricity works, it appears that 31 new consumers have been added. The statistical and financial results for the year ended March 31st, 1912, are satisfactory, the sale of units having increased 15 per cent., and the average price per unit declined 4·6 per cent. The revenue has increased by 4½ per cent., while the cost of production has only increased by 10 per cent. The balance to net revenue has increased by 14 per cent., and the percentage of gross profit to capital expended has grown from 5·76 per cent. to 6·33 per cent. A deficit in 1911 of £300 has been converted into a net surplus (after paying capital charges) of £11. The plant has been maintained in good order, and there is every prospect of further advances in the progress of the department.

**Sutton Coldfield.**—The T.C. has applied to the L.G.B. for a loan of £2,000 for new plant for the electricity works.

**Swinton and Pendlebury.**—St. Stephen's School is to be wired for the electric light, and the Education Committee of the U.D.C. will supply the lamps and provide the renewals.

**Taunton.**—The annual balance-sheet of the Electricity Committee shows a gross profit on the year of £5,127. Of this sum £1,522 has been utilised for payment of interest on loans, and £2,659 in redemption of loans, while £600 has been transferred to the reserve fund.

**Wakefield.**—The T.C. referred back to the Committee for reconsideration a recommendation approving of the Bill promoted by the I.M.E.A., and agreeing to contribute £5 towards the expenses. The opposition was on the ground of municipal trading.

**Weymouth.**—The annual report of the electricity department shows the number of consumers to be 663, an increase of 128. The total connections showed a corresponding increase. The total number of units sold was 528,667; gross receipts amounted to £7,880, and gross expenditure to £3,631, leaving a gross profit of £4,249. The following special items were allowed for:—Interest on loans, £1,720; repayment of moneys borrowed, &c., £1,875. The profit on the year is £634. The Committee has agreed to forgo further loans for the purchase of meters, and has transferred £375 to reserve fund. The total capital expenditure has been £55,145, and £10,104 has been repaid. The electrical engineer (Mr. J. H. Bolam) reported that the growth in output had made necessary the nearly continuous running of the plant, which had naturally affected the works costs for the year, these having increased from 0·92d. per unit sold to 0·97d. The much higher price paid for coal, together with the extra running, accounted for the difference.

**Whitwood Mere.**—A L.G.B. inquiry was held on June 13th into the application of the U.D.C. for a loan of £3,300 for additions to the E.L. undertaking. There was no opposition.

**Worcester.**—The electricity accounts for the year ending March 31st, 1912, show a net deficiency of £676, as against an estimated deficit of £810. The electrical engineer (Mr. C. M. Shaw), in his report, points out that £198 for purchase of meters, £65 extra cost of fuel, caused by the coal strike, and £185 due to the change to the polyphase system, were not included in the



estimates. During the year 70 new customers were connected, the total demand being 35 per cent. greater than any previous year's record. Despite the use of metal-filament lamps, 32,014 additional units had been sold for lighting purposes. The demand for energy for power purposes had also increased. The costs of production showed a slight increase, being 339d. per unit sold. This was due to the increased cost of coal caused by the strike and the inability to generate much electricity by water-power at the station at Powick.

**York.**—On the 13th inst., Mr. T. C. Ekin held a L.G.B. inquiry into the Corporation's application to borrow £9,700 for the purpose of extending the generating and steam-raising plant. There was no opposition.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—After prolonged negotiations, says Reuter, a provisional agreement has been entered into by the Agent-General for Western Australia, on behalf of the Government of that State, and the directors of the Perth Electric Tramways, Ltd., for the purchase of the company's undertaking at £475,000, subject to legislative authority being obtained, and to ratification by the shareholders.

**Continental Notes.**—**GERMANY.**—A preliminary concession has been granted in respect of a projected electric tramway between St. Ingbert and Rohrbach, in the Pfalz district of Bavaria.

**AUSTRIA.**—It is estimated that the cost of the electrification of the Vienna Suburban Railway will amount to 30,000,000 kronen, and that of the building of the underground railways to 120,000,000 kronen.—*Financial News.*

**LISBON.**—Reuter reports that the Federated Trade Unionists, who are supporting the tramway men now on strike, have decided to ask the Municipal Council of Lisbon to cancel its agreement with the Electric Tramway Co.

It is also stated that the first task of the new Cabinet will be to settle the tramway strike. The tramway company has enough men apart from the strikers to work the system, if they are protected. Stones were thrown at Mr. Alfred Giles, the Lisbon manager of the company, as he was leaving the works in a motor-car. He was slightly injured in the leg.

**Dundee.**—It was intimated at the last meeting of the Tramways Committee that the new railless traction system in Clepington Road would be in working order by the beginning of September.

**Glasgow.**—The working of the Corporation tramways, as suggested some weeks ago in the REVIEW, has shown considerable falling-off in net income for the 12 months ending May 31st last, the figures being for the year ending May 31st, 1912, £52,068, against £68,678 for 1911. The deficiency is accounted for mainly by increases of wages to the general staff, which aggregated £28,000, the augmented price of coal during the miners' strike, the losses during the tramwaymen's strike, and increased third party insurance rates. An analysis of the tramway receipts is interesting in comparison with those of the previous 12 months. This shows that the traffic receipts for the past year were £987,280, against £946,021 in the previous 12 months; while other receipts accounted for £3,795, compared with £3,467. The total income was £991,075, against £949,488. From this there fell to be deducted £582,640 for working expenses (excluding depreciation) which last year reached £533,179, leaving this year a balance to be carried forward to net revenue account of £408,435, against £416,310 a year ago. To the latter had to be added £49,592 as interest on investments, and £180 derived from lines rented to Dumbarton Burgh and County Tramways Co.—the figures last year were respectively £43,214 and £230—which left this year a balance of £458,207, compared with £459,753 last May. Various expenditure had to be deducted from the total income. This year this amounted *in toto* to £406,140, against £391,075 12 months ago. These items, in contrast with those of last year, were respectively:—Rental of Govan and Ibrox tramways, £5,046, against £5,061; proportion of traffic receipts due to Paisley District Tramway Co., £5,271, against £4,966; interest on capital, £75,092, against £75,168; sinking fund, £93,863, against £89,794; income-tax, £13,028, against £13,492; Parliamentary expenses, £135, against £15; depreciation fund, £128,073, against £117,129; and permanent way renewals fund, £85,631, against £85,450.

**Kilmarnock.**—At a recent meeting of the T.C., it was reported that while the tramways showed an increase in revenue this year of £446, expenses had also increased, and there would be a deficit on the undertaking of about £2,000.

**Lanarkshire.**—A new situation has been created in connection with the promotion of a Bill by the County Council of Lanark to acquire, by compulsory purchase, the whole undertaking of the Lanarkshire Tramways Co., and the extension of the lines from New Stevenston by way of Bellshill to Uddingston. It is understood that an agreement has been arrived at between the County Council and the Tramway Co., whereby the county

authorities are to find the capital for the immediate extension of the New Stevenston route, the company undertaking to work the line and repay the capital within two years. There exists, however, a signed agreement between the County Council and the T.C.'s of Hamilton, Motherwell, and Wishaw, for co-operation and joint purchase of the whole concern from the Tramway Co., and thus the new proposal has created altered conditions which have been the subject of discussion at a joint meeting of the three T.C.'s. The burghal authorities maintain that no negotiations should have been entered into without their knowledge and consent, and have appointed representatives to consult the Parliamentary agents in London as to the new situation.

**Lancashire.**—The promoters of the Preston, Chorley and Horwich Tramways Bill have obtained an extension of time in which to acquire lands for the purpose of road widening, following which the construction of the tramways will be proceeded with. The total length will be 15 or 16 miles.

**Leeds.**—Between the running of the last car on Saturday night and 8 o'clock on Monday morning, three hundred yards of tramway track were taken up, relaid with new rails, and repaired by the Corporation tramways department, without interfering with the service. The working party was composed of three shifts of 80 men each.

**London.**—It is expected that the Central London Railway extension to Liverpool Street will be opened at the end of July.

**WOOLWICH.**—A scheme is now being put forward for the reconstruction on the conduit system of the electric tramways between Chapel Street and the Free Ferry.

**Luton.**—The T.C. has applied to the B. of T. for an extension of time until August 11th, 1914, for the completion of the tramways under the order of 1905.

**New Zealand.**—According to the *Australian Mining Standard*, it is proposed to install an electric tramway service at Timaru, consisting of a double line, with a total length of about 6½ miles. The estimated capital cost is £57,000; revenue £11,800 per annum; annual expenditure £10,400. Until hydro-electric power is available at a sufficiently low rate, the suggestion is to employ a Diesel oil engine at the power station.

**Sale.**—A new line of tramways from Sale Station to the Leigh Arms has been completed and is awaiting the sanction of the B. of T. Another extension is in progress from Alexandra Park Gates along Alexandra Road South to Chorlton.

**Stalybridge.**—Running has been recommenced on the Stalybridge, Hyde, Mossley and Dukinfield Tramways. During the stoppage, important repairs to cars and generating plant were effected.

**Turkey.**—Reuter states that a German syndicate, headed by the Deutsche Bank, is endeavouring to obtain the concession for an underground railway from Sultan Bayazid, in Stambul, to Chichli, the most outlying suburb on the other side of the Golden Horn. Negotiations are well advanced, and it is expected that an agreement will be reached at an early date. The Germans do not ask for any financial guarantees, so that the scheme will not require the approbation of Parliament. The line will cross the Golden Horn over a special bridge.

Another German syndicate obtained the concession some months ago for an electric railway from Galata, along the shore of the Bosphorus to the Black Sea. Engineers have surveyed the route, but, although the concession has been vested with Imperial sanction, it is understood that the promoters are not yet ready to float a company to carry on the undertaking.

The Deutsche Bank is also largely interested in the group which has taken over the concession of the Constantinople Tramway Co., and which has obtained the monopoly for the supply of electric power and light in Constantinople. The works for the electrification of the Constantinople tramways are being actively pushed forward, and it is announced that the first electric cars will be run between Galata and Ortakoy this autumn. The group has also secured several important extensions to the lines already in being, and expects to push on the Ortakoy line to Bebek within a couple of years.

**U.S.A.**—The *Times* reports that the strike of tramway men in Boston has paralysed many divisions. Men who have been working the tramways have been attacked, cars have been stoned and obstructions have been placed on the lines.

**Watford.**—On Saturday the L. and N.W. Railway, in pursuance of their scheme for a new electric line from Euston to Watford, opened two sections, namely Willesden to Harrow and Croxley Green to Watford. According to a daily paper the lines will not be electrified for some months, and as a temporary measure the old North London Railway stock will be used.

**Worsborough.**—At a meeting of the Council it was resolved "that the Council should urge upon the Barnsley Electric Traction Co. the desirability of making early arrangements for extending their lines from Worsborough Bridge terminus to Birdwell and Hoyland Common." As an alternative the Council may entertain the idea of promoting a motor service.



## TELEGRAPH and TELEPHONE NOTES.

**German Colonies.**—The scheme for the establishment of a system of wireless telegraphy in connection with the German colonies in the South Sea, to which reference was made in the annual report of the German-Netherlands Telegraph Co. a short time ago, has now been advanced a stage by the intimation that the German Government has just granted a joint concession to this company and the Telefunken Co. for the construction and working of four coast stations, to be equipped with plant of a minimum of 120 H.P., the iron towers to be 400 ft. high. At present the South Sea colonies of Yap-Rabaul (New Guinea), Apia (Samoa) and Nauru have no telegraph connection. This disadvantage is to be overcome by the erection of wireless stations which are also to be connected with the island of Yap, where the German-Netherlands cable lands. It is proposed to form a separate company to carry out the undertaking. The distances of transmission are 1,364 miles between Yap and New Guinea, 2,108 miles between Yap and Nauru, 1,054 miles between New Guinea and Samoa, and 1,674 miles between Nauru and Samoa.

**International Radio - Telegraphic Conference.**—Yesterday the delegates were invited to inspect the Woolwich works of Messrs. Siemens Bros. & Co., Ltd., and witnessed a demonstration of the Telefunken system of wireless telegraphy, after which they were entertained to dinner by the company. To-morrow the delegates will visit the new works of Messrs. Marconi's Wireless Telegraph Co., Ltd., at Chelmsford, and will afterwards be the guests of the company at dinner at the Savoy Hotel.

**The Telephone Service.**—According to a recent statement of the P.M.G., tests made during six months with regard to 50,000 calls showed that the average time taken to answer was 5'1 seconds, and the average time to make a connection was 28'6 seconds. During the current financial year 2½ millions will be spent on the telephone service, apart from the payment to the National Telephone Co.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Alford (Lincs.).**—June 24th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

**Australia.**—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" to-day.

VICTORIA.—P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

NEW SOUTH WALES.—August 28th. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

**Birkenhead.**—July 8th. Two 750-KW. mixed-pressure steam turbines and D.C. generators, with condensing plant, &c., and nine superheaters and interconnecting steam pipes, for the Corporation. See "Official Notices" to-day.

**Blackburn.**—The Health Committee has decided to seek tenders for electric lighting in the extensions to the local fever hospital, which are about to be carried out.

**Bradford.**—June 29th. Tramcar equipments, trucks, timber and car fittings, for the Corporation. See "Official Notices" June 14th.

**Brazil.**—July 15th. The Public Works authorities at Cuyaba (State of Matto-Grosso) are inviting tenders for the supply of electrical energy for lighting and power purposes in the town.

**Croydon.**—June 24th. Conversion of two hand lifts into automatic push-button control electric lifts, at the Infirmary, for the B. of G. See "Official Notices" June 7th.

**Dewsbury.**—July 4th. One 1,000-KW. turbine, two 500-KW. D.C. generators, and jet condensing plant for the T.C. See "Official Notices" June 14th.

**Dublin.**—June 27th. Extra-high-pressure and low-pressure cables, for the Corporation. See "Official Notices" June 7th.

**Exminster.**—June 22nd. Electrical appliances for a year, for the Devon County Lunatic Asylum. Mr. H. E. Morgan, clerk.

**Gillingham (Kent).**—June 24th. Coal, for the Corporation electricity works, for a year; Borough Electrical Engineer.

**Glasgow.**—The T.C. Electricity Committee has decided to advertise for offers for the erection of a sub-station in Elliott Street, Byres Road. Mr. W. W. Lackie.

**Halifax.**—The B.C. is inviting tenders for doubling the permanent way, and also for six new cars. Further particulars from the trainways department.

**Hull.**—June 24th. Mains for the Corporation Electricity Department. See "Official Notices" June 14th.

**Hungary.**—July 1st. The municipal authorities of Szekelyhid are inviting tenders for the concession for the public and private electric lighting of the town.

**London.**—ISLINGTON.—July 24th. One 3,000-KW. steam turbine alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" June 14th.

HACKNEY.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, pipework, travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

HAMMERSMITH.—June 26th. High and low-tension switchgear and cable, for the B.C. See "Official Notices" June 14th.

STEPNEY.—July 1st. The Electricity Supply Committee is inviting tenders for meters, demand indicators, time-switches and carbons. See "Official Notices" June 14th.

L.C.C.—July 2nd. Electrical installation at the Old Kent Road special school and divisional offices. See "Official Notices" to-day.

**Manchester.**—June 28th. Traction feeder cables and two years' supply of transformers, D.C. and A.C. motor starting switches, time switches and clock-controlled circuit-breakers, D.C. and A.C. motors, and meters, for the Corporation. See "Official Notices" June 14th.

**Neath.**—July 4th. Overhead and underground high-tension cables and transformer pillars, for the R.D.C. See "Official Notices" to-day.

**Newcastle-upon-Tyne.**—June 28th. Nine-ton electrically-driven crane for use in connection with an anti-coll breakage appliance at No. 5 Coal Shipping Staith, Whitehill Point, for the Tyne Improvement Commission. Deposit £1. Mr. J. M. Manson, general manager and secretary, Tyne Improvement Commission.

**New Zealand.**—August 1st. Public Works Department. The following plant is required in connection with the Lake Coleridge electric power scheme. Section 3A.—Valves and expansion joints. Section 10A.—Steel standards for transmission lines. Section 10B.—Ferro-concrete standards for distribution line. Tenders to the Minister of Public Works, Public Works Office, Wellington, N.Z., from whom specification, &c., can be obtained. Deposit £200.—*Board of Trade Journal*.

**Oldham.**—June 21st. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" May 31st.

**Portsmouth.**—June 27th. Permanent way material and electrical equipment in connection with the Twyford Avenue tramways route, for the Corporation. See "Official Notices" June 14th.

**Rotherham.**—July 8th. (a) Tramway stores and materials for a year for the T.C., and (b) Electricity meters. (a) Tramways manager: (b) Borough electrical engineer.

July 8th.—Smudge or pea nuts for a year for the Corporation electricity works; Borough Electrical Engineer.

**Salford.**—June 24th. Coal for a year, for the Corporation electricity works; Electrical Engineer, Frederick Road, Pendleton.

**Sheffield.**—June 28th. Roof principals and structural steelwork, for Neepsend power station extension, for the Corporation. See "Official Notices" June 14th.

**Spain.**—June 30th. The municipal authorities of Puebla del Caraminal (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Puebla del Caraminal (Coruna).

July 2nd.—Tenders are being invited by the municipal authorities of Calonge (province of Gerona) for the concession of the electric lighting of the town during a period of 10 years. Tenders are to be sent to El Secretario del Ayuntamiento de Calonge (Gerona), whence particulars can be obtained.

**Swindon.**—June 22nd. Steam coal, for the Corporation. See "Official Notices" June 7th.

**Swinton.**—June 26th. Electric light installation at the Refuse Destructor, for the U.D.C. See "Official Notices" June 14th.



**Sunderland.**—June 27th. Cooling tower, travelling crane and switchgear, for the Corporation. See "Official Notices" June 14th.

**Warrington.**—June 25th. E.H.T. cable, for the Corporation. See "Official Notices" June 14th.

**Workshop.**—July 3rd. Battery switchboard and cast-iron exhaust pipes, for the U.D.C. See "Official Notices" June 14th.

**Worthing.**—June 24th. Coal for the Corporation Electricity Works. W. Verrall, town clerk.

### CLOSED.

**Australia.**—The following contracts have been placed, according to the *Australian Mining Standard*:—

#### VICTORIAN RAILWAYS DEPARTMENT.

Australian General Electric Co.—Tramcar equipment, £2,957.  
Westinghouse Brake Co.—Brake gear, £1,844.  
Vanderkelen & Co.—Galvanised telegraph wire, £525.  
Noyes Bros. Proprietary, Ltd.—Truck material, £863.  
Bullers, Ltd.—Insulators, £250.  
Automatic Telephones (Australia), Ltd.—Automatic telephone switchboard, £2,439.  
Automatic Telephones (Australia), Ltd.—200 telephone sets, at £2 19s. 6d. each.

#### SYDNEY MUNICIPAL COUNCIL.

W. T. Henley's Telegraph Works Co., Ltd.—11,000-volt '05 three-core cable, £3,684.  
Noyes Bros.—10,000-volt switchgear and transformers, £2,618.  
Stewarts & Lloyds, steel poles, £1,675; Ferranti, Ltd., D.C. meters, £900;  
Australian General Electric Co., A.C. meters, £1,000; B.I. and Helsby Cables, Ltd., overhead cable, £10,980; Noyes Bros., sub-station switchgear and transformers, £2,289; Australian General Electric Co., lightning arresters, £302; earth detectors, £218; link switches, £307; also other switchgear, £1,509.

#### BRISBANE WATER AND SEWERAGE BOARD.

Large pumping plant (only tender submitted), Thompson & Co., Castlemaine, £108,000.

#### PRAHRAN AND MALVERN TRAMWAYS TRUST.

Stewart & Lloyds.—Steel tramway poles, £7,739.

#### P.M.G.'s DEPARTMENT, BRISBANE.

1,000 Calland cells, 2,000 glass cells for Meidinger battery, and 3,000 porous pots for Daniell cells.—Brisbane Electrical Co.  
10,000 corks and tubes for Meidinger batteries.—I.R.G.P. and T. Works Co.  
6,500 glass cells.—British General Electric Co.

**Barnsley.**—The Corporation has accepted the tender of the Tudor Accumulator Co., Ltd., to maintain the traction battery at the electricity works for 10 years for £108 per annum.

**Bedford.**—The T.C. has accepted the tender of W. H. Allen, Son & Co., Ltd., for new parts and repairs to No. 9 engine at the electricity works, at £293.

**Belgium.**—Five concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the construction of the overhead equipment of the La Rone-Zwen section of the light electric railway between Brussels and Hal, the lowest being that of Messrs. F. & R. Lemoine.

La Société des Ateliers de Constructions Electrique, of Charleroi, submitted the lowest tender to the Belgian military authorities for the supply and laying of a system of sub-river and underground telephone cables in the fortified portion of Antwerp.

**Birkenhead.**—The Guardians, on the recommendation of a Committee, advised by Messrs. Sloan & Lloyd Barnes, accepted the tender of the Northern Electrical and Ventilating Co., of Liverpool, at £2,217, for the electric installation at the workhouse. It was mentioned in the course of the discussion that a Birkenhead tenderer had submitted an offer at £800 less than that recommended, and that between the lowest and highest tenders there was a difference of over £1,000. One of the speakers said that some of the contractors who had sent in very low tenders, now admitted that they had no idea what they were tendering for, and that the job was far above them. An amendment referring the matter back on the ground that the lower tenders should be reconsidered, was lost by 18 votes to 3.

**Glasgow.**—The T.C. Electricity Committee recommend acceptance of the following offers:—

Kelvin & James White, Ltd., direct-current switchboards and instruments for the sub-stations in Osborne Street, Dennistoun, and Byres Road, £2,436.  
British Thomson-Houston Co., Ltd., high-tension switchboards and instruments for sub-stations in Maryhill, and Byres Road, £1,146.  
A. Reyrolle & Co., Ltd., high-tension switchboards and instruments for Osborne Street sub-station, £656 10s.

Acceptance of the following was also recommended:—

John Smith (Keighly), Ltd., £147, one overhead travelling crane for Osborne Street sub-station.  
Carrick & Ritchie, Ltd., one overhead travelling crane for each of the following stations:—Dennistoun sub-station, £137; Byres Road, £39; Maryhill, £140.

**Hindley (near Wigan).**—The U.D.C. has accepted the tender of the Corlett Electrical Engineering Co., Ltd., for a motor and pump for sewerage purposes.

**Manusfield.**—The Corporation has accepted Messrs. Chamberlain & Hookham's tender for electricity meters for the coming year.

**Runcorn.**—The U.D.C. has sealed contracts with the British Westinghouse Electric and Manufacturing Co., Ltd., Mr. Thos. W. Ward, and Messrs. W. Farrell & Son, in connection with the electrification of the pumping plant

**London.**—L.C.C.—The following tenders were received for laying stoneware ducts, repaving, &c., in connection with tramways:—

J. A. Ewa t..	..	..	..	..	..	(accepted)	£1,819
Airds, Ltd.	..	..	..	..	..	..	1,939
Reid Bros., Engineers, Ltd.	..	..	..	..	..	..	2,078
J. Mowlem & Co., Ltd.	..	..	..	..	..	..	2,269

For overhead poles for the tramway extension in East India Dock Road the tenders received were:—

Clough, Smith & Co., Ltd.	..	..	..	..	..	(accepted)	£157
V. Watlington & Co., Ltd.	..	..	..	..	..	..	162
John Spencer, Ltd.	..	..	..	..	..	..	163
Dick, Kerr & Co., Ltd.	..	..	..	..	..	..	168
British Mannesmann Tube Co., Ltd.	..	..	..	..	..	(incomplete)	141
Do.	..	..	..	..	..	..	137
Chief officer's estimate..	..	..	..	..	..	..	146

The Highways Committee accepted tenders from the following firms for brushes for electrical machinery for the year 1912-1913:—Morgan Crucible Co., Ltd., Sloan Electrical Co., Ltd., and W. Geipel & Co.; also that of Siemens Bros. & Co., Ltd., for electric cable, &c., and that of Wilsons, Pease & Co., Ltd., for special iron castings.

The tenders received for the renewal of the electrical installation at Blackwall Tunnel were as follows:—

G. E. Taylor & Co.	..	..	..	..	..	(accepted)	£3,485
Tilley Bros.	..	..	..	..	..	..	3,537
Pinching & Walton	..	..	..	..	..	..	3,604
Drake & Gorham, Ltd.	..	..	..	..	..	..	4,305
Duncan Watson & Co.	..	..	..	..	..	..	4,464
Chief engineer's estimate	..	..	..	..	..	..	3,560

The tender of W. T. Henley's Telegraph Works Co., Ltd., at £155, has been accepted by the Metropolitan Asylums Board for supplying and erecting three concentric feeder cables at the Grove Hospital. The other tenders received were Western Electric Co., Ltd., £160; Siemens Bros. & Co., Ltd., £161; W. T. Glover & Co., Ltd., £163; British Insulated & Helsby Cables, Ltd., £165; Callender's Cable and Construction Co., Ltd., £174.

**FULHAM.**—The tender of Phillips & Co., Ltd., has been accepted by the B.C. for the supply of 100 tons of Kirkby  $\frac{1}{2}$ -in. coal, at 11s. 11d. per ton, for the Electricity Works.

**Southampton.**—The T.C. has accepted the tender of Mr. John Douglas, at £2,571, for reconstructing the tramways in Shirley Road.

**Walsall.**—With reference to the notice in our last issue respecting the Spencer-Dawson brake supplied to Walsall, we are informed that the price quoted only applies to the trial brakes purchased.

**West Bromwich.**—The Electricity Committee of the T.C. has accepted the tender of the Underfeed Stoker Co. for two underfeed stokers, at £285.

**Whitby.**—The North Riding of Yorks E.C. has accepted the tender of Mr. Robert M. Catterson-Smith, of Birmingham, for electric fittings for the Assembly Hall of Whitby Secondary School, at £79.

**Workshop.**—The U.D.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for a storage battery, at £1,357, and for maintenance for 10 years, at £81 per annum.

The Council has also accepted the tender of the Wigan Coal and Iron Co., Ltd., for coal for the electricity works.

### FORTHCOMING EVENTS.

**Exhibition of Non-Ferrous Metals.**—At the Royal Agricultural Hall, Islington, N. This exhibition is open daily to June 28th.

**I.M.E.A.**—Friday, June 21st. Closing meeting at Harrogate.

**Association of Engineers-in-Charge.**—Saturday, June 22nd. At 2.45 p.m. Visit to the Royal Naval College, Greenwich.

Thursday, June 27th. At 7 p.m. Visit to the Exhibition of Non-Ferrous Metals, Agricultural Hall.

**Physical Society.**—Friday, June 28th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "Hysteresis Loss as affected by Previous Magnetic History," by Prof. Ernest Wilson and Messrs. B. C. Clayton and A. E. Power; "The Efficiency of Generation of High-frequency Oscillations by Means of an Induction Coil and Ordinary Spark Gap," by Prof. G. W. O. Howe and Mr. J. D. Peattie; "Dielectric Hysteresis at Low Frequencies," by Prof. W. M. Thornton; and "Self-Demagnetisation of Steel," by Messrs. S. W. J. Smith and J. Guild.

**Optical Convention.**—On Wednesday the Optical Convention was opened at the Royal College of Science, London, by the President, Dr. S. P. Thompson; the programme of meetings extends to Wednesday next week, and an interesting and exhaustive collection of British optical manufactures and apparatus of historical interest has been brought together. Numerous papers on optical and allied subjects are being read during the convention, and a remarkable work of reference in the form of a descriptive catalogue has been prepared by an expert committee, with the assistance of the staff of the National Physical Laboratory.



## ELECTRIC DRIVING IN A KEIGHLEY MILL.

THE town of Keighley is the centre of a thriving textile and machine-making industry, which offers considerable scope for the modernising influence of the electrical engineer, and in the Keighley district some quite modern examples of electrical individual and group driving are to be found in local mills.

Merely to drive a mill electrically is a comparatively simple matter, but to drive it in such a manner as shall ensure commercially satisfactory results, beneficial alike to the textile and electrical industries, requires most careful discrimination and tact on the part of the engineer, especially when variations from customary and long-tried methods are involved.

For the adoption of electricity in connection with an old-time process generally introduces a new set of conditions, lack of appreciation of which too often deprives people of the full benefits obtainable under electrical operation; and

Messrs. Clough were not exactly strangers to electrical methods, having for three years operated a newly built electrically-driven mill in the town of Keighley, but nevertheless all credit is due to them for the progressive policy which resulted in the more recent and much larger development at Ingrow.

The mills in question consist of a fairly modern group of buildings known as the New and Alexandra Mills, and an old mill a short distance away.

A plan of the general lay-out is shown in fig. 3. Messrs. Clough are engaged in the worsted trade, and the New and Alexandra Mills contain the usual complement of combing, drawing, spinning and weaving machinery. The New Mill was originally driven by a beam

engine, but when the Alexandra extension was decided upon a cross-compound Corliss engine was installed to drive by ropes to the head shafts in the usual way.

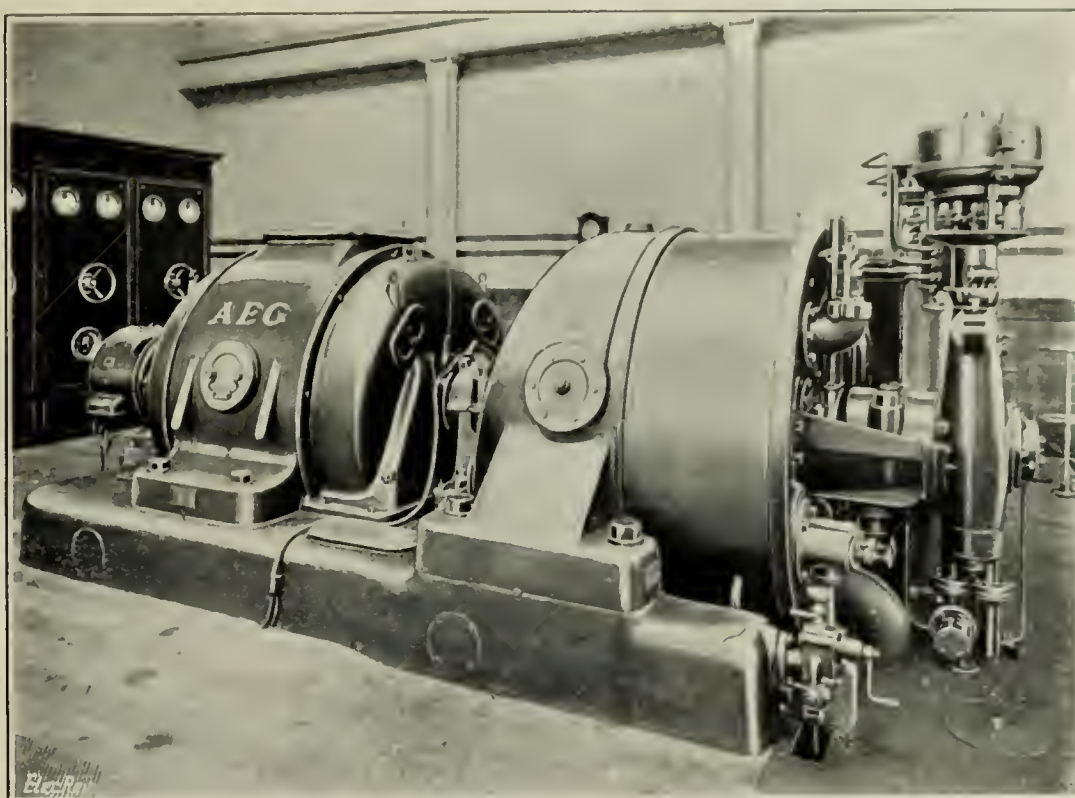


FIG. 1.—A.E.G. TURBO-ALTERNATOR AND EXCITER.

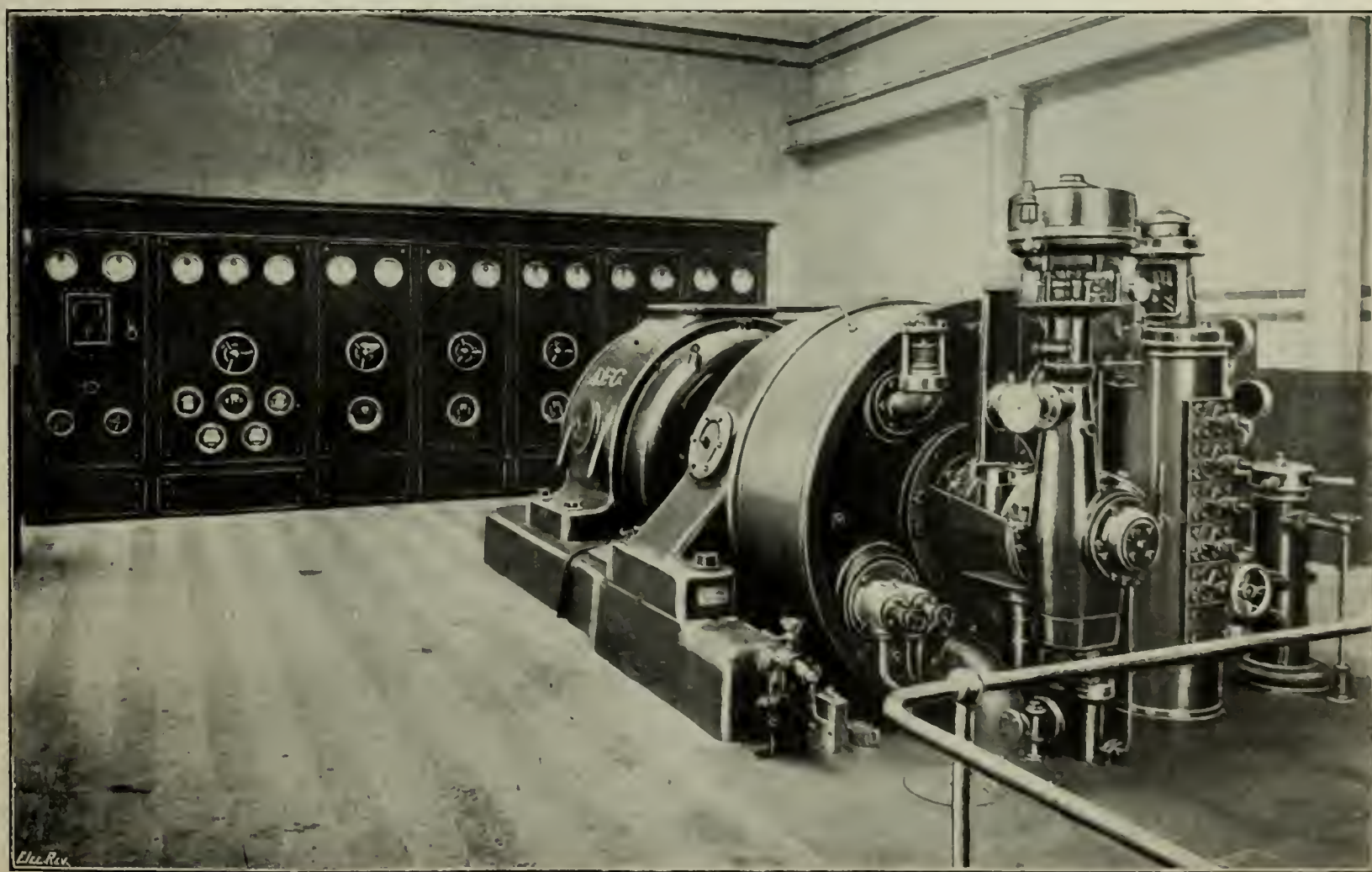


FIG. 2.—GENERAL VIEW OF ENGINE ROOM, MESSRS. CLOUGH'S MILLS, INGROW.

in the case of a mill, it must be remembered that the benefits to be derived are not always large ones.

One of the most interesting examples of mill electrification in the Keighley district is that which has recently been carried out at Messrs. Robt. Clough's mills at Ingrow.

The addition of the Alexandra Mill at one end of the New Mill makes a long drive, but notwithstanding the difficulty, the arrangement was well thought out.

The old mill lies about 120 yd. from the main group. This was driven by a 200-h.p. engine assisted by a



water turbine of about 50 H.P. Thus the three mills were driven by two engines. Messrs. Clough realised the importance of centralising their power plant, and that great economies were to be effected by shutting down the two widely separated engines and supplying all their power from a central point, and this consideration, perhaps, carried the greatest weight with them. Upon arriving at the decision to discard the old drive, Messrs. Clough called in Mr. W. O. Pepper, of Bradford, as their consulting engineer, and, on his advice, a modern turbo-electric plant has been installed, a large and handsome engine house having been built to accommodate the plant, adjacent to the existing boiler house.

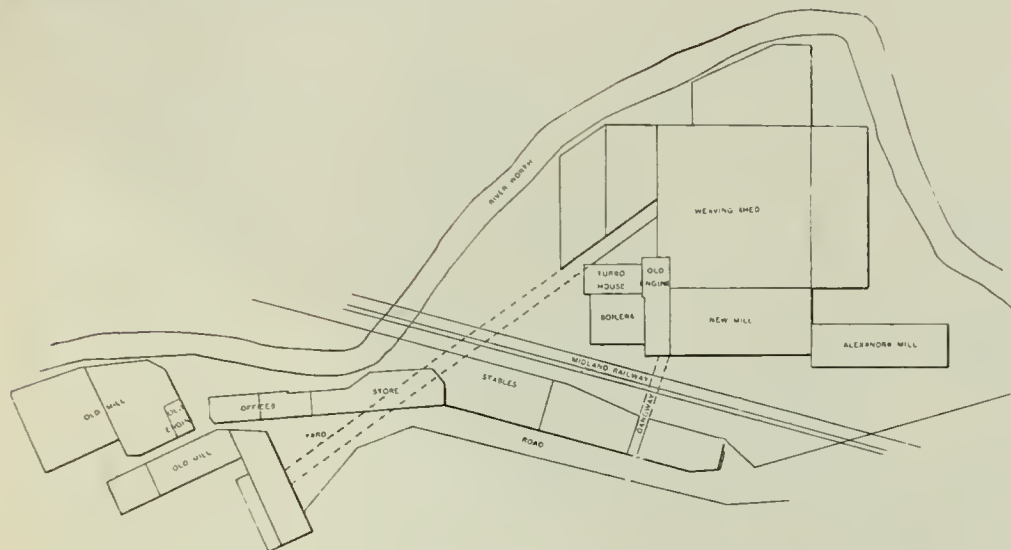


FIG. 3.—PLAN OF MESSRS. CLOUGH'S MILLS, INGROW.

We illustrate in fig. 2 this engine room, with its short and compact 1,250-K.V.A. three-phase turbo-alternator, and main switchboard controlling the various mill circuits; the

plant is of the well-known A.E.G. type. Steam is supplied at about 160 lb. pressure, superheated 150—200° F. The turbine is a two-stage machine, running at 3,000 R.P.M., and exhausts directly into a surface condenser in the basement below, where also are installed a single-throw two-stage air pump driven direct by an 18-H.P. three-phase motor, and a 20-H.P. motor-driven circulating pump with main and liquid starting switches, also the necessary pipe work, a view of this plant being given in fig. 5. The circulating water is taken from a stream flowing near by, which, we understand, provides an ample volume of cold water at all seasons. Provision is made, in case the circulating motor or pump should break down,

for utilising water from a pipe with an 18-ft. head. The water can be directed through the condenser and will maintain a vacuum of 18-19 in.

This arrangement, which provides an effective stand-by,

was suggested by Messrs. Clough's engineer, to whom Mr. Pepper expresses his indebtedness.

An entirely new departure in mill working is the comparatively tiny centrifugal boiler-feed pump designed to feed

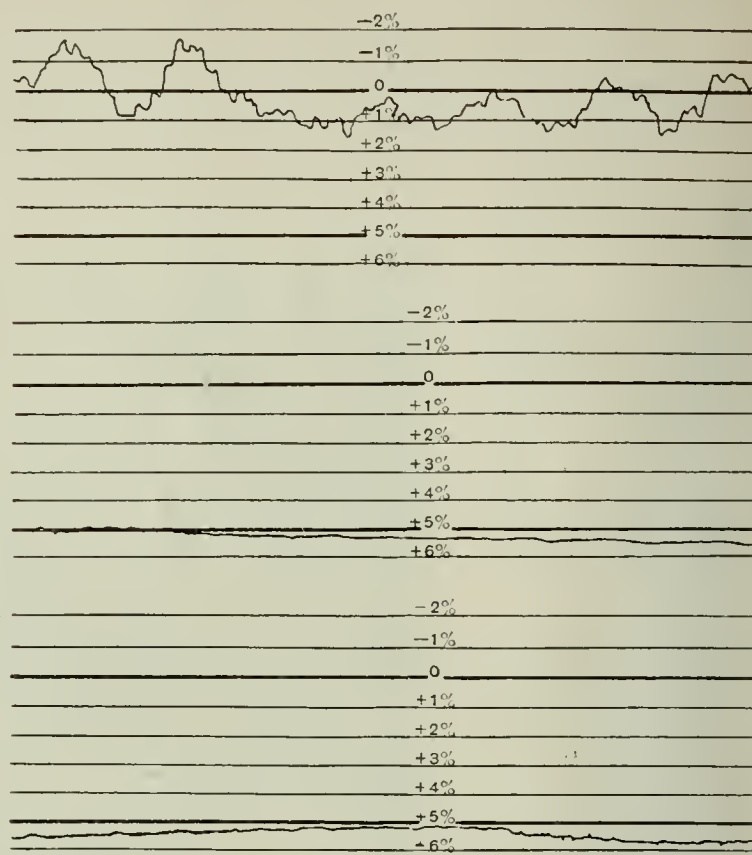


FIG. 4.—TACHOGRAPH CHARTS, SPINNING ROOM, WITH STEAM AND ELECTRIC DRIVE.

3,000 gallons per hour against the boiler pressure of 160 lb. per sq. in.

This is installed in an out-of-the-way corner, and when once set for the load will continue feeding automatically throughout the run.

A Lea recorder is installed to measure the condensed water from the turbine or the whole of the boiler requirements at will. With the integrating wattmeter on the switchboard, the Lea recorder affords a ready and accurate means of taking a water test at a few minutes' notice.

The main generator supplies current at 525 volts and 50 cycles, and is provided with a 110-volt exciter mounted on an extension of the bed, and seen in fig. 1. The generator is ventilated by filtered air, which is discharged through a sheet-iron duct.

The switchboard is of the A.E.G. iron-clad type, fig. 6, with the instruments let in flush with the face of the panels, and

only the oil-switch operating wheels projecting: it consists of one generator panel, equipped with a three-pole main oil switch with overload time relays, main watt-hour meter, power-factor meter, ammeters, &c., and adjoining it a panel

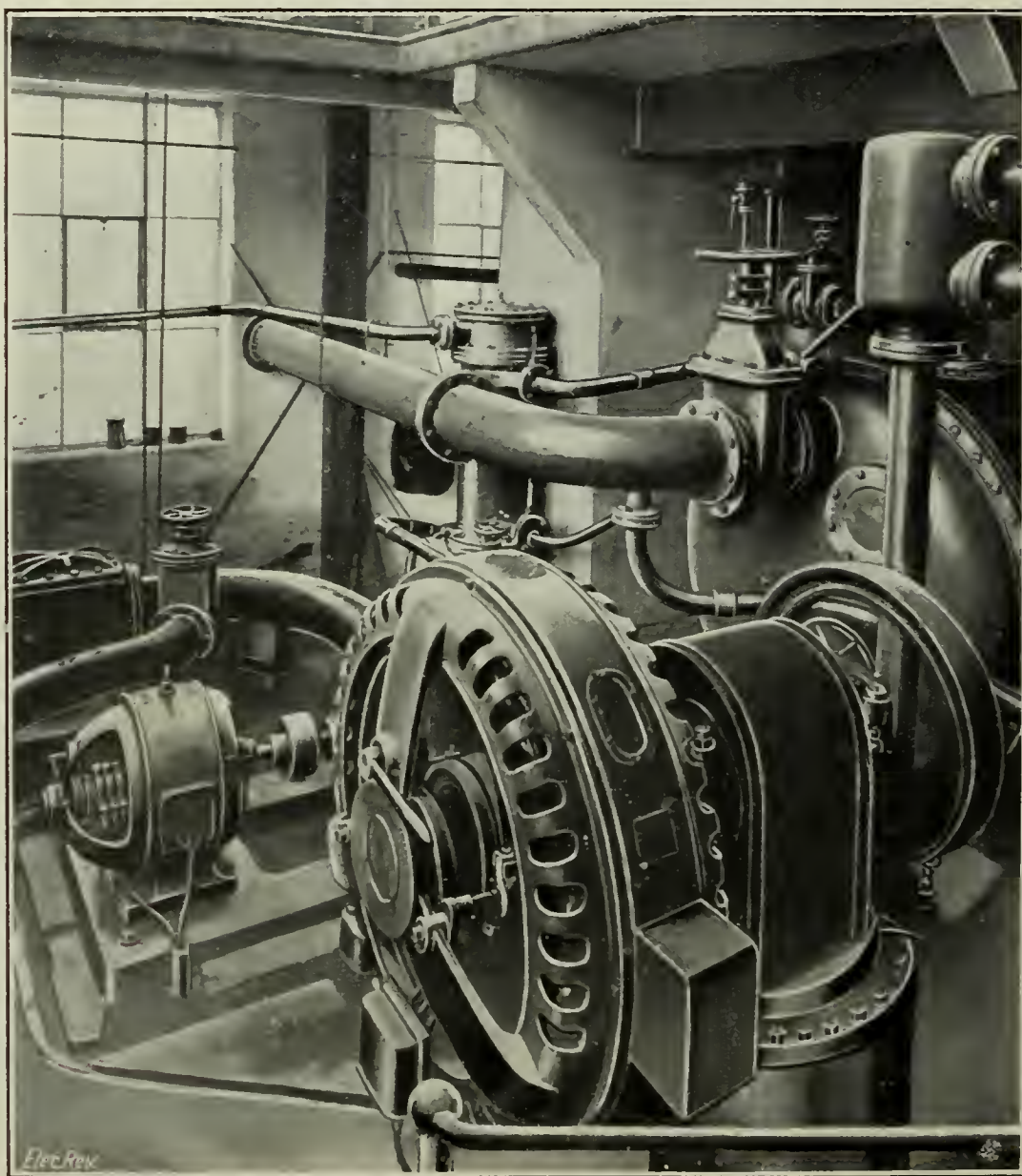


FIG. 5.—CONDENSING PLANT, MESSRS. CLOUGH'S INSTALLATION.



carrying a Tirrill regulator, field regulating switches and the necessary instruments, also five feeder panels each with a main oil switch, watt-hour meter, and ammeters in two phases. The back of the board containing the bus-bars, switch mechanism, &c., is enclosed by a grill partition, and as our view indicates, a very safe and workmanlike arrangement has been adopted. No greater contrast can be imagined than that between the original slow-running multi-cylinder horizontal engines, and the small, compact and cleanly turbo-electric plant now installed.

Turning to the various mill-drives, in the new mill five 100-B.H.P. induction motors, running at 600 R.P.M., are installed for driving the combing, drawing and three spinning rooms. The motors are conveniently situated in storerooms by the lift race at one end of the building, which are separated from the mill itself by fireproof doors. The arrangement adopted, which is common to all the motors, is shown in figs. 10 and 11, where the necessary switch-gear, consisting of an ironclad circuit-breaker, with overload and no-load trips, combined with an ammeter in the top of the case, and the liquid starter are also clearly indicated.

A similar motor of 125 B.H.P. at 500 R.P.M. is installed in an annexe to the weaving shed for driving the weaving, dyeing and finishing machinery.

Again, in the Alexandra Mills a 150-B.H.P. motor, running at 500 R.P.M., shown in figs. 7 and 8, and two 75-B.H.P. motors, speed 600 R.P.M., of which one is shown in fig. 9, are installed for driving spinning machinery, these motors being enclosed in metal grillages.

In connection with the above, perhaps the most striking feature is that in each case the drive is by means of a Hans-

running, vary from 4 in. to 9½ in. in width, and are claimed to have a driving efficiency of 98 per cent. which is maintained in use. We believe this is the first example of a textile mill in which the chain drive from a motor has been employed throughout; there is little doubt, however, that the arrange-



FIG. 6.—MAIN SWITCHBOARD, MESSRS. CLOUGH'S INSTALLATION.

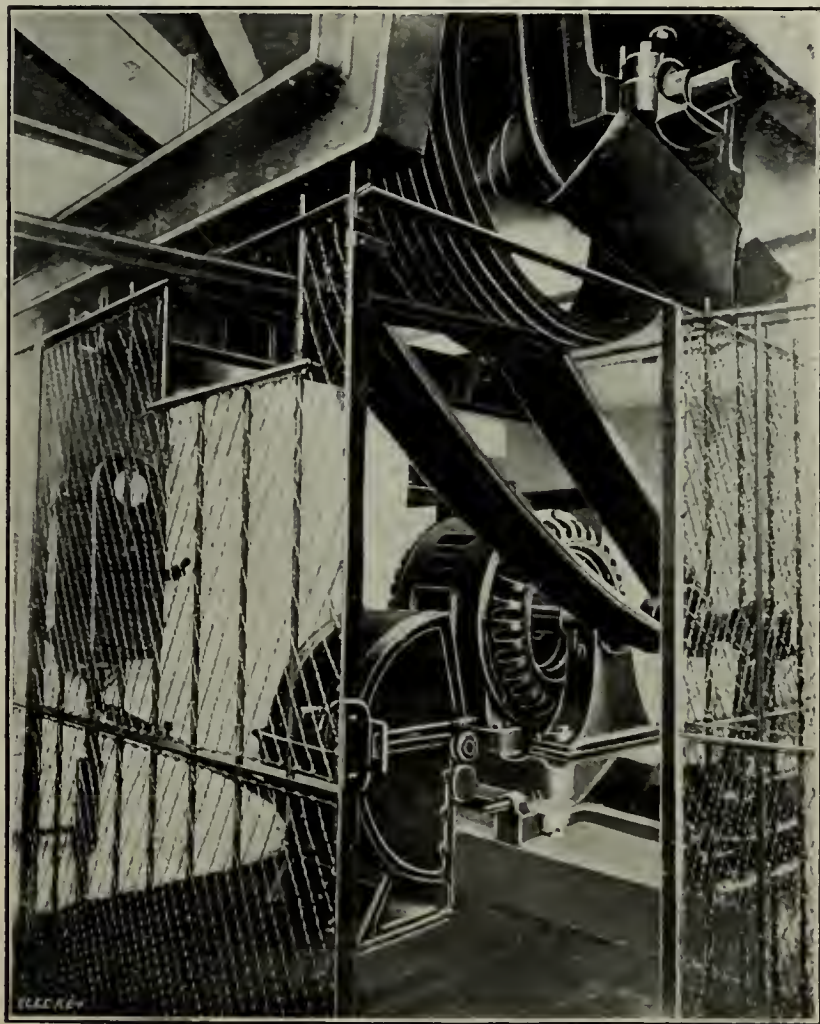
ment is a very satisfactory one under the conditions existing in these mills, and that it solved several difficult problems in connection with the conversion.

Western Electric three-core bitumen wire-armoured feeder cables running through the disused rope race connect the main switch panels to bus-bar boxes, from which branch feeders connect to motors; one main also supplies the old mill, where about 240 H.P. in motors is required.

The installation is a good example of the modern centralised power plant, and shows the facility with which power can be carried to any awkwardly placed shed or new extension. We understand that it is too early to speak of results, but an example of the improved running of the shafting may be gathered from the tachograph charts on a spinning-room shaft before and after conversion, shown in fig. 4.

In conclusion, we are much indebted to Messrs. Clough and to Mr. Pepper, their consulting engineer, for allowing us to describe and illustrate an installation which possesses many features of more than usual merit.

The turbo-electric plant and motors are of the well-known A.E.G. type, and their interests have been handled by Mr. W. Kobs, manager of the Leeds office, to whom also our thanks are due.



FIGS. 7 AND 8.—LARGE MOTOR, ALEXANDRA MILLS; CHAIN SHOWN RUNNING AND WITH GUARD.

Renold chain on to the old line shafting running at from 160 to 190 R.P.M.

These chains, which are indistinguishable from belt drives in our views, owing to their having been photographed while





## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

SEVERAL recent accidents to linemen working on overhead wires in Toronto, two resulting in the death of the unfor-

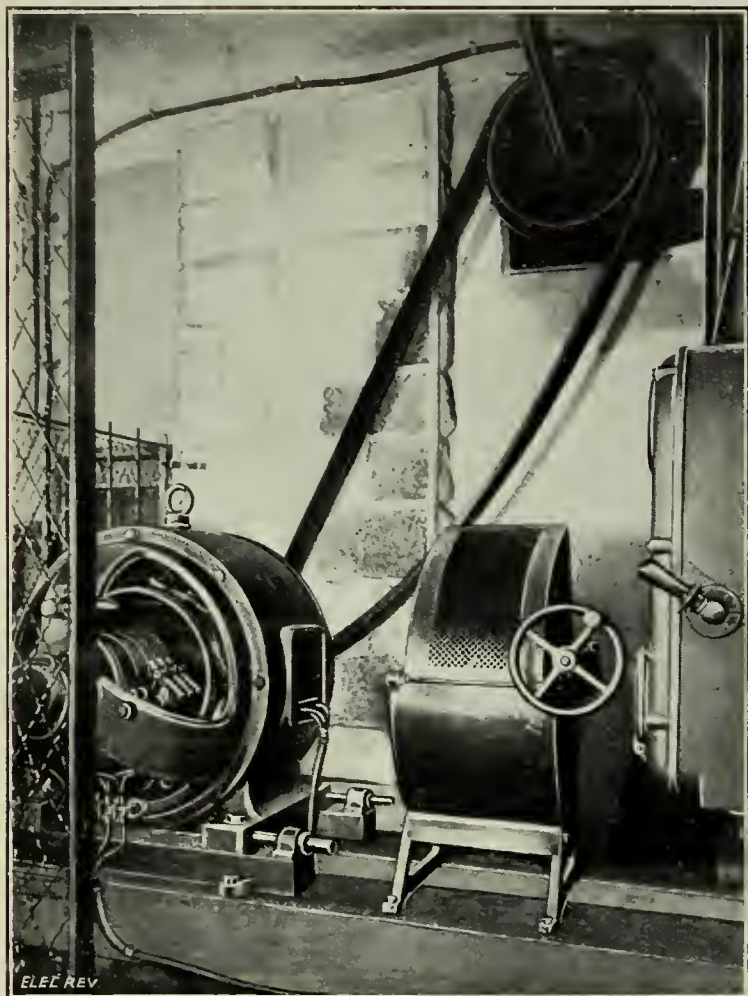


FIG. 9.—75-H.P. MOTOR DRIVING SPINNING MACHINERY.

tunate workmen, have again brought into prominence the danger of having overhead wires, particularly in large cities where large numbers of conductors cross and recross each

to hold the cross-arm rigidly in place; the man touched the brace, which he expected to be dead, and received a shock which resulted in his death. The tangled and hopeless state of confusion of overhead wires which is allowed over here needs to be seen to be appreciated—no wonder people are beginning to ask that the wires should go underground.

There is a possibility that the Canadian Northern Railway line, between Ottawa and Montreal, will be electrified, and it is reported that the electrification of the line entering Toronto may be carried out before very long. A radial electric railway is to be built to connect Toronto and Guelph, which are about 50 miles apart. Hamilton also is to be connected with Toronto in a similar manner. Hamilton lies some 40 miles south-west of Toronto, and is rapidly becoming an important manufacturing centre; being close to Niagara it is well supplied with power, and as it is on the shore of lake Ontario, and has good railway connections, it is favourably situated.

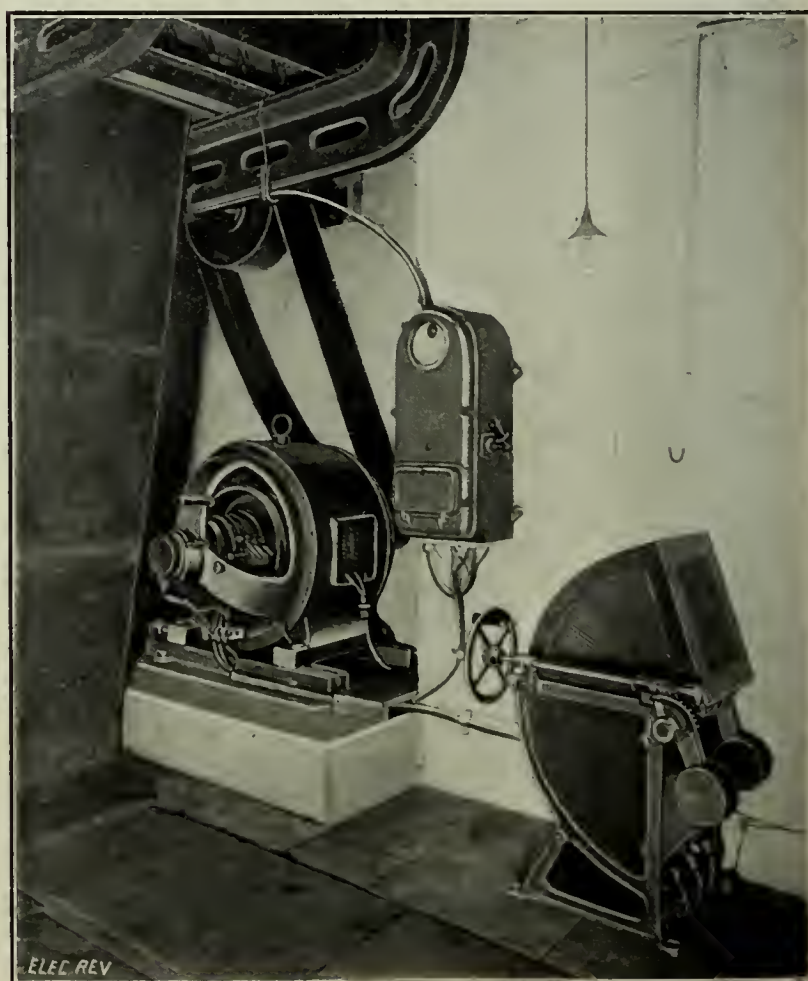
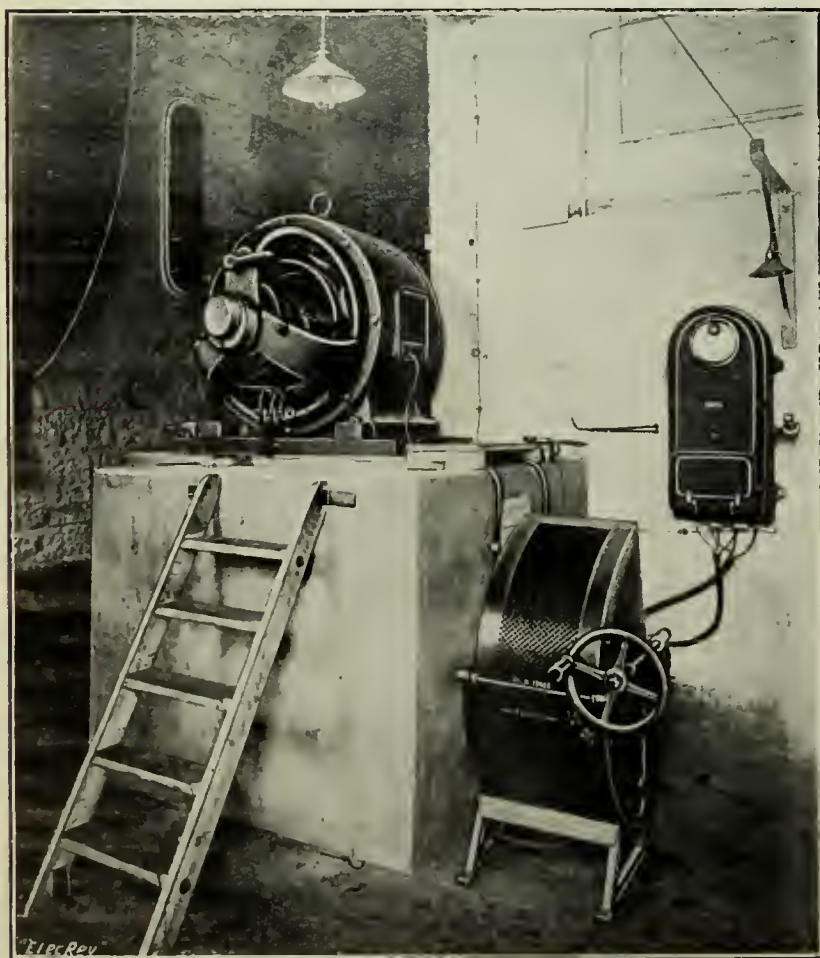
The authorities presiding over the Technical Schools of Toronto have just decided to give four-year industrial courses free of charge, and employers are to be asked to co-operate by permitting boys to attend classes during working hours, twice a week.

Arrangements are being made by the Hydro-Electric Power Commission of Ontario to give a practical demonstration of the application of electricity to farm work, and it is intended to show on a farm pumps, churns, cream separators, choppers, &c., in actual operation.

512, Continental Life Building, Toronto.

**Conditions in Canada.**—After all that we and our Canadian correspondent have said regarding the difficulties confronting British engineering firms in Canada, the following private letter received by a correspondent may be left to speak for itself:—

"The British Columbia Electric Railway Co., who, as you know, are purely an English concern controlled from London, with English engineers on this side, and an English general manager, have just placed an order for over \$600,000 worth of steam turbine and boiler work with the C. C. Moore Co., of Seattle, and I think it is time that some of you fellows brought this matter up in the English technical papers, as this sort of thing is killing business in Canada, and the B.C.E. Railway apparently buy everything in America. The chief engineer . . . has now placed the order



FIGS. 10 AND 11.—TYPICAL MOTOR INSTALLATIONS IN STORE ROOMS AT MESSRS. CLOUGH'S NEW MILL.

other to such an extent that it is almost impossible for any workman attending to them to avoid coming into contact with them. In one case a telephone wire was in contact with a wire at 2,200 volts and also with an iron brace used

with the Allis-Chalmers Co. without even competition, and as the English papers seem to be boosting Canada and its great possibilities, I should like to see someone tell them exactly how things stand out here. Practically all the big jobs in every line of business go to the States."



## NOTES.

**Engineers' Club for Manchester.**—A strongly-supported movement is on foot in Manchester for the formation of a club for engineers and others who are intimately connected with engineering. Its objects are to be these:—(1) To provide a means of social intercourse and the usual club facilities for those who are concerned with engineering; (2) to meet the convenience of members whose business causes them to visit Manchester; (3) to provide a hall for technical and social meetings; (4) to establish a home for a technical library.

According to the outline of the proposed constitution, its membership will be open to the following:—

1. Gentlemen engaged in the design, superintendence, direction or control (technical or commercial) of engineering and chemical works or operations.

2. A limited number of gentlemen intimately connected with engineering, and whom, in the opinion of the Committee, it would be an advantage to the club to enrol as members.

3. Life members may be admitted on payment of a suitable fee.

4. Country members. (Under conditions to be determined.)

It is proposed that the entrance fee shall be £3 3s., and the subscription £3 3s. per annum. Those who signify their intention of becoming members before July 1st, 1912, and are duly elected and pay their subscriptions within one month of their election, will be deemed original members, and admitted without entrance fee.

Mr. A. L. Green, of 8, Westminster Avenue, Manley Park, Manchester, is acting as secretary (*pro tem.*). In a circular issued by him at the instruction of a Committee, composed of members of the Councils of local Technical Societies, he says:—"It is considered that a membership of 500 persons would justify the formation of such a club. . . . The idea has met with general approval from such individuals as have already been approached personally."

A meeting will be called at an early date of all those who may have intimated their desire to join, and a Committee will then be appointed to draw up a constitution and undertake the initiation and management of the club.

**The Electrical Contractors' Association (Inc.).**—On Monday last the annual dinner of this Association was held at Frascati's. The President, Mr. G. Harland Bowden, occupied the chair, and was supported by the President-elect, Mr. W. A. Shaw, and other officers and friends of the Association. After the loyal toasts had been duly honoured, Mr. A. H. Dykes proposed "The Electrical Contractors' Association," which, he said, now numbered over 400 members, with nearly 20 branches, and was unquestionably doing useful work. He referred to the position the Association would occupy 20 years hence, in the "all-electric" era, when the wireman would be the household friend—though doubtless wires would be dispensed with by that time, and all lighting, cooking and heating would be accomplished by wireless transmission from plant at the pit's mouth. When he was chairman of a municipal electricity committee which possessed wiring powers, his committee provided the funds, but did all the work through contractors, and he was emphatically of opinion that that was the proper course to follow; but he had heard that day that the I.M.E.A. Bill had been dropped, so they could rest in peace. He hoped the Association of Consulting Engineers would in the future enter into cordial relations with the Electrical Contractors' Association, to their mutual advantage, and concluded with a reference to the indefatigable activities of the secretary, Mr. L. G. Tate, and the President, Mr. Bowden.

In reply, Mr. R. Tweedy Smith (Hon. Solicitor) said he thought it was time an "electrical Parliament" was organised, on which all the various electrical associations should be represented; the E.C.A. already had great influence with the authorities, and the electrical Parliament would be still more powerful. He foresaw for the coming year further progress in the work of the Association such as their opponents hardly dreamt of.

Mr. W. R. Rawlings proposed the toast of the I.E.E., the B.E.A.M.A. and kindred Associations, remarking on the good work done by the I.E.E. during the last year or two, and the prospect that, with the aid of commercial members, still better work would be accomplished in the future, through the operations of the Industrial Committee. The B.E.A.M.A. had carried out a very fine exhibition, with good financial results to themselves; a great work remained for them—to teach manufacturers outside the Association to carry on business on legitimate lines. He welcomed Mr. Dykes's remarks on municipal wiring, and expressed the hope that the consultant who was neither consulting engineer nor contractor would be crushed out. The Municipal Electrical Association were seeking powers which, they said, they would not exercise if they got them; by so doing they were alarming the industry and hampering the contractor.

Mr. A. B. Anderson, in his reply, emphasised the fact that very often the best way to help oneself was to help one another; in the Manufacturers' Association that feeling was growing strongly, and when the buyer realised that the manufacturer was also his customer, they would all appreciate more fully their mutual interdependence. He was sorry the Municipal Bill had been dropped, for a compromise had nearly been reached through the Industrial Committee of the I.E.E.; and a satisfactory compromise would have afforded a more desirable ending to the struggle. Regarding the Exhibition, he pointed out that the profit was earned on money put up by the manufacturers themselves.

Mr. L. B. Atkinson replied on behalf of the Cable-Makers' Association, whose relations with the E.C.A. had been most friendly for many years; the arrangement between them had achieved a large

measure of success, but a number of members of the E.C.A. unfortunately had not fully carried it out—otherwise the benefits to those who had done so would have been greater. Some said the Cable-Makers had not borne their full share of the keen competition which obtained, and the C.M.A. had been much abused; but it had striven to maintain the high quality for which British-made cables were famous throughout the world, and had not reaped exorbitant profits. The ordinary capital of the cable companies was very small; in the case of four of the largest firms, altogether four million pounds was occupied, of which scarcely 25 per cent. received the large dividends. In the early days these companies built up large reserve funds— $\frac{1}{2}$  to  $\frac{3}{4}$  million—which were invested in the business and on which no dividends were paid; if the profits were divided over the whole of the capital, they were only making a little over  $5\frac{1}{2}$  per cent., which was not an unreasonable return.

Mr. A. Rashleigh Phipps proposed the healths of the retiring president Mr. G. Harland Bowden, and the president-elect Mr. W. A. Shaw, which were awarded musical honours. In reply, Mr. Bowden referred to the work accomplished during his two years' term of office, and tendered a hearty welcome to his successor. Regarding the friendly relations between the C.M.A. and E.C.A., he explained that the recalcitrant contractors, when urged to carry out the compact, retorted that one firm of cable makers took contracts for wiring; he was glad to say that that difficulty had now been definitely removed. He protested against the action of the Municipal Electrical Association, maintaining that the contractor was the best friend of the municipal electrical engineer, if he only got hold of him in the right way, and the best canvasser for the central station. He still hoped that an amicable agreement would be reached, and regretted the waste of time and money in useless fighting. The Scottish branch of the E.C.A. had amicably separated from the latter, because the cost of attending meetings in London swallowed up the receipts; the arrangement was made for the sake of economy and efficiency, but the defence fund was still available for all parties.

Mr. Shaw also briefly responded, remarking that he had served his apprenticeship in connection with the northern branch, and had been fortunate in securing the goodwill of all his colleagues.

An excellent entertainment was provided, and the function was in every way successful.

**The Kearney High-Speed Railway.**—On Wednesday, the 12th inst., a luncheon was given at the London Lounge, Oxford Street, to a number of Press representatives by the directors of the Kearney High Speed Railway Co., Ltd. Sir George Reid had promised to be present, but was unavoidably prevented from doing so. A model showing the proposals embodied in the system was shown in operation, and a small car attained on the level as high a speed as 30 miles per hour. The Kearney system is of the so-called "monorail" type, that is, the cars run between two rails one above and one below the car. This is stated to allow of much higher maximum speeds than is permissible with the ordinary double rail track. Every advantage is taken of gravitation, and the proposal in regard to tube railways is to place the stations at or near ground level, and grade the line according to the distance between the stations. Some time ago there was a proposal to construct a line on this principle between the Strand and the Crystal Palace, and at the time we gave our opinion on the prospects of the venture.

It is now stated that a concession has been obtained for a line 11 miles long (2 miles underground and 9 miles in the open) between Nice and Monte Carlo. It is claimed that the saving in first cost of the Kearney over ordinary standard construction is 60 per cent., and that the Kearney trains will accomplish the journey between the termini in 20 minutes, as compared with 35 minutes on the present steam railway expresses. Mr. Graham White, speaking at the luncheon, spoke of the favourable impression an exhibition of the system at the Crystal Palace gave him, and wished the inventor every success in introducing his system.

Mr. Kearney stated that it was hoped that work on the new line would be commenced in the autumn, and that the first section would be opened for traffic before the end of 1913.

A number of claims are made in regard to this system, which, in our view, can only be substantiated by practical working, and until actual results are obtained, we still hold to our doubts as to the merits of the system.

**Annual Outings.**—On Saturday, June 8th, some 450 members of the works employes and staff of Messrs. Bruce Peebles and Co., Ltd., left Edinburgh in the morning, in excellent weather, for their annual outing, travelling by special train to the ancient town of Stirling. The usual sports were entered into with great gusto, the prizes being presented by Mr. C. J. Hunt, chief of the contract department. After lunch the party split up into groups and various places in the surrounding district were visited by motor car, char-à-banc, or other conveyance. A most enjoyable day was spent.

The employes of Messrs. E. Brook, Ltd., of Huddersfield, held their eighth annual picnic on Saturday, June 15th. Two motor chars-à-bancs left Colne Road at 8 o'clock and arrived at the Leeds showrooms at 9 a.m. After half an hour had been spent in inspecting the Leeds branch, the party left for Harrogate. Dinner, to which 46 sat down, was served at the Somerset Hotel. After dinner Mr. E. Brook, Mr. G. V. Laycock, and Mr. W. Horsfall made a few remarks respecting the very good feeling that existed amongst all connected with the firm, and a wish was expressed that four cars might be required next year. Knaresborough, Otley and Bradford were visited, tea being served at the White Swan Hotel, Otley.



**Railway Electrification.**—A discussion has been proceeding for some time in the *Engineering Supplement* of the *Times*, as to the relative merits of the single-phase and direct-current systems for railway operation. The following letter in a recent issue, signed "Railway Engineer," admirably sums up the position:—

"I have read with great interest the various articles and letters which have appeared from time to time in the *Engineering Supplement* on the question of railway electrification, but as a railway engineer I find it difficult to discover anything very convincing.

"The question whether one system is a few per cent. more efficient than the other is not the deciding factor; both are remarkably efficient, and the reasonable amount of carelessness in handling which is always present and costs too much to eliminate is more than sufficient to hide any difference.

"Railway electrification, if taken up at all, must be treated on broad lines, and all must realise that the problems of the London Underground are not the problems of any of our large railways. We must realise that a contest with a local tramway is not the end of all things, but that electricity can, and will, replace steam entirely both for passenger and goods traffic. The natural consequence of this will be the electric locomotive instead of the motor-coach.

"The real problem then becomes not one of 5 per cent. more efficiency on the motor, but can we install a third and fourth rail in goods yards, shunting yards, terminal stations, or on any complicated special work, in such a way that an electric locomotive can work over it? It is absolutely impossible. The Central London, using locomotives, had to change to overhead at Shepherd's Bush yard. The North-Eastern using motor coaches revert to overhead in their yards: so also do the American companies.

"Would any Board of Trade accept a third and fourth rail construction in even the wayside goods yards, to say nothing of Camden Town, Crewe, Bricklayers' Arms, Waterloo Station, &c., places open to carters, merchants' clerks, and others with no knowledge of the dangers of contact with such things? Some people are talking of inverted third rail at a higher pressure. Can any one imagine the fate of platelayers in Crewe yard or between Waterloo and Clapham Junction with a high-tension fence between each track? I venture to think we should hear more about working in abnormal places than would be good for us.

"Would the various collieries and engineering works with sidings care to have third and fourth rails on their property, and would insurance companies accept the risk? The third and fourth rail is impossible in all these places, which all occur in thickly populated or suburban areas—the Mecca of the D.C. system. On the open line and for long distances, clear of junctions, special work, and goods sidings, both systems can be installed cheaply and efficiently, but under these conditions the D.C. advocates say the single-phase system is the best and even go so far as to propose a dual system.

"Therefore the question the railway manager has to settle is whether he will install a system on which he can use an electric locomotive or not: a system which can handle only passenger traffic and new rolling stock, or one that can deal with both passenger and mineral traffic with the old stock; a system which he can put into his goods yard with safety to the public and his own employés. The answer is a foregone conclusion. The overhead is the only thing possible. Efficiency has nothing to do with the matter of system; maintenance of permanent way alone is sufficient to decide the question. The battle of efficiency must be fought between high-tension D.C. at 4,000 volts, and that only a laboratory experiment, and single-phase at 10,000 volts, a practical system in operation in almost every country; a motor with 4,000 volts on its commutator and only rendered possible by using a patent magnetic blow-out on the control gear, or a motor with 300 volts A.C. on its commutator and any standard control gear.

"Let railway engineers and managers decide the question from the facts in their own offices; their traffic and permanent way officials are far more capable of saying what can or cannot be done on a railway than any electro-mathematical expert."

**An International Tramway Congress.**—An important congress of the International Union of Tramways and Light Railways is to be held in Christiania, Norway, from July 2nd to the 5th, followed by an excursion to Bergen. Among the questions to be dealt with at the various meetings are, "The Influence of New Modes of Public Service Transport on the Development and Extension of Large Towns," "The Employment of Motor-Coaches on Railways in General and Light Railways in Particular." Herr Hradezky, the manager of the Vienna municipal tramway system, will present a report on "The Organisation of Tramway Services to Deal with Large Crowds of People in Important Towns." M. Bacqueyrisse, of Paris, and Herr Eisig, of Chemnitz, will present reports on "The Employment of Continuous-Current Motors with Commutator Poles for Electric Tramway Work"; Herr Buschbaum, of Berlin, one on "German Precautions with regard to Electrolytical Currents in Tramway Operation"; M. E. d'Hoop, and Herr Otto, Berlin, one on "The Control and Upkeep of Tramway Overhead Conductors and Feeders"; Herr A. Busse, of Berlin, one on "The Undulatory Wear of Tram Rails"; and M. F. de Le Haye, of the Société Nationale de Chemins de Fer Vicinaux, of Brussels, one on "Progress in the Heating and Lighting of Trains on Light Railways."

**Institution and Lecture Notes.**—ROYAL SOCIETY OF ARTS.—The Council has awarded the Society's Silver Medal to the following and a number of other readers of papers during the Session 1911-12:—Prof. G. W. Osborn Howe, M.Sc., M.I.E.E., "Recent Progress in Radio-Telegraphy." H. A. Roberts, M.A., "Education in Science as a Preparation for Industrial Work"

George Fletcher, "Technical Education in Ireland." E. Kilburn Scott, Assoc. M.Inst.C.E., M.I.E.E., "The Manufacture of Nitrates from the Atmosphere."

**THE INSTITUTION OF GAS ENGINEERS.**—This Institution at its recent annual meeting, elected Mr. Corbet Woodall as President for the ensuing year, which marks the Jubilee of the Institution.

**VERBAND DEUTSCHER ELEKTROTECHNIKER.**—At the opening ceremony of the annual meeting of the German Society of Electricians, which took place in Leipzig on June 6th, the Council of the I.E.E. presented a portrait of Faraday, admirably painted by Miss Beatrice Bright, to Dr. Budde, the president of the I.E.C., as a mark of personal esteem. The presentation was made by Dr. Gisbert Kapp, who, with the general secretary of the I.E.C. (Mr. le Maistre), journeyed to Leipzig especially for this purpose. In performing this ceremony, Dr. Kapp said the tasks of the Commission became more and more difficult, not only in respect of purely scientific or technical matters, but also on account of national considerations: when they came to definitions and names of units the difficulties were greatly increased. To deal fairly with such difficult and delicate questions, each Commissioner must not only have mastered the purely scientific side of the subject, but he must also be able to consider it in a broad and unbiased manner. In both directions Dr. Budde had earned the gratitude of his colleagues; his unvarying courtesy in discussion, and his tact, had smoothed the way of the Commission.

**Fatalities.**—At an inquest held last week into the circumstances attending the death of Harry Gillis, who was killed at the Knoll Drift colliery, the medical evidence showed that death had resulted from asphyxia caused by an electric shock. The further hearing was adjourned.

While John Greenall, electrical engineer, was in the act of boarding a carriage on the Overhead Electrical Railway, at Liverpool, on Wednesday, June 12th, he fell beneath the moving train and sustained injuries which proved fatal almost instantaneously.

A correspondent states that George Hall, 26, an electrical engineer, working at Buchanan's flour mills, Birkenhead, has died at the Central Hospital, Liscard, as the result of an accident. He was at work near a shaft at the mills, when by some means his clothing was caught in the revolving machinery.

John Bell, aged 34, a linesman, of Ravensthorpe, employed by the Yorkshire Electric Traction Co., was climbing a pole carrying electric wires at Cawthorne, near Barnsley, on Tuesday, when his wrist came into contact with a live wire, and he was instantly killed.

**Appointments Vacant.**—Engineer and manager, for the Corporation electricity undertaking, West Ham (£550); shift engineer, for the electric light department of Southern Nigeria (£300); junior assistant engineers, for the Yorkshire Electric Power Co. (15s.). See our advertisement pages in this issue.

**Smoke Nuisance and the Remedy.**—At the Blackburn Court, on June 14th, Messrs. Kershaw & Co., Crystal Spring Dye Works, were summoned for causing a black smoke nuisance. For the defence, Mr. Bonney explained that the firm were making arrangements to do away with the nuisance: they proposed to run the works by electricity. A fine of 20s. and costs was inflicted and an order made to abate the nuisance.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. R. H. LEE, charge engineer at the Gillingham Corporation electricity works, was on the 10th inst. presented with a travelling bag and slide rule by the staff and workmen of the above works, on the occasion of his leaving to take up the post of junior engineer at the Fulham electricity works. The presentation was made by Mr. Alec. D. Chalmers, borough electrical engineer. Mr. Lee was previously with the Kent Electric Power Co., and at Tunbridge Wells, and Glossop.

MR. G. B. CHURCHILL, of the Croydon electricity staff, who was married at Swynbridge (Devon) last week to Miss K. Houle, has been presented by his colleagues with a marble clock.

The Wakefield T.C. has appointed MR. H. G. FRASER, of Blackburn, as works superintendent at the electricity works, at £140 per annum.

On Wednesday, 12th inst., at Rotherham Parish Church, MR. A. C. WRAGG, of the Corporation electricity works, Rotherham, was married to Miss Cissie Thompson, of Canklow, near Rotherham. The bride and bridegroom were the recipients of a silver-plated tea service on oak tray, from the employés of the electricity works, the presentation being made by the chief engineer, Mr. E. Cross.

MR. WILLIAM AITKEN, who has been for the past 10 years on the clerical staff of the Leith Corporation Electricity Department, was, on 18th inst., presented with a gold Albert by the staff and employés, on the occasion of his leaving for Winnipeg, Canada.



Mr. J. Beveridge, chief clerk, made the presentation, and Mr. Aitken suitably replied.

On June 18th Mr. GILBERT TURNER, assistant to Mr. W. D. Hunter, managing director and engineer of the Newcastle and District Electric Lighting Co., Ltd., was married to Miss Katherine Ann Laws. The officials and workmen of the company presented him with a canteen of cutlery.

**Tramway Officials.**—At the meeting of the Southport T.C. the minute printed in this column in our last issue was discussed. Mr. O'Regan moved that the minute be deleted. He remarked that there was dry rot in the supervision and organisation of the tramway and electricity estates, and the T.C. should go fully into the matter. Mr. Hadfield seconded, and the amendment was defeated. Then Mr. Trounson moved that the consideration of the abolition of the office of deputy tramway manager and electrical engineer be deferred till the Council has received reports of experts to be appointed. This resolution ended in a tie, but the Mayor gave his casting vote for it, and it was carried.

On June 14th, Mr. W. JENSEN, general manager of the Chatham and District Light Railways Co., was presented by the employés with a silver-mounted umbrella and a fountain pen, in appreciation of the good feeling existing between them. Not only were the company able to keep a full service going during the whole of the coal strike, but they were able to extend to the men the privilege of having coal at the company's cost price.

**General.**—In the list of birthday honours announced a few days ago the following, of more or less electrical interest, appear:—MR. H. L. TANGYE, M.I.M.E., F.R.G.S., eldest son of the late Sir Richard Tangye, and deputy-chairman of Tangyes, Ltd., has a baronetcy conferred upon him. The new knights include MR. R. SOTHERN HOLLAND, I.L.M. Trade Commissioner in South Africa; MR. C. A. KING, C.B., Comptroller and Accountant-General of the G.P.O., and MR. W. B. PEAT, of the well-known firm of chartered accountants. The honour of C.B. has been given to Mr. R. A. S. REDMAYNE, Chief Inspector of Mines. The Indian honours include a K.C.I.E. for MR. H. A. KIRK, C.I.E., India Office, Director-in-Chief, Indo-European Telegraph Department, and a C.I.E. for MR. S. K. L. YEATS, Accountant General, Posts and Telegraphs, and for MR. A. CHATTERTON, B.Sc., A.C.G.I., A.M.I.C.E., M.I.M.E., Indian Educational Service, Superintendent of Industrial Education, Madras. MR. H. M. ROBINSON, Deputy Chief Inspector of Factories at home becomes a Companion of the Imperial Service Order, as does also MR. DONALD ROBERTSON, Secretary, P.O. and Telegraph Department, Dominion of New Zealand, and MR. C. J. DEASE, Superintendent of Post Offices, N.W. Frontier Province, India.

According to the *Standard*, the L.C.C. at Tuesday's meeting received, with regret, the resignation of SIR MAURICE FITZMAURICE, C.M.G., its chief engineer, who is about to commence private practice.

MR. V. D. GREEN, late with Messrs. S. Jevons, Ltd., of Birmingham, has now accepted the management of the Pontelec Welding Patents, Ltd., of Birmingham.

The marriage took place recently, in Bath, of MR. C. G. LAWSON, an electrical engineer at the General Post Office, London. Among the presents was an inlaid mahogany clock from his colleagues.

MR. C. H. JESSOP has rejoined the Langdon-Davies Motor Co. as their outdoor representative.

MR. LEONARD A. LEVY, M.A. (Cantab), B.Sc. (London), F.I.C., &c., who has charge of the chemistry department of Messrs. Alex. Wright & Co., Ltd., has just been awarded by the University of London the degree of Doctor of Science. Dr. Leonard A. Levy will continue to take charge of Messrs. Wright's chemistry and research department.

MR. S. D. BARNWELL, electrical engineer, Alcasiza Seccion of the Buenos Ayres and Pacific Railway Co., Argentina, who is on a short visit to this country, will be obliged if manufacturers of dynamos, motors, and electrical accessories will send their catalogues to him at Saint Martin's, Beckenham.

## NEW COMPANIES REGISTERED.

**Tomellin Syndicate, Ltd.** (122,392).—This company was registered on June 4th, with a capital of £5,500 in 5,000 preference shares of £1 each, and 10,000 deferred shares of 1s., to acquire the benefit and undertake the liabilities of R. T. Cottrell under an agreement between himself and E. W. Crane, to acquire all or part of the shares of the Compania Hidro-Electrica de Oaxaca, S.A. (incorporated in Mexico), to acquire a concession granted by the Federal Government of Mexico for the utilisation of the waters of the Rio Grande in the State of Oaxaca for the production of electrical energy, to acquire all or part of the undertaking and assets of the Oaxaca Power and Light Co., &c. The subscribers (with one preference share each) are:—F. J. Abbott, 28, Inderwick Road, Hornsey, N., cashier; F. J. White, Rox-Leigh, Ingrave Road, Brentwood, managing clerk. Private company. The number of directors is not to be less than two or more than four; the first are R. F. Cottrell and F. Deverell; qualification, 25 shares; remuneration (except managing director, if any), £150 per annum. Registered by Surtees, Phillpotts and Co., 6, St. Helen's Place, E.C.

**Finch & Wheeler, Ltd.** (112,458).—This company was registered on June 7th, with a capital of £3,000 in £1 shares (2,000 6 per cent. preference), to carry on the business of electrical engineers, electricians, &c., and to adopt an agreement with A. E. Finch and F. H. Wheeler. The subscribers are:—A. E. Finch, 6, Carolin Place, W.C., gentleman, 1,000 preference shares; F. H. Wheeler, 17, Eatonville Road, Upper Tooting, S.W., gentleman, 1 ordinary share. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Finch and F. H. Wheeler; qualification, £100; remuneration of first directors £260 each per annum. Registered office, 2, Old Queen Street, Westminster, S.W.

**Super Heat Furnace Co., Ltd.** (122,465).—This company was registered on June 7th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and mechanical engineers, founders, smiths, machinists, patentees and manufacturers. The subscribers (with one share each) are:—R. F. Holt, 15, Masham Place, Toller Lane, Bradford, clerk; G. L. Waddington, 11, Hampton Place, Bradford, clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Scientific Treatments, Ltd.** (8286).—This company was registered in Edinburgh on May 30th, with a capital of £5,000 in £1 shares, to acquire the business of Power Appliances Co., 81, West Regent Street, Glasgow, and to carry on business as electrical and general engineers. The subscribers (with one share each) are:—H. A. Thomson, 22, India Street, Glasgow, electrical engineer; T. Brown, 55, Pitt Street, Glasgow, merchant; J. Campbell, 94, Wellington Street, Glasgow, merchant; J. Craig, 494, Sauchiehall Street, Glasgow, cabinet maker; J. M. Symington, 39, Albert Road, East Crosshill, Glasgow, plumber. Private company. The number of directors is not to be less than three or more than seven; the first are H. A. Thomson, T. Brown, J. Campbell, J. Craig and J. M. Symington; qualification, 100 shares. Registered office, 22, India Street, Glasgow.

**S. W. Martyn & Co., Ltd.** (122,388).—This company was registered on June 4th with a capital of £10,000 in 9,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each, to take over the business carried on at 11, Pratt Street, Camden Town, N.W., as "S. W. Martyn & Co.," and to carry on the business of automobile, mechanical, electrical, hydraulic and general engineers, &c. The subscribers (with one preference share each) are:—L. Hamilton, 100, King's Road, Camden Road, N.W., typist; S. W. Martyn, 11, Pratt Street, Camden Town, N.W., electrical engineer. Private company. The first directors are S. W. Martyn (managing director) and two others, to be appointed by him; qualification, £250. Registered by C. Double, 14, Serjeants' Inn, E.C.

**Fred Danks, Ltd.** (122,376).—This company was registered on June 4th, with a capital of £30,000 in £1 shares, to carry on the business of makers of boilers, tanks, superheaters, economisers and other boiler accessories, repairers of boilers, engine builders, motor engineers, motor-car and wagon builders, makers of electric motors, dynamos and electric machines and apparatus, &c. The subscribers (with one share each) are:—F. T. Danks, Glengarth, Quinton, Birmingham, boiler manufacturer; S. Hollingsworth, Deerwood Grange, Four Oaks, Warwickshire, gentleman; A. R. Baxter, Wellington Road, Edgbaston, Birmingham, gentleman; B. Baxter, Wellington Road, Edgbaston, Birmingham, manager. Private company. The number of directors is not to be less than two or more than five; the first are F. T. Danks, S. Hollingsworth, A. R. Baxter and B. Baxter (all permanent, special qualification, 1,000 ordinary shares); qualification of ordinary directors, £100. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

**No Cell, Ltd.** (122,410).—This company was registered on June 5th, with a capital of £3,000 in £1 shares, to acquire from H. C. H. Smyth, of 4, Barley Mow Passage, Chiswick, the benefit of certain existing inventions relating to an improved magneto-electric machine and the existing patent relating thereto, and to adopt an agreement with C. C. Hurford, H. C. H. Smyth, 11, Goldney, H. J. de Barrv Barnett and G. Adams. The subscribers (with one share each) are:—C. Hurford, 48, Dover Street, W., automobile engineer; H. C. H. Smyth, 4, Barley Mow Passage, Chiswick, electrical engineer; H. Goldney, 10, Durham Road, Sheffield, engineer; H. J. de B. Barnett, 48, Dover Street, W., automobile engineer; G. Adams, 48, Dover Street, W., automobile engineer. Private company. The first directors are C. Hurford, H. C. H. Smyth, H. Goldney, H. J. de B. Barnett and G. Adams; qualification, 100 shares. Registered office, 12, Dover Yard, Dover Street, W.

**Louis F. Light Syndicate, Ltd.** (122,429).—This company was registered on June 6th, with a capital of £12,000 in £1 shares, to carry on the business of manufacturers of and dealers in searchlights, lamps, generators, transmitters, receivers and holders of any gas, fluid or substance for the production of light, electricians, &c., and to adopt an agreement with W. S. Searle and L. Girodo. The subscribers (with one share each) are:—J. R. Crellin, 74, Empress Avenue, Ilford, manager; A. J. H. Angier, 84, Stanley Road, Ilford, stenographer. Private company. The number of directors is not to be less than two or more than seven; the first are W. S. Searle and any nominee (if any) of the Automobile and Petrol Syndicate, Ltd. (who may nominate a director while holding 1,000 shares), and others to be appointed by the subscribers; W. S. Searle may retain office while holding 1,000 shares; qualification, one share. Registered office, 20, Copthall Avenue, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Mirfield Garage and Electric Works, Ltd.** (119,654).—Mortgage dated May 1st, 1912, to secure £450, charged on freehold land, motor garage and electric works at Easthorpe, Mirfield, Yorks. Holders: Rev. B. Wilson; and E. B. Wilson, Mirfield.

**Peto & Radford, Ltd.** (79,761).—Return dated April 30th, filed May 1st, 1912. Capital £40,000 in £1 shares. 34,000 shares taken up, £4,850 paid. £29,150 considered as paid. Mortgages and charges: Nil.

**Metalite, Ltd.** (110,919).—Particulars of £25,000 second debentures, created March 22nd, and secured by trust deed dated April 12th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Land at Osmaston, Derby (subject to prior charges), and company's other assets, except uncalled capital. Trustees: W. Jaggard and R. C. J. Goodrich.

**Hong Kong Tramway Co., Ltd.** (75,486).—A memorandum of satisfaction to the extent of £800 on March 29th, 1912, and to the extent of £2,200 on April 12th, 1912, of mortgage dated July 1st, 1903, securing £195,000, has been filed.

**M. E. Robinson & Co., Ltd.** (121,625).—Mortgage on leasehold land with buildings thereon in Grey Street and Wharf Street, Openshaw, Lancs., dated May 8th, 1912, to secure all moneys due, or to become due, from company to National Provincial Bank of England, Ltd., 15, Bishopsgate, E.C.

**Sheerness and District Electric Power and Traction Co., Ltd.** (65,749).—Issue on May 16th, 1912, of £8,400 debentures, part of a series of which particulars have already been filed.

**Campbell & Isherwood, Ltd.** (97,971).—A memorandum of satisfaction in full on June 3rd, 1912, of debentures dated June 17th, 1908, securing £400, has been filed.

**Novelty Construction Co., Ltd.**—(Debenture, dated May 31st, 1912, to secure £915, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holder, J. S. Hecht, Sphere Engineering Works, St. Albans.

**Acton Lamp Co., Ltd.** (110,486).—Issue on May 22nd, 1912, of £400 debentures, part of a series of which particulars have already been filed.



## CITY NOTES.

## Aluminium Corporation, Ltd.

IN their report for the 12 months ending December 31st, 1911, the directors say that the period covered by the accounts was one of unexampled depression in the price of metal. The loss shown on the year's working is due to circumstances which could not have been anticipated. [It appears from the balance-sheet that the loss on trading account was £1,786.—Editors.] There appears to be every prospect of the present improved market price of aluminium being maintained, and the directors look forward with confidence to the company's future. On completion of the Eigiau Dam in March, 1911, it was found necessary to empty the Lake and render the inside of the walls with concrete. This extra work was not completed until August last, and active operations could not be resumed until the Lake refilled in November, 1911. It will thus be seen that the company practically had only two full working months in the whole year. Serious difficulties have also been experienced with the plant installed by the old company at the Wallsend Carbon Works, and after much consideration it was decided to remove these works to Dolgarrog. The directors report that the chairman of the company has agreed to advance upon second mortgage a sum sufficient to enable this programme to be completed, and further economies should result therefrom. The works have been maintained in a high state of efficiency out of revenue, and it has not been deemed necessary, in the present accounts, to make any provision for depreciation. In order to comply with certain conditions of the scheme of reconstruction, an extraordinary general meeting has been convened, and will be held immediately after the close of the annual meeting (June 24th, at Salisbury House, E.C.), for the purpose of passing the necessary formal resolution to enable the balance of the preference shares (750 fully paid) to be converted into preference stock.

Messrs. E. Manville, W. C. Stennett and A. W. Wylie have retired from the board, and it is not proposed at the moment to fill the vacancies caused thereby. The remaining directors are: K. M. Clark, S. G. Bibby, R. Lawson and G. T. Moody.

Prospectus.—*The Letters Patent Insurance Co., Ltd.*—

The subscription list of this company will close on Monday next for town, and on Thursday next for country and abroad. An abstract of the prospectus will be found in our advertisement pages to-day. It offers 125,000 6 per cent. cumulative part preference shares of £1 each, 2,000 6 per cent. ditto of £50 each, and 225,000 ordinary shares of £1 each, all at par. Subscribers for preference shares will be entitled to apply for one ordinary share per £1 share value taken up. The company has been formed to undertake insurances to cover the liability of patentees and others, so far as the law allows, of the costs and expenses of prosecuting and defending actions in connection with letters patent, designs, trade marks, and other monopolies, including any damages awarded against defendants in such actions. It is intended to issue policies not only to patentees but also to licensees. In addition to the directorate, there is a strong advisory council of experts, including Mr. Frank Bailey, Mr. James Swinburne, and Prof. W. C. Unwin. Provisional offers have been made by Lloyd's Underwriters to re-insure a large proportion of the risks.

**India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.**—The half-yearly meeting is called for June 25th, at 11.30 a.m., at 106, Cannon Street, E.C., and sanction will then be asked to the payment on July 1st of the half-yearly preference dividend of 5s. per share, less income-tax, due July 1st, at the rate of 5 per cent. per annum. The board announce that they have decided not to pay on this occasion an interim dividend on the ordinary shares. The circular reads: "It is in the opinion of the board, impossible at this period to estimate with any exactitude what profits will be earned at the end of the financial year. The recent coal strike has thrown a considerable additional expense on the company, and the present disturbance in the labour market is causing anxiety. Under these circumstances, the board feel that it is advisable in the interest of the business to adopt a conservative attitude."

**Hankow Power and Light Co., Ltd.**—The annual meeting of the above company was held on Tuesday at the offices, 21, Ironmonger Lane, Cheapside. A representative of the ELECTRICAL REVIEW was informed that the proceedings were private, and a request for a copy of the annual report was refused.

**Sunderland District Tramways, Ltd.**—Meetings of the prior lien bond and debenture-holders, also of persons, firms and others entitled to the benefit of a charge dated December 14th, 1906, have been called for June 25th, under direction of the Court, to consider a proposed scheme of arrangement between the company and the foregoing.

**Barnsley and District Electric Tramways Co., Ltd.**—The directors have declared a dividend of 2 per cent. on the ordinary shares. The revenue was £9,900 (an increase of £159), and the expenses £7,422, the divisible balance being £2,596.

**Vulcan Boiler and General Insurance Co., Ltd.**—The directors have declared an interim dividend of 4s 6d. per share.

**Provincial Tramways Co., Ltd.**—An interim dividend of 8d. per share (less income-tax) on the ordinary shares for the half-year, is announced.

**Globe Telegraph and Trust Co., Ltd.**—The directors report that the net revenue for the year, after deduction of expenses, amounts to £210,472 and makes, with £28,532 brought forward, £239,005. From this amount there has been distributed the sum of £131,085 in interim dividends, leaving an available balance of £107,919. The directors now recommend the payment of the following final dividends, viz.: 3s. per share, less income-tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax; and 6s. per share net on the ordinary shares, making, with previous distributions, a dividend on these shares at the rate of 6 per cent. net for the year. These dividends will absorb £79,922 and leave a balance of £27,997 to be carried forward. During the year 1,000 shares of £10 each in the Direct United States Cable Co. have been sold; and the proceeds have been invested in shares of the Mackay Companies, and the Telegraph Construction and Maintenance Co., Ltd. The Right Hon. Viscount Middleton has been appointed a director to fill the vacancy created by the death of the Marquis of Tweeddale.

**Yorkshire (West Riding) Electric Tramways Co., Ltd.**—The directors have declared, out of the profits for the half-year ending 30th inst., an interim dividend at the rate of 3 per cent. per annum (less income-tax) on the 6 per cent. cumulative preference shares.

**Direct United States Cable Co., Ltd.**—The directors have issued the accounts for the nine months ended March 31st, 1912, at which date it has been decided to close the company's financial year to coincide with the lease of the cables to the Western Union Telegraph Co., which has been duly completed, and is for 99 years from April 1st, 1911. The accounts differ in form from those that have hitherto been published, as they cover the period during which the lease above referred to has first become operative. It will be observed that after payment of a dividend at the rate of 4 per cent. per annum, and a bonus at the rate of 1 per cent. per annum for the nine months to March 31st, 1912, a surplus of revenue remains of £7,400, which has been credited to the reserve fund account. The reserve fund account shows a balance of £509,128, as compared with £512,323 at June 30th, 1911, a decrease of £3,195, which is accounted for by expenses in connection with the lease above referred to. During the nine months covered by the accounts, the expenses of maintaining the cables were normal, but the directors regret to state that the main cable has been interrupted in deep water in mid-Atlantic. The cable ship *Faraday* left London at the latter end of May for the position, and is now engaged upon the repair thereof. The main cable was also recently crushed off the Newfoundland shore through an iceberg settling upon it, but it has now been repaired.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Alabama Traction, Light and Power Co., Ltd.—Scrip, fully and partly paid for \$6,000,000 5 per cent. first mortgage 50-year gold bonds.

New York Telephone Co.—Scrip, fully and partly paid, for a further issue of £1,750,000 4½ per cent. first and general mortgage 90-year bonds (London issue).

To appoint a special settling day in:—

River Plate Electricity Co., Ltd.—Further issue of 30,000 ordinary shares of £1 each (issued at £1 per share premium), 5s. capital paid (Nos. 119,994 to 120,500 and 120,508 to 150,000).

And to allow the following securities to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each, fully paid (Nos. 750,001 to 1,000,000). (Renewed application.)

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Cuban Telephone Co.—£155,000 additional 5 per cent. first mortgage convertible bonds (Nos. 8,914 to 10,000 and 10,601 to 12,013 of £100, and 13,637 to 13,886 of £20 each).

United Electric Tramways of Monte Video, Ltd.—£100,000 additional 5 per cent. first debenture stock.

**J. G. White & Co., Ltd.**—The report states that the results of the business show a net profit on the year's trading to February 29th of £87,106. According to the *Financier*, the return of interest and dividends on investments during the year was equal to 6½ per cent. on the amount of the valuation. A further £25,000 is allocated out of profits to the special dividend equalisation reserve, making this reserve now £40,000. The directors recommend a dividend of 12 per cent. per annum on both classes of shares, and, in addition, an extra dividend of 10s. per share on the ordinary shares. The balance to the credit of profit and loss, after bringing in £19,812 from the previous account, deducting the interim dividend paid on the preferred and ordinary shares at January 1st, 1912, and making provision for percentages due to directors and staff, is £83,212. This sum the directors recommend should be dealt with in the following manner: Dividend of 6 per cent., less income-tax, on cumulative preferred shares for the half-year to February 29th (making 12 per cent. for the year), £9,000; in payment of a dividend of 6 per cent., less income-tax, on the ordinary shares for the half-year to February 29th (making 12 per cent. for the year), £3,000; in payment of an extra dividend of 10s. per share, less income-tax, on the ordinary share capital for the year, £25,000; to special reserve for equalisation of dividends, £25,000; leaving to be carried forward £21,211.



### The B.E.T. Report.

A PERUSAL of the report and accounts of the British Electric Traction Co., Ltd., for the financial year ended March 31st last is unlikely to afford much encouragement to the stockholders ranking after those comprising the cumulative preference category, though there are indications of improvement.

According to the report, the "gross profit" for the year was £195,040, but at its best the phrase gross profit is from a practical point of view more or less useless. Here its use is incorrect and misleading. Let us arrive with as little preamble as possible at the real profit or result of the revenue operations of the year. The sum mentioned merely represents the total amount standing at the credit of the revenue account for the period, and is composed of dividends and interest on investments, £169,092; net profit on working of undertakings, £7,958; interest on loans and deposits, £3,218; and sundry profits and fees, £14,771. In previous years the revenue from dividends on shares, interest on debentures, and interest on consols, has been shown separately; but for some reason which requires explanation, these items are this year shown in one sum under the title of dividends and interest on investments, which collectively shows a substantial improvement, as also does the result of the working of the undertakings when compared with the previous year's figures. On the other hand, sundry interest on loans and deposits show a decrease of over £8,000, whilst sundry profits and fees are about £1,200 better at £14,771. We should advise the company to revert to the practice of showing separately the revenue from the different sources indicated, and in future to give some reasonable detail of the composition of sundry profits and fees.

£19,063 is debited against revenue in respect of management and general expenses, income-tax and contributions to superannuation fund, whilst debenture interest absorbs £92,799. £23,292 has been written off expenditure on surveys and negotiations, stock and office furniture, so that the profit for the year is about £59,885, as against some £46,000 for the previous year. Adding to that sum £10,831 brought forward from the previous year, we have a credit balance of £70,717, of which there is reserved for—

Investments and undertakings	...	...	£25,000
Debtors	...	...	7,500
Undertakings worked by the company	...	...	3,000
Buildings	...	...	250
			£35,750

The satisfaction of the cumulative preference dividend claims £24,215, so that there is a resulting credit balance of £10,751, which is carried forward, the stock-holders coming after the cumulative preference holders deriving but cold comfort.

The investments stand in the balance-sheet at £5,178,440; but there does not appear to be any record as to whether this represents cost or otherwise. The expenditure on the undertakings at Brighton and Shoreham, Barrow and Mumbles, worked by the company, appear less, £21,500 for reserve, at £140,395, which with the investment book values totals £5,318,835. For the first time the net accumulated reserve (little of which relatively appears to be the product of allocation from profit and loss account) which, according to the previous report, stood at £666,321, and which was previously shown on the liabilities side of the balance-sheet, is now exhibited as in reduction of the £5,318,835 to which we have made allusion.

The reserve, however, has suffered some serious fluctuations during the period represented by the accounts. As we have stated, it had swollen to £666,331 at the last account, and it was augmented at March 31st, 1912, by an appropriation from revenue of £25,000. It has been further increased by £2,831, being profit on sale of investments, and by £1,323 being difference between nominal amount and purchase price of debenture stocks purchased during the year and cancelled, the additions bringing it up to £695,487; but in the meantime it has been adversely affected by a reduction of £71,754, £11,118 being due to loss on sale of consols; investments written down by reason of reductions of capital accounting for £59,805—£36,671 of which is attributed to the Brush Co.; £706, representing cost of participations in syndicates, having been written off; and sundry adjustments amounting to £124, so that the total reserve at the end of the year, which is now shown in reduction of investments and undertakings, is £623,732.

Investments standing at £3,659,861 were revenue-earning during the period, but others representing £1,518,579 did not yield any return in respect of the financial year.

There are uncalled liabilities on the investments amounting to £132,568, which sum is shown as a footnote to Schedule I; but this should also have appeared on the face of the balance-sheet indented, as we have pointed out on several previous occasions.

Buildings and freehold land—Electrical Federation Offices, Kingsway—less a reserve of £4,250, are stated at £43,246, and there is nothing of particular moment until we arrive at sundry debtors and debit balances, which figure, less a reserve of £43,240 at £216,443, against £247,997 at March 31st, 1911. This indebtedness is very large, and if any portion of it is in respect of dividends and interest due by the Associated Companies to the B.E.T., such portion should be separately shown—otherwise it would appear to require drastic treatment. During the year the Brush Co. would seem to have increased its debt to the company by about £17,000, as compared with the record for 1910-11. There are no indications in Schedule V of the nature of the indebtedness in each case, which seriously discounts, for all practical purposes, the value of the schedule. Before leaving the credit side of the balance-sheet, we may refer to an item of stock of cars, equipments, and general stores, which appeared in the balance-sheet as at March 31st, 1911,

at £15,623, less a reserve of £7,000, net £8,623. There is no item of stocks of cars, &c., in the balance-sheet under review; but there has been written off the stock account the sum of £1,519. The accounts might have shown what this stock realised, and whether the amount of £7,000 previously reserved is wholly, or if only partially to what extent, an actual loss to the company, or whether the realisation of the asset has resulted in a profit.

For the first time we have the issued capital of the company shown in the new form in accordance with the agreed rearrangement, totalling £2,917,380. The debenture debt is still heavy, at an amount exceeding 1½ millions, and we should urge upon the company the desirability of reducing this loan debt substantially during the next few years, which, doubtless, would have the effect of improving the position and prospects of the capital stockholders.

Sundry creditors and credit balances stand at the large sum of £62,757, as against £13,267 at March 31st, 1911, which necessitates some explanation, the interest on the debenture stocks accrued to date, which is, of course, a liability, and which is shown at £44,566, calling for no particular observation.

The £266,371 non-interest bearing income certificates (which are redeemable out of profits only) are shown properly on the face of the balance-sheet, indented; but as to when they are likely to be liquidated would appear to be somewhat remote.

A critical review of the accounts only serves to confirm a previously expressed view that the remedy for the position of the B.E.T. does not consist of a rearrangement of capital, such as that to which assent and effect have been given, but in a drastic reduction.

That the Associated Companies have made progress during the year is obvious, inasmuch as the dividend and interest received by the B.E.T. are greater by about £35,000, whilst the receipts of these companies, as compared with 1910, show an improvement.

As we have previously pointed out, some of the schedules accompanying the report and accounts require considerable amplification before they can be of service to stockholders and investors.

For instance, take Schedule I of Investments and Undertakings, we have merely the name of the undertaking, nominal amount held by the B.E.T. Co., and the amount at which the securities stand in the books of the company. There does not appear to be anything showing whether and how much of the investment consists of ordinary or preference shares, debentures or debenture stock, whether at cost, or what. The statement requires considerable dissection to render it of practical service and interest. Again, Schedule IV, which shows the "amounts set aside by Associated Companies for depreciation and other reserve funds including balance of profit carried forward" is of little value: the balances of profit carried forward should be distinctly exhibited.

### Edmundson's Electricity Corporation, Ltd.

THE directors have submitted to the shareholders a scheme for adjusting the capital account, so as to enable them to resume the payment of dividends on the preference shares. The scheme has been submitted to, and approved by, some of the largest holders of preference and ordinary shares.

A circular issued under date June 14th explains the proposals briefly as follows:—

"1. To reduce the paid up capital by £160,000 by writing £2 per share off the 80,000 ordinary shares of £5 each.

"2. To split the existing 80,000 6 per cent. cumulative preference shares of £5 each into 40,000 6 per cent. cumulative preference shares of £5 each and 40,000 6 per cent. cumulative preference shares of £5 each and 40,000 6 per cent. non-cumulative preference shares of £5 each, the cumulative preference shares to rank for dividend ahead of the non-cumulative preference shares until the latter have received their full 6 per cent. dividend for two successive years, when the non-cumulative dividend will become cumulative, and both classes of shares will rank *pari passu*, and be consolidated into a single class as at present.

"3. To attach to both classes of preference shares the right to participate in further profits with the ordinary shares to the extent of ¼ per cent. for every 1 per cent. paid on the ordinary shares, up to a maximum of 7 per cent. inclusive of the fixed 6 per cent. dividend.

"4. To cancel the arrears of cumulative preferential dividends, amounting at March 31st last to £132,000.

"The directors have made a valuation of the assets of the company as shown in the last published accounts, and assuming the company's unsecured investments in the various subsidiary companies require to yield a return of 5 per cent. in order to justify a par value being placed on them, they find that on the basis of the revenue for the past year these investments show a deficiency in capital value of over £700,000; or, in other words, that is the amount of capital yielding no return for the year 1911-12. It is not suggested that the whole of this capital is lost, but after allowing for appreciation in capital value to the extent of £200,000 as the result of further progress, there is still a deficiency of over £500,000, and the existing reserves, the profit balance for the past year, and the £160,000 by which it is proposed to write down the ordinary share capital, approximately make up this figure. The directors believe that the majority of the shareholders will prefer to deal with the above situation by reducing the ordinary share capital by £2 per share, which they are satisfied is sufficient to fully provide for permanent loss of capital, rather than to adopt the alternative course of indefinitely postponing the payment of dividends. In the opinion of the directors, the loss of capital should be entirely borne by the ordinary shareholders, but having regard to its magnitude, and to the fact that it is equally, and indeed primarily, in the interests of the preference shareholders



that the present unsatisfactory position should be adjusted, they feel that the latter may fairly be asked to contribute to the solution of the difficulty by foregoing their arrears of cumulative preferential dividends and part of their future cumulative preferential rights in consideration of the participating rights which it is proposed to concede to them.

"The directors estimate that, after meeting interest and sinking fund on the debenture stocks, the available surplus of profits for the current year will be from £18,000 to £20,000, but with some £10,000 to £12,000 of the profits in the form of trading profits, derived largely from companies in which this company holds the whole or the greater part of the ordinary share capital, and in part represented by the paper of such companies, the directors feel that they are unlikely to be justified in distributing more than £12,000 in respect of the current year. This will suffice to pay a 6 per cent. dividend on £200,000 of capital, and they, therefore, propose that the existing £400,000 of preference share capital should be split into two amounts of £200,000, one carrying a 6 per cent. cumulative preferential dividend, the other a 6 per cent. preferential dividend temporarily non-cumulative until the full 6 per cent. dividend has been paid on such shares for two years in succession. The directors are advised that this splitting of the existing preference shares will tend slightly to enhance their market value, since the new cumulative preference shares, with the dividend assured, should immediately command a good price. With reference to the participating rights which it is proposed to attach to both classes of preference shares, the directors believe that it is better to give the preference shareholders a further permanent participation in the profits of the company, rather than to attempt to deal with arrears of cumulative preferential dividends by issuing funded dividend certificates. The value of the participating rights may appear somewhat remote at the moment, but any other advantage which it is possible to offer to the preference shareholders as compensation for the sacrifice they are asked to make, must necessarily be equally remote. Under the scheme, the first £24,000 per annum of available profits will go to the preference shareholders, as at present, whilst ultimately they will be entitled to an additional £4,000 per annum. The company's legal advisers recommend that advantage should be taken of the present opportunity to bring the articles of association up to date, and accordingly the accompanying notices of meetings to pass the resolutions necessary to give effect to the above scheme, also embody the resolutions for this purpose. One of the proposed alterations of the articles provides for an increase of the directors' remuneration."

Meetings of the different classes of holders are called for Tuesday next, June 25th.

### United Electric Tramways of Monte Video, Ltd.

MR. G. A. TOUCHE presided at the annual meeting held at Winchester House, E.C., on 14th inst. In moving the adoption of the report (see ELEC. REV., page 976), he said that the year had been one of much activity and some anxiety. Important developments have been carried out, but they had had to contend with unusual difficulties. The strike in Monte Video affected all the tramways in the city, and the coal strike in England affected them because the company got its coal supplies here. They had now provided the remainder of the cost of construction of the line to Maldonado, and the greater part of the cost of the extension of the Colon line. This extension was now practically completed, and should be ready for service shortly. The extension of the Colon line completed the lines which they were required, under their concessions, to construct. They had in view, therefore, some cessation of expenditure, at least for the present, on new lines. But expenditure on permanent way had not come to an end. Like other tramways, they were obliged to pave and maintain the roadway between, and for a certain distance on each side of, the tracks. A good deal of expenditure would still have to be met when streets, at present unpaved, were paved, or when streets already paved were repaved with a more expensive form of paving than was in use at present, such as asphalt in place of cobble or setts. The Municipality of Monte Video were at present contracting for the asphalt of a number of streets occupied by the company's lines. Other immediate expenditure would be on the construction of the new office buildings, and on the provision of the additional 25 cars mentioned in the report. An order for these had recently been placed. They were to be delivered in time for the next summer season. When the 25 additional cars came into service there would be a total of 313 cars and trailers available. The extension of the lines and the increased number of cars in service almost necessarily pointed to an extension of the power plant. It might be necessary to construct sub-stations for the supply of some of the outlying districts. The whole question was now under consideration. The unissued share and debenture capital of the company amounted to £250,000. This should provide for all visible prospective capital requirements. It might be necessary to issue a portion of this unissued capital during the current year. As regards maintenance, in the limits of the old city, where the traffics were heaviest, it was natural that some of the tracks should be showing signs of wear. The first lines were opened in the year 1906. As some of the streets were being repaved by the municipality, they would take the opportunity of relaying the rails where the roadways were opened up. The results for the financial year of La Sociedad Commercial de Monte Video, to October 31st, 1911, were satisfactory in view of the adverse conditions under which they had been obtained. There had been exceptionally bad weather throughout the year, (220 days), including more than half the Sundays and

public holidays. They had no summer whatever, while the winter was one of the severest within recollection. The traffic receipts for the year, however, showed an increase. The receipts were £298,553, as compared with £279,990 during the previous year; that was an increase of £18,563, or over 6½ per cent. The loss in traffics during the strike period was about £8,500. The passengers carried during the year numbered 34,662,138, as against 32,474,355, an increase of 2,187,783. The working expenses showed an increase of 1·01 per cent.—56·63 per cent., as compared with 55·62 per cent. The expenses were increased by approximately £5,553, as a result of the increased rates of wages granted by the company and bonuses to loyal employés. Coal cost on an average 4s. 10½d. per ton more than in the previous year. As the coal consumed was 12,661 tons, this increase in price accounted for a further additional charge of £3,086. These increases by themselves, amounting to £8,639, were about 2·89 per cent. of the gross receipts, yet the actual increase in expenses was only 1·01 per cent. This showed that, apart from the special items mentioned, the record of previous years had been maintained. For the first six months of the year (prior to the strike) there was an actual diminution in the ratio of expenses as compared with the previous year. These figures related to a year which was only partially affected by the increase in wages. The current and future years would experience the full extra charge, estimated at nearly £13,000 a year. There was also a proposal to apply to all industries in Uruguay the experiment of a statutory eight hours day, which had resulted so unsatisfactorily to employers and employed alike in the coal-mining industry in this country. If the measure became law it would mean a further increase in working expenses. The traffic receipts for the seven months to the end of May, 1912, showed that expansion had continued, partly owing to the natural growth of traffic and partly to the result of a fine summer. For the six months to the end of April, the receipts were £185,362, as compared with £166,176 to the end of April, 1911, an increase of £19,186. The working expenses for the six months were 52·97 per cent., as compared with 51·17 per cent., an increase of 1·80 per cent. The net receipts for the six months to the end of April were £87,178, as compared with £81,143, an increase of £6,035.

The motion was seconded by MR. T. FRAME THOMSON, and carried unanimously.

### Bombay Electric Supply and Tramways Co., Ltd.

The directors of this subsidiary of the B.E.T. report that, for the year, 1911, the net receipts show an increase of over 16 per cent., as compared with the previous year, the net profit being £77,861, which, with £11,000 brought forward, makes a disposable balance sufficient to pay the 6 per cent. cumulative preference dividend, 3 per cent. on the ordinary share capital, and to allocate £16,700 to depreciation, £6,531 to the sinking fund for capital redemption, £531 being in lieu of interest on debenture stock cancelled, £5,000 to general reserve, leaving £7,385 to be carried forward to the next account.

We have, on several previous occasions, from the days of its promotion, commented at length upon the accounts of this undertaking. The cost of old horse tramways stands at £115,000, these horse tramways, we presume, not now being in existence. Rights and concessions on power station, &c., electrification and reconstruction, goodwill and preliminary expenditure figure at £1,747,354, including the capitalisation, during the year, of £602 of London administrative expenses, which is no new feature in the accounts of the company. This absurdly grouped item conveys little or no tangible information, and should be dissected and shown in reasonable detail. The cost of underwriting and issuing share capital, &c., appears at £159,070, which, of course, is not an asset, the investments totalling £42,480, at cost, the market value of which, as at December 31st, 1911, is omitted and should have been shown indented in the usual way. These investments include £11,300 of the company's own debentures, and the proprietors might pertinently request the board to explain the object and advantage, if any, in adopting such a course. The debenture debt is exceedingly heavy at a figure exceeding three-quarters of a million, and an increased and drastic rate of extinction seems to be required.

The sinking fund for capital redemption is exhibited at £12,882.

The track rents, which are set down at £3,626 seem to be low, and would appear to be capable of increase.

An academic, though important, point is suggested in the use of the phrases "Capital expenditure and other assets" and "Capital and other liabilities," and would be more correct with the omission of the word "other."

### Mexican Light and Power Co., Ltd.

THE annual general meeting is to be held at Toronto on July 3rd. The annual report to December, 1911, shows that the net revenue in gold, after paying all expenses and fixed charges, amounted to \$1,251,679, which, with \$745,848 brought forward, makes a total credit balance to profit and loss account of \$1,997,527. Out of this sum the directors have paid during the year dividends of 7 per cent. on the preferred shares, and 4 per cent. on the ordinary shares, absorbing the sum of \$963,400, and have placed to reserve account the sum of \$50,000, which now stands at \$427,884. After these appropriations there remains a balance to the credit of profit and loss account of \$984,127, which has been carried forward. None of the company's property was interfered with during the revolutionary disturbances which occurred in Mexico during the year, beyond the breaking of some of the arc lamps by unruly crowds on a few occasions, and notwithstanding the disturbed conditions



of the country, the company's business has steadily increased. The increase in the sale of power has been very satisfactory. Especially is this so as regards the quantity of power taken by the Pachuca Light and Power Co., Ltd., and there is every indication that the mining companies in the Pachuca district will continue to increase their electrical equipment now that they can depend upon the regular supply of electric energy. During the year the Nexapa Reservoir was completed, and good progress made in the construction work of the Tenango Reservoir, which should be ready for use during the rainy season of 1912. The construction work to extend the system of canals and tunnels to divert several rivers in the Necaxa watershed has progressed satisfactorily so that the water from one of the rivers will be available by the end of the year 1912. Mr. Pablo Macedo has resigned from the board of directors, and Mr. E. D. Trowbridge has resigned the office of general manager. The directors have considered it wise, in appointing a new general manager, to unite more closely the management of this company and the Mexico Tramways Co., and therefore, Mr. Harro Harrsen, the general manager of the Tramways Co., has also been appointed general manager of this company. Mr. Alexander Strausz, jun., has been appointed treasurer in Mexico City in the place of Mr. Lloyd Lyon, resigned. In December the board also secured the services of Sr. Lic. Jose Vasconcellos as additional counsel and legal adviser in Mexico City. The board look for steady development and increased prosperity of the country in the near future, and, consequently, the further successful growth and profitable operation of the company's undertaking, and they desire to acknowledge the courtesy and consideration which the company and its officials have at all times received from the Government and the Federal, State and City officials in Mexico, and they have every reason to believe that the relations will continue to be as harmonious and as satisfactory as in the past. The directors express their great appreciation of the faithful services of Mr. R. C. Brown, managing director; Mr. Luis Riba, legal representative, and Mr. E. D. Trowbridge, the late general manager, and of the other officials of the company resident in Mexico.

Capacity of generating plants:—Necaxa, 94,000 H.P.; San Ildefonso and other small plants, 10,107 H.P.; Pachuca Light and Power Co., 12,140 H.P.; = 116,247 H.P.; add reserve steam plants in Mexico City, including Mexico Tramways Co. plant, 14,250 H.P., making a grand total of 130,497 H.P.

Installations connected:—

	1910.		1911.	
	No.	H.P.	No.	H.P.
Arc lamps .. .. .	5,088		3,914	
Incandescent lamps ..	398,301	36,616	400,422	33,246
Motors .. .. .		84,690		88,532
Total .. .. .		121,306		121,778

Comparative statement of gross earnings and operating expenses (Mexican currency):—

	1909.	1910.	1911.
Gross earnings .. .. .	\$6,039,713	\$6,990,398	\$7,581,027
Operating expenses and maintenance .. .. .	2,991,207	1,968,773	2,195,028
Net earnings .. .. .	\$3,048,506	\$5,021,625	\$5,385,999

### Mexico Tramways Co.

THE annual meeting is to be held at Toronto on July 3rd. The annual report to December, 1911, shows that the operation of the company's undertaking during the year has been satisfactory. The net revenue in gold for 1911, after paying all expenses and fixed charges, amounted to \$1,383,530, which with the balance brought forward from 1910, makes a total credit balance to profit and loss account for the year of \$2,027,597, out of which the directors have, during the year, paid to the shareholders four quarterly dividends at the rate of 7 per cent. per annum: and have placed \$86,913 to the reserve account, which now stands at \$2,600,000. The above appropriations have absorbed \$1,241,031, leaving a credit balance of \$786,566 to be carried forward. The ratio of operating expenses to gross income was 48'57 as compared with 49'06 for 1910. The revolutionary disturbances which occurred in Mexico during the year did not seriously affect the company or its undertaking. During the whole period of the disturbances the gross receipts showed satisfactory monthly increases. On December 31st, 1911, the tramway system consisted of 195'06 miles of single track, of which 175'506 miles were operated by electricity and 19'554 miles by mules. The electric track mileage has been increased by 16'88 miles, and the mule tracks have been reduced by 1'76 miles. A new line between Mixcoac and the City of Mexico through the Colonia del Valle has been put into operation during the year, and has opened up an attractive residential district, and should be a satisfactory source of income to the company. The company has commenced the construction, under the concessions which it owns, of suburban lines to Puebla and Toluca, and anticipates completing during the year 1912, about seven miles of each line. It also contemplates the electrification of the mule line to Tlalnepantla and also the Santa Fe mule line which will form part of the Toluca line. The usual statistics regarding the company are appended to the report. They show that the physical condition of the company's undertaking in all departments is satisfactory. The whole property has been maintained in excellent condition and repair, and for this purpose \$761,276'00 (Mexican currency) has been expended during the year on maintenance. During the year Mr. Pablo Macedo resigned from the board of directors, and M. Paul Eugene Dutasto of Paris, France, was appointed to fill the vacancy thus formed, while Chev.

Robert de Bauer, of Brussels, Belgium, was appointed as an additional member of the board. Mr. Alexander Strausz, jun., has been appointed treasurer in Mexico City in place of Mr. Lloyd Lyon, resigned. In December, the board also secured the services of Sr. Lic. Jose Vasconcellos as additional counsel and legal adviser in Mexico City. The management contemplates the construction of further extensions to meet the constant growth of the city and the electrification of some of the lines still operated by mules. In view of the fact that this company has such a large interest in the Mexican Light and Power Co., Ltd., the directors gladly consented, on the resignation of Mr. E. D. Trowbridge from the management of that company, to Mr. Harro Harrsen, the general manager of this company, undertaking also the general management of the Mexico Light and Power Co., Ltd. The board believe that by placing the management of the two companies under one head, considerable economy and benefit will result to both undertakings. The board look for steady development and increased prosperity of the country under the new government, and, consequently, the further successful growth and profitable operation of the company's undertaking, and they desire to acknowledge the courtesy and consideration which the company and its officials have at all times received from the Federal, State and city officials in Mexico, and they have every reason to believe that the relations between the company and the Government will continue to be as harmonious and as satisfactory as in the past. The directors express their great appreciation of the faithful services during the past year of Mr. R. C. Brown, managing director, Mr. Luis Riba, legal representative, and Mr. Harro Harrsen, general manager, and of the other officials of the company resident in Mexico.

**Aron Electricity Meter, Ltd.**—The directors' report for the year ending March 31st, 1912, states that the profit and loss account for the year, after providing for general charges and depreciation, shows a net profit of £30,542, making, with the balance of £5,881 carried forward from last year, a total available profit of £36,423. Out of this amount the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving to be disposed of £32,676. The directors recommend a further 3 per cent. on the preference shares, absorbing £3,747, and making a total for the year of 6 per cent.: a dividend of 6 per cent. on the ordinary shares, absorbing £7,500, and a transfer to reserve towards goodwill and patents of £10,000 (making this reserve £40,000), leaving a balance of £11,429. Out of this amount it is proposed to appropriate £6,973 towards writing off the expenses of the debenture issue of 1911, and to carry forward £4,456. The past year's trading in electricity meters and taximeters has again been most satisfactory, the sales having exceeded those of any previous year. The company's factories have been fully employed, and the necessary extensions to cope with the increased business are being carried out.

**Electric and General Investment Co., Ltd.**—The directors' report for the year ended May 31st, 1912, states that the gross profit on the transactions for the year was £17,978. After deducting all general charges, interest on debenture stock, the interim dividend already paid on the preference shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, 1912, there remained a balance of £8,704. As a further reserve to meet depreciation in the company's investments, the directors have carried £2,978 of this amount to the contingencies fund, thereby raising the amount to the credit thereof to £82,000 as at May 31st, 1912, leaving £5,726. The directors recommend that this amount of £5,726 be appropriated as follows: Dividend at the full rate of 10 per cent. on the ordinary shares, £2,000; dividend of 6d. a share on the deferred shares, £1,000, carrying forward £2,726. The warrants for the dividends on the ordinary shares and deferred shares will be paid on July 1st.

**Havana Electric Railway Co.**—The report of this company, as abstracted in the *Financier*, shows the following results for 1911: Gross earnings, \$2,991,501; operating expenses, \$1,519,303; earnings, less operating expenses, \$1,472,198; fixed charges and taxes, \$502,673; adjustments, \$9,487; surplus earnings for the year, \$960,036; surplus, January 1st, 1911, \$1,114,913; total, \$2,074,950. Dividends paid during the year 1911: 6 per cent. on preferred shares, 6 per cent. on common shares. Surplus, January 1st, 1912, \$1,327,132. "These results have been obtained when the service of the company has been disturbed and at times almost demoralised by the torn-up condition of practically all of the streets, incident to the construction of a sewer system throughout the city. The increase of \$334,521, or 12'59 per cent., in the gross earnings of the company in 1911 over those for the preceding year, and the increase of \$180,857, or 14 per cent., in the earnings, less operating expenses, obtained under, or rather in spite of, most adverse operating conditions, is an excellent tribute to the efficient and capable management of Mr. Frank Steinhart, the general manager."

**R. Waygood & Co., Ltd.**—According to a financial paper, the accounts for the year ended March 31st show a profit, including £3,395 brought forward, of £31,604, out of which £3,000 has been written off investments and £2,000 placed to reserve. The directors recommend a further dividend of 4½ per cent., making 7 per cent. for the year, as compared with 6 per cent. for the preceding year, carrying forward £6,254.



MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 19th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. per lb.	22/-	..
a " Oxalic .. .. per lb.	23d.	..
a " Sulphuric .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. "	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. "	£5 10	..
a Bisulphide of Carbon .. .. "	£18	..
a Borax .. .. "	£16 10	..
a Copper Sulphate .. .. "	£24 15	..
a Lead, Nitrate .. .. "	£26 10	..
a " White Sugar .. .. "	£25 10	..
a " Peroxide .. .. "	£32	..
e Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	33d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. per lb.	33d.	..
a " Perchlorate .. .. "	43d.	..
a Potassium, Cyanide (98/100 %) .. .. (for mining purposes only)	7½d.	..
a Shellac .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. "	£6 10	..
a " Recovered .. .. "	£5 10	..
a " Lump .. .. "	£5 5	..
a Soda, Caustic (white 70/72 %) .. .. "	£10 5	..
a " Chlorate .. .. per lb.	33d.	..
a " Crystals .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. .. per lb	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£75	£5 inc.
b " Wire, in ton lots .. .. "	£102	..
b " Sheet, in ton lots .. .. "	£120	..
p Babbitt's metal ingots .. .. "	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	2½d.	3d. dec.
c " Tube (brazed) .. .. "	11½d.	1d. inc.
c " (solid drawn) .. .. "	9½d.	1d. inc.
c " Wire, basis .. .. "	9½d.	1d. inc.
c Copper Tubes (brazed) .. .. "	1/0½d.	1d. inc.
c " (solid drawn) .. .. "	11½d.	1d. inc.
g " Bars (best selected) .. .. per ton	£96	£2 inc.
g " Sheet .. .. "	£96	£2 inc.
g " Rod .. .. "	£96	£2 inc.
d " (Electrolytic) Bars .. .. "	£81	£1 15s. inc.
d " Sheets .. .. "	£99 10	£3 5s. inc.
d " Rods .. .. "	£87 10	£3 5s. inc.
d " H.C. Wire per lb.	10½d.	1d. inc.
f Ebonite Rod .. .. "	5/3	..
f " Sheet .. .. "	4/9	..
n German Silver Wire .. .. "	1/11	..
h Gutta-percha, fine .. .. "	4/7½	..
h India-rubber, Para fine .. .. "	54/1	5d. inc.
l Iron Pig (Cleveland warrants) .. per ton	£14	..
l " Wire, galv. No. 8, P.O. qual. .. "	£18 10s.	£1 inc.
g Lead, English Pig .. .. "	6/6	..
m Manganin Wire No. 28 .. .. per lb.	£8	5/- dec.
g Mercury .. .. per bot.	6d. to 3s.	..
e Mica (in original cases) small .. per lb.	3/6 to 6/-	..
e " " medium .. .. "	7/6 to 11/-	..
e " " large .. .. "	11d.	..
p Phosphor Bronze, plain castings .. "	1/0½	..
p " " rolled bars & rods .. .. "	1/1	..
p " " rolled strip & sheet .. .. "	185/-	..
o Platinum .. .. per oz.	10½d.	3d. inc.
d Silicon Bronze Wire .. .. per lb.	£55	..
r Steel Magnet, in bars .. .. per ton	£208 to £209	£5 dec.
g Tin, Block (English) .. .. "	2/5	..
n " Wire, Nos. 1 to 16 .. .. per lb.	£45 to £150	..
p White Anti-friction Metals .. per ton	£29 15	..
k Zinc, Sh't (Vieille Montagne bnd.) .. "		..

Quotations supplied by—

a G. Boor & Co.	i Bolling & Lowe.
b The British Aluminium Co., Ltd.	k Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	l Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	n P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p W. F. Dennis & Co.
h Edward Till & Co.	

STOCKS AND SHARES.

Tuesday Evening.

THE principal feature of the present week, so far as the Electric markets are concerned, is the special settlement in American Marconi shares. This has absorbed much attention and attracted a huge amount of interest, not only because of the speculation in the shares themselves, but because of the influence which the gamble has had on markets remote from the Marconi section itself. Railway stocks have rather disappointed holders who were looking for a rise on the collapse of the transport strike. National Telephone stock has been moving with considerable velocity. Apart from these items there has not been a great deal eventful during the past week. In the Home Railway market the Undergrounds constitute the most active department, and absorb the largest amount of atten-

tion, both speculative and otherwise. Metropolitans and Districts both spurted, but had to give way again on profit-taking; while City and South London Ordinary, after touching 40, went back to 38½, which leaves them unchanged on the week. Central London stocks are very steady, the coming opening of the Liverpool Street extension being the sheet-anchor of the bulls. East London Ordinary moved in lively fashion, and the Ordinary stock rose to 83, easing off to 8½ later. Notwithstanding the fact that the dock strike has well-nigh petered out, the position in the railway world is still obscure enough to cause anxiety in the Home Railway market, where dealers confess that they do not feel sure enough of the immediate prospect to make them wishful of taking lines of stock upon their books.

Underground Electric Railways are better, the shares rising 3, and the Income bonds a point, upon prophecies—which certainly do not err upon the side of pessimism—that the latter will receive the full 6 per cent. dividend in respect of the current year. The company's "A" shares, after touching 16s., reverted to 15s. 6d. upon the slight recession of London General Omnibus stock from its record price of 400 which it attained the other day to 385. Better prices have developed in British Electric Traction shares upon digestion of the report; both Deferred and 6 per cent. Preferred are ½ higher, while the 6 per cent. Preference stock is better to the same extent, and the Second Debenture stock rose 1.

Changes in the English Electricity Supply group are limited. Folkestones have improved upon a little buying from the provinces, where, perhaps, the recent rise in Bournemouth & Poole has been noted as a possible example of what may happen in other quarters. So far as the London shares are concerned, Charing Cross Preference lost ½ and Cities fell 10s., the last-named on the statement issued the other day denying once more the rumours about the company being taken over by the Corporation. Counties continue very firm, there being buyers at the middle price; and, in spite of journalistic enterprise, there are still a few dealers left in this market, as in other markets round the Stock Exchange.

Mexico is declared—and with a good deal of authority—to be getting over her Revolution, and, as a consequence of this, Mexican issues are steadily going ahead. Various bonds of the Power Companies have improved this week. Mexican Trams at 124 are better on the dividend and report. Rio Trams again improved a little, and Sao Paulo gained the 2½ dividend which came off last Friday. The Anglo-Argentine Tramways group is also *ex* dividend, the deductions being reflected in the quotations. Port of Buenos Ayres Tramway shares have risen to 10s. 6d., the Preference to 15s., and the Debentures to par. Victoria Falls Power Preference improved to 19s. 6d. on the understanding that the company is doing much better, the shares also reflecting by sympathetic strength the firmness of the South African market. Para Electric Railways are ½ down, and most of the other movements in this section consist of small rises in prior-charge issues.

Marconis continue to rule the roost amongst Telegraphs. The prices on the week show a considerable improvement, which was shared by Canadians and Americans. The arrangement of the special settlement in the latter reveals no new trouble, and on this—or, rather, on the expectation that such would be the case—prices went ahead substantially. Americans were carried over at 1½, the rate being 6 per cent., and contangoes being done for the middle of July account. It may be recalled that the shares rose to 4 on the morning of their introduction to the market, since when they have been as low as 25s. Inspired information appears every now and then, following which there is, as a rule, a rally in the price, but holders have very little else to go upon at present. The capital of the Canadian Marconi Company, by the way, is \$5,000,000, in 1,000,000 Ordinary shares of \$5 each, fully paid, so it is not difficult to see that very substantial profits will have to be earned before holders at present figures receive a return on their money adequate to the chances they are taking. Still, it must be admitted that the market looks good for the time being, and prices might go better.

The fall in Great Northern Telegraphs has been further continued, and the price has got down to 29. Direct United States Cable shares are ½ easier, but the Anglo-American group is steady. Speculators have been selling West India and Panama Telegraphs, while, on the other hand, the company's First Preference shares are ½ harder. Reuters have recovered a little, and the Eastern group is firm.

National Telephone Deferred slumped to 140—a drop of 10 points—on the opening of the arbitration case between the Government and the company. Then came a smart recovery of 5 points, and doubtless we shall be treated to these swift fluctuations while the inquiry lasts. The market, as we were saying last week, is very dangerous for the ordinary man. The company's Third Preference shares are ½ down, while the Preferred stocks keep steadily at 101½.

The manufacturing group is noticeable for falls in Edison & Swan shares of both kinds. The "A" shares are 1½ lower, and the fully paid ½ down, there being some pressure to realise in an unwilling market. British Insulated and Helsby Cable shares are good, rising no less than 15s. on the improvement which has been taking place just lately in Automatic Telephone shares, the British Insulated, of course, being the parent of the Automatic Telephone Company. The shares in the last-named are about 35s., after being nearly £2, and they are being dealt in freely. Babcock & Wilcox have begun to creep up in their new form, but Willans & Robinson fell 1½. A slight improvement in General Electric Preference is balanced by a fall in India-Rubber shares, while the rubber share market, after making one or two ineffectual efforts to go better, relapsed into depression upon renewal of the apprehensions regarding synthetic rubber. The Aron Company's report is distinctly satisfactory, but there is no change in the prices of the shares.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 18th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 18th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5 1/2 5 1/2	9 1/2-10 1/2	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 9	7 1/2-7 1/2	..	5 15 2
Do. 4 1/2 % Pref. ....	10	4 1/2 4 1/2	8 1/2-9 1/2	..	4 12 2	Do. 4 % Deb. ....	Stock	4 4	92-95	..	4 4 3
Do. Second 5 % Pref. ....	10	6 6	10 1/2-11	..	5 9 1	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2 4 1/2	80-84	..	5 7 2
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2 4 1/2	100-102	..	4 8 8	London Electric, Ord. ....	5	2 2 1/2	1 1/2-1 1/2	..	4 5 6
Brompton & Kensington, Ord...	5	10 10 1/2	8 1/2-8 1/2	..	5 14 8	Do. 6 % Pref. ....	5	6 6	4 1/2-5 1/2	..	5 14 3
Do. 7 % Cum. Pref. ....	5	7 7	7 1/2-8 1/2	..	4 5 2	Do. 4 % First Mort. Deb. ..	Stock	4 4	90-93 xd	..	4 6 0
Central Electric Supply, 4 % } Guar. Deb. }	100	4 4	97-100	..	4 0 0	Metropolitan ..	5	5 4	3 1/2-4 1/2	..	6 1 3
Charing Cross, West End & City	5	5 5	4 1/2-5	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2 4 1/2	4 1/2-4 1/2	..	4 14 9
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2 4 1/2	4 1/2-4 1/2	- 1/8	4 17 4	Do. 4 1/2 % First Mort. Deb. ..	Stock	4 1/2 4 1/2	101-104	..	4 6 7
Do. " City Undertaking " }	5	4 1/2 4 1/2	8 1/2-4 1/2	..	5 2 10	Do. 8 1/2 % Mort. Deb. ....	Stock	8 1/2 8 1/2	85-88	..	3 19 7
Do. Do. % Deb. ....	100	4 4	93-95 xd	..	4 1 8	Midland Electric Corporation }	100	4 1/2 4 1/2	96-98	..	4 11 10
Chelsea, Ord. ....	5	5 5	4 1/2-4 1/2	..	5 2 7	4 1/2 % First Mort. Deb. }					
Do. 4 1/2 % Deb. ....	Stock	4 1/2 4 1/2	99-102	..	4 8 8	Newcastle-on-Tyne 5 % Pref. }	5	5 5	4 1/2-5	..	5 0 0
City of London, Ord. ....	10	7 8	17 1/2-19 1/2	- 1/2	4 2 1	Non-Cum. }					
Do. 6 % Cum. Pref. ....	10	6 6	15-17	..	3 10 7	North Metropolitan Power Sup- }	100	5 5	97-100	..	5 0 0
Do. 5 % Deb. ....	Stock	5 5	119-123	..	4 1 4	ply, 5 % Mortgages (Red.) }					
Do. 4 1/2 % Second Deb. ....	100	4 1/2 4 1/2	101-104	..	4 6 7	Notting Hill, 6 % Non-Cum. }	10	.. 6	10 1/2-11 1/2	..	5 6 8
County of London, Ord...	10	5 6	10 1/2-11 1/2	..	5 7 0	Oxford ..	5	7 1/2 7 1/2	5 1/2-6 1/2	..	5 13 9
Do. 6 % Pref. ....	10	6 6	11 1/2-11 1/2	..	5 1 1	St. James' and Pall Mall, Ord.	5	10 10	8-8 1/2	..	5 14 3
Do. 4 1/2 % Deb. ....	Stock	4 1/2 4 1/2	108-110	..	4 1 10	Do. 7 % Pref. ....	5	7 7	6 1/2-7 1/2	..	4 15 0
Do. 4 1/2 % Second Deb. ....	Stock	4 1/2 4 1/2	100-103	..	4 8 3	Do. 8 1/2 % Deb. ....	100	8 1/2 8 1/2	85-87	..	4 0 6
Edmundson's, Ord. ....	5	Nil Nil	3-3 1/2	..	Nil	Smithfield Markets, Ord. ....	5	Nil 2	1 1/2-1 1/2	..	..
Do. 6 % Cum. Pref. ....	5	Nil Nil	3-3 1/2	..	Nil	South London, Ord. ....	4	5 5	2 1/2-3 1/2	..	5 8 0
Do. 4 1/2 % First Mort. Deb. ..	100	4 1/2 4 1/2	86-89	..	5 1 2	Do. 5 % First Mort. Deb. ....	100	5 5	100-103	+1	4 17 1
Folkestone ..	5	6 6	4 1/2-5 1/2	+ 1/8	5 14 3	South Metropolitan, 7 % Pref. ..	1	7 7	1 1/2-1 1/2	..	6 1 0
Do. 5 % Cum. Pref. ....	5	5 5	4 1/2-5 1/2	+ 1/8	4 15 3	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2 4 1/2	96-99	..	4 11 0
Do. 4 1/2 % First Deb. ....	100	4 1/2 4 1/2	94-97	+1	4 12 9	Urban, Ord. ....	5	5 5	1-1 1/2	..	..
Hove ..	5	9 9	6 1/2-7 1/2	..	6 4 2	Do. 5 % Cum. Pref. ....	5	5 2	2 1/2-3	..	3 6 8
						Do. 4 1/2 % First Mort. Deb. ..	100	4 1/2 4 1/2	86-88	..	5 2 3
						Westminster, Ord. ....	5	10 10	8 1/2-8 1/2	..	5 14 3
						Do. 4 1/2 % Cum. Pref. ....	5	4 1/2 4 1/2	5 1/2-6 1/2	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	6 6	5 1/2-5 1/2	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	88 1/2-90 1/2	..	5 10 6
Calcutta, Ord. ....	5	8 1/2 8 1/2	7 1/2-7 1/2	- 1/8	5 11 6	5 % 1st Mort. Deb. }					
Do. 5 % Pref. ....	5	5 5	5-5 1/2	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	211-215	..	3 14 5
Calgary Power, 1st Mort. Bds.	100	5 5	97 1/2-99 1/2	+ 1/2	5 0 6	Northern, Lt., Power and Coal, }	\$500	5 5	39-42	..	11 18 2
Canadian Gen. El. Com. ....	\$100	7 7 1/2	112-116	..	6 0 8	5 % 1st Mort. Bonds }					
Do. 7 % Pref. ....	\$100	7 7	118-122	..	5 14 9	River Plate, Ord. ....	Stock	10 10	240-250	..	4 0 0
Cordoba Lt., Power and T., Ord.	1	3 3 1/2	1 1/2-1 1/2	..	3 4 0	Do. 6 % Non-Cum. Pref. ....	Do.	6 6	109-114	..	5 5 3
Do. 5 % Deb. ....	100	5 ..	94-97	..	5 3 1	Do. 5 % Deb. Stock ..	Do.	5 5	103-105	..	4 15 3
Elec. Lt. and P. of Cochabamba, }	100	6 6	92 1/2-94 1/2 xd	..	6 7 0	Roy. Elec. Co., Montreal, 4 1/2 % }	100	4 1/2 4 1/2	99-101	..	4 9 1
6 % Bonds }						1st Mort. Deb. }					
Elec. Supply Victoria, 5 % 1st }	100	5 5	83-86	..	5 16 3	Shawinigan Water, Capital ..	\$100	4 5 1/2	139-143	..	3 10 0
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds }	\$500	5 5	111 1/2-113 1/2	..	4 8 1
Elec. Dev. Ontario, 5 % 1st }	\$500	5 5	94 1/2-96 1/2	..	5 3 8	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2 4 1/2	103-105	..	4 5 9
Mort. Bonds }						Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2 4 1/2	98 1/2-100 1/2 xd	..	4 9 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil ..	7-7 1/2	..	Nil	Vera Cruz Lt., P. and T., 5 % }	100	5 5	92 1/2-94 1/2	..	5 5 10
Do. 6 % Pref. ....	1	6 6	1 1/2-2 1/2	..	8 6 0	1st Mort. Deb. }					
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	106-108	..	4 12 7	Victoria Falls Power, Pref. ....	1	Nil 1 1/2 d.	1 1/2-1	+ 1/2	..
Madras, Ord. ....	5	.. ..	2 1/2-2 1/2	..	..	West Kootenay Power and Lt., }	100	6 6	105 1/2-107 1/2	..	5 11 7
Melbourne, 5 % 1st Mort. Deb.	100	5 5	104-107	..	4 13 6	1st Mort. 5 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	91-93	+ 1/2	5 7 6						
Mexican Lt. & Power, Common	\$100	4 4	91-93	..	4 5 0						
Do. 7 % Cum. Pref. ....	\$100	7 7	105-107	..	6 10 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	97 1/2-99 1/2	+1	5 0 6						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph .. ..	10	Nil	4 1/2	7 1/2-7 1/2	..	..	Monte Video Telephone, Ord. ..	1	6	6	1-1 1/2	..	5 6 3
Do. 5 % Deb. Red. ....	Stock	5	5	97 1/2-99 1/2	..	5 0 6	Do. 5 % Pref. ....	1	5	5	1-1 1/2	..	5 14 3
American Telep. & Teleg., Cap.	\$100	8	8 1/2	148 1/2-150 1/2	..	5 6 4	National Telephone, Pref. ....	Stock	6	6	100-103	..	..
Do. Collat. Trust .. ..	\$1000	4	4	95 1/2-97 1/2	..	4 2 1	Do. Def. ....	Do.	6	6	143-145	-6	..
Anglo-American Telegraph ..	Stock	8 1/2	8	65-67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref. ....	5	5	5	6-6 1/2	- 1/2	..
Do. 6 % Pref. ....	Do.	6	6	109-110	..	5 9 1	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	99-100	..	4 10 0
Do. Def. ....	Do.	80/-	80/-	25 1/2-26	..	5 15 5	Oriental Telep. and Elec. ....	1	8	8	14 1/2-14 1/2	..	4 13 0
Anglo-Portuguese Tel., 5 % }	100	5	5	102-104	..	4 16 2	Do. 6 % Cum. Pref. ....	1	6	6	1 1/2-1 1/2	..	4 16 0
Mort. Deb. }							Do. 4 % Red. Deb. ....	Stock	4	4	89-91	..	4 8 0
Chili Telephone .. ..	5	7	..	7 1/2-8	..	4 10 4	Pacific and European Tel., 4 % }	Do.	4	4	100-102	+ 1/2	3 18 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82-85	..	4 14 2	Guar. Debs. }						
Cuba Telegraph .. ..	10	6	6 1/2	9 1/2-10 1/2	..	5 14 3	Reuter's .. ..	8	5	5 1/2	11 1/2-11 1/2	+ 1/2	3 8 0
Do. 10 % Pref. ....	10	10	10	16 1/2-17 1/2	..	5 14 3	Submarine Cables Trust ..	Cert.	6	6	127-130	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4	4 1/2	8 1/2-9 1/2	..	5 6 8	Telephone Co. of Egypt, 4 1/2 % }	Stock	4 1/2	4 1/2	99 1/2-101 1/2	+ 1/2	4 8 8
Do. 10 % Cum. Pref. ....	5	10	10	7-7 1/2	..	6 9 0	Deb. Red. }						
Direct United States Cable	10	4 1/2	5	7 1/2-7 1/2	- 1/8	6 7 0	United River Plate Telephone	5	8	8	7 1/2-7 1/2	..	5 0 10
Direct W. India Cable, 4 1/2 % }	100	4 1/2	4 1/2	99-101	..	4 9 1	Do. 5 % Cum. Pref. ....	5	5	5	6 1/2-6 1/2	..	4 8 11
Reg. Deb. }							West Coast of America ..	2 1/2	2 1/2	2 1/2	1 1/2-1 1/2	..	4 0 0
Eastern Telegraph, Ord. Stock	Stock	7	5 1/2	130-133	..	5 5 3	Do. 4 % Debs., 1 to 1,500 }	100	4	4	95-98	..	4 1 8
Do. 8 1/2 % Pref. Stock ..	Do.	8 1/2	8 1/2	78-80	- 1/2	4 7 6	guar. by Braz. Sub. Tel. }						
Do. 4 % Mort. Deb. ....	Do.	4	4	99-101	- 1/2	3 19 3	West India and Panama Teleg.	10	1 1/2	1 1/2	2 1/2-3	- 1/2	1 13 4
Eastern Extension .. ..	10	7	5 1/2	12 1/2-13 1/2	..	5 5 8	Do. 6 % Cum. 1st Pref. ....	10	6	6	10 1/2-10 1/2	+ 1/2	5 11 7
Do. 4 % Deb. ....	Stock	4	4	99-101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ....	10	5	6	9 1/2-10 1/2	..	5 17 1
East and S. Africa Tel. 4 % }	25	4	4	97-100	..	3 0 0	Do. 5 % Debs. ....	100	5	5	102 1/2-104 1/2	..	4 15 8
Mt. Db. Mauritius Sub. }							Western Telegraph, Ltd. ....	10	7	6 1/2	13 1/2-13 1/2	..	5 2 9
Globe Telegraph and Trust ..	10	5 1/2	6 1/2	11-11 1/2	..	5 4 4	Do. 4 % Deb. ....	Stock	4	4	98-100	..	4 0 0
Do. 6 % Pref. ....	10	6	6	13-13 1/2	..	4 9 0	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	100-103	..	4 7 5
Great Northern Telegraph ..	10	18	18	28 1/2-29 1/2	- 1/2	6 2 0							
Indo-European Telegraph ..	25	18	6 1/2	56-58	..	5 12 1							
Mackay Companies Common ..	\$100	5	5	86-89 xd	+ 5 1/2	5 17 8							
Do. 4 % Cum. Pref. ....	\$100	4	4	70-73 xd	+1	5 9 7							
Marconi's Wireless Telegraph	1	5	20	6 1/2-6 1/2	+ 1/8	3 4 0							
Do. 7 % Cum. Partic. Pref.	1	16	17	5 1/2-5 1/2	+ 1/2	3 3 2							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.



SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 18th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations June 18th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.						1910.	1911.			
Bath Trams, Pref. Ord. ..	1	Nil	Nil	7 <sup>1</sup> / <sub>2</sub> —8 <sup>1</sup> / <sub>2</sub>	..	£ s. d. Nil	Metropolitan Railway Consol. ..	100	1910.	1911.	64 <sup>1</sup> / <sub>2</sub> —65	..	£ s. d. 2 17 9
Do. 5 % Pref. ..	1	5	5	11 <sup>1</sup> / <sub>2</sub> —13	..	6 8 1	Do. Surplus Lands ..	100	22 <sup>1</sup> / <sub>2</sub>	22 <sup>1</sup> / <sub>2</sub>	67—69	..	4 3 4
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	78—83	..	5 8 5	Do. 8 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	8 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub>	89—91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11—13	+ <sup>1</sup> / <sub>2</sub>	..	Do. 8 <sup>1</sup> / <sub>2</sub> % Pref. ..	100	8 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub>	86—88	..	3 19 7
Do. Do. Deferred ..	100	..	..	6—8	+ <sup>1</sup> / <sub>2</sub>	..	Do. 8 <sup>1</sup> / <sub>2</sub> % Con. Pref. ..	100	8 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub>	87—89	..	3 18 8
Do. Do. 6 % Cum. Pr'f. ..	100	..	6	93 <sup>1</sup> / <sub>2</sub> —95 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	6 5 8	Metropolitan District Ord. ..	100	Nil	..	42 <sup>1</sup> / <sub>2</sub> —43	..	Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100	..	..	42—46	-1	..	Do. 6 % Deb. ..	100	6	6	144—146	..	4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5	5	93—97	..	5 3 1	Do. 4 % Deb. ..	100	4	4	96—98	..	4 1 8
Do. Do. 4 <sup>1</sup> / <sub>2</sub> % 2nd Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	80—84	+1	5 7 2	Do. 4 % Prior Lien ..	100	4	4	99—101	..	3 19 3
Central London Railway, Ord. ..	100	8	8	79—81	..	3 14 1	Do. 4 <sup>1</sup> / <sub>2</sub> % First Pref. ..	100	8 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	90—92	..	4 17 10
Do. Pref. ..	100	4	4	84—86	..	4 13 0	Do. 8 <sup>1</sup> / <sub>2</sub> % Gtd. ..	100	8 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	76—78	..	4 9 9
Do. Def. ..	100	2	2	78—80	..	2 10 9	Metropolitan Elec. Trams, Ord. ..	1	5 <sup>1</sup> / <sub>2</sub>	6	1 <sup>1</sup> / <sub>2</sub> —1	..	5 0 0
Do. 4 % Deb. ..	100	4	4	101—103	..	3 17 8	Do. Def. ..	1	Nil	..	1 <sup>1</sup> / <sub>2</sub> —1	..	Nil
City & South London, Ord. ..	100	1 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	38—39	..	4 3 4	Do. 5 % Pref. ..	1	5	5	2 <sup>1</sup> / <sub>2</sub> —2 <sup>1</sup> / <sub>2</sub>	..	5 10 6
Do. 5 % Pref., 1891 ..	100	5	5	108—110	..	4 11 0	Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	93—100	..	4 10 0
Do. Do. 1896 ..	100	5	5	104—106	..	4 15 8	Do. 5 % Deb. ..	100	5	5	98—100	..	5 0 0
Do. Do. 1901 ..	100	5	5	104—106	..	4 14 4	Potteries, Ord. ..	1	2	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	..
Do. Do. 1903 ..	100	5	5	103—105	..	4 15 3	Do. 5 % Pref. ..	1	5	5	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	6 13 4
Do. 4 % Deb. ..	100	4	4	99—101	..	3 19 3	Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	87—90	..	5 0 0
Dublin United Trams, 6 % Pref. ..	10	6	6	103 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	..	5 2 2	South Metro. Trams, 6 % Pref. ..	1	6	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	Nil	Do. 4 % Deb. ..	100	4	4	72—77	..	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	6	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	8 0 0	Underground Elec. Railways ..	10	..	..	4 <sup>1</sup> / <sub>2</sub> —4 <sup>1</sup> / <sub>2</sub>	- <sup>1</sup> / <sub>2</sub>	Nil
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	71—76	..	5 18 5	Do. 4 <sup>1</sup> / <sub>2</sub> % Bonds ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	99—101	..	4 9 1
Isle of Thanet Trams, 5 % Pref. ..	5	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub> —2 <sup>1</sup> / <sub>2</sub>	..	4 11 0	Do. 6 % Income ..	100	1	1 <sup>1</sup> / <sub>2</sub>	90—92	+1	..
Do. 4 % Deb. ..	100	4	4	75—80	..	5 0 0	Yorkshire (West Riding), Ord. ..	5	Nil	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	Nil
Lancashire United, 5 % Deb. ..	100	5	5	83—85	..	5 17 8	Do. 6 % Pref. ..	5	Nil	..	3—3 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	Nil
London Elec. Railwys, 4 % Deb. ..	100	4	4	97—99	..	4 0 10	Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	80—84	..	5 7 2
London United Trams, 5 % Pref. ..	10	Nil	..	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	..							
Do. 4 % Deb. ..	100	4	4	77—80	..	5 0 0							

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub> xd	..	5 1 2	La Plata Elec. Trms, Ord. ..	1	..	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	..
Do. 2nd Pref. ..	5	5	5 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub> xd	..	5 6 0	Do. Pref. ..	1	6	6	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	6 0 0
Do. 4 % Deb. ..	100	4	4	94 <sup>1</sup> / <sub>2</sub> —96 xd	..	4 3 4	Lisbon Elec. Trams, Ord. ..	1	5 <sup>1</sup> / <sub>2</sub>	6	1—1 <sup>1</sup> / <sub>2</sub>	..	4 8 0
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	99 <sup>1</sup> / <sub>2</sub> —101 <sup>1</sup> / <sub>2</sub>	..	4 8 8	Do. 6 % Pref. ..	1	6	6	1—1 <sup>1</sup> / <sub>2</sub>	..	4 16 0
Do. 5 % Deb. ..	100	5	5	101—103	- <sup>1</sup> / <sub>2</sub>	4 17 1	Do. 5 % Deb. ..	100	5	5	94—98	-1	5 2 0
Auckland Trams, 5 % Deb. ..	100	5	5	104—106	..	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	102—104	+1	4 16 2
Bombay Elec. S. & Trams, Pref. ..	10	6	6	11 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	..	5 3 3	Manaos Trams & Lt., 1st Deb. ..	100	5	5	92—95	..	5 5 3
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	98—100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	102—104	- <sup>1</sup> / <sub>2</sub>	4 16 2
Do. 5 % 2nd Deb. ..	100	5	5	99—101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	123—125	+1	5 12 0
Brisbane Trams Invt., Ord. ..	5	8	8	6 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub>	..	..	Do. Gen. Con. 5 % Bonds ..	..	5	5	98 <sup>1</sup> / <sub>2</sub> —100 <sup>1</sup> / <sub>2</sub>	..	4 19 6
Do. 5 % Pref. ..	5	5	5	4 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	4 15 3	Do. 6 % Bonds ..	100	6	6	104—106 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	5 12 8
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	100—103	..	4 7 5	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 <sup>1</sup> / <sub>2</sub> —7 <sup>1</sup> / <sub>2</sub>	- <sup>1</sup> / <sub>2</sub>	6 18 0
B. Columbia Elec. Rly., Def. ..	100	8	8 <sup>1</sup> / <sub>2</sub>	140—144	..	5 11 1	Do. 6 % Pref. ..	5	6	6	5—5 <sup>1</sup> / <sub>2</sub>	..	7 0 4
Do. Pref. Ord. ..	100	6	6	124—127	..	4 14 6	Do. 5 % 1st Deb. ..	100	5	5	100—102	..	4 18 0
Do. 5 % Pref. ..	100	5	5	111—114	..	4 7 9	Perth (W.A.) Elec. Tr., Ord. ..	1	2 <sup>1</sup> / <sub>2</sub>	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	1 18 4
Do. 4 <sup>1</sup> / <sub>2</sub> % 1st Mort. Deb. ..	40	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	99 <sup>1</sup> / <sub>2</sub> —102 <sup>1</sup> / <sub>2</sub>	+1	4 7 10	Do. 5 % 1st Deb. ..	100	5	5	101—104	..	4 16 2
Do. 4 <sup>1</sup> / <sub>2</sub> % Vancouver Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	103—105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	5 6 8
Do. 4 <sup>1</sup> / <sub>2</sub> % Con. Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	102 <sup>1</sup> / <sub>2</sub> —104 <sup>1</sup> / <sub>2</sub>	-1 <sup>1</sup> / <sub>2</sub>	4 6 2	Do. 4 <sup>1</sup> / <sub>2</sub> % 1st Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	99—101	..	4 9 1
Calcutta Trams, Ord. ..	5	6	7	6 <sup>1</sup> / <sub>2</sub> —6 <sup>1</sup> / <sub>2</sub>	..	5 5 8	Rio de Janeiro Trams ..	\$100	4 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>2</sub>	141 <sup>1</sup> / <sub>2</sub> —143 <sup>1</sup> / <sub>2</sub>	+ <sup>1</sup> / <sub>2</sub>	3 9 8
Do. 5 % Pref. ..	5	5	6	4 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	106—107	+ <sup>1</sup> / <sub>2</sub>	4 13 6
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. ..	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	100—103	..	4 7 5	Do. 5 % Mort. Bonds ..	100	5	5	99—100	..	5 0 0
Cape Electric Trams ..	1	Nil	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub> —2 <sup>1</sup> / <sub>2</sub>	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 <sup>1</sup> / <sub>2</sub>	248—253	+2 <sup>1</sup> / <sub>2</sub>	3 19 0
City Buenos Aires Trams (1904)	5	5	5	5 <sup>1</sup> / <sub>2</sub> —5 <sup>1</sup> / <sub>2</sub>	..	4 10 6	Do. 5 % 1st Deb. ..	\$500	5	5	105 <sup>1</sup> / <sub>2</sub> —107 <sup>1</sup> / <sub>2</sub>	..	4 13 0
Do. 4 % Deb. ..	100	5	5	101—103	..	4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	80—83	..	6 0 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94—98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	96—98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	101—104	..	4 16 2	Un. Elec. Trams Monte Video ..	6	6	7	5 <sup>1</sup> / <sub>2</sub> —6	+1	6 1 11
Kalgoorlie Elec. Trams ..	1	Nil	..	1 <sup>1</sup> / <sub>2</sub> —1 <sup>1</sup> / <sub>2</sub>	..	Nil	Do. 6 % Pref. ..	5	6	6	5—5 <sup>1</sup> / <sub>2</sub>	..	5 14 3
Do. 5 % A Deb. ..	100	5	5	89—93 xd	..	5 7 6	Do. 5 % 1st Deb. ..	100	5	5	100—103	..	4 17 1
Do. 6 % B Deb. ..	100	5	6 <sup>1</sup> / <sub>2</sub>	56—60	..	10 0 0	Winnipeg Elec. Rly., 4 <sup>1</sup> / <sub>2</sub> % Deb.	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	104 <sup>1</sup> / <sub>2</sub> —106 <sup>1</sup> / <sub>2</sub>	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	Nil	6	11—	..	7 7 8	Dick, Kerr . . . . .	1	5	..	27—	..	5 8
Do. 6 % Pref. . . . .	1	9	6	22—	..	7 2 2	Do. Pref. . . . .	1	6	6	1—	..	5 12 1
Babcock & Wilcox . . . . .	1	26	28	31—	+ <sup>1</sup> / <sub>2</sub>	..	Do. Deb... . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	97—100	..	4 10
Do. Pref. . . . .	1	6	6	1—	..	3 13 10	Edison & Swan, A, £3 paid	5	Nil	..	1—	..	Nil
B.I. & Helsby Cables . . . . .	5	10	10	7—	+ <sup>1</sup> / <sub>2</sub>	6 1 3	Do. fully paid . . . . .	5	Nil	..	1—	..	Nil
Do. Pref. . . . .	5	6	6	6 <sup>1</sup> / <sub>2</sub> —	+ <sup>1</sup> / <sub>2</sub>	4 9 0	Do. 4 % Deb. . . . .	100	4	4	68—	..	5 11
Do. Deb... . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	101—103	..	4 7 5	Do. 5 % Second Deb.	100	5	5	75—	..	6 8
British Thomson-Houston, Deb.	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	95—98	+1	4 11 10	Electric Construction . . . . .	2	Nil	2 <sup>1</sup> / <sub>2</sub>	1—	..	..
British Westinghouse, Pref. . . . .	8	Nil	..	7—	..	Nil	Do. Pref. . . . .	2	7	7	1—	..	7 0
Do. Deb... . . . .	100	4	4	61—64	..	6 5 0	Greenwood & Batley, Pref.	10	7	7	7—	..	8 5
Do. 6 % Prior Lien . . . . .	100	6	6	101—104	+1	5 15 5	Do. Deb... . . . .	100	5	5	94—	..	5 4
Browett, Lindley, Ord. . . . .	1	Nil	..	1/6—2/—	..	Nil	General Electric, Pref. . . . .	10	5	5	9 <sup>1</sup> / <sub>2</sub> —	+ <sup>1</sup> / <sub>2</sub>	5 4
Do. Pref. . . . .	1	Nil	..	5/—6/—	..	Nil	Do. Deb... . . . .	100	4	4	85—	..	4 8
Brush, 7 % Pref. . . . .	2	Nil	..	0—	..	Nil	Henley's, Ord. . . . .	5	15	10 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub> —	..	6 0
Do. 5 % Prior Lien Deb. . . . .	100	5	5	77 <sup>1</sup> / <sub>2</sub> —82 <sup>1</sup> / <sub>2</sub>	..	6 1 3	Do. Pref. . . . .	5	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	41 <sup>1</sup> / <sub>2</sub> —	..	4 6
Do. 4 <sup>1</sup> / <sub>2</sub> % Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	54—59	..	7 10 6	Do. Deb... . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	101—103	..	4 7
Do. 4 <sup>1</sup> / <sub>2</sub> % Second Deb. . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	87—42	..	10 14 4	India-Rubber, G. & T. . . . .	10	10	..	8—	..	..
Callender's Cable . . . . .	5	15	10 <sup>1</sup> / <sub>2</sub>	103 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	..	6 10 5	Do. Pref. . . . .	10	5	5	9 <sup>1</sup> / <sub>2</sub> —	..	4 17
Do. Pref. . . . .	5	5	5	5—5 <sup>1</sup> / <sub>2</sub>	..	4 15 8	Telegraph Construction.. . . .	12	20	10 <sup>1</sup> / <sub>2</sub>	33—35	..	6 19
Do. Deb... . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	100—102	..	4 8 3	Do. Deb... . . . .	100	4	4	99 <sup>1</sup> / <sub>2</sub> —101 <sup>1</sup> / <sub>2</sub>	..	4 9
Castner-Kellner . . . . .	1	17 <sup>1</sup> / <sub>2</sub>	20	3 <sup>1</sup> / <sub>2</sub> —8 <sup>1</sup> / <sub>2</sub>	..	5 10 2	Willans & Robinson . . . . .	1	Nil	..	1—	..	Nil
Do. Deb... . . . .	100	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	105—109	..	4 10 7	Do. Pref. . . . .	5	Nil	..	1—	..	Nil
Crompton & Co. . . . .	8	Nil	Nil	3—	..	Nil	Do. Deb... . . . .	100	4	4	58—60	..	6 13
Do. Deb... . . . .	100	5	5	58—68	..	7 7 1							



PROCEEDINGS OF INSTITUTIONS.

The Transmission of Electrical Energy by Direct Current on the Series System.

By J. S. HIGHFIELD, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Glasgow, June 12th, 1912).

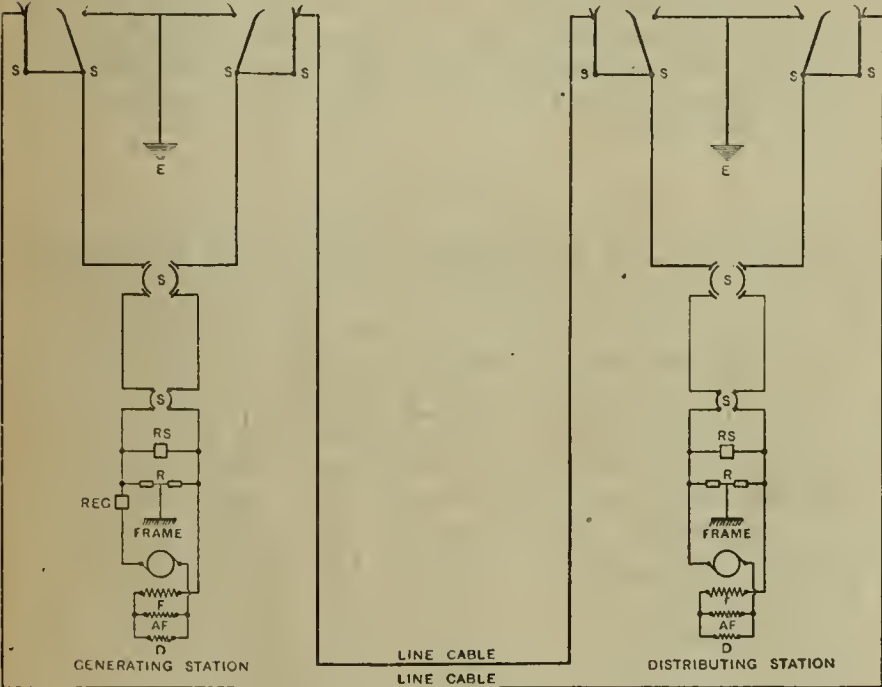
(Concluded from page 988.)

BEFORE deciding upon the use of the earth for regularly carrying considerable currents, it was necessary to make sure that such use would not cause interference with other electrical systems, and would not cause damage to property. M. Thury has carried out a great deal of work on this subject, and the town of Lausanne was supplied from St. Maurice through a single conductor with the earth as the return for 443 days continuously. Iron earth-plates were used, and during the whole time of their use it was found that their resistance changed very little. The current was 150 amperes, and theoretically the plates should have been oxidised away in less than two months, but apparently, after a layer of oxide has been formed, further action is very slow. The total resistance of the earth connections was about 1·6 ohms, and it was found that no inconvenience was experienced in connection with telegraphs and telephones.

Experiments were carried out in order to obtain the following information, namely:—

- (a) At what depth below the surface must the plates be buried in order that the effect of currents at or near the surface should be negligible.
- (b) The size of plates to be used, and their number.
- (c) The distance apart at which the plates should be situated.
- (d) The value of the earth resistance and its constancy.

With the first object in view, four iron plates were buried in the earth, situated vertically above each other, as indicated in the diagram (fig. 8). The area of each plate was 4 ft. × 2 ft. 2 in.,



S, Main switch; RS, Automatic switch; R, Pressure-limiting resistance; REG, Regulator; F, Main field coil; AF, Auxiliary field; D, Diverter.

FIG. 7.—DIAGRAM OF CONNECTIONS.

with the exception of the top plate, which consisted of a length of 6-in. pipe. These plates were made one pole of a circuit, the other pole consisting of large masses of iron buried in the ground round the works, chiefly condensing water pipes of very large size, which make an excellent earth, the resistance of which was found to be negligible as compared with the resistance of the test plates. The following observations were made:—

1. With a steady current of 20 amperes passing between the earth-plate, 20 ft. deep, and the large main earth, the measurements were:—

Between the Earth-plate and—

A point 120 ft. away	...	...	165·0 volts.
A point 60 ft. away	...	...	165·0 "
The surface earth-plate	...	...	163·5 "

Between the Surface Earth-plate and—

A point 120 ft. away	...	...	0·024 volt.
A point 60 ft. away	...	...	0·016 "

Between the Earth-plate, 10 ft. Underground, and—

A point 120 ft. away	...	...	0·035 volt.
A point 60 ft. away	...	...	0·024 "

2. With a steady current of 21 amperes passing between the earth-plate, 30 ft. deep, and the large main earth, the measurements were:—

Between the Earth-plate and—

A point 120 ft. away	...	...	135·0 volts.
A point 60 ft. away	...	...	134·5 "
The surface earth-plate	...	...	133·5 "

Between the Earth-plate, 10 ft. Underground, and—

A point 18 ft. away	...	...	0·008 volt.
---------------------	-----	-----	-------------

Between the Surface Earth-plate, and—

A point 120 ft. away	...	...	0·020 volt.
A point 60 ft. away	...	...	0·010 "
A point 18 ft. away	...	...	0·004 "

Pressure readings were also taken between the surface-plate and spikes driven into the ground at various points.

All the above readings were taken with the positive pole of the generator connected to the test plate.

The foregoing experiments indicated that the pressure fall occurred at the plate itself, and that when the current was carried to a depth of only 10 ft., the pressure drop in the neighbourhood of the plate was exceedingly small.

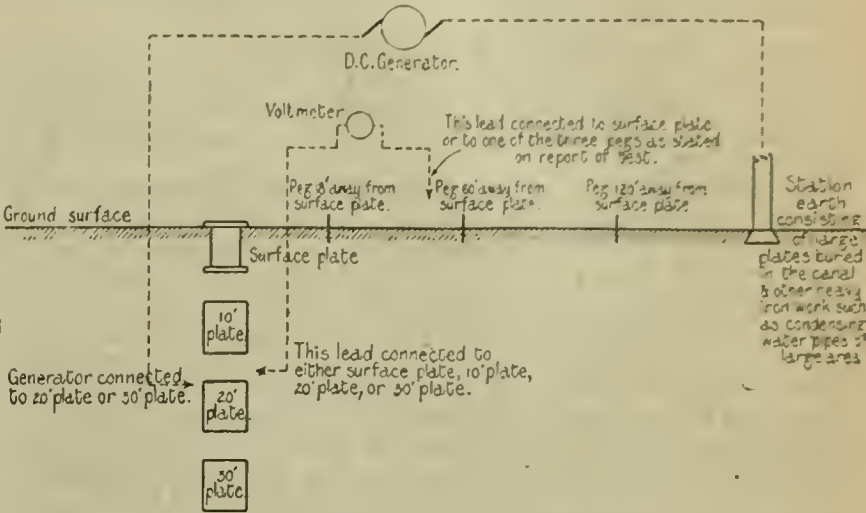


FIG. 8.—EARTH-PLATES AND CONNECTIONS.

Further tests were made by using the pilot wire as the test wire, and taking readings of the difference in pressure between Willesden and an earth-plate in the Brent River, about 1 mile from Southall. Using the pilot wire connected in parallel with the earth, a current of 3 milliamperes was observed without the current in the earth, and 8 milliamperes with 90 amperes flowing, the resistance of the pilot wire being 279 ohms; the difference in pressure between the earth at Southall and Willesden due to the earth current was 1·4 volts.

The latter tests were made by the Post Office engineers.

A series of experiments was carried out with different sizes of plates suspended in the canal; the results show that with a current of 1 ampere per 600 sq. in. of plate, little advantage is obtained by making the plate larger.

Further readings were taken in order to show the difference

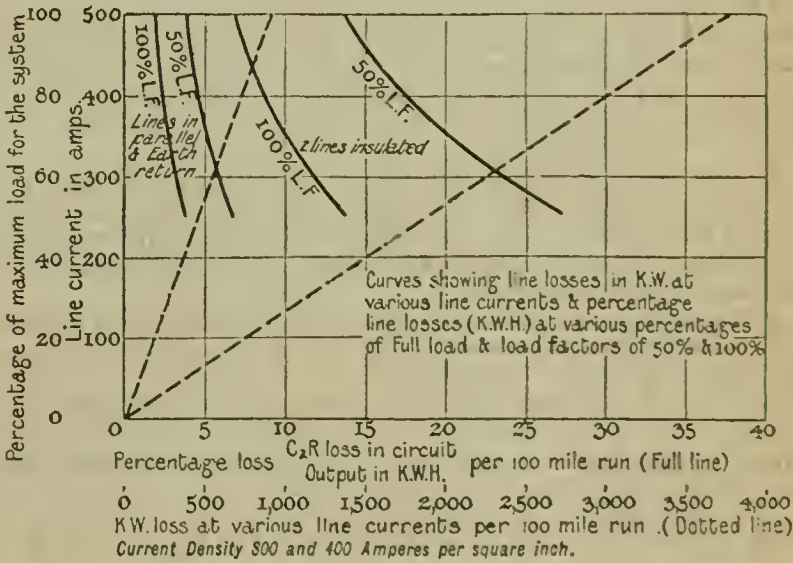


FIG. 9.

between the conductivity of the connection in water and in clay and also to show the effect of using three plates situated close together and the same plates situated at various distances apart. The results indicate that there is little advantage in spacing the plates a greater distance apart than 6 ft., and that plates buried in clay have more than twice the conductivity of similar plates immersed in water. When the plates are buried at a distance of 6 ft. apart, practically the maximum conductivity is obtained, and plates at this distance apart have nearly twice the conductivity of plates 1 ft. apart.

Before completing the above experimental work, earths were made at Willesden and Southall in the following way: At each place three boreholes were made, each borehole having a diameter of 7 in. and a depth of approximately 35 ft. This gave a current of 33 amperes per plate, and it was considered that the plates could carry this current for temporary use; for permanent use, however, probably six plates would be required. The earth-plates consisted of cast-iron pipes having an outside diameter of 6 in. and a length of 9 ft. To each plate an insulated cable was bonded, and



after the pipe was placed in the borehole, the space round it was filled in with chalk, the cable being brought up to the surface by means of an insulating tube. The plates at Willesden are all buried in ordinary London clay, and at Southall in fine gravel, which is generally very dry. After the system was started for permanent supply, careful measurements were made in order to ascertain what variations took place in the resistance of the earth connections. The resistance of the two earths is almost exactly 1 ohm, so that although only three plates were used the earth is a very effective one.

All the experiments show that plates buried at a considerable depth offer less resistance than plates buried at the surface; this is due largely to the heavy pressure on the plate when buried at a depth.

When the earth is put in parallel with either cable, with 90 amperes in the main circuit, 30 amperes flow through the cable and 60 amperes through the earth, so that the ordinary resistance of the two earths is approximately one-half the resistance of either cable.

An earth will now be made by driving a shaft 5 ft. in diameter to a depth of 30 ft., and six earth-plates, consisting of cast-iron pipes 6 in. in diameter and 3 ft. long, will be buried radially at the bottom; in this way it will be possible to keep a close observation of their condition.

The commercial use of the earth as a conductor may be very great. When used as a spare conductor it saves the cost of a spare cable; the cost of the earth connections is a negligible matter as compared with the cost of the cable, and where a very long transmission is required—say, 100 miles—the advantage is immense. A line of 100 miles consisting of two 0.125 sq. in. conductors will have a total resistance of 68.3 ohms, so that with a current of 100 amperes, the number of kilowatts required to keep the line charged is 683, or nearly 7 per cent. of the maximum capacity of 10,000 kW. at 100,000 volts. Using an earth return with the same two cables in parallel, and assuming that the earth resistance is 1 ohm (a figure which can be readily obtained) the total resistance would be 18 ohms, and the number of kilowatts to keep the line charged would be 180 kW., or 1.8 per cent. of the total capacity of the line. In the latter case, either conductor would carry the full load of the system, so that a complete duplicate transmission system is provided for.

The line loss admits of ready calculation, and I find that the most convenient method is to arrive at the mean power to keep the line charged, to estimate the annual cost of running the necessary plant, and to treat this cost as a standing charge.

I show in the form of curves on fig. 9 the amount of the line losses at the various load factors, efficiencies and percentages of the maximum load for which the system is designed. The curves show the value of the losses with a completely insulated system, and for the same system operated with two wires in parallel and with the earth used as the return.

The actual working efficiency of the system described is of little value, as the load at present is small—only some 300 kW. For the last six months the ratio of the three-phase energy sent out at Southall to the direct-current input from Willesden was 77 per cent., and during this time the maximum A.C. load has not exceeded 275 kW.

The actual operating of the plant is exceedingly simple. The first generator is run up to speed by means of its starting motor, either with the mains open or on short circuit, and the regulator is set to give the proper line current; an incoming generator is generally started from the direct-current side, and the motor paralleled into the circuit.

The sub-station motors are started by opening the switch and rotating the brushes until full speed is reached, when the regulator is put into action; the speed can be very closely adjusted, so that paralleling the sub-generators is a particularly easy operation, one man attending to the plant.

With several generators in series all fully loaded, any failure to one necessitating its removal from the circuit results only in the slowing down of the whole plant.

When two insulated mains are in use, an earth at any point does not interfere with the supply; the voltmeters at once show which main is injured, and it can be cut out of circuit after the system has been earthed at each side of the fault.

When running on one cable with earth return, an earth on the cable will cut out all sub-stations beyond the point where the fault occurs.

The present safe limit of pressure on a single commutator appears to be about 5,000 volts. Consequently for a maximum line pressure of 50,000 volts, ten machines are required, and if these are driven in pairs, five units of plant are required in the system. The output of each unit depends on the line current adopted; a 300-ampere line would require five units each of 3,000-KW. output.

It does not seem likely that these high-tension direct-current generators can be built to run at steam turbine speeds, but a turbine drive is now available by the use of the beautiful double helical gear employed by Sir Charles Parsons for driving slow-speed propellers in marine work. A very good plant unit would consist of separate high- and low-pressure turbines each driving by gearing one or two slow-speed generators. Careful designing is required for the couplings, but there appear to be no serious difficulties in constructing plant units of very large size.

I believe that the day will come when internal combustion engines of large size will be used to supplement the steam turbine in our power stations, and for such work the series system offers special advantages, owing to the fact that it is independent of any ordinary speed variations and is clear of all the difficulties inherent in parallel running.

The cost of a series D.C. power station where either water tur-

bines, Diesel, gas, or reciprocating steam engines are used is generally not more than that of a similar alternate-current station. Where large steam turbine stations can be used, direct-current plant of similar output would be more expensive.

The cost of the sub-station plant and gear is about the same as that of an A.C. motor-generator station working at any pressure suitable for direct use on the motors; if step-down transformers are required, the advantage will generally be with the D.C. station.

The transmission line is far less costly than a three-phase line of similar capacity. The actual cost of the line, having a capacity of 10,000 kW., with one cable disabled, worked out at £1,600 per mile; this includes the two cables laid in cast-iron pipes and a telephone cable, and the cost of the earth connections at each end. The cost of a single three-phase armoured cable of 5,000 kW. capacity at 20,000 volts including cost of laying is about £3,000 per mile, or twice the cost without any provision for breakdown. For certain work the series system and series-wound constant-current machines possess great advantages as to cost and convenience over other systems. For very long-distance transmission, especially where underground mains are necessary, it is possible where the A.C. system is not possible. Where energy has to be taken to a great city from a distance, whether from a water-power station or a steam station situated at the coalfields, the underground system offers great advantages, as compared with the overhead system, in respect of security of supply and cost of maintenance. In many instances the underground direct-current system can be laid at no greater cost than the three-phase overhead system. The system might be advantageously used for railway supply, especially where water-power is available, since it enables a very long line to be fed from a single power station. It is nearly as easy and inexpensive to insulate for 100,000 volts as for 20,000 volts; all that is necessary is to design the couplings and machine insulation for the higher pressure. With this high pressure, any practicable distance from a power station is possible.

The series machine is well adapted for any special work where variable speed is required, as for driving winding and hauling gear, and for rolling mills. It has been found economical to install a separate series system consisting of a generator and motor, the former driven by a three-phase motor, to drive a single winding gear. The great advantage for these purposes is, of course, the combination of constant torque with any degree of speed variation and the absence of the losses incurred in any form of rheostatic control. The whole of the plant and cables for the western area supply were built in this country.

#### DISCUSSION.

The discussion on Mr. Highfield's paper was opened by MR. ROGER T. SMITH (G.W.Ry.), who confined himself almost entirely to the author's remarks on the system as applied to railways, pointing out that he made the reservation that his remarks only applied to transmission between a generating station and a sub-station, and not to any use the current might be put to on the other side of a sub-station. He went on to speak of the tracks alongside of the railway lines, and pointed out that these were not always continuous or of the same extent, while they were invariably fully occupied with telegraph and telephone poles, so that the only way of getting over the difficulty would be by bunching the wires or putting them into wooden troughs. It was surprising to find in many places how difficult it was to get even 10 or 12 ft. at the side of the track with the assurance that the space would not be later required for other traffic without widening the line, so that if they took the transmission of the current for, say, 100 miles, as suggested by the author, on a three-phase cable for transmitting alternating currents, or two cables underground, and carried in such a way that they were not going to be damaged, the cost was very considerable. If it was possible to use the earth as suggested, it was a very great advantage on the side of the direct-current system. He drew attention to the fact that there was liability of interference to signals from stray currents, and it was impossible to use anything else but direct current, supplied by primary or secondary batteries, at 2 or 4 volts, and he asked Mr. Highfield if he could give assurance that such small voltages were not likely to be interfered with by such an earth return as was put forward. He also asked if Mr. Highfield had considered the use of sub-station machinery for charging batteries in parallel and also in series.

MR. ROSENBERG (Manchester) held that they could have a very much more simple station and sub-station in the case of alternating currents. He thought there were too many complications, and there might be trouble with governors.

PROF. MARCHANT (Liverpool) spoke chiefly of corrosion. While not suggesting that in the cases quoted there was more than usual corrosion, he suggested that in pipes already laid, that was a serious point.

MR. WIGHAM (Edmundson's, Ltd.) said that in the Highlands of Scotland there were many falls, from which, by the expenditure of a comparatively moderate capital, they might get anything from 2,000 to 5,000 H.P. His experience was that there was no more difficult undertaking than the handling of D.C. machinery.

MR. B. WELBOURN (B. I. & H. Cables) said that the Thury system had received serious consideration in the United States and Canada, and there was a large field for D.C. transmission; the introduction of the system had led to a vast amount of research on the part of cable manufacturers, from which valuable results had accrued.

PROF. BAILY (Edinburgh) pointed out the ease with which the earthing system could be carried out in the vicinity of London, where the sub-soil was water-laden, compared with places with dry stoney sub-strata, like some districts in Scotland.



MR. M'WHIRTER (Glasgow) dealt with the same topic, instancing a case where in the installation of a lightning conductor a series of copper plates had to be laid around the house to secure safe conductivity.

The CHAIRMAN (Mr. Ferranti) spoke of an occasion when his company were conducting on the single line and earth principle when there was a breakdown, and it was reported that atmospheric conditions had been responsible for the resulting interruptions to telegraphs in the neighbourhood of London.

In reply, MR. HIGHFIELD argued that there were frequently occasions when the transmission lines should be laid underground, as in his opinion the line overhead might often lead to a great deal of interference with traffic. He thought the charging of batteries would not be sufficiently effective, and would be somewhat complicated. It was interesting to note that the building of generators such as had been described had resulted in the construction of parallel working direct-current motors at a much higher pressure than hitherto. Mr. Rosenberg was not quite right in the assertion that the machinery was complicated. The author had taken a number of engineers over his plant, and they were surprised at the little there was to see. There was an emergency governor on the motors to come into action in case the plant showed an indication of running away. He agreed with the remarks as to the water contained in the sub-soil around London, but pointed out that they had sometimes to resort to pouring water down the wells to give good conductivity.

### THE I.E.E. SUMMER MEETING.

THE first summer meeting ever held by the Institution of Electrical Engineers has come and gone. Glasgow was chosen for the convention, and certainly from an engineering point of view, no place could have been more appropriate. In that busy hive of industry, engineering of practically every kind may be seen in its most advanced, most aggressive and most pronounced character, and to London men Glasgow and its neighbourhood must have formed an object lesson not easily to be forgotten.

Everything must have a beginning; a good start has been made, and each succeeding year should see the summer meeting of the I.E.E. achieve greater and greater success and become more and more useful to our profession.

We understand it was an open secret that the visit was in danger of being abandoned from lack of support, but luckily a sufficient muster of members came to the rescue, and the Institution was enabled to carry out its intention in a manner which did it infinite credit, and which is deserving of the congratulations of all those who took part therein.

The number present was about 155, including ladies, in addition to a goodly number of members and friends of the Scottish Section. As many as 220 took part in the various excursions on the Wednesday. The Council was represented by 10 of its members.

Mr. Highfield's paper, "The Transmission of Electrical Energy by Direct Current on the Series System," was of much importance, but as the subject is little known except to a few, the discussion, although animated enough, did not lead to any further elucidation of it. Dr. Rosenberg criticised it adversely from many points, but as he, apparently, had not seen the system in operation, he brought into his comments a certain number of disadvantages which in reality have no existence, as Mr. Highfield showed in his reply.

It seems not a little strange that the contractors for the plant should not have had a representative present to participate in the discussion, as we know that more than one of their engineers are quite familiar with the Thury system; the cable-makers were not so reserved, Mr. Welbourn for his company making out a good case.

But the feature of the meeting was the lecture on "Permanent Magnets," at the University on Thursday morning, by Prof. Silvanus Thompson. His audience consisted of some 70 to 80 of the sterner sex athirst for knowledge, and some five or six ladies. The majority of the I.E.E. had, alas! gone on a trip to Edinburgh, and therefore lost what would have been a never-to-be-forgotten event in

their lives. For two hours, Prof. Thompson held his hearers absolutely fascinated by his usual masterly exposition of his subject.

Many of us probably thought we knew a good deal concerning the properties of permanent magnets, but not one of us left that lecture without a feeling that in those two hours he had learned that which he never knew before.

The quality of steel, the shape and dimensions of bars, heat treatment, magnetising, maturing, and safeguards for preserving; these were the heads of the Professor's discourse, and never have we heard him to greater advantage. He was always eloquent, but at times he became impassioned, probably feeling that he was speaking in the place that had so often been occupied by that greatest of modern physicists, Lord Kelvin, to whose memory he paid a glowing tribute. That lecture alone was well worth the journey to Glasgow, and when we say that Dr. Thompson travelled all night on Wednesday to deliver his discourse at 10.30 the next morning, and then left for London by the 2 o'clock train, we think that the Institution owes him a debt of gratitude.

It may be questioned whether afternoon visits to works, covering acres of dusty, dirty shops, and dustier, dirtier ground, or to power stations are really of much value. And when a tiring afternoon is followed by a reception, there is on the part of the weary ones a decided disinclination to go to the trouble of attiring themselves for evening functions when the time for that and dinner is very limited.

We have every respect for those firms who so obligingly open their workshops to the visitors, but it is becoming a matter for consideration whether, after a morning devoted to the reading and discussion of papers, the afternoon should not be solely devoted to social amenities.

The trip on the Clyde was undertaken in weather not calculated to bring the beauties of the scenery before the visitors to the best advantage; for although the rain which fell in Glasgow did not affect the river party, the sunshine was only fitful. Still, the catering was good, and everybody seemed thoroughly to enjoy the change from arduous labour to pleasure seeking, and as they returned to Glasgow punctually at 5 o'clock, there was ample time left to prepare leisurely for the Institution dinner at the Grosvenor Restaurant, at which some 200 ladies and gentlemen assembled. Amongst the guests were representatives of the Corporation and the University, besides other public men. Dr. S. Z. de Ferranti, the president of the Institution, presided, and among the gentlemen present were Lord Inverclyde, Sir John Ure Primrose, Bailie J. C. King, Chief Magistrate, Sir George T. Beatson, Sir David C. M'Vail, Prof. A. Barr, the Very Rev. F. L. Dean, Provost of St. Mary's, Bailie Nelson, Prof. Glaister, ex-Bailie Willock, chairman of the Corporation Electricity Committee, Prof. Mellanby, Prof. G. G. Henderson, the Rev. Dr. John Smith, Mr. E. Hall Brown, Prof. Andrew Gray and Dr. David Murray. The croupiers were Prof. F. G. Baily, Mr. W. W. Lackie, Mr. W. Judd, Mr. W. Duddell, Mr. Robt. Kaye Gray and Mr. W. M'Whirter.

The chairman proposed "The Corporation of Glasgow," and spoke of the intimate tie binding the Corporation and the Institution—the object of promoting a wider and more general application of electricity for all purposes. The Institution, he continued, was fortunate in having met in Glasgow, where the Corporation had pursued a most enlightened policy of doing all that was possible to push the development of electricity.

Mr. Ferranti then spoke of the labour unrest which permeated almost every trade in the country. There was, he said, a great deal of legitimate dissatisfaction in the life of the greater proportion of the people, and a great deal they would like to see altered. There was, he would not say one remedy only, but one remedy that stood out clearly, if the general mass of the people were to have a better time. He held, and felt very strongly, that the solution of much of the trouble was the introduction of machinery to lighten labour. The country must work at a higher efficiency. His point of view was that electricity was the greatest labour-saving contrivance which had ever been introduced, and that when properly developed it would bring immense benefits in the future to the people of this country.

Bailie King acknowledged the toast, in the absence of the



Lord Provost, in a richly humorous speech. No longer would anyone hearing Bailie King believe that a surgical operation was necessary to make a Scotsman see a joke; they not only see them, but manufacture them at every opening.

Mr. Duddell, the President-Elect of the Institution, gave the toast of "The University," to which Prof. Barr replied in a speech full of witticisms, his references to short and long bars showing how much he had appreciated the lecture on "Permanent Magnets" earlier in the day.

The University, he said, deserved to be toasted at any dinner of electrical engineers, for, as they had been reminded, it was the University of Black and Watt, of Kelvin and Rankine. The physics taught in the early times must have been of a very speculative character, because the old records told them that one branch of the subject was pneumatics, in which was comprised the nature of spirits, including angels. The present learned Professor of Natural Philosophy would hardly venture to go so far in his lectures, but he could wish he had listened to some lectures on that interesting view of the subject, as then, perhaps, he might have been able to estimate the real unearthly nature of the electrical engineer. He looked upon him as being quite ethereal—someone quite outside the common run of engineers, the common five-eighths, as they were usually called.

Lord Inverclyde replied for "The Guests," proposed by Mr. Robt. Kaye Gray. To him as a ship-owner, he said, it was a special gratification to attend their dinner, because although the propulsion of ships by electricity was still in its infancy, the application of electricity to lighting and to other contrivances on board ship had done more to make travel pleasant and convenient than anything else they could refer to.

The toast of "The Chairman" was proposed by Sir John Ure Primrose, and cordially pledged.

The indefatigable secretary, Mr. Rowell, and his *fidus Achates*, Mr. Tree, were here, there and everywhere; we received many little courtesies at the hands of these gentlemen, and to them we offer our salaams.

To the business man it is rather unfortunate that this meeting, the Convention of the M.E.A. and that of the Light Railways and Tramways Association, should all take place within three weeks, for the tax upon one's time is very severe.

In our "Notes" last week we gave a brief outline of the proceedings on the first day of the convention. The second day's meeting took place in the James Watt Laboratory of Glasgow University, Dr. Ferranti presiding, when Prof. Silvanus P. Thompson, D.Sc., F.R.S., lectured on "The Magnetism of Permanent Magnets." In an introductory reference to Lord Kelvin's work, Prof. Thompson said the deceased scientist did so much, not only in regard to magnetism, but as to the allied parts of the science, as to make them all keenly feel that they owed a great debt to him, and that his writings were still an inspiration to them. The lecturer proceeded to point out that the magnetism of permanent magnets was a subject which interested electrical engineers more than others, and he had some doubt whether the majority had really understood the true importance of the subject. Permanent magnets were used in very many pieces of apparatus and very many instruments, and while they had known magnets from their boyhood, they hardly yet realised what advances had been made, what problems confronted, investigated and solved by their agency. They hardly understood the later developments of the subject, but he ventured to think that if one collected the scattered data of the researches of the past 20 or 25 years and put them into a connected whole, the influence of the permanent magnet on the present state of matters electrical would be found to be of vast importance. He would deal not with his own researches, but with what had been done by people in this and other countries. In the first place it went without saying that they had to deal with steel, for there were no permanent magnets for ordinary purposes, except those made of steel. Of course, there were also load-stones, but these could be dismissed from the present occasion, as could also be a material lately discovered—an alloy of cobalt and iron which had not been sufficiently investigated. These they would dismiss and confine themselves to steel. But in that connection there were half a dozen points of view which it would be well to discuss. He put down first in order of consideration, the consistency and the quality of steel. Were they to use carbon steel, and, if so, of what percentage, or if they were to use an alloy steel, what alloy, and of what percentage? That was a point which could not be answered right off, and they had also to consider the second, viz., the shape and dimensions of the magnet. They had then to consider the purely metallurgical question. Steel might differ very largely in its condition, depending upon how it had been heated, cooled, or worked,

the temperature at which it had been tempered, cooled, or quenched, in hot or cold water, in oil, or mercury, or liquid air. This was a most important question. Another point was whether it was advisable to temper the steel. Then came the question of magnetising, which was the least important, and that of ageing or maturing, whether by time or shock, or by warming and maturing by repeated partial magnetisation. What was important to know was, how much magnetism was lost and how much residual magnetism left? The professor proceeded to discuss in detail the properties, metallurgical and magnetic, of the various kinds of steel and alloys, with profuse diagrams from the research data of Madame Curie and others, and went on to show that steel heated about 800° C. was non-magnetic. It was not attracted by a magnet and they could not make a magnet of it. A little below that it was capable of being magnetised. Of the various steels he suggested pearlite as the most easily magnetised and the most retentive of magnetism. Proceeding to deal with the dimensions and size of magnets, the lecturer pointed out that Lord Kelvin had told him the better part of 40 years ago that short bars had short memories. They did not remember having been magnetised and gradually lost their magnetism, while long bars, even of soft steel, would remember and would keep it. The self-demagnetising forces in a short bar were greater than in long ones; the nearer the poles were to each other, in the greater degree did the one act upon and combat the influence of the other. His point was that the distance between the poles should not be less but much more than 20 times the diameter or the thickness of a bar magnet, while as to permanence he suggested sudden quenching at the degree he had previously mentioned. In subsequent processes there were various methods, that of dropping the magnet or subjecting it to force, or successive warmings to temperatures of 60 down to 20 degrees—temperatures to which it was likely to be subjected when in ultimate use. He repressed a passing regret that the disappearance of big horse-shoe magnets had synchronised with the passing away of the tea clipper ship, pointing out that such magnets were at one time used for the discovery of nails and other metallic substances which might have found their way into the tea chests. Magnets were now, however, in much greater demand, particularly in those horrid little telephones the Post Office had foisted upon the country, and magnetic steel was therefore in great request. He considered that this was an opportunity of which Sheffield steelmakers should take more advantage. He noticed that recently 300 tons of such steel, at £60 a ton, had been supplied by a foreign firm. He thought the Sheffield makers had not shown their usual keenness in this connection. He admitted, in conclusion, that while they had learned much from improved metallurgical methods, a great deal yet required to be done in the perfecting of their knowledge in this matter. Prof. Thompson subsequently showed a variety of magnets of different shapes and strengths for different uses.

The chairman expressed his confidence that the facts of the lecture would greatly help on what he would term the permanent magnet business. Dr. Thompson might have given them some information, however, as to the applications of such magnets. It was a matter of wide interest, and anything that could be done to stimulate the better production of magnets must be of the greatest advantage to the general development of electrical work.

After Prof. Thompson had been thanked, Messrs. J. S. Nicholson and B. P. Haigh gave a demonstration and description of a single-phase motor with pole-changing windings, in the laboratory, to which we have already referred in our previous note.

In the course of the day a party of the members visited Edinburgh, under the direction of Messrs. E. George Tidd and W. F. Mitchell, while there were visits to the Glasgow Corporation power stations at Pinkston and at Port Dundas, under the guidance of Messrs. W. W. Lackie and John Ferguson; the North British locomotive works, and the Corporation electricity substation at Springburn, with Mr. Sam Mavor as guide; to the Clyde Valley Co.'s power-house at Motherwell, under the direction of Mr. David A. Starr; and to Messrs. Babcock & Wilcox's works, at Renfrew, with Mr. J. K. Stothert as guide.

In the evening the members were the guests of Sir Donald and Lady McAlister, Prof. and Mrs. Barr, and Prof. and Mrs. Milligan. A musical programme was afterwards rendered, while a demonstration of gyroscopic apparatus was given in the Randolph Hall by Dr. J. G. Gray and the assistants in the Natural Philosophy Department.

On Friday the members enjoyed a cruise on the estuary of the Clyde, and later dined in the Grosvenor Restaurant, under the presidency of Dr. Ferranti. In proposing "The Corporation of Glasgow," the Chairman spoke of the T.C.'s intimate association with the tramways and electricity supply as a binding tie between the Institution and the Corporation. He did not feel at all shy of speaking of the Corporation pushing the use of electricity. They might think it too commercial a thing for a municipality to do, but it was not. He felt there was nothing they could do more beneficial to their citizens and to the trade of the city than to push electricity as much as they possibly could. He suggested that the country must work at higher efficiency, and his opinion was that electricity was the greatest labour-saving contrivance which had ever been introduced, and that when properly developed it would bring immense benefits in the future to the people of this country. Bailie King acknowledged the toast in the absence of Lord Provost Stevenson, and in responding for the toast of "The University," proposed by Mr. W. Duddell, Prof. Barr, after recalling the association with the University of Black, Watt, Kelvin and Rankine, said the subjects which the University taught to-day were quite as exten-



sive as they ever were. He thought they professed to be able to teach almost everything, but if they could think for one moment of the most characteristic element of all that teaching, he would say it was they were trying to teach them how they could get 9d. for 4d. In replying to "The Guests," Lord Inverclyde said that the application of electricity to lighting and to other uses on board ship had done more to make travel pleasant and convenient than anything else that he knew of.

## LEGAL.

BRITISH, FOREIGN AND COLONIAL AUTOMATIC  
LIGHT-CONTROLLING CO. AND GUNNING v. METROPOLITAN GAS  
METERS, LTD.

THIS case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Farwell and Kennedy, on Tuesday and Wednesday last week, upon the appeal of the plaintiffs from a judgment of Mr. Justice Warrington.

In this case the plaintiffs brought the action for an injunction to restrain the defendants from infringing the plaintiffs' letters patent of alleged improvements in apparatus for automatically lighting and extinguishing lamps, both gas and electric light, at predetermined times, and for improvements in conical plugs, with the object of doing away with the necessity of hand lighting.

It appeared that the plaintiffs' apparatus, so far as it related to gas, was the use of a stop-cock with passages through its plug, so that on turning it partly round the gas could pass, and on turning it another stop round the passage was closed, there being, however, a small by-pass to maintain a kindling light. When the lamps were electric a rotating switch was employed which when turned partly round closed the circuit, and when turned a step further opened it. The turning movement of the stop-cock or switch was effected by means of clockwork which would go a week with one winding up, and parts of the clock were adjusted to act on the stop-cock or switch so as to partly turn it at the hours to which the parts were adjusted. Plaintiffs contended that the combination of these things produced a new result, and that the defendants had been guilty of infringement. Mr. Justice Warrington, however, held that there had been no infringement by the defendants, and entered judgment for them with costs. Hence the present appeal of the plaintiffs.

Mr. T. Terrell, K.C., Mr. Courtney Terrell, and Mr. Goodland appeared for the appellants; and Mr. Walter, K.C., and Mr. J. H. Gray for the respondents.

At the conclusion of the arguments, their LORDSHIPS upheld the decision of Mr. Justice Warrington that the defendant company had not infringed the plaintiffs' patent, and dismissed the appeal, with costs.

### TRAMWAY ACCIDENT COMPENSATION.

A CARMAN named Lingi Rouchetti, of Battersea, employed by Messrs. Carlo Gatti, ice merchants, on June 12th, was awarded, in the King's Bench Division, by a common jury sitting with Mr. Justice Horridge, £50 damages against the London United Tramways, Ltd., for personal injuries sustained by a collision with a tramcar belonging to the defendant company in July last.

### SIMPSON v. LORD AND OTHERS.

BEFORE Mr. Justice Bucknill, at the Liverpool Assizes on June 13th, Mrs. Annie Simpson, of Birkenhead, sued Wesley Sutton, Samuel Lord and John Wm. Garsden, formerly trading as the Howe Electrical Engineering Co., Ltd., of 18, James Street, Liverpool, for money lent and interest.

MR. HUGH GAMON, for plaintiff, said the claim was for £1,118, made up of £930 principal and £188 interest.

In the course of LORD's evidence, it transpired that plaintiff was his sister, and had advanced various sums amounting to £930, up to 1909, to the Howe Electrical Engineering Co. It was agreed by the partnership that plaintiff should be paid interest at the rate of 5 per cent. per annum.

Judgment was given for plaintiff, for the full amount, with costs.

### BRAULIK v. MITCHELL & Co.

IN the City of London Court on 14th inst., before Judge Rentoul, K.C., plaintiff, of 8, Lambeth Hill, sued Messrs. Fred Mitchell and Co., electric contractors, of Ardwick, Manchester, for £14 8s. 10d. for electric goods supplied. Defendant, Mr. Mitchell, complained that the plaintiff had overcharged him in many instances. For instance, he had been charged 6s. for electric lamps when the traveller who took his order agreed to supply them at 4s. 6d. Plaintiff's representative said that the price of the lamp was 8s., and a discount was allowed off that of 25 per cent., which was the sum everyone in the electric lamp trade had agreed to. It was ridiculous for the defendant to suggest that he should have them for 4s. 6d. Their traveller, who had no authority to make such terms, had left their service. Defendant said if the traveller had

not had important work in Liverpool he would have been present in court to support his (defendant's) case.

JUDGE RENTOUL said he would not have thought much of the evidence of a former traveller if he gave it against the interests of his former employer. As the traveller was not there the plaintiff must put up with the deductions. He (the Judge) was not supposed to know anything about business, but he frequently had travellers offering him goods for next to nothing. Unfortunately merchants were in the hands of their travellers. In his view employers ought to get some guarantee from the men whom they appointed and then let loose on the country. It should be some security to fall back upon to meet cases like the one before him. They were constantly coming before the Court. Defendant might be quoting the correct figures, but the plaintiff was at his mercy. He found for the plaintiff for £9 16s. 6d. and costs. Plaintiff's representative had done his best in the conduct of the case. Plaintiff should be more wise in the selection of his travellers.

### HERBERT MORRIS, LTD. v. RICHARD MILES.

IN the Chancery Division, last week, Mr. Justice Swinfen Eady had before him a motion in this action to restrain defendant from committing a breach of agreement entered into by him when in plaintiffs' employ.

Mr. Miles appeared in person.

The motion asked that the defendant should be restrained from carrying on either as principal or agent, or employé, the business of electrical overhead travelling cranes, manufacturer or maker of pulley blocks, runways, or conveyors, or be concerned in any such business contrary to an agreement dated June 1st, 1910.

MR. MICKLEM, K.C., appeared for the plaintiffs, and stated that the defendant entered into the agreement under which he was to be employed by plaintiffs at a salary of £3 a week, subject to a fortnight's notice on either side, as engineer and salesman. Plaintiffs were one of two or three firms which made electrical cranes and lifting machinery. It was a limited trade, but the plaintiffs' business was world-wide, and they had branches practically all over the globe. The agreement in question in its terms called upon defendant not to divulge any of the secrets of plaintiffs' business or impart a knowledge of their business acquired whilst in their service, and restricted him from carrying on the same trade, &c., for a period of seven years after leaving their employ. Defendant was employed in the Swansea district for a time, but the company found it necessary to transfer him to Manchester. He objected to this, and told plaintiffs that if they persisted in their decision he had no option but to seek employment elsewhere. Defendant left plaintiffs' employ in February of this year on his own motion, and immediately afterwards entered that of plaintiffs' chief rivals, Messrs. Vaughan & Sons, Ltd., of Manchester. The fact that defendant had done this was brought to plaintiffs' knowledge by their coming in contact with him in connection with contracts for the erection of electric cranes.

In answer to his LORDSHIP, MR. MICKLEM said plaintiffs' works were known as the Empress Works, London. They also had a large factory at Loughborough, employing over 600 hands. There were few firms engaged in the business, and the trade for overhead travelling cranes was practically confined to themselves and Messrs. Vaughan & Sons.

On his own behalf, DEFENDANT alleged that the agreement was too wide, because, if bound by it, he would be debarred practically from getting his living as an engineer. All engineering firms manufactured some part of the machinery made by the plaintiffs. He denied that he left plaintiffs of his own motion. When he went to Manchester he wanted another £1 a week, but he was given to understand that if he demanded it he could "clear out." He did do so, and was asked for his keys.

In answer to his LORDSHIP, DEFENDANT admitted that for some eight years before entering plaintiffs' service he had been engaged with a firm at Aberdare, who, of all the machinery mentioned in the restrictive covenants, only made parts of conveyors.

His LORDSHIP, in giving judgment, said he thought if plaintiffs would omit the word "conveyors" from the agreement, they were entitled to the injunction asked for. With that omission the agreement was not too wide.

MR. MICKLEM agreed to do this, and his Lordship, with that amendment, granted the injunction asked for.

DEFENDANT asked when the injunction would come into operation.

His LORDSHIP: At once.

DEFENDANT: Then I am out of employment.

His LORDSHIP said defendant must endeavour to obtain employment outside the scope of the agreement as speedily as he could.

### THE TELEPHONE ARBITRATION.

(Continued from page 959.)

MR. GILL explained in great detail what he called his priced inventory. Dealing with underground plant, he said that there were throughout the country 3,428'6 miles of ducts for carrying the underground wires, and he estimated the cost of constructing this portion of the plant at £2,840,000.

The SOLICITOR-GENERAL objected to a mass of calculations being given without a single detail as to the price of the articles.

A long discussion followed on this point, and eventually SIR ALFRED CRIPPS produced a letter from Sir Robert Hunter, solicitor to the Post Office, which stated that the Post Office authorities'



estimate of the value of purchasable conduit plant was £1,429,910, and the depreciated value was £1,083,021.

SIR JAMES WOODHOUSE (to Sir A. Cripps): There is a difference of 1½ millions, and you will have to establish that. I wish to appreciate what the company are seeking to establish, and should be greatly assisted if the company would supply the Court with tables showing the details of the items which made up the total sum.

The SOLICITOR-GENERAL stated that when the Post Office authorities had been able to consider the details asked for he would be able to indicate the figures to which no objection was taken.

In answer to other questions, the WITNESS gave the percentages he allowed for various services as follows: Two per cent. for contingencies; 5.1 per cent. for interest on capital during construction, and 4.44 per cent. as the cost of raising capital, the last being the percentage actually paid by the Telephone Co.

MR. GILL having concluded his evidence with reference to the item of £2,839,742 in respect of the underground conduits,

SIR J. SIMON suggested that this item should be disposed of before taking the next in the company's claim. Such a course might probably save time, and they could then arrive at a true conclusion with regard to the principle for dealing with other items.

It being considered that the suggestion was of great importance, it was ultimately arranged that the case should be adjourned until later in the day to enable counsel for the company to consult with their clients on the matter.

On the Court resuming after the adjournment, SIR A. CRIPPS said that at first he thought the Attorney-General's suggestion was a good one, but on further consideration they had come to the conclusion that it was not practicable. They felt that the case ought to take its natural course, which in the end would be found to be the most convenient. There were several heads of claim dealing with plant which contained elements of similarity, but the applicants would ask for a lump sum for valuation of the plant.

The ATTORNEY-GENERAL said that the P.M.G. would object to a judgment being given for a lump sum for plant as Sir Alfred Cripps suggested. There would be many instances in which it would be necessary to give separate judgments, for various reasons.

MR. GILL then proceeded to give further evidence with regard to underground plant. Dealing with the item of cables, he said the estimated cost of construction was £3,276,664, and the value on December 31st, 1911, was £3,186,582. Under the word "cable" he included all the necessary material, viz., the actual cable, petroleum jelly, calcium chloride, &c. Continuing, witness mentioned an item of £2,614,444 for poles and standards, and stated that the number of standards claimed for was 422,779. The cost of an ordinary creosoted telephone pole was placed at about £1 in the valuation.

WITNESS next dealt with an item of two million pole steps at a valuation of £83,000. Having dealt in detail with an item of £1,017,000 for aerial cables, the quantities in the large items making up the total, he said, were agreed to by the Post Office, and the smaller items which were not agreed were, in his opinion, correctly valued. With regard to exchange equipments, witness said that some of the larger exchanges had been valued one by one. There was no method by which they could value exchange equipment generally.

SIR A. CRIPPS said he would not question witness closely as to the details under this head, but would call Mr. Cook, who had an intimate knowledge of the matter, later on. He hoped, however, before Mr. Cook was called, some agreement would be arrived at which would tend to shorten the inquiry before the Court.

MR. BUCKMASTER said he agreed it was of the utmost consequence that what could be agreed upon outside should be agreed. The Post Office had always been willing to do so, but it was not until the company's witnesses were called that they could examine the cost of material.

SIR ALFRED said Mr. Cook would not be called for some time yet, and in the meantime something might be done.

MR. JUSTICE LAWRENCE suggested to Mr. Buckmaster that the gentleman in charge of the exchange equipment for the Post Office should meet Mr. Cook and see how far they could agree.

MR. BUCKMASTER promised that this should be done. There was no desire on the part of the Post Office to prevent these figures being agreed.

Mr. Gill's examination in chief having concluded, MR. BUCKMASTER, K.C., proceeded to cross-examine witness, and in answer to his questions, WITNESS said he had endeavoured to ascertain the cost of preparing and constructing the plant and apparatus of the company as it existed on December 31st, 1911. He had made allowance for depreciation, owing to the fact that the plant was not new. Taking all the factors into consideration, Mr. Gill agreed that if it were possible to ascertain what would be charged by the contractor for the construction of the plant, that might be the best and surest method of ascertaining the first item of witness's figures, but of course the contractor's price would be affected by the state of the copper market or the labour market on a particular day, and therefore it would be an unreal estimate to fix the price as at December 31st, 1911.

MR. BUCKMASTER: You think the contractor's price is not what the contractor would charge on December 31st, 1911, but it would be the cost of building up the concern during the whole period the company had it?—No, I take the cost of building up the concern during a portion of the period the company had it, in order to give the best representation I can arrive at of what it would in fact cost to replace the plant.

MR. BUCKMASTER: I understand the difference between us is this

You say the cost is to be determined by considering what it has cost the company during the 11 years to build up the plant. I am suggesting that it should be determined by the price the contractor would give for it on December 31st, 1911?—I do not say my price is to be determined by what it had cost the company. I say the price is to be what it would cost to construct and establish the plant, and the best guide I can get in certain particulars is by reference to what it has cost the company.

WITNESS denied that his figures represented what the plant had, in fact, cost the company during the period of its construction. There were certain points at which he had made additions.

SIR JAMES WOODHOUSE said he understood Mr. Gill to say that if he were a contractor called upon to construct that plant he would know a period of years was required for the construction, and from that point he would bear in mind the fluctuations in the market as to the cost of materials and labour, and he would base his calculations accordingly?—WITNESS: Quite right.

MR. DANCKWERTS said that the company's point was that it would take 12 years to construct the plant, and the price was what the contractor would charge on completing the work on December 31st, 1911. The Post Office authorities put out a contract on December 31st, 1911, to be completed at some future time.

WITNESS, further cross-examined, said that after consideration he had come to the conclusion that 11 years would be a fair period to take for the construction of the company's existing plant.

Cross-examining with regard to the estimate of freight charges, MR. BUCKMASTER pointed out that there was a big discrepancy between the company's figures and those of the Post Office.—WITNESS: I can only say your figures are not true. Further pressed, he said he could not explain the difference.

MR. BUCKMASTER was still continuing to question witness on the point, when SIR JAMES WOODHOUSE, interposing, said the Court knew a great deal about freight charges, and that often an agreement in cases of difference might very simply be arrived at. It might be that by pursuing the matter, counsel was simply pursuing a mare's nest.

MR. JUSTICE LAWRENCE said that what Sir James was suggesting was the desirability of the parties ascertaining what their quotation stood for, in order to be quite certain that they were disputing the same thing. It might be that, in one case, the quotation was for station to station charges, whilst, in the other case, it might be from station to station plus cartage of goods from works to station.

SIR JAMES WOODHOUSE: Exactly; that is the thing you had better clear up.

(To be continued.)

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Witton-Kramer Fatigue Tester.

The system of testing materials for fatigue patented by Prof. Kapp, and described in our issue of January 12th, 1912, has been put into commercial form by the Witton-Kramer Electric Tool and Hoist Co., for whom the GENERAL ELECTRIC CO., LTD., are the sole selling agents. As already explained, the loading

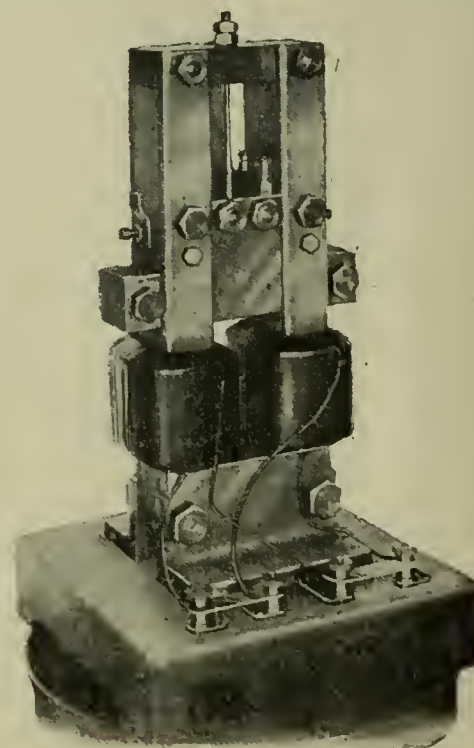


FIG. 1.—WITTON-KRAMER FATIGUE TESTER.

of the sample is effected by the attraction of an electromagnet on its armature: one end of the sample is held in the frame of the machine, and the other supports the armature at a short distance from the polar faces. An alternating current is passed round the electromagnet, producing stresses at twice the frequency of the current, which may be of any desired value. The magnitude of the stress can be regulated by adjusting the voltage applied to the magnet. At 50 cycles per second, 360,000 stresses are applied to the sample in an hour, so



that a test is carried through in a comparatively short period. If the material yields to the stress, the armature rattles on the poles, giving an immediate indication of the fact. By using two-phase current, alternating stresses can be applied.

Two samples may be used, only one of which is treated in the machine; after the desired number of stresses has been applied, both samples are tested in an ordinary testing machine, and by comparison the effect of the treatment can be inferred. Alternatively, a sample may be tested to destruction in the fatigue tester. The power consumed is trifling, and practically no attention is required; the time of application at a known frequency gives at once the number of stresses applied, without the aid of any counter.

#### G.E.C. Rotary Converter with Booster.

The accompanying illustration, fig. 2, shows a 300-kw. 50-cycle six-phase rotary converter with self-contained synchronous booster, supplied by the GENERAL ELECTRIC CO., LTD., to the Yorkshire Electric Power Co. The supply is three-phase at 10,000 volts, and is converted by transformers to six-phase current at 340 volts for lighting and 390 volts for power, these being the voltages on the A.C. side of the converter. The normal lighting and traction voltages on the D.C. side are respectively 480 volts and 550 volts.

Starting is effected by a three-phase six-pole slip-ring motor coupled to the end of the main shaft, the converter and booster having each eight poles. The converter field is shunt-wound only and self-excited, but the booster field has both shunt and series windings, which are respectively used for lighting and traction

mounting space is extremely limited, and the necessary great reduction in the size of the relay calls for considerable ingenuity.

Fig. 3 shows the neat arrangement of the lamp, lamp socket and relay in one frame, which will mount at  $\frac{1}{2}$ -in. horizontal and 1-in. vertical centres, and is no longer than an ordinary switchboard jack. The glow-lamp is held in the contact springs at the bottom, and a piece of sheet fibre shades one side of the lamp, so that its rays do not interfere with the signal immediately adjacent. The armatures are of new and improved design. One pattern is made for telephone circuits; its relay is wound to 1,000 ohms, operates on 6 milliamperes, and releases on 1 milliampere. Another is for the telegraph circuit, and is wound to 100 ohms; with a fine adjustment of the armature it operates on 10 milliamperes, and with a coarser adjustment on 35 milliamperes, this meeting the requirements of the circuit. The modified armature employed permits of the wide adjustment required. By means of a suitable winding, satisfactory adjustment can be obtained on an operating current of 2 to 3 milliamperes. Ten or 20 combined relays are usually mounted together on one plate or alternately with spring jacks to the number of 20.

#### High-Pressure Direct-current Instruments.

In connection with the description of the 100,000-volt direct-current transmission system of the Metropolitan Co., contained in our last issue, mention was not made of the fact that all the measuring instruments for working at this voltage were manufactured by MESSRS. EVERETT, EDGEMBE & CO., LTD., of Collindale Works, Hendon.

The voltmeters are of the moving-coil type the series resistances

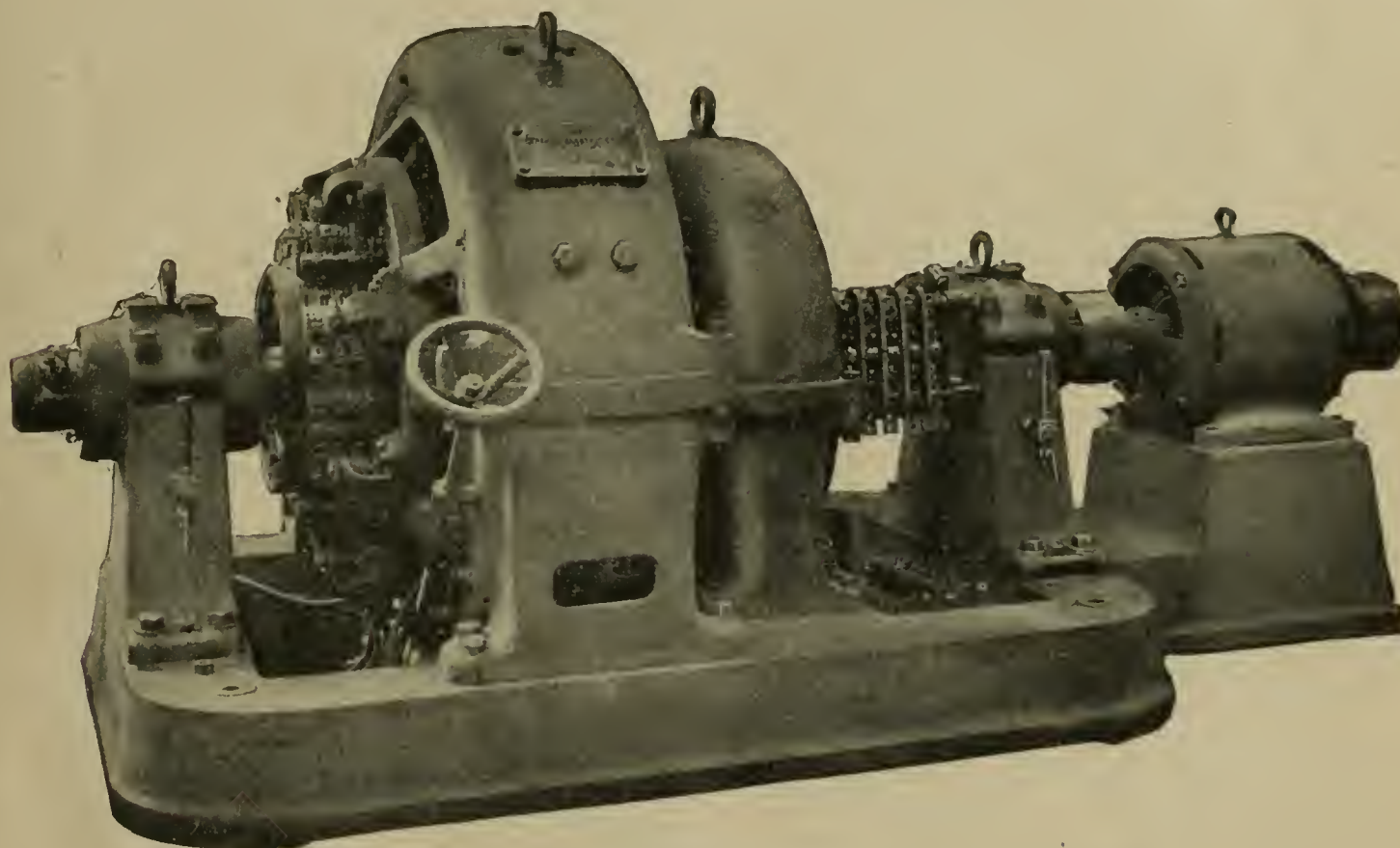


FIG. 2.—G.E.C. ROTARY CONVERTER FOR LIGHTING AND TRACTION.

service. The normal D.C. voltage for lighting is 480 volts, but with the booster shunt excited the voltage can be regulated plus or minus 20 volts, *i.e.*, from 460 to 500 volts.

When the converter is on traction service, the series winding only is used, and varies the terminal voltage from 550 volts at no load to 580 volts at 100 per cent. overload.

#### The W.E. Combined Telephone Signal Lamp and Relay.

As is now generally known, the electric glow lamp plays a very important part in the modern central-battery telephone switchboard as used in telephone exchanges, the signals to the operator being given by this means. It has been the practice up to the present to place the operating relay for the lamp separately at the back of the switchboard, but recently the need arose for a single unit lamp and



FIG. 3.—W.E. COMBINED SIGNAL LAMP AND RELAY.

relay for the smaller telephone switchboards and certain telegraph circuits, and this has been met by the WESTERN ELECTRIC CO., LTD., of North Woolwich. As a large number of lamps must be mounted close together, each associated with its corresponding spring jack,

being oil-immersed and contained in porcelain boxes, suitably subdivided. The ammeters are also of the moving-coil type, and in both ammeters and voltmeters, special precautions have been taken to ensure efficient screening from both electrostatic and electromagnetic effects.

#### OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"H. E. C." writes:—"Since the end of 1909 we have been supplying a 'Picture Palace,' situated on the opposite side of the road to our works, with electrical energy from our own plant by means of overhead cables.

"Our position with respect to the local Council is clear to us, but we would say that there is a company in existence which owns, but does not yet work, a provisional order for the supply of the town.

"We should be glad if you could inform us in what way our position as a 'free lance' is affected by the late Electric Lighting Act with respect to this latter company. Can they prevent us from supplying?"

\* \* Something depends upon the date when our correspondent commenced to grant a supply of electricity to his neighbour in the manner described. The Act of 1909 came into force on April 1st, 1910, and if the supply in question was afforded before that date, it is clear that our correspondent is at liberty to continue it. Sec. 23 of the Act provides that "Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament, or under licence or provisional order granted under the



Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts; provided that this Section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers, provided also that this Section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to the company's undertaking other than the conveyance of public traffic." Having regard to the proviso to this Section, and even assuming that supply was commenced since April 1st, 1910, it is reasonably plain that the supply which our correspondent is furnishing can hardly be interfered with by the company when they commence to work their provisional order.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 12,961. "Brush-holder." E. MOSES. June 3rd.  
 12,966. "Electric safety lamps." J. F. RILEY. June 3rd.  
 12,973. "Telephone exchange systems." W. AITKEN. June 3rd.  
 12,974. "Telephone switching systems." W. AITKEN. June 3rd.  
 12,975. "Branch telephone exchange switchboards." W. AITKEN. June 3rd.  
 12,979. "Valve fitted to the sand-distributing pipes of either tramway, railway, or road vehicles to prevent water and mud being drawn into the orifice of same." T. C. WINFIELD and S. H. JONES. June 3rd.  
 12,980. "Electric switches." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 3rd. (Complete.)  
 13,001. "Portable electric lamps." H. NEUBURGER. June 3rd. (Complete.)  
 13,046. "Electric condenser." H. SEFTON-JONES. (F. Jacoviello & Jacoviello Soc. Anon., Italy.) June 3rd. (Complete.)  
 13,048. "Manufacture of filaments for incandescent lamps." PATENT CORPORATION, LTD., and W. P. THOMPSON. June 3rd.  
 13,061. "Pendants for gas and electric lights." A. N. HASSELL. June 4th.  
 13,063. "Instruments for graphically recording the surface contour of track rails, especially applicable for electric car tracks." R. CHADWICK. June 4th.  
 13,079. "Devices for insuring electrical continuity in metallic conduits for electric cables." L. M. WATERHOUSE and SIMPLEX CONDUITS, LTD. June 4th. (Complete.)  
 13,080. "Electrical immersion heaters." W. FRISBY. June 4th.  
 13,098. "Switchboard connecting cords and the like." P. P. CRAVEN. (Addition to No. 11,366, of 1912.) June 4th.  
 13,111. "Terminals for electric conductors." J. P. ANDERSON and C. E. FRITTS. June 4th. (Complete.)  
 13,138. "Electro-deposition of metals." S. O. COWPER-COLES. June 4th.  
 13,139. "Process for the production of fine wires." S. O. COWPER-COLES. June 4th.  
 13,152. "Portable electric light fixtures." L. A. WILLIAMSON. June 4th. (Complete.)  
 13,154. "Brakes for trams and similar vehicles." F. VAN DER STRAETEN. June 4th. (Complete.)  
 13,155. "Electric telegraphy." E. S. HEURTLEY. June 4th.  
 13,157. "Telephone receivers." A. PLECHER. June 4th. (Complete.)  
 13,158. "Electrical lifts for dinner or service use." F. HODGSON. June 4th.  
 13,160. "Spark arresters." O. FROMM and F. WELTZIEN. June 4th.  
 13,162. "Dynamo-electric machines." E. D. PRIEST. (Convention date, Jan. 18th, 1912, United States.) June 4th. (Complete.)  
 13,171. "Securing electrical contact with, and continuity of, the wire armouring on electric cables where the cables are joined together or where they are connected to apparatus." A. HEPBURN. June 4th.  
 13,195. "Electrical switches." A. WYNNE. June 5th.  
 13,203. "Means for the control of electric pressure and current regulators." W. J. POOLE. (Addition to 23,314, 1910.) June 5th.  
 13,208. "Electric signalling lamp." H. F. CHAPMAN. (E. H. S. Chapman, India.) June 5th.  
 13,218. "Polarised electrical receiving instruments." A. HONIG. June 5th.  
 13,233. "Electro-mechanical propulsion-systems for trains." H. PIEPER. (Convention date, June 27th, 1911, Germany.) June 5th. (Complete.)  
 13,250. "Method of protecting electrical systems from leakage." ASHINGTON COAL CO., LTD. and T. MCKIE. June 5th.  
 13,282. "Process for the manufacture of articles of refractory metals and alloys." P. SCHWARZKOPF, S. BURGSTALLER and WOLFRAM-LABORATORIUM. June 5th.  
 13,287. "Methods of constructing non-conducting coverings, walls or the like." A. J. ROACH-CUMING. June 5th.  
 13,291. "Electric bells and the like." S. A. BHISEY. June 5th.  
 13,295. "Induction coil or transformer for the transmission of speech." J. SIMPSON and R. SIMPSON. June 6th. (Complete.)  
 13,298. "Magnetic compasses." R. KENNEDY. June 6th.  
 13,300. "Electric lighting systems of the dynamo-battery type." VAN RADEN & Co., LTD., M. METZ and C. SAUNDERS. June 6th.  
 13,325. "Telephone time indicators." C. M. BERINGTON. June 6th.  
 13,328. "Electrically-driven developing apparatus, chiefly for writing telegraphs." A. E. RAPPENECKER. June 6th. (Complete.)  
 13,355. "Systems for the electrical transmission of power and simultaneous telephonic, telegraphic or signalling purposes." P. V. HUNTER and W. L. SHAND. June 6th.  
 13,358. "Arc lamps." HARLE & Co. (Convention date, June 15th, 1911, France.) June 6th. (Complete.)  
 13,365. "Supporting insulator." M. MEIROWSKY. June 6th. (Complete.)  
 13,375. "Electrodes for arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 6th.  
 13,396. "Dynamo-electric machines for use in electric generative systems of motor-vehicles and the like." B. BROOKS and W. HOLT. June 7th.  
 13,401. "Insulators for securing and hanging electric flexible cords, wires and the like." W. SCHOLES. June 7th.  
 13,415. "Self-contained key panel for semi-automatic telephone exchanges." SIEMENS BROS & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) June 7th. (Complete.)

- 13,416. "Electro-medical electrodes." SIEMENS & HALSKE AKT.-GES. (Convention date, December 20th, 1911, Germany.) June 7th. (Complete.)  
 13,425. "Copying or like telegraphic apparatus." A. E. RAPPENECKER. June 7th. (Complete.)  
 13,428. "Automatic safety catch for electric lines." P. MICHAELSEN. June 7th. (Complete.)  
 13,430. "Apparatus for selective electric signalling." A. H. NICHOLSON. June 7th. (Complete.)  
 13,432. "Electrical switch contact devices." W. F. HOSFORD. (Convention date, September 8th, 1911, United States.) June 7th. (Complete.)  
 13,446. "Electrodes for vapour electric apparatus." BRITISH THOMSON-HOUSTON CO. LTD. (General Electric Co., United States.) June 7th.  
 13,462. "Bread-making by the electrical stimulation of the fermentation of yeast." W. A. BENTON and W. JONES. June 7th.  
 13,455. "Electrical switches." A. WYNNE. June 8th.  
 13,487. "Electric motor." H. L. ZABRISKIE. (Convention date, July 15th, 1911, United States.) June 8th. (Complete.)  
 13,490. "Receiver for telegraph printing machines." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) June 8th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- MEANS FOR OPERATING ELECTRIC RAILWAY TRACK POINTS AND SWITCHES. P. M. Justice. (American Automatic Switch Co.) 4,885. February 21st.  
 TROLLEY BASES FOR ELECTRICALLY-PROPELLED VEHICLES. E. M. Munro and Railless Electric Traction Co. 12,102. May 19th.  
 AUTOMATIC TELEPHONE INSTRUMENT. S. A. Bhisey. 12,135. May 19th.  
 CORD-GRIP ELECTRIC LAMPHOLDER. C. E. H. S. Walter. 12,177. May 20th.  
 COMPOUND OR MIXTURE FOR HARDENING OR PRESERVING OR MODIFYING THE MAGNETIC OR ELECTRIC PROPERTIES OF METALS. J. Vigneault and J. A. H. Hebert. 13,483. June 6th.  
 PORTABLE ELECTRIC BATTERY LAMPS. B. Pordes. 14,866. June 26th.  
 ELECTRO-PNEUMATICALLY OR ELECTRICALLY-OPERATED ORGAN OR MULTIPLE-INSTRUMENT PLAYING MECHANISM AND THE LIKE. A. R. Trist. 17,140. July 26th.  
 ARRANGEMENT FOR AUTOMATIC VOLTAGE REGULATION OF ALTERNATORS, DECREASING THE CURRENT IN CASE OF SHORT-CIRCUIT. T. Lehmann. 18,580. August 12th.  
 PROTECTIVE DEVICES FOR ELECTRICAL APPARATUS. British Thomson-Houston Co. (General Electric Co.) 19,583. September 2nd.  
 ARC-RUPTURING DEVICES FOR ELECTRICAL APPARATUS. Allgemeine Elektrizitäts Ges. 20,409. September 14th. (September 15th, 1910.)  
 ELECTRIC CONTROLLERS. H. R. Canfield. 20,534. September 16th. (September 21st, 1910.)  
 DYNAMO-ELECTRIC MACHINES FOR MINE EXPLODING. Sterling Telephone and Electric Co. (Schaffner & Co.) 21,913. October 4th. (Addition to 22,618 of 1907.)  
 CONNECTION FOR LIGHTING METALLIC-VAPOUR ELECTRIC LAMPS. Quarzlampen Ges. 23,284. October 21st. (October 22nd, 1910.)  
 ARC LAMPS. H. Weiss. 25,899. November 20th.  
 COMMUTATION OF DIRECT-CURRENT DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 27,212. December 5th.

### 1912.

- ELECTRICAL SELECTIVE CONNECTING APPARATUS OPERATED FROM A DISTANCE. G. A. Betulander. 410. January 5th. (January 10th, 1911.)  
 ELECTRICALLY HEATED FLAT-IRONS. K. Kaltschmid. 2,221. January 27th.  
 WINDING METHODS FOR ROTATING MAGNET COILS. "Vulkan" Maschinenfabriks Akt.-Ges. 3,919. February 16th. (February 20th, 1911.)  
 CIRCUIT ARRANGEMENTS FOR POLYPHASE SERIES MOTORS. Siemens Schuckertwerke Ges. 4,165. February 19th. (February 18th, 1911.)  
 TELEPHONES. T. W. Tattersall. 4,773. February 26th.  
 FUSEBOARDS, PANELS AND THE LIKE FOR ELECTRIC DISTRIBUTION. Siemens Schuckertwerke Ges. 5,322. March 2nd. (March 3rd, 1911.)  
 CONTROLLING ARRANGEMENTS FOR ELECTRIC CABLES. Siemens Schuckertwerke Ges. 8,158. April 4th. (April 12th, 1911.)

**Peat as Fuel.**—A paper discussing the utilisation of peat as fuel at the power station on the Wiesmoor, East Friesland, was read by Prof. J. Teichmüller at the Leipzig conference of the Union of German Electrical Engineers. The peat is used on the spot for raising steam and the electrical energy is employed in connection with the establishment of the channels necessary for the drainage of the moor so as to render the land suitable for cultivation. The quantity of peat needed for the generation of a kilowatt-hour is stated to amount to 2½ kg. and the cost of production is 1.25 pfennig per KW.-hour, which is said to enable the peat-fired station to compete with one where pit coal is used as fuel. At the beginning the working of the station was favoured by the construction of a large lock which necessitated the use of considerable power, but compensation for this loss of business on the completion of the lock has been obtained, and the total consumption is expected to reach 8,000,000 KW.-hours next year. It is calculated that the peat already raised from the channels which have been made will assure a supply of fuel for from 20 to 30 years, whilst the total available deposits in the district are reckoned to last for 450 years. If the electricity works had not been established there would have been no sale for the peat, and the cultivation of the land would have been generally doubtful, whilst mechanical working could only have been carried out to a slight extent.



# THE ELECTRICAL REVIEW.

VOL. LXX.

JUNE 28, 1912.

No. 1,805.

## ELECTRICAL REVIEW.

## SYNTHETIC RUBBER.

Vol. LXX.]	CONTENTS: June 28, 1912.	[No. 1,805.
		Page
Synthetic Rubber ...	...	1029
Australian Views on Electrical Development ...	...	1030
The Sheffield Corporation and its Wiring Department ...	...	1031
Our Electricity Works Table ...	...	1031
The I.M.E.A. Convention, 1912 ...	...	1032
Electric Cooking and Electric Cooking Apparatus ...	...	1033
The Cooking Load from the Supply Point of View ...	...	1034
Electric Cooking and the I.M.E.A. ...	...	1036
Correspondence:—		
Bonus Systems ...	...	1037
Coal Strikes and Tramways ...	...	1038
An Objectionable Clause ...	...	1038
Trade with Canada ...	...	1039
The Indirect Lighting of Rooms ...	...	1039
International Radio-Telegraphic Conference ...	...	1040
Parliamentary ...	...	1041
Business Notes ...	...	1042
Notes ...	...	1049
City Notes ...	...	1051
Stocks and Shares ...	...	1055
Electric Tramway and Railway Traffic Returns ...	...	1056
Share List of Electrical Companies ...	...	1057
Trade Statistics of Mexico ...	...	1059
Aczol: A New Preservative Material for Timber ...	...	1059
The Optical Convention, 1912 ...	...	1060
The Application of Electricity to Railway Cab Signalling (illus.) ...	...	1061
A Method of Determining the Distance of a Partial Disconnection in a Submarine Cable (illus.) ...	...	1063
Proceedings of Institutions:—		
Power Generation and Distribution in the Clyde Valley (illus.) ...	...	1064
Legal ...	...	1066
New Electrical Devices, Fittings and Plant (illus.) ...	...	1068
New Patents Applied For, 1912 ...	...	1068
Abstracts of Published Specifications ...	...	1068
Contractors' Column ...	Advertisement pages xxii and xxiv	

## THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

**OFFICE:—4, LUDGATE HILL, LONDON, E.C.**

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

**ADVERTISEMENT RATES ON APPLICATION.**

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

**BY FAR THE LARGEST CIRCULATION**

of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. (\$5.30). To all other countries, £1 10s.

**Binding.**—Subscribers' numbers bound, including case, for 4s. each volume.

**Cases.**—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

**Foreign Agents.**—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHNER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1912 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill London, E.C.

THE uses to which rubber and its congener gutta-percha are put in the electrical industry are so important and numerous, that any circumstances making for the development of the supply or cheapening the cost of production of either or both of these substances, must be regarded as of the highest importance to the welfare of its various branches. Rubber, as we all know, is used in its soft form very largely in light and power cables, and partly in the vulcanised form, partly in the unvulcanised state as an insulator and protective agent in flexible strip. In its hard form, *i.e.*, ebonite, it is used very largely for switchboards, for accumulator cases, and so on. It is difficult to form any reliable estimate of the actual value of the rubber employed in the British electrical industries, but we know that during the year 1910 the value of electrical wires and cables of various kinds exported from this country was not far short of three millions sterling. These figures, of course, include gutta-percha covered, *i.e.*, submarine cables; but, on the other hand, there can be little doubt that the exported cables, &c., form only a small proportion of the goods turned out by the electrical industry in this country, in which rubber or gutta-percha plays a prominent part. A somewhat better idea of the importance of the rubber supply to the United Kingdom may be gathered from the fact that during the past two years the consumption has been something like 20,000 tons, of a value approximating to 10 millions sterling. With regard to gutta-percha a recent estimate places the amount in cables actually laid at well over 20,000 tons. In view of these facts it is not a matter for surprise that the paper recently read before the Society of Chemical Industry by Prof. W. H. Perkin, F.R.S., on synthetic or chemically-prepared rubber should have caused the greatest interest, an interest not untinged with excitement and sensation among the widest circles. Prof. Perkin's paper was actually entitled "The Production and Polymerisation of Isoprene and its Homologues," and essentially consisted of an historical review of the attempts to make rubber artificially, followed by an account of the work conducted by an organisation of chemists directed by Messrs. Strange and Graham, working in conjunction with Prof. Perkin and later with Prof. Fernbach, of the Pasteur Institute, Paris. Prior to the advent of Prof. Fernbach on the scene Sir William Ramsay had already become associated with the group as consultant. The history of synthetic rubber may be said to have started with the discovery by an Englishman, namely, Greville Williams, in 1860, of the fact that among the products obtained by the dry distillation of rubber was a substance, subsequently termed isoprène, which on standing in a sealed vessel thickened and became viscous. In 1875 Bouchardat, of Paris, discovered that by the action of hydrochloric acid on isoprene (also obtained from rubber), a substance which closely



resembled natural rubber could be obtained. Subsequently Prof. Tilden found that isoprene could be derived not only from rubber, but from another natural product—namely, turpentine—by passing this substance through a heated tube under certain conditions, and from the isoprene so prepared Prof. Tilden was able by two processes to obtain a material, the qualities of which appeared to be much the same as those of natural rubber. The next step was to clear up the constitution of the material isoprene, and, to pass over all the intermediary stages, it may be stated that this substance has been proved to be a methyl-butadiene—that is to say, a chain compound containing five carbon atoms and two double linkages. For a time the views of Tilden regarding the basis substances of natural rubber were strenuously combatted by a German school of chemists, headed by Prof. Harries, and the failure of Harries to obtain rubber from isoprene as described by Tilden led him to express a serious doubt as to whether Tilden had not been wrong in his observations, or had not drawn wrong deductions from his experiments. Not the least interesting part of Prof. Perkin's discourse consisted in the production of some of the original specimens of the rubber-like material prepared by Prof. Tilden, and the refutation of the claims of the chemists of the German school to the effect that they were the original and true discoverers of the synthesis of rubber. That isoprene can be converted into rubber is now acknowledged by the German school, inasmuch as recent researches have enabled them to convert this material into the substance in question. There can be no doubt, in view of the evidence brought forward by Prof. Perkin, that the credit of the original discovery of a method of synthesising rubber lies to the credit of this country, and a further triumph of British science lies in the fact that it is an Englishman—namely, Dr. Matthews, the chief of the organisation of chemists working under the direction of Messrs. Strange and Graham—who may claim priority for a method of converting isoprene rapidly and surely into a rubber. At this point it may be explained that, from a commercial point of view, the difficulties associated with the production of rubber consist, first, in the problem of producing isoprene cheaply, and secondly, in the problem of devising a rapid and approximately quantitative method for converting this material. The latter problem appears to have been adequately solved, inasmuch as Dr. Matthews has discovered that if isoprene is left in contact with metallic sodium in a closed vessel, it rapidly loses its limpidity, becomes highly viscid, and is ultimately converted, almost without loss, into a rubber. We advisedly say “a rubber,” because it would appear from the publications of Prof. Harries, who, independently, but later, it would appear, than Dr. Matthews discovered this method of conversion, that the rubbers obtained either from isoprene or from its higher or lower homologues by the sodium process differ appreciably in regard to their chemical and physical properties from natural rubbers, at any rate from rubbers of the Para or plantation type. A process for the production of isoprene cheaply does not yet appear to have been worked out. Prof. Perkin and his colleagues rightly started with the basis idea that a synthetic process which should prove to be commercially successful must necessarily be based on a raw material cheap in price and practically unlimited in supply, and in this connection they took into consideration wood, petroleum, coal and starch. The three first-named materials failing to give any promising result, it was suggested that the last-named substance, starch, might by a suitable process of fermentation be converted into a type of fusel oil, namely iso-amyl alcohol, which in its turn offered the possibility of conversion by fairly simple methods into isoprene. Iso-amyl alcohol has actually been converted first of all into its chloride and by further chlorination into a di-chloro derivative, and finally by the removal of two molecules of hydrochloric acid by means of soda lime, into isoprene, but unfortunately the process of fermentation on which Prof. Fernbach has, according to reports, been working for the last eighteen months, has not yet produced iso-amyl alcohol on a commercial basis. In the course of

his labours, however, Prof. Fernbach discovered that starch could be readily converted with a high yield into a lower homologue of the desired alcohol, namely, into a butyl alcohol. From butyl alcohol it is stated that butadiene, that is to say, a straight chain compound containing four carbon atoms, or, to put it in other words, an isoprene in which the methyl group has been replaced by hydrogen, can readily be obtained with a good yield. Meanwhile it was well known that butadiene as well as the higher homologues of isoprene could be converted similarly to the latter body into rubber-like substances, and according to the views of Prof. Harries and others, the rubbers so obtained offer much promise. In connection with Prof. Fernbach's process for the production of butyl alcohol, we are informed that a process by which acetone can be produced at about one-third of its present price has been discovered, and there can be very little doubt that even though the hopes which have been founded by Prof. Perkin and his colleagues on the production of rubber commercially from starch may not be fulfilled, they should be amply rewarded for their labours by the results which will undoubtedly accrue if acetone and fusel oil can actually be produced on a very large scale and at the price which is anticipated. Acetone at present is produced solely from wood, and owing to the rapidly-increasing demand the price of this material has risen steadily within the last few years from about £40 to £90 per ton. It is essential to the manufacture of modern high-power explosives, and it is used on a very large scale indeed as a solvent in other industries, and would be still more largely employed were its price not rapidly becoming prohibitive. With regard to the possibility of the commercial production of a synthetic rubber, either of the normal rubber derived from isoprene, or of the new butadiene rubber, it is acknowledged that the matter is still in the laboratory stage, and there can be little doubt that so far, particularly in view of the small quantities of these materials which have been produced, there is very little, if any, practical experience of a satisfactory character to guide us in forming an opinion as to how the material will behave during the manufacturing process or afterwards. Prof. Perkin and his colleagues have expressed the view that they may in time produce a synthetic rubber with the probability of a profit at a selling price of 2s. 6d. per lb., and the possibility of a production at 1s. per lb. We are admittedly then still dealing with probabilities and possibilities, and it is interesting to note in this connection that the leading chemist of one of the great German organisations, which has occupied itself very largely with the synthetic rubber problem, has this year said that progress is very slow, and has lent point to this statement by saying that if the chemical industry were but given the 36 years' start which the plantation rubber industry possesses in this connection, he has very little doubt that it would be shown that synthetic rubber would make for itself, *side by side* with plantation rubber, a place in the world's industrial markets. The electrical industry then will view with interest and sympathy the efforts of chemists in the continuation of a struggle, which, if carried to a successful issue by them, must lead to a cheapening and broadening of the world's rubber supplies: but meanwhile the wild rumours circulating as to the approaching downfall of the plantation industry, not to speak of wild rubber, need not be given more credence than they deserve.

---

#### Australian Views on Electrical Development.

MR. H. R. HARPER, City Electrical Engineer of Melbourne, has recently published a very complete report to the City Council dealing with his official tour in the States, Great Britain, France and Germany.

and we trust that electrical developments in Melbourne will receive considerable impetus from the recommendations and criticisms presented.

The chief impression gained in France seems to have concerned the “rather chaotic” state of electricity supply in Paris, but there are hopes that a homogeneous system will gradually be attained. England, Germany and the States



all receive generous praise. The L.C.C. Tramways are justly considered the finest in the world, but we are rather sorry to note that Mr. Harper has been persuaded to believe that the conduit system is the one best adapted to Melbourne's requirements. That city is one of the few remaining places in the world where cable tramways are in vogue. Mr. Harper gives figures relating to the surplus on working of the L.C.C. trams, but the prospect is not by any means so pleasing as he suggests; a statement published on another page of this issue shows that the margin of net surplus is far short of what it ought to be when the capital outlay is taken into account. The equipment of the Berliner Electricitätswerke (the company supplying the whole of the electric lighting, power and tramways in Berlin) is stated to be the most up-to-date and complete on the Continent, and the report describes Berlin as the best lighted city in the world (both as regards interiors and streets), and emphasises the great field for illuminating engineers in the Victorian capital.

The history of electricity supply in America is a tale of private enterprise and gradual consolidation of competing interests into gigantic monopolies. Municipal enterprise is practically confined to small street lighting installations and to the collection of a percentage of the receipts of private supply companies. Mr. Harper speaks favourably of the system of State control of public utilities in the U.S.A., and is especially warm in his praise of the commercial organisation of American undertakings which enables them to supply at rates which would be prohibitive in any other country. Our power rates, in particular, compare favourably with those in the States.

Considerable space in the report is devoted to a consideration of our tariff systems for domestic supply and of the question of municipal trading. While mainly confining his remarks to a statement of facts, Mr. Harper appears to approve of our new tariff scales, and to support the policy of municipal trading. Favourable mention is made of trolley 'buses, and special attention is called to the extraordinary development of electric road vehicles in the States. Chicago alone has 3,000 of various types in use; electric vehicles are to be used exclusively in the New York Fire Brigade, and the Berlin postal authorities have ordered 750 electric wagons for departmental use. But we blush for Old England in this particular.

#### The Sheffield Corporation and its Wiring Department.

It will be remembered that on February 23rd of this year Mr. Justice Eve delivered judgment in the case of the Attorney-General *v.* the Corporation of Sheffield. This was a suit brought against the Corporation by the electrical contractors, with the object of putting a stop to the wiring and installing of fittings for lighting, bells, telephones, and all apparatus except motors and heating devices. The Corporation, under its Act of 1903, has power to sell, install, fix, and repair motors and heating apparatus, but not to manufacture them. Before 1898 the Sheffield Electric Light and Power Co., Ltd., had carried on an extensive business, both within and beyond the area covered by their provisional order authorising the supply of electricity. In that year the Corporation bought up the company, and it has continued to carry on the wiring and fittings business down to the present time. The Corporation very naturally claimed that, having bought the business, and having obtained Parliamentary authority for the raising of the necessary capital, it was entitled to carry it on. The contractors, on the other hand, thought the contrary, since the wiring department seems not to have been expressly mentioned in the Act authorising the transfer. The judgment was in favour of the contractors, and notice of appeal was given by the Corporation. So much is public knowledge, but we have thought it well to summarise briefly the history of the matter.

The Corporation, at the time of the trial, had either presented or was about to present a Bill to Parliament seeking

authority to legalise completely the work of the wiring department. This was known to the judge, and was mentioned in Court. An undertaking was given by the Corporation that it would not carry the appeal further if it were successful in Parliament.

So the matter stood, until Thursday of last week. On that day, a Committee of the House of Commons, presided over by Sir Henry Kimber, passed the wiring clauses of the Bill without alteration or deletion of any kind. The Chamber of Commerce opposed the clauses, and submitted resolutions condemning them. On the facts and figures put before the Committee the latter came to the conclusion that it would have been very hard upon the Corporation to have refused the powers which it was seeking, and which it has—illegally, as at present decided—been exercising for the past 14 years.

Our views upon municipal wiring are well-known to our readers, and they have not changed. When it is possible, it is better to work with the contractors. The contractors in Sheffield complain that the existence of the Corporation's wiring department makes it impossible for them to obtain business. The Corporation's view is that, but for the existence of that department, it would not have had the supply business which is now connected; or, at any rate, that it would have been very much less. We will not theorise over this matter. It is quite impossible to say what would have happened if the circumstances had been fundamentally different.

When the news became known in Harrogate, where the I.M.E.A. Convention was in progress, it naturally created considerable discussion, and the view was expressed by some that it would now be difficult for Parliament to refuse to other municipalities the powers which it now seems willing to grant to Sheffield. We cannot find any grounds for this view. Sheffield is a special case, and must be regarded as such. There is not another municipality in the United Kingdom to which the Sheffield arguments apply, and if other Corporations want wiring powers they must seek them for themselves, either jointly or severally, and prove their own claims to be valid in each case. Moreover, we very much doubt whether, even in the case of Sheffield, the Bill will ever win through the later stages and become an Act of Parliament.

As we have often said before, we do most earnestly hope that the end of these too-long existing quarrels between municipalities and contractors will come soon. There must be—there is—room for agreement, and we once more commend the suggestion to the attention of the bodies concerned, that they should, with the co-operation of the Institution, and possibly also of the B.E.A.M.A., endeavour to bring about that agreement.

#### Our Electricity Works Table.

We are publishing with this issue our table of statistics relating to the electricity works of the United Kingdom, and trust that it will be found of use to our readers. Barely a dozen new stations have been added to the list since its last appearance, two years ago, and several names have been removed owing to absorption by larger concerns; nevertheless, the total is now over 460, and the sheet has attained to dimensions somewhat unwieldy. Our thanks are again due to the many engineers and managers who have assisted us in revising the data—a task which, we know, is at all times distasteful, and therefore all the more thankworthy.

Amongst the features which have been impressed upon us in producing the table are the great progress of the tungsten lamp in street lighting, the general recovery from its effect on the private lighting output, the continued expansion of the motor load, and the amazing variety of tariffs offered to the consumer. The tariffs, in some cases, are so diversified that they cannot possibly be briefly summarised. The modern tendency towards concentration is also noteworthy, and, in our opinion, most salutary. In many cases small and therefore uneconomical generating stations have become distributing sub-stations, and there is no doubt that great benefit will be derived by the community from the continued operation of this process.



## THE I.M.E.A. CONVENTION, 1912.

THE Harrogate Convention, to the opening of which we referred last week, came to a conclusion on Friday last, when many of those who had been living the strenuous life indicated by the official programme enjoyed some relaxation, in the form of an afternoon visit to Studley Royal and Fountains Abbey.

The earlier proceedings have already been briefly summarised in our pages, but writing after the event, it seems necessary in view of the importance of electrical cooking to all concerned and the great diversity of opinion—favourable and unfavourable—held by central station engineers, that joint action in some form or another should be taken to establish the position of the electric cooker once and for all.

The means for disseminating information already exist, but apparently many engineers are still in ignorance of the doings of their more progressive *confrères*, of the progress made by manufacturers of apparatus and of the results obtained by users in different parts of the country. The misdeeds of some of the early apparatus still live, and it seems evident that in many cases the engineer as well as the consumer can profitably receive attention at the hands of those who are developing this important branch of supply work.

Wednesday's proceedings in Leeds included, after the morning's business, afternoon visits to both the electricity supply and tramway departments' stations and an inspection of the Leeds railless traction system (which was described recently in our pages), and concluded with the annual dinner at the Hotel Majestic, Harrogate, in the evening.

Some 300 of the members and visitors attended this function, which produced a wealth of speech-making of a more than usually interesting kind. Mr. S. Z. de Ferranti, who proposed the toast of the evening, indicated his agreement with the President as to the future of large electricity stations, and with much of the Bill which the Association was promoting in Parliament to secure additional powers, but he urged the necessity for promoting more friendly relations between the municipal and privately owned supply interests, and those engaged in the manufacturing and contracting business. The smaller undertakings were at a disadvantage in supply work, and Mr. Ferranti suggested as a way out of the difficulty, co-operation between municipal authorities and a general supply company, in which they would be shareholders in the ordinary way. In this way the advantages of modern business organisation and a large and cheap output could be secured.

Mr. H. Richardson (Dundee), who proposed "The Guests," and delighted the numerous ladies present, drew a delightfully humorous speech from Mr. H. E. Blain (West Ham) in response.

A short musical programme followed the speeches, and subsequently many of those present adjourned for dancing.

The busiest day of the Convention was Thursday, which commenced with an early journey to Middlesbrough, where, in the Town Hall, a welcome by the Mayor, Councillor Harkness, awaited the visitors. The morning was given up to the discussion of automatic pressure regulation, a subject introduced by Mr. S. J. Watson, of Bury.

Automatic regulation of bus-bar pressure has, of course, become familiar, and obviously the regulation of pressure at feeding points and places distant from the station is a logical development, to which many speakers drew attention. The subject has been ventilated at the Institution of Electrical Engineers recently, but its inclusion in Thursday's proceedings was peculiarly appropriate in view of the success which has attended the Taylor-Scotson regulator introduced by Mr. H. M. Taylor, the borough electrical engineer.

At the conclusion of the discussion, the visitors adjourned to the crypt of the town hall for luncheon at the invitation of the Corporation. The afternoon was spent in visits to some of the iron and steel works for which Tees-side is famous, a short trip on the river to Teesmouth and back, and a brief inspection of the Middlesbrough transporter bridge, which was opened towards the end of last year.

Much might be written in regard to these visits, but it must suffice to say that at Messrs. Samuelson's works, the Newport turbine station of the Cleveland and Durham Power

Co., which operates on the surplus steam from blowing engines and boilers, was shown to the visitors. This installation includes some 6,000 kW. of Westinghouse, Willans and Brush plant, and forms one of the chain of eight power plants, having a combined capacity of 28,000 kW., and all utilising some waste heat, which are operated by the Cleveland and Durham Co., in conjunction with its 69 substations and 140 miles of transmission line.

A brief inspection of the modern turbine and older reciprocating blowing plant was also made, and later Messrs. Dorman, Long's power house and electrically-driven rolling mills claimed the attention of the visitors. The power station contains four 1,200-kW. A.E.G. turbo-alternators, together with motor-generators and a remarkably fine switchboard, and operates on both live and exhaust steam from rolling-mill engines. Two large electrically-driven reversing rolling mills, equipped by the B.T.-H. Co. and A.E.G. respectively, and one of the continuous type equipped by the Westinghouse Co., are in use in these works, where the visitors were able to compare, so far as a brief inspection permitted, their performance with that of adjoining steam-driven rolling mills.

The spectacle of a mill motor reversing with from 8,000 to 11,000 amperes, three or four times a minute with practically sparkless commutation is a sight worth seeing, which well repaid the fatigues of the afternoon's pilgrimage.

In addition to the above the waste-heat power station of the Cargo Fleet Iron Co., where several types of gas engine are in use, was shown to another party of the visitors, as also the electrically-driven rolling mill of the Ormesby Rolling Mill Co., which was equipped by Messrs. Siemens, while some members visited the Westgarth-Diesel engined ship which is being completed on the Tees.

Tees-side, and indeed the whole of the North-East Coast, abounds in subjects of interest to the electrical engineer, and the day left us with the reflection that a more extended visit would be both profitable and welcome to the majority of central station men.

For those less energetically inclined, an alternative visit to York was provided, where the historic features of the old city, the Corporation Electricity Works, &c., and Messrs. Rowntree's Cocoa Works claimed attention.

The last day's business of the Convention was confined to the annual general meeting, at which the first item is the election of officers and council for the ensuing year.

As the result of the voting the executive for 1912-13 is as follows:—

President.—C. E. C. Shawfield, Wolverhampton.

Vice-Presidents.—R. A. Chattock, Birmingham; H. Richardson, Dundee.

Past Presidents.—W. W. Lackie, Glasgow; J. Christie, Brighton; G. Wilkinson, Harrogate.

Hon. Solicitor.—Alderman G. Pearson, Bristol.

Hon. Treasurer.—J. E. Edgcome (Past Pres.), Kingston-upon-Thames.

Hon. Secretary.—H. Faraday Proctor (Past Pres.), Bristol.

Council.—F. Ayton, Ipswich; Alderman Bruce, Sunderland; A. C. Cramb, Croydon; Councillor Crowther, Sheffield; C. Furness, Blackpool; Councillor Gibson, Wolverhampton; F. M. Long, Norwich; S. L. Pearce, Manchester; \*Councillor Sinclair, Swansea; A. H. Seabrook, Marylebone; S. J. Watson, Bury; Alderman Smith, Barrow; Bailie Willock, Glasgow; \* T. Roles, Bradford.

\* Take office for one year.

Mr. Shawfield's election as president was received with acclamation, and it was subsequently decided, in view of all the circumstances, to hold the next Convention in London, which was last visited some six years ago.

Mr. W. G. Pickvance (Wrexham) raised the question of the representation of the smaller undertakings on the Council, which he brought forward, without tangible result, the year before, and other speakers drew attention to what they considered was the unsatisfactory method of conducting the election of officers.

Mr. A. S. Blackman (Sunderland) urged the advantages of securing more frequent changes in the Council executive, and, after some discussion, a resolution was agreed to which it is intended shall secure that engineer members of Council shall not serve more than two consecutive periods of two years, and shall then be ineligible for re-election for a year.

Discussion then took place on a recommendation in the report which proposed to secure half a day for a meeting of engineer members only, for the consideration of any subject



which, one supposes, would not bear the light of publicity. This proposal naturally raised the ire of certain Councillor members of the Association, and, after much explanation, it was agreed to modify the proposal in their favour.

Mr. Hoadley (Maidstone) then asked exactly how "the Bill" stood, and on the President intimating the desirability of discussing the matter in private, the Press representatives withdrew.

[The "Further Powers" Bill promoted by the Association was, as a matter of fact, abandoned the day prior to the opening of the Convention, after having passed through the initial stages; this was mentioned in our last issue.]

The report and accounts, which were passed, show that the membership of the Association stands at 388, a decrease of 11 on the previous year, and that the surplus funds in hand amount to £663. The report mentions, among other matters, that a scheme for the permanent establishment of the publicity organisation has been prepared, which, it is hoped, will receive adequate support from those most concerned; also that the Council's efforts to form an information bureau met with but a half-hearted response.

The question of amending the Board of Trade form of accounts has received the attention of the Council, as also the Model General Conditions for Contracts, which we gather the B.E.A.M.A. are desirous of considerably modifying.

The Convention, as a whole, passed off very smoothly, Harrogate, indeed, being more noted for its health-giving attributes than for its amusements. While we know not the effect of the strong and mild sulphur waters, the magnesia, Kissingen, Alexandra Chalybeate and others upon the visitors, the Harrogate firewaters apparently developed strange doings in more than one quarter, but then these liquids are neither diuretic nor alterative, hence their wayward and unexpected results to the consumer.

In conclusion, it is only just that we should say a few words in praise of the Grand Hotel, which we found replete with every comfort. The architect who designed it had an eye to both elegance and convenience, and every nook and corner shows the true artist. The gardens are beautiful, as, indeed, is the case throughout Harrogate and its hotels.

### Electric Cooking and Electric Cooking? Apparatus.

By H. H. HOLMES, Sales Manager, Borough of St. Marylebone Electric Supply.

(Abstract.)

If every household now using electric light were to use electric cooking as well, the consumption per house would be increased by at least 400 per cent. The reductions per unit in working costs and capital charges which such an increase of load would permit would be enormously to the advantage of electric supply undertakings in particular, and the community in general.

The cooking outfit which consists of separately heated utensils is not suitable for domestic purposes, because the housewife or cook will not put up with a set of apparatus clumsy to handle, expensive to repair, difficult to clean, and which is not fool proof. The gas cooker has created a standard of convenience and usefulness to which the public has become accustomed, and the designer of the popular electric cooker cannot do better than to follow generally for the present along the same lines.

The average family now using electric light, and likely to use electric cooking, will consist of, including servants, say, seven persons, but the cooker installed must be sufficiently large to cook for, say, 16 persons.

The outfit, which should be of similar shape to a gas cooker, would have a top plate containing three boiling plates and one grill. The top plate should be at least 30 in. wide  $\times$  24 in. deep. Plenty of room is a convenience which the cook appreciates. Two boiling plates—the number generally provided—are not sufficient even in a smaller cooker. The grill should provide a cooking space 12 in. long  $\times$  9 in. wide, at least. The pan and grid underneath the grill should be at least as large as the cooking space.

The size (cooking space) of the oven should be 22 in. high  $\times$  14 in. deep  $\times$  15½ in. wide, or the equivalent in cubical contents.

In addition to the above, a separate rapid water boiler should be provided, which will boil 2 pints of water in not more than 4 minutes. This separate water boiler is absolutely necessary if the cooker is to be popular. One of the greatest recommendations of the gas cooker is the quickness with which it will boil water, and the electric cooker must provide the same convenience.

The space between the oven and the top plate should be boxed in except at the front. The waste heat from the oven, grill, boiling and hot plates, will provide sufficient heat in this enclosed space for plate warming.

The type of boiling plate now almost universal is made with a heating element of nichrome, or other non-oxidisable wire, wound on mica sheets insulated on both sides from the metal plates by mica sheets and clamped firmly between the upper and lower plates.

The top portion of the boiling plate must be provided with a

lip coming at least 1 in. below the bottom clamping plate in such a way that it is impossible for water or fat to creep up between the plates, and so on to the heating element; insufficient provision in this respect has been a fruitful cause of failure.

Both the top and bottom plate must be strong enough to withstand the tendency to buckle under the wide variations of temperature.

The top surface should be turned, not ground. Experience shows that a turned surface is a better heat transmitter to the utensil than a ground surface.

The wires of the heating element, from the point where they leave the heating element, should be strengthened up to at least three times the section of the element wire, and a sufficiently large hole provided in the bottom plate for bringing them away. Inattention to both these points (and it is common) spells trouble.

A terminal box should be provided on the base of the hot plate, and a flexible metallic connecting tube taken thence to the main terminal box of the cooker. In some boiling plates the heating wire is joined on to the copper wire running to the main cooker terminal box by simply wrapping the two wires together. Experience shows that the only way to avoid trouble is to provide a terminal box as near the heat element as possible, but far enough away to be not unduly affected by the heat.

The heating element should consist of two distinct and equal elements arranged one in the centre of the hot plate, and the other divided up, half on each side of the centre element.

The loading of an efficient boiling plate should not exceed 25 watts per sq. in., or be less than 20 watts per sq. in. of boiling plate surface. With a less loading than 20 watts per sq. in., the plate will be too slow for the cook's liking. A higher loading than 25 watts per sq. in. will produce too high a temperature if the plate be left full on without doing work. In such a case the temperature of the plate will exceed 650°—700° F. and the mica insulation will disintegrate and lose its insulating properties. All boiling plates should be tested, before being put out on circuit, for maximum temperature obtainable.

Nichrome wire can safely be used up to a temperature of 1,800° F. if an insulation to stand this temperature can be found.

The grill should be of the radiant heat type, loaded to 15 watts per sq. in. of surface for satisfactory and quick cooking. It is essential that as few leading-in wires be used as possible. Beaded wires are a more frequent source of trouble in a cooker than any other accessory. In the latest type of grill no leading-in wires whatever are used. The standard element is nichrome or other wire wound on mica, the full element being subdivided into six elements connected in parallel; by this arrangement, a failure of one element does not prevent cooking.

The oven must be thoroughly well heat insulated. If lagging is used, it must be very closely packed, and it is well to examine the lagging every 18 months or so, to see if it has powdered and settled down, leaving the upper part of the sides of the oven unlagged. The loading of an efficient oven need not exceed 1,000 watts per cb. ft. capacity. Sufficient regulation is provided by dividing the element into two parts, one of two-thirds heat and the other one-third heat. The oven should be white enamelled inside. A ventilation grill must be provided.

The oven heating plates or elements should be distributed over as wide an area as possible, for, by keeping the watts per sq. in. of heating surface low, the life is considerably increased. It is essential that the elements be arranged so that the leading-in wires are as few and as short as they can possibly be made. Beaded wires should be got rid of altogether if possible. It is safe to say that 75 per cent. of the oven and hot plate faults in the past have occurred on the leading-in wires and not in the heating element itself.

The rapid water boiler is fixed on the side of the cooker. It is advisable that it be fitted with a ball cock and connected to the main water supply; a burn-out is thus rendered impossible. It must be loaded to boil two pints of water in not more than four minutes.

The whole of the leads from the various terminal boxes of the cooker should be run to a main terminal box by means of metallic flexible tubing with a mechanical joint on to each piece of apparatus. The metallic flexible tubing provides the very necessary means of directly earthing each boiling plate, grill and boiler.

Only flat bottom utensils should be used. After long investigations, the "Judge" brand of spun steel utensils has been adopted, and found to be quite satisfactory for the purpose, and reasonable in price.

It has been found undesirable to fix the switches on the cooker itself. The type of switch now generally used is the Diamond "H," or Hart Manufacturing Co., type. Many other types have been tried and found quite unsatisfactory.

Owing to the necessity of equally distributing the heat in the boiling plates, the simplest and most advantageous method of control is by a series-parallel arrangement giving four positions.

The switches for the grill, oven (two switches) and boiler, should be of the ordinary "on" and "off" Diamond "H" type. Particular attention should be paid to the switches being large enough for the work, as the manufacturers are inclined to greatly over-rate their capacity.

It is certain that the name for unreliability which electric cooking has had in the past has been greatly due to only one main fuse being provided. It is a very serious thing for a household if, owing to a fault developing on a section of a cooker, the whole cooker is put out of action. The type of fuse used is of the "Dial," "Zed," or cartridge type. Open type fuses are not suitable.

One fuse is provided for each hot plate, one for the grill, one for the boiler, and two for the oven (one for the two-thirds heat, one for the one-third heat). By this arrangement it is well-nigh impossible



for a breakdown sufficiently serious to prevent cooking to happen; in fact, such a breakdown is now almost unknown. An indicating lamp is provided for each switch.

The wires between the main terminal box on the cooker and the switchboard are run in flexible tubing, which is metallically connected to the terminal box at the cooker end, and to the tubing of the mains at the switchboard end. This method is cheap, it allows of the cooker being shifted a foot or so, when repairs have to be carried out, without disturbing the connections, and the switchboard can be connected to the cooker before leaving the stores.

For the mains between the service and the switchboard, the armoured wire used in Martyn's wiring system is particularly useful, and is cheaper than the flexible tubing system.

The list price of the full equipment before described (not including rapid boiler or utensils) would be as follows:—

Cooker ... ..	£15	0	0
Switchboard ... ..	4	10	0
Connections and metallic tubing ... ..	0	15	0
Mains 30 ft. run ... ..	1	10	0
Main switch and fuse ... ..	1	10	0
<b>Total ... ..</b>	<b>£22</b>	<b>15</b>	<b>0</b>

Bought in quantities a discount of 33½ per cent. should be obtainable, so that the cost to the central station should be, say, £15.

The life of the apparatus is at least 10 years, and during that time the whole of the heating elements might require renewal three times, at a cost of 40s. Switches, fuses and lamps in the same time should not cost more than another 40s. Cleaning and inspecting once a month would cost, say, 10s. per year per cooker.

The total cost per annum, therefore, at an outside estimate, is:—

Depreciation, 10 per cent. on £15 ... ..	£1	10	0
Repairs to heating elements and repairs to switches and fuses ... ..	0	8	0
Cleaning and inspection ... ..	0	10	0
Establishment charges ... ..	0	5	0
<b>Total ... ..</b>	<b>£2</b>	<b>13</b>	<b>0 p.a.</b>

Say, 12s. 6d. per quarter.

This figure may be objected to by some engineers as too high to compete with other forms of cookers. Such would do well to consider what they would be content to spend on a service to obtain such a load as this cooker will provide if it were offered to them in the shape of a motor load. It is conceivable that they would spend £12 without a murmur. But nine out of ten cookers need no extra service: why then should not the supply undertaking credit the cooker hire account with the sinking fund and other charges they would if necessary be prepared to incur for such a load, and are in fact not called upon to incur?

Although it is not *now* actually necessary, the hire scheme at Marylebone includes weekly not monthly inspection. It is only recently that we have been able to supply just the apparatus which absolutely satisfies the consumer, and by these weekly inspections, or nursings, not only has the consumer been kept in a good humour, but the department has been able to obtain quick and sure information of the troubles to be remedied before they become pressing or serious enough to lead to loss of business. About once every six weeks for the first few months our lady demonstrator also makes a call and, if necessary, gives a demonstration.

The consumption of an electric cooker is one of those things that cannot be calculated. The average consumption for a family of eight persons in full and constant occupation of the house, doing the whole of the cooking operations by electricity, but having a separate hot water supply for baths, and washing purposes (by means of a coke boiler or low fired kitchen range) works out at 1·9 units per person per day in Marylebone. It is to be remembered, however, that the whole of the cases taken represent well-to-do people, who not only entertain a good deal (often two or three times a week), but even, in the normal way, cook on an extensive scale. The figure given, therefore, represents a maximum consumption for an average well-to-do house. The consumption of a middle-class house would probably be, and by experience often is, as low as one-half to one unit per person per day. Where approximate comparisons can be made, the results show that with gas at 2s. 6d. per 1,000 cb. ft. and electricity at 1d. per unit, the cost is as nearly as possible the same.

As more exact comparisons can be made between the cost of a kitchen range used for cooking and supplying hot water for the house, and the kitchen range supplying hot water only and the cooking done electrically. In almost every instance a substantial saving is shown. A still greater saving can be shown by dispensing with the coal range altogether and installing a special coke-fired hot water apparatus such as an "Ideal" boiler.

At present prices for electricity and gas, neither can compete on cost with a coke-fired boiler. Consumers now using electricity for cooking tell us that it is clean, cool, and produces no fumes; that it gives better and surer cooking results, and that there is a saving of a least 10 to 15 per cent. in cooking meat.

The rapid electric boiler gives boiling water quicker than any other means, and it is principally for this reason that it is considered an absolutely necessary part of the apparatus. There is but small expense incurred by installing a cooker on approval. It has been found that only one in 10 cookers put out on approval ever comes back.

Commercial cooking offers an extremely attractive load to the central station, for it is either absolutely non-peak or of an extremely good load factor. The electric radiant heat grill is an extremely strong commercial proposition. First, because its competitors are not too satisfactory in cooking results; secondly,

because it is quicker in action than other types; thirdly, because in cost of operation it is the most economical. (Current, 1d. per unit; gas, 2s. 6d. per 1,000; coke at varying London prices.) It is generally the first step to the complete electrification of the commercial kitchen.

In a large commercial grill the heating elements should be subdivided as much as possible. Separate heating elements of 250 watts each across the full supply voltage should be the maximum for moderate size grills, so that if an element open-circuits, only 250 watts of the apparatus is affected.

Every 1,000 or 2,000 watts of element according to the size of the grill should be separately fused, so that an earth will put out of action only a portion of the grilling surface.

The cost of operation is extremely low. A well-designed grill will grill as many as six chops at a time in 10 minutes for a consumption of ¼ unit only. A particularly good point of the commercial electric grill is the rapidity and extreme accuracy with which toast can be made with it.

The electric oven is about as good a line as the grill. The saving in weight of meat cooked in it, as against other forms of cooking, represents at least 75 per cent. of the cost of energy. The heating elements should be divided up into as many complete elements as space and other conditions will allow. Not more than 2,000 watts should be on one switch and fuse, and the elements comprising this 2,000 watts should again be subdivided into, say, 500-watt sections represented by one terminal each on the oven terminal box.

The loading of all ovens for commercial work should not be less than 1,000 watts per cb. ft. capacity, or the oven will be too slow.

The author hopes that it has been made clear that cooking can be done electrically, that the apparatus, if properly chosen, is satisfactory and reliable, and that the cost of operation to the consumer is, at 1d. per unit, and under, at the most not heavier than by other methods. The electrical contractor will not hire apparatus because, in itself, it does not pay. The right people to push the cooking business are the supply undertakings, and not only must they push the business, but they must handle the apparatus; and until the apparatus is installed and working the supply man must be the only man to deal with the consumer.

### The Cooking Load from the Supply Point of View.

By F. M. LONG, City Electrical Engineer, Norwich.

(Abstract.)

In order to arrive at some conclusion as to the cost of supply, the author takes the conclusions arrived at in the report of the Joint Committee of the I.M.E.A. and M.T.A. with reference to "charges for electrical energy supplied for traction purposes from combined stations."

In this report the expenses are divided into standing costs and running costs, and the allocation gives for the majority of existing stations a standing cost of £10 to £15 per KW., and a running cost of a fraction of a 1d. per unit.

The standing costs in most stations are made up to a large extent of capital charges covering expenditure on plant, part of which was put down many years ago at a cost per KW., perhaps three or four times that at which the plant can be purchased to-day, and the author thinks that most engineers will agree with him that it would be unreasonable and unnecessary to saddle a new load with a proportion of such charges which were incurred for the lighting load, and which the lighting load is well able to bear.

In order to treat the matter on general lines the author has taken the increase in the standing costs during the past five years and divided this by the increase in the maximum load, and he finds that for the majority of stations this works out at a figure between £3 and £5 per KW.; the author proposes to take £4 per KW. as the basis for the standing costs.

The running costs per unit vary very much, from about 20d. in large stations and where coal is cheap, to 5d. or 6d. for small stations with dear coal.

As a mean figure that will apply to a large number of stations that have economical plant installed, the author proposes to take 3d. per unit.

The different classes of cooking load comprising the total load on a station fall generally under three headings, as follows:—(1) Small and medium houses where the principal meal is at midday; (2) large and medium houses where the dinner is in the evening; (3) hotels, restaurants, luncheon and tea-rooms, &c., where the load is spread fairly evenly over a number of hours.

The magnitude of the load resulting from a cooking demand is important from the supply point of view. It is obvious that it will never be anything like equal to the maximum installed.

Mr. Street informs the author that at Southampton he finds that cooking apparatus produces, in the morning, a load of 20 per cent. to 25 per cent. of the maximum installed, and it is probable that 25 per cent. is as much as need be allowed for.

In individual houses it may be taken at about 20 to 25 per cent. of the maximum installed, but as the diversity factor is high, probably 5 per cent. would be ample to allow for the load produced on the station.

To reduce the cost per KW. to an average cost per unit it is necessary to know approximately the annual consumption per KW. For the present this may be taken at 400 units per KW. installed and the standing costs based on the above assumption of £4 per KW. will be:—5 per cent. of £4 divided by 400, 12d.; which, added to the running cost, 30d.; gives 42d. as the total for the first-class of supply, excluding any special cost for distributing mains and services which will be dealt with later.



In houses where the principal meal is in the evening, the author finds that the cost would be :—

Standing costs, 25 per cent. of £4 divided by 400 ...	'60d.
Running costs ... ..	'30d.
Total ... ..	'90d.

This is on the assumption that the cooking apparatus is used all the year round, but as this is not the case with gas cookers, it is not likely to occur with electrical cookers.

In houses where the late dinner is the rule, the kitchen range would, in the majority of cases, be used in the winter, and it would be quite safe to assume that only half of the total number of electric cookers would be in use in the winter months giving a load at peak time of 12½ per cent. of the maximum installed, but in this case the units used would not be so much. Assuming 300 only instead of 400 per annum per KW. installed, we should have :—

Standing costs, 12½ per cent. of £4 divided by 300...	'40d.
Running costs ... ..	'30d.
Total ... ..	'70d.

Restaurants should form a very useful load, as the demand would be more or less continuous. This class generally will produce a load somewhat similar to a motor load with a load factor of probably 30 per cent., and the cost of supply would be :—

Standing costs ... ..	'39d.
Running costs ... ..	'30d.
Total ... ..	'69d.

The author gives load curves, two from houses in Marylebone, and a third from a house in Norwich, while a fourth curve shows the cooking load at the Polytechnic, London.

The question of what additional expense would be involved on account of services and mains is one that naturally occurs to an engineer.

It has been the general rule not to use anything less than 7/18 for services even for small houses, and when it is remembered that, with this size, the drop of pressure with 12 amperes on a length of 20 yards is only 1 volt, it will be seen that, with this size, a Tricity duplex outfit, taking a maximum of 10 amperes at 220 volts, which would be sufficient for a small house, can be installed without any alteration.

For a cooker with a maximum capacity of 5 KW., or, say, 25 amperes, a 7/16 service would be sufficient for a distance not exceeding 20 yards, or, for a short service, a 7/18 might be retained, as the average current would not be more than about 12 amperes, with occasionally 15 to 20 amperes for short intervals, which is well within the safe limit.

It may therefore be anticipated that not many additions would be required for services, and Mr. Street gives this as his experience at Southampton.

In all the central and industrial portions of a town, the distributing mains will generally be large enough to carry, without addition, a cooking load which, in such parts, will be small as compared with the general demand for lighting and power, or, if additions are required, the cost will not be abnormal in proportion to the revenue derived; but in residential areas where the density of load is very much less, and the cost of mains in proportion to revenue derived is much greater, the case may be different.

To arrive at any conclusion, it is necessary to estimate what the cooking load is likely to amount to, in proportion to the lighting load.

For small houses, with, say, 10 to 15 lights installed, the average lighting load may be taken at 150 watts per house, and for such houses a small cooking outfit, such as a duplex Tricity consuming as a maximum 2,000 watts, would be sufficient.

Assuming for some years to come that half the number of houses lighted had electric cookers and also, as earlier in this paper, that the average maximum load on the mains were 25 per cent. of the maximum installed, the load on the mains for cooking would be equivalent to 250 watts per house.

In the same way in a medium sized house with, say, 20 to 30 lights, and, say, a 5-KW. cooker, the lighting load would be, say, 300 to 400 watts and the average cooking load 625 watts.

It would appear, therefore, that the cooking load will probably be less than, and it is not likely to exceed, twice the lighting load in any residential area.

In districts where midday dinners are the rule, this would not be serious, and would not involve any addition to the mains, as a drop of four volts during the day would not much matter, but in suburbs of London and districts where late dinners prevail, some addition to the mains would be necessary.

The author finds that in Norwich in streets in which practically all the houses are lighted by electricity, the average of the lamps installed works out at from 2 to 2½ 30-watt lamps per yard run of street, and the maximum demand to ⅓ of this or 20 to 25 watts per yard, so that for 220-volt supply the demand for lighting may be taken at 1 ampere per yard.

This applies to two storey houses in continuous rows or to detached houses with gardens and having an average frontage of 20 to 30 yards, and generally to modern residential areas surrounding a town.

The requirements for larger houses in continuous rows may be double this.

Taking the higher figure of 1 ampere at 440 volts per yard run and allowing a drop of 2 volts across the outers at the extreme end, it will be found that a .05 triple cable will suffice for a distance of 200 yards assuming every house to be connected.

The author does not think, therefore, that it will be found necessary in the majority of cases to allow more than the rate per KW. ascertained as above and assumed at £4 per KW. The most that would be necessary would be to allow another 10s. to £1 to the figure ascertained for standing costs.

Assuming an extra 10s. to the £4 per KW., it will bring the case of late dinners from '70d. to '75d.

It is probable that in three-wire systems the greatest trouble will arise through drop of pressure in the middle wire owing to the fact that individual cooking loads will be heavy in proportion to lighting loads, and liable to come on suddenly. New mains should, therefore, be laid with ample capacity in this respect.

Summing up, it appears that the cost per unit under the conditions assumed will vary from '42d. in the most favourable cases where the principal load is in the day to '75d. when the load is mostly in the evening. The cost for other places being somewhere between.

As to the probable consumption of electricity for cooking, it has been assumed, for the purpose of reducing the standing costs to a rate per unit, that 400 units would be used in a private house per KW. installed; i.e., 2,000 units per annum in a 5-KW. outfit, but this is rather a tentative figure, and more information on this point would be useful.

It is probable that the figure would vary very much in different houses, and it is possible that the consumption would vary more in proportion to the number of persons in a house than on the KW. installed. By some it is reckoned at about 300 units per annum per head.

It is the experience of gas undertakings, the author understands, that the maximum cooking load occurs on Sundays, and it may be assumed that the bulk of the output between sunrise and sunset on Sundays in the summer is due to cooking, although in the winter a good deal is also due to gas radiators.

It would appear that if electricity were used to the same extent as gas for cooking, we should have a peak in the middle of the day as high, if not higher, than the peak in the evening.

This, however, is a condition that need not be seriously considered at present, but it indicates that cooking will have a greater effect in levelling the load output curve in the case of electricity than in the case of gas.

Although not strictly included in the title of the paper, the use of electricity for the heating of rooms and of water for domestic purposes must be considered.

Radiators in private houses are principally a non-peak load, and can be supplied at a low rate, which is necessary if they are to be used extensively.

This is not the case though with radiators used in shops and offices. They are not required more than 1,000 hours in the year at the most, and this includes the peak hours.

While, therefore, in private houses a charge of ⅓d. or even ½d. might be made, not less than 1½d. ought to be charged for shops and offices, which is, of course, too high for general use. There is however, the author believes, great scope for heating such places at a low rate, and he suggests that a restricted hour service might in many cases be arranged, especially for shops, either by a time-switch or by controlling the radiator and window light circuits with a throw-over switch, so that both could not be on together.

There are on the market some forms of geysers for heating water as it passes through, taking anything up to 16 KW. These the author regards as quite impossible from the supply point of view.

The only feasible plan would seem to be to use a Therol heater, or where the cost of installation would be a hindrance, simply an immersion element in a well-lagged storage tank, so that the expenditure of energy can be more or less continuous. With sufficient capacity in the tank there is no reason why the heating should not be done during the day and after the lights are out at night, which could be accomplished by means of a very simple "cut-out" operated by the lighting circuit. Under such circumstances, the only expense of supply would be the running costs, or, say, '3d. per unit, as assumed above. At this figure, and assuming 85 per cent. efficiency, the cost would be at the rate of 19s. per annum for every 10 gallons per day required, allowing for raising the temperature 60° F.

As to the charges that should be made for current, it seems that at 1d. per unit, electric cooking with economical apparatus and careful use, is equivalent to gas at about 2s. 9d. per 1,000 cb. ft., and assuming that electrical apparatus could be supplied on the same terms as gas cookers, it would not be necessary to drop below this figure where gas is above 2s. 6d. per 1,000. If, however, consumers have to buy their stoves or hire them on a commercial basis, which could not be less than 20 per cent. of the cost per annum, there must be some prospect of saving on the current.

It would seem, therefore, that where undertakings have no powers of hiring out apparatus it will be necessary to make the charge for current as low as possible but, where there are powers it may be as well to ease the terms of hire somewhat at the expense of the current.

In conclusion, the author thinks that supply authorities need not hesitate to supply current at rates which will be low enough to make the cost of cooking by electricity as cheap as by gas, and it is desirable that they should be prepared to do this as although at the present prices of apparatus the development is likely to be slow, the prices can only be reduced by the manufacture of greater quantities and everything possible should be done to stimulate this.



## DISCUSSION.

MR. A. H. SEABROOK (Marylebone), in opening the discussion on the two papers, referred to the fact that ten or a dozen supply authorities had now introduced the  $\frac{1}{2}$ d. rate for cooking. In Marylebone they had put on 1,400 kw. of heating and cooking load during the last year, and it had not appreciably affected the peak load. Some 70 or 80 complete cooking outfits had been installed, and it had not been necessary to add to the existing services in any way. The peak of a cooking load lasted only a short time; in his own case with a 30-ampere service he often took 60 amperes without troubling his neighbours.

MR. SILLERY (Partick) was of opinion that there was not one complete cooking apparatus that could be relied on; the designs adopted were open to criticism, and the attention of the engineer was always required.

MR. GROGAN (Berry Construction Co.) said if Mr. Long referred to the cooking load for individual houses, he must certainly allow for the maximum load of the apparatus (not 20 or 25 per cent. of it), and that on the top of the lighting load, which he forecasted would be negligible compared to the cooking load in future. He disagreed strongly with many of the statements made by Mr. Holmes, suggesting that he was bold to state emphatically certain matters of design which both maker and user had found from experience should be otherwise. Mr. Holmes favoured the radiant heat grill, but he (the speaker) pointed out that there were far more Tricity type grills in use than radiant heat grills. The speaker did not agree that the electric stove should follow gas stove design, or that three heats were required for a hot plate; the objection to the medium heat, when only one heater was in use, being a tendency to buckle the plate. The use of imperfect utensils on a hot plate tended to burn the latter out, owing to the lagging of air between the pan and plate. The introduction of fuses on all hot plates was not necessary; there were between 4,000 and 5,000 Tricity cookers in use, and fuse troubles were rare—in any case the fuses should be sufficiently heavy to neglect small troubles. The hiring out of cooking apparatus and sending it out on approval was important; in one town where 200 Tricity cookers were in use, only 4 per cent. were sold. It appeared from the figures given by Mr. Holmes that with a heavy black oven a family of eight persons would take, say, 6,000 units per annum with a 7-kw. demand, but with the Tricity oven he had found that the same service could be obtained with at most 4,000 units and a 3-kw. demand. In conclusion, he urged the necessity of show-rooms and a complete selling organisation to the engineer.

COUNCILLOR SINCLAIR (Swansea) emphasised from his personal experience the advantages of electrical cooking; it cost rather more than other methods, but if he could purchase energy at  $\frac{1}{2}$ d. per unit he would not be a loser as regards cost, and in any case he had better cooked food, and was not going to give it up.

MR. R. BORLASE MATTHEWS said there was a great need for more information on electric cooking from the user's point of view. It was not a matter of experiment now, the apparatus was reliable, and the advantages as to saving in weight of cooked meat and in other ways were well recognised. He urged the necessity of further co-operation between central station engineers and between the users and makers of the apparatus, in order that the results might be available.

MR. W. A. VIGNOLES (Grimsby) emphasised the simplicity and exactness of electrical cooking. He had instructed his staff by telephone as to what switches to use in cooking a joint, and the latter was cooked perfectly; consumers in difficulties could quite well be instructed over the telephone, as with electrical cooking the results could be predetermined with accuracy. There were a number of assumptions in Mr. Long's paper, and it was a question how far the  $\frac{1}{2}$ d. rate for cooking could be justified, but probably the experience at Southampton might give further information as to this. He pointed out that the overloading of feeders and services with resulting pressure drop would affect the heat and cooking time of an oven, and further urged the necessity of hiring out such apparatus. From his experience with various types of apparatus, while not prepared to say that the bright oven was better or worse than the black oven, it seemed that the Tricity type of cooker did consume less energy for its output.

COUNCILLOR CROWTHER (Sheffield) spoke as to the necessity for cheapening cooking apparatus and lowering the cost of energy to promote electric cooking in the smaller houses.

MR. JOHN CHRISTIE (Brighton) made the somewhat novel suggestion that municipal authorities instead of voting surplus money to the rates should buy outright a certain number of cooking outfits. He estimated that £1,000 spent in this way on 100 outfits would yield quite £150 in rentals and an output of a quarter of a million units, valued at, say, £1,000.

They had recently purchased 25 outfits in this way in Brighton and obtained very satisfactory results. He added that the heavy laundry iron yielded in Brighton a revenue of £11 5s. per year per kw. demand.

MR. W. H. COOKE (Luton) said his investigations of cooking conditions convinced him that a price of  $\frac{1}{2}$ d. per unit was necessary for electric cooking with gas competing at 1s. 11d. per 1,000 cb. ft. He had introduced the  $\frac{1}{2}$ d. rate two years ago, and had now some 390 kw. of cooking load as compared with 30 kw. previously when the rate was 1 $\frac{1}{2}$ d. per unit. For the last three years the heating and cooking units supplied had been 19,000, 59,000 and 260,000, and the profit on the last year was the biggest one ever made. The rate was a flat one of  $\frac{1}{2}$ d. per unit, with no initial charge. He thought it remained for the manufacturer to reduce the cost of apparatus.

MR. BIRKETT (Southend-on-Sea), MR. HAME (York), and the PRESIDENT also took part in the discussion (the latter hinting that failing reduction in price of apparatus by the manufacturer, the station engineer would have to consider the question of providing ovens himself), and both authors briefly replied.

## Electric Cooking and the I.M.E.A.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E.

Electric cooking was *the* subject of conversation above all others at this year's Convention. One of the most valuable features of these conventions is the interchange of personal experiences in an informal and unofficial manner in the intervals between the official meetings. Certainly the personal experiences covered a wide range, and a few, at any rate, had had most unhappy and unfortunate experiences, but they were in the minority, and their troubles seemed largely due to an imperfect understanding of both the practical requirements of cooking, and the adaptation of electricity for that purpose.

The general conclusion was that electric cooking was now well beyond the experimental stage, and that in fact it had attained to its true and merited position, and was going to form a very important load for central stations. There were still a few who had not fully appreciated the fact that the electrically cooked product was far superior to food cooked by any other process, but they were more difficult to find than last year, thanks, doubtless, to the self-sacrifice of their patient wives, who had, so it was stated, carried out countless experiments with good, bad, and indifferent stoves.

Then, also, the fact now seems to be more generally recognised that there is really a considerable economy in the cooking of meat by the electric way, as compared with other methods. This fact was emphasised during the afternoon devoted to the discussion on electric cooking by a diagram, which summarised, albeit in a very conservative manner, a number of tests made with various weights of meat.

It would, undoubtedly, be of very great assistance to central station engineers and to manufacturers of electric cooking apparatus, and also to the ultimate advantage of the general public, if the data that has been collected as the results of experiment by individual central station engineers could be collected and analysed, and thus be rendered of service to everyone who is interested in the distribution of electrical energy. Perhaps the readers of this paragraph would communicate their views on this matter to the Editor of the ELECTRICAL REVIEW. Really, as a matter of fact, the time for petty experimental work has now passed, for electric cooking is now well established, so that it is rather a waste of time to keep on repeating minor experiments; it is just like a body of students proving that Ohm's law is true, over and over again—it is becoming tedious. Still, the constant repetition has driven home slowly, but surely, the realisation that electric cooking is not only as good as, but also has many superior advantages over, other methods.

The next trouble, or, perhaps, it might be termed nightmare, of those who had found out that electric cooking was entirely satisfactory, was the question whether the apparatus was really reliable. This matter of reliability, of course, is not one that can be determined by isolated experiments, rather, it can only be determined by those who have had the opportunity of handling the apparatus in large quantities. Unfortunately, central station managers who have this experience are few and far between, hence Mr. H. H. Holmes's paper was very greatly appreciated, for it essentially bore the stamp of experience. There is no question but that Mr. Holmes's paper forms an excellent guide as to the main points of an electric cooker.

It should not, however, be too slavishly followed, for several of the minor details are open to question, and further modifications will undoubtedly be made in many of these minor details as more and more experience is gained. Of course, if one is anxious to specify an ideal electric cooker, it must be realised that the stove that is constructed to that specification cannot be built for a mere song. Mr. Holmes draws special attention to this fact. Even when compared with a gas cooker, the first cost of an electric cooker of the same capacity must be higher, for, in addition to the equivalent



component parts of a gas cooker, an allowance must be made for the thicker and better lagging and the cost of the heating elements and switches.

It was noteworthy that the critical remarks of Mr. Sillery, of Partick, as to the unreliability of electric cooking apparatus (unless built by his department, with elements supplied by a heating apparatus manufacturer), were not endorsed by the general body of engineers present. For it is now generally recognised that the apparatus supplied by good makers can be depended upon.

Actual systems of cooking were not much discussed—that is, as to whether it were better to employ (a) separate utensils, each provided with its own heating element, or (b) combinations of hot plates and portable ovens (often rudely called “biscuit boxes”) of which the “Tricity” and “Simplex” cookers are prominent types, or (c) the complete stove, with heavily lagged oven, which was advocated in Mr. Holmes’s paper, and of which the General Electric Co.’s “Beeton” cooker is an excellent example, or (d) heat-storage ovens, of which the “Therol” is an illustration.

If anything was said, preference was usually given to the lagged oven. The objection raised against the portable oven was that not only did it involve the conversion of the cook to the advantages of electric cooking, but also the necessity for educating her in a new way of cooking.

The discussion waged hot round the prices that should be charged for energy sold for electric cooking purposes. It was positively fanned into a flame of righteous indignation in some quarters when Mr. A. H. Seabrook invited engineers to join his “Halfpenny a Unit Dining Association.” It quite brought one back to the now almost historic days when the controversy raged as to whether it were possible to make a profit out of units sold for power purposes at 2d. or even as low as 1½d. Nowadays, of course, central station engineers are only too glad to get all the power load they can at a penny a unit or just under, for they have found it very profitable. And so it will undoubtedly be with a cooking load—it is the big turnover that counts. The load curve diagrams exhibited were of a nature well calculated to make a doubting engineer take his courage in both hands and prepare to meet the demand with more foresight than when the introduction of the tungsten lamp had to be tackled. Mr. Long’s paper demonstrated very clearly the basis of the essential calculations necessary for investigating what a profitable rate of charging should be, and, further, contains some very interesting data. It will, however, be necessary in conjunction with this paper to refer to the report of the joint committee of the I.M.E.A. and the M.T.A. with reference to “charges for electrical energy supplied for traction purposes from combined stations,” otherwise such items as the percentages given at the beginning of the paper will not readily be comprehended. Some of the statements are a little involved, especially in connection with the comparisons made between gas and electricity.

A lead has been set by members of the Halfpenny a Unit Dining Association, and as they comprise the more enterprising members of the profession, it is only a question of time before the others follow suit.

It was very clearly emphasised that the diversity factor of an electric cooking load was an excellent one, hence a bogie vision as to the requirements of large sums for new mains extensions was exploded. Anyhow the growth of public demand for cooking apparatus is bound to be gradual, it cannot possibly reach its zenith in a few months, even if the manufacturers could supply the apparatus quickly enough. Its growth will certainly be extremely slow, unless well thought-out hiring schemes are offered to the public.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Bonus System.

With regard to the interesting article in last week’s ELECTRICAL REVIEW on bonus systems, this, I think, is a subject which should always be argued out direct from first principles.

To start by defining our terms, we may say, for the purpose of this argument, that there are only two speeds at which a man works—day-work and piece-work speed. There are only two speeds, that is, providing he is working honestly in each case.

When being paid at day-work rate he works at ordinary speed, and when being paid at piece-work rate, he works at extraordinary speed—a speed at which no one could expect him to work without the special inducement which is given by this system of payment.

The question now arises as to what the piece-work rate should be, and this can only be determined in a backward kind of way. Suppose we say that it should be twice the day-work rate, then we see that this would mean that his speed when being paid day-work rate is only half his greatest. But a man’s ordinary honest speed is certainly greater than half his greatest speed, and so we see that the ratio 2 is too high, and take a lower figure.

The ultimate determination of this ratio will be based upon a knowledge of practical conditions guided by the above considerations, and it will probably be thought to be between 1½ and 1¾.

We can now consider the various systems in use. First, take the ordinary piece-work system in which a man is paid so much per piece, and makes as much money as he can. It is clear from the above argument that the prices of the pieces should be such that a man makes 1½ to 1¾ times his ordinary day-work rate, when working at top speed.

Next take the bonus system in which only half the amount saved is paid to the man. Arguing as above the man should make 1½ to 1¾ times his ordinary rate, and since only half of the amount saved is paid to the man, it is clear that the price of the articles should be such that the amount saved, when working at top speed, is exactly twice the amount of the bonus determined by the above reasoning.

Thus this system is only a more complicated method of working the old piece-work system, though it has the advantage that any error in pricing the articles produces a smaller result on the pay sheet. But it also contains a great disadvantage, viz., that the faster a man works, the less he gets paid *per article*. It is difficult to see why a definite amount of work should be worth less because it has been done quickly—especially when speed is the very object of these systems.

I also notice that Messrs. Walton and Brewerton, in their interesting article, consider it to be a disadvantage of the bonus system that the rate of wages increases out of proportion to the saving in cost of production. They consider this unfair to the employer, but it is difficult, I think, to see where the unfairness comes in.

It is quite true that the rate of wages does increase as the man works faster—but so does the rate of work. We must compare rates with rates. And it is difficult to see why we should consider rates of wages at all when dealing with men on piece-work systems. After all a man’s day-work rate is fixed entirely in proportion to his skill and without any regard to the speed at which he works. The question of rate only enters into piece-work systems when fixing prices: for example, a certain number of articles have to be made, and they require such skill to make that we know from practical experience that the man who makes them will expect to earn so much per hour: so that the price of the articles has to be such that when working at top speed a man’s rate is equal to his ordinary rate plus the bonus, the amount of the bonus being determined as already shown. So that we only consider rate of pay when pricing an article, because it represents the amount that has to be paid having regard to the skill required.

**New Telephone Works in Russia.**—The Mix and Genest Telephone and Telegraph Works Co., of Berlin, has concluded an agreement with a Russian syndicate, with which French and Russian banks are closely associated, for the formation of a Russian telephone factory to manufacture, on the basis of the Berlin company’s patents and experience. The new company will have a capital of £50,000. The Russian company has been placed under the obligation to purchase from the Berlin company all apparatus not made in the Russian factory.



With reference to the system devised by Messrs. Walton and Brewerton, it will be noticed that whereas in the ordinary bonus system the price *per article* paid to the man decreases as his speed of working increases, it can be shown that in this new system the price also decreases, but at a greater rate, and seems, therefore, to me to be still more unfair to the workman.

These gentlemen claim the advantage for their system that it is impossible for a man to earn double his ordinary rate, but surely this should be a physical and not an arithmetical impossibility.

To sum up, therefore, it appears that there is nothing so satisfactory as the whole system, in which a man is paid a fixed price per article and makes as much per hour as he can.

A. G. H.

June 19th, 1912,

#### Coal Strike and Tramways.

The unrest associated with the recent coal strike may, as you have indicated in your columns, spread in the future to the employes connected with electric supply and tramway undertakings.

Certain forms of advanced legislation in Australia have, from time to time, been severely criticised, and very rightly so. Legislation here has, however, produced at any rate one form of regulation which could, with advantage, be copied at Home. Acts have been brought into force making it a penal offence for any employe to break his contract with his employer, when such action shall interfere or shut down any railway or tramway, or the supply of gas, water or electricity, or any sanitary service. The South Australian Act deals with railways, tramways and gas and water supply only. Sec. 17 of the Employers' and Employes' Act for Victoria curiously does not include either railways or tramways, but refers only to the supply of gas, water, electricity and the control of sanitary service.

During recent unrest here, I had occasion to post up Sec. 17 from the latter Act, and to inform employes of both their and our own responsibility in connection with the continuity of our electric supply, and that any improper action on their part would make them liable to a penalty of £20, or three months' imprisonment. I enclose you herewith copies of the clauses in the Acts referred to above. In view of the great importance of tramway transit, and the supply of electricity for light, tramway, and power purposes, it would seem very desirable that home legislation should follow on these lines.

P. J. Pringle,

Engineer and General Manager,  
Electric Supply Co. of Victoria, Ltd.

Ballarat, May 22nd, 1912.

#### EMPLOYERS' AND EMPLOYES' ACT, SEC. 17.

Where a person employed by a municipal authority, or by any company or contractor, upon whom is imposed by Act of Parliament the duty, or who have otherwise assumed the duty, of removing, dealing with, or treating sewage of any city, town, or borough, or shire, or supplying any city, town, borough, or shire, or any part thereof with gas, or electric light, or any other species of light, or water, wilfully and maliciously breaks a contract with that authority or company, or contractor knowingly or having reasonable cause to believe that the probable consequences of his so doing, either alone, or in combination with others, will be to deprive the inhabitants of that city, town, borough, or shire, wholly, or to a great extent, of their supply of gas, or electric light, or other species of light, or water, or to interfere with the sewerage thereof, he shall on conviction thereof, by a Court of Petty Sessions or on indictment or presentment as hereinafter mentioned, be liable to pay a penalty not exceeding £20, or be imprisoned for a term of three months with or without hard labour.

#### SOUTH AUSTRALIAN ACT.

Any servant in the employ of the Government or of any person or persons or body corporate upon whom is, or may be, imposed by any Act or ordinance the duty, or may have otherwise assumed the duty, of carrying on and conducting railways or tramways for passenger and goods traffic, or for either of such purposes at any place within the said province, or who may have the duty imposed as aforesaid, or who may assume the duty of carrying on and conducting railways and tramways for passenger and goods traffic, or for either of such purposes at any place within the said province, or who may have the duty imposed as aforesaid, or who may assume

the duty of supplying any city, town, village or place, or any part of either with gas or water, wilfully and maliciously breaking his contract of service, or hiring with the Government, or such person or persons or body corporate, knowing or having reasonable cause to believe that the probable consequence of his so doing, either alone or in combination with others, will be to deprive any of the inhabitants of the said province, or of any city, town, village, place or part of either, wholly, or to a great extent, of the use of such railway or tramway, or of their supply of gas or water shall, on conviction, be liable either to pay a penalty not exceeding £20, or to be imprisoned for a term not exceeding three months with or without hard labour. But provided that no servant shall be liable to conviction under this section unless there shall be posted up at the railway, tramway works, gas works or water works as the case may be, a printed copy of this section in some conspicuous place where the same may be conveniently read by the persons employed.

#### An Objectionable Clause.

Mr. W. J. Webb has apparently missed the point of the letter which began the correspondence under the above heading. If he will take the trouble to read it again, it will be—or ought to be—clear to him that I was objecting, not to the clause stipulating for the payment of Trade Union rates, but to that appointing the Trade Union *sole* arbitrator between the contractor and his men.

The condition that Trade Union rates should be paid was too usual to have required comment. To my mind, indeed, it is a fair clause, as it simply amounts to the enforcement of a recognised standard of wages. There are few employers but would gladly pay their skilled workmen half-a-crown an hour if their competitors were obliged to do the same. All labour is admittedly underpaid. Skilled manual labour in particular ought to be esteemed more honourable, and be better remunerative than the "genteel" avocations of quill-driving or counter-jumping. But it is not, unfortunately. To-day the disproportion between the fruits of labour and commerce is as markedly unfair as it doubtless was in the days of Tyre and Sidon. It is the inevitable result of the first law of nature; a law which neither the Poplar Guardians nor Parliament can override. Competition—competition between man and man, firm and firm, nation and nation. That is the factor which in the long run must wreck the most Utopian dreams of Socialism. A Labour Government might enact that all electrical tradesmen should be paid 50 per cent. more than they are now. Unless they could, at the same time, enforce the same rate among the Germans, the Chinese, the Fiji Islanders, the only result would be the closing of every electrical workshop in the United Kingdom, and such a further rise in unemployment as has attended every successful effort of the Trade Unions to raise wages. Pardon me, Sir, if I appear to digress; I am attempting—in vain, I fear—to persuade Mr. W. J. Webb that no fair-minded contractor objects from *malice prepense* to paying his men good wages; and he gladly does so when, as in the present instance, he is safeguarded against the undercutting of his rivals.

The unusual and objectionable clause is that which constitutes the Trade Union sole arbitrator. The objection is not to the Trade Union *qua se*. It has been raised repeatedly against architects and consultants when these have been appointed sole arbitrators. It would assuredly be raised in the unthinkable event of that unlucky bottom dog, the contractor, being appointed sole arbitrator. In brief, it is an objection to the principle of any one party interested in a dispute being appointed sole arbitrator thereon. How can such a one give an unbiased verdict in a dispute affecting, in the case of an architect, his client; in the case of a Trade Union, its member or potential member? Unfortunately, moreover, the Trade Unions in particular have made themselves notorious by their class partisanship, by their openly professed repudiation of contracts and contempt of equity in any dispute involving their interests. No thinking man would deny the good done by Trade Unions in the past in bettering the lot of the workers. But, petted by Parliament and petted by the Press, they have grown mighty in the land; and with power has come the abuse of power, corruption, communism and class war. He would be mad who would look to-day for impartial justice from a Trade Union leader.

Mr. W. J. Webb's own organisation is a weak one, and one which most of the best men in the trade ignore. But there is no reason to suppose that Mr. W. J. Webb would



prove a more impartial judge between master and man than more prominent labour leaders—such as those doughty wagers of class war, Messrs. Ben Tillett and Will Thorne, M.P. Indeed, the tone of Mr. W. J. Webb's letter is little calculated to increase confidence in his fitness to act as a sole arbitrator. Previous correspondence on this matter he sums up as a "howl"; the opinion of those who are so unfortunate as not to agree with him is "twaddle." Such epithets may tickle the taste of the more ignorant of his followers; they are of no avail in proving his case to your readers, who alone, as non-disputants, are in a position to say whether one side or the other is talking "twaddle." Mr. W. J. Webb has not yet been appointed "sole arbitrator." He himself has supplied additional reason, if such be needed, against the objectionable clause that would so appoint him.

#### Fairplay.

Referring to the E.T.U. letter in last week's ELECTRICAL REVIEW, I certainly think Mr. Webb should carefully read my letter over again, he will then understand that my suggestion was to delete all reference to Trade Union rates and conditions, and substitute "local conditions and rates of pay," with the wages rate scheduled. If this suggestion was carried out, I fail to see how this would be "leaving it to the fairness of the contractor." Dear me, what a crime it would be if a member of the E.C.A. should happen to employ a workman at a bawbee per hour under Union rate! I suppose Mr. Webb would take no explanation, therefore the contractor would have to clear out. Alas! for the poor contractor who is found guilty of such an iniquitous offence. What a pity to think the first time the E.T.U. get a fair show, the wicked contractor should try and upset same. Next time I should advise a show founded on principles of wisdom and fair play, and eradicate all the socialist rot by which the atmosphere of Trade Unionism is permeated. Regarding my compliment, I would ask the E.T.U., when making their suggested new rules, to remember the old fable of the "two frogs" with the moral, "easier in the mud than out."

Percy D. Collins,  
Electrical Contractor.

Wimbledon, June 24th, 1912.

#### Trade with Canada.

In your issue of May 17th I saw under the heading, "Trade with Canada," a suggestion from Mr. Philbrow regarding the education of emigrants on matters of loyalty to home firms in a new land. His suggestion is obviously well meant, but does not by any means offer a solution to the difficulty of inducing Canadians to pay British prices. The people who form the object of Mr. Philbrow's suggestion are, for the most part, agricultural or skilled labourers, and do not, until many years after their arrival, become the purchasing element of this country. I speak generally, and, of course, recognise that there are exceptions to this rule.

The real need is this. Old country firms must of a necessity get in touch with this country in a very much more thorough sense than they were in the habit of doing. The Canadian buyer wants good stuff, and knows he can get it from the British Isles. In fact, he will go out of his way to get old country goods, and will pay with good grace the extra price for the better article; but he absolutely will not stand the scant attention bestowed upon him by the majority of old country manufacturers. The firms in England, Ireland and Scotland who have proper organisations in this country are doing a big business, simply because they give the service and local attention. The Canadian wants efficient service, and if he gets it will open his purse strings and pay handsomely for it. There is no time in this country to wait for things which ought to be available on the ground, and when firms in the old country condescendingly permit stuff to casually drift through weeks late in delivery, a buyer turns round and goes to the States where the system of prompt and efficient service is everyday business. Who can blame him?

It is truly gratifying to find that the tendency is for British manufacturers to come here and see for themselves that enormous business is to be done if properly handled. Let them not treat Canada as a new, crude and uneducated

country which may amount to something worth their attention in years to come. The buying is being done now, and the tendency is being moulded now. In years to come it will be too late to retrieve lost opportunities.

The business being done is truly wonderful, and let me conclude by saying with the utmost conviction that Canada *wants* to do business with the old country. But believe me, unless the old-country manufacturers drop the patronising and condescending attitude with which they have hitherto (many of them) regarded Canada, they will most surely alienate the business interest of a wonderful and surpassingly rich country.

Let us, therefore, educate the man who does buy by showing him how well we can do things and how smartly we can look after him, rather than educate the very worthy but temporarily unimportant ordinary emigrant.

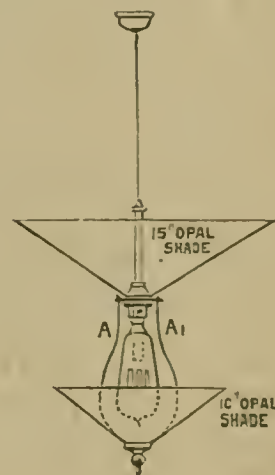
I have the honour of Mr. Philbrow's acquaintance, and am sure he will agree with me as to the commercial end of things engineering.

Thurstan W. Fairhurst.

Winnipeg, Canada,  
June 10th, 1912.

#### The Indirect Lighting of Rooms.

Many readers have, doubtless, been interested in "Whistlefield's" recent article upon the above subject, also the remarks made by "Resident Engineer," in your last issue, and it occurs to me to submit a simple design which I have found very effective, and which at the same time is easily and cheaply made from *standard* material. The legs of the



ordinary shade carrier  $AA_1$  can easily be bent by hand to accommodate almost any kind of lamp, and to vary the distance between the shades should it be desirable to do so. The 15-in. and 10-in. conical opal shades are very old friends, and the  $\frac{1}{2}$ -in. S.C. holder and short length of brass tube, with a cord grip at the top, completes the job—not forgetting, of course, the lamp, flex and ceiling rose.

J. R. Parkington.

Newcastle Emlyn, South Wales.  
June 24th, 1912.

Most people will agree with the remarks in your issue of June 14th concerning the shadowless and restful qualities inherent to indirect lighting, and "Whistlefield" has stated the case in a concise manner that is easily understood. But he is also responsible for some most extraordinary statements regarding the practical side of the question, and it would appear that he pays no attention whatever to the information imparted by the technical Press anent this subject.

The object of any indirect lighting fitting is to reflect as much light as possible on to the ceiling, in such a manner that the minimum amount is absorbed by the walls, and the maximum possible evenly distributed over the working plane, even illumination of the ceiling being no criterion of the proper or most efficient lighting of the room; in practice the illumination is required on the working plane, and not upon the ceiling.

In order to attain this object efficient reflectors must be used, and since it is an established fact that an opal shade is a most inefficient and unscientific reflector, one marvels at the advocacy of your contributor in this respect. Not only



is an opal shade translucent—so that such a fitting as detailed would produce what is usually termed “semi-indirect lighting,” owing to the large amount of light directly transmitted, which incidentally produces shadows—but also the light distribution from an opal shade is entirely uncontrolled, so that the maximum efficiency can only be obtained under the *most* favourable conditions of height of ceiling and dimensions of room. A properly designed reflector is not only more efficient, but also allows the efficiency to be maintained under varying conditions, according to the type employed.

It is generally known that silvered glass is a most excellent reflector, and, if scientifically designed, it can now be made for almost any particular requirement.

After much research and infinite trouble, a type has been evolved which is eminently adapted for indirect lighting. There is no streaky image of the lamp filament as with an opal shade, and when correctly suspended an ideal light is obtained on the working plane, without the losses due to wall absorption. Such reflectors as these are used in the B.T.-H. eye-rest system of indirect illumination. The exterior bowl, which is opaque, can be designed so as to harmonise with the decorative scheme of the room, or may be chosen from a utilitarian point of view, so that in this case at least, the main object of the fitting is to provide both efficient lighting and a pleasing appearance at one and the same time, the efficiency being obtained without in any way sacrificing decorative considerations.

By using several lamps with a reflector for each lamp, one obtains the advantage of a multiple control and lessens the risk of failure, while retaining all the other advantages consequent on indirect lighting, which are obtained at a very slight loss in efficiency and a considerable gain in comfort, compared with a properly designed direct lighting scheme.

John H. Asdell, M.Sc.

Rugby, June 18th, 1912.

## INTERNATIONAL RADIO-TELEGRAPHIC CONFERENCE.

THE delegates attending the Conference (which will be sitting until the middle of next week) are undergoing an almost continuous round of festivities and excursions; except on Sundays, they have had only about four free evenings during their sojourn in London. Last week they were the guests of the leading exponents of wireless telegraphy in this country.

On Thursday, June 20th, we joined with a large party in a visit to the Woolwich Works of Messrs. Siemens Bros. and Co., Ltd., who, as our readers will remember, have taken up the manufacture of wireless apparatus on the Telefunken system in this country. A special train conveyed the visitors from Charing Cross to Charlton, whence they proceeded to the works in brakes; there were about 300 present in all, including many well-known engineers and a considerable number of ladies. The cable manufacturing departments were thrown open for inspection, and the work of stranding, taping and lead-sheathing cables, both for heavy currents and for telephone and telegraph purposes, was in full swing, presenting many features of novelty and interest to the lay visitors. A large aerial has been erected between the chimney shafts of the works, and a 10-kw. ship station was shown communicating by this means with the station at Nauen, 1,000 km. away: this equipment, with an output of 5 kw. from the antenna, can transmit waves of 300 to 2,500 km., the adjustment being effected by means of a variometer. Next, a variety of portable sets of apparatus was inspected, designed mainly for military purposes; these sets were respectively installed in wheeled vehicles, for use with artillery, &c., and in leather cases suitable for transport on horseback, special pack-saddles being provided for the purpose. Four horses or mules suffice to carry a complete outfit of the latter type, including a petrol-electric generating set and a pair of telescopic masts, each 12 metres in length when expanded. The wheeled military station, weighing in all less than 2 tons, with a mast 25 m. high, has a range of 200 or 300 km., but with a mast 45 m. high, twice this distance can be covered.

The guests then proceeded to a large room on the upper floor of the new buildings which have been erected by Messrs. Siemens Bros., where an exhibition of Telefunken apparatus, ancient and modern, had been arranged; this display was of great historic interest, and will remain open to the delegates until the end of the Conference. It included, besides examples of experimental and commercial apparatus dating from 1902 onwards, the most modern types of equipment for warships, merchant vessels and airships; a land station transmitter of 15—20 kw., specially designed for use in tropical countries, with the high-pressure apparatus immersed in oil; various receivers and measuring instruments, a sound intensifier and photographic receiver, and a variety of miscellaneous apparatus. Not the least interesting item was a scale model of the great station at Nauen, the 200-m. tower of which was destroyed in a gale on March 30th last; a still higher tower will be erected at an early date.

A practical demonstration of a number of new apparatus followed, in which Count Arco himself took part. The Telefunken compass, described in our issue of June 7th, and the secret telegraph system of Capt. Hovland, which we described on September 15th, 1911, were shown, as well as a miniature apparatus simultaneously receiving messages from two other stations, on a single antenna, with two receivers. The principal feature of the demonstration, however, was the new high-frequency generator developed by Count Arco; the construction of this has not yet been made public, owing to patent questions, but we gather that, like the Arnold generator, described in our issue of November 24th, 1911, it is of the self-resonant type of inductor alternator, generating impulses at frequencies far beyond the polar frequency of alternation, and capable of producing waves of 10,000, 5,000, or 2,500 m., with power sufficient for a range of at least 1,000 km. A large bank of lamps was shown, supplied with power through the ether from this machine, and the high frequency was demonstrated with the aid of a resonating coil and lamp, and in other ways. As regards the keynote of the Telefunken system—the “singing quenched spark”—we may refer our readers to the article published in our issue of February 17th, 1911.

The proceedings concluded with a dinner given by Messrs. Siemens Bros. & Co. to the delegates and other visitors, in the other half of the enormous room in which the demonstration took place; the room had been decorated with charming effect, and by some magic process an excellent repast was provided in a style that could hardly have been surpassed even in one of the great London hotels. Mr. G. von Chauvin presided, and offered a hearty welcome to the guests in the name of the company, to which Sir H. Babington Smith, president of the Conference, responded. M. A. Frouin proposed the toast of “Messrs. Siemens Bros.,” which was acknowledged by the chairman, and other guests expressed their appreciation of the hospitality of their hosts and of the progress made by the Telefunken system of wireless telegraphy, of which they carried away souvenirs in the shape of a silver model of the Telefunken spark-gap. The visitors then returned to London by special train.

On Saturday the delegates were entertained by Messrs. Marconi's Wireless Telegraph Co., Ltd., at their new works at Chelmsford, travelling from Liverpool Street by special train. These large works have been erected to cope with the increasing demand for Marconi apparatus, the previously existing factory, though working night and day, having proved inadequate for the purpose. The new buildings were completed and brought into use last month, and have been laid out on the most modern and scientific lines, in the short space of 17 weeks from the purchase of the 10-acre site. The first item of the programme was an inspection of the factory, of which a detailed description must be deferred for the present; suffice it to say that the manufactures and processes there seen were of great interest, and the equipment of the highest class, British machinery and apparatus having been installed throughout; the workpeople also appeared to be of an exceptionally high standard. The show-room was especially interesting, as it contained working examples of wireless stations for warships and the mercantile marine, including a new  $\frac{1}{2}$ -kw. set for cargo boats, comprised in the smallest possible space and fitted with the Marconi disk discharger. A 15-kw. ship set in this room was in operation, communicating with the Marconi station



at Poldhu, throughout the afternoon. A temporary tubular mast, built up of flanged steel segments to a height of 200 ft., has been erected near the works for this purpose, but later two masts 450 ft. high will be erected, and the 100-ton concrete anchors for these are already in position. In the grounds demonstrations took place of various Marconi equipments: military sets mounted on wheels, or arranged for transport on mule back, were shown in operation, with various types of portable masts, communicating with the company's station at Golder's Green; a photographic receiver capable of working at 50 words per minute, and representing the type of instrument to be used in connection with the Imperial chain of long-distance stations which is to be established by the Marconi Co. for the Post Office, was demonstrated; an experimental apparatus on the lines of the automatic calling device recently foreshadowed by Mr. Marconi was operated; and Mr. Bellini demonstrated the working of the Bellini-Tosi system of determining the direction of origin of wireless signals (described in our issue of December 15th, 1911), which has been taken up by the Marconi Co. There was very much to see, and the display was of great interest. In the course of the afternoon the guests were entertained with light refreshments in a large marquee, and afterwards they were conveyed back to Liverpool Street.

In the evening the delegates were the guests of the Marconi Co. at dinner at the Savoy Hotel. About 360 were present, including many ladies, and during the evening the latter were presented with silver scent flasks, while the gentlemen each received a handsome souvenir consisting of a silver model of the Marconi disk discharger, cleverly designed to form a cigar-lighter, and packed in a leather case. After proposing the health of the King, the chairman, Commendatore Marconi, welcomed the delegates, and thanked them for their presence at Chelmsford and at that table; he invited them to accept the souvenir of that occasion, and drank to their healths. Herr Koehler, president of the German delegation, responded, eulogising the achievements of their host, especially in respect of communication with ships at sea; in the name of the Conference he thanked the Marconi Co. for their hospitality, and for the souvenirs with which the guests had been presented. Prof. A. Battelli also spoke in similar vein, and Mr. Godfrey Isaacs briefly replied on behalf of the company. Capt. Cecil Norton then proposed the health of Com. Marconi, which was enthusiastically received, with musical honours. Mr. Marconi, in reply, expressed his gratitude for the manner in which the toast had been received. Herr Bredow proposed the health of Mr. Isaacs, the organiser of the company's world-wide business, who responded. Dr. Webster made a clever and humorous speech, commenting on the extraordinary change effected by Mr. Marconi in 15 years, and Messrs. da Silva and Pullino, and the Mayor of Chelmsford, also took part in wishing success to the company. In every respect the occasion was a memorable one, and the function a notable success.

To-day the delegates are to go to Falmouth, and tomorrow they will visit the Marconi Co.'s wireless station at Poldhu, afterwards proceeding to Truro on Sunday and returning to London in the evening. Next week Sir H. Babington Smith and the British delegates will give a dinner to the visiting delegates at the Hotel Great Central.

## PARLIAMENTARY.

### Brighton and Hove Tramways Bills.

HAVING passed the House of Lords' Committee, the Bills promoted by the Brighton and the Hove Corporations came on June 20th before Sir W. H. Davies' Committee of the House of Commons. Mr. H. Lloyd, K.C., Mr. G. J. Talbot, K.C., and Mr. Clode represented the Brighton Corporation; Mr. Balfour Browne, K.C., Mr. J. W. Fitzgerald, K.C., and Mr. Tyldesley Jones the Hove Corporation; and Mr. C. C. Hutchinson, K.C., and Mr. Lynden Macassey the British Electric Traction Co., who opposed.

MR. LLOYD, K.C., explained that when the Bills were before the House of Lords' Committee there were two other schemes, one by the British Electric Traction Co., and the other by the Brighton and Hove Omnibus Co. The latter came to an arrangement with the Brighton Corporation, and the Bill was withdrawn, whilst the Committee rejected the Bill of the British Electric Traction Co. The House of Lords' Committee decided that the trackless trolley

system was the most suited for the district, and it was arranged that the Brighton and Hove Corporations should each install their own system, and would by mutual agreement work in harmony and run over each other's systems. The only opposition now came from the British Electric Traction Co., who owned a horse tramway at Hove, and who wished to electrify and considerably extend that tramway. He contended that the tramway company had allowed their line to become derelict, and had only a strategical line with a view to harrassing the Corporation, and of trying to get into Brighton, where the Corporation was the tramway authority.

ALDERMAN GEERE, the Deputy Mayor of Brighton, gave evidence in support of the Bill. He said that the Corporation had no idea of continuing a motor-'bus service, but would run 'buses as feeders to the tramway system. The Committee could be satisfied that there was no intention of running 'buses and not constructing the trackless system.

Evidence was also given by ALDERMAN WILSON, and by MR. HAMILTON, the general manager of the Leeds City Tramways.

MR. BALFOUR BROWNE, K.C., opened the case for the Hove Bill, and said that the only complication was the existence of the tramway which the Corporation asked for power to clear away.

ALDERMAN MARKS, the Mayor of Hove, was called in support of the Bill, and said that it would be open to the Tramway Co. to electrify that portion of their line which was outside the borough of Hove. If that was done, passengers using it could then change on to the Hove trackless trolleys.

In cross-examination by MR. HUTCHISON, WITNESS admitted that the Hove Corporation had always opposed tramways through Hove. They objected to the rails through the streets. He agreed that Hove was in a peculiar position, inasmuch as they were practically forced into a system of trackless trolleys against their will, but they were prepared to run such a system in conjunction with the Brighton Corporation, so as to be the masters of their own roads.

Questioned by the CHAIRMAN, WITNESS said it was essential that there should be some system of through communication, both for Brighton and Hove, but their objection to tramways was as strong as ever.

The Committee sat again on Tuesday, when further local evidence from Brighton was heard in favour of the Brighton Bill, and the Committee expressed themselves satisfied about Brighton. The CHAIRMAN said the Committee were desirous of finding out what the real feeling of the inhabitants of Hove was.

MR. WEDDERBURN, K.C., who represented frontagers, said that public opinion was against the introduction of the system, except, perhaps, the provision of a through route.

The CHAIRMAN suggested that the Hove authorities might be prepared to make some pecuniary payment to the tramway company to get rid of their opposition, and MR. BALFOUR BROWNE said his clients would be prepared to give the company the present value of the materials in the road, but MR. HUTCHINSON, of the tramway company, declined to consider such an offer, which, he contended, was unreasonable. Mr. Wedderburn having called evidence in opposition to the Hove Bill, the Committee adjourned till July 5th.

### North Ormesby, South Bank, Normanby and Grangetown Railless Traction Co.

ON Thursday last week a Select Committee of the House of Commons, presided over by Sir J. Compton Rickett, considered the Bill promoted by this company.

MR. WEDDERBURN, K.C., in opening the case, said the Bill was promoted by Sir Hugh Bell, Mr. Erasmus Darwin, and eight other gentlemen, representing various large firms in the district. There were a large number of industrial undertakings in the district, and the proposed tramway was for the convenience of the workmen who lived some distance from the works. Years ago there were no roads at all, but since then many private toll roads had been made, and a large portion of the proposed route was still private. Counsel then proceeded to give a history of the case, which, he said, went back to the year 1902, when some of the present promoters, together with the toll owners, started a Bill with the object of constructing a tramway from North Ormesby to Grangetown, and their intention was to continue the tramway to Middlesbrough. That Bill was withdrawn by the promoters on an agreement with the Imperial Tramways Co., who owned the tramways in Middlesbrough, to continue the Middlesbrough trams to Grangetown. In 1904 the company obtained powers for such extension, but from that time to this they had done absolutely nothing. They had got two extensions of time, but in 1911 Parliament refused a further extension, and so the powers had elapsed. Since the promoters of the present scheme first had the idea of a tramway in their mind, the system of railless traction had become an important factor, and now they came forward with a proposal to construct such a system  $4\frac{1}{2}$  miles long. The only opposition came from the Ormesby District Council, which was asking for a contribution at the rate of  $\frac{1}{4}$ d. per car-mile run towards the cost of the extra expense to which they said they would be put in maintaining the roads. He should ask the Committee to follow the example of the House of Lords and refuse to give the Council the contribution they asked for. Although the trams would run for 2,248 yards in Ormesby, the Corporation would only have to repair them for a distance of 517 yards, the remainder being private. When the company was established they would have to pay rates on the whole 2,248 yards, which he estimated would amount to between £50 and £60 a year—more than sufficient to recoup the Council for any additional expense they might be put to in respect of the trams.

Evidence in support of counsel's opening was given by MR. J. B. HAMILTON, general manager of the Leeds tramways, who said that



he was perfectly satisfied that the trackless trolley system would be largely used in the future in those places where the traffic was not sufficiently heavy to warrant the equipment of an ordinary electric tramway, and after hearing further evidence, the Committee suggested that the parties should seek to come to an agreement.

After an adjournment, Mr. WEDDERBURN intimated that they had been unable to come to an agreement with the Ormesby Council regarding the making up of the roads.

Having heard arguments by counsel, the Committee passed the preamble of the Bill as it stood.

**Newton-in-Makerfield U.D.C. Electricity.**—Viscount Wolmer asked the Under-Secretary to the Board of Trade whether he could see his way to give some indication to the Newton-in-Makerfield Urban District Council as to what conditions it would have to fulfil before it could obtain an order from the Board of Trade to proceed with its scheme for generating and supplying electricity locally, in view of the fact that the site upon which it intended to erect its plant might not be available next Session, and that the various large firms in the district would, in all probability by that time have been forced to make other arrangements.—Mr. J. M. Robertson replied that if the Council made a further application it would be necessary for them to satisfy the Board of Trade that there was a reasonable prospect of there being a sufficient number of consumers to render it unlikely that any serious burden would be imposed on the rates. The former order granted to the Council in 1903 was revoked in 1909, as the Council took no steps to give effect to it, the reason presumably being that there was no general demand for a supply. The Board did not consider that success of an electricity undertaking should be dependent upon the custom of two or three large power-users.

**Keighley Corporation Bill.**—On the motion for the third reading of the Keighley Corporation Bill in the House of Commons on Thursday last week, Mr. Lane Fox moved an amendment to re-commit the Bill to the Committee which previously dealt with it for the purpose of considering the liability of a Corporation for alterations and maintenance of roads used by trolley vehicles.—Mr. J. M. Robertson opposed the amendment on behalf of the Government, and it was eventually withdrawn, and the Bill was read a third time.

**The Lighting of the House of Commons.**—In reply to Sir J. D. Rees, Mr. Wedgwood Benn says that electric light will not be substituted for gas in the Debating Chamber before the House can make a practical trial of the effect of the former illuminant on the eyes of the members. The First Commissioner is quite willing to change his views should it appear to be necessary.

**Second and Third Readings.**—In the House of Lords on Monday the following were read a second time:—London United Tramways Bill, and the Begnor Gas Light and Coke Co. (Electricity) Bill.

In the House of Commons on June 20th the Preston, Chorley and Horwich Tramways Bill, and on June 21st the L.C.C. (Tramways and Improvements) Bill were read a third time.

## BUSINESS NOTES.

**Discovery of Tungsten Deposits.**—It is stated that deposits of tungsten have been discovered in the mining concession of the Société des Mines de Vaulry et Cieux, in the department of the Haute Vienne. The deposits are apparently of large extent, and have a high content of metal. The company now proposes to increase its share capital to £400,000 for the purpose of working further mines.

**Illuminations at Olympia.**—MESSRS. WILLIAM WHITELEY, LTD., secured the contract for the decoration of Olympia for the International Horse Show this season. The contract, which was completed in seven days, included the installing of 5,000 electric lights and 100 arc lamps in the arena.

**Lamp Prices.**—We learn that MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., are now in a position to supply stock orders for 200-250-volt "Wotan" lamps in 10-C.P. sizes, as well as 16-C.P. The prices of the 10-C.P. lamps have now been fixed at 3s. 6d. for pear-shaped bulbs, and 3s. 9d. for round bulbs.

**Annual Sports.**—The fourth annual sports meeting of the HART ACCUMULATOR CO., LTD., took place last Saturday week at the Memorial Grounds, Canning Town, E., when a good programme of cycling, running and fun events was much appreciated by about 1,000 spectators. No fewer than 178 competitors were entered for the 27 events, and the chief successes were scored by A. Yate, E. G. Warren, and T. Cook, the former being awarded a special medal as sports champion for the highest number of points obtained. He secured three successes by winning the lap, half-mile, and one mile cycle handicaps from scratch, in each case just obtaining the verdict from Warren, and second place in the 100 yards staff, and fourth in the 120 yards flat handicap; brought the champion's aggregate of points to 18, as against 17 scored by Warren. The latter, in addition to the partial successes above mentioned, won the 100 yards slow cycle and took second and fourth positions respectively in the 110 yards potato race and 100 yards staff handicap. There were, as usual, one or two "dark horses" in attendance, and the victories of G. Harding

in the 120 yards and of T. Cook in the half mile and mile flat handicaps were surprises. C. R. Cartwright won chief honours in the 100 yards works flat handicap, and he also took second position in the 300 yards event when he followed J. A. Clark past the tape. Clark also took the leading place in the staff handicap, in which he showed splendid form in getting off his mark. Other winners were as follows:—One mile walking handicap, S. Robertson; 300 yards boys' flat handicap, P. Gullen; 100 yards veterans' flat handicap, S. Mears; 50 yards all fours race, T. Brightmore; 100 yards scratch boat race, F. Marsh; 100 yards scratch sack race, W. E. Taylor; tug-of-war, Team 3; one lap obstacle race, F. Grigr; 75 yards ladies' egg-and-spoon race, Mrs. Brightmore; 80 yards juvenile (girls') handicap, Miss Thompson; 80 yards (boys under 14) Master E. Edwards; 80 yards juvenile (boys under 8) Master C. Edwards. At the conclusion of a very enjoyable afternoon's sport, 78 prizes of a useful description were presented to the successful competitors by Miss N. Clark, daughter of the managing director, Mr. F. J. Holmes (works superintendent) opening this part of the proceedings with a short speech befitting the occasion. The judges in attendance were Messrs. F. J. Holmes, J. H. Poulton and W. Clark. To Mr. E. G. Warren, the hon. sec., fell the brunt of the work involved in ensuring the success of the meeting.

**Annual Outings.**—THE WALSALL ELECTRICAL CO., LTD., announce that their works will be closed to-morrow, Saturday, June 29th, on account of the annual outing which takes place to Llandudno.

The head office staff of W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., had a very successful and enjoyable trip on June 15th. Leaving Paddington at 9.15 a.m. in special saloons to Taplow, then proceeding by launch from "Boulter's Lock" through the well-known Clevedon and Quarry Woods, Marlow, to Harley Lock, and returning through Windsor and Staines, reaching Paddington at 10 p.m. The party, numbering 70, were photographed at Cookham Lock, and during the evening a presentation was made to Mr. W. J. Potter for the interest he had taken in this, the first launch party. There was plenty of music on board, and the catering was admirably carried out through the efforts of Mr. A. J. Kips.

**Aluminium Prices Advance.**—The INTERNATIONAL ALUMINIUM SYNDICATE has raised prices from 80 fr. to 92½ fr. per cwt. for any further contracts concluded in the present year. A proposal was made to increase the quotations to 100 fr. per cwt., but this failed to meet with general approval at the recent conference. Since then, however, the Neuhausen Aluminium Industry Co. has made a further increase to M. 77½ per cwt., and only limited quantities are on offer.

**Dissolutions and Liquidations.**—ARC LAMPS, LTD.—The joint liquidators (Messrs. H. B. Clark and G. E. Corfield) have just paid a first and final dividend of 1s. 10½d. in the £, and in doing so they issue a statement explaining to the creditors the apparent delay in completing the winding up and distributing the balance. The summary of receipts and expenses is as under:—Receipts: Cash received by liquidators under the terms of the assignment to the purchasers, £538. Payments: Advertising, income-tax, legal expenses, bank charges, £50; paid to purchasers in settlement of all claims *re* stock in hands of agents, £28; winding-up expenses, £29; liquidators' remuneration, £42; balance available for distribution, £389.

LONDON ELECTRIC FIRM, electrical and general engineers, 6A, George Street, Croydon.—Messrs. A. Wunderlich & G. A. Hughes have dissolved partnership. Mr. Hughes attends to debts, &c.

HEINRICH MESSMANG.—Persons who have claims upon or debts to the estate of the late H. Messmang, of Stieling, Kempten, Bavaria, should communicate by July 3rd, with Oberamtsrichter Zübert, Kempten.

SUNBEAM LAMP CO., LTD.—The adjourned meeting of creditors was held at Newcastle-on-Tyne on the 21st inst. The meeting had been adjourned in order to see if it were possible to effect a reconstruction of the company, but in the notice calling the meeting, Mr. T. Wallace, the liquidator, intimated that "the Committee appointed by the shareholders have informed me that they have come to the conclusion that it is not possible to devise any scheme of reconstruction which, under the circumstances, could be carried through."

Mr. Wallace, the liquidator, presided, and in opening the proceedings, said he was afraid that the position was not quite so rosy as when they last met. If there were sufficient to pay the debenture-holders that would be all. There would be nothing left for the shareholders or creditors, even with a forced sale.

Mr. Swan (Receiver for the debenture-holders) said that without the land and buildings, he estimated that the assets were worth about £15,000. That was not enough to pay off the debentures, to do which £20,000 would be required. In reply to a creditor, he added that with a forced sale there could be nothing left for either the shareholders or the creditors. The scheme which they had had in mind would not have been a perfectly satisfactory business. Something between £30,000 and £50,000 would have been necessary to launch it, and they would have had to depend on the debenture-holders to join in with their money. The majority of the latter, however, had come to a decision that meant that they wanted their money out. He had not been able to find the money for that purpose, and the chance of the liquidator getting any was nil. The plant on the premises was largely for the lamp-making trade.

Mr. Scholey asked if it were suitable for any lamp trade?—Mr. Swan said the plant might not be suitable for any other lamp trade. Mr. Scholey pointed to the fact that last year the company paid a dividend of 5 per cent., and urged the necessity of the appointment of an independent liquidator and a committee of



inspection. Would it not be possible, he asked, to sell the whole business as a going concern?—Mr. Swan said there was a chance of selling part of the concern, but it was only a question of about £200.

Mr. Perkins (representing the Westinghouse Co.) said it was an extremely unsatisfactory business. He agreed as to the desirability of the appointment of an independent liquidator. The creditors to the number of 20 had had a meeting in London, and he was instructed to move that a joint liquidator be appointed, as well as a committee of inspection representing the largest creditors; and that an application be made to the Courts for compulsory winding-up. He moved that Mr. G. E. Corfield, of London, be appointed joint liquidator with Mr. Wallace, that a Committee of five be appointed, and that the application to the Court be made by the Sterling Telephone Co.—Mr. W. Sodon Bird seconded the resolution.

The Liquidator, in reply to Mr. Russ who asked how the loss of £6,000 last year was made up, replied that £3,000 was by trading, and £3,000 by stock.

Mr. Perkins's motion was then put to the meeting, and five voted in favour of it and three against, 18 being neutral.

Mr. Scholey asked the chairman to declare the motion carried, but the chairman declined. Mr. Scholey then moved that another chairman be appointed. After some further discussion, the chairman declared the resolution carried on a show of hands, but declined to sign it. However, eventually, after an appeal by Mr. Perkins, the chairman signed the resolution.

The Committee of Inspection was then appointed as follows:—Mr. K. Kornfeld, Westinghouse Co.; Mr. Jos. Wilson, Blaydon Manure Co.; Mr. J. Russ, Messrs. J. & H. Greverer; Mr. H. F. Marchant, Armorduct Co., Ltd.; and Mr. H. Morton, Messrs. Berry, Skinner & Co.

**Trade Announcements.**—Mr. Robert H. Lasch having resigned his position as chairman and managing director of the Selson Engineering Co., Ltd., Mr. Henry M. Sonnenthal has been appointed in his place. Messrs. John M. Kadisch and Arthur Lord have joined the board of directors. The business will be carried on as heretofore.

MESSRS. EDWARD WILCOX & CO., electrical engineers and contractors, have changed their name to Willoughby & Wilcox. Their office and works are at Central Buildings, Trafford Road, Salford, with showroom and sales department at 161, Trafford Road, Salford.

We understand that MESSRS. WILLIAM MCGEOCH & CO., LTD., ships' brassfounders, lamp makers and electrical engineers, of Glasgow, Birmingham and London, are transferring their premises from Baltic Chambers, Sunderland, to 30, Cloth Market, Newcastle-on-Tyne, as from July 1st. Mr. Philip Lodwidge, who has been their representative in the Newcastle district for many years past, is retiring from business. The new branch will be under the charge of Mr. R. W. Waddle, who has for many years assisted Mr. Lodwidge.

MESSRS. PIRELLI, LTD., removed on 24th inst. to larger premises at 144, Queen Victoria Street, E.C., and 14, Knightrider Street, E.C., and all correspondence should be addressed to them there.

**Meters Approved.**—The *London Gazette* contains notice of approval given by the Board of Trade to the following meters deposited by MESSRS. CHAMBERLAIN & HOOKHAM, LTD.:—C. & H. prepayment meter, type C.P. 2; C. & H. A.C. prepayment meter, type A.P. 1.

**Western Canada.**—In a recent report the Imperial Trade Correspondent at Calgary (Mr. J. W. Hugill) points out that it is essential that British firms with any intention of doing business in Western Canada should bear in mind the prospective cheapening of transportation with the opening of the Panama Canal, and they should get on the spot at the earliest opportunity. These remarks refer more particularly to the heavier and rougher class of products, such as steel pipes, which are in demand for the municipal authorities at Calgary and other cities. It is purely a question of price, it being recognised that the British-made article is more durable and of better average quality than that made in the United States for the same purpose, and is preferred in consequence, if the delivered price will permit of a preference being shown.

The Imperial Trade Correspondent at Edmonton, Alberta (Mr. F. T. Fisher) considers that the opportunity for United Kingdom manufacturers to get business there is constantly improving. In the past, owing to the limitations of the market, the consumption of many classes of British-made goods was too limited to permit of direct shipment in car-load lots, and merchants got their supplies of such goods through middlemen in Montreal, Winnipeg, or Vancouver. Owing to the growing importance of the market, it is constantly getting easier for wholesalers at Edmonton to buy car-loads for direct shipment. The prospects for the future suggest an even more rapid development in Alberta than in the past, with a larger consumption of all kinds of goods, and that market will become of vastly more value each year. At the same time, wholesalers and importers are gradually wresting the trade away from importers at the older and larger Canadian ports of entry. The building trades promise to be particularly active during 1912, it being estimated that building operations in Edmonton alone will aggregate over seven million dollars. This will involve the use of considerable quantities of structural steel, galvanised sheet iron, sanitary fittings, heating boilers and radiators, steam pipes, &c. A most active era of railway construction is in sight, with Edmonton as its centre. It is expected that the construction of something like 2,000 miles of branch lines will be arranged for during the present session of the Alberta Legislature, and consequently a large amount of construction

supplies and bridge material will be needed. Development in the coal industry also promises to be very active. While the production of coal in and around Edmonton has increased in the last dozen years from about 100 tons to 3,000 tons per day, it is still only a fraction of what the accessible market would consume. A considerable amount of new equipment, including hoisting machinery, cables, &c., is being installed, both in new mines and in many of those previously worked.

Very extensive additions to all the public services in Edmonton, such as water supply, sewers, electric light, &c., are proposed, the expenditure of something like six million dollars being contemplated. There is similar activity on a smaller scale in many of the other towns, which will lead to a demand for steel or iron pipe, engines, boilers, pumps, electrical equipment, &c.—*Board of Trade Journal*.

**Bankruptcy Proceedings.**—ARCHIBALD FRANK MANDERS (trading as Mander Brothers, and lately trading as A. F. Manders, late 62, Victoria Road, and 258, Lozells Road, Aston, Birmingham, electrical engineer, &c.).—An application was made to his Honour Judge Amphlett, sitting at the Court House, Corporation Street, Birmingham, last week, for the discharge from bankruptcy of the above-named debtor. The Official Receiver stated that the receiving order was made in February, 1908. From the statement of affairs, the liabilities to rank for dividend were estimated at £256, but the proofs actually admitted to date amounted to £181, and the probable claims not yet admitted amounted to £143, making a total of £324. The assets realised a sum which only met the costs incidental to the bankruptcy, and consequently no dividend had been paid. Mr. Povey-Harper, for the debtor, said his client found the electrical business and the cycle business carried on under different roofs were more than he could cope with. His Honour said there had been a good deal of rash and hazardous trading, but there were exceptional circumstances, in that the debtor got into the immediate trouble by the breach of contract on the part of his manager. As the debtor was willing to consent to a judgment for £30, payable by monthly instalments of £10, there was no reason why the discharge should not be granted, subject to that undertaking being carried out.

G. E. HERVEY, gas and electrical engineer, and ironmonger, Eastbourne.—First meeting July 2nd, at Brighton; public examination, July 16th at Eastbourne.

OLIVER HUXLEY, consulting engineer, 120, Coldershaw Road, Ealing.—Receiving order made June 21st, at Brentford, on a creditor's petition.

H. E. SCARBOROUGH, electrical and mechanical engineer, Halifax.—Application for debtor's discharge is to be heard on July 29th.

**Catalogues and Lists.**—MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, London, W.C.—Two new pamphlets have been issued. No. 667 (24 pages) contains full particulars, including much tabulated data and prices of "Aston" wires and cables (600 and 2,500-megohm grades), also cab-tire sheathed cables, aerial wires and cables, electrolier wires and flexible cords, telephone cables and wires, &c. List No. 677 (four pages) shows and gives reduced prices of a number of types of "Aston" desk fans ("Typhoon" and "Delhi" types), also D.C. ventilating fans.

MESSRS. SIMPLEX CONDUITS, LTD., Birmingham.—Neat illustration price card relating to their electric toaster. Quantities of these cards can be supplied to contractors and central stations with appropriate name printing.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.—Eight-page pamphlet containing descriptive particulars, with illustrations, diagrams and prices of Thermo-blink flashers, magnetic mercury-contact type sign flashers, motor-driven flashers, and other lines for electric advertising and other sign purposes.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Twelve-page pamphlet entitled "Factory Lighting at Half the Cost," dealing with the "Kohinoor" semi-enclosed arc lamp, and its suitability for the lighting of small factories and increased efficiency compared with metal-filament lamp lighting.

MR. H. M. TURNER, Nutsford Vale Works, Manchester.—Folder and postcard illustrations of a portable quick baking oven for drying armatures, field coils and electrical materials and work generally. It is stated that any armature or other work less than 17½ in. in diameter may be baked in the oven in less than three hours. The oven, with its cover removed, can be used for shop-warming purposes.

MESSRS. COX-WALKERS, LTD., Darlington.—Two leaflets, one showing the new protected pattern "C.W." electric head lamp for motor-cycles and cars, the other giving particulars of a world's record ride of 3,008 miles in six days with one of these lamps, which gave not the least trouble.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, Kent.—Catalogue No. 533 (16 pages), in which are given full particulars of the Siemens electrical water-level signalling apparatus, transmitters, indicators (with and without recording device), bell switches, telephones with buzzer call, accessories and parts—all of these are well illustrated, and prices are plainly set out, while diagrams of connections, inquiry forms and a telegraphic code are given at the end.

THE FOSTER ENGINEERING CO., LTD., Wimbledon.—Price list of Beck flame arc lamps of D.C. and A.C., single and double-carbon types, prices of carbons, choking coils and resistances are also clearly tabulated.

MESSRS. ABERCROMBIE & SON, 36, Whitfield Street, London, W.—Eight-page reprint relating to some excellent "Adams" and Sheraton candle brackets and pendants, also a Chippendale bowl light for reflected lighting.

THE ELECTRICAL TRADES SUPPLY, LTD., Britannia Works, Great Charles Street, Birmingham.—Switchgear catalogue of 48 pages.



The contents are very fully illustrated, and prices are clearly given in tabular form. The manufactures described include various types of switches for lighting, traction and power work, wall plugs and sockets of ironclad and Home Office patterns, distribution fuse-boards, circuit-breakers, controllers, Igranic motor-starters, lighting arresters, shunt regulators, and ammeters and voltmeters.

MESSRS. W. T. GLOVER & CO., LTD., Trafford Park, Manchester.—The company has just issued its new Rubber List, No. 10, which consists of some 90 and more pages of neatly-arranged tabular matter, bound in a strong cover. There is a thumb index to the different sections which deal respectively with:—Details of conductors; "Association" and "non-Association" single and twin vulcanised wires and cables, pure rubber wires and cables, trailing cables, vulcanised concentric cables, aerial cables and suspenders, twin flexible cords and cables, motor-car flexibles, resistance wires, &c. The concluding pages are devoted to conversion tables and useful formulae.

THE QUEEN'S ENGINEERING CO., 60, Queen's Road, Battersea, London, S.W.—Leaflet describing and giving prices of the "Halso" box-blade fans and belt-driven fans. Both fans and electric motors are built at the firm's works at Battersea.

THE ELECTRIC CONSTRUCTION CO., LTD., 9, New Broad Street, London, E.C.—New illustrated sheet (B/299), giving a description of the firm's oil-immersed auto-transformer starter for two or three-phase motors.

THE SANDYCROFT FOUNDRY CO., LTD., Sandycroft, near Chester.—List giving particulars of the "Sandycroft" storage battery, which is the outcome of a long series of experiments carried through by their predecessors, the Epstein Accumulator Co., Ltd., and themselves. Pictures of plates and of complete batteries as installed are included.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—70-page catalogue (No. 354), printed on art paper throughout, giving a great deal of illustrated information relating to Curtis turbo-alternators. The contents are divided up into six sections, thus:—(1) General; (2) high-pressure turbines; (3) low-pressure steam turbines (mixed-pressure type); (4) turbine-driven alternators; (5) reducing turbines; (6) small turbines. Throughout these sections there are half-tone views of complete turbo plants, parts of machines, explanatory diagrams and sectional drawings and curves. We understand that the sales of Curtis turbo-alternators to municipalities, H.M. Government, tramway, power and railway companies, &c., aggregate over 228,609 kW. Doubtless power station engineers at home and abroad will find much of interest in this catalogue.

MESSRS. GALSWORTHY, LTD., of 15 and 16, Newman Street, Oxford Street, London, W., will send a copy of their new electric light fittings list to any firm not yet supplied, on application.

**British and Foreign Tenders for Cables.**—At a meeting of the Southwark Borough Council on the 20th inst., Alderman Hewitt proposed that it be an instruction to the Electric Light Committee that, with respect to all future purchases of cable, quotations be obtained only from firms whose works are situated in Great Britain, and who undertake to manufacture the cable in their own works. He said it was desirable that all cable should be manufactured by British firms. The Committee had a great deal of difficulty when the lowest tender happened to be from a foreign firm, as the Council had laid down very stringent regulations as to Trade Union conditions, and if they gave tenders to firms abroad, it was impossible to see that these conditions were carried out. Councillor Bird, in seconding, held that the resolution, if carried, would not "set up rings," but would give the finest scope to British enterprise that was possible. Councillor J. O. Devereux said that, whilst he agreed that work should be given to the Britisher, he could not be a party to paying the same prices as the London County Council, who had to pay 75 per cent. more than the foreigners' price to the ring of English manufacturers. Councillor B. W. Williams moved, as an amendment, that all contracts be advertised for in open tenders. He said the electricity undertaking was a purely business concern, and was the property of the Council. Would those who proposed to restrict the tenders on the lines suggested apply the same rule to their private businesses? Of course not; they would buy in the cheapest market. Councillor Haworth, in seconding, said that to throw the tenders open was the only way to keep clear of "the rings." The amendment proposed by Councillor Williams was carried by 29 votes to 18.

**Glover's Almanac.**—We are reminded of the lapse of time—*Eheu! fugaces*—by the receipt of this periodical, which is unique, in that every page of it represents the exercise of industry and careful discrimination in the choice of an appropriate and useful or entertaining extract from the technical Press, the proceedings of Societies, or the inner consciousness of Glover's staff. Many a useful hint or timely reminder will be brought to the notice of the engineer who keeps it at hand, and the inscriptions on the leaflet of July 1st, in the familiar handwriting of one of our valued correspondents, bring back to us the hours we have spent in trying to decipher it. The electrical profession is indebted to MESSRS. W. T. GLOVER & CO. for this annual collection of engineering scraps.

**Belgium.**—A company has just been formed in Brussels with a capital of £24,000, and the title *La Société Belge de Téléphonie Perfectionnée*, to exploit a new automatic telephonic system.

**Lamp Varnishing.**—We have received from MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, a post-card showing an illustration of a lamp which had been varnished in the ordinary manner on one side, but on the other side by a special process which has been developed by the firm. The picture shows that lamps varnished under this new process do not flake when subjected to

weather conditions, and to heating effect, whilst the ordinary method used is not at all satisfactory. The illustration of the lamp was taken from an untouched photograph of a carbon-filament lamp after it had been on circuit some months to test the lasting qualities of the various systems. The method can be applied to "Wotan," tantalum, or carbon-filament lamps, and we are informed the colours will remain fast for a very long period. It is also possible to match any shade of colour or delicate tint, which is important when working out colour schemes for decoration purposes.

**Trade Openings in Denmark.**—MESSRS. AAGE HAVE-MANN'S EFTF (Chr. A. Olsen), of Kjobenhavn (Admiralgade, 16, Hj. Af Fortunstræde) in a communication just received by us, say:—"We are one of the biggest wholesale supply houses in the electrical line in Denmark, and as Denmark is manufacturing very little in this line, we have to look to the manufacturing countries around us to find our sources of supply. Now Germany has for many years been gaining a very strong foothold on the Danish market owing partly to her being our next door neighbour, and partly to her excellent products and her energetic ways of going after the business and studying our special conditions with a view of adapting her products to our needs. We feel, however, that English manufacturers once convinced that it was worth their while would be just as willing to make a few sacrifices in order to get their share of our business, and it is with this in mind that we are writing to you to-day feeling certain that you would like to help us in making some more connections with first-class English manufacturers, thereby serving the interest of some of your many friends and subscribers." Our correspondents then briefly outline their proposal, which is that English manufacturers should send a sample and description of electrical devices with export prices f.o.b. Hull, for investigation. Such samples as are thought suitable for the market will be sent to the municipal testing commission for trial and approval, and thereafter an effort would be made to secure business in the manufactures. Any of our firms interested in the matter are invited to communicate with the firm.

**Book Notices.**—*Patents and their Exploitation.* By H. A. Gill and R. Ellis.—This is a little pamphlet giving briefly the main facts relating to patents, designs and trade marks, issued by the authors at 55, Chancery Lane, W.C.

A catalogue of books on engineering and allied subjects in the Bolton Public Libraries has been sent us by the chief librarian, Mr. Archibald Sparke: it is arranged mainly on the Dewey decimal system, and is a model of ease of reference, while the collection of books comprises most of the best works, including many issued in 1911 and 1912. Some of the headings on the Dewey system produce curious effects—for example, "602 Compendiums," "621.39 Applications of Electricity": and the division of electrical subjects into "Heavy Current Engineering" and "Weak Current Engineering," after the German method, is dangerous, for in this case the latter heading is followed not only by telephony and telegraphy, but also by sections on electricity in workshops and in mining and metallurgy—the last-named employing probably the strongest currents known to electrical engineering—while electrostatic apparatus and induction coils are found associated with the former class. But these are minor defects; a technical library is useless unless it is well arranged, and above all, up-to-date, and we are glad to see these principles followed at Bolton.

"Prospectus of the Working Men's College, Melbourne." 1912. Melbourne: The College.

"Fortschritte der Elektrotechnik." By Dr. Karl Strecker. 1912. Berlin: Julius Springer. Price 9 M.

"Transactions of the University of Toronto Engineering Society." May, 1912. Toronto: The Society.

"Report of the Council of the City and Guilds of London Institute, 1912." London: 3, St. Helen's Place, E.C.

"Journal of the Franklin Institute." Vol. CLXXIII, No. 6. June, 1912. Philadelphia, Pa.: The Institute. Price 50 cents.

"Bulletin of the Association des Ingenieurs Electriciens." March, 1912. Liège: The Association. Price 8 fr.

**Diesel Works at Ipswich.**—THE DIESEL ENGINE CO., LTD., has definitely decided to erect extensive new works at Ipswich, as recently foreshadowed in the ELECTRICAL REVIEW. A site of 20 acres has been secured from the T.C., with an option upon another 20 acres, and workshops large enough to employ over 1,000 men are to be erected. The cost of the works and equipment will approach £200,000.

**Germany.**—The manufacture of sparking plugs for petrol motor-cars has lately been taken up by Messrs. Siemens & Halske, of Berlin.

## LIGHTING and POWER NOTES.

**Argentina.**—It is reported from San Juan that a contract has been signed for the sale of a waterfall on the San Juan River to an English syndicate formed by Messrs. Howard, Bowen and Co., of London. The syndicate has a capital of \$2,700,000 for the installation of hydro-electric works. — *Review of the River Plate.*



**Bath.**—The accounts of the Electricity Department disclose a net loss on the year's working of £1,521, as compared with £1,196 in the year 1910-11, while in the previous year the loss was only £580. The gross profits on the undertaking, however, show an increase. In 1909-10 a balance of £9,186 was brought from the revenue account; in 1910-11 the amount had increased to £9,708, and this year the figure of £9,885 was reached. The total charges to be met by the gross profit increased from £10,940 in 1910-11, to £11,407 in 1911-12. The total expenditure was £11,329, as compared with £10,718 the previous year; while the total income increased from £20,435 to £21,247.

**Bolton.**—The application of the Corporation for sanction to borrow £45,000 has been the subject of an inquiry by the L.G.B. In reference to the item of £20,000 for electric lighting purposes, the borough electrical engineer (Mr. A. A. Day) explained that this was required for the laying of cables and service mains to cover the next three years. No opposition was raised to the proposals.

**Brazil.**—The Brazilian Government has granted a concession to the firms of Valle, Rodrique & Romos, of London, and Bromberk, Hacker & Co., of Rio de Janeiro, to utilise the water-power of the Paulo Alfonso Falls on the San Francisco River. The concession is for a period of 70 years. The output of the installation will total 200,000 H.P., gradually increasing within a period of 15 years to 1,300,000 H.P.—*Zeit. für das Gesamte Turbinenwesen.*

**China.**—The *Indian Textile Journal* recently quoted a Consular report giving particulars of the first mill in China operated by its own electrical plant. The mill, situated in Shanghai, is owned by a Japanese Co., and spins cotton yarn; the power house contains two Belliss triple-expansion engines coupled to Siemens dynamos each of 600 KW. output, and ultimately 40,000 spindles will be installed in the mill.

A central electric lighting station has recently been completed in the Embassy quarter of Peking. The plant, which was supplied by the A.E.G., of Berlin, through Messrs. Arnhold, Karberg & Co., comprises three Körting 80-H.P. suction-gas engines directly coupled to 112.5-ampere 240-volt generators, and a similar set, but of 240-volt 208-ampere capacity. The plant is run by the Peking Electric Co., Ltd., which, though registered in Hong Kong, is a German undertaking.

**Continental Notes.**—GERMANY.—The experiments made by the Electric Uberlandcentral at Mülhausen, in Thuringia, to adapt electric driving to the numerous spinning mills in the Eichsfeld district have yielded good results, and a tariff has been fixed on the basis of a guaranteed number of KW.-hours at a moderate price that will both induce current consumption and favour the industry.—*Elektrotechnische Nachrichten.*

Reviewing the official statistics for 1909-10 of the operation of the 296 German gasworks and the electrical companies, *Der Elektrotechnik* observes:—A comparison of the yearly output of the gas establishments in Germany with the output of the electric companies gives the following results:—The gasworks in Germany up to date have produced about 2,400 million cubic metres of gas. The public electric stations have furnished 2,150 million KW.-hours. Whence it follows that the latter to-day yield almost as much as the existing gasworks which have been in existence for 86 years, although the electric undertakings have only been established 30 years. This means a victory of electricity over gas, which must go on increasing. Notwithstanding all the improvements effected, gas can only continue the struggle by dint of its by and secondary products.

An agreement has been come to between the A.E.G. and the T.C. of Saarbrücken for the establishment of an electric power station in the Saar coalfields, and the supply of the rural communes in the district. Of the capital of the company to be formed, the T.C. will subscribe about one-half, the balance being furnished by the communes, the A.E.G. and the Berlin-Anhaltische Maschinenbau Gesellschaft.

FRANCE.—The *Journal Officiel* of June 8th contains decrees authorising (1) the Chamber of Commerce of Havre to borrow and expend a sum of 1,530,000 fr. for the provision of 15 electric cranes on the Pondicherry Quay, and two electric cranes on the Renaud Quay, at the port of Havre; (2) the Chamber of Commerce of Dunkerque to borrow and expend a sum of 1,020,000 fr. to acquire 19 electric cranes and electric capstans to complete the machinery at that port; (3) the Chamber of Commerce of Rochelle to borrow and spend a sum of 350,000 fr. for the installation at Rochelle Pallice of four electric cranes, with accessories, an electric sub-station, and other apparatus.

SPAIN.—La Société de l'Energie Electrique du Centre de l'Espagne is the name of a new company which has lately been formed in Paris with a capital of £80,000.

BELGIUM.—La Société des Charbonnages de Ressaix, of Ressaix-lez-Binche, has decided to establish an electric lighting and power plant at its collieries at Genck (Lembourg). The plant will comprise two 2,000-KW. steam turbines and generators.

RUSSIA.—One of the principal electric lighting companies in St. Petersburg is reported to have decided to put down a plant to utilise the water-power of the Imatra Falls. It is stated that no less than 50,000 H.P. will be available.

**Epsom.**—The L.G.B. has written to the U.D.C. asking for particulars of that body's proposal to extend its electricity mains to Ewell, and stating that a local inquiry will be held into the Council's application for sanction to borrow £4,221 for the purpose.

**Erith.**—The U.D.C. has decided to offer a supply of energy to Messrs. Vickers, Ltd., for their factory and workshops at 1d. per unit. The company asked for a figure less than 1d. per unit on a consumption of about 2,000,000 units per annum, with a maximum demand of 800 KW.

**Falkirk.**—A long discussion has taken place at the T.C. as to whether the Corporation should oppose the Falkirk and Linlithgow electric lighting order in its remaining stages, the B. of T. having intimated that it did not consider it necessary to include in the measure the protective clauses for which the Corporation asked. On a vote, it was agreed to oppose the order.

**Finchley.**—From the report of the electrical engineer on the undertaking for the year ended March 31st last, it appears that the "profit on the year's trading amounted to £491. The number of units generated was 1,540,000, of which 79.1 per cent. was for private lighting, 5.7 per cent. for power, and 15.2 per cent. for public lighting, while those sold were put at 1,173,029, 175,920 being entered as mains loss and unaccounted for. The works cost per unit sold was 1.6d." Councillor Syrett, in moving the adoption of the report at the last Council meeting, stated that 9,289,000 gallons of water had been drawn from the well at the electricity works, this representing a saving of £100, which, on a capital charge of £1,500, he considered a good return. The number of consumers amount to about 3,000. The balance carried to the net revenue account was £9,483, as compared with £9,184 in 1911. Discussion on the report was adjourned.

**Fleetwood.**—At the Council meeting, on June 20th, Mr. Whiteside mentioned that the Council's electricity undertaking had made a net profit during the year of £460. Of this amount it had been decided to place £140 to reserve, and transfer the balance to the improvement rate. The total expenditure of the department during the year was £6,021.

For the sum of £1,500 the Electricity Committee has agreed to undertake the lighting of the streets for the year ending March 31st, 1913.

**Greenock.**—In the agreement arrived at between Greenock and Port Glasgow Corporations on the question of the supply of electricity to power users in Port Glasgow, it is stipulated that "Greenock Corporation withdraw all prohibition as to Port Glasgow laying down generating works of its own, or purchasing a supply from any other authority."

**Halifax.**—The profit earned by the electricity department for the year ending March 31st amounted to £2,174, but had it not been for payments of £4,737 for special work, the profit would have been £6,911, compared with £5,322 in the previous year.

**Hastings.**—The T.C. on June 21st decided to extend the mains so as to supply current to All Souls' Church, at a cost of £304. *En route* 15 gas lamps will be converted to electric lighting.

**Hazel Grove.**—Mr. H. C. Crews, consulting engineer, of Manchester, has been instructed by the Electricity Committee of the Hazel Grove and Bramhall Urban Council to prepare a report and scheme for supplying electrical energy in the Council's area.

**Lincoln.**—The returns for the last year's working of the Electricity Department show that 1,840,167 units were sold, or some 20,000 in excess of the previous year. Power and traction supply accounted for over 1,200,000 units, and Messrs. Clayton and Shuttleworth alone took over three-quarters of a million units. The total revenue amounted to £13,315, and the gross and net profits to £6,950 and £3,034 respectively. The works cost amounted to .62d. per unit, and the total cost (including financial charges) to 1.34d. The average price for all supply was 1.72d. per unit, the supply to Messrs Clayton & Shuttleworth averaging .682d. per unit. The undertaking has a depreciation fund of £9,256.

**London.**—ISLINGTON.—According to the accounts of the electricity undertaking for the year ended March 31st last, it appears that the surplus available to be carried to the reserve fund after payment of interest on, and repayment of, loans, is £3,989, which is practically the same as last year (£4,076). The total number of units sold amounted to 6,416,973, as against 5,793,599 in 1911, while the total average cost per unit was 1.93d., compared with 2.01d. Regarding the revenue account there was an expenditure of £29,953, as against an income of £58,839, leaving a net balance of £28,885 (as against £27,974 last year). Of the former amount £3,167 went towards repairs and maintenance. The power load continued to increase satisfactorily: the number of units sold at, or under a penny, having increased from 1,936,322, yielding an income of £7,984 in 1910-11, to 2,261,482, yielding £9,423 during the year under review. £9,766 was realised from the sale of units at 3d. per unit, nearly £6,000 of which was contributed by places of entertainment. For the first time in the history of the undertaking the works costs were below 1d. per unit and the total cost below 2d. per unit. The number of consumers had increased from 3,354 to 3,566, and the total equivalent of 30-watt lamps was 29,868, or an increase amounting to 996 KW.; 119 motors totalling 738 H.P. had been connected and the equivalent of 105 KW. for radiators and cooking. The remaining increase is accounted for by 264 KW. in lighting, and the increase in public lighting during the year amounted to 12 KW. The miles of frontage of mains had been increased to a total of 59 miles 835 yards, representing an increase of



three miles. The maximum load on the station was 4,218 kW. The engineer states that whilst the progress of the undertaking and the accounts can be viewed as very satisfactory, he is of opinion that if the undertaking is to obtain its full measure of success, consideration will have to be given to the further development of the business on lines which are being largely adopted by other electric lighting undertakings, and such policy will be essential if the popularising of electricity for domestic purposes is to be achieved. The Cooking Exhibition, which was held during the past year, resulted in the adoption of electrical cookers, but their general use is handicapped by the fact that it is the practice of the gas companies to hire out such apparatus. The purchase of gas stoves by the consumer is very limited, and the general use of electrical cooking is prevented by the department being unable to let out the apparatus on hire.

**Hammersmith.**—Application is to be made to the L.C.C. for £3,775, being the balance of the loan sanctioned by the Council in 1911.

**City.**—The Corporation has had under consideration the question of exercising in the near future its powers to purchase so much of the undertakings of the City of London Electric Lighting Co., and of the Charing Cross Electricity Supply Co., as relates to the City. In a report presented to the Court of Common Council by the Streets Committee the opinion was expressed that it would be inexpedient to take any steps in the matter at the present time, and that such rights of purchase should not be exercised in 1914 or 1915.

**Loughborough.**—The T.C. has decided to apply to the L.G.B. for a loan of £10,238, required for extensions necessary through the arrangement to supply current to the Brush Electrical Engineering Co., whose minimum annual consumption will be 1,600,000 units. The total capital outlay will be about £15,000, and the company will provide plant to the value of £4,762, to be paid for by instalments covering a period of 10 years.

**Merthyr Tydfil.**—The Public Works Committee of the T.C. has decided by seven votes to four not to further extend the period for the purchase by the Corporation of the lighting and tramway undertakings for the Merthyr Traction Co.

**Peterboro'.**—The T.C. has decided to fit all the public electric lamps with automatic time switches, at a total estimated cost of £237.

**Preston.**—The Streets and Buildings Committee has been recommended, and has decided, that as an experiment Stanley Street be lighted by metal filament lamps at a cost not exceeding £70.

**Rangoon.**—A correspondent writes that a wealthy resident of Rangoon is bearing the cost of the electrical installation of the famous Shwe Dagon Pagoda, and the work has been undertaken by Messrs. Siemens Bros. Dynamo Works at a cost of Rs. 16,000. A large number of 100-C.P. metal lamps will light up the staircases, and the platform, on which also will be lamps of 2,000 C.P., suspended from steel lattice towers 85 ft. high. There are also four searchlights of 7,000 C.P., which will be used to throw light on the magnificent building itself, rendering it visible for many miles round.

**Rawtenstall.**—A L.G.B. inquiry has been held into the application of the Corporation for sanction to borrow amongst other sums, £7,500 for the extension of the electricity undertaking. In the course of the inquiry the Inspector said he was glad to notice that the Corporation was placing the profits from the electricity undertaking to the reserve fund.

**Stirling.**—The surplus in the Corporation electric lighting department for the year amounted to £526. This sum it has been agreed to add to the reserve fund, which now amounts to £1,815.

The County Council has consented to the T.C. supplying electricity for purposes other than power in the Park Place district.

**San Domingo.**—A contract has been signed by the magistrate of the city of San Domingo and the banker S. Michelena for the formation of an electricity company, styled the Electra Dominica. The share capital of the company is fixed at \$160,000, \$60,000 of which will be subscribed by the city. The company contemplates building a central station, and to supply current for street lighting, private consumption and industrial purposes. The contract is for a period of 50 years, when the entire plant becomes the property of the municipality.—*Elek u. Masch.*

**Tunbridge Wells.**—The accounts of the electricity department for the year ended March last, show a total revenue of £14,867 and £6,793 carried to the net revenue account. Loan contributions, interest, &c., absorbed £5,954, and the balance of £839 was placed to the appropriation account—the reserve fund (amounting to £6,097) benefiting to a small extent. During the year 1,215,330 units were generated, and 896,143 sold, including 247,000 estimated as being supplied to public lamps.

**Whitchurch (Cardiff).**—The electric light undertaking had a deficiency of £419 only, as the result of the first year's working.

**Yarmouth.**—The gross trading profit on the undertaking for the year ended March 31st last amounted to £9,191. Of this amount £702 was written off the cost of new meters, transformers and other works, including part cost of altering the system of public street lighting, which is being charged to revenue; £7,898 applied to interest, sinking fund, rebates and discounts, and £590 added to appropriation account.

## TRAMWAY and RAILWAY NOTES.

**Ardsley (East and West).**—At a recent Council meeting it was resolved to urge on the Wakefield Corporation that the three authorities, namely, Wakefield, Ardsley and Stanley, who were successful in opposing the application of the Wakefield and District Light Railway Co. (part of the West Yorkshire Light Railway Co.) for permission to drop the Ardsley and Stanley extensions, should now take steps to hurry the Light Railway Co. on with the scheme.

**Continental Notes.**—**AUSTRIA.**—The Austrian Ministry of Railways has just granted a concession for the construction of an express electric railway from Vienna to Brunn, a distance of 210 km., which is planned to be covered at the speed of 120 km. an hour. The line is mainly for express passenger traffic—goods and ordinary traffic being separately catered for. The trains will consist of an engine and two passenger coaches, carrying 50 passengers each. Current will be drawn from the Vienna Central municipal power house. The cost of the line is put at 28,000,000 kronen.

**PORTUGAL.**—A Reuter message to the *Financial Times*, referring to the strike on the British-owned tramways of the Lisbon Electric Tramways Co., which has now been in progress since May 29th, shows that the strike has become largely influenced by political considerations. Incitement to riot and intimidation culminated recently in an attack on the British staff, in which we gather that the manager and one employé were injured by stones thrown. The manager, it may be recalled, is Mr. A. S. Giles, formerly electrical engineer at Blackburn. The *Times*, in referring to the matter, says that, since Friday, a number of bombs have been thrown, resulting in death and injuries, and that many arrests have been made.

**SPAIN.**—A serious tramway accident occurred in Madrid last week, when an electric car hauling a trailer was derailed on a curve, the leading car running into a shop and the following one being overturned. About 20 people were injured seriously.

**HOLLAND.**—According to the *Nieuwe Rotterdamse Courant*, application has been made to the Amsterdam municipal authorities for powers to construct a further three sections of electric tramway in that city. It is also proposed to take this opportunity of increasing the Amsterdam tramways rolling stock by the purchase of 50 new electric tramcars, 37 of which would be required for the above-mentioned extensions. The cost of these 50 cars is estimated at £41,666.

**ITALY.**—A concession has been granted to the Neapolitan Tramway Co., authorising the construction of an electric tramway line from the Piazza Santa Caterina to Chiaia, through the Margherita Park, and thence from the Via Tasso to Vomero.—*Board of Trade Journal.*

**Croydon.**—The financial result of the working of the tramways undertaking up to March 31st last, according to the tramway manager's report, was a credit balance of £32,780. The total traffic receipts amounted to £92,539, and other receipts to £1,891, while working expenses came to £61,649. The total gross balance, with bank interest and income-tax on stock, was £33,587. After deducting interest on capital (£8,046), contribution to sinking fund (£7,428), and income-tax (£808), there was a total net balance of £17,304, which is to be disposed of by contributing £8,000 in aid of the rates and £9,304 to the renewals fund. The gross balance is equal to 11.79 per cent. of the capital outlay, and the net balance to 6.07 per cent. Compared with 1910-11, the traffic receipts increased by £6,732, or 7.84 per cent.; miles run increased by 184,890, or 8.14 per cent.; passengers carried by 1,372,654, or 7.04 per cent. Working expenses had decreased by £2,141, or 3.36 per cent. The percentage of working expenses to traffic receipts was 66.62 per cent., or a decrease of 7.73. The gross balance had increased by 37.81 per cent., and the net balance by 104.56 per cent., or £8,845. The number of passengers carried in the year was 20,849,230, an increase of 1,372,654. Through-running arrangements between the Corporation and the South Metropolitan Tramways Co. over the combined lines from West Croydon to Penge and the Crystal Palace, which had been in operation during the year, had resulted in the Corporation receiving the sum of £2,903, the difference in fares collected by both parties, the company having been paid £994 for the excess mileage run. There had been a decrease in the number of through-booking tickets issued by the Corporation and the L.C.C., amounting to 356,248, but the receipts on the Norbury route had increased, compared with 1910-11 by £3,114. Since the L.C.C. tramway extension from Streatham Hill to Norbury was opened, the receipts on the Norbury route, states the tramway manager, had increased by no less than £16,438.

**Finchley.**—The Middlesex C.C. is to be asked to carry out the work of removing and reinstating the tramway centre poles in the Great North Road, at a cost of £3,587, made up as follows:—Alteration to street lighting, £900; alteration to ventilation shafts, £212; new pole, £10; road works, £96; alterations by the Metropolitan Tramways Co., £2,354; painting, £15. It is also agreed that the County Council be asked to continue the present arrangement with the Metropolitan Electric Tramways Co. for all-night lighting at 10s. per pole per annum.

**Gateshead.**—The Gateshead and District Tramway Co. formally inaugurated on the 25th inst. the service of P.A.Y.E. cars on two routes, to Bensham and Saltwell. These are the first cars of the kind to be used in Europe. The promoters of the



system claim that their cars make for the provision of a better service with greater safety, comfort, and convenience to passengers, as those leaving the cars are not brought into contact with entering travellers. The Mayor and Mayoress of Gateshead (Alderman and Mrs. W. J. Costelloe) formally inaugurated the system, the Mayor congratulating the company on its enterprise. Mr. L. C. Huppert, managing director of the International Pay-as-You-Enter Co., said the company he represented had worked the system successfully in 138 different cities, and had now in operation more than 15,000 cars, and wherever introduced they had proved a benefit to the public and an advantage to the operating company. The idea emanated from the brain of a Scotsman, and if there was prejudice in the minds of some people with regard to American methods, the company claimed that they had something which was meritorious, and Gateshead would be known as the first progressive town to inaugurate that system of tramway operation.

**Glasgow.**—The official balance-sheet and accounts of the year's working of the T.C. tramways department has just been issued, and the figures in the principal items of income and expenditure are exactly those which were published in last week's issue of the REVIEW, the surplus being £52,067, against £68,678 a year ago. Some interesting details are provided, it being pointed out that the gross revenue for the year showed an increase of £47,914, compared with that of the previous year, and the average traffic revenue per car-mile had been increased from 10'461d. to 10'561d. The working expenses showed an increase of £49,461, equal to 337d. per car-mile. The increase in the revenue was due to the Exhibition traffic, the prosperous state of trade, and to the comparatively mild weather throughout the winter months. The increase in the working expenses was chiefly in wages, which alone accounted for £28,538; the third-party risk showed an increase of £9,821. It would be observed that the power expenses show a considerable increase over those of the preceding year. This increase was due to the coal strike in the Spring. The net amount of borrowing powers as at May 31st amounted to £2,495,236, but this had been exceeded by £51,686; additional borrowing powers to the extent of £191,498 were applied for in the Corporation provisional order of 1912. On capital account the amount expended up to May 31st, 1912, was £3,532,735, while the balance of tramway debt, owing to the common good, now amounted to £2,546,923. The reserve fund stood at £1,921,361, and the net capital liabilities of the undertaking amounted to £625,562. The only extension during the year was one of 154 yd., but three new sidings had been erected, and the total length of track in operation (measured as single track) was 197 miles, exclusive of depot connections, crossings, sidings, &c. The cars in stock numbered 808, of which 673 were top-covered, while 100 of the converted horse-cars were to be replaced with new cars of the latest type, besides which 50 additional cars are to be constructed.

For years past the Corporation has been in negotiation with the burgh of Clydebank for the erection of bridges capable of carrying tramway traffic over the canal within the latter jurisdiction, and at which the Glasgow system meets that of the Dumbartonshire company—the only hiatus being that caused by the bridges. Clydebank T.C. has approved of a proposal of the Glasgow Committee that the latter Corporation should pay a sum of £11,000 towards the construction of such bridges, the Clydebank authorities to meet any expenditure in excess.

**Lincoln.**—The accounts of the Corporation (G.B. surface contact) Tramways for the year just closed show (for the first time since the electrification) a credit balance of £140. The working costs amounted to 6'05d. per car-mile on the small mileage of 161,897; and the revenue was 9'92d. per car-mile. The car-mileage, it may be mentioned, is the smallest of any municipal tramway in the kingdom.

**London.**—L.C.C.—The report of the Highways Committee on the year's working of the Council's tramway undertaking shows that the system extended over 146½ street miles, including 13½ miles of horse tramways. The total capital expended on the undertaking was £12,193,648 and the debt outstanding £9,658,250. The income during the year amounted to £2,356,181 and the working expenses to £1,421,968, leaving a surplus of £934,212 (the horse lines produced a deficit of £11,966). Debt charges amounted to £703,529, and with other charges made the total to be deducted £711,509, leaving a surplus of £222,703. From the latter the renewals fund benefited to the extent of £135,641 (3d. per c.m.) and the balance of £84,551 was transferred to the general reserve fund, and compares with £103,498 so transferred in the previous year. The renewals fund now amounts to £654,844 and the general reserve to £265,558. Due to the increased rating of the permanent way by local authorities, the operating expenses for electric traction increased from 6'48d. per c.m. in 1910-11 to 6'63d. per c.m. in 1911-12. A total of 533,440,235 passengers were carried and 50,457,812 car-miles were run.

The Committee estimates that the working of the tramways during 1912-13 will result in a gross surplus of £955,105, and after deducting debt charges will leave a net surplus of £200,105 from which it would be possible to place £143,407 to renewals and £56,698 to reserve. The Committee draws attention to the large contributions of the tramways to the rates and to street improvements, and points out the necessity of exercising the utmost caution in dealing with proposals which might adversely affect either the revenue or the expenses of the tramways undertaking. The report also discusses the question of omnibus competition at great length, pointing out the fact that omnibus companies are practically able to pick their routes and traffic, while they pay no rates for the roads used, provide no all-night service, and have no workmen's fares—the latter alone in the case of the tramways being estimated at a loss of £7,000 a year.

According to the *Daily News*, negotiations are still pending between the Omnibus Co. and the Council with a view to arranging an amicable working agreement as to fares and stages.

**Morecambe.**—In moving the adoption of the Tramway Committee's minutes at the meeting of the T.C., Alderman Brown stated that after making inquiries at several places, the Committee had come to the conclusion that it would be a wrong policy to issue yearly tickets. With regard to the balance-sheet of the undertaking, the total income for the year 1911-12 was £9,003, and the working expenses £5,884, leaving a gross profit of £3,208. With the addition of bank interest, there was a sum of £3,278 to be disposed of. Of this amount £1,502 was absorbed by interest and sinking fund, leaving a net profit of £1,776, of which £1,000 was devoted to the relief of the rates and the balance carried to renewals fund, which now stood at £1,116.

**Mountsorrel.**—The ratepayers of this parish have petitioned Leicester T.C. urging the Corporation to consider the question of a railless traction service for the district.

**Newcastle-on-Tyne.**—The Tramways Committee of the Corporation has decided to link up the routes between Chillingham Road and Shields Road, at an estimated cost of £6,000.

**West Hartlepool.**—The T.C. has decided to enter into an agreement with the Hartlepool Tramways Co. to purchase the Seaton Carew section and that part of the Hartlepool section of the system within the borough of West Hartlepool, and to obtain a lease of the lines within the borough of Hartlepool, assuming the latter Corporation does not exercise its option to lease the latter portion. It is stated that the purchase price of the Seaton Carew section, and the portion of the Hartlepool section, is between £44,000 and £45,000. When this agreement is effected the West Hartlepool Corporation will be the owners or lessees of the whole of the tramway system in the two boroughs.

## TELEGRAPH and TELEPHONE NOTES.

**Germany.**—The Swedish long-distance microphones have proved so successful that telephonic communication between Berlin and Stockholm will shortly be opened to the public, and it is hoped that this improvement will eventually enable communication to be established between Berlin and London.

**Marconi Patents in America.**—The Marconi Wireless Telegraph Co. has received information from New York that the Boston Court of Appeals has delivered judgment against the National Electric Signalling Co., with costs. This judgment allows of the immediate transfer of the title of the assets of the United Wireless Telegraph Co. to the Marconi Co., and it is expected that the arrangements for the passing of title will shortly be completed.

**Press Telegrams.**—The Postmaster-General recently stated that the loss incurred by the Post Office on Press telegrams in each of the years 1907-8 and 1908-9 was about £205,000. Later figures are not available at present.

**Radio-Telegraphic Conference.**—At the first business meeting of the Conference it was announced that the British Empire, Italy and Japan had accepted the principle that all messages, and not only those relating to cases of distress, must be accepted by ships from other ships, no matter what system of wireless telegraphy was employed.

Votes have been allotted to the five principal Colonial possessions of the British Empire, in addition to the vote of the United Kingdom; the Colonies and dependencies of other countries have also been accorded votes.

According to figures put forward by the German delegation, 926 ships (apart from warships) have been equipped for wireless telegraphy, and there are 155 coast stations open for public service. The total number of ships equipped is no less than 1,577, and the total number of coast stations, 286.

**Signalling to Trains.**—A demonstration of the Von Kramer system of communicating with trains in motion is to take place at Stratford-on-Avon to-day.

**Reply-paid Telegrams.**—From July 1st the period of validity of reply-paid vouchers issued for inland telegrams is extended to 12 months.

**Wireless Telegraphy.**—According to the ninth supplement of the *Internationalen Verzeichnis der Funkenstationen*, on March 15th last, the following new wireless stations were in operation:—Among coast stations—the station at Colombo in Ceylon; that at Athens, and those at Aranjuez and Vigo—all on the Marconi system; besides the Ingö Rodio and Spitzbergen stations, on the Telefunken system. All these stations work with a normal wave-length of 600 metres, and are open to public traffic.—*Z. f. Schwaachstromtechnik.*

The Liverpool and North Wales Steamship Co. is installing wireless plants in all its boats.



## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" June 21st.

NEW SOUTH WALES.—August 28th. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—October 22nd. Fourteen sections of common battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

**Barlborough (near Chesterfield).**—Construction of tramway, railway siding, &c. Mr. C. Robinson, Westfield Lodge, Barlborough.

**Birkenhead.**—July 8th. Two 750-KW. mixed-pressure steam turbines and D.C. generators, with condensing plant, &c., and nine superheaters and interconnecting steam pipes, for the Corporation. See "Official Notices" June 21st.

**Bradford.**—June 29th. Tramcar equipments, trucks, timber and car fittings, for the Corporation. See "Official Notices" June 14th.

**Bridgend.**—July 9th. 325-KW. steam engine, alternator, and accessories, for the U.D.C. See "Official Notices" to-day.

**Bury.**—Motor tower wagon, for the T.C. General Manager, Tramway Offices, Market Place.

**Chichester.**—Cables, for the Chichester Electric Light and Power Co. See "Official Notices" to-day.

**Derby.**—Steam coal, for the Corporation electricity works. Borough Electrical Engineer, Full Street.

**Dewsbury.**—July 4th. One 1,000-KW. turbine, two 500-KW. D.C. generators, and jet condensing plant for the T.C. See "Official Notices" June 14th.

**Dundalk.**—July 8th. Materials and stores for the U.D.C. Electricity Department. See "Official Notices" to-day.

**London.**—ISLINGTON.—July 24th. One 3,000-KW. steam turbine alternator, with exciter, condensing plant, switch-gear, piping, &c., for the B.C. See "Official Notices" June 14th.

STEPNEY.—July 1st. The Electricity Supply Committee is inviting tenders for meters, demand indicators, time-switches and carbons. See "Official Notices" June 14th.

L.C.C.—July 2nd. Electrical installation at the Old Kent Road special school and divisional offices. See "Official Notices" June 21st.

July 22nd.—The Howard Smith Co., 33, Cornhill, London, E.C., are inviting tenders for the following:—One 350-KW. Rateau mixed pressure turbine; one 350-KW. three-phase alternator; one surface condensing plant, together with electrically-driven pumps; two 30 ft. x 8 ft. 3 in. Lancashire boilers. Specifications and forms of tender on application.

**Manchester.**—June 28th. Traction feeder cables and two years' supply of transformers, D.C. and A.C. motor starting switches, time switches and clock-controlled circuit-breakers, D.C. and A.C. motors, and meters, for the Corporation. See "Official Notices" June 14th.

July 9th.—Corporation Tramways. (a) Tramcar trucks; and (b) Motors and controllers for tramcars. Mr. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

**Neath.**—July 4th. Overhead and underground high-tension cables and transformer pillars, for the R.D.C. See "Official Notices" June 21st.

**Newcastle-upon-Tyne.**—June 28th. Nine-ton electrically-driven crane for the Tyne Improvement Commission. See last issue.

**Rotherham.**—July 8th. (a) Tramway stores and materials for a year for the T.C., and (b) Electricity meters. (a) Tramways manager; (b) Borough electrical engineer.

July 8th.—Smudge or pea nuts for a year for the Corporation electricity works; Borough Electrical Engineer.

**Salford.**—July 25th. Electric light, telephone and fire alarm installations at the Union Infirmary, Hope, Pendleton, for the B.G. See "Official Notices" to-day.

**South Africa.**—PIETERMARITZBURG.—July 29th. One steam turbine with tandem generators, switchboard and condensing plant for the Corporation.—*South African Mining Journal*.

**Spain.**—July 2nd. The municipal authorities of Ovildo are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

July 3rd.—The municipal authorities of Cartagena (province of Murcia) are inviting tenders for the concession for the electric lighting of the town during a period of 20 years.

**Stoke-on-Trent.**—Coal and slack for a year, for the four electricity works of the T.C. Chief Electrical Engineer, St. Peter's Chambers, Glebe Street, Stoke.

**Weymouth.**—July 1st. Small steam coal, for the Corporation electricity works. Mr. H. A. Huxtable, Town Clerk.

**Workshop.**—July 3rd. Battery switchboard and cast-iron exhaust pipes, for the U.D.C. See "Official Notices" June 14th.

### CLOSED.

**Ashford (Kent).**—The South-Eastern and Chatham Railway Co. has accepted the tender of Messrs. Tyler & Freeman for the electrical equipment of the railway works at Ashford.

**Belgium.**—Eight concerns—one Belgian, six German and one Austrian—submitted tenders last week for the supply and laying of telephone cables in the Courtrai district, the lowest being that of the Société des Ateliers de Constructions Electriques, of Charleroi.

**Brighton.**—The T.C. has accepted the tender of Messrs. W. Cory & Son, Ltd., for from 20,000 to 24,000 tons of washed nuts, for Southwick power station, at 15s. 9d. per ton.

**Epsom.**—The U.D.C. has accepted the tender of Messrs. Pritchetts & Gold, to maintain the storage battery at the electricity works for 10 years, at £80-a year.

**Erith.**—For the supply of 1,200 yd. of .075 sq. in. cable and 650 yd. of .100 sq. in. cable, the U.D.C. received the following tenders:—

Callender's Cable and Construction Co., Ltd.	(accepted)	£382	and	£253
Western Electric Co.	.. .. .	891	"	259
Henley's Telegraph Works Co., Ltd.	.. .. .	389	"	258
Siemens Bros.	.. .. .	389	"	259
Johnson & Phillips, Ltd.	.. .. .	387	"	257

**Glasgow.**—The Tramways Committee recommends acceptance of the following tenders:—

Piping and valves for turbo-alternator for Pinkston.—Babcock & Wilcox.  
 Controllers.—British Thomson-Houston Co., Ltd.  
 Block tin.—T. B. Campbell & Son, Ltd.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

#### ADMIRALTY, CONTRACT DEPT.

X-ray apparatus.—Henry W. Cox & Co., Ltd.

#### WAR OFFICE.

Electric cable.—British Insulated & Helsby Cables, Ltd., Hooper's Telegraph and India-Rubber Works, Ltd., London Electric Wire Co. and Smiths, Ltd., and Siemens Bros. & Co., Ltd.  
 Installation of electric light, Central Flying School, Salisbury Plain.—Foote & Milne, Ltd.

#### INDIA OFFICE, STORE DEPT.

Insulators.—Bullers, Ltd.  
 Motors.—Electromotors, Ltd., Lancashire Dynamo and Motor Co.

#### CROWN AGENTS FOR THE COLONIES.

"Lux" cells.—Chloride Electrical Storage Co., Ltd.  
 Telegraph poles.—Siemens Bros. & Co., Ltd.

#### GENERAL POST OFFICE.

Telephonic apparatus.—British Insulated & Helsby Cables, Ltd., C. Macintosh & Co., Ltd., Peel-Conner Telephone Works, Ltd., and Siemens Bros. & Co., Ltd.  
 Telephonic cables.—Callender's Cable & Construction Co., Ltd., and Johnson & Phillips, Ltd.  
 Dry cells.—Siemens Bros. & Co., Ltd.  
 Insulator spindles.—T. W. Lench, Ltd.  
 Two electric lifts at Eastbourne new Post Office.—R. Waygood & Co., Ltd.  
 Telephone exchange equipment, Pontypriid.—Peel-Conner Telephone Works, Ltd.

**Hull.**—The B. of G. has accepted the tender of the City Electrical Installation Co. for the supply of electric requirements for six months.

**Llandaff and Dinas Powis.**—The Council has accepted the tender of Messrs. Ellis & Ward for the construction of an overhead line at Whitchurch, at £229.

**London.**—L.C.C.—The Highways Committee received the following tenders for 7,000 gallons of machinery oil for use at the Greenwich generating station:—

	Per ton.
Vacuum Oil Co., Ltd.	£8 8 0
Charles Price & Co.	8 12 6
Stern Sonneborn Oil Co., Ltd.	9 5 0
Matthew Wells & Co.	10 0 0
Price's Patent Candle Co., Ltd.	10 5 0
W. B. Dick & Co., Ltd.	11 10 0
Spurrier, Glazebrook & Co., Ltd.	11 10 0
C. C. Wakefield & Co.	12 0 0
Snowdon, Sons & Co., Ltd.	12 10 0
John A. Brenner & Co.	13 10 0



With the exception of the contractors for last year (Matthew Wells & Co.), each of the firms forwarded samples of oil to the chemist for analysis. The Committee say that they are advised that the sample of oil supplied by the second lowest tenderer is better suited to the Council's particular purpose than that supplied by the lowest tenderer.

The Main Drainage Committee received the following tenders for three gas engines, required for completing the equipment of the Falcon Brook pumping station:—

Campbell Gas Engine Co., Ltd.	.. .. . (recommended)	£5,680
Swiss Locomotive and Machine Works, Winterthur	..	6,818
Browett, Lindley & Co., Ltd.	..	8,524
British Westinghouse Electric and Manufacturing Co.	..	9,620
"	(alternative)	6,150

**HAMMERSMITH.**—It is proposed to alter the crane at the Chancellor's Wharf and to attach to it one of Priestman's grabs to enable the Electricity Department to deal more expeditiously with the handling of coal delivered at the wharf for use at the electricity works. The cost will be £120 10s.

**POPULAR.**—The B.C. has accepted the tender of Messrs. G. & J. Weir for the provision of a steam-driven boiler feed pump, with a speed of 6,200 R.P.M., at the generating station. Other tenders received were:—

A.E.G. Electrical Co.	.. .. .	£230
W. H. Allen, Son & Co.	.. .. .	247
Belliss & Morecom	.. .. .	250
British Electrical Plant Co.	.. .. .	277
"	(alternative)	326
British Westinghouse Co., Ltd.	.. .. .	320
British Thomson-Houston Co.	.. .. .	322
Jens Orten Boving	.. .. .	365

The following tenders were also received for vertical pumps, but these, according to the engineer, were not suitable:—

J. P. Hall & Sons	.. .. .	£205
"	(alternative)	254
F. Friedenthal	.. .. .	240
Caird & Rayner	.. .. .	249
Storey & Sons	.. .. .	315

**STEPNEY.**—By the recently arranged-for conversion into alternators of two double-current turbine-driven sets, the Council is enabled to dispose of the generators attached thereto and a spare armature and coils. The offers received for the purchase of these from the Council were as under:—

	A. Brown and Sons.	J. G. Sneath.	C. Parsons and Co.
Lot 1.—Two generators of No. 2 turbine	£310	£290	£284
Lot 2.—Two generators of No. 1 turbine	310	290	284
One armature	42	40	40
Total	£662	£620	£598
One set field coils	per ton £78	£55	£50

The Conditions of Sale anticipate that the first two machines (lot 1) will be released before the end of June, 1912, and the second two machines, spare armature and field coils (lot 2) by about the end of August, and guard the Council in case the work of converting the two double-current turbine-driven sets should not be completed by the contract time by reserving to the Council the right to cancel lot 2 if required for supply purposes during the ensuing winter.

It is proposed to accept the tender of Messrs. A. Brown & Sons.

**STOKE NEWINGTON.**—The B.C. has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., at £1,720, for additional converting plant at the Edward's Lane transformer station, required in order to cope with increasing demands.

**Norwich.**—The T.C. has accepted the tender of Messrs. Whipp & Bourne for four feeder panels, at £185.

**Plymouth.**—The T.C. has accepted the tender of Messrs. W. G. Heath & Co. for wiring the wholesale meat market for the electric light and providing electric fans, at £68.

**Royal Mail Steam Packet Co.**—This company has again placed a contract with Messrs. Siemens Bros. Dynamo Works, Ltd., for the sole supply of metal-filament lamps for the ensuing 12 months. The lamps to be supplied are tantalum drawn-wire lamps, and they are to be used for all purposes, including ship and office lighting.

**South Africa.**—The Department of Posts and Telegraphs has accepted the tender of the British General Electric Co. for 100 Edison Lalande cells, and 250 sets of renewals for ditto, at £157.—*South African Mining Journal.*

**Southend-on-Sea.**—The E.L. Committee has accepted the tender of Messrs. S. Stone & Co. for band-sawing, screw-cutting, and vertical drilling machines, for the electricity works.

**Taunton.**—The T.C. has accepted the tender of Messrs. Newtons, Ltd., for a 15-H.P. motor for driving the induced draught fan, at £56.

**Trim.**—The contract for the electric lighting of the Union Buildings has been placed with Messrs. F. Carr & Co., of Belfast and Dublin. The plant includes a Hornsby oil engine, accumulators, &c. Specifications were prepared by Mr. A. E. Porte, of Dublin.

**West Ham.**—The T.C. has accepted the tender of Messrs. E. Newbald & Co., at £150, for the installation of electric light at the Education Offices extension. The following tenders have also been accepted for carrying out works at the generating station:—Messrs. J. Garret & Son, construction of coal wharf bunker, £3,158; Messrs. J. & E. Spencer, supply of hot-wells.

**Yarmouth.**—The T.C. has accepted the following tenders for annual supplies, except where otherwise stated:—

British Thomson-Houston Co., Ltd.—Dry batteries.	.. .. .
British Electric & Manufacturing Co.—Lampholders and cable.	.. .. .
Brush Electrical Engineering Co., Ltd.—Armature coils (three years).	.. .. .

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, June 28th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "Hysteresis Loss as affected by Previous Magnetic History," by Prof. Ernest Wilson and Messrs. B. C. Clayton and A. E. Power; "The Efficiency of Generation of High-frequency Oscillations by Means of an Induction Coil and Ordinary Spark Gap," by Prof. G. W. O. Howe and Mr. J. D. Peattie; "Dielectric Hysteresis at Low Frequencies," by Prof. W. M. Thornton; and "Self-Demagnetization of Steel," by Messrs. S. W. J. Smith and J. Guild.

**Tramways and Light Railways Association.**—Friday, June 28th. Annual Congress at Swansea, last day.

**Faraday Society.**—Tuesday, July 2nd. At 8 p.m. At the I.E.E. Annual general meeting, followed by an ordinary meeting. Papers on "Electrocapillary Pulsation of a Mercury Meniscus," by Messrs. A. P. Roddestwensky and W. C. McC Lewis; and "On the Variation of the Conductivity of Aluminium Anode Films with Temperature," by Mr. G. E. Bairsto.

**Association of Engineers-in-Charge.**—Saturday, July 26th. At 7.30 p.m. At the St. Bride's Institute, E.C. Discussion on "Condensers: Their Construction and Efficiency."

## NOTES.

**Fatalities.**—A verdict of "Accidental death" was returned at an inquest on the body of Harry Gillis, pit labourer, who was killed on the 11th inst. by an electric coal-cutting machine at the Wharnccliffe Silkstone Colliery, Barnsley. It was stated that new rules had been framed, whereby an earth wire should have been attached to the machine, but these could not be put into operation for some time, owing to its being necessary to complete other work in connection with the new rules. A Government Inspector of Electricity in Mines said that he thought the management of the colliery had had ample time to comply with the new regulations, and if they had done so the accident would not have occurred.

A terrible accident occurred at Cawthorne to a lineman named Bell, in the employ of the Yorkshire Electric Power Co. Three linemen were engaged on the work of increasing the capacity of an overhead line (10,000 volts). The foreman received word that No. 1 was dead, and instructed Bell to earth it. Bell, ignoring Rule 4 of the company's regulations—that a sling chain should be first thrown over the line before the work of earthing the cable was commenced, climbed the pole, and when standing on the outrigger slightly overbalanced, his wrist coming in contact with the line, which was alive, due to some mistake in switching. Bell was killed instantly; his wrist was burnt through, and his hand fell to the ground. His body fell soon afterwards. At the inquest a verdict of "Accidental death" was given.

A South African paper reports that a young man named Kingston was killed at the New Rietfontein Mine on June 1st. He was working underground, and while sitting on a ledge in No. 2 shaft, overbalanced and seized a live wire to prevent himself falling down the shaft. He gave one piercing scream for help, and a native rushed to his rescue. Kingston went out from England eight months ago.

At the tramway sheds at Johannesburg early this month a young electrician named W. Dunlop fell from the top of a tramcar, and sustained injuries from which he died. He had mounted the roof in order to "clear" the wires. It is thought that he must have reversed the pole, and then tripped on the canvas ridge on the roof of the car, with the result that he fell backwards on to the edge of the pit below.

**Smoke Nuisance.**—Last week the Bromley Electric Light and Power Co., Ltd., was summoned for black smoke nuisance in May. The secretary of the company said that they had had to use some rather dirty coal, owing to the coal strike. An order of prohibition was made, with ordinary costs.

**Installation Contractors in Germany.**—The varied interests of installation contractors in Germany formed the subject of discussion at the tenth annual conference of the Verband der Elektrotechnischen Installations Firmen, which was held at Frankfurt-on-Main on June 17th and 18th in the presence of representatives of other German electrical and engineering associations and of delegates from friendly associations in Austria and Switzerland. During the course of a sketch of the history of the Verband since its formation in 1902, Mr. G. Montanus, the president, expressed the opinion that the introduction of the tax on illuminating appliances had caused immense injury to the installation branch, and business in glow lamps had become almost entirely unprofitable. Prof. Epstein, who presented a paper on the requirements demanded of contractors, states that the large firms still participate to a large extent in the orders and deliveries in the installation department. The supply works require special technical knowledge on the part of the installation firms, although it is possible for the latter to work without coming into conflict with the former. In any case, the supply works are able to exercise an educational influence on the contractors. The relationship between contractors and manufacturers frequently suffers from the circumstance that the latter will not agree to a better standardisation of materials. Yet it is considered that the manufacturer has a great interest in contractors becoming acquainted with his materials and machinery to a far-reaching extent. As far as education is concerned, the author remarks that both technical and commercial skill are needed for accurate and valuable work. The trade continuation schools are certainly able to provide a good finishing education, but young men cease attending at the age of 18 because they are unable to get away from



work for long, and they are too tired for mental work in the evening hours. In this respect, ways and means must be found for assuring to young installation workers a fundamental and good theoretical finishing education, as well as workshop training. The question of education was also discussed in a paper by Mr. Hohnhof, the secretary of the association, who contends that the period for the instruction of apprentices should be extended to four years, although it is admitted that no prospects exist of this being carried out at present. Special courses by experts in the installation branch are held to be desirable. Efforts have been put forth to prevent such courses being operative for too short a period, or the creation of bunglers in consequence of inadequate finishing training. Trade schools for installation work are desired in larger numbers, especially as good results have attended the new school at Cologne. Messrs. Nolzen & Baumann, who raised the subject of the regulations of electricity supply works, state that it has been found that the best way to keep unsuitable forces at a distance and to satisfy the requirements of the works is by means of a friendly understanding between the district branches of the Association and the works. A friendly reception is, however, not accorded to the branches by all supply works, particularly in the case of private works. It is held that efforts should be made to bring about a simplification of the conditions under which contractors are permitted to carry out installations for connection to distributing mains. The labour problem was also brought forward by Mr. Hohnhof, who reports that as a result of the experience gained in four towns where strikes took place last year, new and definite instructions have been arranged in the case of strikes. Negotiations in respect of workmen's wages are in future not to be undertaken through the Metal Workers' Union, but directly with the workers, and minimum rates of wages will not be agreed to. The members of the Association, on the presentation of workmen's demands, are in all cases to make a correct examination as to whether the labour and wage conditions are capable of improvement, and it is considered desirable that the negotiations should be made public for general enlightenment. The question of overland central stations, and the monopolistic endeavours of the manufacturing industry, was raised in a further paper, which, after referring to the petitions addressed to the Imperial Government on the subject, submits that the results attending the issue of Government instructions have been satisfactory on the whole. Nevertheless, great improvements are necessary in the matter of contract competitions, and it is held that the various Governments can still do good work in this direction, in so far as the communes or the State come into consideration. The final paper was presented by Mr. Kuckuk, who points out that whilst employment is declared to be good, installation firms state that they are not earning any profits. This fact has led to the wish for the establishment of standards for the improvement of prices. As a consequence, the author submits that the management of the association should endeavour to make arrangements with the large firms on a definite basis. The price-forming factors are very varied, and the district branches of the association should first prepare local lists for price arrangements, and from these a committee on prices could calculate standards for the whole area covered by the association. During the discussions, sound proposals were made with the object of securing uniform prices, and the fact that such prices already existed in some localities was adduced in order to show that an arrangement in this respect was not impossible.

**Institution Notes.—IRON AND STEEL INSTITUTE.**—The autumn meeting is to be held at Leeds from September 30th to October 4th. A provisional programme has been issued by the secretary, Mr. G. C. Lloyd.

**INSTITUTION OF CIVIL ENGINEERS.**—The annual conversazione was held on Thursday last week at the Albert Hall, when Dr. Unwin, F.R.S., the President, with other members of the Council, received the guests.

**Factory Steam Whistles.**—Action is being taken by the U.D.C. at Acton respecting the noise occasioned by the use of steam whistles at large factories in the Vale, and the clerk has communicated thereon with Messrs. D. Napier & Son, Ltd., Messrs. Eastman & Son, and Messrs. W. and G. du Cros, Ltd. Messrs. Napier & Son replied that they had given instructions that their steam whistle was not to be blown for more than ten seconds, and they trusted that this would mitigate any annoyance. It was, however, necessary for them to use a steam whistle, and, as the Council was aware, their use was universal in all large factories. Mr. E. Monson, J.P., had informed the clerk that he, as a resident in the locality, had cause for complaint, and he requested that steps be taken by the Council for the discontinuance altogether of the use of this means of summoning workmen. The Council has referred the subject to the Works Committee with a view to considering the prohibition of the use of steam whistles throughout the district.

**The Lot's Road Appeal.**—The appeal of the British Westinghouse Co. in the case between themselves and the Underground Electric Railways Co., of London, respecting the turbo-plant at Lot's Road power station came before the House of Lords on June 21st. At the conclusion of Tuesday's sitting the hearing was adjourned to yesterday (Thursday).

**Appointments Vacant.**—The L.C.C. Education Committee has recommended the Council to appoint from September next a full-time head of the Physics and Electrical Engineering Department at the Hackney Institute, at a salary of £260, rising by annual increments of £20, to £300. Shift engineer, for the Borough Electricity Department, Rawtenstall (80s.). See our advertisement pages to-day.

**Localising Ore Deposits.**—The problem of finding hidden bodies of ore with the aid of electricity, which was attacked by Daft and Williams with results fully described in our pages in 1903, has again been brought under discussion by Messrs. Löwy and Leinbach, and by Mr. O. Trüstedt, who claims indeed to have suggested the use of electric waves as long ago as 1901. The method put forward by Mr. Trüstedt is based upon the fact that Hertzian waves are reflected from the surface of a conducting body. He proposes to transmit such waves in a definite direction into the ground, and to seek for their emergence with a similarly directed coherer. If the waves are thus found to be reflected, the reflecting surface will be found, of course, at the point of intersection of the directions of the transmitted and reflected waves, which are easily determined. Water-bearing strata might, and probably would, prove as good reflectors as ore bodies, and it remains to be proved whether the method is of any practical value.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The salaries of Mr. J. H. EADES, senior draughtsman in the mains department of the West Ham undertaking, and of Mr. W. BRIDGER and Mr. H. W. PUTTICK, assistant engineers in charge at the generating station, are to be advanced.

The Stirling T.C., on the recommendation of its Lighting Committee, has increased the salary of the burgh electrical engineer, by £35, making it £260 per annum.

The Rochdale Electricity Committee has received a recommendation from the works sub-committee, in favour of an advance of the salary of Mr. ATCHISON, the electrical engineer, by £50 per annum, raising it from £400 to £450. He has been manager of the electricity works since 1900.

The Taunton T.C. has increased the salary of the electrical engineer, Mr. A. J. HOWARD, from £200 to £250 as from April 1st, with a further increase to £300 a year hence, if the accounts of the undertaking for the year ending March 31st, 1913, are as favourable as those for the previous year.

**Tramway Officials.**—The Tramways Committee of the Exeter T.C. has recommended that the salary of the manager be increased from £160 to £200 per annum by four annual increments of £10.

At Holy Trinity Church, Bingley (Yorks.), on June 19th, the marriage took place of Mr. HORACE I. PALMER, assistant manager of the Liverpool Corporation Tramways, and Miss Lydia A. Atkinson, eldest daughter of Mr. R. Atkinson, of Prospect House, Bingley.

**General.**—Mr. H. R. MOTT, M.I.E.E., has been appointed electrical engineer and electric inspector under the City of London Electric Lighting Orders, to the Corporation of London. Mr. A. ROBERTS has been appointed as meter testing and chief assistant.

MESSRS. F. C. POULTON & Co, Eccles, Manchester, are the consulting engineers to the Ambajee Taranga Railway Co., Ltd., and their Mr. Williamson is now on his way to Bombay, relative to proposed extensions of the original scheme.

Mr. S. L. BENTLEY, Northern representative of the Electrical Power Storage Co., has resigned after 12 years' service. He was elected in 1900 member of the "International Society of French Electrical Engineers," after studying at the Technical Schools of Buda Pesth, Zürich and Paris. He informs us that he intends to take up inter-Continental agency work.

Mr. W. H. ROWE, for many years with the Edison & Swan United Electric Light Co., Ltd., as their South London representative, and lately engineer and representative to E.M.F., Ltd., has resigned his position with the latter firm, and is, we understand, open to consider the representation of an electrical firm.

Messrs. P. C. Crews and S. Handford (Crews & Handford, consulting engineers) have dissolved partnership, the share of the latter being purchased by the former. The business will in future be carried on by Mr. CREWS under his own name, at Clarence Chambers, Piccadilly, Manchester.

**Obituary.**—The death has occurred of Mr. R. H. MEASURES, late managing director of Measures, Ltd., who was last year sentenced to a term of imprisonment. Deceased, who was 73 years of age, underwent an operation in London on Sunday, but he passed away on Monday.

The death has taken place, at the age of 85 years, of Mr. W. B. BEYNON, principal of the firm of Beynon & Son, electrical engineers, of Fleet Street, Torquay. Deceased was one of the best known commercial men of the town.

**Globe Electric Co., Ltd. (in liq.).**—The adjourned meeting of creditors is to be held at Cannon Street Hotel on Tuesday next, July 2nd, at 12 o'clock noon.



## CITY NOTES.

## Aron Electricity Meter, Ltd.

THE annual meeting was held on Tuesday at Winchester House, E.C., Colonel R. E. Crompton presiding, in the absence of Mr. H. Hirst through illness.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 1017), said the figures in the balance-sheet spoke for themselves. The net profits had risen from £27,520 to £30,542, representing an increase of over 10 per cent. The rate of dividend for both classes of shares was the same as last year. They were in the fortunate position of being able to put to the reserve against goodwill and patents the sum of £10,000 instead of £5,000, as last year, thus raising that reserve to £40,000. After this generous provision there was still sufficient left to clear off the remainder of the expenses incurred by the debenture issue of 1911. The special feature of last year's trading was the severe drop in selling prices. They had made every effort to counteract this tendency by trying to cheapen production, by economy in administration and by increasing the sales of their instruments. That they had been successful was proved by the year's results. In conclusion, he could only express the hope that they had many equally or even more satisfactory years in front of them. He would like to take the opportunity of once more thanking Prof. Aron and his loyal staff for the intelligence and determination with which they treated the many difficult problems that had to be overcome during the past year. The speaker also alluded to the splendid work done for the company by its chairman (Mr. Hirst).

MR. ROGER W. WALLACE, K.C., in seconding the motion, said he had just returned from a visit to the Continent, and he was glad to say that the prospects of the company abroad continued to be everything that could be desired, and to promise in the future still greater returns, especially in Austria, where the work was going on in a wonderfully successful manner. The name of Dr. Aron was a tower of strength to the company. The personal element in the concern contributed very largely to the enormous sale of meters throughout the Continent. Dr. Aron was not so well known in this country, but he was getting better known day by day, and he hoped that the sale of their meters here would soon equal those they had abroad.

MR. WIMP remarked that the balance of profit available for dividend on the ordinary shares amounted to 18 per cent., including the amount carried to reserve and the writing-off of the cost of the debenture issue last year. While he agreed that it was sound finance to clear the debenture issue expenses out of the way, when they remembered that the preference shareholders had always had their pound of flesh and that the arrears of commission and directors' fees had been paid, he hoped that next year the board would see their way to take into consideration the claims of the ordinary shareholders.

The CHAIRMAN, in reply, said he thought a conservative policy was the best. They wished to put the company in an unassailable condition by building up the reserve. He himself was a considerable holder of ordinary shares, and they would all like to have large dividends, but he thought it was preferable to have their property increasing in value, which would be reflected in the price of the ordinary shares in the market.

The report was adopted.

## Edmundson's Electricity Corporation, Ltd.

A LARGELY attended meeting of shareholders was held on Tuesday at Salisbury House, under the chairmanship of Mr. P. D. Tuckett, for the purpose of considering a series of resolutions for the reduction of the capital of the company from £800,000 to £640,000, and also for altering the articles of association in various respects.

The CHAIRMAN said the meeting had been called to deal with a situation which had existed ever since the reconstitution of the board four years ago, and which was not dealt with then, not because they had any hope of avoiding a reduction of capital, but simply because they hoped to avoid, as in the event he was glad to say they had avoided, the excessive sacrifices on the part of both preference and ordinary shareholders which any scheme of reorganisation must necessarily have involved at that time. To-day, thanks to the marked progress which had been made in the profitable development of the business during the past four years, they were able to look forward to the future with sufficient confidence to justify an immediate resumption of dividends, and they accordingly felt that the time had now arrived for submitting a scheme for the approval of the shareholders. He would briefly explain some of the considerations which guided the board in arriving at the conclusions to which they had come. Taking, first, the capital position, there would be no question that, in spite of the improvement which had taken place, the figure at which their investments stood in the balance-sheet was still very seriously in excess not only of their present value, but also of the value which they were likely to command within any reasonable period. They estimated the permanent loss of value at £500,000. Under these circumstances, most of them would agree that it was very much better, in the interests of preference and ordinary shareholders alike, that they should put themselves in a position to resume the payment of dividends by lopping off the dead capital rather than indefinitely postpone the payment of dividends until such capital had been made good in the only way in which it could be made good, viz., out of revenue; and that being so, they would equally agree that the loss should be borne exclusively by the ordinary shareholders, this, fortunately, being rendered possible by the fact that they had reserves of approximately £340,000, which, with the £180,000, by which it

was proposed to reduce the ordinary share capital, made up the figure of £500,000. Coming next to the revenue position as it affected the preference shareholders, they found themselves with the prospect of having approximately £12,000 of distributable profits available for the current year. The reason they regarded no more than £12,000 as being available for distribution was because they were determined to safeguard and secure the position of the preference shareholders, as during the past four years that of the debenture stockholders had been secured, and if they were to rely substantially on their trading profits, which to a large extent were represented by the paper of the subsidiary companies in which they held the whole or the greater portion of the ordinary share capital, they would simply be inviting a repetition of the difficulties in which the company found itself involved four years ago. This £12,000 would suffice to pay a 6 per cent. dividend on £200,000 of capital, so that the most convenient and advantageous arrangement appeared to be to split the existing £400,000 of preference share capital into two amounts of £200,000, one carrying a 6 per cent. cumulative preferential dividend, the other a 6 per cent. preferential dividend temporarily non-cumulative until they were in a position to pay the full dividend on the entire amount. This would result in the preference shareholders having half their present holding with the dividend assured, and consequently in a form in which it should immediately command a good price, whilst the other half would, he hoped, receive a steadily advancing dividend year by year. This splitting arrangement would thus afford any shareholder who, during the next few years, had occasion to realise part of his holding, the opportunity of choosing between the half with the more assured and the half with the less assured dividend prospects, and they were advised that this choice would tend slightly to enhance the market value of the dividend as compared with the existing undivided shares. They had no doubt of their ability to maintain the cumulative dividend, and as soon as the scheme had received their approval and that of the Court, they proposed to pay an interim dividend on the cumulative preference shares. With reference to the sacrifice which the preference shareholders were asked to make in temporarily abandoning their cumulative rights in respect of half the preferential dividend, he could only say that force of circumstances rendered it inevitable, since it was obviously impossible to pay away profits which unfortunately did not exist, and almost equally impossible to contemplate a scheme of reorganisation under which arrears of dividend would immediately begin to accumulate. They proposed to pay and to continue to pay the preference shareholders the whole of the available profits up to the full £24,000 a year, and they could do no more. With reference to the existing arrears of cumulative dividend, it seemed to them to be very much better to cancel these and to give the preference shareholders a permanent participation in the profits beyond the £24,000 per annum to which they were at present entitled, rather than to attempt to deal with the situation by issuing funded dividend certificates. The extra dividend arrangement afforded a far cleaner and simpler method of satisfying the claims of the preference shareholders, whilst the net result to them was for all practical purposes the same. As this cancellation of the arrears of dividend was the one feature of the scheme to which he foresaw that some of the preference shareholders were likely to take exception, he would invite their particular attention to the following considerations. In the first place, he asked them to remember that the arrears of dividend existed at all, simply because in their interests they found it desirable to postpone the readjustment of the position until now. Had it been dealt with four years ago, not only would there have been no question of any arrears of dividend, but there was every probability that they would have been called upon to sacrifice either the whole or a portion of their preferential capital rights. At that time the position of the company was as grave and critical as it well could be, so that in spite of the disappointment of the last few years, a disappointment shared to the full by the ordinary shareholders who had lost both capital and dividends, he thought they might well derive some consolation from the fact that they were now able to present a scheme which left them with all their original rights ultimately intact, and with the prospect of having an additional 1 per cent. added to their dividend. In the next place, he would warn them not to be misled into supposing that the figure of £132,000 represented 132,000 sovereigns. If it represented 132,000 shillings, that was probably as high a value as could fairly be put upon it at the present time, having regard to the fact that it was only payable out of future profits after making good lost capital, after paying the current preferential dividend in full, and after satisfying the arrears of dividend which would have accumulated between now and then, were the dividends, which they now proposed to resume, to be indefinitely withheld. Moreover, any value which attached to the arrears, equally attached to the extra dividend, and would be reflected in the price of the shares, since in both cases it was equally dependent on the same future profits. He knew it was in human nature to prefer to handle a piece of printed paper with so many pounds, shillings and pence inscribed on it, but if the actual value of that paper was no more than the value which was represented by the extra dividend, then the preference lacked any valid basis, so that if they were right in believing that the permanent addition to the preference dividend of an extra 4 per cent. for every 1 per cent. paid on the ordinary up to a maximum of 7 per cent. more than represented the value of the arrears, then it was a fair equivalent for the immediate sacrifices they were asked to make. However sacred they might consider the rights of preference shareholders, practical considerations compelled them to recognise that where a company was in the unfortunate position in which they found themselves, some sacrifice on the part



of the preference shareholders was inevitable if the position was to be adjusted for their benefit equally with that of the ordinary shareholders, and during the next few years primarily for their benefit. No one questioned the right of the preference shareholders to be paid their arrears of cumulative dividend before the ordinary shareholders were entitled to participate in the distribution of profits, but under the circumstances with which they were confronted, he more than questioned the wisdom of their adhering to their strict legal rights. Were they to do so, instead of enjoying the prospect of an immediate resumption of dividends, they would be depriving themselves of any hope of a dividend for many years to come. Not only so, but probably for some years they should see the price of their shares standing lower than it did to-day, instead of at the premium at which he fully expected to see them stand some five or six years hence. He knew it was impracticable to expect everyone to see eye to eye on questions of this kind where an infinite variety of possibilities of adjustment presented themselves, but although they might not have succeeded in reconciling every point of view, he was glad to say they had received a very large measure of support from preference and ordinary shareholders alike, and he, therefore, sincerely hoped that in their interests, as well as in those of the company, they would see their way to adopt the scheme with comparative unanimity.

MR. GRIPPER seconded the resolutions for the reduction of the capital, and they were put to the meeting, and carried unanimously, amidst loud applause.

The CHAIRMAN then dealt with the resolutions for the alteration of the articles of association, and said he had received suggestions of disapproval of the proposal to empower the directors to issue shares at a commission of 25 per cent. The provision was put in by their legal advisers, and the board were quite satisfied to substitute 10 per cent. Then there was an objection to the addition of words to Article 94, which would exclude the provision as to the directors being prohibited from voting in regard to any contract by which the directors made advances to the company, or subscribed for or underwrote shares. If the shareholders did not want the addition, the board did not mind, but if they did not have it, it would preclude the directors from advancing money at any time it might be needed. Then there was the article fixing the remuneration of the directors at £1,200 a year, with the further proviso that after 5 per cent. was paid on the ordinary shares, the directors should receive 10 per cent. of the surplus profits. Seeing that they had to control a capital of something like £3,000,000, and that they practically administered 30 companies, he thought they were entitled to receive a larger remuneration than at present.

MR. SWINTON seconded the motion.

MR. HITCHIN doubted if the directors would be wise to tie their hands by substituting 10 per cent. for the 25 per cent. in the resolution.

MR. BINGHAM and MR. HEDGES spoke at some length, and suggested that the chairman should receive higher remuneration than the other directors.

The CHAIRMAN said the other directors had intimated that he would receive £500 a year.

The resolutions were then carried.

A SHAREHOLDER asked if the chairman could give any idea when the ordinary shareholders would get a dividend.

The CHAIRMAN said he could guess, but it would only be a guess.

The SHAREHOLDER: Give your guess.

The CHAIRMAN said he thought he had better not commit himself. He would be surprised if they did not see a steady improvement in the position. It would not seem very rapid at first, because until the Urban Electricity Corporation were in a position to resume the payment of a dividend on their ordinary shares, the profit would not come through to them.

At a subsequent meeting of the preference shareholders, the resolutions were carried unanimously.

**Continental.**—BELGIUM.—The report of the Antwerp Telephone and Electrical Works, of Antwerp, for the last financial year, shows a loss of £7,081.

GERMANY.—Elektrolight, Spezialfabrik für Moderne Illuminationen und Reklame Beleuchtung G.m.b.H., Berlin, is the style of a company formed to take over all the patent rights of the Engineer Otto Weber, dealing with glow-lamp and other illumination arrangements for advertising purposes; also the manufacture of the same. The granting of patent licences can only be effected with the agreement of the societies. The capital is 55,000 marks; Eng. Otto Weber is the managing director.

**Cleveland and Durham County Electric Power Co., Ltd.**—The report states (says the *Financier*) that after deducting debenture interest, the accounts for 1911 show a profit, including £194 brought forward, of £13,776, from which the directors have declared a dividend of 2½ per cent., as compared with 2½ per cent. for 1910, leaving £528 to be carried forward.

**Direct United States Cable Co., Ltd.**—The board announce an interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum for the quarter ending June 30th, 1912, payable on and after July 31st.

**Japan.**—The Yokohama Electric Co., Ltd., is declaring a dividend of 11 per cent. for the last financial year.

**Winnipeg Electric Railway Co.**—A quarterly dividend at the rate of 12 per cent. per annum is announced. This does not relate to the shares recently issued.

## Electric and General Investment Co., Ltd.

THE meeting of this company was held on Tuesday at Winchester House, E.C., Mr. J. B. Braithwaite in the chair.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 1017), the CHAIRMAN said that they were able to show a profit of £17,977, as compared with £11,840 last year, an improvement of a little more than £6,000. The changes in the balance-sheet were largely due to the scheme of reorganisation which they adopted last year, and which did away with the two reserve funds which previously appeared in a separate account belonging to the ordinary and the founders' shares respectively. The investments in debentures and shares of other companies now stood at £268,390, as compared with £250,154, an increase of £18,000. Sundry debtors stood at £42,762, against £9,208. On the other hand, sundry creditors had risen from £28,000 to £42,600, due to the syndicates in which they were interested and which they managed. The balance carried to profit and loss amounted to £5,726, against £1,200 last year. They were proposing to adopt a conservative policy, and of the additional profit they were placing £2,762 to a carry forward, which they were able to do this year for the first time, owing to the alterations which the shareholders consented to at the last meeting. They were adding £2,978 to the provision for contingencies, raising it to an even figure of £82,000, so that they were putting away into the carry forward and into the contingencies fund rather more than the whole of the extra profit made, which, he thought, they would agree was a sound and conservative policy. That left them with an amount for dividend of £3,000, which enabled them to pay the full 10 per cent. on the £1 that was paid up on the 20,000 ordinary shares and 6d. per share on the newly created 40,000 deferred shares of 1s. each. With regard to the depreciation, he was glad to say that the satisfactory progress which had been noticeable during the last two years had continued at an accelerated ratio. The year before last he told them that the figures had improved to £7,000; last year they had improved a further £13,000, making £20,000 in two years. This past year they had shown an improvement of £22,000 more, so that now on the whole £268,000 there was only a depreciation of £12,000, and another year's progress on the same lines should put them on the right side. He was pleased to say that the present year had opened in a promising manner. They had got some very good business on hand at the present time and also some profits over from last year, which he hoped would be substantial.

MR. E. GARCKE seconded the motion.

Replying to a shareholder, the CHAIRMAN said that if they continued to go on as they were now, their policy would be to build the company upon a sound financial basis, and probably increase the carry-forward, and no doubt when the depreciation was wiped out and they got a credit balance, they might possibly establish a special fund for the depreciation on investments. The board were sparing no efforts to bring the company into the position of a very sound concern, and he had every hope that within a very few years it would be in a fine financial position.

The report was adopted.

**Stock Exchange Notices.**—The Committee has appointed special settling days as under:—

Friday, June 28th.—Consolidated Gas, Electric Light and Power Co. of Baltimore.—\$700,000 additional common stock, in shares of \$100 each.

Wednesday, July 3rd.—Constantinople Telephone Co.—Provisional certificates for 50,000 ordinary shares of £T5 50 each fully and partly (£2) paid, Nos. 1 to 50,000.

County of London Electric Supply Co., Ltd.—Further issue of 19,000 ordinary shares of £10 each, fully and partly paid, Nos. 80,001 to 99,000 (provisional certificates).

River Plate Electricity Co., Ltd.—Further issue of 30,000 ordinary shares of £1 each (issued at £1 per share premium), fully and partly (5s. capital) paid, Nos. 119,994 to 120,500 and 120,508 to 150,000.

**Companies Struck off the Register.**—The following companies have been struck off the Register, and are accordingly dissolved:—

Electric Timber-Seasoning and Preservation Co., Ltd.

Improved Electric Glow Lamp Co., Ltd. (Registered July 2nd, 1900).

Johnstone, Benjamin & Co., Ltd.

London and Provincial Electric Construction Co., Ltd.

McPhail & Simpson's Dry Steam Patents Co., Ltd.

Scott-Snell Self-Intensifying Gas Lamp Co., Ltd.

**R. Waygood & Co., Ltd.**—Mr. D. W. R. Green presided at the annual meeting held at Cannon Street Hotel, E.C., on 24th inst. He said that their turnover for lifts was 15 per cent. above the preceding year, which was itself a record year. Alterations had been made at their factories, and a new building had just been completed which would afford additional facilities for their electrical work. The financial result of the year's operations was briefly mentioned on page 1017 of our last issue. The chairman referred to some of the important contracts executed during the year, including the provision of 14 electric passenger lifts for the Royal Liver building, and 16 lifts for the *Olympic* and the ill-fated *Titanic*. Mr. H. Harmsworth seconded the adoption of the report, and it was carried unanimously.

**Rio de Janeiro Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent. on the issued capital stock.

**Hobart Electric Tramways Co., Ltd.**—A further dividend of 1s. per share, free of income-tax, is announced.

**Held Over.**—Owing to heavy pressure upon our space, reports of meetings of several telegraph and other companies are held over until next week.



### General Electric Co., Ltd.

THE directors' report, which is to be submitted at the meeting to be held at Cannon Street Hotel, E.C., on Monday, July 8th, states that the net trading profits and income from investments, &c., to March 31st, 1912, amount to £133,561 plus £12,214 brought forward, making a total available profit of £145,777. After deducting debenture interest and depreciation amounting to £32,400, there remains a balance of £113,377, out of which the dividend on the preference shares at the rate of 5 per cent. for the year ended March 31st, 1912, has been paid, absorbing £12,500, leaving an available balance of £100,877, which the directors recommend should be appropriated as follows: Provision for managing director's and employés' bonus, £8,866; provision for dividend on ordinary shares at the rate of 7½ per cent. for the year ended March 31st, 1912, £29,960; to reserve account, £30,000; balance to be carried forward, £32,050. The reserve account balance at March 31st, 1911, was £110,000, and with the above appropriation of £30,000, there is a total reserve account of £140,000.

"The directors are satisfied with the result of the year's trading. All the company's works have been fully employed throughout the year. The extensions to works as well as in the trading organisation of the company, required in consequence of increased business, have been carried out successfully. The increase in the investment account is due principally to the incorporation and establishment of subsidiary trading companies abroad."

Mr. M. Railing offers himself for re-election as a director, and the auditors offer themselves for re-appointment.

We give below the comparable figures from the reports for the three years ended March, 1910, 1911 and 1912:—

	1910.	1911.	1912.
Net trading profit and income from investments ...	£95,462	£119,146	£133,564
Depreciation and debenture interest ...	27,057	32,331	32,400
Balance ...	68,404	95,734	113,377
Pref. dividend 5 per cent. for the year ...	12,500	12,500	12,500
Available balance ...	55,904	83,233	100,877
Managing director's and employés' bonus ...	5,590	7,431	8,866
Ordinary dividend ...	19,395 (5 %)	19,973 (5 %)	29,960 (7½ %)
To reserve account ...	22,000	43,615	30,000
Balance carried forward ...	8,919	12,214	32,050
Reserve fund total ...	158,488	202,104*	140,000

\* As £92,104 of this was applied towards writing down goodwill and patents, the total reserve was £110,000.

Goodwill and patents stand at £1 in the balance-sheet.

The company's investments consist of debentures, stocks and shares to the amount of £239,943, and the income upon these was £21,224 for the year. Sundry creditors stand at £335,819; sundry debtors at £411,857; stock in trade at £404,458; and bank balances and cash in hand amount to £50,974. The capital issued is £250,000 preference, £399,470 ordinary, and £200,000 in 4 per cent. first mortgage debenture stock = £849,470.

The directors and officers of the General Electric Co. are to be heartily congratulated upon the excellent position of affairs reflected in the above comparison. Bearing in mind the company's aggressive developments in different Colonial and foreign parts of the world by means of subsidiary companies, which should soon be bringing in a good share of business, if, indeed, they are not already doing so, the outlook of the company seems to promise a period of continued, if not still greater, prosperity.

From an article in the *Financial News*, we gather that at a special meeting held last Friday, the board resolved, subject to confirmation, to raise the rate of dividend on the preference shares from 5 to 6 per cent.

### India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

MAJOR LEONARD DARWIN, who presided on Tuesday at the meeting of this company, held at the offices, said that at these half-yearly meetings there were no accounts to present to the shareholders, and that the object of bringing them together was to enable the directors to give the shareholders, so far as could be done, some idea of how the business was progressing. This information could only be of a general character in view of the fact that no complete statement of accounts had been drawn up. The board very much regretted that they could only see their way to make a distribution of dividend to the preference shareholders. The ordinary shareholders might feel aggrieved that, while they received no dividend, the preference shareholders were more favourably treated. But the payment of the preference dividend should in itself re-assure them to a certain extent that things were not quite so unsatisfactory as they might otherwise be led to assume. What, however, was of more importance to them was to feel that the phase of passing the interim dividend on the ordinary shares was brought about by causes which were abnormal, and which, in due time, would not disturb their trading to the same extent as had unfortunately been the case recently. In the first place, he was sorry to say they had not had a time of peace in which to recover from last year's disaster. The unrest in the labour market was notorious to all.

The coal strike brought about an increase in the cost of fuel, disorganised a good many of the railways, and consequently interfered with the transport of raw material and the distribution of manufactured goods. The recent trouble in the docks, although never very serious, had brought about a certain amount of disorganisation in traffic. The coal strike was, however, a serious matter, as the increase in the price of coal at given periods during the strike was very great, and a permanent increase had been left in its trail. The selling of rubber goods had not been an easy matter during the past six months, that was to say the obtaining of profitable prices for their productions. As a matter of fact, the price of raw material had not varied very greatly since a year ago, but the ever-increasing surplus of plantation rubber had probably instilled a belief into manufacturers that prices lower than those which actually were ruling would eventually result, and with this view they had been underselling so as to clear their stocks preparatory to replacing them at lower figures. In other words, whilst the prices paid for the raw material should not result in a low profit, yet the selling market of manufactured goods might do so for the reason above stated; for one heard complaints on every side among rubber manufacturers at the prices obtainable for their finished stuff. Again, it was perhaps worth mentioning that the National Insurance Act would throw a further burden on their shoulders, not only on account of the contribution which their company would have to make, but on account of the extra clerical expenses they would be put to in order to carry out its provisions. He was glad to say they had secured an order for the manufacture and laying of a submarine telegraph cable, and their cable steamer *Silvertown* would shortly sail to lay it down between Australia and New Zealand. Under all the circumstances the board had thought it best in the interest of the business not to recommend the payment of a dividend on the ordinary shares. He moved "that a distribution of 5s. per share, less income-tax, to the holders of preference shares be approved and sanctioned."

MR. ROBERT KAYE GRAY seconded the motion.

MR. HENDERSON said that he had visited the works, and was shocked at the disorganisation. It was true he was told that the works were being reorganised, and he would like to know what progress had been made.

A SHAREHOLDER asked the chairman if he could give them any hope of a dividend for the year.

The CHAIRMAN said there was, of course, great difficulty in speaking with confidence of the future. It must be more or less of a speculative estimate of what the future was going to be. The real difficulty of arriving at an estimate was the fact of the large amount of seasonal trade they did. In other words, the amount of their sales was very much greater in the second half of the year than the first, whilst the expenses ran evenly throughout the whole year. It would be quite possible to make no profit during the first half of the year and yet make a very considerable profit in the second half. Under these circumstances they felt it necessary not only to be cautious in their remarks, but to be conservative with regard to dividends. The dividend at the end of the year would depend on the total profit, and at the end of the year they would see how things went. At the last meeting he told them that they had considerable confidence in the future, but they regretted the record of the past. He had nothing to retract from that. He stated last year that their disaster was mainly due to the high price of rubber, and as they knew rubber had been fairly steady since then. There had also been no special circumstances like last year, although the coal strike caused them some loss. Last December he mentioned that certain other companies had been unfavourably affected by the same circumstances that had affected their company, and he had a list in his hand bearing that out. The chairman proceeded to give the losses sustained by different rubber companies, and said it indicated that there had been widespread trouble amongst the rubber manufacturing trade. When a disaster occurred to a company like theirs, it was natural that everyone concerned searched the whole machine for weak spots. That had been so with them, and things had been put right. He thought, however, that Mr. Henderson's phrase as to the works being disorganised was too strong. The difficulty of carrying on work on an old crowded site was great, but he believed there had never been anything approaching disorganisation. He did not believe it was safe to give a definite prophecy, but he did say that they were rapidly getting into their normal stride. He did not know how near to the old level they would get by the end of the year, but he was as hopeful of that company as of any manufacturing company. He asked them to be patient for one more half-year, and then he trusted they would meet under happier circumstances.

A vote of thanks was proposed to the board and the staff, and MR. HENDERSON, in seconding the motion, said that perhaps his remark was too strong. He was perfectly satisfied that the board and staff were capable of carrying out their duties.

The motion was carried.

**Greenwood & Batley, Ltd.**—The directors' report (according to the *Times*) shows that after providing for interest on the debentures, expenses of management, and doubtful debts, there is a profit for the year ended March 31st of £25,295, making, with the balance brought forward, £27,677. The directors have allocated to depreciation £8,000; provision for contingent loss on certain contracts, £2,500; written off book value of an investment, £1,000; provision for additional plant, £4,000; and provision for estimated charges to March 31st, 1913, under the National Insurance Act, £1,500. The dividend on the paid-up cumulative preference shares for the year at the rate of 7 per cent. per annum is to be paid, leaving £3,649 to be carried forward. The profits for the preceding year were £20,198.



### Nairobi Electric Power and Lighting Co., Ltd.

THE directors report that during 1911 the company shared in the general progress and prosperity of Nairobi, as may be seen by the following comparative figures:—

	1910.	1911.
Units generated .. .. .	416,621	581,418
Motors connected, B.H.P. .. .. .	147	173
Lights connected, S.C.P. equivalents .. .. .	5,732	8,193
Street lighting .. .. .	2,000	2,000
Net profit .. .. .	£403	£2,027

The latest advices from Nairobi indicate greatly improved results for the present year, and the revenue for the first quarter of 1912 is equal to that of the first two quarters of 1911. In consequence of the growing demand for current, it has now become necessary to arrange for the installation of further power plant to supply same, and additional power stations on the Ruera river will be established. Mr. Chas. Udall, the chief engineer, who has been at Nairobi for the past four years, is coming to England on a holiday and to confer as to the new installations.

### British Electric Traction Co., Ltd.

MR. E. GARCKE, chairman, presided on Thursday, June 20th, at the Holborn Restaurant, over the 16th ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 1015), the CHAIRMAN referred to the re-arrangement of the capital of the company, and congratulated the shareholders on the unanimity of the decision and upon the result. The directors were particularly indebted to the shareholders' committee for the reasonable spirit in which they co-operated with the board to bring about a solution. The result of the various meetings had been to produce a better understanding and an appreciation by the shareholders of the difficulties under which the company had laboured. The chairman referred to the retirement of Sir Rivers Wilson and Sir Charles Freemantle from the board, and to the election of Mr. Symons and Mr. Tegetmeier to the board. He said that altogether the board, as now constituted, was both varied in experience and composite in opinion. They had as much optimism as was good for them and as much pessimism as they could do with. There was plenty of initiative, and no lack of criticism, and there was no waste of time due to misunderstandings or want of knowledge of the language of business. The report and accounts were as full of information and as accurate in preparation as any report and accounts he had seen, and they could not fail to produce on the minds of anyone who carefully perused them an impression of the magnitude of the business they were carrying on, and a belief in the inherent soundness of the enterprise. The only regrettable conclusion to be drawn from the document was that the business was not as profitable as it deserved to be, having regard to the important services they rendered to the public. But inadequate though the profits were, they were doing as well as could be expected. He had before him the published figures of the profit made by all the electricity supply undertakings of the United Kingdom. The average profit was 4.3 per cent., whilst the profit made by their electricity supply undertakings was 4.4 per cent. The average profit made by all the electric traction undertakings in the United Kingdom was 3.8 per cent., whilst the net profit on their tramways was 3.54 per cent. In the case of the tramways, their average was slightly below the general average, but this was due to the fact that their tramways were situated for the most part in rural and interurban districts, whilst the tramways of the large cities, where more profit was made, were in the hands of the local authorities. Their receipts per route-mile were lower than the general average, but their expenses of working were also lower, which pointed to the efficiency and economy with which their undertakings were worked. He could not, of course, deal with all the matters, but he would touch on the salient facts in the accounts and hoped to be able to show that practically in every department there was some improvement. The number of passengers carried, and the receipts per route mile, showed a good increase. The electricity generated showed an increase of over 5 million units, representing an increase of about 10 per cent. The net profit earned by all the affiliated companies was £708,000, an increase of £86,000, and the amount placed to reserve and carried forward by all the companies was £247,000, or an increase over the preceding year of £25,600. The net profit made by the British Electric Traction Co. was £176,000, an increase of £26,000, and the amount placed to reserve or written off by the B.E.T. Co. was £59,000, or an increase of £23,600, so that altogether no less than £308,000 had been reserved by the B.E.T. Co. and the associated companies out of the last year's accrued profits of £708,000. In the memorandum which was issued to the shareholders last year in connection with the rearrangement of capital, he said: "According to the present practice the associated companies set aside varying amounts for depreciation of capital after charging the costs of repairs and maintenance. Besides these reserves, the British Electric Traction Co. is setting aside annually out of its profits an amount to meet depreciation in the value of the shares and debentures which it holds in these same companies, and in 1910 the directors decided so long as such depreciation continues, to transfer to reserve any profits or losses, other than accrued dividends or interest, made by realisation of the then existing investments. I am expressing no opinion as to whether the reserves are adequate or otherwise, but I wish to point out that the question of what reserves should be made deserves further consideration." The federated companies were now engaged in an exhaustive examination of the whole question of reserves, and they hoped before the next accounts were made up to arrive

at a satisfactory conclusion on the subject, so that each company would hereafter allocate its profits between reserve and dividends in such a way that the shareholders might feel full confidence that adequate provision had been made for the replacement of circulating and reservable capital, and also that dividends were not withheld because of some unnecessary and indefinite apprehension that depreciation of fixed or permanent capital was in every case to be provided for. On this occasion, however, they could not do otherwise than apply all the surplus profits after paying the 6 per cent. on the cumulative preference stock, to the placing of their house in order. They might have paid a small dividend on the 7 per cent. preference stock, but by not doing so they were able to present a much nicer balance-sheet, and the directors felt that the right thing on this occasion in the best interests of the company was that in the first balance-sheet produced, after the re-arrangement of capital, all items not strictly represented by tangible assets, should be eliminated so far as necessary; so that the whole of the reserve could be made applicable towards meeting the deficiencies on investments and undertakings. The reserve now appeared in the balance-sheet as a deduction from the cost price of the investments and undertakings, and they would continue to increase the reserve by any profits they made by the realisation of the investments, and also by an annual contribution out of the profits, and *pro rata*, of course, they would reduce the reserve by any losses they might from time to time make on the realisation of investments and undertakings. This was a wise and perfectly intelligible policy which would enable the shareholders to follow the progress of the business from year to year without any difficulty. Shareholders, however, must not be alarmed if from time to time they made large inroads on the reserve. Whenever a depreciated investment could be sold to advantage they would not hesitate to realise, although by so doing they might show a loss on capital account, which would be met by the reserve. They were continuing the policy previously announced of gradually selling their consols and investing the proceeds in other good securities with a better yield. One good feature presented by the item of investments this year was that the proportion of investments which was unproductive had been reduced by £160,000, and the market value of these investments which were quoted was £48,000 higher. But the most satisfactory feature was the increase in the average yield. This year it was 3.77 per cent. on the total cost after deducting the reserves, which compared with 3.1 per cent. for 1910, and 3 per cent. for 1909. This increased profit had been for the most part utilised in strengthening the position of the company, and to a small extent in paying dividends. The position of the company had been strengthened in various important ways which could not be represented in the accounts, but to some of which he would refer. In view of the policy he had explained of carrying the profit and loss on the realisation of investments direct to the reserve, the figure showing the yield each year on the net amount of investments would be the key to the position of the company. With 57 companies in their list, it was impossible for him to refer to everyone, but some of the developments were so important that he must call attention to these. The Metropolitan Electric Tramways Co., which paid 6 per cent. on its ordinary shares, had arranged for through running with the L.C.C., and another development of importance was that they had decided to run motor-omnibuses through London in connection with the tramways. They had also an associated company, the British Automobile Traction Co., which was arranging to work several motor-omnibus routes in London and in the provinces, but they had no intention of encouraging unremunerative competition. The North Metropolitan Electric Power Supply Co. was increasing its business most satisfactorily, and for the past year paid a dividend of 9 per cent. on its ordinary shares. The Bombay Co. had now entered on the dividend list, and paid 3 per cent. on the ordinary capital, and he thought he was justified in saying this was but an indication of better results which would be obtained in the future. The Auckland Electric Tramways Co., in which they had a large holding, was also developing very satisfactorily, and whilst paying 7 per cent. on the ordinary shares, was building up a strong reserve fund. In the case of the Potteries Co., the net balance was £35,500, compared with £27,300 in the preceding year. The Barrow Co.'s surplus was £7,700, compared with £6,100; Birkdale paid a dividend of 7 per cent., compared with 5 per cent.; the Yorkshire Co. had a surplus of £9,500, compared with £8,100; the Devonport Co. had a revenue of £26,700, compared with £22,900; Weston had a balance of £5,000, compared with £3,600; the Greenock Co. paid 5 per cent., instead of 3 per cent. on the ordinary shares; the Swansea Co.'s revenue was £62,400, an increase of £3,151, and this company had also made a satisfactory arrangement with the Corporation for the co-ordination of the tenures, which had an important bearing on the capital value of the undertaking, although it was not expressed in the revenue account. Without going further into details, he might say there had been an all-round improvement not only in net profits but also on capital account, which would find expression later on when they realised the investments. Of course, there were inevitably some bad features, and some of the undertakings while paying their debenture interest and the dividends on the preference shares, were not earning sufficient profits to pay anything on the ordinary shares, whilst a few companies were actually losing money; but even in those cases they had the consolation of knowing that the losses were less than in the preceding year. There were six or seven companies which showed debit balances on their revenue account, and the total losses on these companies last year was between £8,000 and £9,000. Regrettable as the losses were, they were small in relation to the profit of £708,000 made by the other companies in the federation. In the case of the Brush Co., the loss was less than in the preceding year, and they were anxiously considering how the situation could be further im-



proved; but with the frequent strikes in other industries, which had a bad effect on their business, and with the intense home and foreign competition, the electrical manufacturing companies of this country had a very uphill struggle. They were mainly looking abroad for their new enterprises, and during the past year they acquired, jointly with some financial friends, an important interest in the British Canadian Power Co., which supplied power to the large silver-producing district near Cobalt in Canada. They were at present engaged in developing the business, and probably next year would make an issue of capital. The figures in the balance-sheet explained themselves. An important feature in the present position arose out of the liquidation of the City of Birmingham Tramways Co. They made an investment in the shares of the company some years ago with the intention of dealing with the tramways there, but they had been prevented from doing so. Still they had made a satisfactory investment. They paid £1 17s. 6d. for each share, and were now receiving a return of the capital equal to £4 per share, representing a profit on capital account of £113,900. They had also received dividends of 10 per cent. last year, and for the past 18 months had had 19 per cent. The City of Birmingham Tramways Co. had been accumulating large resources, amounting to between £600,000 and £700,000, and had established a profitable investment business. It had, therefore, been decided to form a new company—the Electrical and Industrial Investment Co.—and take over the investments of the tramway company, and their federated company, which held the shares, would, therefore, receive shares in the new company of a higher value than the shares which it held in the City of Birmingham Tramways Co., but the appreciation in the value of these shares would be treated as a profit on capital account, and not as profit on revenue account available for dividend. The formation of the Investment Co. would give them the opportunities of utilising their surplus capital to greater advantage than had been possible hitherto. They had been looking out for new directions in which to employ their energies and invest their spare capital, and they hoped, by doing general financial business, they would be able to increase their profits. They would continue to give preferential consideration to suitable and profitable electrical enterprises, because that was the department of industry of which they had special knowledge and experience, but he feared that the scope for investment of capital in electrical enterprises in this country would be restricted so long as the Legislature treated the electrical industry as the Cinderella of commerce, with labour troubles and municipal veto as the ugly sisters. Proceeding to touch on the question of fares, the chairman observed that it was impossible to obtain any marked improvement in the situation in regard to them without the sympathy and support of public opinion, and he asked all of them to assist in that direction. The chairman next dealt with the continued unrest in the labour world and the prejudicial effect it had on all industries, and expressed the hope that a statesman would be forthcoming who was able to equitably adjust the altered relations between capital and labour. Their superannuation fund for the benefit of the officers had been converted into an endowment fund, but the cost to the company would be the same as before. With regard to the Friendly Society, which included 3,000 men, they had, in view of the Insurance Act, decided to register as an approved society, and to extend its operations to the clerks and others who came within the scope of the Act. How the arrangement would work remained to be seen. In conclusion, the chairman said he was glad to be able to assure the shareholders that he now felt more hopeful as to the future of the company than he had done at any time since they were overtaken by adversity, and he was confident, not without reason, that if they continued along the course on which they were now proceeding, and the political, social and economic conditions of the country did not get worse, the time was not very distant when they would recover some measure of their former prosperity.

MR. J. S. RAWORTH seconded the motion, and the report was adopted without discussion.

**Brazilian Amalgamation.**—It is announced that a company has been incorporated under the laws of Canada, entitled the Brazilian Traction, Light and Power Co., Ltd., with a capital of \$120,000,000, divided into 1,200,000 shares of \$100 each. The principal object of the new company is to bring about a consolidation of the Rio de Janeiro Tramway, Light and Power Co., Ltd., the Sao Paulo Tramway, Light and Power Co., Ltd., and the Sao Paulo Electric Co., Ltd., by issuing its share capital in exchange for the issued share capital of the three companies. The principal shareholders, representing a large percentage of the capital of each company, have expressed their approval of the exchange, and a circular will shortly be issued to the general body of shareholders, inviting them to make the exchange on the terms mentioned above. Sir William Mackenzie will be chairman, and Dr. F. S. Pearson president of the new company, and Mr. E. R. Wood, Mr. Z. A. Lash, Sir William C. Van Horne, Sir H. M. Pellatt, Mr. Alexander Mackenzie, and Mr. R. M. Horne Payne are to be on the board.

**Trafford Power and Light Supply (1902), Ltd.**—The report states that the accounts for the year to March 31st show a net profit, after charging interest on debenture and loans, &c., and £3,000 for depreciation, of £512, a debt balance of £2,823 brought forward being reduced to £2,311.—*Financier*.

**Eastern Extension, Australasia and China Telegraph Co., Ltd.**—The directors have declared an interim dividend, for the quarter ended March 31st, of 2s. 6d. per share, free of income-tax.

**Prospectuses.**—*The Canadian-British Engineering Co., Ltd.*—In our advertisement pages this week will be found the prospectus of this company with whose objects our readers are already familiar by reason of the article on "Trade with Canada," which appeared on page 701 of the ELECTRICAL REVIEW for May 4th, 1912, and wherein the scheme of Mr. Leonard Andrews for extending British engineering trade in the Canadian market was outlined. After what we have already said it is not necessary for us to do more than indicate one or two supplementary points which the prospectus makes public. The share capital is £205,000 divided into 200,000 non-cumulative 7 per cent. preferred ordinary shares of £1 each and 100,000 deferred ordinary of 1s. each. The former will also be entitled to 50 per cent. of the surplus profits available for dividend after they have had their 7 per cent. The deferred will take the remaining 50 per cent. The present issue is of 100,000 of the preferred, and the subscriber is entitled also to subscribe for one deferred share for every five preferred allotted to him. The directors of the company are: C. Leonard Agnew (Illingworth & Agnew, brokers to the company), W. H. Patchell, Leonard Andrews (of the Key Engineering Co., Ltd., who is to be managing director in Great Britain), and W. A. Martin, of Toronto (late assistant general manager of the Toronto Electric Light Co., who is to be managing director in Canada). There will be a local board in Canada as follows: W. A. Martin, E. M. Sellon, C. Ruttan and N. Thompson. The offices of the company are at 4, Queen Victoria Street (secretary *pro tem.* R. G. Sidford). The company will carry on the business of an engineering supplies and construction company in Canada on the lines already explained, the plant required being purchased, as far as possible, from leading firms in the United Kingdom. Sole agency agreements have been obtained from the following firms: Sir W. G. Armstrong, Whitworth & Co., Ltd. (cranes, and dock and harbour equipments); Cammell, Laird and Co., Ltd. (for Western Canada, for steels, tires, axles, &c.); Dorman, Long & Co., Ltd. (for Western Canada, for steel beams, angles, &c.); the Power Gas Corporation, Ltd. (for Mond gas producers, &c.); Ransomes, Sims & Jefferies, Ltd. (agricultural machinery); Sandycroft Foundry Co., Ltd. (for Eastern Canada, for mining plant equipments); Willans & Robinson, Ltd. (for Eastern Canada, for steam turbines, Diesel engines and condensing plants). Negotiations are proceeding with other firms, and also for the acquisition of certain established businesses in different centres in Canada with a view to utilising their local connections. Mr. Andrews and Mr. Martin, under agreements entered into, will act as managing directors at £800 per annum each, plus 5 per cent. of the divisible profits. The Key Engineering Co., who are the vendors, have underwritten 20,000 preferred ordinary shares at a commission of £1,500 in cash. The Key Engineering Co. transfer the agency contracts to the company for £6,000 in 4,500 preferred and 30,000 deferred shares. The preliminary expenses, estimated at £2,500, exclusive of underwriting commission, will be paid by the company. Mr. Andrews has sub-underwritten 5,000 preferred shares at 5 per cent. cash commission. It is intended that the company's capital shall be principally utilised in carrying stocks of standard machinery and appliances and in executing contracts for the construction and equipment of engineering works. The company will have a London office or buying house, through which all communications with manufacturers will pass.

*Consolidated Cities Light, Power and Traction Co.*—This company has been offering \$4,000,000 first lien 5 per cent. gold bonds at 90 (£90 per bond of \$500) for subscription. The company is interested in a large number of electric power and traction and gas undertakings in the U.S.A. The list was to close on Wednesday.

**Pulford Bros., Ltd.**—We are informed that the 14th annual meeting of this company was held at the registered office of the company on 20th inst. Mr. Egerton G. Pulford, who presided, reported that the business during the past year showed a very satisfactory increase. Resolutions declaring a dividend of 25 per cent., free of income-tax, for the year ended March 31st last, and carrying the balance of profit to reserve fund, were passed.

**Westinghouse Electric Co. (U.S.A.).**—The directors have declared a quarterly dividend of 1½ per cent. on the preferred stock.

## STOCKS AND SHARES.

Tuesday Evening.

CERTAIN specialised markets have been doing all the trade this week: outside of them there is little that is exciting to record. The stocks and shares in Latin-Canadian undertakings have been soaring like rockets, attracting a good deal of business in the process—in fact, speculation is running rife in certain of the favourites, and it is rather a moot point whether the advance does not threaten to become too rapid for safety.

Home Railways are under the labour cloud which continues to depress so many of the industrial departments. Most of the steam stocks are lower, and the dividend outlook in respect of the current six months is an added factor in making prices dull. The prospect here is not pleasant at the moment, though it may alter when traffics begin to run against those of the railway strike period last year. So, while a further fall is not unlikely to take place, holders of Home Rails hug to themselves the hope that better prices may be in store for them when the holiday rush begins in August.



The announcement that the London General Omnibus Company is to be put into voluntary liquidation came as rather an unpleasant surprise to the few remaining proprietors of the company's non-assenting stock, causing a fall of 100 points, from 390 to 290, before any recovery occurred. An interim dividend of 10 per cent. was declared at the same time, and this was taken to indicate that the distribution on the 6 per cent. income bonds of the Underground Electric Railways Company will be made up to 4 per cent. in September, instead of the full rate. If this prophecy turns out to be correct, it will, of course, confirm the warning raised once or twice here as to a probable disappointment for those who were looking for 6 per cent. on their income bonds next September. The price of the bonds has shed 3 points, while the shares are  $\frac{1}{2}$  lower, and the 1s. shares, from 15s. 6d., fell back to 13s. 9d. Districts gave way as well, and Metropolitans fell 1, while falls of 4 occurred also in Central London Ordinary and Deferred. City and South London shed  $1\frac{1}{2}$ , and London United Tramway Debenture fell 1. In all these concerns there is a sympathetic sentiment, which has its palpable effect upon quotations, so that if one is weak the others are influenced in the same direction. The London General Omnibus directors threaten to pay out their "non-assenting" stockholders at £275 per cent.

English Electric Supply shares are firm as a whole, with rises in Bournemouth and Poole and County Ordinary. It is stated that the Bournemouth Corporation is considering the question of purchasing the Bournemouth and Poole undertaking, which will, of course, come as no surprise to those who adopted our hint two or three weeks ago as to what was likely to happen in this case. As the County Company holds a controlling interest in the Bournemouth, the rise in the former is the natural corollary. Both Companies' Preference shares are also better. On the other hand, City Ordinary again lost 10s. on the decision of the Streets Committee of the City Corporation that it would be inexpedient to take any steps at the present time to purchase those portions of the property of the City of London and the Charing Cross Electric Supply Companies which relate to the City. Bulls of the shares, however, maintain as stoutly as ever that the recent rise was fully justified: though it will be noticed that they do not back up their convictions with purchases of shares to any appreciable extent. Metropolitans are a shade easier, but North Metropolitan Power Debentures have risen 3 points. An excellent report from the General Electric Company had the effect of raising the price of the Preference 17s. 6d. to 10 $\frac{1}{4}$ , this following upon several improvements recently. The company has made big strides during the last year, and its net revenue has increased by £14,000, the Ordinary dividend being raised from 5 per cent. to 7 $\frac{1}{2}$  per cent. Brush 4 per cent. Debenture stock is 2 points over.

As mentioned above, it is in the Latin-Canadian group that the principal excitement of the week has come. To quote some of the most important movements: Mexican Light and Power Common gained 10 $\frac{1}{2}$  (to lose 6 points later), and the Preferred put on 6 $\frac{1}{2}$ , while Rio Trams are no less than 15 up. Sao Paulo Trams rose 7, but reacted 5, and Mexico Trams are 7 $\frac{1}{2}$  better. Shawinigan Water gained 3, Canadian General Common and Preference 2, and Mexican Northern Power jumped from 23 to 32, falling back to 31. As may be supposed, various rumours are afloat to account for these sensational rises. There is said to be an important scheme on foot for amalgamating the Sao Paulo with the Rio Tramways Company, and it is not without its significance that part of the buying should come from the Continent. The Mexican Light and Power rise is attributed to the patent fact that the revolution is over, and that the country has now settled down to the prosperity and trade which are expected to follow the recent disturbances. The rise in Mexican Northern Power is stimulated by the comparatively low price at which these shares stand, and the scope which they present for substantial improvement tacked on to the heels of the rise in other Mexican issues. It may be mentioned, by the way, that in the last-named company there are 5 per cent. bonds standing at 75, with coupons payable on January 1st and July 1st; so if the Common shares are worth anything like 31, it would seem that the bonds are too low at 75. So far as we are aware, however, the company has done no work yet, and its success or otherwise, lies all in the future. According to particulars in front of us, it is estimated that the works will be completed and power delivered in November, 1912—or, at latest, some six months afterwards.

British Columbia Electric Deferred and Preferred are both *ex* rights, and show nominal falls of about 5 points. Anglo-Argentine Trams are steady, and Rangoon Preference rose  $\frac{1}{4}$ .

The Telegraph market is sustained by the business in Marconis and National Telephone stock. Fluctuations in Marconis are rather less violent than they have been recently, but it seems manifest that the weak account is not yet entirely eliminated from the market. National Telephone Deferred has again fallen, though not so heavily as it did last week. United River Plate Telephones are  $\frac{1}{8}$  lower. Steady selling of West India and Panama shares put down the price  $\frac{1}{4}$ , and Great Northern Telegraphs are £1 lower. The Anglo and Eastern groups are both firm, without showing any special feature.

Amongst Manufacturing shares, the principal change, apart from General Electrics, is a fall of 10s. in India-Rubber shares, while Telegraph Constructions are also down, and the company's Debenture fell  $\frac{1}{2}$ . Babcock & Wilcox Preference are  $\frac{1}{2}$  lower, holders taking advantage of the high price to get out and to put the money into something which yields a better rate of interest. Castner-Kellners are a shade harder on buying from the country, and Dick, Kerr Preference improved a trifle. Keen interest is taken in the latest discovery of synthetic rubber, and in spite of the criticism launched at Prof. Perkin's invention, the rubber share market has been upset by selling on the part of nervous holders.

ELECTRIC TRAMWAY AND RAILWAY  
TRAFFIC RETURNS.

Locality.	Fort- night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen .. ..	June 19	3,086	+ 64	3	4,269	— 853	11.4	..
Ayr .. ..	" 22	684	+ 61	5	1,731	— 26	8	..
Bath .. ..	" 23	2,805	— 8	11	18,507	— 595	18.68	..
Birkenhead .. ..	" 15	20,805	+ 5,804	11	115,597	+ 84,000	57.17	..
Birmingham Corp.	" 19	2,854	+ 158	12 $\frac{1}{2}$	14,750	+ 100	14.62	..
Blackburn .. ..	" 20	2,281	— 5.0	..	14,999	+ 1,534	11.87	..
Blackpool Corp. ..	" 22	1,486	— 283	21	11,597	+ 251	8	..
Blackpool-Fleetw'd	" 19	3,418	+ 95	11 $\frac{1}{2}$	20,920	+ 856	21.95	..
Bournemouth .. ..	" 15	10,857	— 1,721	11	62,234	— 707	56	1.2
Bradford .. ..	" 23	2,011	— 101	12	11,924	— 632	9.5	..
Brighton .. ..	" 21	13,687	+ 253	..	162,960	+ 13,147	30.5	..
Bristol .. ..	" 14	610	+ 139	24	6,835	+ 1,695	3.65	..
Brit. Elec. Trao. Co.	" 14	362	— 40	"	8,933	— 337	..	..
Airdrie .. ..	" 14	795	+ 59	"	8,315	+ 2,118	5.37	..
Barnsley .. ..	" 14	1,183	+ 25	"	12,893	+ 1,795	8.85	..
Barrow .. ..	" 14	2,107	+ 104	"	23,904	— 155	11.25	..
Devonport .. ..	" 14	898	— 128	"	4,840	+ 153	6.5	..
Gateshead .. ..	" 14	1,707	+ 29	"	18,307	+ 2,223	7.25	..
Gravesend .. ..	" 14	440	— 269	"	5,572	+ 189	6.72	..
Greenock .. ..	" 14	212	— 189	"	2,625	+ 97	..	..
Hartlepool .. ..	" 14	395	— 114	"	3,821	+ 237	..	..
Kidderminster .. ..	" 14	385	— 156	"	4,364	— 436	2.9	..
Leamington .. ..	" 14	18,005	— 3,161	"	207,497	+ 7,997	22	..
Merthyr .. ..	" 14	780	— 206	"	7,613	— 119	8.5	..
Metropolitan .. ..	" 14	6,218	— 1,476	"	74,952	+ 2,977	..	..
Middleton .. ..	" 14	1,324	— 17	"	14,384	+ 1,007	9.13	..
Mid. Joint Com'tee	" 14	268	— 47	"	2,890	+ 2.6	5.31	..
Oldham—Ashton ..	" 14	3,832	— 267	"	43,190	— 2,414	29	..
Peterborough .. ..	" 14	532	— 66	"	2,557	+ 45	2.75	..
Potteries .. ..	" 14	674	— 272	"	6,560	+ 37	8.17	..
Rotherham .. ..	" 14	1,851	— 418	"	19,563	+ 457	..	..
Southport .. ..	" 14	2,169	+ 3.7	"	26,146	+ 129	12.5	..
S. Metropolitan ..	" 14	454	— 498	"	4,490	— 236	3.75	..
Swansea .. ..	" 14	293	— 425	"	1,664	— 240	8	..
Tynemouth .. ..	" 14	650	— 156	"	6,435	— 6	5.75	..
Weston-s-Mare ..	" 14	216	— 29	"	2,543	+ 245	..	..
Worcester .. ..	" 14	2,165	— 201	"	25,187	+ 756	17	..
Wrexham .. ..	" 14	478	— 101	"	5,190	+ 111	..	..
Yorks. Wool. Dist.	" 14	..	..	"	..	..	..	..
Miscellaneous .. ..	" 14	..	..	"	..	..	..	..
Burnley .. ..	" 21	2,881	+ 147	..	..	..	11.73	..
Burton-on-Trent ..	" 23	551	— 179	12	3,090	— 200	10	..
Bury .. ..	" 23	2,591	+ 97	12	16,063	+ 103	22.5	..
Cardiff .. ..	" 15	5,276	— 167	11	24,307	+ 3,527	17.35	..
Chatham and Dist.	" 20	1,751	— 41	25	20,234	+ 44	14.98	..
Cork .. ..	" 20	1,061	— 11	25	11,656	— 212	9.89	..
Croydon .. ..	" 14	3,777	— 426	11	23,601	+ 103	11.6	75
Darlington .. ..	" 15	283	+ 19	11	2,395	+ 51	4.87	..
Darwen .. ..	" 21	554	— 2	12	3,363	..	4.36	..
Dover .. ..	" 15	486	— 77	11	2,570	— 105	4.75	..
Dublin .. ..	" 21	12,350	+ 265	21	110,531	+ 6,304	54.25	..
East Ham .. ..	" 22	2,049	— 241	12	12,718	— 187	7.87	..
Exeter .. ..	" 21	667	— 100	12	3,878	— 316	5.5	..
Glasgow .. ..	" 22	38,651	+ 1,102	..	61,577	— 1,351	98	25
Hastings .. ..	" 21	1,928	— 110	..	..	— 1,044	19.3	..
Huddersfield .. ..	" 22	3,978	+ 205	12	23,881	+ 82	29.5	1
Hull .. ..	" 22	5,840	— 355	12	31,063	— 949	13.5	—1
Ilkeston .. ..	" 20	231	— 8	12	1,061	— 539	..	..
Ilpswich .. ..	" 22	935	+ 11	12	6,249	— 5	10.5	..
Kilmarnock .. ..	" 22	321	— 4	5	905	— 23	4.25	..
Lancashire United	" 19	2,692	— 123	25	31,726	— 398	39	..
Leeds .. ..	" 24	15,398	+ 1,077	12	93,174	+ 2,906	112.7	..
Leicester .. ..	" 22	5,340	— 378	..	..	..	20	..
Leith .. ..	" 15	690	+ 36	4 $\frac{1}{2}$	3,023	— 14	3.724	..
Liverpool .. ..	" 15	23,962	— 788	23 $\frac{1}{2}$	280,335	+ 11,680	103	..
L.C.C. .. ..	" 12	85,859	— 8,812	..	458,977	— 8,639	140.5	1.5
London United ..	" 22	13,194	— 2,744	25	153,332	— 4,218	..	..
Lowestoft .. ..	" 22	312	— 135	18	5,870	— 361	8.5	..
Manchester .. ..	" 22	33,563	+ 1,443	12	202,209	+ 7,302	105	..
Newcastle .. ..	" 22	8,769	— 2,438	..	50,622	— 2,090	31.3	..
Newport .. ..	" 22	1,417	— 397	12	8,151	— 912	7.25	..
Oldham .. ..	" 23	4,014	+ 113	13	26,645	+ 344	23	..
Pontypridd .. ..	" 22	703	— 58	12	4,175	— 1,005	5.5	..
Portsmouth .. ..	" 15	4,320	— 84	11	23,544	— 233	15.75	..
Preston .. ..	" 19	1,570	— 22	12	9,673	+ 298	10	..
Rotherham .. ..	" 19	1,443	+ 163	11 $\frac{1}{2}$	7,944	+ 149	12	..
Salford .. ..	" 17	4,975	+ 531	11	57,211	+ 1,524	41	..
Sheffield .. ..	" 25	13,688	+ 931	..	84,076	+ 1,003	40	..
Southampton ..	" 19	2,503	— 67	11	14,210	+ 638	11	..
Southend-on-Sea ..	" 19	741	+ 1.7	12	8,461	+ 1,147	7	..
South Shields ..	" 15	1,215	— 214	..	6,580	— 208	10.25	..
Tyneside .. ..	" 19	983	— 819	25	11,354	— 473	11	..
Wallasey .. ..	" 22	2,271	— 115	11 $\frac{1}{2}$	13,254	— 527	8.72	..
Walthamstow .. ..	" 22	1,652	— 25	12	9,604	+ 8	9	..
West Ham .. ..	" 13	5,100	— 204	10 $\frac{1}{2}$	29,042	— 228	16.45	1
Wolverhampton ..	" 19	1,967	+ 100	12	11,716	+ 136	13.75	..
Cen. London Rly... ..	" 23	8,987	— 4,204	25	115,768	— 16,889	6.82	..
City & S. Lon. Ply.	" 23	5,720	— 1,403	25	78,393	— 5,992	7.26	..
Dublin-Lucan Rly.	" 21	321	— 8	25	3,393	+ 70	7	..
G.N. and City Rly.	" 23	8,123	+ 45	25	40,883	+ 2,410	8.5	..
L'pool Overh'd Rly.	" 23	3,206	+ 864	25	33,835	+ 2,644	6.6	..
Llandudno-Col. Bay	" 21	645	— 48	2 $\frac{1}{2}$	5,771	+ 306	6.5	..
Lon. Elec. Ry. Co.	" 22	26,970	— 9,645	25	85,240	— 5,155	21.26	..
Mersey Railway ..	" 22	4,615	+ 454	25	52,501	+ 618	4.5	..
Metropolitan Rly... ..	" 28	86,462	— 2,318	25	418,149	— 12,028	25.75	..
Met. District Rly... ..	" 22	25,793	— 5,041	25	314,743	+ 8,129	25	..
Anglo-Argentine ..	" 17	101,718	+ 4,070	25	1,235,271	+ 46,623	..	..
Auckland .. ..	May 31	18,179	+ 1,090	..	202,937	+ 16,660	23.31	..
Bombay (B.E.T.) ..	" 24	5,977	+ 365	21	63,717	+ 8,901	..	..
Brisbane .. ..	" ..	..	..	..	..	..	..	..
Brit. Columbia Rly.	" ..	..	..	..	..	..	..	..
Calcutta .. ..	June 22	7,525	+ 318	..	..	..	..	..
Cape Electric T.Ld.	" ..	..	..	..	..	..	..	..
Kalgoorlie, W.A... ..	May	8,270	..	5	15,806	..	20.5	..
Lisbon .. ..	" ..	..	..	..	..	..	..	..
Madras .. ..	May 31	1,738	+ 387	..	16,653	+ 1,931	18.5	75
Montevideo .. ..	May	26,669	+ 10,852	7	212,080	+ 29,596	..	..
Perth (W.A.) .. ..	June 21	8,571	+ 429	..	46,861	+ 6,704	29	..

\* Compared with the corresponding period of 1911. † One week only.  
‡ Includes horse, steam and other receipts. § One month.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 25th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 25th.	Rise or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½ 5½	9½-10½	+ ¼	5 2 4	Kensington & Knightsbridge, Ord.	5	9 9	7½-7½	..	5 16 2
Do. 4½ % Pref. ...	10	4½ 4½	9-10	+ ¼	4 10 0	Do. 4 % Deb. ...	Stock	4 4	92-95	..	4 4 3
Do. Second 6 % Pref. ...	10	6 6	10½-11	..	5 9 1	Kent Elec. Power, 4½ % Deb. ...	Stock	4½ 4½	80-84	..	5 7 2
Do. 4½ % Deb. Stock ...	Stock	4½ 4½	100-102	..	4 8 3	London Electric, Ord. ...	8	2 2½	1½-1½	..	4 5 6
Brompton & Kensington, Ord. ...	5	10 10½	8½-8½	..	5 14 3	Do. 6 % Pref. ...	5	6 6	4½-5½	..	5 14 8
Do. 7 % Cum. Pref. ...	5	7 7	7½-8½	..	4 6 2	Do. 4 % First Mort. Deb. ...	Stock	4 4	90-98 xd	..	4 6 0
Central Electric Supply, 4 %	100	4 4	97-100	..	4 0 0	Metropolitan	5	5 4	8½-4	- ¼	6 1 3
Guar. Deb. }						Do. 4½ % Cum. Pref. ...	5	4½ 4½	4½-4½	..	4 14 9
Charing Cross, West End & City	5	5 5	4½-5	..	5 0 0	Do. 4½ % First Mort. Deb. ...	Stock	4½ 4½	101-104	..	4 6 7
Do. 4½ % Cum. Pref. ...	5	4½ 4½	4½-4½	..	4 17 4	Do. 3½ % Mort. Deb. ...	Stock	3½ 3½	85-88	..	3 19 7
Do. "City Undertaking"	5	4½ 4½	8½-4½	..	5 2 10	Midland Electric Corporation	100	4½ 4½	96-98	..	4 11 10
4½ % Cum. Pref. }						4½ % First Mort. Deb. }					
Do. Do. 4 % Deb. ...	100	4 4	94-96 xd	+ 1	4 3 4	Newcastle-on-Tyne 5 % Pref. }	5	5 5	4½-5	..	5 0 0
Chelmsca, Ord. ...	5	5 5	4½-4½	..	5 2 7	Non-Cum. }					
Do. 4½ % Deb. ...	Stock	4½ 4½	99-102	..	4 8 3	North Metropolitan Power Sup-	100	5 5	100-103	+ 3	4 17 1
City of London, Ord. ...	10	7 8	17-19	- ½	4 4 3	ply, 5 % Mortgages (Red.)					
Do. 5 % Cum. Pref. ...	10	6 6	15-17	..	3 10 7	Notting Hill, 6 % Non-Cum.	10	6 6	10½-11½	..	5 6 8
Do. 5 % Deb. ...	Stock	5 5	119-123	..	4 1 4	Pref. }					
Do. 4½ % Second Deb. ...	100	4½ 4½	101-104	..	4 6 7	Oxford	5	7½ 7½	5½-6½	..	5 13 9
County of London, Ord. ...	10	5 6	10½-11½	+ ½	5 5 6	St. James' and Pall Mall, Ord.	5	10 10	8-8½	..	5 14 3
Do. 6 % Pref. ...	10	6 6	11½-12	+ ½	5 0 0	Do. 7 % Pref. ...	5	7 7	6½-7½	..	4 15 0
Do. 4½ % Deb. ...	Stock	4½ 4½	108-110	..	4 1 10	Do. 8½ % Deb. ...	100	8½ 8½	85-87	..	4 0 6
Do. 4½ % Second Deb. ...	Stock	4½ 4½	100-103	..	4 8 3	Smithfield Markets, Ord. ...	5	Nil 2	1½-1½	..	6 8 0
Edmundson's, Ord. ...	5	Nil Nil	1½-1½	- 1/8	Nil	South London, Ord. ...	4	5 5	2½-3½	..	4 17 1
Do. 6 % Cum. Pref. ...	5	Nil Nil	3-3½	..	Nil	Do. 5 % First Mort. Deb. ...	100	5 5	100-103	..	5 1 0
Do. 4½ % First Mort. Deb. ...	100	4½ 4½	86-89	..	5 1 2	South Metropolitan, 7 % Pref. ...	1	7 7	1½-1½	..	4 11 0
Folkestone	5	6 6	4½-5½	..	5 14 3	Do. 4½ % First Deb. Stock ...	100	4½ 4½	96-99	..	3 6 8
Do. 5 % Cum. Pref. ...	5	5 5	4½-5½	..	4 15 3	Urban, Ord. ...	£3	5 5	1-1	..	5 2 3
Do. 4½ % First Deb. ...	100	4½ 4½	94-97	..	4 12 9	Do. 5 % Cum. Pref. ...	5	5 2	2½-3	..	5 14 3
Hove	5	9 9	6½-7½	..	6 4 2	Do. 4½ % First Mort. Deb. ...	100	4½ 4½	86-88	..	4 4 8
						Westminster, Ord. ...	5	10 10	8½-8½	..	
						Do. 4½ % Cum. Pref. ...	5	4½ 4½	5½-6½	..	

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 6	5½-5½	..	5 2 2	Monterey Rly. Light & Power, }	100	5 5	89½-91½	+ 1	5 9 3
Calcutta, Ord. ..	5	8½ 8½	7½-7½	..	5 11 6	5 % 1st Mort. Deb. }					
Do. 5 % Pref. ...	5	5 5	5-5½	..	4 15 3	Montreal, Lt., H. and Power ..	\$100	7 8	211-215	..	3 14 5
Calgary Power, 1st Mort. Bds.	100	5 5	97½-99½	..	5 0 6	Northern, Lt., Power and Coal,	\$500	5 5	39-42	..	11 18 2
Canadian Gen. El. Com. ...	\$100	7 7½	114-118	+ 2	5 18 8	5 % 1st Mort. Bonds }					
Do. 7 % Pref. ...	\$100	7 7	120-124	+ 2	5 13 0	River Plate, Ord. ...	Stock	10 10	240-250	..	4 0 0
Cordoba Lt., Power and T., Ord.	1	8 3½	1½-1½	..	3 4 0	Do. 6 % Non-Cum. Pref. ...	Do.	6 6	109-114	..	5 5 3
Do. 5 % Deb. ...	100	5 5	94-97	..	5 3 1	Do. 5 % Deb. Stock ...	Do.	5 5	103-105	..	4 15 3
Elec. Lt. and P. of Cochabamba,	100	6 6	91½-93½ xd	..	6 8 4	Roy. Elec. Co., Montreal, 4½ %	100	4½ 4½	99-101	..	4 9 1
6 % Bonds }						1st Mort. Deb. }					
Eleo. Supply Victoria, 5 % 1st	100	5 5	83-86	..	5 16 3	Shawinigan Water, Capital ...	\$100	4 5½	142-146	+ 3	8 8 6
Mort. Deb. }						Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	111½-113½	..	4 8 1
Elec. Dev. Ontario, 5 % 1st	\$500	5 5	94½-96½	..	5 3 8	Do. 4½ % Per. Deb. ...	Stock	4½ 4½	104-106	+ 1	4 5 0
Mort. Bonds }						Toronto Power, 4½ % Deb. ...	Do.	4½ 4½	98½-100½ xd	..	4 9 7
Kalgoorlie Elec. P. and L., Ord.	10½	Nil ..	1½-1½	- 1/8	Nil	Vera Cruz Lt., P. and T., 5 %	100	5 5	92½-94½	..	5 5 10
Do. 6 % Pref. ...	1	6 6	1½-1½	..	8 6 0	1st Mort. Deb. }					
Kaministiquia Power, 5 % G. Bs.	\$500	5 5	106-108	..	4 12 7	Victoria Falls Power, Pref. ...	1	Nil 11½d.	1½-1	..	..
Madras, Ord. ...	5	.. ..	2½-2½	..	..	West Kootenay Power and Lt., }	100	6 6	105½-107½	..	5 11 7
Melbourne, 5 % 1st Mort. Deb.	100	5 5	104-107	..	4 13 6	1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	..	5 5	91-93	..	5 7 6						
Mexican Lt. & Power, Common	\$100	4 4	94-99	+ 4½	4 0 10						
Do. 7 % Cum. Pref. ...	\$100	7 7	111-114	+ 6½	6 2 10						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	98½-100½	+ 1	4 19 6						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	Nil	4½ 7½-7½	..	..	Monte Video Telephone, Ord. ...	1	6 6	1-1½	..	5 6 3
Do. 5 % Deb. Red. ...	Stock	5 5	97½-99½	..	5 0 6	Do. 5 % Pref. ...	1	5 5	1-1½	..	5 14 3
American Telep. & Teleg., Cap.	\$100	8 8½	148½-150½	..	5 6 4	National Telephone, Pref. ...	Stock	5 6	100-103	..	..
Do. Collat. Trust	\$1000	4 4	95½-97½	..	4 2 1	Do. Def. ...	Do.	6 6	142-144	- 1	..
Anglo-American Telegraph ..	Stock	3½ 3	65-67	..	4 9 7	Do. 5 % Non-cum. 3rd Pref.	5	5 5	5½-6½	- ½	..
Do. 6 % Pref. ...	Do.	6 6	109½-110½	+ ¼	5 8 10	New York Telep., 4½ % Gen. Bnds.	100	4½ 4½	99-100	..	4 10 0
Do. Def. ...	Do.	30½ 30½	25½-25½	- ¼	5 16 6	Oriental Telep. and Elec. ...	1	8 8	14½-14½	..	4 13 0
Anglo-Portuguese Tel., 5 %	100	5 5	102½-104½	+ ½	4 16 2	Do. 6 % Cum. Pref. ...	1	6 6	1½-1½	..	4 16 0
Mort. Deb. }						Do. 4 % Red. Deb. ...	Stock	4 4	89-91	..	4 8 0
Chili Telephone ..	5	7 7	7½-8	..	4 10 4	Pacific and European Tel., 4 %	Do.	4 4	100-103	..	3 18 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4 4	82½-84½	+ ½	4 14 8	Guar. Debs. }					
Cuba Telegraph ..	10	6 6½	94-104	..	5 14 3	Reuter's ..	8	5 5½	11½-11½	..	3 8 0
Do. 10 % Pref. ...	10	10 10	16½-17½	..	5 14 3	Submarine Cables Trust	Cert.	6 6	127-130	..	4 12 4
Direct Spanish Telegraph, Ord.	5	4 4½	8½-8½	..	5 6 8	Telephone Co. of Egypt, 4½ %	Stock	4½ 4½	99½-101½	..	4 8 8
Do. 10 % Cum. Pref. ...	5	10 10	7-7½	..	6 9 0	Deb. Red. }					
Direct United States Cable	10	4½ 5	7½-7½	..	6 7 0	United River Plate Telephone	5	8 8	7½-7½	- 1/8	5 1 7
Direct W. India Cable, 4½ %	100	4½ 4½	99-101	..	4 9 1	Do. 5 % Cum. Pref. ...	5	5 5	6½-6½	..	4 8 11
Reg. Deb. }						West Coast of America ..	2½	2½ 2½	1½-1½	..	4 0 0
Eastern Telegraph, Ord. Stock	Stock	7 5½	130-133	..	5 5 3	Do. 4 % Debs., 1 to 1,500	100	4 4	96-99	+ 1	4 0 10
Do. 8½ % Pref. Stock ...	Do.	3½ 3½	77½-79½	- ½	4 8 1	guar. by Braz. Sub. Tel. }					
Do. 4 % Mort. Deb. ...	Do.	4 4	99-101	..	3 19 3	West India and Panama Teleg.	10	1½ 1½	2½-2½	- ½	1 14 9
Eastern Extension ..	10	7 5½	12½-13½	..	5 5 8	Do. 6 % Cum. 1st Pref. ...	10	6 6	10½-10½	..	5 11 7
Do. 4 % Deb. ...	Stock	4 4	99-101	..	3 19 3	Do. 6 % Cum. 2nd Pref. ...	10	6 6	9½-10½	..	5 17 1
East and S. Africa Tel. 4 %	25	4 4	97-100	..	4 0 0	Do. 5 % Debs. ...	100	5 5	102½-104½	..	4 15 8
Mt. Db. Mauritius Sub. }						Western Telegraph, Ltd. ...	10	7 6½	19½-19½	..	5 2 9
Globe Telegraph and Trust	10	5½ 6½	11-11½	..	5 4 4	Do. 4 % Deb. ...	Stock	4 4	98-100	..	4 0 0
Do. 5 % Pref. ...	10	6 6	12½-13½	- ½	4 9 9	Western Union 4½ % Fdg. Bonds	\$1000	4½ 4½	100-103	..	4 7 5
Great Northern Telegraph	10	18 18	27½-28½	- 1	6 6 4						
Indo-European Telegraph	25	18 5½	56-58	..	5 3 5						
Mackay Companies Common ..	\$100	5 5	83-91 xd	..	5 10 0						
Do. 4 % Cum. Pref. ...	\$100	4 4	70-73 xd	..	5 9 7						
Marconi's Wireless Telegraph	1	5 20	6-6½	- 1/8	3 5 4						
Do. 7 % Cum. Partic. Pref.	1	16 17	5½-5½	- 1/8	3 1 10						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page



## SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

## ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 25th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 25th.	Rise + or Fall	Present Yield p.c.
		1910. 1911.			£ s. d.			1910. 1911.			£ s. d.
Bath Trams, Pref. Ord. ..	1	Nil	78 — 83	..	6 3 1	Metropolitan Railway Consol. ..	100	12 1/2	63 1/2 — 64	—1	2 18 7
Do. 5 % Pref. ..	1	5	78 — 83	..	6 3 1	Do. Surplus Lands ..	100	2 1/2	67 — 69	..	4 3 4
Do. 4 1/2 % Deb. ..	100	4 1/2	78 — 83	..	5 8 5	Do. 8 1/2 % Deb. ..	100	8 1/2	89 — 91	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	11 — 13	..	..	Do. 8 1/2 % Pref. ..	100	8 1/2	86 — 88	..	3 19 7
Do. Do. Deferred ..	100	..	6 — 8	..	..	Do. 3 1/2 % Con. Pref. ..	100	3 1/2	87 — 89	..	3 18 8
Do. Do. 6 % Cum. Pr'f. ..	100	..	93 — 95	— 1/2	6 6 4	Metropolitan District Ord. ..	100	Nil	41 1/2 — 42 1/2	— 1/2	Nil
Do. Do. 7 % Non-Cum. Pr'f. ..	100	..	41 — 45	— 1	..	Do. 6 % Deb. ..	100	6	144 — 146	..	4 2 2
Do. Do. 5 % Perp. Deb. ..	100	5	93 — 97	..	5 3 1	Do. 4 % Deb. ..	100	4	96 — 98	..	4 1 8
Do. Do. 4 1/2 % 2nd Deb. ..	100	4 1/2	80 — 84	..	5 7 2	Do. 4 % Prior Lien ..	100	4	99 — 101	..	3 19 3
Central London Railway, Ord.	100	8	75 — 77	— 4	3 18 0	Do. 4 1/2 % First Pref. ..	100	8 1/2	90 — 92	..	4 17 10
Do. Pref. ..	100	4	84 — 86	..	4 13 0	Do. 3 1/2 % Gtd. ..	100	3 1/2	76 — 78	..	4 9 9
Do. Def. ..	100	2	74 — 76	— 4	2 12 8	Metropolitan Elec. Trams, Ord.	1	5 1/2	1 1/2 — 1	..	6 0 0
Do. 4 % Deb. ..	100	4	101 — 103	..	5 17 8	Do. Def. ..	1	Nil	1 1/2 — 1 1/2	..	Nil
City & South London, Ord.	100	1 1/2	96 1/2 — 97 1/2	— 1 1/2	4 6 8	Do. 5 % Pref. ..	1	5	98 — 100	..	5 10 6
Do. 5 % Pref., 1891 ..	100	5	108 — 110	..	4 11 0	Do. 4 1/2 % Deb. ..	100	4 1/2	98 — 100	..	4 10 0
Do. Do. 1896 ..	100	5	104 — 106	..	4 15 3	Do. 5 % Deb. ..	100	5	98 — 100	..	5 0 0
Do. Do. 1901 ..	100	5	104 — 106	..	4 14 4	Potteries, Ord. ..	1	2	5 1/2 — 5 1/2	..	..
Do. Do. 1903 ..	100	5	103 — 105	..	4 15 3	Do. 5 % Pref. ..	1	5	5 1/2 — 5 1/2	..	6 13 4
Do. 4 % Deb. ..	100	4	99 — 101	..	3 19 3	Do. 4 1/2 % Deb. ..	100	4 1/2	87 — 90	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6	103 — 11 1/2	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6	72 — 77	..	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil	18 — 12 1/2	..	Nil	Do. 4 % Deb. ..	100	4	72 — 77	..	5 4 0
Hastings Trams, 6 % Pref. ..	5	Nil	71 — 76	..	8 0 0	Underground Elec. Railways	10	..	4 — 4 1/2	— 1/2	Nil
Do. 4 1/2 % Deb. ..	100	4 1/2	71 — 76	..	5 18 5	Do. 4 1/2 % Bonds ..	100	4 1/2	100 — 102	+1	4 8 8
Isle of Thanet Trams, 5 % Pref.	5	2 1/2	21 — 2 1/2	..	4 11 0	Do. 6 % Income ..	100	1	87 — 89	— 3	..
Do. 4 % Deb. ..	100	4	75 — 80	..	5 0 0	Yorkshire (West Riding), Ord.	5	Nil	3 — 3 1/2	..	Nil
Lancashire United, 5 % Deb. ..	100	5	83 — 85	..	5 17 8	Do. 6 % Pref. ..	5	Nil	3 — 3 1/2	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4	97 — 99	..	4 0 10	Do. 4 1/2 % Deb. ..	100	4 1/2	80 — 84	..	5 7 2
London United Trams, 5 % Pref.	10	Nil	5 1/2 — 5 1/2	..	..						
Do. 4 % Deb. ..	100	4	76 — 79	— 1	5 1 3						

## ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5 1/2	5 1/2 — 5 1/2 xd	..	5 1 2	La Plata Elec. Trms, Ord. ..	1	..	..	1 1/2 — 3 1/2	..	..
Do. 2nd Pref. ..	5	5	5 1/2	4 1/2 — 5 1/2 xd	..	5 6 0	Do. Pref. ..	1	6	6	3 1/2 — 1	..	6 0 0
Do. 4 % Deb. ..	100	4	4	94 1/2 — 96 xd	..	4 3 4	Lisbon Elec. Trams, Ord. ..	1	5 1/2	6	1 — 1 1/2	..	4 8 0
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	99 1/2 — 101 1/2	..	4 8 8	Do. 6 % Pref. ..	1	6	6	1 — 1 1/2	..	4 16 0
Do. 5 % Deb. ..	100	5	5	101 — 103	..	4 17 1	Do. 5 % Deb. ..	100	5	5	94 — 98	..	5 2 0
Auckland Trams, 5 % Deb. ..	100	5	5	104 — 106	..	4 14 4	Manaos Elec. Tr. (1904), Deb. ..	100	5	5	102 — 104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	11 1/2 — 11 1/2	..	5 3 3	Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 95	..	5 5 3
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	98 — 100	..	4 10 0	Manila Elec. R. and Lt., Bonds	\$1000	5	5	103 — 105	+1	4 15 2
Do. 5 % 2nd Deb. ..	100	5	5	99 — 101	..	4 19 0	Mexico Trams Com. ..	\$100	7	7	130 — 133	+7 1/2	5 5 3
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7 1/2	+ 1/2	5 6 8	Do. Gen. Con. 5 % Bonds ..	..	5	5	98 1/2 — 100 1/2	..	4 19 6
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2	..	4 15 3	Do. 6 % Bonds ..	100	6	6	105 — 107	+1	5 12 2
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	101 — 104	+1	4 6 7	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 1/2 — 7 1/2	..	6 18 0
B. Columbia Elec. Rly., Def. ..	100	8	8 1/2	135 — 140 xrts	..	5 14 4	Do. 6 % Pref. ..	5	6	6	5 — 5 1/2	..	7 0 4
Do. Pref. Ord. ..	100	6	6	118 — 123 xrts	..	4 17 7	Do. 5 % 1st Deb. ..	100	5	5	100 — 102	..	4 18 0
Do. 5 % Pref. ..	100	5	5	107 — 110	— 4	4 11 0	Perth (W.A.) Elec. Tr., Ord. ..	1	2 1/2	..	1 1/2 — 1 1/2	..	1 18 4
Do. 4 1/2 % 1st Mort. Deb. ..	40	4 1/2	4 1/2	99 1/2 — 102 1/2	..	4 7 10	Do. 5 % 1st Deb. ..	100	5	5	101 — 104	..	4 16 2
Do. 4 1/2 % Vancouver Deb. ..	100	4 1/2	4 1/2	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2 — 5 1/2	+ 1/2	5 11 7
Do. 4 1/2 % Con. Deb. ..	100	4 1/2	4 1/2	102 1/2 — 104 1/2	..	4 6 2	Do. 4 1/2 % 1st Deb. ..	100	4 1/2	4 1/2	99 — 101	..	4 9 1
Calcutta Trams, Ord. ..	5	6	7	6 1/2 — 6 1/2	..	5 5 8	Rio de Janeiro Trams ..	\$100	4 1/2	5 1/2	156 1/2 — 158 1/2	+15	3 3 1
Do. 5 % Pref. ..	5	5	5	4 1/2 — 5 1/2	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	106 — 107	..	4 13 6
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	101 — 104	+1	4 6 7	Do. 5 % Mort. Bonds ..	100	5	5	99 — 100	..	5 0 0
Cape Electric Trams ..	1	Nil	2 1/2	8 — 8	..	..	Sao Paulo Tram, Lt. and P. ..	\$100	10	10 1/2	250 — 255	+2	3 18 5
City Buenos Aires Trams (1904)	5	5	5	5 1/2 — 5 1/2	..	4 10 6	Do. 5 % 1st Deb. ..	\$500	5	5	105 — 107	— 1/2	4 13 6
Do. 4 % Deb. ..	100	5	5	101 — 103	..	4 17 3	Singapore Trams, 5 % Deb. ..	100	5	5	80 — 83	..	6 0 5
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	\$1000	5	5	100 — 103	— 1	4 17 2	Un. Elec. Trams Monte Video ..	5	6	7	5 1/2 — 6 1/2	+ 1/2	5 14 3
Kaloorie Elec. Trams ..	1	Nil	..	1 1/2 — 1 1/2	..	Nil	Do. 6 % Pref. ..	5	6	6	5 — 5 1/2	..	5 14 3
Do. 5 % A Deb. ..	100	5	5	8 1/2 — 9 1/2 xd	..	5 7 6	Do. 5 % 1st Deb. ..	100	5	5	100 — 103	..	4 17 1
Do. 6 % B Deb. ..	100	5	6 1/2	56 — 60	..	10 0 0	Winnipeg Elec. Rly., 4 1/2 % Deb.	100	4 1/2	4 1/2	104 1/2 — 106 1/2	..	4 4 6

## MANUFACTURING COMPANIES.

Aron, Ord. ..	1	Nil	6	1 1/2 — 1 1/2	..	7 7 8	Dick, Kerr ..	1	5	..	3 1/2 — 3 1/2	..	5 8 1
Do. 6 % Pref. ..	1	9	6	4 1/2 — 4 1/2	..	7 2 2	Do. Pref. ..	1	6	6	1 — 1 1/2	+ 1/2	5 6 8
Babcock & Wilcox ..	1	26	28	3 1/2 — 3 1/2	— 1/2	..	Do. Deb. ..	100	4 1/2	4 1/2	97 — 100	..	4 10 0
Do. Pref. ..	1	6	6	1 1/2 — 1 1/2	..	4 0 0	Edison & Swan, A, £3 paid	5	Nil	..	1 1/2 — 1 1/2	..	Nil
B.I. & Helsby Cables ..	5	10	10	7 1/2 — 8 1/2	..	6 1 3	Do. fully paid ..	5	Nil	..	1 1/2 — 1 1/2	..	Nil
Do. Pref. ..	5	6	6	6 1/2 — 6 1/2	..	4 9 0	Do. 4 % Deb. ..	100	4	4	68 — 72	..	5 11 1
Do. Deb. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5	Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
British Thomson-Houston, Deb.	100	4 1/2	4 1/2	96 — 98	..	4 11 10	Electric Construction ..	2	Nil	2 1/2	1 1/2 — 1 1/2	..	..
British Westinghouse, Pref. ..	3	Nil	..	7 1/2 — 7 1/2	..	Nil	Do. Pref. ..	2	7	7	1 1/2 — 2	..	7 0 0
Do. Deb. ..	100	4	4	61 — 64	..	6 5 0	Greenwood & Batley, Pref.	10	7	7	7 1/2 — 8 1/2	..	8 5 8
Do. 6 % Prior Lien ..	100	6	6	102 — 105	+1	5 14 3	Do. Deb. ..	100	5	5	94 — 96	..	5 4 2
Browett, Lindley, Ord. ..	1	Nil	..	1 1/2 — 2 1/2	..	Nil	General Electric, Pref. ..	10	5	5	10 — 10 1/2	+ 1/2	4 15 3
Do. Pref. ..	1	Nil	..	5 1/2 — 6 1/2	..	Nil	Do. Deb. ..	100	4	4	85 — 90	..	4 8 11
Brush, 7 % Pref. ..	2	Nil	..	0 — 1 1/2	..	Nil	Henley's, Ord. ..	5	15	10 1/2	11 1/2 — 12 1/2	..	6 0 0
Do. 5 % Prior Lien Deb. ..	100	5	5	77 1/2 — 82 1/2	..	6 1 3	Do. Pref. ..	5	4 1/2	4 1/2	4 1/2 — 5 1/2	..	4 6 9
Do. 4 1/2 % Deb. ..	100	4 1/2	4 1/2	52 — 57	— 2	7 17 10	Do. Deb. ..	100	4 1/2	4 1/2	101 — 103	..	4 7 5
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	87 — 92	..	10 14 4	India-Rubber, G. & T. ..	10	10	..	7 1/2 — 8 1/2	..	..
Callender's Cable ..	5	15	10 1/2	10 1/2 — 11 1/2	..	6 10 5	Do. Pref. ..	10	5	5	94 — 10 1/2	+ 1/2	4 17 7
Do. Pref. ..	5	5	5	5 — 5 1/2	..	4 15 3	Telegraph Construction ..	12	20	10 1/2	32 1/2 — 34 1/2	— 1/2	6 17 0
Do. Deb. ..	100	4 1/2	4 1/2	100 — 102	..	4 8 3	Do. Deb. ..	100	4	4	99 — 101	— 1/2	3 19 3
Castner-Kellner ..	1	17 1/2	20	3 1/2 — 8 1/2	+ 1/2	5 8 1	Willans & Robinson ..	1	Nil	..	1 1/2 — 1 1/2	..	Nil
Do. Deb. ..	100	4 1/2	4 1/2	105 — 109	..	4 10 7	Do. Pref. ..	5	Nil	..	1 1/2 — 1 1/2	..	Nil
Crompton & Co. ..	3	Nil	..	1 1/2 — 1 1/2	..	Nil	Do. Deb. ..	100	4	4	58 — 60	..	6 13 4
Do. Deb. ..	100	5	5	58 — 68	..	7 7 1							

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.



TRADE STATISTICS OF MEXICO.

THE following figures, showing the imports of electrical and similar materials into Mexico during the year ended June 30th, 1911, are taken from the recently-issued official trade statistics: the figures for the previous year are given for purposes of comparison, with notes of increases or decreases:—

Peso = 4s.

	1909-10.	1910-11.	Increase or decrease.
	Pesos.	Pesos.	Pesos.
<i>Copper, brass or bronze wire, covered with other materials.—</i>			
From Germany ...	70,000	83,000	+ 13,000
" Austria ...	1,000	2,000	+ 1,000
" United States ...	389,000	461,000	+ 72,000
" France ...	—	1,000	+ 1,000
" Great Britain ...	1,000	4,000	+ 3,000
" Other countries ...	—	9,000	+ 9,000
Total ...	461,000	560,000	+ 99,000

<i>Copper, brass or bronze wire, bare.—</i>			
From Germany ...	26,000	40,000	+ 14,000
" United States ...	119,000	364,000	+ 245,000
" Great Britain ...	11,000	9,000	— 2,000
" Other countries ...	13,000	7,000	— 6,000
Total ...	169,000	420,000	+ 251,000

<i>Cables of copper, brass, &amp;c., not armoured.—</i>			
From Germany ...	41,000	23,000	— 18,000
" Austria ...	4,000	8,000	+ 4,000
" United States ...	242,000	231,000	— 11,000
" Great Britain ...	2,000	20,000	+ 18,000
" Other countries ...	4,000	30,000	+ 26,000
Total ...	293,000	312,000	+ 19,000

<i>Cables of copper, &amp;c., armoured.—</i>			
From Germany ...	61,000	50,000	— 11,000
" United States ...	64,000	129,000	+ 65,000
" Great Britain ...	53,000	121,000	+ 68,000
" Other countries ...	5,000	2,000	— 3,000
Total ...	183,000	302,000	+ 119,000

<i>Iron wire.—</i>			
From Germany ...	167,000	168,000	+ 1,000
" United States ...	342,000	338,000	— 4,000
" Great Britain ...	27,000	25,000	— 2,000
" Other countries ...	13,000	5,000	— 8,000
Total ...	549,000	536,000	— 13,000

<i>Rails.—</i>			
From Germany ...	403,000	335,000	— 68,000
" Belgium ...	101,000	98,000	— 3,000
" United States ...	4,340,000	3,148,000	— 1,192,000
" Great Britain ...	780,000	355,000	— 425,000
" Other countries ...	23,000	8,000	— 15,000
Total ...	5,647,000	3,944,000	— 1,703,000

<i>Insulators of glass or porcelain.—</i>			
From Germany ...	28,000	17,000	— 11,000
" Austria ...	5,000	3,000	— 2,000
" United States ...	95,000	84,000	— 11,000
" Other countries ...	1,000	1,000	—
Total ...	129,000	105,000	— 24,000

<i>Commutators, interrupters, contacts, safety cut-outs, &amp;c.—</i>			
From Germany ...	77,000	92,000	+ 15,000
" Austria ...	5,000	1,000	— 4,000
" United States ...	191,000	277,000	+ 86,000
" France ...	2,000	11,000	+ 9,000
" Great Britain ...	12,000	4,000	— 8,000
" Other countries ...	1,000	5,000	+ 4,000
Total ...	288,000	390,000	+ 102,000

<i>Arc lamps.—</i>			
From Germany ...	20,000	16,000	— 4,000
" United States ...	32,000	35,000	+ 3,000
" Other countries ...	1,000	1,000	—
Total ...	53,000	52,000	— 1,000

<i>Incandescent electric lamps.—</i>			
From Germany ...	275,000	233,000	— 42,000
" Austria ...	25,000	26,000	+ 1,000
" United States ...	360,000	398,000	+ 38,000
" France ...	10,000	11,000	+ 1,000
" Great Britain ...	26,000	2,000	— 24,000
" Switzerland ...	8,000	1,000	— 7,000
" Other countries ...	—	11,000	+ 11,000
Total ...	704,000	682,000	— 22,000

	1909-10.	1910-11.	Increase or decrease.
	Pesos.	Pesos.	Pesos.
<i>Machines for industries, mining, &amp;c.—</i>			
From Germany ...	2,116,000	2,955,000	+ 839,000
" Austria ...	6,000	6,000	—
" Belgium ...	79,000	139,000	+ 60,000
" Canada ...	—	5,000	+ 5,000
" Spain ...	32,000	43,000	+ 11,000
" United States ...	13,352,000	16,661,000	+ 3,309,000
" France ...	371,000	394,000	+ 23,000
" Great Britain ...	2,891,000	3,158,000	+ 267,000
" Italy ...	17,000	46,000	+ 29,000
" Sweden ...	91,000	219,000	+ 128,000
" Switzerland ...	159,000	125,000	— 34,000
" Other countries ...	31,000	18,000	— 13,000
Total ...	19,136,000	23,769,000	+ 4,633,000

<i>Carriages of all kinds for railways, &amp;c.—</i>			
From Germany ...	40,000	94,000	+ 54,000
" United States ...	1,747,000	4,048,000	+ 2,301,000
" France ...	—	5,000	+ 5,000
" Great Britain ...	119,000	10,000	— 109,000
" Other countries ...	1,000	2,000	+ 1,000
Total ...	1,907,000	4,159,000	+ 2,252,000

<i>Asbestos sheets, &amp;c.—</i>			
From Germany ...	6,000	2,000	— 4,000
" United States ...	106,000	123,000	+ 17,000
" France ...	1,000	4,000	+ 3,000
" Great Britain ...	3,000	—	— 3,000
" Other countries ...	1,000	1,000	—
Total ...	117,000	130,000	+ 13,000

<i>Scientific instruments and apparatus.—</i>			
From Germany ...	94,000	114,000	+ 20,000
" United States ...	199,000	218,000	+ 19,000
" France ...	82,000	74,000	— 8,000
" Great Britain ...	11,000	13,000	+ 2,000
" Italy ...	15,000	29,000	+ 14,000
" Other countries ...	9,000	8,000	— 1,000
Total ...	410,000	456,000	+ 46,000

ACZOL: A NEW PRESERVATIVE MATERIAL FOR TIMBER.

By WM. MANKTELOW.

THE conservation of the world's timber supply is a matter of vital importance, for, by no means, can the growth of good wood be appreciably expedited; and, meanwhile, the consumption of timber for every purpose—from the support of transmission lines to the manufacture of paper pulp—increases by leaps and bounds. Lumber has to be collected from more and more inaccessible areas (a fact which, alone, considerably increases the market cost), and forest fires continue to devastate enormous areas yearly. The problem of timber supply has become really acute, and the most obvious solutions—the practice of systematic reafforestation and the prevention of premature decay of timber used in outdoor, mining and similar services—are now receiving more or less effective application.

In a recent article in these columns (ELECTRICAL REVIEW, February 2nd, 1912, page 193, *et seq.*) the author dealt with various methods of pole preservation, the period of efficacy of which is limited by the antiseptic properties of the preservative and by the time which elapses before the latter is largely washed out (in the case of metallic salts and other materials soluble in water), or evaporated (in the case of creosote and the allied oils).

No metallic salt or salts which will not form an insoluble (in water) compound with cellulose can be of any lasting value in timber preservation, and, in any case, it is specially desirable that the salts should not cause or favour the corrosion of iron and steel. Creosote has hitherto proved the most generally useful preservative, but the treatment required is costly, and the wood is left in a more or less objectionable state, besides being very materially increased in weight by the process (a matter of some importance where transit over long or difficult routes is con-



cerned). Besides the gradual "settling" of creosote towards the foot of the pole, and eventually, more or less, completely out of the latter, the phenols and naphthaline in the oil evaporate more quickly the higher the atmospheric temperature, and the antiseptic properties of the remaining constituents are comparatively low.

A new preservative material, which obviates the defects of older preparations, has lately been brought forward under the name of "Aczol." This is a patent compound of metallic ammoniates with an antiseptic acid having no deleterious action on wood or metals. The chemical properties and preservative action of the new material are as follows:—

*On Cellulose.*—Copper ammoniate, which is one of the constituents of Aczol, possesses the well-known property of dissolving cellulose and thereby enabling the capillary attraction of the whole of the preservative compound into the innermost pores. By evaporation of the alkali, the walls of the cells receive a stable, preservative coating which fixes the nitrogenous matter in the fibres, and forms small quantities of metallic sulphates and phosphates, which repel insect and fungus attack.

*On Paracellulose* (which is not soluble in copper ammoniate until it has been acted upon by acids or alkalis), the presence of the antiseptic acid enables a similar action to the above—a point which is of special importance in the preservation of poplar, fir and oak—the ligneous tissues of which contain more paracellulose than cellulose.

*Albumenoidal matter*, between and within the cellular cavities, is never eliminated, particularly from the sapwood, however careful the drying. The zinc ammoniate in Aczol coagulates and mineralises this nitrogenous matter.

*Vasculose* forms the chief part of the wood vessels in plants, and is insoluble in concentrated acid and in copper ammoniate, but is converted, by the joint action of an organic acid in presence of copper and zinc ammoniates, to resin soluble in ammonia. As the latter evaporates, the resin is deposited as a laquer on the fibres. This action enables the deep penetration of the preservative acid and ammoniated cellulose during the treatment, and ensures their subsequent diffused retention. According to Fremy and Urbain, the woody fibres of poplar and oak contain 18 per cent. and 28 per cent. respectively of vasculose.

*Comparisons Between Aczol and Other Timber Preservatives.*—The results summarised in Table I, of tests carried out by the authorities stated, are reproduced from reports published in an article on Aczol in the *Revue de l'Ingenieur*. The method of conducting the various tests is outlined below, and from the results obtained, it will be seen that Aczol offers very considerable advantages over copper sulphate (Boucherie) treatment. It is only fair to remark that the superiority of Aczol to creosote, as regards preservative value, is not clearly demonstrated, though its advantages as regards lightness, strength, cleanliness and non-inflammability of the treated wood are obvious. It would seem, however, that in *permanence* of effect, Aczol is superior.

In Test 1, wood treated by various processes was reduced to sawdust and macerated with distilled water saturated with carbonic acid and carbonates: the percentage solution of Aczol was negligible, whereas the demetallisation of the samples treated by other processes was very serious. In Test 2, treated specimens were maintained at 30° C. for 48 hours in damp soil charged with a 2 per cent. solution of inverted sugar to which yeast was added to set up fermentation; again, the stability of the Aczol compound was demonstrated. The combination of Aczol with cellulose is insoluble in water, so that no Aczol is dissolved from treated timber by from 1 to 6 hours' boiling in water. Since Aczol contains no sulphates, chlorates, nitrates or other oxidising agents, it cannot corrode iron or steel.

The remaining tests were of a more practical nature; in Test 3, samples of elder, beech, pine, birch, oak and fir were exposed to the rotting action of a mixture of dung and clayey soil during nine months. Those specimens treated with Aczol showed the best preservation—not only as determined by low loss of weight, but also as indicated by the general condition of the wood after the test. Timber props exposed to moist hot air in the return air galleries of two Belgian collieries are found to rot to the limits of safety within 4-7 months if untreated, but props impregnated with

Aczol have already been in use from two to three times this period without undergoing appreciable damage.

Owing to the surface solution of the fibres and tissues, which occurs during the impregnation of timber with Aczol, and the subsequent "sealing" or "binding" of these parts one with another, the mechanical strength of the wood is materially increased by the treatment—as is clearly shown by the data in Table 1 (Tests 4-6).

The double salts of heavy metals and ammonium, contained by Aczol, render the wood unflammable as long as the salts are not volatilised by the continued application of a high temperature. In this respect, the new preservative is preferable to creosote and its derivatives. It is possible to vary considerably the appearance of wood impregnated with Aczol and to paint or polish it when dry.

As marketed, Aczol is in a highly concentrated form needing dilution in 10-20 volumes of water for use as an impregnant or in 5-10 volumes when used as a paint. Where facilities are not available for vacuum and pressure impregnation, cold immersion gives satisfactory results, though the more elaborate process is, of course, always preferable.

The fluidity of Aczol enables it to be applied cold, whereas creosote and other tar products need heat to reduce their viscosity during injection.

TABLE I.—CONDITION OF TIMBER.

Test.	Authority.	Plain wood.	—Impregnated with—			
			2 % CuSO <sub>4</sub>	2 % CuSO <sub>4</sub> 3% Amm.	Creo- sote.	Aczol.
1. % Copper re- moved	Bergé	...	77	41	...	3½
2. % Copper re- removed	Bergé	...	81	...	...	4½
3. % Loss wt. of wood	Durieux	38·3	22·6	...	...	9·1
4. Resistance ; com- pression	State testing dept. Malines	Ult. kg. ...	530	...	290	574
5. Ditto ditto		No. tests...	4	...	5	4
		Ult. kg. ...	390	...	353	573
		No. tests...	4	...	7	7
6. Resistance ; tear- ing		Ult. kg. ...	465	...	...	902
		No. tests	4	...	...	4

## THE OPTICAL CONVENTION, 1912.

THE second Optical Convention met on Wednesday, June 19th, under the presidency of Prof. Silvanus P. Thompson, in the Science Museum at South Kensington. The Southern Galleries, which had been kindly placed at the disposal of the Committee by the Board of Education, were well filled with a representative collection of instruments and processes connected with all branches of optics, exhibited by some of the best known firms of opticians and instrument-makers. The use of the Lecture Theatres of the Imperial College of Science was also granted for the purposes of the Convention.

The inaugural meeting was held at 8 p.m. on Wednesday, June 19th, when the presidential address was delivered. After sketching the progress of optics and kindred sciences from the earliest times to the present day, Prof. Thompson spoke very strongly on the necessity for proper co-operation between the mathematical optician and the actual maker of optical instruments, and advocated the formation of a "monotechnic" for the teaching of optics, where both lens calculation and lens grinding could be taught in one institution, thus ensuring a real co-ordination of the science and technology of optics. Prof. Thompson's remarks on this head could undoubtedly be applied with equal force to many other industries besides that of optics.

Many distinguished men of science were present at the reception and conversazione which followed the presidential address, and keen interest was displayed in the numerous working exhibits, and especially in the historical exhibits, in which the original experiments of Newton and Fresnel were demonstrated. During the five days of the Convention



many valuable papers were read. Among these, that by Dr. Harker, on "Optical Pyrometry," was of great interest, in view of the recent advances in the theory and practice of optical methods of temperature estimation.

#### EXHIBITS.

Although the great majority of the exhibits were of a purely optical character, a few firms showed some interesting electrical apparatus.

The Cambridge Scientific Instrument Co. had a number of electro-meteorological instruments on view, including the Callendar recorder and open-wound resistance thermometer. This instrument gives a very sensitive and accurate record of a rapidly fluctuating temperature. Records of its performances during thunderstorms and the recent solar eclipse illustrate the instrument's rapidity of action in its quick response to a rapid fall in temperature.

Another application of the Callendar platinum thermometer was shown by the same firm in the bolometric sunshine receiver. The essential part of this instrument consists of two platinum resistances mounted on a mica framework, the whole hermetically sealed up in a glass bulb filled with dry air. One resistance is blackened and the other left bright. They are connected differentially to a Callendar recorder. Atmospheric temperature changes affect both arms equally, but radiant heat is indicated—its absorption by the blackened surface throwing the recorder out of balance. The record indicates not only the duration of sunshine, but also the intensity of the sun's radiation.

The Wilson Universal electrometer was also shown in a portable form, especially suitable for measurements of atmospheric potential.

An improved form of the Thomson galvanometer designed by Paschen for use with his thermopile in radiometry measurements was shown, as well as the thermopile itself. A Fery pyrometer used in conjunction with a thread recorder, and a selection of pyrometers and resistance thermometers, were also on view.

Much of the space on the lower floor of the Museum was taken up by photometric apparatus. As the compilers of the wonderfully complete catalogue remark, "it is probable that before long the public will awake to the fact that it is possible to measure the candle-power of a lamp, or the illumination produced by it." Portable photometers were represented by the Holophane Lumeter and the Everett-Edgcumbe Luxometer, both of which appear to measure "surface brightness" with convenience and accuracy. The ranges of both instruments can be varied to meet any requirements from  $\frac{1}{100}$  candle-foot to 2,000 candle-feet. For use with the Lumeter, Messrs. Beck showed a new polar curve apparatus, which affords a convenient method of determining the intensity of light in every direction with rapidity.

Some elegant photometer benches were shown by the Holophane Co., Everett, Edgcumbe & Co., Wm. Sugg and Co., and the Alexander Wright Co. The latter company also exhibited a street photometer with carriage, but we tremble to imagine the panic that would result from its passage down Oxford Street or the Strand. It is claimed for this apparatus that it is accurate, simple and independent of colour difficulty.

Some examples of the Harcourt lamp were also shown by Messrs. Sugg and Messrs. Wright.

Recent progress in illuminating engineering has led to the design of greatly improved forms of globes, shades and reflectors. The exhibition illustrated most of the recent forward steps in the science of illumination. Distributing and concentrating reflectors were shown by the Benjamin Electric Co., and various methods of indirect lighting by reflection on to white surfaces were also shown. The "Excello" flame arc lamp was shown fitted with a dioptric inner globe with a lenticular formation upon its outer surface, which gives greater light emission at high angles. This effect was demonstrated most clearly by photographs, diagrams and polar curves.

An attempt to produce the same effect as is obtained in diffused sunlight was shown in the Benjamin daylight unit. This consists of a special metal reflector equipped with a "Wratten" screen.

Among the scientific specialities of the Holophane Co., perhaps the most striking was the "Uniflux" reflector, de-

signed to give a uniform illumination over a plane surface with the aid of sources placed near one or more edges of the area illuminated, *e.g.*, pictures, maps, &c.

Three cases provided by Siemens Bros. served to illustrate the process of manufacture of "Tantalum" lamps, the different types of lamp bulbs and the characteristic curves of these lamps, with various reflectors.

The automatic feed arc lamp for optical lanterns, as exhibited by one or two of the firms, will probably serve to make many lectures run smoothly that have hitherto been marred by sudden and ill-timed lantern failures. The "Westminster" arc lamp, in which the carbons are at right angles, was also shown, and appears to have many advantages, especially in the matter of steadiness, over the existing open type of arc.

## THE APPLICATION OF ELECTRICITY TO RAILWAY CAB SIGNALLING.

By WILLIAM H. DAMMOND.

EVERY existing railway block signalling system is an electrical system. Even in those instances in which the signalling devices themselves are purely non-electrical, a signalman must never mechanically move any one of his block signals to the "clear" indication until he first electrically asks permission to do so and then electrically receives such permission.

Despite the serious faults incident to the development of cab signalling—faults which cannot intelligently be urged against the cab signal idea, but which can rightly weigh only against the particular inventions in which they occur—such development has, in an important particular, proceeded in the right direction; so that, practically, cab signals may now be considered as belonging exclusively to the class in which the signalling devices themselves are electrically operated, in contradistinction to the class in which such devices are mechanically operated. Automatic stops are identical as to ultimate aim with cab signals, and are used to a considerable extent in the United

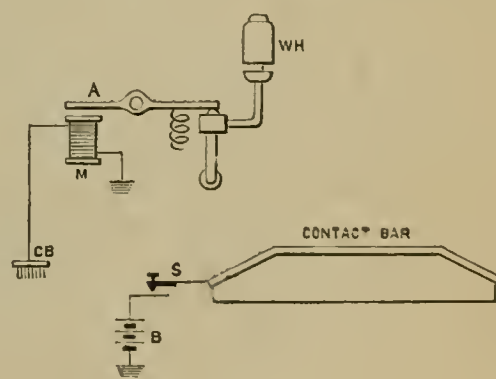


FIG. 1.

States and England. In both countries, however, the automatic stops are decidedly inferior to the best cab signals now in regular service in England. These automatic stops contain none of the electrical safeguards, met with in cab signals, against the dangerous consequences of failure by impact.

Fig. 1 shows a simplified diagram of a cab signal that has been in use for several years on about 2,000 miles of track in France. Here the locomotive equipment consists essentially of a danger whistle WH, a whistle armature A, an electromagnet M, and a collector brush CB, the magnet being grounded on one side on the locomotive frame, and connected on the other side to the collecting brush. At each point along the track at which it is desired to give cab-signal information, is located an insulated contact bar, which is connected, through a switch S, to one side of a battery B, the other side of B being grounded on the track rails. This signal, like that shown in fig. 2, is used merely as a supplement to manually-operated fixed block signals, and in both cases switch S is operated by the fixed signal lever. In fig. 1 the arrangement is such that switch S is closed when



the signal lever is at "danger," and is open when the signal lever is at "clear."

In fig. 1 the whistle valve is held closed by a spring except when armature A, which controls this valve, is attracted by whistle magnet M. So long, then, as the collector brush is not in communication with the contact bar the whistle remains mute. When the signalman throws the fixed signal to "clear," the contact bar becomes disconnected from its battery B, so that brush C B, if it then passes over the contact bar, receives no current from the latter. Whistle W H, therefore, remains silent. When, *per contra*, the signalman sends his lever to "danger," switch S is thereby closed, causing a partial circuit to extend from B to the contact bar; so that if the train proceeds until collector brush C B touches the contact bar, this partial circuit is completed through M. Magnet M then attracts armature A, causing the whistle valve to open, and whistle W H to give

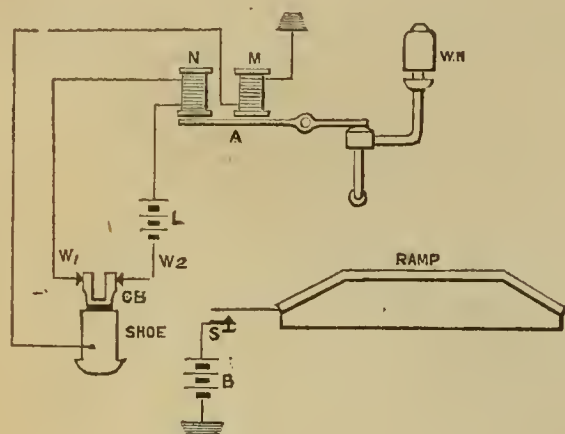


FIG. 2.

an audible danger indication. This system cannot be too strongly condemned. It violates the most important principle of electrical block signalling. If battery B should become either exhausted or short-circuited; or if C B should be prevented, by dirt or ice, for instance, from making sufficiently good contact with the contact bar; or if a single wire should become broken, the cab signal would continue to indicate "clear" (by remaining silent), no matter if the real condition ahead were "danger."

Fig. 2 shows, in simplified form, a cab signal used extensively at present in England. It is free from the objections just mentioned as to fig. 1. This superiority may be considered as arising from the fact that in fig. 2 the whistle valve is held closed only when armature A is held up by one or the other of the two electromagnets M and N. In addition to these parts, the locomotive equipment in fig. 2 includes a battery L, a shoe, and in mechanical connection with the shoe, a circuit-breaker. On the track a ramp is provided, between the track rails, at each cab-signalling point.

Between ramps the whistle W H, fig. 2, is held mute by magnet N, the circuit here being fed by locomotive battery L. Whenever the locomotive arrives at a signalling point, the shoe is raised by engagement with the ramp, causing the circuit-breaker C B to leave this circuit open between wires  $w_1$  and  $w_2$ . Thus far, then, the whistle valve would open, by gravity, and the whistle blow every time the locomotive encountered a ramp. But when the signalman throws his fixed signal lever to "clear," switch S (fig. 2) is thereby closed, electrically connecting up the ramp with battery B. Current from B will then be conducted (through the ramp and the shoe) to magnet M, and the latter (by attracting A) will hold the whistle mute. If, therefore, the fixed signal is at "clear," the cab signal will remain silent while the locomotive passes over the ramp; but if the signalman sends the fixed signal to "danger," the cab signal will audibly indicate "danger" when the shoe encounters the ramp.

The shoe of fig. 2 is subject to very violent impact at high train speeds. Obviously, if the bottom part of this shoe should become broken by impact with a ramp or with a foreign body on the track, the cab signal would fail to indicate "danger" at the next signalling point, even though the track ahead were obstructed. It has been suggested that the false clear indication, in this case, should be provided against by making the fastening of the shoe supports to the locomotive sufficiently weak to ensure that breakage would occur there, since such breaking would effect the opening of the

circuit at the circuit-breaker. But this would be extremely bad designing, since it would be dangerous to have such a heavy and large mass of iron drop under a locomotive running at high speed, for the danger of breaking, in the case of a shoe, varies directly as the square of the train speed.

While the stipulation that all errors at all likely to occur should be "on the side of safety" is the most important, it is certainly not the only important consideration. Even the false danger indication, which is the safe error, must be the rare exception under ordinary—that is, very trying—conditions. In order that the signal in fig. 2 shall not violate this second important rule, it is necessary to have heavy shoe pressures, so as to ensure good contact on dirty, rusty, or icy ramps. But this increment to pressure increases impact, thus rendering all the more likely the occurrence of the most serious consequences.

Another cab system has been proposed, as both a cab signal and an automatic stop, in which the shoe of fig. 2 is replaced by a ramp-engaging wheel, which is driven from the axle of a wheel that runs on one of the track rails. The rotation, at the instant of striking the ramp, of the ramp-engaging wheel produces an enormous reduction of impact. But a discussion of this interesting and important mechanical improvement cannot be attempted here; so that we must proceed at once to the only proper arrangement that has as yet appeared at this point in cab systems.

This arrangement is the wheel E, shown in fig. 3. This wheel is set in rotation by impact with a ramp, but ceases to rotate soon after leaving the ramp. Such a member accomplishes a great reduction in that component of the total impact which is expended in rotation, and which is by far the greater of the two components arising at the ramp. Assume, for simplicity, that this wheel is a simple circular lamina. The radius of gyration, then, equals the radius divided by  $\sqrt{2}$ , while the moment of inertia is equal to  $\pi/2$  times the fourth power of the radius. From this it follows that the impact speed for rotation is half as great as the train speed, and that the destructive tendency due to rotation is only one-fourth of what the corresponding component would be for a shoe. This reduction, together with

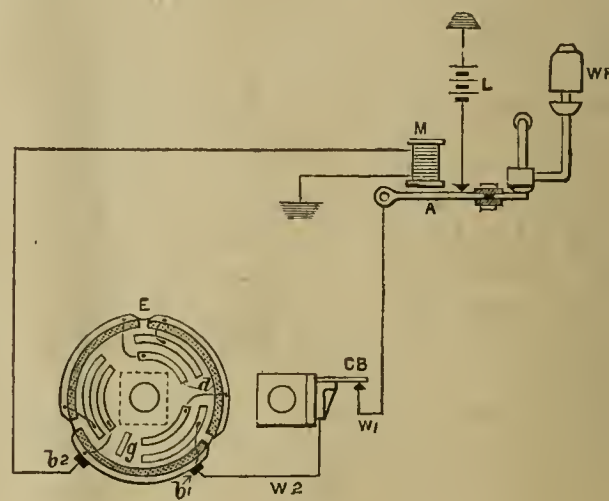


FIG. 3.

the electrical features of fig. 3, leaves this system practically free from any impact danger. In fact, this arrangement corrects all the faults mentioned in connection with the other systems.

Although fig. 3 is the diagram of a locomotive equipped with a single audible signal only, the system of which it shows a part has been so developed as to afford distinctive home and distant cab signals, both visual and audible; it can also be used as an automatic stop. In the diagram, the axle box (to which the circuit-breaker C B is attached) of the insulated wheel is put out of its proper position, in order to show the locomotive circuit clearly. The correct location of this axle box is indicated broken lined at the wheel. The whistle valve is held open by gravity; so that the whistle W H blows except when armature A, which controls the whistle valve, is attracted by signal magnet M. The division of the rim of the wheel into insulated segments, as shown, renders it impossible to complete the circuit (between the brushes  $b_1$  and  $b_2$ ) from locomotive battery L to magnet M except through the lower arc of the circumference of the wheel, which is the part depended upon for engaging ramps.



When the wheel rotates so as to cause at the rim an open circuit between the brushes  $b_1$  and  $b_2$ , the insulated contact pieces  $d$ , fastened to the wheel and rubbed by the stationary bridging piece  $g$ , close the circuit between the brushes without in any manner impairing this element of safety.

On encountering a ramp, the insulated wheel is raised, carrying the axle box and circuit-breaker with it. This opens the circuit here shown between wires  $w_1$  and  $w_2$ . If, however, the ramp is connected to one side of a battery (not shown), the other side of which is grounded on the track rails, current from the battery will energise  $M$ , thus causing  $A$  to continue attracted. When, therefore, the insulated wheel is raised by a ramp to which current is not supplied from the track, the audible danger signal will be given; while the whistle will remain silent whenever the insulated wheel rides over a ramp to which such current is supplied.

As regards the control of the ramp current, this system exists in a manual and an automatic form. In the manual form it closely resembles, at this point, the system illustrated by fig. 2; while in the automatic it differs but little here from the corresponding part of an automatic fixed signal. Contrary to opinion widely held in England, an "all-electric" automatic fixed block system is cheaper both as to first cost and as to subsequent costs (operation, maintenance and depreciation combined), than a system of fixed mechanical block signals. This same difference in favour of the automatic form holds in the case of the cab system illustrated by fig. 3. This is the only cab system yet proposed which is capable of giving complete protection without the aid of any form of fixed block signals.

## A METHOD OF DETERMINING THE DISTANCE OF A PARTIAL DISCONNECTION IN A SUBMARINE CABLE.

By CHAS. E. HAY.

To localise the position of a so-called partial disconnection unaccompanied by an earth fault in a cable is a matter of some difficulty, especially when the resistance of the fault is varying. The term partial disconnection is generally understood to mean that at a certain point of the cable the resistance of the conductor has increased abnormally, but is not infinite. The method described herein was designed to meet this particular case, and was successfully applied to

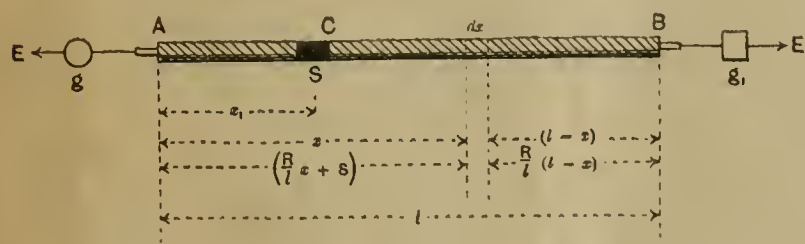


FIG. 1.

localise a fault of this character, which had proved peculiarly elusive, owing to the extraordinary way in which its resistance was varying. It is also applicable when the resistance of the fault is very small or indefinitely great, as will be seen.

Fig. 1 is a theoretical representation of the full diagram of the necessary apparatus shown in fig. 3.

At the distant end a good core of the cable is looped with the faulty core, which, in fig. 1, is represented by A—B as one straight length.

$l$  = length of A—B.

$x_1$  = distance of the fault.

$S$  = resistance of the fault.

$R$  = resistance of A—B.

$g$  = resistance of galvanometer.

$g_1$  = a resistance equal to resistance of galvanometer.

First, consider the section C—B, and let the charge on unit length of the cable equal  $q$ . On an element  $dx$ , at a

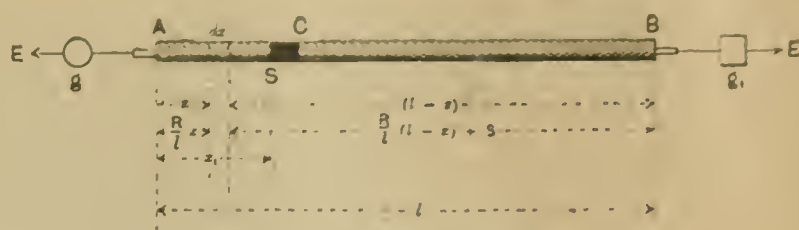


FIG. 2.

distance  $x$  from A, the charge is  $q \cdot dx$ . Of this quantity, a part flows out at B equal to—

$$\int_{x_1}^l \frac{(R x/l + S + g)}{R + S + 2g} q \cdot dx$$

$$= \frac{q}{R + S + 2g} \int_{x_1}^l (R x/l + S + g) dx. \quad (1)$$

Second, consider the section A—C, fig. 2. The quantity on the element  $dx$  is  $q \cdot dx$ , and of this quantity a part flows out at B equal to—

$$\int_0^{x_1} \frac{R x/l + g}{R + S + 2g} q \cdot dx$$

$$= \frac{q}{R + S + 2g} \int_0^{x_1} (R x/l + g) dx. \quad (2)$$

Therefore, the total quantity flowing out at B when both cores are put to earth at the same instant, is—

$$\frac{q}{R + S + 2g} \left[ \int_{x_1}^l (R x/l + S + g) dx + \int_0^{x_1} (R x/l + g) dx \right] \quad (3)$$

$$= \frac{q}{R + S + 2g} \left[ \frac{1}{2} R l - x_1 S + l(S + g) \right].$$

Let  $x_1 = n l$

$$= \frac{q l}{R + S + 2g} \left[ \frac{1}{2} R - S(n - 1) + g \right]$$

$$= \frac{Q}{R + S + 2g} \left[ \frac{1}{2} R - S(n - 1) + g \right], \quad (4)$$

where  $Q$  is the total charge on the looped cores.

From (4)

$$n = \frac{(R + 2g) \left( \frac{1}{2} Q - D \right) + S(Q - D)}{Q S} \quad (5)$$

where  $D$  is the total quantity flowing out at B as measured on the galvanometer joined up as shown in fig. 3.

Also from (4), if  $S = 0$ ,

$$D = \frac{1}{2} Q,$$

and if  $S = \infty$ ,

$$D = Q(1 - n)$$

$$= Q(1 - x_1/l),$$

which are obviously correct.

It will also be seen from equation (5) that if  $(R + 2g)$  is small compared with  $S$ , the value of  $S$  need not be very

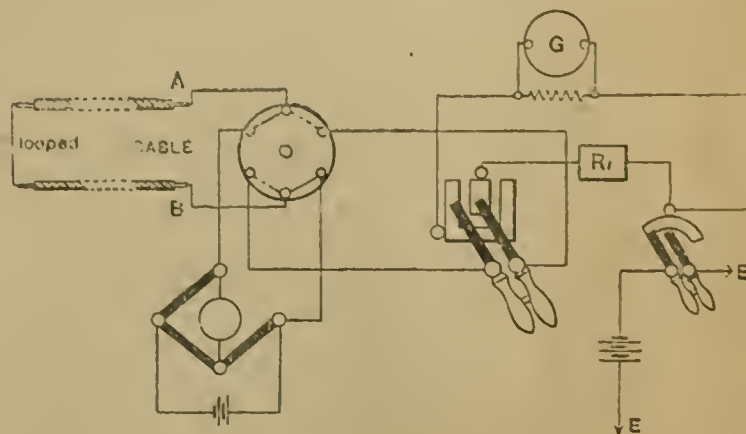


FIG. 3.

accurately determined, which is a very great advantage when  $S$  is varying continuously. For this reason, it is advantageous to keep the resistance of the galvanometer as low as possible, which can always be effected by means of a suitable shunt.



For example, suppose  $(R + 2g) \approx 500$ ,  $Q = 200$ ,  $D = 150$ , and  $s$  is varying between 10,000 and 100,000 ohms, the total variation in  $x_1$ , as calculated, will only be 5 per cent. If  $s$  varies between 10,000 and 20,000 ohms,  $x_1$  will only vary 2 per cent. As the resistance of the fault approaches  $(R + 2g)$  in value, more accurate measurements of  $s$  become necessary. A switch is provided for rapidly transferring the looped cores from the bridge to the apparatus for measuring the discharge, fig. 3. A reversing key is also inserted for the purpose of enabling the quantity flowing out at A, as well as at B, to be measured. If the sum of these two quantities equals  $Q$ , it may be safely concluded that the resistance of the fault has not altered during the test. The resistance  $R_1$ , which corresponds to  $g_1$  in the theoretical diagrams, is made equal to the combined resistance of the galvanometer and its shunt, and is inserted in the other core, so that in case the resistance of the fault falls to zero during the test, the fact is indicated by the quantities flowing out at A and B being equal.

## PROCEEDINGS OF INSTITUTIONS.

### Power Generation and Distribution in the Clyde Valley.

By DAVID A. STARR, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Glasgow, May 15th, 1912.)

IN August, 1901, royal assent was given to the Clyde Valley Electrical Power Act (1901). Besides the general powers conferred, authority was given to construct three generating stations, and to lay cables and distribute power in the counties of Lanark, Renfrew, Dumbarton and Stirling, an area of 750 sq. miles in all, excluding the city of Glasgow, the burghs of Partick, Govan and Paisley, and other burghs within the boundaries of the company's area, where local plants were already established or provisional orders had been granted.

The system of generation and distribution decided upon was three-phase alternating current at a pressure of 10,000 to 11,000 volts between phases, and a periodicity of 25 cycles per second.

It was decided to erect two power stations—one at Yoker, on the Clyde, opposite Renfrew, and the other near Motherwell. The contractors were the British Westinghouse Electrical and Manufacturing Co., Ltd. Construction work was commenced on the buildings during 1902, and in August, 1905, the Yoker power house and generating plant was handed over to the company. In December of the same year the Motherwell power house was completed and taken over, as were also a certain amount of main cables and several sub-stations. The power-house buildings were very similar in design, and the plants identical in each, excepting the system of condensing.

At the time the plant was handed over to the company the following had been installed in each power house\* :—Four Babcock and Wilcox water-tube boilers, land type, each having a guaranteed evaporation of 16,000 lb. per hour, with superheaters and economisers, and Roney (American) stokers.

Two turbo-generators with condensing plant were installed in each power-house; these had a nominal capacity of 2,000 kW. each.

The turbines are of the Westinghouse-Parsons double-flow type direct connected to generators of a similar capacity, generating 10,000 to 11,000 volts, three-phase, 25-period current. The main and selector E.H.T. switches, as well as some of the auxiliaries, such as coal conveyors and hot-well pumps, were formerly operated by current from the exciters, which were direct-connected to independent steam-engines of Westinghouse compound type with Worthington condensers. At Yoker surface condensers were used, whilst at Motherwell the condensing was done on the barometric jet principle.

Several additions and alterations have been made to the general equipment to meet the increased demands for supply, and to accomplish more economical and efficient operation. It was discovered that the Roney stokers were unsuited for Scotch coal, and they were replaced by chain-grate stokers. The steam engines driving the Roney stokers were scrapped, and electric motors were substituted. The change has been justified by the large saving which afterwards took place in the coal consumption. At Yoker the steam-driven circulating pumps were replaced by motor-driven pumps placed in the well at the river instead of at the head of the pipe line next the condensers. This work soon justified itself by a further reduction in the fuel consumption. It was also found, owing to the fluctuating load and the small amount of power which was used during the night and over week-ends, that it would be advisable to install a smaller generating unit in each power house to handle these small loads. Accordingly a turbo-generator of 600 kW. capacity was installed at Yoker, and one of 1,000 kW. at Motherwell. Next, it was found that the day load was increasing beyond the capacity of any one of the generators, and having

realised in practical operation that the turbines were of a much greater capacity than their nominal rating, it was decided to increase the capacity of the generators in proportion. The British Westinghouse Co. undertook to rewind the generators on site and increase their output by 50 per cent., and this work was satisfactorily carried out. Additional by-pass valves were placed on the turbines, and the whole work was carried out without any interruption to supply. This gave at the beginning of the year 1910 a generating plant capacity in Yoker of 6,600 kW. and 7,000 kW. at Motherwell. Four additional boilers of a similar size to those first installed had been erected in Motherwell and also a second cooling tower. At this period the maximum load on feeders at Yoker was 2,500 kW. and at Motherwell 4,500 kW. The total connections of consumers' plant to mains aggregated 26,000 H.P.

At the end of 1909 a new line of underground cable was laid between Rutherglen and Renfrew, which connected the Yoker and Motherwell networks together. This immediately effected a decided saving, as during periods of light load the supply could be given from either one or other of the power houses. It also had other advantages, as current could be transferred from one area to another when and as required, and the loads could be so adjusted as to keep the plants in both power houses running at their best efficiency.

Early in 1910 it became necessary to increase the generating plant at Motherwell, and an order was placed with the British Westinghouse Electric and Manufacturing Co., Ltd., for a 5,000-kW. turbo-generator of the Rateau type, the manufacturers agreeing to take in part payment the 1,000-kW. turbo-generator, as there was now no necessity for the smaller unit. This 5,000-kW. set was put in commission at the end of the year. On test the steam consumption indicated on the average day's load at least 25 per cent. less than the consumption of the turbines originally installed. The turbine was constructed on the Rateau system, with a Curtis ring for the high-pressure impulse end. The generator embodied all the latest improvements in modern power plant design. The field is energised from an exciter directly coupled on the end of the main shaft. The windings are kept cool by means of an external electrically driven fan. A series of exhaustive tests were taken on site, with the following results, which are corrected to 175 lb. steam pressure, 150° F. superheat, and 28½-in. vacuum :—

Per cent. load	...	...	125	100	75	50	25
Steam consumption :—							
(Lb. per KW.-hour)							
Guaranteed	...	...	15'00	15'00	15'2	17'5	21'6
Actual	...	...	13'45	13'35	13'6	14'5	17'8

Two new boilers were installed of the Babcock & Wilcox water-tube type, but of larger capacity than those originally installed, each giving an evaporation of 33,000 lb. of steam per hour. A steel stack was erected common to both boilers, also an exhaust-draught system with motor-driven fan, taking not more than 30 B.H.P.

These boilers, as well as two similar additional sets, were placed in a building directly opposite the first set of boilers, and in a position where the same bunkers and conveyors could serve the new units. This also brought the boilers nearer to the turbines, and effected quite a large saving in the original estimate for boiler extensions.

The condensing system, due to the poor vacuum obtainable with long lengths of exhaust piping, and the high temperature of water from the cooling towers, next received very careful consideration by the engineers and management, and it was decided to install a system of surface condensing for the new plant, with a pipe line of sufficient capacity for four 5,000-kW. sets or their equivalent. The condenser is of the Weir Uniflux type, having a capacity of 80,000 lb. of steam per hour with 7,000 gallons of water per minute and a cooling surface of 6,000 sq. ft. The air-pump in the power house is of the Weir dual motor-driven type, and two pumping units have been placed in the pump house at the river, each consisting of an Allen rotary circulating pump direct coupled to a three-phase 400-volt 25-period motor, having a nominal output of 350 H.P., but with a guaranteed overload of 100 per cent. for six hours. It was found that 650 H.P. was required to drive each of these pumps and supply sufficient water for the condenser, and advantage is taken of the difference in levels to obtain a certain amount of power from the head of return water. A water turbine is direct coupled to the other end of the pump shaft, and the main motor, circulating pump and water turbine are erected on a common bed-plate. The pipe line is first filled by the motor on its overload, and as soon as there is sufficient head in the return pipe, the valves of the water turbine are opened gradually, when the full volume of return water is flowing. A saving of over 40 per cent. is effected in the power required to operate the circulating pumps. In practice, it has been found quite practicable to operate the condensers for two turbo-generators of 5,000 kW. each at or near full load, with one of these pumping sets. The results actually obtained with the new turbo-generator and the pumping and condensing plant have shown a saving of 30 per cent. in the fuel consumption at the Motherwell power house. The air-pump at the power house, which is motor driven, takes only 12½ H.P. when the turbine is running full or on overload, and no trouble is experienced in maintaining a vacuum of from 96 to 96½ per cent. of the barometer.

The first 5,000-kW. set with the condensing plant was put on commercial load in January, 1911. As the demands on the power house were still increasing, a second 5,000-kW. set, with similar condensing plant and to the same specification, was ordered and installed before the end of 1911.

At Yoker a new 5,000-kW. set is now being installed, the good results obtained from the operation of the Motherwell plant having decided the company to install similar generators and condensing

\* These stations were fully described in the ELECTRICAL REVIEW of June 23rd, 1905.



plant there. The installation of a 10,000-kw. unit is now being considered for the next extension to the Motherwell power house. In a short time the available generating plant will consist of the following:—Motherwell, four units; two of 5,000 kw. and two of 3,000 kw.; total, 16,000 kw. The two smaller machines are kept as reserves in case of an accident to either of the other two sets. At Yoker there will be three units; one of 5,000 kw. and two of 3,000 kw.; total, 11,000 kw. For the present the two 3,000-kw. sets will be kept as a reserve for the 5,000-kw. set.

The boiler capacity at present at Yoker is six boilers, each having an evaporation of 16,000 lb. per hour, and at Motherwell eight boilers, each having an evaporation of 16,000, and two having an evaporation of 33,000 lb.

The excitors of the first generators that were installed were driven by independent steam engines; the steam consumption of those sets was very large, and a great deal of fuel was being consumed to keep them running. A storage battery has now been installed in each power house and a motor-driven exciter. These take the place of the steam-driven sets, which are only kept in case of accident. Each battery consists of 60 Tudor accumulator cells of 400 ampere-hours' capacity, connected in series with a reversible booster.

At the present time there are upwards of 96 route miles of underground cable and 21 miles of overhead lines, all operating at 11,000 volts, with 84 sub-stations and six switch houses. All the E.H.T. distribution is at a frequency of 25 cycles, and almost all the low-tension distribution is at the same frequency, the only exception being the Burgh of Clydebank, where lighting and small powers are distributed at 50 cycles.

The main E.H.T. network is laid out on the ring-main system. The longest ring is upwards of 30 miles in route length. The main cables in the neighbourhood of the power stations are lead-covered and are drawn into four or eight-way stoneware conduits, so that spare ducts are available for future extensions. On other sections further removed from the generating stations the cables are laid in earthenware troughs. Stamped steel bridge-pieces hold the cable in position in the trough, the trough being then filled up with bitumen, and the whole protected with a hard-burnt tile 2 in. thick. This method of laying, while it probably gives the greatest security from electrolysis or acids, was found to involve rather too much capital outlay, particularly in outlying districts. During the past two years armoured cable laid direct in the ground has been used with success and economy; 11,000-volt street-disconnecting boxes are employed in cases of smaller power supplies, where the

experienced during heavy wind-storms by the cages swinging and making contact with the conductors. Within the last year, however, the Board of Trade have been induced to alter their specification, and now a double conductor is strung across the highways on separate insulators close together, and the two conductors are firmly clamped together at intervals of about 3 to 4 ft., so that in the event of a conductor breaking the strain is taken up by the remaining one. This system of road-crossing has now been adopted by the company, and the cages are being gradually replaced.

The protective system used is that generally known as the Merz-Price balanced protective gear. The pilot wires required for these are laid alongside the main cables in the case of underground work, whilst for overhead work they are carried as separate conductors on the pole line. The relays used are adjusted to operate on a fault current of 60 amperes, and by this means an ample margin of safety is left to allow of one or two branches being tapped off each protected section. Originally each section of overhead line was provided with lightning arresters at points where the overhead line joined underground cables. It was found, however, that these arresters disturbed the balanced protective gear whenever the atmosphere became electrically charged. Trouble from this source became so acute that it was decided to discard the use of these and depend entirely upon the lightning arresters installed on the sub-station bus-bars. Although there have been many severe thunderstorms since this change was made, there has been complete immunity from accident or interruption. The sub-station equipments as now installed are the result of a gradual process of evolution. All the original sub-stations had four single-phase transforming units, one of these being kept as a spare. Gradually three-phase transformers were used, and latterly when it was found from experience that these were absolutely dependable even under the most severe conditions, their installation has become standard practice. All the transformers are oil-cooled, and are wound for operating on primary 10,000 to 11,000-volt circuits mesh-connected and with tapplings so arranged as to give a pressure of 400 to 440 volts on the star-connected secondary side. The star-point is brought out and connected to the neutral of the four-core low-tension distribution cables. Lighting circuits are connected between phase and neutral. As a general rule current is supplied at 25 cycles 400 volts three-phase. In some cases, however, special conditions have had to be met and current furnished at a different voltage to meet these conditions.

At the beginning of 1908, 12,400 H.P. was connected to the mains, and the following shows subsequent development:—

January, 1909	...	...	19,500 H.P. connected.
" 1910	...	...	27,000 " "
" 1911	...	...	36,600 " "
" 1912	...	...	46,500 " "

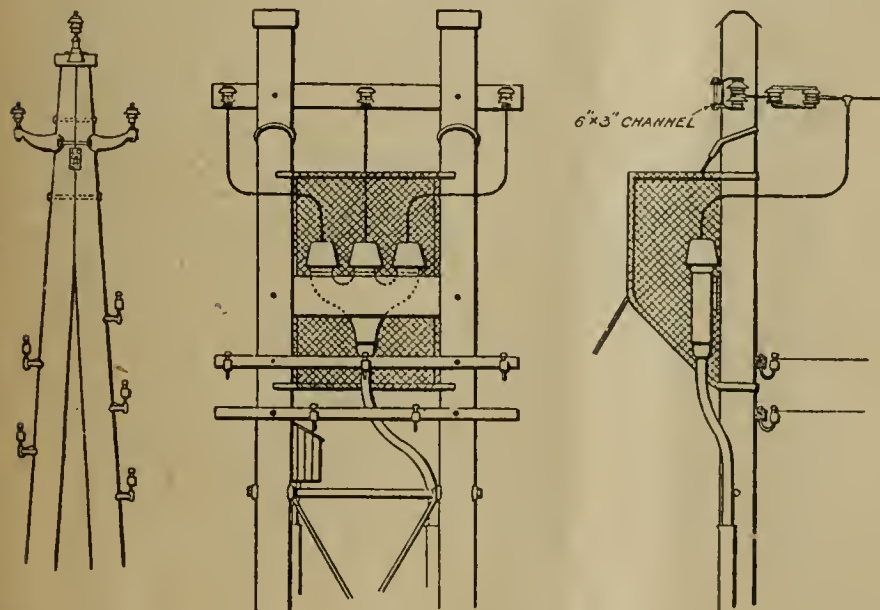
On May 1st, 1912, this had been increased by some 6,000 H.P. The 46,500 H.P. which was connected to the company's mains at the beginning of this year consisted of 43,500 H.P. in motors, &c., and the equivalent of 3,000 H.P. in lighting. About 2,200 H.P. of the latter represents shop and domestic lighting and heating (exclusive of lighting connected with bulk supply), and the remaining 800 H.P. represents lighting used in works where power is supplied. It will be observed that with such a small proportion of lighting (less than 8 per cent. of the whole load) the company have no appreciable lighting peak at any time during the year.

The diversity factor is also noteworthy. The highest peak reached by the combined stations during 1911 was 12,500 kw., this being only 27 per cent. of the kilowatts connected at that time. The sum of the highest observed loads on the stations taken separately each week is invariably much higher than the actual demand of the two stations when running in parallel. This difference has at times exceeded 1,000 kw. One reason for this is the different class of works being supplied from each power house, and the different hours of working, stoppages for meals, &c., between the districts. At Yoker the supply is largely to shipyards and engineering works, whereas at Motherwell iron and steel works and collieries are the largest consumers. The night load at Motherwell is, as a rule, not less than 20 per cent. below the day load, and the week-end load is never below  $\frac{1}{3}$  of the ordinary day load. The load factor on units generated at Motherwell is frequently 65 per cent. and over during a complete week of 168 hours, whilst at Yoker the load factor on similar conditions is frequently 40 per cent. The combined load factor of the two stations sometimes reaches 58 per cent. over a week. At the beginning of 1906 the coal consumption at Yoker was 35 lb., and at Motherwell 49 lb., per unit generated. In the beginning of the year 1907 there was a maximum demand on Yoker of 480 kw., and at Motherwell of 570, and even with a 40 per cent. load factor over the week the coal consumption was between 10 and 11 lb. per unit. At the beginning of this year the coal consumption per unit generated was under 3 lb. per kw.-hour for both power houses, and it is confidently expected that a further reduction will take place when the new Yoker plant is in regular commission, and the full benefit is being derived from the installation of the storage batteries and the closing down of the reciprocating engines already referred to.

The company appears to have good prospects for the future.

One of the company's largest bulk consumers is the Coatbridge and Airdrie Electric Supply Co., Ltd. Previously to 1908 they generated their own current by steam, and during the past six years their output has increased by 700 per cent., their revenue shows an increase of nearly 300 per cent., and gross profits have increased 100 per cent.

During the recent strike amongst the coal miners the company were enabled to maintain their supply to all their consumers until the strike was settled without having to purchase any additional



STANDARD A POLE

STANDARD TERMINAL POLE

FIG. 1.

FIG. 2.

revenue to be derived from the load is not sufficient to justify the expense of looping in the main ring cables or the cost of erecting a switch house. These boxes are of special design, the distinctive feature being that each phase is brought into a separate porcelain cell to permit of the disconnecting link being oil-immersed. Some of these have been in use for four years, and have given satisfactory service. The company also have a considerable amount of extra-high-tension overhead transmission in sparsely-populated districts. These serve a very useful purpose in development work; isolated works are thus secured as customers which otherwise would have to be passed over on account of the revenue not being sufficient to meet the heavy cost of underground mains. On some lines the trouble experienced from birds was of a most serious nature; it was confined principally to terminal poles or poles where shackle insulators are used, and the difficulties were finally surmounted by placing three shackle insulators tandemwise.

The general design of pole is as shown in fig. 1, which represents a creosoted A pole having malleable cast bracket arms. The main conductors are set 30 in. apart, with the telephone and relay conductors carried underneath. The insulators are of the two-part design. Single-part insulators were tried, but had to be discarded on account of unequal expansion and contraction during hot weather.

Where it was necessary to cross highways with E.H.T. lines a pole was erected on each side of the road, and the wires were protected by an earthed cage in accordance with the model description of the Board of Trade then in force. Although these cages were of ample size, and made of the strongest possible material, much trouble was



fuel, having carried a large reserve of coal for some years in case of such a contingency. In many cases considerable additional load was connected to the company's mains, and many works were enabled to keep in full operation that otherwise would have been completely shut down. The good effects of this have already been shown by the increased demands on the company for connection.

#### DISCUSSION.

MR. M'WHIRTER (Glasgow) complimented Mr. Starr on the condensing plant at the Motherwell power station, and on the load factor he had got; they had also to congratulate Mr. Starr on the means he had taken to prevent a stoppage in case of a coal strike.

MR. W. W. LACKIE (Glasgow) said the Clyde Valley Co. had performed a signal service to the whole electrical industry by showing that electrical energy taken from a large central power house was a thoroughly economical and efficient prime mover. As to coal consumption, they in Glasgow, in the early days, never managed to burn 35 to 49 lb. of coal per kw.-hour. Their working figure was 28½ lb. in 1892, and this was reduced to 15 lb. in 1893. Since then they had come steadily down until they now ran at a figure of 3 lb. As to underground mains, he could never understand why stamped-steel bridge pieces should continue to be used, as they seemed to be simply inviting trouble by giving contact between the lead sheathing of the cable and the surrounding soil. He believed Mr. Starr was correct in saying that for outlying districts where the cartage and transport charges on the various materials amounted to quite a large sum, a specially prepared armoured cable laid direct in the ground would be found cheapest. But where cartage and transport did not run to a big sum, it would be found that the cost of wooden troughing and pitch did not exceed the cost of armoring. They had trouble with burning accidents when they used bitumen for running up the cables, but he could not remember ever hearing of a single burning accident with pitch. The fact was that pitch had such a low specific heat that a workman could put his hand into a bucket of hot pitch, which would harden on his hand without harm.

MR. J. A. ROBERTSON (Greenock) characterised Mr. Starr's paper as a very frank one. He pointed out that nearly all the power companies had adopted a frequency of 25 cycles, and asked, in the light of modern experience with rotary converters, if that would be done now if the work had to be gone over again. He asked for information on distribution losses. As to the coal strike, he thought that that was the best advertisement power supply had received from its commencement, as a commercial concern. He believed that the whole of the power stations maintained their supply without any diminution throughout the whole dispute.

MR. G. STEVENSON (B.T.-H. Co.) said that, with regard to generators, the author stated that the neutral was the "earth," which, he took it, meant that the earthing was done at the power station, and if that was so he would like to know what precaution was taken to prevent circulating current between the various machines.

MR. ROBERTSON (Glasgow) asked if there was any difficulty with the supply at 25 cycles.

MR. J. D. MACKENZIE (Glasgow) suggested that Mr. Starr might have dealt at some length with the financial aspects of the business—such as the price per unit and the average cost per unit. He asked, too, if any attempt was made to increase the demand for lighting among small consumers.

MR. STARR, in his reply, said they did not push lighting very vigorously, even in parts where there was no gas lighting, but took all people who came in their way, and as to Mr. Lackie's remarks on coal consumption with regard to greater height of efficiency, he thought he was referring to a reasonably used unit of plant in proportion to its load. In Motherwell they had not only to run 2,000 H.P. of plant, but they had to run on an average 100 to 150 H.P. of auxiliary plant to keep that going. With regard to finance, he was afraid that when it came to that they would require to make a rule debarring consumers from being present at the discussion. As to Mr. Robertson's point on distribution, he knew, speaking without actual figures, that they sent out 95 per cent. of the energy generated. From 4½ to 6 per cent. was used in the works, and they sold about 80 per cent. of what they sent out, the rest being units lost or used otherwise. As to the periodicity, a great many of their consumers who started on 50 were now getting 25 cycles and did not know the difference.

**Electrical Industry.**—In the annual report of the Wolverhampton Chamber of Commerce, the following reference is made to the electrical engineering industry: "This industry, during the past 12 months, has continued to expand, and the local factories have been very well supplied with orders, and many important plants have been installed at home and in various parts of the world. The use of electricity is extending rapidly in almost every direction where power and artificial light are required. Electricity is also beginning to be used very largely for domestic purposes, and a considerable volume of business is now being done in house radiators, cookers, vacuum cleaners, &c. The rapid recent development of wireless telegraphy has made a great demand for electrical machinery, of which a very large proportion has been supplied locally. The outlook for electrical manufacturers is decidedly encouraging, the intense 'cut-throat' competition which has existed for the past six or seven years is abating, and better prices are being obtained."

## LEGAL.

### AMALGAMATED RADIO-TELEGRAPH CO., LTD.

IN the Chancery Division, on Tuesday, June 25th, Mr. Justice Swinfen Eady had before him a motion in the matter of the Amalgamated Radio-Telegraph Co., Ltd., to declare dissolution void.

MR. WELLS said the company went into voluntary liquidation in March, 1908; the property of the company consisted of a number of patents in connection with wireless telegraphy. Some difficulty was found in disposing of the assets and obtaining a purchaser, but eventually a purchaser was found and steps were taken to complete the sale. Disputes, however, arose and litigation ensued, with the result that the sale had never been completed. The matters arising in the litigation were adjusted, but by arrangement with the purchaser it was agreed that certain patents should not be transferred for a couple of years. Forgetting this fact, the liquidator convened a final meeting of the company, and in February last it became technically dissolved. The purchaser had now called the attention of the liquidator to the fact that certain patents had yet to be assigned, and it was for the purpose that the assignment of these patents might be completed that application was now made to his Lordship to re-open the company.

HIS LORDSHIP: Who are to pay the costs and expenses?

COUNSEL said an arrangement had been made between the purchaser and the liquidator with regard to that.

HIS LORDSHIP made the necessary order.

### THE TELEPHONE ARBITRATION.

(Continued from page 1026.)

MR. GILL was questioned by MR. BUCKMASTER with regard to a charge of £4,000,000 in respect of supervision and engineering expenses, which counsel said was nearly 25 per cent. of the total cost of construction. He asked witness if it did not strike him as strange.—Mr. Gill replied that it did not. The figures given which produced that sum were, in his opinion, well founded.

MR. BUCKMASTER: Can you give me an illustration of any undertaking in which the cost of construction has been loaded with any item comparable to it?—I am a telephone engineer, and my experience is confined to that.

The measure of your outside experience does not tell you whether this charge is high or low?—What the cost of a railway undertaking may be does not tell you what the cost of a telephone undertaking would be.

As far as the reasonableness of this claim is concerned, your judgment depends on the fact that figures have been produced to you by officers of the company which have caused this total to be introduced?—That is a very unfair way of putting it. You infer that figures have been produced to me and I have accepted them blindly.

You told me you did not know the items which made up the totals?—That is a different thing.

Well, it seems to me it is everything.

Counsel next cross-examined witness at considerable length on the question of supervision charges, with a view of showing that the company's experts had adopted a wrong incidence with regard to these charges. Witness put in a table showing an expenditure of £27,000,000 on capital and revenue accounts, land and buildings, from 1895 to 1910, and said it included supervision and engineering. The head office charges in the tables were given at £1,500,000, a proportion of head office expenses on the total outlay of 5½ per cent.

The SOLICITOR-GENERAL continued the cross-examination of Mr. Gill, dealing with the item of underground cables. The agreed inventory of these, stated witness, he had priced out.

The SOLICITOR-GENERAL: The total exceeds £3,276,000?—Witness said this was so, and the tables which had been handed in gave the details. Continuing, he added that in laying a cable they were bound to have a certain amount of waste through overlap. It would be impracticable in working to allow the workmen the exact distance of cable only. If a slight mistake were made in such a case, the whole of the cable might be wasted. In every £100 of cable laid the waste was to the extent of about £3 12s. all round, over and above the wastage at the joint.

The SOLICITOR-GENERAL asked witness what would be a reasonable amount, in yards, to apply as wastage to this valuable cable, worth £1,000 per mile, when laying a mile of it.—Witness said he could not state it, except the percentage already given—3½. There were a number of firms who supplied cables and laid them at an overall price, including wastage, jointing, &c., and he agreed that the prices they might undertake to do the work for could be taken as a criterion of the fair market figure for executing such works, providing they fulfilled all the conditions. He had been chief engineer to the company since 1902, and the company had always laid their own cables. They might possibly have had cables laid as suggested, but it would be so small an amount that he did not recollect it.

The SOLICITOR-GENERAL put it to witness that his valuation for tools showed that he considered their value varied with the amount paid for labour. He asked witness if he did not think this an absurdity.—Witness said he was not aware of any other way. Where the work was constant and steady he thought it reasonable.

Do you say that in order to arrive at the right amount to attribute to tools you can depend on a calculation which assumes that



the value of tools used varies with the amount paid to the labourers who use them?—Yes.

The SOLICITOR-GENERAL: Am I right in assuming that the principle of that method is illustrated again and again in the percentages which you have used in these tables?—Yes, to some extent.

The SOLICITOR-GENERAL said he was bound to go into this point, because it involved hundreds of thousands, and it might be millions. Would witness be surprised to know that according to his percentages, supervision upon the works and plant came to 4 millions, or nearly 40 per cent. of the whole, and that after he had already added 3 per cent. for supervision of contractors' works?—Witness said no; it was a question of percentages, and expressed the opinion that counsel was trying to frighten him with huge figures.

MR. GILL, in reply to the SOLICITOR-GENERAL, explained an item of £5,080,249 which was entered in the company's books as capital expenditure over a period of six years. Witness stated that after making deductions for supervision, &c., the cost of the plant for that period amounted to £4,404,000. The sum shown in the company's books for capital expenditure was not the total amount that should be shown under that heading, because the company had consistently charged to its revenue account items which he believed should properly be charged to capital account. For instance, engineering should be charged to capital account, but the company had regularly made it a revenue charge. Witness said he could not give the figure for the cost of poles during the same six years.

SIR JAMES WOODHOUSE asked him why he could not.—Witness replied that the company did not keep accounts of its expenditure on poles distinct from that on wires, because the men who erected the poles also put up the wires. The construction account was treated as a whole.

The SOLICITOR-GENERAL remarked that that was unfortunate. He asked witness what was the work which had cost £4,000,000 for supervision. "Was it wages," he queried, "Who were the lucky people who had got £4,000,000?"—Witness replied that there were a great number of figures, and they were spread over a long period. The figures were not all accountable to wages, however. He could not say what amount was for wages.

SIR J. SIMON: The figure is absurd. You are asking the country to pay £4,000,000 sterling for the privilege of having your staff supervised in the past. What does it mean in substance?—MR. GILL replied that another witness had the figures.

Do you really think that if a contractor was going to do this work for £11,000,000 plant cost, he would want another £4,000,000 for supervision?—Yes.

In the course of further cross-examination, SIR J. SIMON asked if it were not a fact that the National Telephone Co. had had some of its important exchanges constructed by contract.—Witness said that about 33 per cent. of the value of the whole exchange equipment had been constructed by contractors.

Are some of the large exchanges included in that 33 per cent.?—Yes.

Has this practice of having part of your exchanges constructed by contractors been instituted over a substantial period, or has it only been resorted to recently?—I should say, roughly, since 1904.

During 1903-4 the greater part of the exchanges erected were done by contractors?—Witness admitted that that was so.

Have you had more than one contractor?—No, only one, the Western Electric Co.

MR. JUSTICE LAWRENCE: Is that an English company?—Witness: Legally, it is an English company. It is recognised by the Post Office as an English company.

The SOLICITOR-GENERAL: Oh, yes. Do not think I desire to attack that company in any way.

Counsel said he would like a list of these contracts, and witness promised to supply counsel with a list, mentioning that there were about 66 of them.

Questioned with regard to depreciation and sinking-fund charges, MR. GILL said that if the life of any article was 20 years, it would depreciate under ordinary circumstances at precisely the same rate as any other article, the life of which was given at the same period. That was to say, putting on one side special circumstances, when material things had reached about one-half through their lives they had lost about one-third their value. He had worked on this basis in calculating the values of the telephone plant of the company.

Questioning witness further upon this doctrine, SIR J. SIMON asked whether it was not a fact that in the case of aerial cables there came a period eventually when, owing to the action of the atmosphere, the cable ceased to give satisfactory service.—Witness said that that was so.

And that is a point which can only be covered by careful examination?—Yes.

If that is so, am I not right in saying that as an aerial cable gets older its efficiency gets less, and its cost of maintenance gets more?—No, because long before it reaches that point it is dead. If you insist on keeping plant alive when it is coming to the end of its proper life, I admit there is bound to be extra charge for maintenance. For instance, if a pole has decayed and you insist on propping it up, and doing foolish things like that, there are bound to be extra maintenance charges, but that is not the position I take up at all.

A consultation having taken place at this juncture between the parties, the SOLICITOR-GENERAL said they were trying to agree as to the figures given for the age of the company's plant. There had been an agreement as to some of the company's plant, and as regarded the rest, the company had given figures but not the statistics on which the figures were based. By having the statistics they might be able to agree upon the calculations being fair. The

figures would also assist in the speculation as to the life of certain of the plant.

SIR A. CRIPPS agreed that the statistics ought to be, and would be, supplied to the Postmaster-General. It would shorten the cross-examination and save time.

In reply to SIR J. SIMON, witness said that the probability of the company's undertaking being acquired by the Government did not give the plant additional life.

The cross-examination of the witness was concluded.

MR. BUCKMASTER said the company had based their figures of value of materials on the average prices taken over a period of years. The investigation of that part of the claim involved inquiry into the prices of materials during each year of the period taken. They had been busily engaged in an endeavour to arrive at an arrangement, and he was glad to say, as far as tin, lead and copper were concerned, they had been able to agree to the figures as to quantities, but the principle upon which the value should be taken would have to be discussed. He hoped the parties would be able to come to a similar arrangement with regard to iron.

MR. JUSTICE LAWRENCE said he was sure it would be found to be advantageous if the process could be continued.

MR. STANLEY JAMES GODDARD, chartered accountant and an Associate of the Institution of Electrical Engineers, was then called, and said that from 1892 to 1907 he acted as chief assistant to the general manager of the National Telephone Co., and since that date he had been general superintendent of the company. He had made a careful investigation of the books of the company, the cost of district and local management charges, local engineering supervision, wayleaves, &c. When it became necessary to frame the company's claim, special investigations had to be made, in order to arrive at the figures which had to be added to the ordinary plant cost as shown by the company's books. The investigations in support of the company's claim started in July, 1909, and had continued up to the time of the present proceedings.

(To be continued.)

#### NEWBERRY v. BRISTOL TRAMWAYS & CARRIAGE CO., LTD.

ON June 22nd, at the Bristol Assizes, plaintiff claimed damages from defendants for personal injuries sustained, owing to the trolley arm having slipped off the wire whilst he was travelling on an electric tramcar.

According to the *Times* report, it was alleged that the arm was pulled down with a rope by the conductor, broke out of the socket, and fell on the plaintiff.

Counsel for the defendants said it would be a serious matter for tramway undertakings everywhere if the plaintiff succeeded in such a case. Evidence was called to prove that the trolley arm had broken by coming into contact with the transverse wires. Tramway officials from Leeds, Sheffield and elsewhere gave evidence that the trolley was perfect.

The jury awarded £150 damages, and expressed the view that the defendants knew the use of the trolley was risky. A stay of execution was granted.

#### DAMAGES FOR A TRAMCAR ACCIDENT.

AT a trial before Mr. Justice Banks and a common jury, Miss Jane Franks, of Crisp Street, Poplar, was awarded £15 damages against the L.C.C. in respect of injuries sustained in December last, alleged to have been caused through a tramcar conductor improperly starting the car without warning.

His LORDSHIP expressed the opinion that it was a fit case for the High Court, and awarded High Court costs.

#### SALE v. MANCHESTER CORPORATION.

AT the Manchester Police Court on Monday, Mr. Brierley, the city stipendiary, gave his decision in a case in which the defendants were summoned for having an alleged dangerous and defective tramline at the corner of Upper Lloyd Street and Moss Lane East. The case had been adjourned to give the stipendiary an opportunity to inspect the line. The summons was issued at the instance of Mr. John Sale, greengrocer and fruiterer, Emden Street, Moss Side, for whom Mr. Burgis (instructed by Mr. Lewis) appeared. Mr. Burgis stated that the complaint arose owing to the condition of one of the inside rails on the curve at the corner of Upper Lloyd Street and Moss Lane East. The allegation was that the groove of the line was  $\frac{1}{2}$  in. wider than was required by the Board of Trade, with the result that the wheels of bicycles and vehicles were likely to enter it. Another danger was that the "lip" side of the rail was higher by  $\frac{1}{2}$  in. than the "tread" side. These defects rendered the road unsafe for traffic at this point, and had actually caused a number of accidents, though none of a fatal character.

MR. SUTTON, who represented the Corporation, denied that the line was dangerous.

MR. BRIERLEY, in giving his decision, said the complainant had to prove that there was some substantial danger to the ordinary traffic in the present state of the rail, over and above any element of risk that might be necessarily incidental to the laying of tramway rails in the city. He said he had inspected the groove in question and also other grooves in the same quarter of the town, and he had come to the conclusion that this curve was dangerous to the ordinary traffic, and therefore he was bound to convict. There must be a penalty of £5. The complainant was entitled to reasonable costs of his summons.



MR. BURGIS pointed out that when the case should first have come before the Court the defendants asked for an adjournment after complainant had got all his witnesses present—some coming from London. On that occasion it was agreed that the question of costs should be considered after the decision.

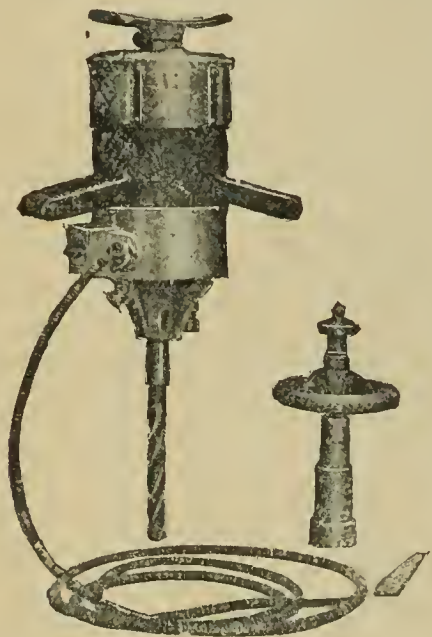
The STIPENDIARY allowed 30 guineas costs for the two days.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Witton-Kramer D.C. Portable Drills.

In these machines, which are of the self-contained type, the motor is fitted with two aluminium end shields, the top shield enclosing the brush gear, and carrying the feed screw of the breast-plate, while the bottom shield forms the gear case and the bearing for the drill spindle. The motor is series-wound, so that the speed at which the drill rotates can be controlled by the operator, by varying the amount of feed pressure exerted; the heavier the pressure the slower the speed, and therefore it is possible to adjust the speed to suit the material to be drilled, without the aid of mechanical devices.

The tools are standardised in two sizes, the small machine, which is illustrated below, being used either as a breast drill, or, when desired, as a feed-screw drill, and being capable of drilling holes  $\frac{5}{8}$  in. in diameter into steel by breast pressure, or  $\frac{3}{4}$  in. diameter into steel with feed screw. The drilling speed is 300 R.P.M., and the



WITTON-KRAMER ELECTRIC DRILL.

weight of the tool complete is 28 lb. With a machine of this type it is possible to drill holes of  $\frac{3}{4}$  in. diameter through  $1\frac{3}{8}$  in. mild steel with a feed screw in  $2\frac{1}{2}$  minutes. The larger machine is capable of drilling holes up to  $1\frac{1}{2}$  in. diameter into cast-iron, or  $1\frac{1}{4}$  in. into steel, at a speed of 125 R.P.M., and the weight complete is 60 lb. It is provided with a telescopic feed screw, and both machines have Morse taper sockets in the drill spindle. With the larger tool it is possible to drill holes of  $1\frac{1}{4}$  in. diameter into  $2\frac{1}{8}$  in. cast-iron in 1 minute 35 seconds, this being the average time of drilling 38 holes.

Special attention has been paid to the solidity and reliability of all working parts, which, whilst increasing the weight slightly, gives undoubted advantages through the increase in life and freedom from breakdown.

These drills are made by the Witton-Kramer Tool & Hoist Co., for whom the GENERAL ELECTRIC CO., LTD., are the sole selling agents.

### Yacht-Lighting Accumulators.

MESSRS. PRITCHETTS & GOLD, LTD., of 58, Victoria Street, S.W., have brought out a new pattern of yacht-lighting cell, in which the positive plates are of the standard P. & G. Planté formed type, and the negatives of the modern box-grid or cage pattern, contained in teak boxes with lead linings; the weight is low in proportion to the capacity, reliability and durability of the cell. As an instance, the Pritchett Y C 11-plate accumulator, giving an output of 50 amperes for seven hours, weighs 138 lb. per cell, and only occupies a space of  $11\frac{1}{2}$  in.  $\times$   $9\frac{1}{2}$  in.  $\times$   $19\frac{1}{2}$  in. high overall. The cells generally follow the design of the Pritchett train-lighting accumulator, which is extensively used on railway systems in Great Britain and other countries, and has proved itself capable of withstanding rough treatment.

These accumulators can be supplied fitted either with bolted lids and india-rubber joint rings, or with Messrs. Pritchett & Gold's patent double lids, which do away with the necessity of bolts and joint rings. If desired, the cells can also be provided with a float, which will indicate the level of the electrolyte.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 13,522. "Unspillable electric accumulator cells." W. THOMSON. June 10th.  
 13,534. "Portable electric battery lamps." K. R. SMITH. (Divided application on 13,718, December 8th, 1911.) June 10th. (Complete.)  
 13,590. "Means for supplying current to electric railways and the like." N. MAZEN and P. LACROIX. (Convention date, June 10th, 1911, France.) June 10th. (Complete.)  
 13,599. "Receiving apparatus for electric telegraphs." W. J. LYONS. June 10th.  
 13,645. "Gearing electric tramway and railway motors and the like." W. H. TURNER and W. H. ISHERWOOD. June 11th.  
 13,669. "Switch clutch." J. KIEREN. June 11th. (Complete.)  
 13,679. "Searchlights." L. PASQUALINI. June 11th. (Complete.)  
 13,680. "Electric searchlights." L. PASQUALINI. June 11th. (Complete.)  
 13,695. "Contact fingers for electric controllers or the like." A. H. SALISBURY-DYER. June 11th.  
 13,737. "Iron or steel tubes as used for bedsteads, conduits for electric wires or cables, and for other purposes." A. L. F. CARR. June 12th.  
 13,740. "Switches for multiple unit control systems." P. S. TURNER. June 12th.  
 13,746. "Apparatus for electro-plating." G. P. M. LEE. June 12th.  
 13,747. "Apparatus for electro-plating." G. P. M. LEE. June 12th.  
 13,763. "Electric railways and the like." A. DE VERE MACLEAN. June 12th.  
 13,767. "Manufacture of metallic filaments for incandescent lamps." E. R. GROTE. June 12th.  
 13,768. "Telephones and other apparatus embodying exposed diaphragms." E. A. GRAHAM. June 12th. (Complete.)  
 13,771. "Direct-current dynamo-electric machinery." W. G. FRANCE. June 12th.  
 13,780. "Power transmission system for driving a dynamo whose electrical energy is subsequently utilised for the electric propulsion of motor vehicles, boats, airships, or the like." P. MARINO. June 12th. (Complete.)  
 13,781. "Electric starting switches." J. M. SANCHEZ. June 12th.  
 13,788. "Machines for making incandescent lamp boxes." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektrizitäts Gesellschaft, Germany.) June 12th.  
 13,796. "Combination electric lamp bulb and diffuser." E. L. FRENOT. June 12th. (Complete.)  
 13,801. "Conductor rails for electric railways and the like." C. H. MERZ and S. G. REDMAN. (Addition to 11,347/08.) June 12th.  
 13,804. "Swivel joint, particularly applicable to electric lamp and other similar supports." J. GOURDON. June 12th. (Complete.)  
 13,807. "Method of, and apparatus for, telephonically ordering cabs, messengers and the like." A. HINZPETER. (Convention date, June 12th, 1911, Germany.) June 12th. (Complete.)  
 13,826. "Trolley poles for electric traction." S. OLDHAM. June 13th.  
 13,843. "Thermo-electric generators." P. FERRA. June 13th.  
 13,853. "Protecting devices for telephone apparatus and the like." SIEMENS & HALSKE AKT.-GES. (Convention date, December 22nd, 1911, Germany.) June 13th. (Complete.)  
 13,854. "Means for indicating faults in the circuits of electrical transmission systems." SIEMENS BROS & CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) June 13th. (Complete.)  
 13,858. "Electric relay apparatus." E. O. MÖLLER. June 13th.  
 13,861. "Electric heating apparatus." A. F. BERRY. (Convention date, December 28th, 1911, Norway.) June 13th. (Complete.)  
 13,865. "Construction of electric ceiling roses." G. MARKT. June 13th.  
 13,906. "Electric water-heating apparatus." E. M. T. BODDAM. June 15th.  
 13,942. "Electric heating elements." ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., J. D. MORRISON and L. H. DAVIES. June 15th.  
 13,945. "Connecting electric lamps." H. F. L. STEVENTON. June 15th.  
 13,962. "Electric resistances or dimmers for use in governing the flow of current through incandescent lamps." E. T. MIDDLEMISS. June 15th.  
 13,963. "Intercommunicating telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., WM. AITKEN, H. COOPER and C. REMINGTON. June 15th.  
 13,970. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,971. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,972. "Signalling systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,973. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,974. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,975. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) June 15th. (Complete.)  
 13,988. "Electrodes." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 15th.  
 13,989. "Controlling plurality of apparatus by means of Hertzian waves." T. E. R. PHILLIPS. June 15th.  
 13,997. "Dash-pot devices applicable to electric circuit-breakers and other apparatus." W. A. HARRIMAN and A. REYROLLE & CO., LTD. June 15th.  
 14,015. "Wireless telegraphy." W. DUBILIER. June 15th.  
 14,026. "Route indicators for tramcars and the like." R. R. GREENE. June 15th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- ELECTRICAL SWITCHING APPARATUS. F. J. WALTON. 11,699. May 15th. (November 15th, 1911.)  
 AUTOMATIC ELECTRIC FIRE-ALARMS. O. RENNERT. 12,485. May 23rd. (May 23rd, 1910.)  
 ELECTRICAL HEATING APPARATUS. W. P. PERRY. 12,923. May 30th.  
 MEANS FOR VARYING THE INFLUENCE OF ELECTRIC CIRCUITS. G. ECHIEFERSTEIN. 12,978. May 30th. (May 30th, 1910.)  
 ELECTRICAL CONTACTS. ANSCHUTZ & CO. 16,440. July 17th. (November 26th, 1910.)







# "ELECTRICAL REVIEW" LIST OF ELECTRICITY SUP

Place.	Supply Authority.	Year of opening.	Engineer.	Pressure of supply, volts.	Frequency and phase.	Total capacity of plant in k.w.	Max. load in k.w.	Storage battery, max. discharge.	Total capital expended.	Private lighting.	Public lighting.	No. and h.p. of private motors.	No. and h.p. of traction motors.	Total connections of all kinds.	Increase during year.	Price charged per unit, pence.	System of charging.	Units sold during last complete year.	Remarks.	Place.	
1 ABERDEEN	Aberdeen Corporation	1894	J. Alex. Bell	220, 230 & 440	Direct & 50- h. & 3-ph.	5,369	3,456	420 kw.	£378,874	5,770 kw.	312 arc, 82 mtl.	941=5,858 H.P.	102=4,050 H.P.	11,830 k.w. (ex. tr.)	..	..	Max. dem., flat rate, cont. & special	5,170,421	Lg. & tr. an. Supply extended into two counties. *Also 1	233 LINCOLN	
2 ABERTILLY	Abertillery Urban District Council	1910	Dan Lloyd	220 & 500	Direct	..	..	..	£10,360	106 kw.	60 chm., 300 mtl.	9=12 H.P. (pr. 60 chm., 300 mtl.)	..	122 kw..	38 kw.	..	Flat rate, sl. scale	73,271	Supply commenced June, 1910. Data to Mar. 31, 1912	234 LIVERPOOL	
3 ABERYSTWYTH	Chiswick Electricity Supply Corporation, Ltd.	1895	E. P. Perkins	220 & 440	Direct	..	74	74 kw.	£35,019	406 kw.	20 arc, 5 chm., 4 mtl.	18=123 H.P.	..	585 kw.	..	..	Flat rate with dis.	160,331	Data to Dec. 31, 1911	235 LLANGILLO	
4 ACCINGTON	Accington Corporation	1900	Harold Gray	230 & 440	50- h. & 3-ph. & direct	1,888	1,719	278 kw. (tr. only)	£92,941	1,272 kw.	3 arc, 112 mtl.	310=1,340 H.P.	60=1,300 H.P.	3,182 kw.	501 kw.	..	Flat rate with dis.	8,915,513	Lg. & tr. *Tr. 500 v. Ext. in progress, two 700 kw. 4,500 v. Sph. gas-driven motor to Mar. 31, 1912	236 LLANRINDOG WELLS	
5 ALDERLEY EDGE AND WILMSLOW	Alderley & Wilmslow Electric Supply Ltd.	1899	Edgar Hesketh	210 & 420	Direct	..	370	119	£1,658	629.5 kw.	258 mtl.	16=51 H.P.	..	707.8 kw.	42 kw.	..	Flat rate and contract	177,471	*To Dec. 31, 1911. Data to Apr. 30, 1912	237 LLANQUILLO	
6 ALDERSHOT TOWN	Aldershot Urban District Council	1902	F. Garasid	210 & 420	Direct	..	440	199	£27,376	439 kw.	13 arc, 44 mtl., 20 N.	31=77 H.P.	..	407 kw.	..	..	Max. demand and flat rate	224,771	Data to Mar. 31, 1909	238 LLANCOLLEN	
7 ALLOA	Alloa Corporation	1902	J. W. Napier	220 & 440	Direct	..	147	101.8	£15,995	265 kw.	..	36=92 H.P.	..	296.4 kw.	..	..	Flat rate	115,609	Section Gas Plant. Data to May 15, 1911	239 LLANRWST AND TREFRW	
8 ALNWICK	Newcastle-upon-Tyne Elec. Supply Co., Ltd.	1902	J. W. Summerside (Res.)	230 & 460	Direct	..	150	150	..	303 kw.	..	100 kw. pr. & b.g.	..	400 kw.	..	..	Flat rate & sliding scale	..	*C. W. Fairweather (Mecr.), Cons. engr. Mera & McEllan. Data to Dec. 31, 1911	240 BATTERSEA	
9 ALTRINCHAM & DIST.	Altrincham Electric Supply Ltd.	1895	Geo. H. Fawcett	100	80- h., 1-ph.	660	480	..	£71,016	2,209 kw.	..	28=107 H.P.	..	2,816 kw.	..	..	Flat rate, contract and special	470,336	Data to Dec. 31, 1911	241 BERMINGSEY	
10 ARBROATH	Arbroath Electric Light and Power Co., Ltd.	1908	J. C. Christie	250 & 500	Direct	..	450	191	£92,193	192 kw.	20 fl. arc, 40 mtl.	61=610 H.P.	..	690 kw.	..	..	Flat rate, sliding scale & contract	573,410	Data to Dec. 31, 1911	242 CHELSEA	
11 ASCOT & DISTRICT	Ascot District Gas and Electricity Company	1907	A. E. Brooks	220 & 440	Direct	..	100	87	£26,993	876.4 kw.	..	9=28 H.P.	..	893.9 kw.	80 kw.	..	Flat rate with dis.	111,077	*Diesel Engine and mains extensions in hand. Data to Dec. 31, 1911	243 CITY OF LONDON	
12 ASTON-U-LYNE	Aston Corporation	1899	N. Appellbes	210 & 460	Direct	1,760	1,891	..	£85,525	1,083 kw.	98 arc, 126 chm., 164 mtl.	124=851 H.P.	130=3,000 H.P.	4,389.6 kw.	..	..	Sl. scale, 2-rate, cont. w. dis. & switch	3,834,295	Lighting and traction. Energy supplied to four tramway undertakings. Data to Mar. 25, 1910	244 FINSBURY	
13 ATHERTON	Atherton Urban Dist. Council	1903	Chas. T. Astbury	50- h., 2-ph. & direct	800	450	..	..	£13,000	200 kw.	12 arc	26=450 H.P.	..	500 kw.	200 kw.	..	Flat rate, sl. scale, cont. & special	418,694	*Supply in tank at 7,000 v. A.C. from South Lancs. Tramway Co., Ltd. Data to Mar. 31, 1912	245 FULHAM	
14 AYR	Ayr Corporation	1895	Roland Marshall	100 & 200 A.C.	60- h., 1-ph. & direct	1,825	806	145 kw.	£103,367	1,601 kw.	109 arc, 242 mtl., 6 N.	138=500 H.P.	32=800 H.P.	2,759 kw.	39 kw.	..	Flat rate & sliding scale	1,156,394	Lighting and traction. *Traction 600 v. Data to May 15, 1911	246 GREENWICH LEWISHAM PENCK & SYDENHAM	
15 BANBURY	Banbury & District Electric Supply Co., Ltd.	1903	Arthur J. Wray	230 & 460	Direct	..	963	850	100 kw.	..	408 kw.	67=237 H.P.	..	838 kw.	..	..	Max. demand and flat rate	416,039	Data to Mar. 31, 1912	247 HACKNEY	
16 BANCOR (WALES)	Bangor Corporation	1903	P. Price F. Whitto.	200 & 420	Direct	..	440	230	£30,116	424 kw.	..	23=118 H.P.	..	508 kw.	..	..	Lg. flat rate & 2-rate mtr. pr. sl. sc.	176,077	Data to Mar. 31, 1910	248 HAMMERSMITH	
17 BARKING	Barking Urban District Council	1899	H. L. Howard	230 & 440	Direct	..	1,010	478	..	403,000	461 kw.	19 arc, 494 inc., 64 Nemat	64=439 H.P.	24=600 H.P.	1,476 kw.	..	Lg. & tr. pr. sl. sc. & sliding scale	760,089	Lighting and traction	249 HAMSTEAD	
18 BARNES, MORTLAKE & EAST SHEEN	Barnes Urban District Council	1901	C. S. Davidson.	210 & 420	Direct	..	1,470	700	£77,139	1,440 kw.	571 mtl., 206 N.	62=421 kw.	..	2,639 kw.	..	..	Sliding scale with dis.	1,101,470	Data to March 31, 1912. *Also 100 m.a. on rate, va., & 13. p. (lg. or 1st. winter & 1st. summer (lg. & hg. or ekg. Data to Mar. 31, 1912	250 ISLINGTON	
19 BARNLEY	Barnley Corporation	1900	B. A. Barker	230 & 460	Direct	1,825	910	150 kw.	£91,887	1,347 kw.	110 arc, 707 mtl.	148	..	2,570 kw.	..	..	Max. dem., flat rate & sl. scale with dis.	1,716,245	Data to Mar. 31, 1912	251 KENSINGTON	
20 BARNSTAPLE	Barnstaple Corporation	1903	J. W. Hadfield.	230 & 440	Direct	..	876	195	£14,400	625 kw.	30 arc, 78 chm., 99 mtl.	26=70 H.P.	..	616 kw.	..	..	Flat rate w. dis., 2-rate mtr., & special	221,050	Data to Mar. 31, 1909	252 KENSINGTON H. OF HIGH STREET	
21 BARROW-IN-FURNESS	Barrow-in-Furness Corporation	1899	H. B. Bennett	230 & 440	Direct	1,585	1,000	800 kw.	£118,203	1,335 kw.	42 arc, 106 chm., 43 mtl.	218=1,473 H.P.	40=1,072 H.P.	4,577 kw.	707 kw.	..	Lg. & tr. pr. sl. sc. & 2-rate, cont. & special	1,404,322	Lighting and traction. *Pb. lg. are £173, inc. £8, 24, and £22. 1/2 to 1 1/2. Data to Mar. 31, 1912	253 KENSINGTON AND ST. JAMES'S BRIDGE	
22 BATH	Bath Corporation	1880	Francis Teague	100 A.C., & direct	1,256	850 kw.	..	..	£170,538	2,397 kw.	153 arc, 63 inc.	228=950 H.P.	..	3,699 kw.	423 kw.	..	Flat rate, 2-rate mtr. & cont. w. dis.	1,723,106	Supply by company 1890-5. Data to March 31, 1912	254 KENSINGTON AND NOTTING HILL	
23 BATLEY	Batley Corporation	1903	S. D. Jones	220 & 440 C.	Direct	850	607	30 & 150 kw.	£48,248	553 kw.	23=57 H.P.	113=570 H.P.	32=1,173 H.P.	1,906 kw.	..	..	Max. demand & flat rate	951,210	Lighting and traction. Data to Mar. 31, 1912	255 LAMBETH	
24 BECKENHAM	Beckenham Urban District Council	1900	J. E. Tapper	200 & 400	50- h., 1-ph.	1,300	706	600 kw.	£122,000	1,784 kw.	17 arc, 34 mtl.	23=56 H.P.	..	1,356 kw.	..	..	Flat rate	911,840	*Free wiring 6d. per unit plus fittings returns. Data to Mar. 31, 1909	256 LONDON & WESTMINSTER	
25 BEOFORD	Bedford Corporation	1894	R. W. L. Phillips	100 & 210	00- h., 1-ph.	2,340	1,155	..	£189,290	3,016 kw.	35 arc, 1,784 mtl.	100=972 H.P.	..	4,050 kw.	1,908 kw.	..	Flat rate 2-rate mtr. w. dis. & spec. for	1,923,173	Lg. & tr. 500 v. n.c. Data to Mar. 25, 1912	257 MARYLEBONE	
26 BELFAST	Belmont Corporation	1885	Thos. W. Dorman	210 & 420	Direct	1,000	971	100 A.	£282,948	7,113 kw.	80 arc	7,716 H.P.	3,885 kw.	17,072 kw.	2,025 kw.	..	Lg. & tr. 500 v. n.c. (Data to Mar. 31, 1912)	15,021,264	Lg. & tr. 500 v. n.c. (Data to Mar. 31, 1912)	258 MIDLAND RAILWAY CO. STATION	
27 BERWICK-UPON-TWEED	Urban Electric Supply Co., Ltd.	1900	W. T. Le Feuvre	230 & 440	Direct	1,150	625	39 kw. 10 to 30 inc.	£73,093	1,610 kw.	35 arc, 423 mtl.	67=128 H.P.	..	1,700 kw.	100 kw.	..	Max. dem., flat rate, 2-rate mtr. & cont.	960,094	*Tren. meters 6d. per unit. Data to March 31, 1912	259 POP LAR	
28 BEXHILL-ON-SEA	Bexhill Corporation	1900	C. Mittelhausen	230 & 440 C.	50- h., 1-ph.	502	325	37 kw.	£16,440	399 kw.	241 inc. & 8 mtl., 54 N.	14=23.8 H.P.	32=800 H.P.	1,167 kw.	..	..	Flat rate	662,557	*Tr. sl. giving bulk supply for lg. *Also 55,187 spent on pr. etn. 1/200 25%—14 days. Data to Mar. 31, 1909	260 ST. JAMES' WESTMINSTER	
29 BEXLEY	Bexley Urban District Council	1903	H. Dentham	230 & 460	Direct	..	890	863	..	241,104	1,076 kw.	8=191 H.P.	8=105 H.P.	1,190 kw.	167 kw.	..	Flat rate	89,346	Lighting and traction. Data to Mar. 31, 1912	261 ST. PANCRAS	
30 BIRKDALE	Birkdale District Electric Supply Co., Ltd.	1896	W. Wyld	230 & 460	Direct	8,125	2,200	598 kw. lg. 20 to 100 kw. tr.	£167,000	8,074 kw.	58 arc, 15 mtl.	237=1,815.5 H.P.	..	4,730 kw.	563 kw.	..	Lg. & tr. 500 v. n.c. (Data to Mar. 31, 1912)	4,981,093	Lg. & tr. Elec. Comm. took over the tramway gear stations from Nov. 10, 1900. Data to Mar. 31, 1912	262 SHOREDITCH	
31 BIRKENHEAD	Birkenhead Corporation	1896	B. A. Chattell	230 & 440	Direct	30,540	15,260	1,150 kw.	£139,861	11,139 kw.	..	2,999=30,065 H.P.	See other Table	28,092 kw. (ex. tr.)	..	..	Max. dem., flat rate with discount	20,079,276	Lighting and traction. Data to Mar. 31, 1910. *Three ph. 250 v. at 5,000 v. to substation and to large consumers Station opened March, 1912	263 SMITHFIELD MARKETS	
32 BIRMINGHAM	Birmingham Corporation	1912	J. S. Hollinrake	220 & 500	Direct	..	96	40	£2,110,000 (approx.)	..	120 mtl.	1=40 H.P.	..	..	..	Flat rate	..	*Tr. sl. giving bulk supply for lg. *Also 55,187 spent on pr. etn. 1/200 25%—14 days. Data to Mar. 31, 1909	264 SOUTHWARK		
33 BISPHAM-WITH-NORRECK	Bispham Urban District Council	1896	P. P. Wheelwright	110, 220 A.C. & 220 & 440 C.	60- h., 1-ph. & direct	7,000	8,300	550 kw.	£290,995	9,664 kw. inc. hg.	204 arc, 478 mtl.	773=6,537 H.P.	202=4,655 H.P.	11,238 kw.	570 kw.	..	Max. dem., flat w. dis. sl. 2-rate & t. w.	4,801,935	Lg. & tr. *Traction, 600 v. n.c. Data to Mar. 25, 1912	265 STONEWINGTON	
34 BLACKBURN	Blackburn Corporation	1898	Charles Furness	300 A.C. & 230 & 460	83- h., 1-ph. & direct	5,850	2,765	175 kw.	£207,000	..	256 arc, 874 mtl.	326=1,421 H.P.	144=8,888 H.P.	11,238 kw.	570 kw.	..	Lg. & tr. *Traction, 600 v. n.c. Data to Mar. 25, 1912	8,326,368	Lg. & tr. *Traction, 600 v. n.c. Data to Mar. 25, 1912	266 STONEWINGTON	
35 BLACKPOOL	Blackpool Corporation	1900	T. P. O. Yale	230, 280 & 650	Direct	720	..	..	£20,000	233 kw.	170 arc & inc.	2=6 H.P.	700 H.P.	917 kw.	..	..	Max. dem., flat rate and sliding scale	..	Lighting & traction. Water power. Data to Dec. 31, 1911	267 WANDSWORTH	
36 BLAENAU-FESTINIOG	Duke of Atholl	1908	James McInnes	110 & 230 C.	Direct	119	86	..	..	60 kw.	7 chm.	..	180 kw.	240 kw.	..	..	Water-power	..	*Used as engine for; Bulk supply from No. 0/7. E. S. Co. Cons. engr. Mera & McEllan. Data to Dec. 31, 1911	268 WESTMINSTER	
37 BLAIR ATHOLL	Northern Counties Electricity Supply Co., Ltd.	1902	C. W. Fairweather	230 & 460	Direct	1,000	604	..	..	393 kw.	2 kw.	1,749 kw. (inc. hg.)	..	2,020 kw.	..	..	Flat rate, sl. scale & contract	11,676,087	*Used as engine for; Bulk supply from No. 0/7. E. S. Co. Cons. engr. Mera & McEllan. Data to Dec. 31, 1911	269 WESTMINSTER & ST. JAMES' HOL	
38 BLYTH & COWPEN & BEDLINGTONSHIRE	Bolton Corporation	1894	J. G. Lowley (Res.)	100 & 200 A.C.	83- h., 1-ph. & direct	7,600	..	..	£383,718	6,046 kw.	..	1,167=11,734 H.P.	See other Table	..	..	..	Max. demand & flat rate	693,000 (est.)	Lighting and traction station. *Also three ph. supply at 400 v. 600 v. tr. 500 v. Data to March 31, 1912	270 WESTMINSTER HOL	
39 BOLTON	National Electric Construction Co., Ltd. (for the Corporation)	1905	H. G. Young	230 & 460 C.	60- h., 1-ph. & direct	6,000	292	36.8 kw.	£25,000	452.4 kw.	30 arc, 87 chm., 72 mtl.	30=87 H.P.	..	713 kw.	..	..	Flat rate and contract	..	*Also stand-by supply—150 H.P. Data to May 16, 1910	271 WOODWICH, FLYING L. STAND & ELTHAM LONGWORTH	
40 BO'NESS	Booth Corporation	1899	T. Dawson	230 & 440 C.	60- h., 1-ph. & direct	2,050	1,450	150 kw.	£118,212	1,493 kw.	183 arc, 100 kw. inc.	2=62 H.P.	530 kw.	4,231 kw.	810 kw.	..	..	Max. demand, flat rate, cont. & spec.	8,079,831	Lighting and traction. A.C. 8,000 v. *Traction 600 v. Data to Mar. 31, 1912	272 LONC EATON
41 BODILE	Donnemouth Corporation	1902	J. Dulbn	230 & 440 C.	60- h., 1-ph. & direct	1,300	1,000	..	£75,000	..	133 arc	..	..	..	..	..	Flat rate	1,831,638	Public lighting & traction station (92% of output for traction). *Station plant and cables	273 LONC EATON	
42 BOURNEMOUTH	Bournemouth & Poole Electric Supply Co., Ltd.	1899	E. L. Ingram	100 & 200 A.C. & 230 & 500 C.	100- h., 1-ph. & direct	4,400	2,262	355 kw.	£470,260	7,099 kw.	120 mtl.	258=606 H.P.	52=1,300 H.P.	8,364 kw.	7,000	..	Max. dem., flat w. dis.	3,078,816	Lighting and traction. *Also 400 kw. in traction	274 LONC EATON	
43 BOURNEMOUTH POOLE AND CHRISTCHURCH	Bradford Corporation	1880	Thomas Jones	230 & 460 C.	60- h., 1-ph.	13,830	10,814	700 kw. tr.	£2,400,000	7,319 kw. approx. inc. bulk	68 arc, 6 chm., 6 mtl.	2,240=12,729 H.P.	See other Table	18,905 kw.	2,744 kw.	..	Lg. & tr. 500 v. n.c. (Data to Mar. 31, 1912)	22,103,000 (approx.)	Lg. & tr. 500 v. n.c. (Data to Mar. 31, 1912)	275 LONC EATON	
44 BRADFORD	Bray Urban District Council	1892	W. J. O. Sower	230 & 460	Direct	..	130	..	£17,000	900 kw.	350 chm., 200 mtl.	4=16 H.P.	..	547 kw.	87 kw.	..	Max. dem., flat rate	185,000	Lg. & tr. Lamps traction (one p. 800 v. = at 6,000 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n.c. 1400 v. & 1400 v. to subst. Tr. 500 v. n		



**COPYRIGHT**

**LONDON.**

Place.	Supply Authority.	Year of opening.	Engineer.	Pressure of supply, volts.	Frequency and phase.	Total capacity of plant in kw.	Max. load recorded in kw.	Storage battery, mch. discharge.	Total capital expended.	Private lighting.	Public lighting.	No. and h.p. of private motors.	No. and h.p. of traction motors.	Total connections of all kinds.	Increase during year.	Price charged per unit, pence.	System of charging.	Units sold during last complete year.	Remarks.	
233 LINCOLN	Lincoln Corporation	1898	Stanley Clegg	230 & 460 tr. 700	Direct	1,305	1,004 kw. 100 tr.	84.5 kw.	£58,174	1,366 kw.	36 arc, 87 mtl.	264-1,934 h.p.	16-420 h.p.	3,183 kw.	7.6%	1p. 6d. 2d. or 4d. (pb. 1); pb. 1p. 6d. 2d. or 4d. (pb. 2); pb. 1p. 6d. 2d. or 4d. (pb. 3); pb. 1p. 6d. 2d. or 4d. (pb. 4); pb. 1p. 6d. 2d. or 4d. (pb. 5); pb. 1p. 6d. 2d. or 4d. (pb. 6); pb. 1p. 6d. 2d. or 4d. (pb. 7); pb. 1p. 6d. 2d. or 4d. (pb. 8); pb. 1p. 6d. 2d. or 4d. (pb. 9); pb. 1p. 6d. 2d. or 4d. (pb. 10); pb. 1p. 6d. 2d. or 4d. (pb. 11); pb. 1p. 6d. 2d. or 4d. (pb. 12); pb. 1p. 6d. 2d. or 4d. (pb. 13); pb. 1p. 6d. 2d. or 4d. (pb. 14); pb. 1p. 6d. 2d. or 4d. (pb. 15); pb. 1p. 6d. 2d. or 4d. (pb. 16); pb. 1p. 6d. 2d. or 4d. (pb. 17); pb. 1p. 6d. 2d. or 4d. (pb. 18); pb. 1p. 6d. 2d. or 4d. (pb. 19); pb. 1p. 6d. 2d. or 4d. (pb. 20); pb. 1p. 6d. 2d. or 4d. (pb. 21); pb. 1p. 6d. 2d. or 4d. (pb. 22); pb. 1p. 6d. 2d. or 4d. (pb. 23); pb. 1p. 6d. 2d. or 4d. (pb. 24); pb. 1p. 6d. 2d. or 4d. (pb. 25); pb. 1p. 6d. 2d. or 4d. (pb. 26); pb. 1p. 6d. 2d. or 4d. (pb. 27); pb. 1p. 6d. 2d. or 4d. (pb. 28); pb. 1p. 6d. 2d. or 4d. (pb. 29); pb. 1p. 6d. 2d. or 4d. (pb. 30); pb. 1p. 6d. 2d. or 4d. (pb. 31); pb. 1p. 6d. 2d. or 4d. (pb. 32); pb. 1p. 6d. 2d. or 4d. (pb. 33); pb. 1p. 6d. 2d. or 4d. (pb. 34); pb. 1p. 6d. 2d. or 4d. (pb. 35); pb. 1p. 6d. 2d. or 4d. (pb. 36); pb. 1p. 6d. 2d. or 4d. (pb. 37); pb. 1p. 6d. 2d. or 4d. (pb. 38); pb. 1p. 6d. 2d. or 4d. (pb. 39); pb. 1p. 6d. 2d. or 4d. (pb. 40); pb. 1p. 6d. 2d. or 4d. (pb. 41); pb. 1p. 6d. 2d. or 4d. (pb. 42); pb. 1p. 6d. 2d. or 4d. (pb. 43); pb. 1p. 6d. 2d. or 4d. (pb. 44); pb. 1p. 6d. 2d. or 4d. (pb. 45); pb. 1p. 6d. 2d. or 4d. (pb. 46); pb. 1p. 6d. 2d. or 4d. (pb. 47); pb. 1p. 6d. 2d. or 4d. (pb. 48); pb. 1p. 6d. 2d. or 4d. (pb. 49); pb. 1p. 6d. 2d. or 4d. (pb. 50); pb. 1p. 6d. 2d. or 4d. (pb. 51); pb. 1p. 6d. 2d. or 4d. (pb. 52); pb. 1p. 6d. 2d. or 4d. (pb. 53); pb. 1p. 6d. 2d. or 4d. (pb. 54); pb. 1p. 6d. 2d. or 4d. (pb. 55); pb. 1p. 6d. 2d. or 4d. (pb. 56); pb. 1p. 6d. 2d. or 4d. (pb. 57); pb. 1p. 6d. 2d. or 4d. (pb. 58); pb. 1p. 6d. 2d. or 4d. (pb. 59); pb. 1p. 6d. 2d. or 4d. (pb. 60); pb. 1p. 6d. 2d. or 4d. (pb. 61); pb. 1p. 6d. 2d. or 4d. (pb. 62); pb. 1p. 6d. 2d. or 4d. (pb. 63); pb. 1p. 6d. 2d. or 4d. (pb. 64); pb. 1p. 6d. 2d. or 4d. (pb. 65); pb. 1p. 6d. 2d. or 4d. (pb. 66); pb. 1p. 6d. 2d. or 4d. (pb. 67); pb. 1p. 6d. 2d. or 4d. (pb. 68); pb. 1p. 6d. 2d. or 4d. (pb. 69); pb. 1p. 6d. 2d. or 4d. (pb. 70); pb. 1p. 6d. 2d. or 4d. (pb. 71); pb. 1p. 6d. 2d. or 4d. (pb. 72); pb. 1p. 6d. 2d. or 4d. (pb. 73); pb. 1p. 6d. 2d. or 4d. (pb. 74); pb. 1p. 6d. 2d. or 4d. (pb. 75); pb. 1p. 6d. 2d. or 4d. (pb. 76); pb. 1p. 6d. 2d. or 4d. (pb. 77); pb. 1p. 6d. 2d. or 4d. (pb. 78); pb. 1p. 6d. 2d. or 4d. (pb. 79); pb. 1p. 6d. 2d. or 4d. (pb. 80); pb. 1p. 6d. 2d. or 4d. (pb. 81); pb. 1p. 6d. 2d. or 4d. (pb. 82); pb. 1p. 6d. 2d. or 4d. (pb. 83); pb. 1p. 6d. 2d. or 4d. (pb. 84); pb. 1p. 6d. 2d. or 4d. (pb. 85); pb. 1p. 6d. 2d. or 4d. (pb. 86); pb. 1p. 6d. 2d. or 4d. (pb. 87); pb. 1p. 6d. 2d. or 4d. (pb. 88); pb. 1p. 6d. 2d. or 4d. (pb. 89); pb. 1p. 6d. 2d. or 4d. (pb. 90); pb. 1p. 6d. 2d. or 4d. (pb. 91); pb. 1p. 6d. 2d. or 4d. (pb. 92); pb. 1p. 6d. 2d. or 4d. (pb. 93); pb. 1p. 6d. 2d. or 4d. (pb. 94); pb. 1p. 6d. 2d. or 4d. (pb. 95); pb. 1p. 6d. 2d. or 4d. (pb. 96); pb. 1p. 6d. 2d. or 4d. (pb. 97); pb. 1p. 6d. 2d. or 4d. (pb. 98); pb. 1p. 6d. 2d. or 4d. (pb. 99); pb. 1p. 6d. 2d. or 4d. (pb. 100); pb. 1p. 6d. 2d. or 4d. (pb. 101); pb. 1p. 6d. 2d. or 4d. (pb. 102); pb. 1p. 6d. 2d. or 4d. (pb. 103); pb. 1p. 6d. 2d. or 4d. (pb. 104); pb. 1p. 6d. 2d. or 4d. (pb. 105); pb. 1p. 6d. 2d. or 4d. (pb. 106); pb. 1p. 6d. 2d. or 4d. (pb. 107); pb. 1p. 6d. 2d. or 4d. (pb. 108); pb. 1p. 6d. 2d. or 4d. (pb. 109); pb. 1p. 6d. 2d. or 4d. (pb. 110); pb. 1p. 6d. 2d. or 4d. (pb. 111); pb. 1p. 6d. 2d. or 4d. (pb. 112); pb. 1p. 6d. 2d. or 4d. (pb. 113); pb. 1p. 6d. 2d. or 4d. (pb. 114); pb. 1p. 6d. 2d. or 4d. (pb. 115); pb. 1p. 6d. 2d. or 4d. (pb. 116); pb. 1p. 6d. 2d. or 4d. (pb. 117); pb. 1p. 6d. 2d. or 4d. (pb. 118); pb. 1p. 6d. 2d. or 4d. (pb. 119); pb. 1p. 6d. 2d. or 4d. (pb. 120); pb. 1p. 6d. 2d. or 4d. (pb. 121); pb. 1p. 6d. 2d. or 4d. (pb. 122); pb. 1p. 6d. 2d. or 4d. (pb. 123); pb. 1p. 6d. 2d. or 4d. (pb. 124); pb. 1p. 6d. 2d. or 4d. (pb. 125); pb. 1p. 6d. 2d. or 4d. (pb. 126); pb. 1p. 6d. 2d. or 4d. (pb. 127); pb. 1p. 6d. 2d. or 4d. (pb. 128); pb. 1p. 6d. 2d. or 4d. (pb. 129); pb. 1p. 6d. 2d. or 4d. (pb. 130); pb. 1p. 6d. 2d. or 4d. (pb. 131); pb. 1p. 6d. 2d. or 4d. (pb. 132); pb. 1p. 6d. 2d. or 4d. (pb. 133); pb. 1p. 6d. 2d. or 4d. (pb. 134); pb. 1p. 6d. 2d. or 4d. (pb. 135); pb. 1p. 6d. 2d. or 4d. (pb. 136); pb. 1p. 6d. 2d. or 4d. (pb. 137); pb. 1p. 6d. 2d. or 4d. (pb. 138); pb. 1p. 6d. 2d. or 4d. (pb. 139); pb. 1p. 6d. 2d. or 4d. (pb. 140); pb. 1p. 6d. 2d. or 4d. (pb. 141); pb. 1p. 6d. 2d. or 4d. (pb. 142); pb. 1p. 6d. 2d. or 4d. (pb. 143); pb. 1p. 6d. 2d. or 4d. (pb. 144); pb. 1p. 6d. 2d. or 4d. (pb. 145); pb. 1p. 6d. 2d. or 4d. (pb. 146); pb. 1p. 6d. 2d. or 4d. (pb. 147); pb. 1p. 6d. 2d. or 4d. (pb. 148); pb. 1p. 6d. 2d. or 4d. (pb. 149); pb. 1p. 6d. 2d. or 4d. (pb. 150); pb. 1p. 6d. 2d. or 4d. (pb. 151); pb. 1p. 6d. 2d. or 4d. (pb. 152); pb. 1p. 6d. 2d. or 4d. (pb. 153); pb. 1p. 6d. 2d. or 4d. (pb. 154); pb. 1p. 6d. 2d. or 4d. (pb. 155); pb. 1p. 6d. 2d. or 4d. (pb. 156); pb. 1p. 6d. 2d. or 4d. (pb. 157); pb. 1p. 6d. 2d. or 4d. (pb. 158); pb. 1p. 6d. 2d. or 4d. (pb. 159); pb. 1p. 6d. 2d. or 4d. (pb. 160); pb. 1p. 6d. 2d. or 4d. (pb. 161); pb. 1p. 6d. 2d. or 4d. (pb. 162); pb. 1p. 6d. 2d. or 4d. (pb. 163); pb. 1p. 6d. 2d. or 4d. (pb. 164); pb. 1p. 6d. 2d. or 4d. (pb. 165); pb. 1p. 6d. 2d. or 4d. (pb. 166); pb. 1p. 6d. 2d. or 4d. (pb. 167); pb. 1p. 6d. 2d. or 4d. (pb. 168); pb. 1p. 6d. 2d. or 4d. (pb. 169); pb. 1p. 6d. 2d. or 4d. (pb. 170); pb. 1p. 6d. 2d. or 4d. (pb. 171); pb. 1p. 6d. 2d. or 4d. (pb. 172); pb. 1p. 6d. 2d. or 4d. (pb. 173); pb. 1p. 6d. 2d. or 4d. (pb. 174); pb. 1p. 6d. 2d. or 4d. (pb. 175); pb. 1p. 6d. 2d. or 4d. (pb. 176); pb. 1p. 6d. 2d. or 4d. (pb. 177); pb. 1p. 6d. 2d. or 4d. (pb. 178); pb. 1p. 6d. 2d. or 4d. (pb. 179); pb. 1p. 6d. 2d. or 4d. (pb. 180); pb. 1p. 6d. 2d. or 4d. (pb. 181); pb. 1p. 6d. 2d. or 4d. (pb. 182); pb. 1p. 6d. 2d. or 4d. (pb. 183); pb. 1p. 6d. 2d. or 4d. (pb. 184); pb. 1p. 6d. 2d. or 4d. (pb. 185); pb. 1p. 6d. 2d. or 4d. (pb. 186); pb. 1p. 6d. 2d. or 4d. (pb. 187); pb. 1p. 6d. 2d. or 4d. (pb. 188); pb. 1p. 6d. 2d. or 4d. (pb. 189); pb. 1p. 6d. 2d. or 4d. (pb. 190); pb. 1p. 6d. 2d. or 4d. (pb. 191); pb. 1p. 6d. 2d. or 4d. (pb. 192); pb. 1p. 6d. 2d. or 4d. (pb. 193); pb. 1p. 6d. 2d. or 4d. (pb. 194); pb. 1p. 6d. 2d. or 4d. (pb. 195); pb. 1p. 6d. 2d. or 4d. (pb. 196); pb. 1p. 6d. 2d. or 4d. (pb. 197); pb. 1p. 6d. 2d. or 4d. (pb. 198); pb. 1p. 6d. 2d. or 4d. (pb. 199); pb. 1p. 6d. 2d. or 4d. (pb. 200); pb. 1p. 6d. 2d. or 4d. (pb. 201); pb. 1p. 6d. 2d. or 4d. (pb. 202); pb. 1p. 6d. 2d. or 4d. (pb. 203); pb. 1p. 6d. 2d. or 4d. (pb. 204); pb. 1p. 6d. 2d. or 4d. (pb. 205); pb. 1p. 6d. 2d. or 4d. (pb. 206); pb. 1p. 6d. 2d. or 4d. (pb. 207); pb. 1p. 6d. 2d. or 4d. (pb. 208); pb. 1p. 6d. 2d. or 4d. (pb. 209); pb. 1p. 6d. 2d. or 4d. (pb. 210); pb. 1p. 6d. 2d. or 4d. (pb. 211); pb. 1p. 6d. 2d. or 4d. (pb. 212); pb. 1p. 6d. 2d. or 4d. (pb. 213); pb. 1p. 6d. 2d. or 4d. (pb. 214); pb. 1p. 6d. 2d. or 4d. (pb. 215); pb. 1p. 6d. 2d. or 4d. (pb. 216); pb. 1p. 6d. 2d. or 4d. (pb. 217); pb. 1p. 6d. 2d. or 4d. (pb. 218); pb. 1p. 6d. 2d. or 4d. (pb. 219); pb. 1p. 6d. 2d. or 4d. (pb. 220); pb. 1p. 6d. 2d. or 4d. (pb. 221); pb. 1p. 6d. 2d. or 4d. (pb. 222); pb. 1p. 6d. 2d. or 4d. (pb. 223); pb. 1p. 6d. 2d. or 4d. (pb. 224); pb. 1p. 6d. 2d. or 4d. (pb. 225); pb. 1p. 6d. 2d. or 4d. (pb. 226); pb. 1p. 6d. 2d. or 4d. (pb. 227); pb. 1p. 6d. 2d. or 4d. (pb. 228); pb. 1p. 6d. 2d. or 4d. (pb. 229); pb. 1p. 6d. 2d. or 4d. (pb. 230); pb. 1p. 6d. 2d. or 4d. (pb. 231); pb. 1p. 6d. 2d. or 4d. (pb. 232); pb. 1p. 6d. 2d. or 4d. (pb. 233); pb. 1p. 6d. 2d. or 4d. (pb. 234); pb. 1p. 6d. 2d. or 4d. (pb. 235); pb. 1p. 6d. 2d. or 4d. (pb. 236); pb. 1p. 6d. 2d. or 4d. (pb. 237); pb. 1p. 6d. 2d. or 4d. (pb. 238); pb. 1p. 6d. 2d. or 4d. (pb. 239); pb. 1p. 6d. 2d. or 4d. (pb. 240); pb. 1p. 6d. 2d. or 4d. (pb. 241); pb. 1p. 6d. 2d. or 4d. (pb. 242); pb. 1p. 6d. 2d. or 4d. (pb. 243); pb. 1p. 6d. 2d. or 4d. (pb. 244); pb. 1p. 6d. 2d. or 4d. (pb. 245); pb. 1p. 6d. 2d. or 4d. (pb. 246); pb. 1p. 6d. 2d. or 4d. (pb. 247); pb. 1p. 6d. 2d. or 4d. (pb. 248); pb. 1p. 6d. 2d. or 4d. (pb. 249); pb. 1p. 6d. 2d. or 4d. (pb. 250); pb. 1p. 6d. 2d. or 4d. (pb. 251); pb. 1p. 6d. 2d. or 4d. (pb. 252); pb. 1p. 6d. 2d. or 4d. (pb. 253); pb. 1p. 6d. 2d. or 4d. (pb. 254); pb. 1p. 6d. 2d. or 4d. (pb. 255); pb. 1p. 6d. 2d. or 4d. (pb. 256); pb. 1p. 6d. 2d. or 4d. (pb. 257); pb. 1p. 6d. 2d. or 4d. (pb. 258); pb. 1p. 6d. 2d. or 4d. (pb. 259); pb. 1p. 6d. 2d. or 4d. (pb. 260); pb. 1p. 6d. 2d. or 4d. (pb. 261); pb. 1p. 6d. 2d. or 4d. (pb. 262); pb. 1p. 6d. 2d. or 4d. (pb. 263); pb. 1p. 6d. 2d. or 4d. (pb. 264); pb. 1p. 6d. 2d. or 4d. (pb. 265); pb. 1p. 6d. 2d. or 4d. (pb. 266); pb. 1p. 6d. 2d. or 4d. (pb. 267); pb. 1p. 6d. 2d. or 4d. (pb. 268); pb. 1p. 6d. 2d. or 4d. (pb. 269); pb. 1p. 6d. 2d. or 4d. (pb. 270); pb. 1p. 6d. 2d. or 4d. (pb. 271); pb. 1p. 6d. 2d. or 4d. (pb. 272); pb. 1p. 6d. 2d. or 4d. (pb. 273); pb. 1p. 6d. 2d. or 4d. (pb. 274); pb. 1p. 6d. 2d. or 4d. (pb. 275); pb. 1p. 6d. 2d. or 4d. (pb. 276); pb. 1p. 6d. 2d. or 4d. (pb. 277); pb. 1p. 6d. 2d. or 4d. (pb. 278); pb. 1p. 6d. 2d. or 4d. (pb. 279); pb. 1p. 6d. 2d. or 4d. (pb. 280); pb. 1p. 6d. 2d. or 4d. (pb. 281); pb. 1p. 6d. 2d. or 4d. (pb. 282); pb. 1p. 6d. 2d. or 4d. (pb. 283); pb. 1p. 6d. 2d. or 4d. (pb. 284); pb. 1p. 6d. 2d. or 4d. (pb. 285); pb. 1p. 6d. 2d. or 4d. (pb. 286); pb. 1p. 6d. 2d. or 4d. (pb. 287); pb. 1p. 6d. 2d. or 4d. (pb. 288); pb. 1p. 6d. 2d. or 4d. (pb. 289); pb. 1p. 6d. 2d. or 4d. (pb. 290); pb. 1p. 6d. 2d. or 4d. (pb. 291); pb. 1p. 6d. 2d. or 4d. (pb. 292); pb. 1p. 6d. 2d. or 4d. (pb. 293); pb. 1p. 6d. 2d. or 4d. (pb. 294); pb. 1p. 6d. 2d. or 4d. (pb. 295); pb. 1p. 6d. 2d. or 4d. (pb. 296); pb. 1p. 6d. 2d. or 4d. (pb. 297); pb. 1p. 6d. 2d. or 4d. (pb. 298); pb. 1p. 6d. 2d. or 4d. (pb. 299); pb. 1p. 6d. 2d. or 4d. (pb. 300); pb. 1p. 6d. 2d. or 4d. (pb. 301); pb. 1p. 6d. 2d. or 4d. (pb. 302); pb. 1p. 6d. 2d. or 4d. (pb. 303); pb. 1p. 6d. 2d. or 4d. (pb. 304); pb. 1p. 6d. 2d. or 4d. (pb. 305); pb. 1p. 6d. 2d. or 4d. (pb. 306); pb. 1p. 6d. 2d. or 4d. (pb. 307); pb. 1p. 6d. 2d. or 4d. (pb. 308); pb. 1p. 6d. 2d. or 4d. (pb. 309); pb. 1p. 6d. 2d. or 4d. (pb. 310); pb. 1p. 6d. 2d. or 4d. (pb. 311); pb. 1p. 6d. 2d. or 4d. (pb. 312); pb. 1p. 6d. 2d. or 4d. (pb. 313); pb. 1p. 6d. 2d. or 4d. (pb. 314); pb. 1p. 6d. 2d. or 4d. (pb. 315); pb. 1p. 6d. 2d. or 4d. (pb. 316); pb. 1p. 6d. 2d. or 4d. (pb. 317); pb. 1p. 6d. 2d. or 4d. (pb. 318); pb. 1p. 6d. 2d. or 4d. (pb. 319); pb. 1p. 6d. 2d. or 4d. (pb. 320); pb. 1p. 6d. 2d. or 4d. (pb. 321); pb. 1p. 6d. 2d. or 4d. (pb. 322); pb. 1p. 6d. 2d. or 4d. (pb. 323); pb. 1p. 6d. 2d. or 4d. (pb. 324); pb. 1p. 6d. 2d. or 4d. (pb. 325); pb. 1p. 6d. 2d. or 4d. (pb. 326); pb. 1p. 6d. 2d. or 4d. (pb. 327); pb. 1p. 6d. 2d. or 4d. (pb. 328); pb. 1p. 6d. 2d. or 4d. (pb. 329); pb. 1p. 6d. 2d. or 4d. (pb. 330); pb. 1p. 6d. 2d. or 4d. (pb. 331); pb. 1p. 6d. 2d. or 4d. (pb. 332); pb. 1p. 6d. 2d. or 4d. (pb. 333); pb. 1p. 6d. 2d. or 4d. (pb. 334); pb. 1p. 6d. 2d. or 4d. (pb. 335); pb. 1p. 6d. 2d. or 4d. (pb. 336); pb. 1p. 6d. 2d. or 4d. (pb. 337); pb. 1p. 6d. 2d. or 4d. (pb. 338); pb. 1p. 6d. 2d. or 4d. (pb. 339); pb. 1p. 6d. 2d. or 4d. (pb. 340); pb. 1p. 6d. 2d. or 4d. (pb. 341); pb. 1p. 6d. 2d. or 4d. (pb. 342); pb. 1p. 6d. 2d. or 4d. (pb. 343); pb. 1p. 6d. 2d. or 4d. (pb. 344); pb. 1p. 6d. 2d. or 4d. (pb. 345); pb. 1p. 6d. 2d. or 4d. (pb. 346); pb. 1p. 6d. 2d. or 4d. (pb. 347); pb. 1p. 6d. 2d. or 4d. (pb. 348); pb. 1p. 6d. 2d. or 4d. (pb. 349); pb. 1p. 6d. 2d. or 4d. (pb. 350); pb. 1p. 6d. 2d. or 4d. (pb. 351); pb. 1p. 6d. 2d. or 4d. (pb. 352); pb. 1p. 6d. 2d. or 4d. (pb. 353); pb. 1p. 6d. 2d. or 4d. (pb. 354); pb. 1p. 6d. 2d. or 4d. (pb. 355); pb. 1p. 6d. 2d. or 4d. (pb. 356); pb. 1p. 6d. 2d. or 4d. (pb. 357); pb. 1p. 6d. 2d. or 4d. (pb. 358); pb. 1p. 6d. 2d. or 4d. (pb. 359); pb. 1p. 6d. 2d. or 4d. (pb. 360); pb. 1p. 6d. 2d. or 4d. (pb. 361); pb. 1p. 6d. 2d. or 4d. (pb. 362); pb. 1p. 6d. 2d. or 4d. (pb. 363); pb. 1p. 6d. 2d. or 4d. (pb. 364); pb. 1p. 6d. 2d. or 4d. (pb. 365); pb. 1p. 6d. 2d. or 4d. (pb. 366); pb. 1p. 6d. 2d. or 4d. (pb. 367); pb. 1p. 6d. 2d. or 4d. (pb. 368); pb. 1p. 6d. 2d. or 4d. (pb. 369); pb. 1p. 6d. 2d. or 4d. (pb. 370); pb. 1p. 6d. 2d. or 4d. (pb. 371); pb. 1p. 6d. 2d. or 4d. (pb. 372); pb. 1p. 6d. 2d. or 4d. (pb. 373); pb. 1p. 6d. 2d. or 4d. (pb. 374); pb. 1p. 6d. 2d. or 4d. (pb. 375); pb. 1p. 6d. 2d. or 4d. (pb. 376); pb. 1p. 6d. 2d. or 4d. (pb. 377); pb. 1p. 6d. 2d. or 4d. (pb. 378); pb. 1p. 6d. 2d. or 4d. (pb. 379); pb. 1p. 6d. 2d. or 4d. (pb. 380); pb. 1p. 6d. 2d. or 4d. (pb. 381); pb. 1p. 6d. 2d. or 4d. (pb. 382); pb. 1p. 6d. 2d. or 4d. (pb. 383); pb. 1p. 6d. 2d. or 4d. (pb. 384); pb. 1p. 6d. 2d. or 4d. (pb. 385); pb. 1p. 6d. 2d. or 4d. (pb. 386); pb. 1p. 6d. 2d. or 4d. (pb. 387); pb. 1p. 6d. 2d. or 4d. (pb. 388); pb. 1p. 6d. 2d. or 4d. (pb. 389); pb. 1p. 6d. 2d. or 4d. (pb. 390); pb. 1p. 6d. 2d. or 4d. (pb. 391); pb. 1p. 6d. 2d. or 4d. (pb. 392); pb. 1p. 6d. 2d. or 4d. (pb. 393); pb. 1p. 6d. 2d. or 4d. (pb. 394); pb. 1p. 6d. 2d. or 4d. (pb. 395); pb. 1p. 6d. 2d. or 4d. (pb. 396); pb. 1p. 6d. 2d. or 4d. (pb. 397); pb. 1p. 6d. 2d. or 4d. (pb. 398); pb. 1p. 6d. 2d. or 4d. (pb. 399); pb. 1p. 6d. 2d. or 4d. (pb. 400); pb. 1p. 6d. 2d. or 4d. (pb. 401); pb. 1p. 6d. 2d. or 4d. (pb. 402); pb. 1p. 6d. 2d. or 4d. (pb. 403); pb. 1p. 6d. 2d. or 4d. (pb. 404); pb. 1p. 6d. 2d. or 4d. (pb. 405); pb. 1p. 6d. 2d. or 4d. (pb. 406); pb. 1p. 6d. 2d. or 4d. (pb. 407); pb. 1p. 6d. 2d. or 4d. (pb. 408); pb. 1p. 6d. 2d. or 4d. (pb. 409); pb. 1p. 6d. 2d. or 4d. (pb. 410); pb. 1p. 6d. 2d. or 4d. (pb. 411); pb. 1p. 6d. 2d. or 4d. (pb. 412); pb. 1p. 6d. 2d. or 4d. (pb. 413); pb. 1p. 6d. 2d. or 4d. (pb. 414); pb. 1p. 6d. 2d. or 4d. (pb. 415); pb. 1p. 6d. 2d. or 4d. (pb. 416); pb. 1p. 6d. 2d. or 4d. (pb. 417); pb. 1p. 6d. 2d. or 4d. (pb. 418); pb. 1p. 6d. 2d. or 4d. (pb. 419); pb. 1p. 6d. 2d. or 4d. (pb. 420); pb. 1p. 6d. 2d. or 4d. (pb. 421); pb. 1p. 6d. 2d. or 4d. (pb. 422); pb. 1p. 6d. 2d. or 4d. (pb. 423); pb. 1p. 6d. 2d. or 4d. (pb. 424); pb. 1p. 6d. 2d. or 4d. (pb. 425); pb. 1p. 6d. 2d. or 4d. (pb. 426); pb. 1p. 6d. 2d. or 4d. (pb. 427); pb. 1p. 6d. 2d. or 4d. (pb. 428); pb. 1p. 6d. 2d. or 4d. (pb. 429); pb. 1p. 6d. 2d. or 4d. (pb. 430); pb. 1p. 6d. 2d. or 4d. (pb. 431); pb. 1p. 6d. 2d. or 4d. (pb. 432); pb. 1p. 6d. 2d. or 4d. (pb. 433); pb. 1p. 6d. 2d. or 4d. (pb. 434); pb. 1p. 6d. 2d. or 4d. (pb. 435); pb. 1p. 6d. 2d. or 4d. (pb. 436); pb. 1p. 6d. 2d. or 4d. (pb. 437); pb. 1p. 6d. 2d. or 4d. (pb. 438); pb. 1p. 6d. 2d. or 4d. (pb. 439); pb. 1p. 6d. 2d. or 4d. (pb. 440); pb. 1p. 6d. 2d. or 4d. (pb. 441); pb. 1p. 6d. 2d. or 4d. (pb. 442); pb. 1p. 6d. 2d. or 4d. (pb. 443); pb. 1p. 6d. 2d. or 4d. (pb. 444); pb. 1p. 6d. 2d. or 4d. (pb. 445); pb. 1p. 6d. 2d. or 4d. (pb. 446); pb. 1p. 6d. 2d. or 4d. (pb. 447); pb. 1p. 6d. 2d. or 4d. (pb. 448); pb. 1p. 6d. 2d. or 4d.				



270	WESTMINSTER	Charing Cross, West End & City Electricity Supply Co., Ltd.	1893	G. W. Keats	210 & 450	Direct	1,798	787	1,038,065	1,972 K.W.	18 arc, 104 inc., 92 Nernst	820 H.P.	1,008 K.W.	1,000,000	270 v. a.c. 60-1 p.h., for Eltham only	271	
271	WOOLWICH	Woolwich Corporation	1894	R. V. Macrory	220 & 440	Direct	700	494	£54,532	591 K.W.	186 arc, 97 cbn. 8 mtl.	72=463 H.P.	1,071 K.W.	711,869	*Pb. lg. arc 18 1/2 in., inc. (32 c.p.) 2 1/2 in. p.a. Data to Mar. 31, 1916	272	
272	LONDONDERRY	Londonderry Corporation	1897	W. B. Smith	115	Direct	210	120	£5,436	133 K.W.			161 K.W.			273	
273	LOND EATON	Harrington Electric Light Co., Ltd.	1903	F. Worrall	220	Direct	450	242	£22,854	463 K.W.	2 arc, 296 inc., 23 Nernst	57=140 H.P.	629 K.W.			274	
274	LOND EATON	Long Eaton Urban District Council	1901	C. E. Yeaman	230 & 460	Direct	600	291	£31,983	890 K.W.	23 arc	248 K.W.	645 K.W.	425,935	Data to Mar. 31, 1912	275	
275	LONDON	Stoke-on-Trent Corporation	1904	W. B. Allen	220 & 440	Direct	700	440	£35,328	491 K.W.	12 clusters, 4 x 40-c.p. mtl.	120=584 H.P.	1,037 K.W.	685,965	Data to Mar. 31, 1912	276	
276	LOUGHBOROUGH	Loughborough Corporation	1901	G. A. Bruce	230 & 460	Direct	1,825	955	£25,348	1,633 K.W.	576 mtl.	117=682 H.P.	2,378 K.W.	1,232,650	Lighting and traction. Data to Sept. 30, 1911	277	
277	LOWEST	Lowestoft Corporation	1901	G. A. Bruce	230 & 460	Direct	1,825	955	£25,348	1,633 K.W.	576 mtl.	117=682 H.P.	2,378 K.W.	1,232,650	Lighting and traction. Data to Sept. 30, 1911	277	
278	LUDLOW	Ludlow Electric Light Co., Ltd.	1907	Edwards and Armstrong	230	Direct	75	80	£4,020	70 K.W.	6=22 H.P.		70 K.W.			278	
279	LUTON	Luton Corporation	1901	W. H. Cooke	250 & 500	Direct	2,297	1,723	£80,331	1,833 K.W.	12 arc, 27 x 50 c.p. mtl.	559=3,041 H.P.	4,578 K.W.	2,979,530	Data to March 31, 1912	279	
280	LYME REGIS	Lyme Regis Electric Light & Power Co., Ltd.	1903	F. Cheshire	116	Direct	150	103	£35,876	463 K.W.	118 mtl.	31=136 H.P.	193 K.W.	127,487	Data to Dec. 31, 1911	280	
281	LYMINGTON	Lymington Electric Light & Power Co., Ltd.	1900	C. L. Holman	240 & 480	Direct	337	92	£8,514	165 K.W.	165 mtl.	8=18 1/2 H.P.	77 K.W.	170,403	Water power only. Data to Mar. 25, 1913	281	
282	LYNANTON & LYNNMOUTH	Lynant & Lynnmouth Electric Light Co., Ltd.	1896	P. T. Kimmins	100	106-1-ph.	237	92	£8,000	67 K.W.	57 inc.		320 K.W.	502,000	Data to Mar., 1911	282	
283	MACROON	Macroon Electric Light Co., Ltd.	1899	D. E. McDonnell	230	100-1-ph.	150	47	£59,000	760 K.W.	55 arc, 200 mtl.	98=160 H.P.	2,352 K.W.	217 K.W.		283	
284	MAIDENHEAD DISTRICT	Maidenhead Corporation	1902	C. O. Milton	230	Direct	556	376	£10,000	1,107 K.W.	29 arc, 440 mtl., 216 N.	1,556 H.P.	46=1,000 H.P.	2,138,151	Ltg. & tr. "Traction. 43 arcs repl. by mtl. 20 or 6/8 per 32-w. lp. p.a. + 1 d. p.a. Tr. 1.25. Data to Mar. 31, 1913. Norton supplied from Malton. "C.W. Fairweather (Mgr.) Cons. engs. Merz & McLellan. Data to Dec. 31, 1911	284	
285	MAIDSTONE	Maidstone Corporation	1901	E. E. Hoadley	230 & 400, tr. 500	Direct	1,250	751	£18,000	156 K.W.	156 mtl.	96 K.W.	247 K.W.	6.5%		285	
286	MALTON & NORTON	Northern Counties Electricity Supply Co., Ltd.	1904	A. E. Squires (Res.)	100 & 200	50-1-ph.	256	108	£21,006	463.9 K.W.	14=38.5 H.P.		492 K.W.	121,375		286	
287	MALVERN	Malvern Urban District Council	1904	W. J. Rendell Baker	100, 200, & 400 D.C.	Direct, and 50-3-ph.	54,800	42,025	£2,792,463	28,407 K.W.	114 arc	5,431=54,980 H.P.	See other Table	69,568 K.W.	93,682,946	Lighting and traction, three stations. "Also 216 and 400 v. a.c. 500 v. d.c. Data to Mar. 31, 1913	287
288	MANCHESTER	Manchester Corporation	1893	S. L. Pearce	240 & 480	Direct	1,300	373	£77,733	693 K.W.	40 arc, 24 mtl.	127=446 H.P.	2,318 K.W.	1,127,139	Lighting & traction. "Incl. destructor, £13,400. Data to Mar. 31, 1912	288	
289	MANSFIELD	Mansfield Corporation	1903	E. Holcombe Hewlett	250-600	Direct	60	49	£3,000	133 K.W.	2 arc, 60 mtl.	5=10 H.P.		60,000	Overhead mains. "Private lg. 220 volts 2-wire; public lg. 110 volts 3-wire. Data to April 15, 1910	289	
290	MARDY (CLAM.)	Mardy Electric Light Co., Ltd.	1898	E. A. Davies	240 & 480, tr. 500	Direct	1,600	1,209	£18,565 (1910)	246 K.W.	111.5 K.W., inc. lg.		11 K.W.	1,725,358	Lighting and traction station. Data to Sept. 30, 1911	290	
291	MARCAE & BROAD-STAIRS & S. PETERS	Iale of Thanet Electric Tramways & Lighting Co., Ltd.	1908	S. Lambert	240 & 480	Direct	90	78.8	£18,565 (1910)	246 K.W.	111.5 K.W., inc. lg.		11 K.W.	66,471	Data for 1911	291	
292	MARKET DRAYTON	Market Drayton Electric Light & Power Co., Ltd.	1900	J. E. Edmondson	240 & 480	Direct	800	171	£10,640	465 K.W.	65=190 H.P.		111 K.W.	251,211	Data to Dec. 31, 1911	292	
293	MELTON MOWBRAY	Melton Mowbray Electric Light Co., Ltd.	1904	K. A. Scott-Moncrieff	225 & 450	Direct	66	21	£10,380	80 K.W.	2 cbn., 44 N.	12=31 H.P.		23,204	*Resident engineer S. Johnston. Gas power. Data to Dec. 31, 1909	293	
294	MELROSE	Melrose Electric Supply Corporation, Ltd.	1901	L. W. Dixon	230 & 460	Direct	820	432	£55,393	656 K.W.	1,427 natl.	313 H.P.	82=1,650 H.P.	954,128	Lighting and traction. *Max. average, 8 1/2 l. Data to Dec. 31, 1911	294	
295	MERTHYR TYDFIL	Merthyr Electric Traction and Lighting Co., Ltd.	1896	F. Johnson	110	Direct	15	11	£11,000	24 K.W.	57 mtl.		26 K.W.	12,100	Data to Mar. 25, 1916	295	
296	MEVAGISSEY	Mevagissey Electric Supply Co., Ltd.	1902	John Senior	220 & 416	Direct	400	280	£23,000	440 K.W.	22 arc, 221 cbn., 41 mtl.	14=91 H.P.	550 K.W.	353,737	Data to Mar. 31, 1913	296	
297	MEXBOROUGH	Mexborough Urban District Council	1902	Horace M. Taylor	220 & 440	Direct	1,600	1,238	£107,000	2,627 K.W.	18 arc, 36 cbn.	67=450 H.P.	3,126 K.W.	1,668,996	Motors on hire-purchase system. Data to Mar. 31, 1909	297	
298	MIDDLESBROUGH	Middlesbrough Corporation	1901	S. Pauls	220 & 440	Direct	768	780	£46,255	235 K.W.	18 arc, 36 cbn.	67=450 H.P.	3,126 K.W.	991,519	Lighting and traction; local Tramway Co. and Manchester Corporation supplied. Data to Mar. 31, 1913	298	
299	MIDDLETON	Middleton Corporation	1902	S. Pauls	220 & 440	Direct	768	780	£46,255	235 K.W.	18 arc, 36 cbn.	67=450 H.P.	3,126 K.W.			299	
300	MILFORD-ON-SEA	Milford-on-Sea Electric Supply Co., Ltd.	1906	L. Nicholson	230 & 460	Direct	100		£48,000	246 K.W.	246 A.H.		396 K.W.	159,156	Gas power. Supply has been extended to Dunster. Data to Dec. 31, 1911	300	
301	MINNEHEAD AND DUNSTER	Minnehead Electric Supply Co., Ltd.	1903	H. W. Gothard	226 D.C. 110 & 222 A.C.	Direct, and 50-1-ph.	276	175	£3,200	56 mtl.	56 mtl.	15=68 H.P.	229 K.W.	47,714	*Fans and radiators, 15 n.p. Bulk supply from Yorkshire Electric Power Co. Data to Mar. 31, 1913	301	
302	MIRFIELD	Mirfield Urban District Council	1905	John Lomas	100 & 200	60-1-ph.	123	69.3	£18,100	175 K.W.	7 cbn., 208 mtl.	14=46.5 H.P.	204 K.W.	153,880	Water power. Data to Mar. 31, 1912	302	
303	MONMOUTH	Monmouth Corporation	1899	F. R. Windsor	100 & 200	60-1-ph.	123	69.3	£18,100	175 K.W.	7 cbn., 208 mtl.	14=46.5 H.P.	204 K.W.	222,164	Data to Dec. 31, 1911	303	
304	MONTROSE	North of Scotland Electric Light & Power Co., Ltd.	1901	F. Darritt Billa	246 & 480	Direct	282	163	£30,888	441 K.W.	20 H.C.P. lns., 12 cbn., 315 mtl.	75=253 H.P.	698 K.W.	204,145		304	
305	MORCAMBE	Morcambe Corporation	1898	W. H. Ball	226	Direct	700	335	£62,593	446 K.W.	104 arc, 275 inc., 3 N.	22=99 H.P.	524 K.W.	166,923	Output again decreased owing to use of rail lamps. "Two motor-generators, 350 kw. each. Data to Mar. 31, 1912	305	
306	MORLEY	Morley Corporation	1898	J. E. Ellis	100 & 200	60-1-ph.	240	160	£29,300	475 K.W.	15 arc, 71 mtl.	45=115 H.P.	223 K.W.			306	
307	MORPETH	Northern Counties Electricity Supply Co., Ltd.	1904	W. H. Bibby (Res.)	230 & 460	Direct	1,410	643	£106,904	765.5 K.W.	60 arc, 597 inc., 92 Nernst	163=1,439 H.P.	2,933 K.W.			307	
308	MOTHERWELL	Motherwell Corporation	1901	S. Williams	230 & 460	Direct	800	200	£55,223	803 K.W.	20 arc	18=85 H.P.	379 K.W.	673,511	Lighting and traction. Lighting output reduced by use of metallic filament lamps. Data to Dec. 31, 1911	308	
309	MUSSELBURGH	Musselburgh & District Electric Light & Traction Co., Ltd.	1904	A. A. Watkins	230 & 460, tr. 500	Direct	1,000	755	£75,251			395 H.P.	22=576 H.P.	819,291	Lighting and traction. Data to Mar. 31, 1913	309	
310	NELSON	Nelson Corporation	1892	D. Helme	246 & 490	Direct	497	215	£54,909	497 K.W.		50=233 H.P.	778 K.W.	229,111	Gas and water power. Data to Dec. 31, 1911	310	
311	NEWBOURY	Urban Electric Supply Co., Ltd.	1905	Herbert W. Bush	246 & 490	Direct	50	15	£1,700 (approx.)	54 mtl.					Water power. Supply commenced Sept. 29, 1900. Data to April 30, 1912	311	
312	NEWCASTLE-EMLYN & DISTRICT	Newcastle-Emlyn & District Electric Supply Co., Ltd.	1909	J. R. Parkinson & Co.	110	Direct	50	15	£1,700 (approx.)	54 mtl.						312	
313	NEWCASTLE-ON-TYNE	Newcastle & District Electric Lighting Co., Ltd.	1890	W. D. Hunter	240 & 480 D.C. 100 & 210 A.C.	80-1-ph. & direct	9,000	6,000	£206,330				21,766 K.W.	13,123,792	Large power load. Data to Dec. 31, 1911	313	
314	NEWCASTLE-ON-TYNE	Newcastle Corporation	1901	Ernest Hutton	240 & 480, tr. 550	Direct	5,160	3,200	£1,188,223 (approx.)	1,200 K.W.	174 K.W.	437 arc	17=146 H.P.	117,168	*Lighting and traction. Light and power supplied to public buildings only. Data to Mar. 31, 1912	314	
315	NEWCASTLE-ON-TYNE AND TYNESIDE	Newcastle-on-Tyne Electric Supply Co., Ltd.	1899	R. P. Sloan (Man.) J.S. Watson (Tech)	240 & 480 D.C. 440 A.C.	40-3-ph. and direct	67,200	43,400	£2,119,114	1,440 K.W.	7,814 K.W.	84 K.W.	31,553 K.W.	8,888 K.W.	Lg. & tr. Cons. engs. Merz & McLellan (see other table) Power Cos. "Tr. 500 & 600 v. Data to Dec. 31, 1911	315	
316	NEWCASTLE-UNDER-LYME	Newcastle-under-Lyme Corporation	1904	A. J. C. de Renzi	230	Direct	140	80	£9,700	160 K.W.		4=9 H.P.	167 K.W.	61,500	Gas power; town gas at 18. 9d. per 1,000 cubic ft.	316	
317	NEWMARKET AND EXHINC	Newmarket Electric Light Co., Ltd.	1899	F. A. Simpson	210 & 420	Direct	600	308	£41,957	750 K.W.	12 arc	15=37 H.P.	765 K.W.	158,319	Data to Dec. 31, 1908	317	
318	NEWPORT & COWES	Iale of Wight Electric Light & Power Co., Ltd.	1901 and 1903	A. E. Mayes	240 & 480	Direct	560	990	£30,888	441 K.W.	20 H.C.P. lns., 12 cbn., 315 mtl.	75=253 H.P.	698 K.W.	3,615,783	Supply from N. to C. at 2,500 volts D.C. Data to Dec., 1911	318	
319	NEWPORT (MON.)	Newport Corporation	1895	A. Nichols Moore	100 & 200 A.C. 230 & 460 D.C.	87.5-1-ph. & direct	4,100	3,891	£206,000	3,889 K.W.	108 arc, 300 mtl., 95 N.	344=3601 H.P.	6,590 K.W.		Lighting and traction. "Tr. 600. Two gen. stns.; energy sold to tramways. Data to Mar. 31, 1912	319	
320	NEWQUAY	Newquay Electric Light & Power Co., Ltd.	1909	A. S. Hawkins	230 & 460	Direct	200	110	£17,500	890 K.W.	10 cbn., 200 mtl.	1=20 H.P.	406 K.W.			320	
321	NEWTON ABBOT	Urban Electric Supply Co., Ltd.	1903	G. E. Smith	240 & 480	Direct	180	181	£11,736	401 K.W.	29 arc, 288 mtl.	45=227 H.P.	684 K.W.	64.7 K.W.	Data to Dec. 31, 1912	321	
322	NORTHALLERTON	Northallerton Electric Light & Power Co., Ltd.	1893	H. W. Milnes	220	Direct	205	76	£7,947 (writn. dn.)	152.5 K.W.	32 arc, 84 mtl.	33=90 H.P.	235 K.W.	85,798	Decrease in total connections due to use of metal lamps. Data to Dec. 31, 1911	322	
323	NORTHAMPTON	Northampton Electric Light & Power Co., Ltd.	1891	G. H. Jackson	210 & 420	Direct	2,646	1,566	£106,980	3,660 K.W.		2,162 H.P.	3,765 K.W.	2,497,871	*Alternative, 12 1/2% per annum on assessment, and 1 1/2% per unit for energy used for dom. purp. Data to Dec. 31, 1911	323	
324	NORTHWICH	Northwich Electric Supply Co., Ltd.	1897	W. Boyd	220 & 440	Direct	415	206	£57,108	627 K.W.	43 mtl.	86=547 H.P.	1,128 K.W.	2,497,871	W. W. Selner, Cons. eng. Mond gas power. Data to Dec. 31, 1911	324	
325	NORWICH	Norwich Corporation	1893	F. M. Long	220 & 440	Direct	3,694	2,650	£209,306	4,228 K.W.	20 arc	186=2,662 H.P.	6,581 K.W.	4,066,899	Purchased from Co. in 1902. *Also 12 1/2% on assessment and 1 d. p.u. Data to Mar. 31, 1909	325	
326	NOTTINGHAM	Nottingham Corporation	1894	H. Talbot	200 & 400	Direct	10,851	6,558	£173,627	100 K.W.	60 arc	1,349=5,210 H.P.	13,600 K.W.	12,577,326	Lighting and traction. Data to Mar. 31, 1912	326	
327	NUMATON	Numaton Corporation	1900	S. C. Gibson	220 & 440	Direct	800	494	£41,793	141 K.W.	20 600 c.p., 134 601/375 c.p. mtl.	24=156 H.P.	442 K.W.	677,636	*Alternative tariff based on assessment, with low charge per unit. Data to March 31, 1913	327	
328	OBAN	Oban Corporation	1903	Duncan	230 & 460	Direct	180	109	£24,377	292 K.W.	33 arc, 120 mtl.	21=156 H.P.	442 K.W.	159,994 (est.)	*On fcdom. Data to May 15, 1912	328	
329	OGMORE VALLEY	Ogmore Valley Electric Light & Power Supply Co., Ltd.	1891	A. E. Marks	210 & 230	40-1-ph. & direct	900	150	£8,958	120 K.W.	210 inc.		200 K.W.		Data to April 20, 1909	329	
330	OLDHAM	Oldham Corporation	1894	S. W. Newington	210 & 420, tr. 500	Direct	5,232	3,318	£226,476		23 arc, 16 mtl.		4,690 K.W.	5,720,331	Lighting and traction. Data to Mar. 25, 1916	330	
331	OSWESTRY	Oswestry Electric Light and Power Co., Ltd.	1896	E. B. Smith	220	Direct	225	106	£12,680	173 K.W.		3=12 H.P.	215 K.W.	129,179	Data to Dec. 31, 1911	331	
332	OUTLON BROAD	Dulton Broad Electricity Co., Ltd.	1903	B. Barber	230	Direct	45	18	£3,200	88.5 K.W.	32 inc.	3=6 H.P.	98 K.W.	30,000		332	
333	OXFORD	Oxford Electric Co., Ltd.	1892	F. H. Francis	100	Direct, & 50-3-ph.	1,550	1,306	£196,001	3,142 K.W.	32 arc, 48 mtl.	133=213 H.P.	8,461 K.W.	1,199,944	Data to Dec.		



270 L  
271 W  
272 L  
273 L  
274 L  
275 L  
276 L  
277 L  
278 L  
279 L  
280 L  
281 L  
282  
283 L  
284 L  
285 L  
286 L  
287 L  
288 L  
289 L  
290 L  
291 L  
292 L  
293 L  
294 L  
295 L  
296 L  
297 L  
298 L  
299 L  
300  
301  
302  
303  
304  
305 L  
306 L  
307 L  
308 L  
309 L  
310 L  
311 L  
312 L  
313 L  
314 L  
315 L  
316 L  
317 N  
318 L  
319 M  
320 M  
321 N  
322 M  
323 N  
324 N  
325 N  
326 N  
327 N  
328 O  
329 O  
330 O  
331 O  
332 O  
333 O  
334 P<sub>1</sub>  
335 P<sub>1</sub>  
336 P<sub>1</sub>  
337 P<sub>1</sub>  
338 P<sub>1</sub>  
339 P<sub>1</sub>  
340 PE  
341 PE  
342 PE



112

DUBLIN ..

Dublin Corporation ..

1892

Mark Ruddle ..

1g. 200,  
pr. 34g  
230 & 400  
tr. 500

50-<sup>1</sup>/<sub>2</sub>, 1-ph.  
& 3-ph.  
Direct ..

6,030

3,300

..

£202,000

9,944 K.W.

55 arc, 120  
mnl., 110 mtl.

117=1,557 H.P.

See other  
Table

1,730 KW.  
(ex. tr.)  
73 KW.

Counts  
Flat rate ..

2,172,117

Lighting and traction. \*Being changed to metal. Data  
to Mar. 31, 1911

112

113

DULVERTON ..

Dulverton Electric Lighting  
Co., Ltd.

1904

J. P. Davis (Res.) ..

230

Direct ..

60

30

50 KW.

£3,780

62 KW.]

..

..

..

3=12 H.P.

..

Flat rate & sliding  
scale ..

12,200

Data to Sept. 30, 1909 ..

113

114

DUMBARTON ..

Electric Supply Corporation,  
Ltd.

1906

K. A. Scott-  
Moncrieff\*  
Telford Ely,  
Manager\*

210 & 480  
tr. 500

Direct ..

310

763

50 KW.

£13,180

191 KW.

..

69=685 H.P.

60=1,020 H.P.

73 KW.

Max. demand, flat  
rate & sl. scale ..

1,449,193

Lighting and traction station. \*Resident engineer,  
A. R. Howden. Data to Dec. 31, 1909

114

115

DUMFRIES ..

Dumfries Electric Supply  
Co., Ltd.

1906

Telford Ely,  
Manager\*

230

Direct ..

203

52

125 KW.

£31,536

93 KW.

..

35=50 H.P.

..

Flat rate, with dis-  
counts ..

26,334

\*W. R. Scott, resident. Data to Dec. 31, 1909 ..

115

116

DUNDEE ..

Dundee Corporation ..

1893

H. Richardson ..

200&400 D.C.  
6,200 A.C.  
102 & 204

50-<sup>1</sup>/<sub>2</sub>, 8-ph.  
& direct  
40-<sup>1</sup>/<sub>2</sub>, 1-ph.

6,500

3,057

140 KW.

£223,861

5,201 KW.

110 arc, 22  
mtl., 72 arc, 804 mtl.

737=6,402 KW.

144=3,580 H.P.

15,239 KW.

1,000 KW.

Flat rate with dis-  
count ..

4,719,035

Lighting and traction. \*Tr. 550 v. (Htg. l.d. to d.).  
Data to April 30, 1912

116

117

EALING ..

Ealing Corporation ..

1894

J. Douglas Knight ..

200

50-<sup>1</sup>/<sub>2</sub>, 1-ph.

1,770

1,132

94 KW.

£205,853

..

97 arc, 60 mtl.

155=485 H.P.

..

..

Flat rate & max.  
demand ..

1,449,770

\*Oscram lamps supplied free for ph.l.g. Decrease in units  
sold due to mt. lamps. Data to Mar. 31, 1910

117

118

EASTBOURNE ..

Eastbourne Corporation ..

1882 &  
1900\*

J. K. Brydges ..

200

50-<sup>1</sup>/<sub>2</sub>, 1-ph.

1,350

1,350

..

£195,422

5,524 KW.

..

..

..

..

Flat rate, max. de-  
mand, & 2-rate mtr.  
dis. & sl. scale cont.

1,432,323

\*Purchased from Company in 1900. \*Also double tariff,  
5d. night, 2½d. day. Data to Mar. 31, 1912

118

119

EAST HAM ..

East Ham Corporation ..

1901

W. C. Ullmann ..

240 & 480  
tr. 503

Direct ..

1,925

1,627

..

£124,393

2,016 KW.

202 arc, 111  
mtl.

142=528 H.P.

90=2,250 H.P.

1,225 KW.

276 KW.

Flat rate ..

3,410,197

Lighting and traction. Data to Mar. 31, 1911 ..

119

120

EBSW VALE ..

Ebbw Vale Urban District  
Council

1906

Wm. Horsfall\* ..

230 & 480

Direct ..

Bulk  
supply†

212

..

396 KW.

£16,252

383 mtl.

13=37 H.P.

..

..

Flat rate, sl. scale &  
contract

232,348

\*R. P. Wilson, Cons. eng. \*Bulk supply from Ebbw  
Vale Steel, Iron & Coal Co. Data to Mar. 31, 1912

120

121

ECCLES ..

Eccles Corporation ..

1898

H. W. Angus ..

200 A.C.,  
tr. 500 D.C.  
210 & 415

50-<sup>1</sup>/<sub>2</sub>, 1-ph.

910

277 KW. lg.,  
all KW. tr.

tr. 150  
KW.

£49,413

540 KW.

27 arc,  
303 posts

47=198 H.P.

..

795 KW.  
(ex. tr.)  
10.5 KW.

Max. dem., fl. sl. sc.  
2-rate mtr. & cont.

1,050,034

Lighting and traction. Tramways leased to Salford  
Corporation. Data to March 31, 1909

121

122

EDGWARE ..

North Metropolitan Electric  
Power Supply Co.

1911

N. E. North\*  
(Res.)

230 & 480

50-<sup>1</sup>/<sub>2</sub>, 3-ph.

60

..

..

£6,027

6 KW.

..

..

..

..

Flat rate (with dis-  
count for lg. only)

8,845

\*Engineer-in-Chief, E. T. R. Murray. Data to Dec. 31,  
1911

122

123

EDINBURGH ..

Edinburgh Corporation ..

1895

F. A. Newington ..

290 A.C.,  
230 & 480 D.C.

50-<sup>1</sup>/<sub>2</sub>, 1-ph.  
& direct

15,217

11,436

3,600 A.H.

£1,042,855

23,383 KW.

1,219 arc, 1,115  
cbs., 24 mtl.,  
27 flame arc,  
5 mtl.

2,585=11,403  
H.P.

..

33,271 KW.

1,703 KW.

Flat rate with dis-  
count for lg. only

10,238,906

\*Tr. 1¼d. Data to May 15, 1911 ..

123

124

EDMONTON ..

North Metropolitan Electric  
Power Supply Co.

1907

C. J. Barnett\*  
(Res.)

240 & 415

50-<sup>1</sup>/<sub>2</sub>, 3-ph.

560

245

..

£23,299

257 KW.

..

..

..

..

Max. demand, flat  
rate & contract

515,154

\*Eng.-in-Chief, E. T. R. Murray. Data to Dec. 31, 1911

124

125

EGHAM AND STAINES ..

Elmham & Staines Electricity  
Co., Ltd.

1912

F. L. Strickland ..

100

50-<sup>1</sup>/<sub>2</sub>, 1-ph.

200

..

..

..

43 KW.

2 mtl.

1=2 H.P.

..

47 KW.

..

Flat rate, 2-rate  
meter, & t. switch

218,400

Data to Mar. 31, 1912 ..

125

126

ELLAND ..

Elland Urban District Council

1903

Wm. C. Knowles ..

240 & 480

Direct ..

280

155

75 KW.

£19,716

469 KW.

24 arc, 6 cbs.,  
63 mtl.

58=213 H.P.

..

630 KW.

75 KW.

Flat rate, special &  
sl. scale

187,671

\*Eng. in chief, E. T. R. Murray. \*Bulk supply from  
North Metropolitan E.P.S. Co. Data to Dec. 31, 1911

126

127

ENFIELD ..

North Metropolitan Electrical  
Power Distribution Co., Ltd.

1902

A. H. Dennett\*  
(Res.)

240 & 480

Direct ..

1

164

..

£21,591

317 KW.

..

..

..

..

Max. demand & flat  
rate ..

212,517

\*Tantalum, £5; inc., £3½ p.a. Data to Mar. 31, 1910 ..

127

128

EPSOM ..

Epsom Urban District Council

1906

A. C. Gilling ..

230 & 480

Direct ..

560

202

37 KW.

£40,015

16,679 KW.

14 arc, 97  
cbs., 323 mtl.

110=803 H.P.

34=850 H.P.

2,150 KW.

..

Flat rate ..

1,433,999

I.g. and tr. \*Erc. £12,1¼ for tramway plant. \*Inc. (2 x 8  
ct.) £3.17s. N. 25½ p.a. Data to Mar. 31, 1909

128

129

ERITH & DISTRICT ..

Erith Urban District Council

1903

A. Coveney ..

350, 400 & 200  
tr. 500 D.C.  
100 A.C.,  
225 & 450

50-<sup>1</sup>/<sub>2</sub> & 1-ph.

1,350

830

..

£67,835\*

913 KW.

19 arc, 511 cbs.,  
54 N.

176=600 H.P.

40=1,000 H.P.

2,329 KW.

156 KW.

Flat rate, contract  
& sl. scale

1,473,693

Lighting and traction. \*By company. Bought by  
T.C. in 1896. Data to Mar. 31, 1912

129

130

EXETER & HEAVYTREE ..

Exeter Corporation ..

1889\*

H. D. Manro ..

100 A.C.,  
tr. 500 D.C.

50-<sup>1</sup>/<sub>2</sub>, 1 & 2  
ph.

1,500

957

..

£111,638

1,830 KW.

47 arc, 527  
mtl.

14=47 H.P.

..

341 KW.

..

Flat rate with dis.

77,486

\*Resident engineer, F. C. Mann. Data to Dec. 31, 1903

130

131

EXMOUTH ..

Electric Supply Corporation,  
Ltd.

1904

K. A. Scott-  
Moncrieff\*  
J. McMillan

230 & 430

50-<sup>1</sup>/<sub>2</sub>, 3-ph.  
& direct

500

292

150 KW.

£35,600

634 KW.

51 arc, 100  
mtl., 10 N.

86=633 H.P.

..

30,268 KW.

..

Flat rate with dis.

450,000

A.C. supply at present taken in bulk. Data to May 15,  
1910. (Est.)

131

132

FALKIRK ..

Falkirk Corporation ..

1903

J. McMillan ..

230 & 430

50-<sup>1</sup>/<sub>2</sub>, 3-ph.  
& direct

500

292

150 KW.

£35,600

634 KW.

51 arc, 100  
mtl., 10 N.

86=633 H.P.

..

30,268 KW.

..

Flat rate ..

105,233

\*Resident engineer, F. E. Smeeton. Data to Dec. 31,  
1909

132

133

FALMOUTH ..

Electric Supply Corporation,  
Ltd.

1906

K. A. Scott-  
Moncrieff\*

240 & 480

Direct ..

300

102

88 KW.

£29,270

205 KW.

..

18=20½ H.P.

..

319 KW.

..

Flat rate ..

97,668

..

133

134

FARNHAM ..

Farnham Urban District  
Council

1890

A. Blake ..

105

125-<sup>1</sup>/<sub>2</sub>, 1-ph.

135

85

..

£12,888

163 KW.

27 arc, 111 cbs.,  
9 mtl.

2=½ H.P.

..

186 KW.

..

Flat rate ..

827,816

Lighting and traction. Supply to Kearsley, and light  
railway to Pendlebury. Data to Mar. 31, 1912

134

135

FARNWORTH ..

Farnworth Urban District  
Council

1901

A. J. Hutchinson ..

220 & 440  
tr. 500

Direct &  
50-<sup>1</sup>/<sub>2</sub>, 3-ph.

550

520

160 A.

£19,365

402 KW.

133 arc, 135  
inc.

10=30 H.P.

..

200 KW.

..

Sliding scale

119,889

Gas power. Data to Mar. 1908 ..

135

136

FAVERSHAM ..

Faversham Corporation ..

1904

G. Sommerville ..

230 & 460

Direct ..

270

110

46 KW.

£22,442

150 KW.

10 arc, 8 cbs.,  
20 mtl., 100 N.

15=23 H.P.

..

850 KW.

..

Flat rate & sliding  
scale

100,000

\* Undertaking leased to Co. by Felicitous & Walton  
U.L.C.

136

137

FELIXSTOWE &  
WALTON ..

Suffolk Electricity Supply Co.,  
Ltd.\*

1899

Napier Pratice ..

200

Direct ..

200

165

100 KW.

..

800 KW.

40 arc, 10  
mtl.

15=23 H.P.

..

850 KW.

..

Flat rate & sliding  
scale

100,000

Data to Mar. 31, 1912 ..

137

138

FINCHLEY ..

Finchley Urban District  
Council

1903

Edward Calvert ..

250 & 500

Direct ..

1,750

672

200 KW.

£119,816

2,703 KW.

133 cbs., 899  
H.P.

81=320 H.P.

..

3,206 KW.

218 KW.

Flat rate, max. dem.,  
cont. t. sw. & spl.

1,173,029

Data to Mar. 31, 1912 ..

138

139

FLADBOURY ..

Fladbury Electric Light and  
Power Co., Ltd.

1900

J. Wm. Wagstaff ..

220

Direct ..

40

..

..

..

189 inc.

1=4 H.P.

..

..

Flat rate & contract  
tract

..

Water power ..

..

139

140

FLEETWOOD ..

Fleetwood Urban District  
Council

1900

W. H. Miller ..

200 & 400

Direct ..

645

393

83 KW.

£27,397

730 KW.

1,030 mtl., 50  
c.p. equiv.

604 H.P.

..

1,227 KW.

77.9 KW.

Sl. scale & 2-rate  
meter

415,451

Data to March 31, 1912 ..

140

141

FOLKESTONE ..

Folkestone Electricity Supply  
Co., Ltd.

1898

T. Hesketh ..

210 & 420

Direct ..

2,250

1,211

..

£213,715

..

..

..

..

..

Flat rate ..

1,537,670

Supply to Sandgate and Hythe at 2,750 v. d.c. Data to  
Dec. 31, 1911

141

142

FOLKESTONE AND  
DISTRICT ..

Folkestone District Electric  
Light & Power Co., Ltd.

1899

W. G. F. Webster ..

110

Direct ..

100

50

10 KW.

£6,000

50 KW.

..

7=15 H.P.

..

217 KW.

..

Flat rate ..

10,650

Data for 1908 ..

142

143

FORT WILLIAM ..

Fort William Electric Light-  
ing Co., Ltd.

1895

I. Reid ..

150 & 300

Direct ..

120

130

30 KW.

£11,091

200 KW.

6 arc, 60 inc.

2=4 H.P.

..

210 KW.

..

Flat rate ..

..

Water power, also part oil ..

..

143

144

FRINTON-ON-SEA ..

Frinton-on-Sea & District Electric  
Light & Power Co., Ltd.

1903

A. F. M. Oatvill ..

230 & 460

Direct ..

195

109

28 KW.

..

..

..

..

..

Flat rate ..

..

Section gas plant. Data to May 14, 1912 ..

144

145

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

145

146

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

146

147

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

147

148

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

148

149

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

149

150

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

150

151

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

151

152

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

152

153

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

153

154

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

154

155

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

155

156

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

156

157

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

157

158

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

158

159

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

159

160

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW.

10 arc, 262 mtl.

234=1,137 H.P.

..

1,320 KW.

34 KW.

Max. dem., flat, 2-  
rate and contract

638,909

Data to April 30, 1912 ..

160

161

FROME ..

Frome Electricity Supply ..

1901

E. H. Merritt ..

210 & 480

Direct ..

625

882

65 KW.

£54,006

257 KW



344	PONTYPOL	Pontypool Electric Light & Power Co., Ltd.	1898	G. Elwell	230 & 400	Direct	169	138	111,412	125 kw. (approx.)	6 arc	12-64 H.P.	200 kw. (approx.)	2,210 kw.	1.6 p. 11, 12, 13; 1.7 p. 14, 15; 1.8 p. 16, 17; 1.9 p. 18, 19; 2.0 p. 20, 21; 2.1 p. 22, 23; 2.2 p. 24, 25; 2.3 p. 26, 27; 2.4 p. 28, 29; 2.5 p. 30, 31; 2.6 p. 32, 33; 2.7 p. 34, 35; 2.8 p. 36, 37; 2.9 p. 38, 39; 3.0 p. 40, 41; 3.1 p. 42, 43; 3.2 p. 44, 45; 3.3 p. 46, 47; 3.4 p. 48, 49; 3.5 p. 50, 51; 3.6 p. 52, 53; 3.7 p. 54, 55; 3.8 p. 56, 57; 3.9 p. 58, 59; 4.0 p. 60, 61; 4.1 p. 62, 63; 4.2 p. 64, 65; 4.3 p. 66, 67; 4.4 p. 68, 69; 4.5 p. 70, 71; 4.6 p. 72, 73; 4.7 p. 74, 75; 4.8 p. 76, 77; 4.9 p. 78, 79; 5.0 p. 80, 81; 5.1 p. 82, 83; 5.2 p. 84, 85; 5.3 p. 86, 87; 5.4 p. 88, 89; 5.5 p. 90, 91; 5.6 p. 92, 93; 5.7 p. 94, 95; 5.8 p. 96, 97; 5.9 p. 98, 99; 6.0 p. 100, 101; 6.1 p. 102, 103; 6.2 p. 104, 105; 6.3 p. 106, 107; 6.4 p. 108, 109; 6.5 p. 110, 111; 6.6 p. 112, 113; 6.7 p. 114, 115; 6.8 p. 116, 117; 6.9 p. 118, 119; 7.0 p. 120, 121; 7.1 p. 122, 123; 7.2 p. 124, 125; 7.3 p. 126, 127; 7.4 p. 128, 129; 7.5 p. 130, 131; 7.6 p. 132, 133; 7.7 p. 134, 135; 7.8 p. 136, 137; 7.9 p. 138, 139; 8.0 p. 140, 141; 8.1 p. 142, 143; 8.2 p. 144, 145; 8.3 p. 146, 147; 8.4 p. 148, 149; 8.5 p. 150, 151; 8.6 p. 152, 153; 8.7 p. 154, 155; 8.8 p. 156, 157; 8.9 p. 158, 159; 9.0 p. 160, 161; 9.1 p. 162, 163; 9.2 p. 164, 165; 9.3 p. 166, 167; 9.4 p. 168, 169; 9.5 p. 170, 171; 9.6 p. 172, 173; 9.7 p. 174, 175; 9.8 p. 176, 177; 9.9 p. 178, 179; 10.0 p. 180, 181; 10.1 p. 182, 183; 10.2 p. 184, 185; 10.3 p. 186, 187; 10.4 p. 188, 189; 10.5 p. 190, 191; 10.6 p. 192, 193; 10.7 p. 194, 195; 10.8 p. 196, 197; 10.9 p. 198, 199; 11.0 p. 200, 201; 11.1 p. 202, 203; 11.2 p. 204, 205; 11.3 p. 206, 207; 11.4 p. 208, 209; 11.5 p. 210, 211; 11.6 p. 212, 213; 11.7 p. 214, 215; 11.8 p. 216, 217; 11.9 p. 218, 219; 12.0 p. 220, 221; 12.1 p. 222, 223; 12.2 p. 224, 225; 12.3 p. 226, 227; 12.4 p. 228, 229; 12.5 p. 230, 231; 12.6 p. 232, 233; 12.7 p. 234, 235; 12.8 p. 236, 237; 12.9 p. 238, 239; 13.0 p. 240, 241; 13.1 p. 242, 243; 13.2 p. 244, 245; 13.3 p. 246, 247; 13.4 p. 248, 249; 13.5 p. 250, 251; 13.6 p. 252, 253; 13.7 p. 254, 255; 13.8 p. 256, 257; 13.9 p. 258, 259; 14.0 p. 260, 261; 14.1 p. 262, 263; 14.2 p. 264, 265; 14.3 p. 266, 267; 14.4 p. 268, 269; 14.5 p. 270, 271; 14.6 p. 272, 273; 14.7 p. 274, 275; 14.8 p. 276, 277; 14.9 p. 278, 279; 15.0 p. 280, 281; 15.1 p. 282, 283; 15.2 p. 284, 285; 15.3 p. 286, 287; 15.4 p. 288, 289; 15.5 p. 290, 291; 15.6 p. 292, 293; 15.7 p. 294, 295; 15.8 p. 296, 297; 15.9 p. 298, 299; 16.0 p. 300, 301; 16.1 p. 302, 303; 16.2 p. 304, 305; 16.3 p. 306, 307; 16.4 p. 308, 309; 16.5 p. 310, 311; 16.6 p. 312, 313; 16.7 p. 314, 315; 16.8 p. 316, 317; 16.9 p. 318, 319; 17.0 p. 320, 321; 17.1 p. 322, 323; 17.2 p. 324, 325; 17.3 p. 326, 327; 17.4 p. 328, 329; 17.5 p. 330, 331; 17.6 p. 332, 333; 17.7 p. 334, 335; 17.8 p. 336, 337; 17.9 p. 338, 339; 18.0 p. 340, 341; 18.1 p. 342, 343; 18.2 p. 344, 345; 18.3 p. 346, 347; 18.4 p. 348, 349; 18.5 p. 350, 351; 18.6 p. 352, 353; 18.7 p. 354, 355; 18.8 p. 356, 357; 18.9 p. 358, 359; 19.0 p. 360, 361; 19.1 p. 362, 363; 19.2 p. 364, 365; 19.3 p. 366, 367; 19.4 p. 368, 369; 19.5 p. 370, 371; 19.6 p. 372, 373; 19.7 p. 374, 375; 19.8 p. 376, 377; 19.9 p. 378, 379; 20.0 p. 380, 381; 20.1 p. 382, 383; 20.2 p. 384, 385; 20.3 p. 386, 387; 20.4 p. 388, 389; 20.5 p. 390, 391; 20.6 p. 392, 393; 20.7 p. 394, 395; 20.8 p. 396, 397; 20.9 p. 398, 399; 21.0 p. 400, 401; 21.1 p. 402, 403; 21.2 p. 404, 405; 21.3 p. 406, 407; 21.4 p. 408, 409; 21.5 p. 410, 411; 21.6 p. 412, 413; 21.7 p. 414, 415; 21.8 p. 416, 417; 21.9 p. 418, 419; 22.0 p. 420, 421; 22.1 p. 422, 423; 22.2 p. 424, 425; 22.3 p. 426, 427; 22.4 p. 428, 429; 22.5 p. 430, 431; 22.6 p. 432, 433; 22.7 p. 434, 435; 22.8 p. 436, 437; 22.9 p. 438, 439; 23.0 p. 440, 441; 23.1 p. 442, 443; 23.2 p. 444, 445; 23.3 p. 446, 447; 23.4 p. 448, 449; 23.5 p. 450, 451; 23.6 p. 452, 453; 23.7 p. 454, 455; 23.8 p. 456, 457; 23.9 p. 458, 459; 24.0 p. 460, 461; 24.1 p. 462, 463; 24.2 p. 464, 465; 24.3 p. 466, 467; 24.4 p. 468, 469; 24.5 p. 470, 471; 24.6 p. 472, 473; 24.7 p. 474, 475; 24.8 p. 476, 477; 24.9 p. 478, 479; 25.0 p. 480, 481; 25.1 p. 482, 483; 25.2 p. 484, 485; 25.3 p. 486, 487; 25.4 p. 488, 489; 25.5 p. 490, 491; 25.6 p. 492, 493; 25.7 p. 494, 495; 25.8 p. 496, 497; 25.9 p. 498, 499; 26.0 p. 500, 501; 26.1 p. 502, 503; 26.2 p. 504, 505; 26.3 p. 506, 507; 26.4 p. 508, 509; 26.5 p. 510, 511; 26.6 p. 512, 513; 26.7 p. 514, 515; 26.8 p. 516, 517; 26.9 p. 518, 519; 27.0 p. 520, 521; 27.1 p. 522, 523; 27.2 p. 524, 525; 27.3 p. 526, 527; 27.4 p. 528, 529; 27.5 p. 530, 531; 27.6 p. 532, 533; 27.7 p. 534, 535; 27.8 p. 536, 537; 27.9 p. 538, 539; 28.0 p. 540, 541; 28.1 p. 542, 543; 28.2 p. 544, 545; 28.3 p. 546, 547; 28.4 p. 548, 549; 28.5 p. 550, 551; 28.6 p. 552, 553; 28.7 p. 554, 555; 28.8 p. 556, 557; 28.9 p. 558, 559; 29.0 p. 560, 561; 29.1 p. 562, 563; 29.2 p. 564, 565; 29.3 p. 566, 567; 29.4 p. 568, 569; 29.5 p. 570, 571; 29.6 p. 572, 573; 29.7 p. 574, 575; 29.8 p. 576, 577; 29.9 p. 578, 579; 30.0 p. 580, 581; 30.1 p. 582, 583; 30.2 p. 584, 585; 30.3 p. 586, 587; 30.4 p. 588, 589; 30.5 p. 590, 591; 30.6 p. 592, 593; 30.7 p. 594, 595; 30.8 p. 596, 597; 30.9 p. 598, 599; 31.0 p. 600, 601; 31.1 p. 602, 603; 31.2 p. 604, 605; 31.3 p. 606, 607; 31.4 p. 608, 609; 31.5 p. 610, 611; 31.6 p. 612, 613; 31.7 p. 614, 615; 31.8 p. 616, 617; 31.9 p. 618, 619; 32.0 p. 620, 621; 32.1 p. 622, 623; 32.2 p. 624, 625; 32.3 p. 626, 627; 32.4 p. 628, 629; 32.5 p. 630, 631; 32.6 p. 632, 633; 32.7 p. 634, 635; 32.8 p. 636, 637; 32.9 p. 638, 639; 33.0 p. 640, 641; 33.1 p. 642, 643; 33.2 p. 644, 645; 33.3 p. 646, 647; 33.4 p. 648, 649; 33.5 p. 650, 651; 33.6 p. 652, 653; 33.7 p. 654, 655; 33.8 p. 656, 657; 33.9 p. 658, 659; 34.0 p. 660, 661; 34.1 p. 662, 663; 34.2 p. 664, 665; 34.3 p. 666, 667; 34.4 p. 668, 669; 34.5 p. 670, 671; 34.6 p. 672, 673; 34.7 p. 674, 675; 34.8 p. 676, 677; 34.9 p. 678, 679; 35.0 p. 680, 681; 35.1 p. 682, 683; 35.2 p. 684, 685; 35.3 p. 686, 687; 35.4 p. 688, 689; 35.5 p. 690, 691; 35.6 p. 692, 693; 35.7 p. 694, 695; 35.8 p. 696, 697; 35.9 p. 698, 699; 36.0 p. 700, 701; 36.1 p. 702, 703; 36.2 p. 704, 705; 36.3 p. 706, 707; 36.4 p. 708, 709; 36.5 p. 710, 711; 36.6 p. 712, 713; 36.7 p. 714, 715; 36.8 p. 716, 717; 36.9 p. 718, 719; 37.0 p. 720, 721; 37.1 p. 722, 723; 37.2 p. 724, 725; 37.3 p. 726, 727; 37.4 p. 728, 729; 37.5 p. 730, 731; 37.6 p. 732, 733; 37.7 p. 734, 735; 37.8 p. 736, 737; 37.9 p. 738, 739; 38.0 p. 740, 741; 38.1 p. 742, 743; 38.2 p. 744, 745; 38.3 p. 746, 747; 38.4 p. 748, 749; 38.5 p. 750, 751; 38.6 p. 752, 753; 38.7 p. 754, 755; 38.8 p. 756, 757; 38.9 p. 758, 759; 39.0 p. 760, 761; 39.1 p. 762, 763; 39.2 p. 764, 765; 39.3 p. 766, 767; 39.4 p. 768, 769; 39.5 p. 770, 771; 39.6 p. 772, 773; 39.7 p. 774, 775; 39.8 p. 776, 777; 39.9 p. 778, 779; 40.0 p. 780, 781; 40.1 p. 782, 783; 40.2 p. 784, 785; 40.3 p. 786, 787; 40.4 p. 788, 789; 40.5 p. 790, 791; 40.6 p. 792, 793; 40.7 p. 794, 795; 40.8 p. 796, 797; 40.9 p. 798, 799; 41.0 p. 800, 801; 41.1 p. 802, 803; 41.2 p. 804, 805; 41.3 p. 806, 807; 41.4 p. 808, 809; 41.5 p. 810, 811; 41.6 p. 812, 813; 41.7 p. 814, 815; 41.8 p. 816, 817; 41.9 p. 818, 819; 42.0 p. 820, 821; 42.1 p. 822, 823; 42.2 p. 824, 825; 42.3 p. 826, 827; 42.4 p. 828, 829; 42.5 p. 830, 831; 42.6 p. 832, 833; 42.7 p. 834, 835; 42.8 p. 836, 837; 42.9 p. 838, 839; 43.0 p. 840, 841; 43.1 p. 842, 843; 43.2 p. 844, 845; 43.3 p. 846, 847; 43.4 p. 848, 849; 43.5 p. 850, 851; 43.6 p. 852, 853; 43.7 p. 854, 855; 43.8 p. 856, 857; 43.9 p. 858, 859; 44.0 p. 860, 861; 44.1 p. 862, 863; 44.2 p. 864, 865; 44.3 p. 866, 867; 44.4 p. 868, 869; 44.5 p. 870, 871; 44.6 p. 872, 873; 44.7 p. 874, 875; 44.8 p. 876, 877; 44.9 p. 878, 879; 45.0 p. 880, 881; 45.1 p. 882, 883; 45.2 p. 884, 885; 45.3 p. 886, 887; 45.4 p. 888, 889; 45.5 p. 890, 891; 45.6 p. 892, 893; 45.7 p. 894, 895; 45.8 p. 896, 897; 45.9 p. 898, 899; 46.0 p. 900, 901; 46.1 p. 902, 903; 46.2 p. 904, 905; 46.3 p. 906, 907; 46.4 p. 908, 909; 46.5 p. 910, 911; 46.6 p. 912, 913; 46.7 p. 914, 915; 46.8 p. 916, 917; 46.9 p. 918, 919; 47.0 p. 920, 921; 47.1 p. 922, 923; 47.2 p. 924, 925; 47.3 p. 926, 927; 47.4 p. 928, 929; 47.5 p. 930, 931; 47.6 p. 932, 933; 47.7 p. 934, 935; 47.8 p. 936, 937; 47.9 p. 938, 939; 48.0 p. 940, 941; 48.1 p. 942, 943; 48.2 p. 944, 945; 48.3 p. 946, 947; 48.4 p. 948, 949; 48.5 p. 950, 951; 48.6 p. 952, 953; 48.7 p. 954, 955; 48.8 p. 956, 957; 48.9 p. 958, 959; 49.0 p. 960, 961; 49.1 p. 962, 963; 49.2 p. 964, 965; 49.3 p. 966, 967; 49.4 p. 968, 969; 49.5 p. 970, 971; 49.6 p. 972, 973; 49.7 p. 974, 975; 49.8 p. 976, 977; 49.9 p. 978, 979; 50.0 p. 980, 981; 50.1 p. 982, 983; 50.2 p. 984, 985; 50.3 p. 986, 987; 50.4 p. 988, 989; 50.5 p. 990, 991; 50.6 p. 992, 993; 50.7 p. 994, 995; 50.8 p. 996, 997; 50.9 p. 998, 999; 51.0 p. 1000, 1001; 51.1 p. 1002, 1003; 51.2 p. 1004, 1005; 51.3 p. 1006, 1007; 51.4 p. 1008, 1009; 51.5 p. 1010, 1011; 51.6 p. 1012, 1013; 51.7 p. 1014, 1015; 51.8 p. 1016, 1017; 51.9 p. 1018, 1019; 52.0 p. 1020, 1021; 52.1 p. 1022, 1023; 52.2 p. 1024, 1025; 52.3 p. 1026, 1027; 52.4 p. 1028, 1029; 52.5 p. 1030, 1031; 52.6 p. 1032, 1033; 52.7 p. 1034, 1035; 52.8 p. 1036, 1037; 52.9 p. 1038, 1039; 53.0 p. 1040, 1041; 53.1 p. 1042, 1043; 53.2 p. 1044, 1045; 53.3 p. 1046, 1047; 53.4 p. 1048, 1049; 53.5 p. 1050, 1051; 53.6 p. 1052, 1053; 53.7 p. 1054, 1055; 53.8 p. 1056, 1057; 53.9 p. 1058, 1059; 54.0 p. 1060, 1061; 54.1 p. 1062, 1063; 54.2 p. 1064, 1065; 54.3 p. 1066, 1067; 54.4 p. 1068, 1069; 54.5 p. 1070, 1071; 54.6 p. 1072, 1073; 54.7 p. 1074, 1075; 54.8 p. 1076, 1077; 54.9 p. 1078, 1079; 55.0 p. 1080, 1081; 55.1 p. 1082, 1083; 55.2 p. 1084, 1085; 55.3 p. 1086, 1087; 55.4 p. 1088, 1089; 55.5 p. 1090, 1091; 55.6 p. 1092, 1093; 55.7 p. 1094, 1095; 55.8 p. 1096, 1097; 55.9 p. 1098, 1099; 56.0 p. 1100, 1101; 56.1 p. 1102, 1103; 56.2 p. 1104, 1105; 56.3 p. 1106, 1107; 56.4 p. 1108, 1109; 56.5 p. 1110, 1111; 56.6 p. 1112, 1113; 56.7 p. 1114, 1115; 56.8 p. 1116, 1117; 56.9 p. 1118, 1119; 57.0 p. 1120, 1121; 57.1 p. 1122, 1123; 57.2 p. 1124, 1125; 57.3 p. 1126, 1127; 57.4 p. 1128, 1129; 57.5 p. 1130, 1131; 57.6 p. 1132, 1133; 57.7 p. 1134, 1135; 57.8 p. 1136, 1137; 57.9 p. 1138, 1139; 58.0 p. 1140, 1141; 58.1 p. 1142, 1143; 58.2 p. 1144, 1145; 58.3 p. 1146, 1147; 58.4 p. 1148, 1149; 58.5 p. 1150, 1151; 58.6 p. 1152, 1153; 58.7 p. 1154, 1155; 58.8 p. 1156, 1157; 58.9 p. 1158, 1159; 59.0 p. 1160, 1161; 59.1 p. 1162, 1163; 59.2 p. 1164, 1165; 59.3 p. 1166, 1167; 59.4 p. 1168, 1169; 59.5 p. 1170, 1171; 59.6 p. 1172, 1173; 59.7 p. 1174, 1175; 59.8 p. 1176, 1177; 59.9 p. 1178, 1179; 60.0 p. 1180, 1181; 60.1 p. 1182, 1183; 60.2 p. 1184, 1185; 60.3 p. 1186, 1187; 60.4 p. 1188, 1189; 60.5 p. 1190, 1191; 60.6 p. 1192, 1193; 60.7 p. 1194, 1195; 60.8 p. 1196, 1197; 60.9 p. 1198, 1199; 61.0 p. 1200, 1201; 61.1 p. 1202, 1203; 61.2 p. 1204, 1205; 61.3 p. 1206, 1207; 61.4 p. 1208, 1209; 61.5 p. 1210, 1211; 61.6 p. 1212, 1213; 61.7 p. 1214, 1215; 61.8 p. 1216, 1217; 61.9 p. 1218, 1219; 62.0 p. 1220, 1221; 62.1 p. 1222, 1223; 62.2 p. 1224, 1225; 62.3 p. 1226, 1227; 62.4 p. 1228, 1229; 62.5 p. 1230, 1231; 62.6 p. 1232, 1233; 62.7 p. 1234, 1235; 62.8 p. 1236, 1237; 62.9 p. 1238, 1239; 63.0 p. 1240, 1241; 63.1 p. 1242, 1243; 63.2 p. 1244, 1245; 63.3 p. 1246, 1247; 63.4 p. 1248, 1249; 63.5 p. 1250, 1251; 63.6 p. 1252, 1253; 63.7 p. 1254, 1255; 63.8 p. 1256, 1257; 63.9 p. 1258, 1259; 64.0 p. 1260, 1261; 64.1 p. 1262, 1263; 64.2 p. 1264, 1265; 64.3 p. 1266, 1267; 64.4 p. 1268, 1269; 64.5 p. 1270, 1271; 64.6 p. 1272, 1273; 64.7 p. 1274, 1275; 64.8 p. 1276, 1277; 64.9 p. 1278, 1279; 65.0 p. 1280, 1281; 65.1 p. 1282, 1283; 65.2 p. 1284, 1285; 65.3 p. 1286, 1287; 65.4 p. 1288, 1289; 65.5 p. 1290, 1291; 65.6 p. 1292, 1293; 65.7 p. 1294, 1295; 65.8 p. 1296, 1297; 65.9 p. 1298, 1299; 66.0 p. 1300, 1301; 66.1 p. 1302, 1303; 66.2 p. 1304, 1305; 66.3 p. 1306, 1307; 66.4 p. 1308, 1309; 66.5 p. 1310, 1311; 66.6 p. 1312, 1313; 66.7 p. 1314, 1315; 66.8 p. 1316, 1317; 66.9 p. 1318, 1319; 67.0 p. 1320, 1321; 67.1 p. 1322, 1323; 67.2 p. 1324, 1325; 67.3 p. 1326, 1327; 67.4 p. 1328, 1329; 67.5 p. 1330, 1331; 67.6 p. 1332, 1333; 67.7 p. 1334, 1335; 67.8 p. 1336, 1337; 67.9 p. 1338, 1339; 68.0 p. 1340, 1341; 68.1 p. 1342, 1343; 68.2 p. 1344, 1345; 68.3 p. 1346, 1347; 68.4 p. 1348, 1349; 68.5 p. 1350, 1351; 68.6 p. 1352, 1353; 68.7 p. 1354, 1355; 68.8 p. 1356, 1357; 68.9 p. 1358, 1359; 69.0 p. 1360, 1361; 69.1 p. 1362, 1363; 69.2 p. 1364, 1365; 69.3 p. 1366, 1367; 69.4 p. 1368, 1369; 69.5 p. 1370, 1371; 69.6 p. 1372, 1373; 69.7 p. 1374, 1375; 69.8 p. 1376, 1377; 69.9 p. 1378, 1379; 70.0 p. 1380, 1381; 70.1 p. 1382, 1383; 70.2 p. 1384, 1385; 70.3 p. 1386, 1387; 70.4 p. 1388, 1389; 70.5 p. 1390, 1391; 70.6 p. 1392, 1393; 70.7 p. 1394, 1395; 70.8 p. 1396, 1397; 70.9 p. 1398, 1399; 71.0 p. 1400, 1401; 71.1 p. 1402, 1403; 71.2 p. 1404, 1405; 71.3 p. 1406, 1407; 71.4 p. 1408, 1409; 71.5 p. 1410, 1411; 71.6 p. 1412, 1413; 71.7 p. 1414, 1415; 71.8 p. 1416, 1
-----	----------	--------------------------------------------	------	-----------	-----------	--------	-----	-----	---------	-------------------	-------	------------	-------------------	-----------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



**DUCT CABLE IN  
IT CONDUIT IS  
AND RELIABLE  
ION.**

# "BEATARK"



194 HOYE ALDRINGTON	Hoye Electric Lighting Co., Ltd.	1892	C. B. Smith	220 & 440	Direct	3,080	1,018	96 KW.	£174,998	588 (inc. hgt.)	40 mil.	198 KW.	18 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate and max. demand	1,189,328	193
195 HOYLAK & W. KIRBY	Hoylake & W. Kirby Urban District Council	1901	H. H. Scott (Dyng Surveyor) C. J. Turner	230	50-, 1-ph.	635	830	800 A.H.	£52,019	1,341 KW.	8 arc, 420 chm. 50 mil., 6 N.	10=80 H.P.	18 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate and max. demand	401,002	184
196 HUDDERSFIELD	Huddersfield Corporation	1898	A. B. Mountain	100, 200, & 400	100-, 1-ph. 5,760 5-ph. 50-, 8-ph. 6,454	4,790	3,152	438 KW.	£338,841	5,185 KW.	28 arc, 420 chm. 50 mil., 6 N.	769=5,831 H.P.	60.9 KW.	Lg. 5; pb. lg. arc £174, inc. 83a.	Flat rate w. dia., sl. scale, 2-rate & 1-c.	5,003,890	195
197 HULL	Hull Corporation	1898	H. Bell	230 & 460	Direct	3,600	1,856	438 KW.	£364,977	6,657 KW.	28 arc, 420 chm. 50 mil., 6 N.	769=5,831 H.P.	60.9 KW.	Lg. 5; pb. lg. arc £174, inc. 83a.	Flat rate w. dia., sl. scale, 2-rate & 1-c.	5,003,890	195
199 ILFORD	Ilford Urban District Council	1901	A. H. Shaw	230 & 460	Direct	3,600	1,856	438 KW.	£364,977	6,657 KW.	28 arc, 420 chm. 50 mil., 6 N.	769=5,831 H.P.	60.9 KW.	Lg. 5; pb. lg. arc £174, inc. 83a.	Flat rate w. dia., sl. scale, 2-rate & 1-c.	5,003,890	195
199 ILFRACOMBE	Ilfracombe Electric Light & Power Co., Ltd.	1903	H. J. F. Stewart	240 & 480	Direct	980	194	8 1/2 KW.	£26,425	484 KW.	38 arc, 50 chm. 1,579 mil.	50=131 H.P.	615 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate w. dia., sl. scale, 2-rate & 1-c.	176,412	196
200 ILKESTON	Ilkeston Corporation	1903	H. P. Stokes	230 & 460	Direct	985	710	..	£21,443	2,102 KW.	20 arc, 192 chm. 40 mil.	88=170 H.P.	26=650 H.P.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate w. dia., sl. scale, 2-rate & 1-c.	706,444	199
201 INCLETON (YORKS)	Ingleton Electric Lighting & Power Co., Ltd.	1900	D. Tattersall	100 & 200	Direct	29	22	12 1/2 KW.	£8,000	69 KW.	8 arc, 420 chm. 50 mil., 6 N.	9=25 H.P.	85 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate, sliding scale and contract	19,000 (approx.)	200
202 INYERNESS	North of Scotland Electric Light & Power Co., Ltd.	1903	E. J. Williams	240 & 480	Direct	890	924	100 KW.	£35,945	507 KW.	50 mil., 6 N.	90=400 H.P.	105 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	413,634	201
203 IPSWICH	Ipswich Corporation	1903	F. Ayton	280 & 460	Direct	1,511	1,318	210 KW.	£104,415	1,888 KW.	14 mil.	402=1,903 H.P.	8,791 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	2,050,895	202
204 JEORSURCH	Electric Supply Corporation Ltd.	1903	K. A. Scott-Moncrieff	225 & 450	Direct	66	80	85 KW.	£13,000	69 KW.	5 arc, 12 chm. 102 Nernst	7=34 H.P.	113 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	37,960	203
205 KEICHLEY	Keighley Corporation	1901	..	230 & 460	Direct	740	880	100 KW.	£37,409	893 KW.	18 arc, 24 chm. 48 N.	103=490 H.P.	1,365 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	522,433	204
206 KENDAL	Kendal Corporation	1902	John A. T. Barnes	230 & 460	Direct	109.5	77	40 KW.	£13,838	160 KW.	..	26=97 H.P.	244 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	55,594	205
207 KESWICK	Keswick Electric Light Co., Ltd.	1890	W. Jackson	100	75-, 1-ph.	120	60	..	£19,761	..	9 arc, 20 inc.	..	237 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	63,568	206
208 KETTERING	Kettering Urban District Council	1904	W. A. Walker	230 & 460	Direct	1,540	718	92 KW.	£29,405	684 KW.	30 arc, 920 mil.	212=1,091 H.P.	1,002 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate, sl. scale, & 2-rate	1,032,598	207
209 KEYNSHAM	Keynsam Electric Light & Power Co., Ltd.	1901	G. T. J. Parrott	230	Direct	75	55	60 KW.	£4,350	119 KW.	6 Nernst, 119 inc.	6=26 H.P.	151 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate with discount	68,400	208
210 KIDDERMINSTER	Kidderminster & District Electric Light & Traction Co., Ltd.	1900	A. Charlton	230 & 460	Direct	1,550	575	220 KW.	£45,774	605 KW.	..	41=918 H.P.	2,919 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	1,042,194	209
211 KILGAREE	Naas Rural District Council	1905	H. Ryland	200	Direct	92	..	..	£3,300	..	..	..	230 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	..	210
212 KILLARNEY	Kerry Electric Supply Co., Ltd.	1899	Valentine Ryan	100	100-, 1-ph.	160	62	..	£9,000	133 KW.	..	..	150 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	..	211
213 KILMACOLM	Kilmacolm Electric Lighting Co., Ltd.	1903	James White	240 & 480	Direct	50	52	20 KW.	£10,000	316 KW.	14 mil.	5=7 H.P.	300 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	55,071	212
214 KILMARNOCK	Kilmarnock Corporation	1904	W. M. C. Deron	340 & 480	Direct	1,033	771	128 KW.	£55,897	917 KW.	50 arc, 31 mil., 100 on arc post-74 mil.	109=669 1/2 H.P.	2,110 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	1,145,989	213
215 KINGSBURY	North Metropolitan Electric Power Supply Co. (Res.)	1910	W. E. North	240 & 415	50-, 3-ph.	50	10.5	..	£4,395	10.5 KW.	..	..	14.5 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	19,645	214
216 KINC'S LYNN	King's Lynn Corporation	1899	C. W. Jackson	200 & 400	Direct	680	645	60 KW.	£50,766	767 KW.	20 x 2 chm., 528 mt. 1/2	86=410 1/2 H.P.	1,104 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	78,757	215
217 KINGSTON-UPON-THAMES	Kingston-upon-Thames Corporation	1898	J. E. Edgecombe	105	77-, 1-ph.	860	672	..	£109,334	83 KW.	76 arc, 308 mil.	111=482 1/2 H.P.	3,015 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	871,039	216
218 KIRKCALDY	Kirkcaldy Corporation	1902	O. F. Francis	230 & 460	Direct	1,000	765	..	£65,098	..	104 arc, 212 chm.	8=2 H.P.	..	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	1,072,856	217
219 LANCASTER	Lancaster Corporation	1893	Gco. C. Milnes	230 & 460	Direct	1,320	700	..	£62,232	1,093 KW.	41 arc, 84 mil.	669 H.P.	24=840 H.P.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate, contract and special	808,927	218
220 LARNE	Larne Electric Light Works, Ltd.	1891	M. O. Smyth	105 & 210	100-, 1-ph.	150	72	..	78 KW.	14 arc, 130 inc.	..	..	100 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	..	219
221 LEAMINGTON	Midland Electric Light & Power Co., Ltd.	1887	Percy Oliver	230	Direct	524	285	110 KW.	..	960 KW.	1 arc	48=101 H.P.	1,104 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	238,207	220
222 LEATHERHEAD	Leatherhead & District Electricity Co., Ltd.	1902	H. Leslie Dixon	220 & 440	Direct	300	192	60 KW.	£37,383	390 KW.	58 mil.	90=855 H.P.	494 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	175,769	221
223 LEEDS	Leeds Corporation	1893	H. Dickinson	100, 200 & 400	60-, 1-ph. 2 & 3-ph.	16,440	0,000	..	£687,904	10,814 KW.	600 arc, 312 mil.	2,935=17,670 H.P.	26,626 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	17,641,572	222
224 LEEM	Leek Urban District Council	1904	R. M. Carr	230 & 460	Direct	650	312	73.5 KW.	£24,444	299 KW.	..	574 H.P.	793 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	522,416	223
225 LEICESTER	Leicester Corporation	1904	T. Robert Smith	100 & 200	60-, 1-ph.	4,100	2,340	..	£307,680	8,029 KW.	..	50=1,678 H.P.	9,379 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	9,340,163	224
226 LEIGH	Leigh Corporation	1890	Arthur T. Smith	220 & 440	Direct	790	471	132 KW.	£46,000	700 KW.	..	180=1,100 H.P.	1,444 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	809,275	225
227 LEITH	Leith Corporation	1899	A. P. Rutherford	230 & 460	Direct	8,450	2,135	75 KW.	£163,677	3,635 KW.	337 arc, 2 mil.	72=2,160 H.P.	6,005 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	3,442,297	226
228 LETCHWORTH	First Garden City Co., Ltd.	1937	Charles Gould	250 & 500	Direct	540	250	150 KW.	£30,000	50 KW.	..	25=134 H.P.	552 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	157,798	227
229 LEWES	Lewes & District Electric Supply Co., Ltd.	1901	H. J. Williams	230 & 460	Direct	830	145	92 KW.	..	405 KW.	..	35=232 H.P.	5,700 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	3,533,993	228
230 LEYTON	Leyton Urban District Council	1896	F. Darman Lewis	150 & 300	Direct	9,140	1,050	64 KW.	£179,203	2,050 KW.	82 arc, 219 chm., 637 mil.	120=8,600 H.P.	5,700 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	..	229
231 LIMAVADY	Limavady Power & Light Works	1897	E. J. S. Ritter	110 & 220	100-, 1-ph.	60	50	..	..	60 KW.	..	..	50 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	..	230
232 LIMERICK	Limerick Corporation	1902	P. T. MacNamara	230	Direct	400	275	95 KW.	£45,000	..	61 arc, 1 mil.	..	500 KW.	Lg. 7 & 4, or 5; pb. lg. 2, pr. 6	Flat rate	200,000	231

# ARC LAMPS MOTORS CABLES

And all Accessories for the above.

J. & H. GREVENER,  
40, Southwark St., London, S.E.

Telegram: "GREVENER, LONDON."  
Telephone: 7180 CITY (4 Lines)



# THE BASTIAN METER

Has stood the test of  
TIME.  
Upwards of  
70,000  
in use in all  
parts of the  
World.  
(For D.C. only.)

Manufactured and Sold only by  
THE BASTIAN METER CO., Ltd., Kentish Town, N.W.

# The Commercial Engineer's Pocket Book.

ELECTRICITY SUPPLY.  
A Handbook for Publicity Department Managers,  
Electricity Supply and Contractors'  
Representatives.

By FRANCIS H. DAVIES, A.M.I.E.E.  
Second Edition, Revised and Enlarged. Limp Cloth,  
cut flush, round corners, red edges, demy 12mo,  
suitable for pocket (size 6 1/2 x 3 1/2).  
Price 1s. 6d. net.; Post Free 1s. 7d.  
H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.

# ARMORDUCT CABLE

# ARMORDUCT COND

# THE IDEAL AND RE COMBINATION.







TK                      The Electrical review  
1  
E45  
v.70

~~Physical &~~  
~~Applied Sci~~  
~~Serials~~

Engineering

PLEASE DO NOT REMOVE  
CARDS OR SLIPS FROM THIS POCKET

---

UNIVERSITY OF TORONTO LIBRARY

---

**ENGINE STORAGE**



